TECHNICAL DOCUMENTATION

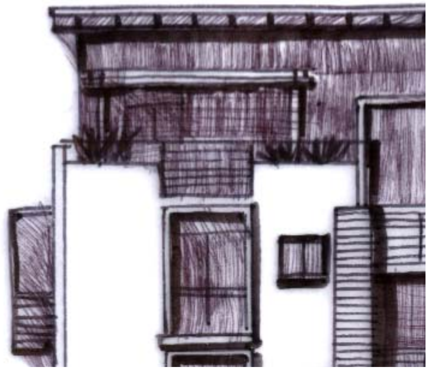


Fig 7-1

7 TECHNICAL INVESTIGATION.

7.1 STRUCTURE

7.1.1 THE STRUCTURAL FRAME

Gravity always requires a technical response. The need to array parts functionally keeps us reinventing the framework, creating new shapes for it. The framework does not seek spatial identity. It has only a single purpose: positioning related things in space. (Habraken,1998. p.150)

First a lightweight structure was considered because of attributes such as fast construction and the properties such as recyclablility of materials. From a housing point of view this benefit does not justify the greater cost of construction and a more robust approach is taken. Another problem that a light system passed was that a lightweight structure reacts too much to temperature swings and there is no thermal mass to store excess heat and coolth for later use. Therefore its was decided on a robust in-situ concrete columns and beams to support the pre-cast concrete floor slab. This structure provides mass for thermal storage, as well as create a Structural frame within which the housing infill can take place.

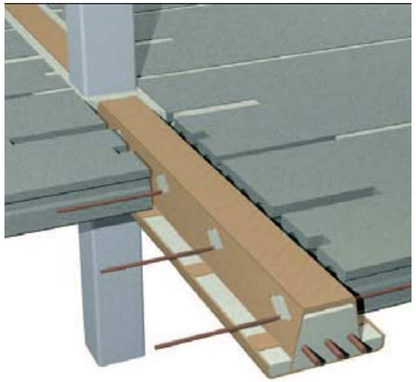


Fig 7-2 Pre-cast soncrete infill slabs

Fig 7-3 Floor slabs incorporate services

Fig 7-4

Fig 7-5

Fig 7-6

7.1.2 WALLS

The walls are not structural and can consist of a number of different infill systems. The perimeter walls of each apartment consist of 220mm masonry brickwork because of its robustness and acoustic qualities.
The units are designed in such a manner that the minimal internal walls are necessary. The internal walls of the apartment can be of robust chipboard wall portioning or similar system so that the owner will be able to insert or remove infill walls according to their needs.

The Retaining walls in the landscape, low garden walls and screen walls on ground floor will be made from a variety of experimental earth construction such as rammed earth and wattle and adobe. Gabion walls and pre cast concrete breeze blocks will also be used. These alternative construction methods are primarily introduced as an educational tool giving people the opportunity to experiment and learn from these low cost skills. The idea is that they will have the skills and courage to continue developing the rest of the site in a low cost way.

External walls will be finished with either a plastered brick or un-plastered concrete block. This is essentially a cost effective solution.

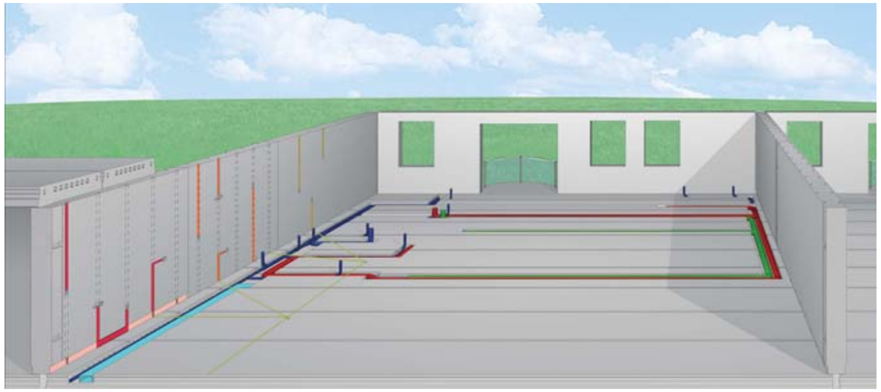


Fig 7-7

Fig 7-8

7.2 MATERIALS

In aiming towards sustainability the embodied energy of materials is very important. Factors influencing this are the actual sourcing of material, renew ability and recyclability or reusability. Using locally available materials will assist in saving cost and energy and less transportation will result in less pollution.

7.2.1 MASONRY BRICK

Masonry work is relatively robust and labor intensive with good thermal and acoustic qualities. Masonry has a long lifetime and fairly infrequent maintenance and repair. The longer construction time is a disadvantage and it is difficult to make changes in future.

Large hollow core cement blocks are used unfinished as a cost-effective building material and to create a contrast with the plastered brick work.

7.2.2 PAINT AND PLASTER WALL RENDERING

External – plaster generally consist of lime or cement plus sand and additives. The high cement content of plaster makes the wall surface watertight

7.2.3 CONCRETE

Columns and beams are cast in situ. Concrete is produced from cement, aggregate and water and in some cases additives. The embodied energy of concrete is relatively high because of the large amount of energy used to produce the cement. The most important factors taken into account when concrete was chosen are embodied energy, compressive strength, fire resistance and heat capacity.

Steel used to reinforce the concrete should be recycles with 10 percent new steel added to increase the strength. Durability of reinforced concrete depends on the quality of workmanship and raw materials, as well as the proportions of the mix and the location of the building. Carbon dioxide and sulphur dioxide, both of witch occur in high concentrations around industrial areas and towns are particularly damaging. It has been proved that carbon dioxide can carbonize up to 40mm into concrete. The concrete loses its alkaline properties as a result and can be subject to corrosive attack (Berge,1992,197) To prolong the lifespan of the concrete all reinforcement should have at least 40mm coverage and construction detailing is done to minimize the time water takes to move off the surface.

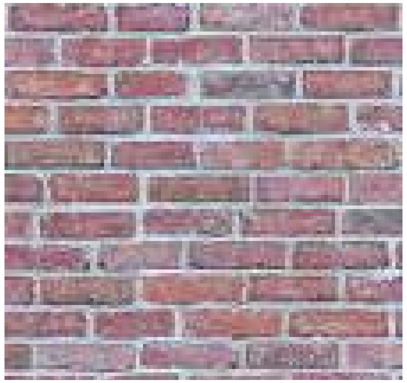


Fig 7-9


Fig 7-10


Fig 7-11


Fig 7-12


Fig 7-16 Timber and steel - pergola detail


Fig 7-17 Wattle lathes screen

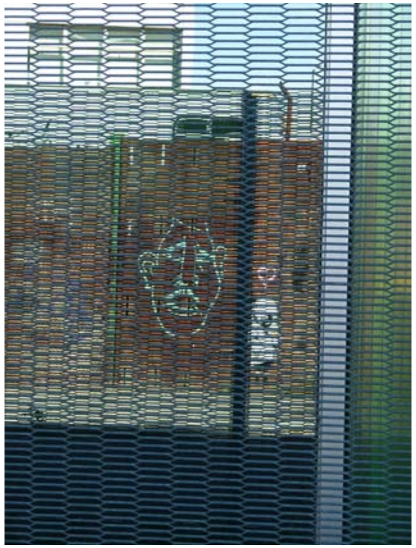


Fig 7-13 Steel mesh screen detail

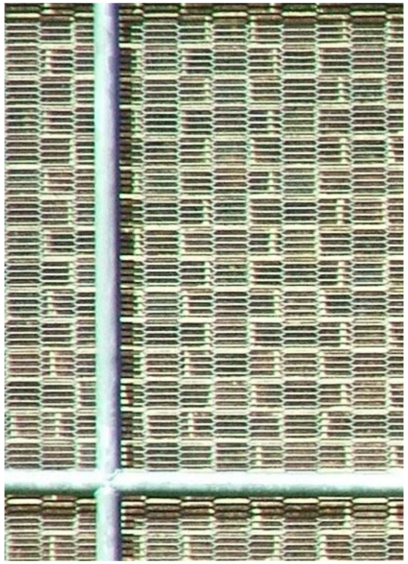


Fig 7-14 Steel mesh screen detail

7.2.4 TIMBER

Timber resources are renewable. The use of wattle lathes gives the architecture an earthy texture. The details can be easily constructed by local laborers. The biggest advantage when using timber is the relatively easy recyclability and reusability. Prefabricated components, such as rafters, battens and planks for external shading devices as well as other standard timber board products are used. If the lifespan of the components exceeds that of the building, it will be possible to reuse it directly.

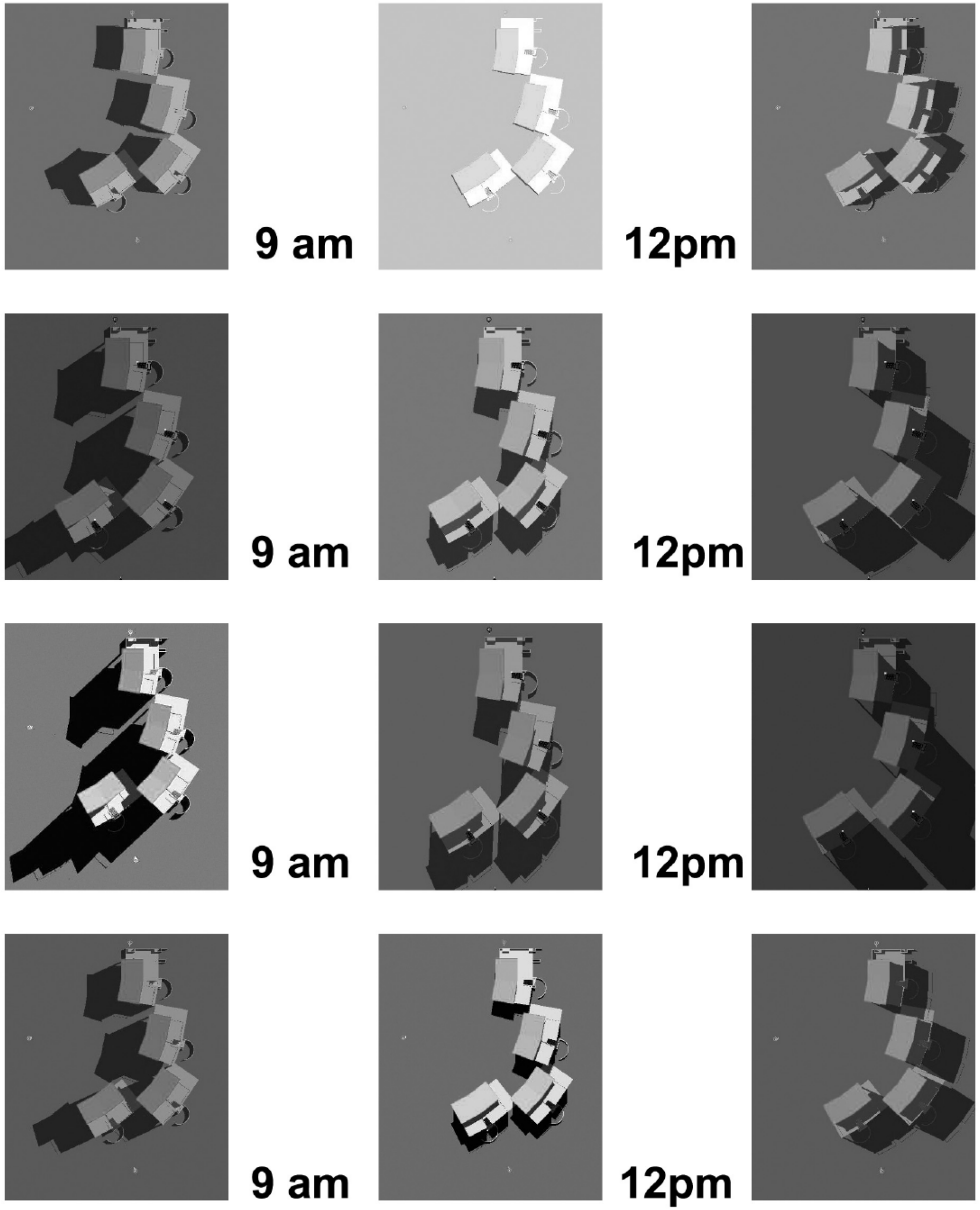
7.2.5 METAL

Good properties of steel are that it is completely recyclable. In this case standard steel sections are used as far as possible. The shading devices consist of a steel frame of standard size components. The welding can be done on site or at a workshop where the skills can be thought to the unemployed people of the area. Because of cost, robustness and need for maintenance, all window and door frames are standard steel frames by manufacturer.


Fig 7-15

Sun and Shadow study

Pretoria, south africa.
Azimuth: 135
Altitude 35



3pm
December

3pm
March

3pm
June

3pm
September

Fig 7-18

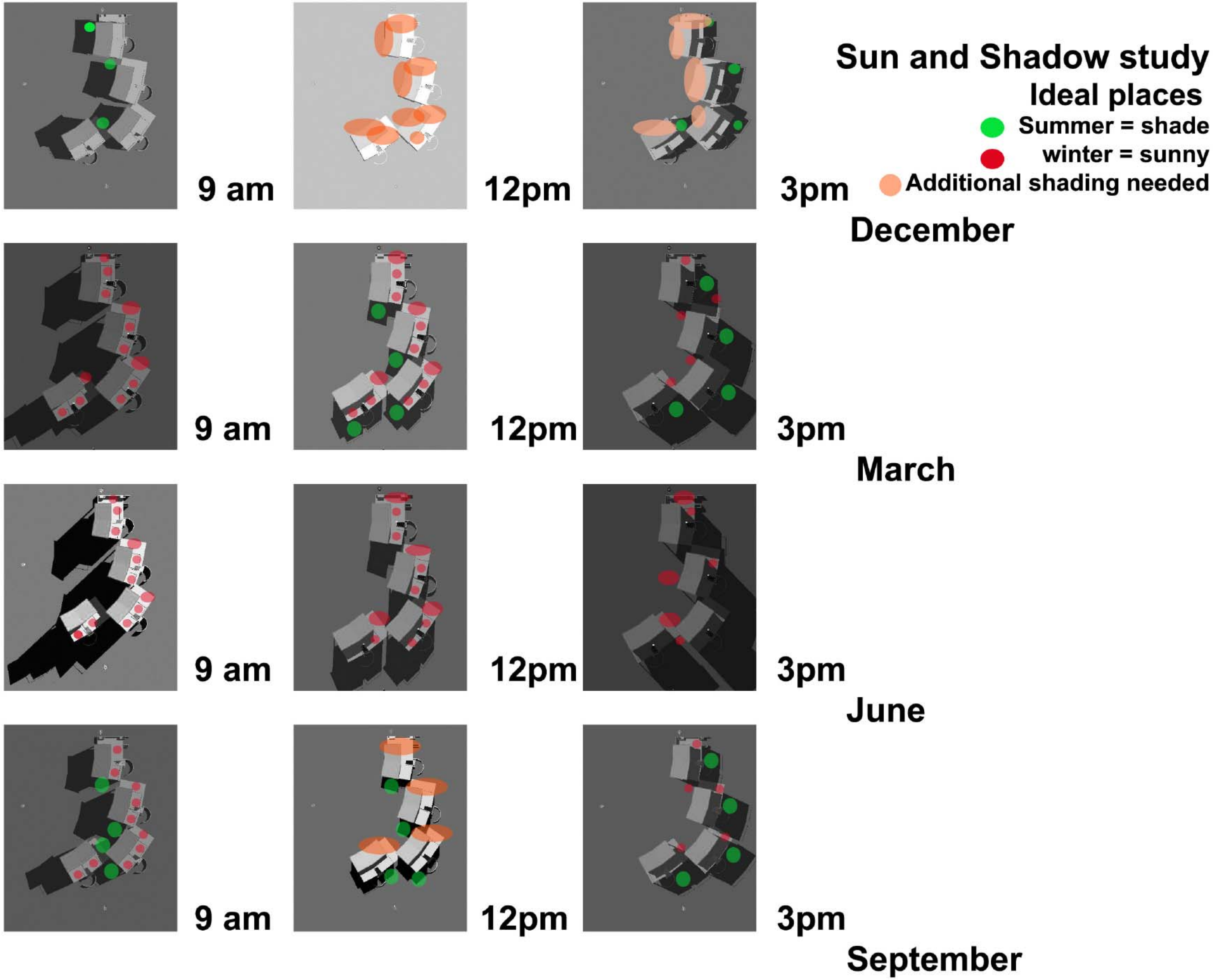

Sun and Shadow study
Ideal places
Summer = shade
winter = sunny
Additional shading needed
9 am
12pm
3pm
December
9 am
12pm
3pm
March
9 am
12pm
3pm
June
9 am
12pm
3pm
September

Fig 7-19


Fig 7-20

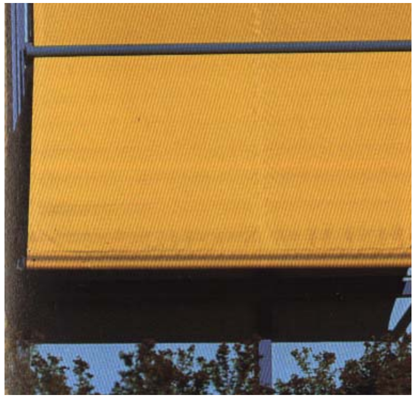


Fig 7-21


Fig 7-22


Fig 7-23


Fig 7-24


Fig 7-25


Fig 7-26

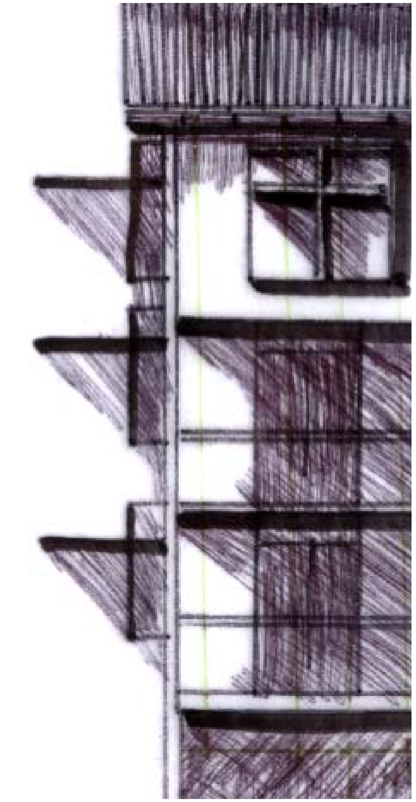


Fig 7-27

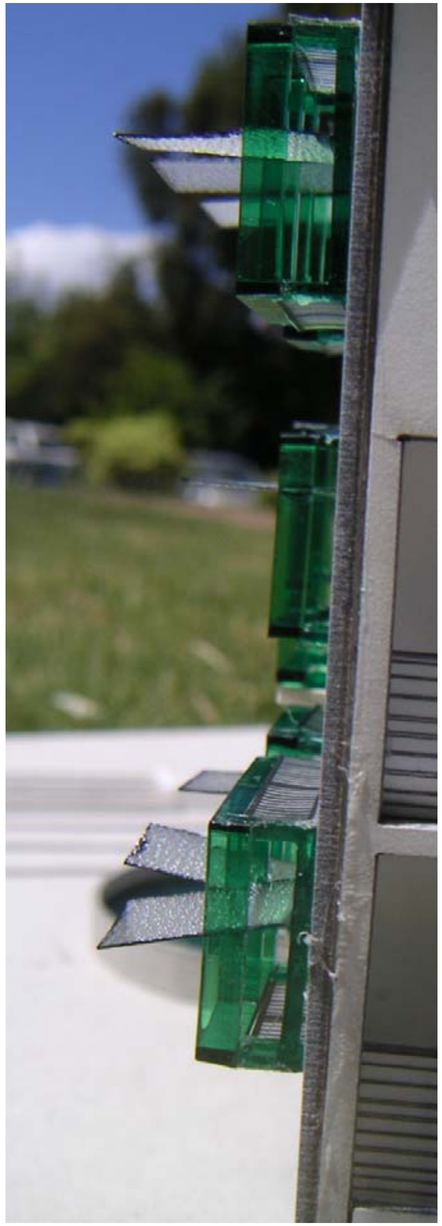


Fig 7-28

7.2 .3 WINDOWS

7.3 CLIMATE SYSTEMS

7.3.1 PASSIVE SYSTEMS:

"Good design exploits the potential for passive solar gain by consideration for glazing area, thermal mass and orientation" (baker&steemers,2006. P.56)

Passive solar design is about allowing daylight, heat, and airflow into a building only when beneficial. The objectives are to control the penetration of sunlight and airflows into the building at appropriate times and to store and distribute heat and cool air so its is available when needed. Many passive solar design options can be achieved at little or no additional cost.

7.3.2 WINDOWS

The positioning of windows and doors is allow to no cost intervention. Although windows can provide welcome heat in winter, they lead to overheating in summer. A window to floor area ratio of between 1 to 5 and 1 to 4 is considered appropriate with the largest windows facing north. Windows and doors can also be positioned on opposite sides of rooms to allow air-flow through the house

Windows provide visual contact with the out doors Al of the occupy able rooms have windows to the outside. It is a legal requirement for natural ventilation as well as the psychological advantages for humans to be able to see what's going in outside: weather conditions, time of day etc. A very important aspect when designing openings on the facade is a energy consideration. The size and orientation of these the window and shading elements determines heat gain, heat loss and the quality and quantity of natural interior lighting.

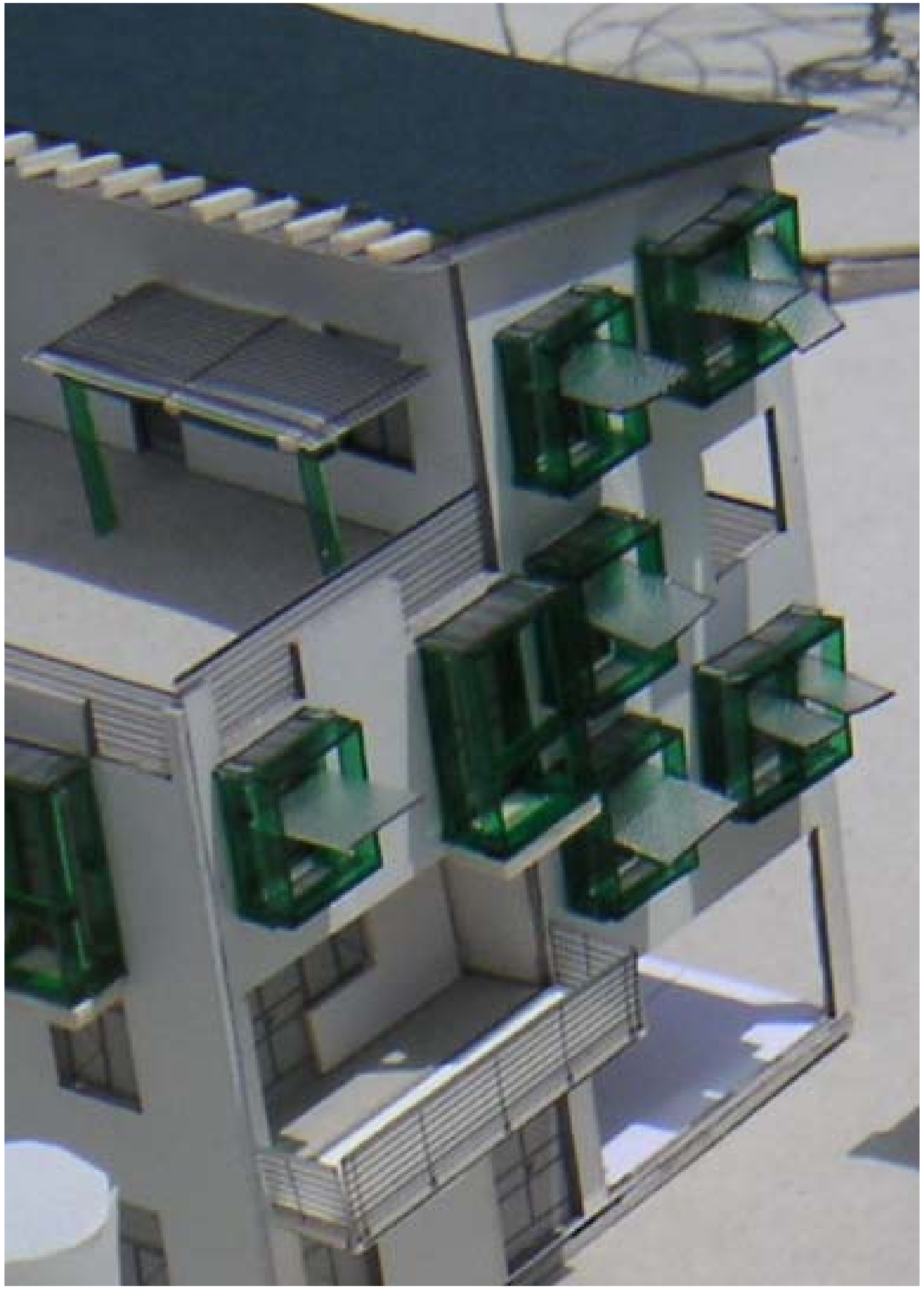


Fig 7-29

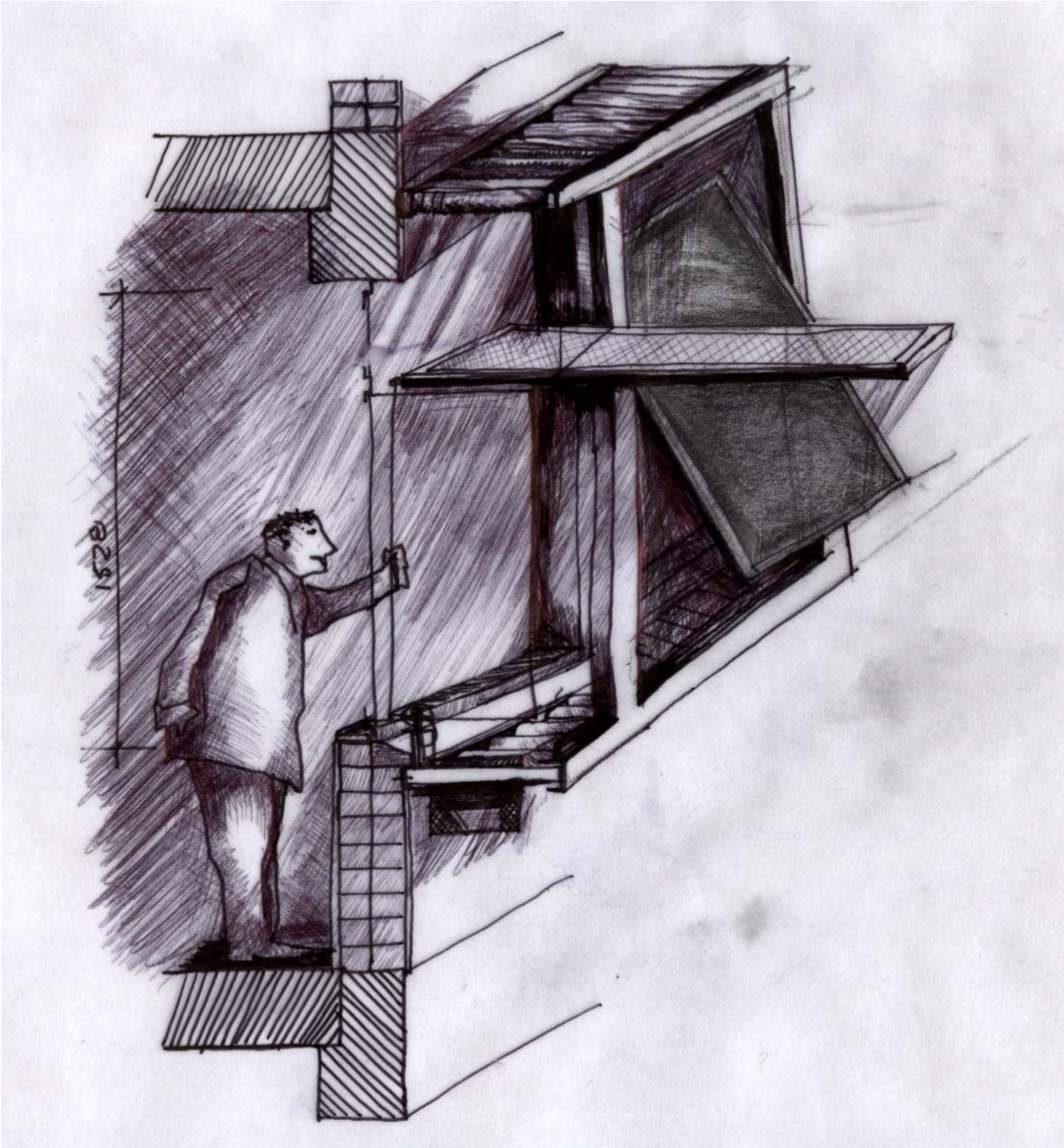


Fig 7-30

7.2 .3 WINDOW SHADING DEVICE

The most glazing occurs on the north and eastern facades. By the use of solar shading that can be manually operated by the inhabitant on the north and west façade, direct radiation is kept out during the summer but allowed through the façade during winter. Heat gain is important during winter – mainly on the north facade. This is primarily retained by the material use on the façade. The amount of heat storage depends on the thermal mass and its color. Concrete floor will be used as thermal storage element, storing it during the day and releasing it during the night.

On the western façade the openings are moved back in the façade to create balconies. The top floors are protected by the roof overhang, and planting.

As a protective measure against solar heat, protection of the sun is best achieved on the outside of the window. Protection against direct solar radiation is provided by external shading boxes Solar shading system- lightweight shading material covers a steel frame painted dark brown to restrict reflected solar radiation during summer months.

7.3.3.DAY LIGHTING

"Daylight is desired not only for energy conservation but is usually considered superior (psychologically) to electric lighting. In most domestic buildings this is potentially the most significant energy-saving measure." (baker&steemers, 2000, 42)

7.3.4 NATURAL VENTILATION

"It appears that in many cases occupants are much happier and healthier in naturally ventilated buildings, in spite of the variability of environmental conditions which results" (Baker et al, 2000, 52)

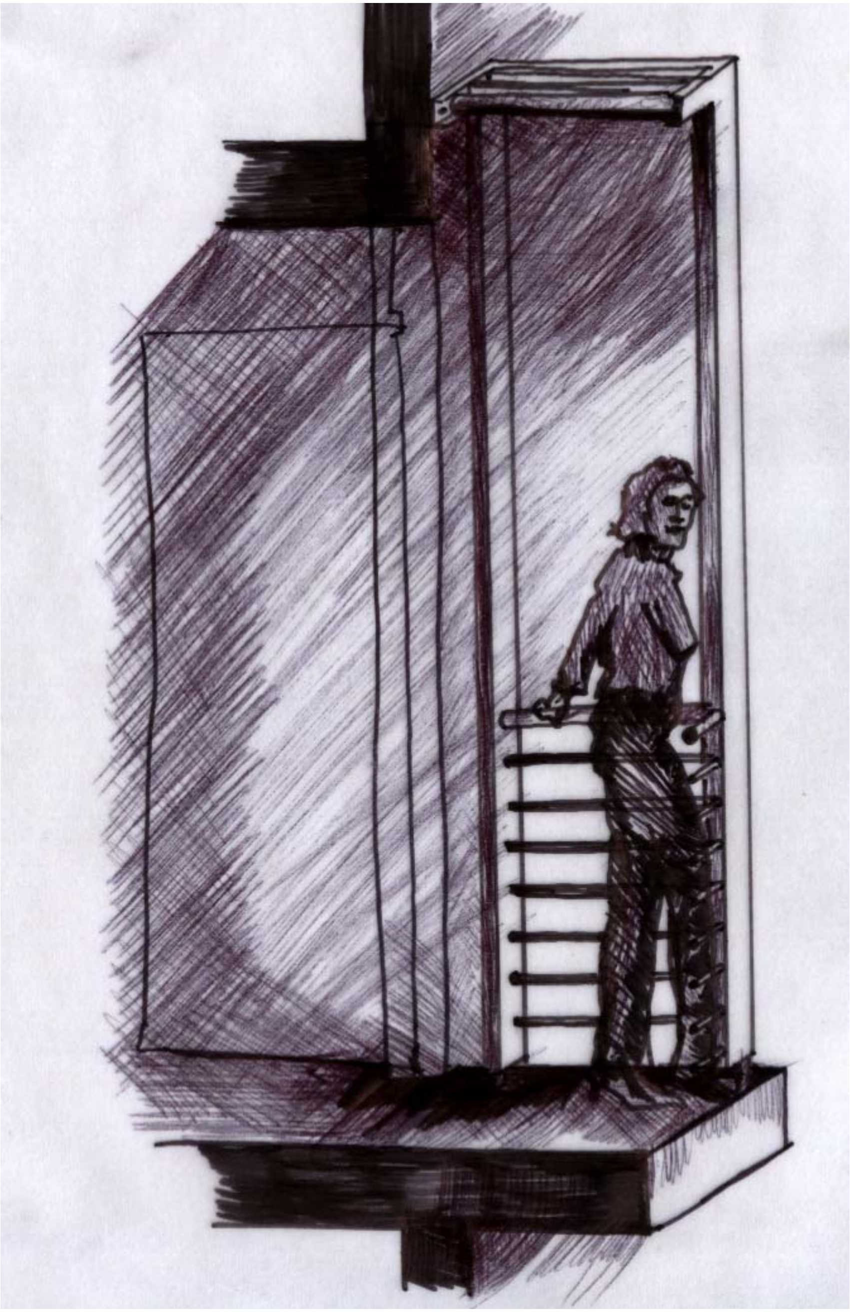


Fig 7-31

7.3.5 WIND PRESSURE

Ideally each apartment would have the possibility to ventilate naturally. When wind blows up against the building there will be positive pressure on the windward side and negative pressure on the leeward side. Because openings are distributed over all the facades of the building, it is ensured that, no matter what the wind directions, openings will be at different pressures that will introduce a natural airflow through the building that would introduce cross ventilation. The opening above the door directs pressure towards the stairwell.

7.3.6 WATSE WATER SYSTEMS

Rain water is harvested from the roof and made available for use in the garden. Grey water – from shower, bath and washing machine will be directed through the artificial wetland and used in the green areas.
Although there is a number of experimental ways to handle sewage more environmentally friendly the urban nature of the development, it was decided to simply connect to the municipal connection.

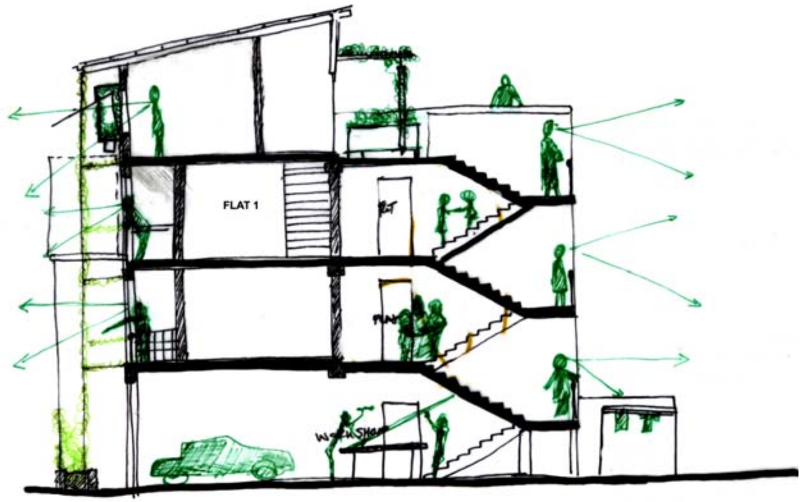


Fig 7-32 Openings in the facade

Fig 7-33

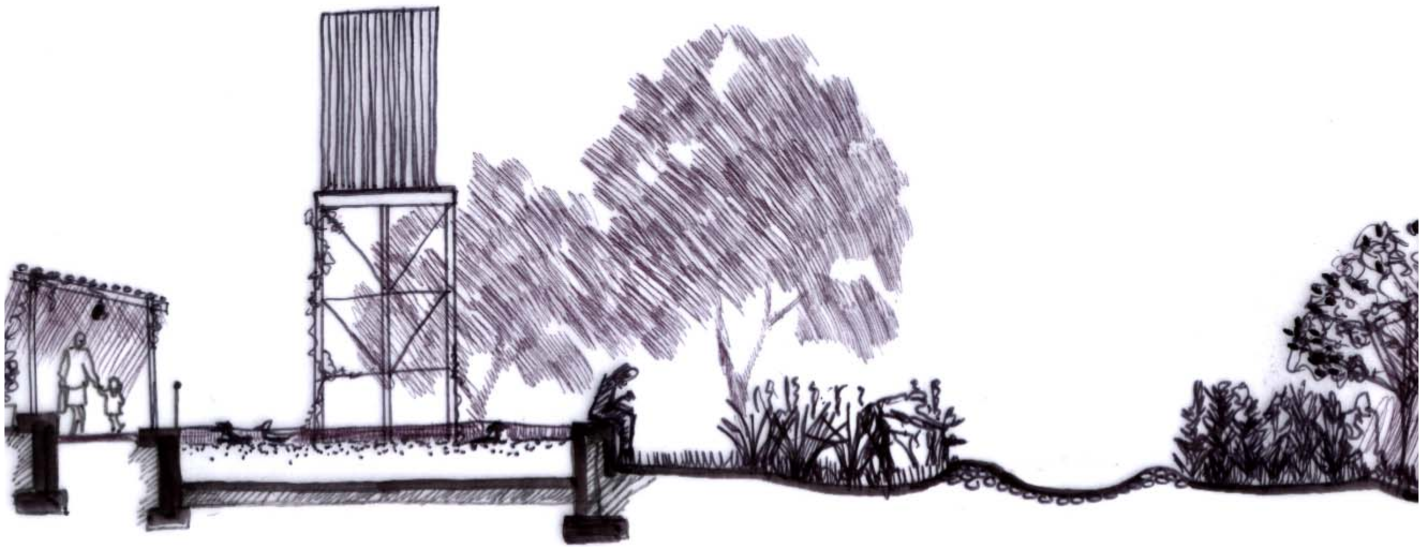


Fig 7-34

7.4 RAINWATER HARVESTING

Rainwater will be harvested, stored, and used as water supply in the gardens. Water average consumption per Household in cubic meter per year: (Abraham, Fisher and Schmitz-Gunter 1999)

Person

1person = 57 m³ 2persons = 95 m³ 3 = 131 m³ 4persons = 161 m³ 5 5 persons = 182 m³

Fig 7-35

Estimated water consumption per day: 1 person +household: 120l
1 ha garden 10 000l (Grobler.1999 p 271)

Total roof surface: 740m2
Possible annual savings by using rain water:
Harvested rainwater volume = 688,764 kl 1kl = 1m³
Current Cost per 1m³ = R4
Possible savings per annum = R 2755.00

When considering this system it is important to look past the financial savings and rather consider the ecological impact that this can have in the long term.

	Aggregate rainfall in mm/month fir the Pretoria area	Potential annual rainwater harvesting volume:	Harvesting from the roof into a 10 000 l tank: Total roof surface leading into tank: 94 m2 Potential annual rainwater harvesting volume:
Jan	101.33mm	75 kl	9 000 l
Feb	108.8mm	80,512 kl	10 000 l
Mar	63mm	46,620 kl	6 000 l
Apr	48.4mm	35,816 kl	4 500 l
May	48.4mm	35,816 kl	4 500 l
Jun	3.8mm	28,12 kl	350 l
Jul	2.3mm	17,02 kl	220 l
Aug	2.3mm	17,02 kl	220 l
Sept	11.3mm	83,62 kl	1000 l
Oct	82.5mm	61,05 kl	7000 l
Nov	168.8mm	124,912 kl	15 000 l – tank will overflow
Des	112.5mm	83,250 kl	10 500 l – tank will overflow
	Total kl water per annum:	688,764 kl	

The tank will possible be filled to capacity in November, December and February, a bigger tank cannot be justified during the rest of the year.
It is more important to design the overflow facility.
Rainwater faucets have to be clearly marked so they are not confused with drinking water. A good precautionary method is to have the tap high so that children cannot reach and accidentally use it.


Fig 7-36


Fig 7-37

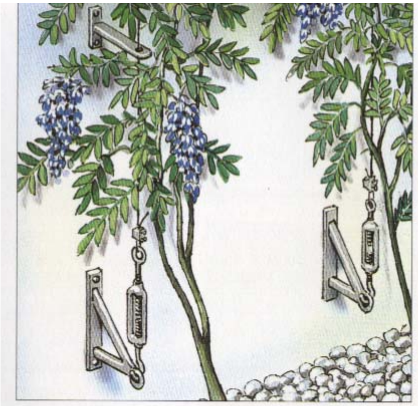
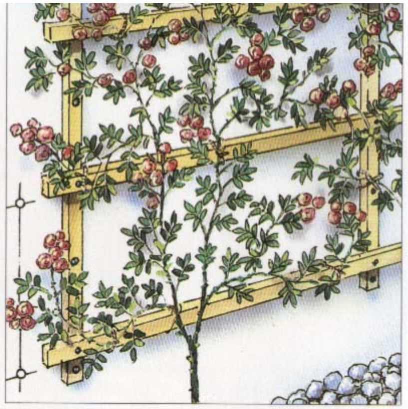


Fig 7-38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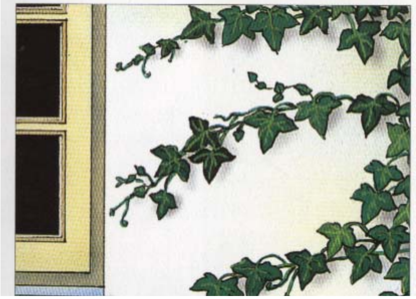


Fig 7-40

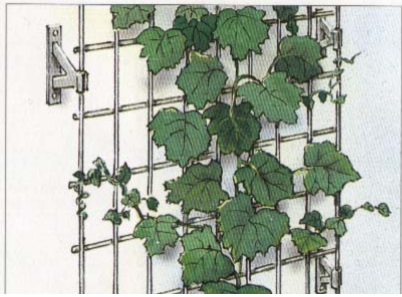


Fig 7-41

7.5 FACADE SYSTEM

Cultivating plants on the façade is an ideal way both of adding interest to a facade and also improving it from an environmental standpoint. It can provide a habitat and an indispensable food resource for a wide variety of different animals. The plants increase the local atmospheric humidity, provide shade and filter dust. It can also provide a degree of climate control in both summer and winter. Growing plants on the façade can bring a touch of nature into the most cramped city centre environments. If done correctly, virtually all buildings can be planted in some shape or form without any risk to the structure of the building. A distinction should be made between trellis climbing and clinging plants, while plants that need a trellis or other climbing assistance are easy to keep off areas where they are not wanted, clinging plants are more difficult to control.

The Indigenous trellis climber or any form of wine that bears fruit. for the Tshwane area:

Clemantis Brachiata – Travelers joy

Senecio tamoides - Canary creeper

5x3m wind resistant, yellow flowered climber.

Rhicissus tridentate – Bushman's Grape.

Attractive dark green foliage, with edible red berries. Drought tolerant, with medicinal properties

7.6 PAVING. A green car park.

Eco friendly alternatives to paving: The type of surface depends primarily on the degree of use. Paths that are not heavily used can be surfaced with a gravel lawn. Pre cast cement blocks are good for car parks but not good for walking paths. Paving with spaces for grass looks attractive but needs maintenance.

Fig 7-42 Permiable paving block

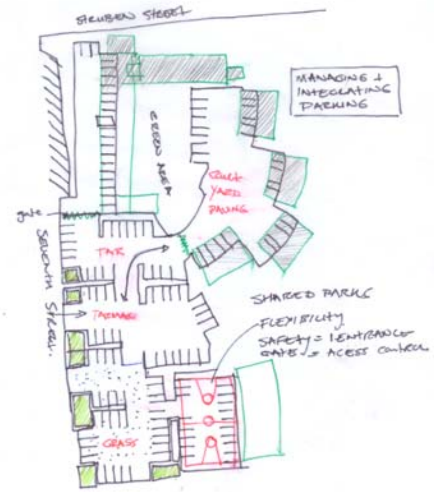


Fig 7-43 Sketch of parking area

Fig 7-44

7.7 LANDCAPING

Planting of deciduous trees can control heat gain by providing shade in summer and when the leaves fall in winter, sunshine can warm the house though north facing windows. Furthermore, breezes entering the house will be cooler if they have passed through gardens or courtyards that have shade, pools or shrubs and lawns.

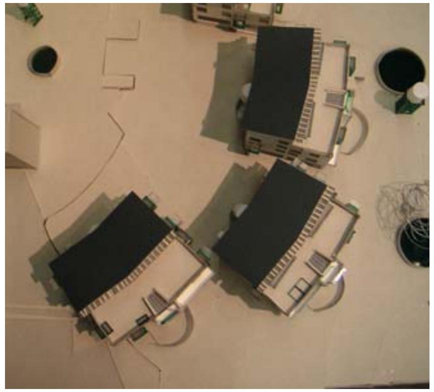
Fig 7-45 Parking area and bioswale system

Fig 7-47 Parking area and bioswale system

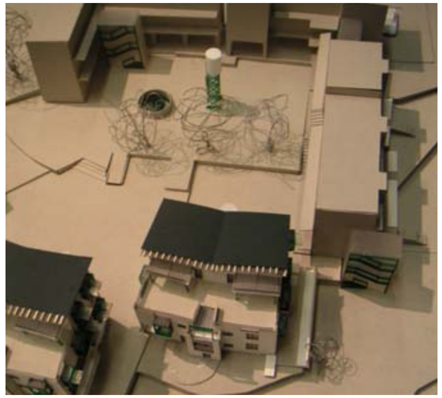
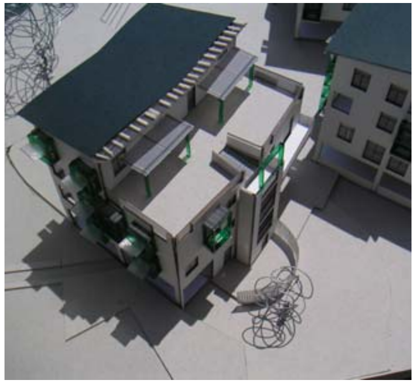
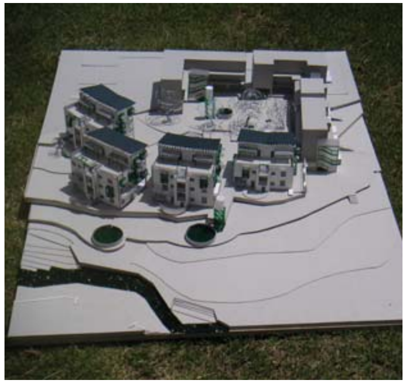
Fig 7-46 Parking area and bioswale system

Fig 7-48 Parking area and bioswale system





7 SITE PLAN SCALE TO FIT