

Introduction

List of Figures and Tables

01 Design Development

02 Context

03 Precedents

04 Baseline Indicators

05 technical investigation

05 Technical Investigation and Drawings

5.1 Conceptual Design

5.2 Structure

5.3 Indoor Environment and Human Comfort

5.4 Services

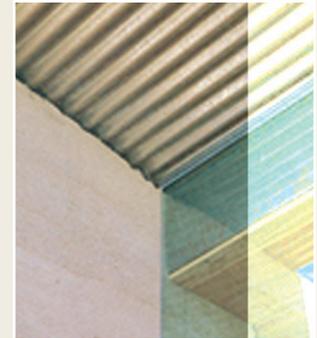
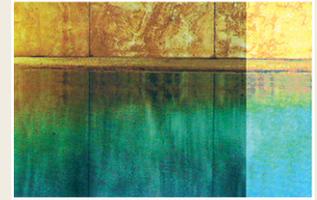
5.5 Landscaping

5.6 Materials

5.7 Drawings

06 Appendix

References



technical investigation

Technical Investigation

Architecture has a profound effect on human beings, on place, on human consciousness and the world. Anything with such powerful effects has responsibilities (Day 1990:16). Architecture has responsibilities to minimise pollution and ecological damage; minimise adverse biological effects on occupants; responsibilities to be sensitive to and to act harmoniously in the surroundings; responsibilities to humans who will come into contact with the building; responsibilities in visual aesthetics, intangible perception and 'spirit of place'.

These responsibilities involve energy conservation-ranging from insulation, organisation, re-use of waste heat and alternative energy production (solar energy). It involves careful selection of building materials and the ways they are put together, both with regard to occupants, manufacturing and building workers health, to environmental impact of products from primary extraction to demolished rubbish.

The technical investigation is the concrete realization of a theoretically generated architectural form. Once the theoretical standpoint and baseline have been explored, the concept and design are developed into a definite building.

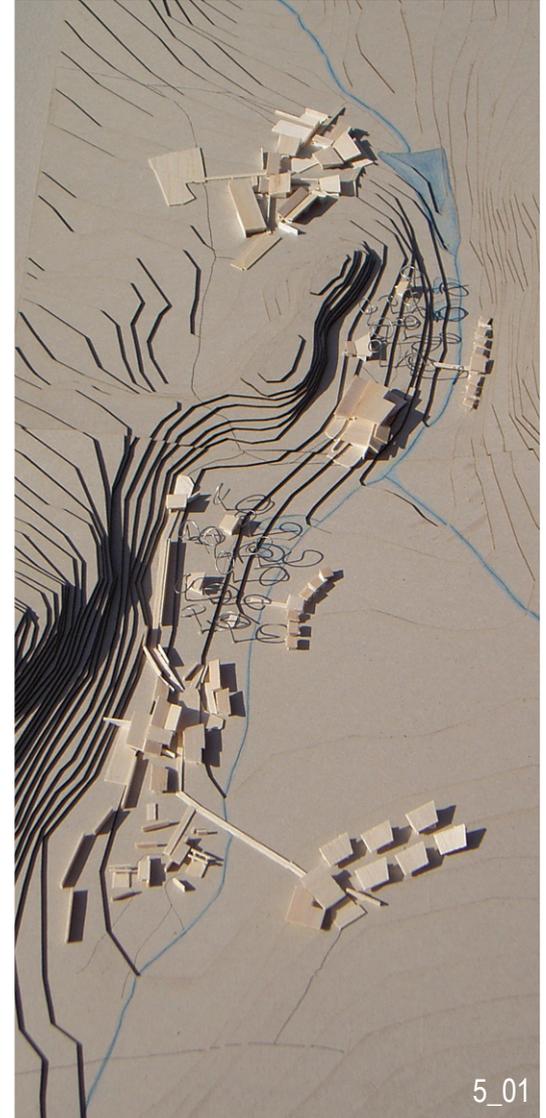
5.1 Conceptual design

The starting point for the design and construction of the building complex was the site. In considering the natural elements and features of the site, as well as the nature of the building complex, the aesthetics to be embodied in the design were formed. As the main function of the Healing Centre is emotional and psychological healing, the materials chosen compliment this, that is that they do not create a clinical environment.

The form and plan of the design evolved due to spatial organisation, accommodation schedule, and the features of the site, such as the views, vegetation and topography. The angular placement of walls emphasis views and spaces within the building complex, making the user aware of the site and their surroundings.

The topography of the site separated the building complex into three parts, and determined their location on site due to privacy and noise considerations.

Orientation of the buildings is influenced by local topography, the requirements for privacy, views, reduction of noise and the climatic factors of wind and solar radiation. The sun is an important consideration due to its thermal effect, natural lighting and psychological benefits.



5.2 Structural Overview

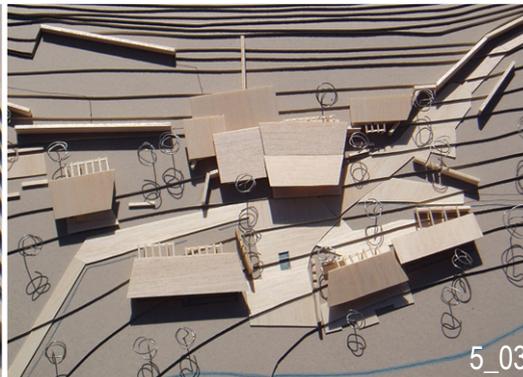
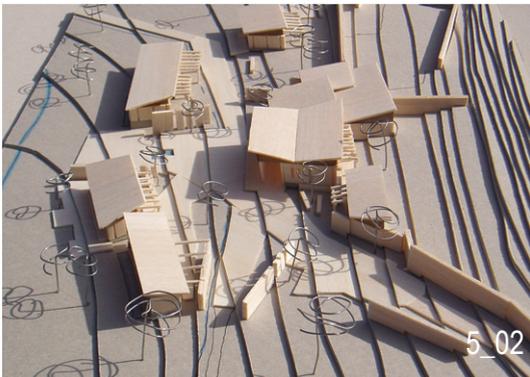
The main structure consists of a timber column structure and rammed earth in-fill panels. Rammed earth was chosen due to its construction qualities and aesthetics, and is supplemented with timber columns to relieve it of any structural and service responsibilities. The main function of the timber columns are to support the roof and act as support frames for service ducting. This system of construction is used modularly throughout the building complex, with column spacing dependent on room dimensions and wall angles.

The timber columns are made up from two 75x225 softwood structural timber columns, grade S7, to become a 125x225 timber column. The two pieces of the column are held together with M10 threaded rod and M10 friction grip nuts.

The earth walls are constructed at a thickness of 500mm, in panels in-between the exterior columns. The sides of the columns not in contact with the earth walls are left exposed, and act as frames for service ducting. Due to the ramming method and the nature of the material, services are a design challenge. Timber service ducts are attached to the exposed surfaces of the columns in which the services are accommodated.

The roof is constructed of a double roof system made up of a main supporting beam, a purlin, a common rafter and a top purlin onto which the galvanised roof sheeting is attached. The double roof system is necessary as the grid spacing of the timber columns is a maximum of 4500mm. The roof beams are attached directly to the top of the timber columns, with the rest of the roof resting on the beam.

The structure is discussed in further detail in section 6.6 Materials.



5.3 Indoor environment and human comfort

Shelter is the main instrument for fulfilling the requirements of comfort. It modifies the natural environment to approach optimum conditions of liveability (Olgay 1963:15). It should filter, absorb or repel environmental elements according to their beneficial or adverse contributions to man's comfort. Man strives for the point at which minimum energy expenditure is needed to adjust to the environment.

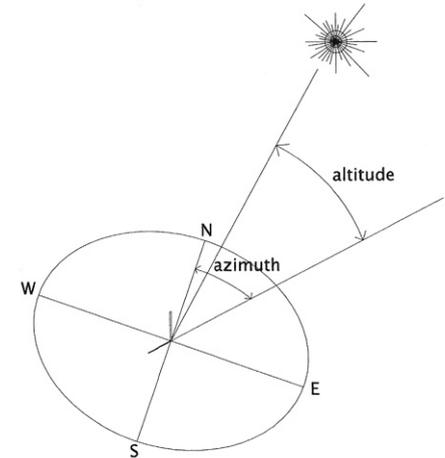
Basic climatic data for the site

- summer rainfall 125-375mm
- winter rainfall 62-250mm
- summer temperatures 15° - 30°C
- winter temperatures 6° - 23°C
- prevailing winds, N-E in summer and N-E to N-W in winter
- relative humidity 30-50%
- hours sunshine 60-80

The following are the optimum conditions for thermal comfort:

- Air temperature – 20 to 25°C
- Humidity – 20 to 80% (80% at 24°C)
- Air speed – comfort up to 3.5m/s

The above factors combine to make occupancy bearable or not. These factors can compensate for each other to increase comfort. Thermal comfort is also affected by human factors; clothing levels and activity levels. On site humidity is within the acceptable range. Winter temperatures need to be increased, and summer temperatures kept low, while controlling air flow so that it falls within a comfortable level.



facing the sun, its height as an angle upward from the horizon is the ALTITUDE
facing the sun, its angle on the ground away from north is the AZIMUTH

Solar chart

Pretoria, Latitude nearest 26 South, 28East.

	Solar time	06.00	08.00	10.00	12.00	14.00	16.00	18.00		
	Clock time	06.18	08.18	10.18	12.18	14.18	16.18	18.18	sunrise	sunset
Summer 21/12	Azimuth°	112E	101E	91E	0	91W	101W	112W	05.28	19.08
	Altitude°	10	35	63	88	63	35	10		
Equinox 21/3&9	Azimuth°	90E	76E	53E	0	53W	76W	90W	06.18	18.18
	Altitude°	0	26	51	65	51	26	0		
Winter 21/6	Azimuth°	-	55E	34E	0	34W	55W	-	07.08	17.28
	Altitude°	-	14	32	40	32	14	-		

(From Napier 2000:4.10)

azimuth and altitude 5_05

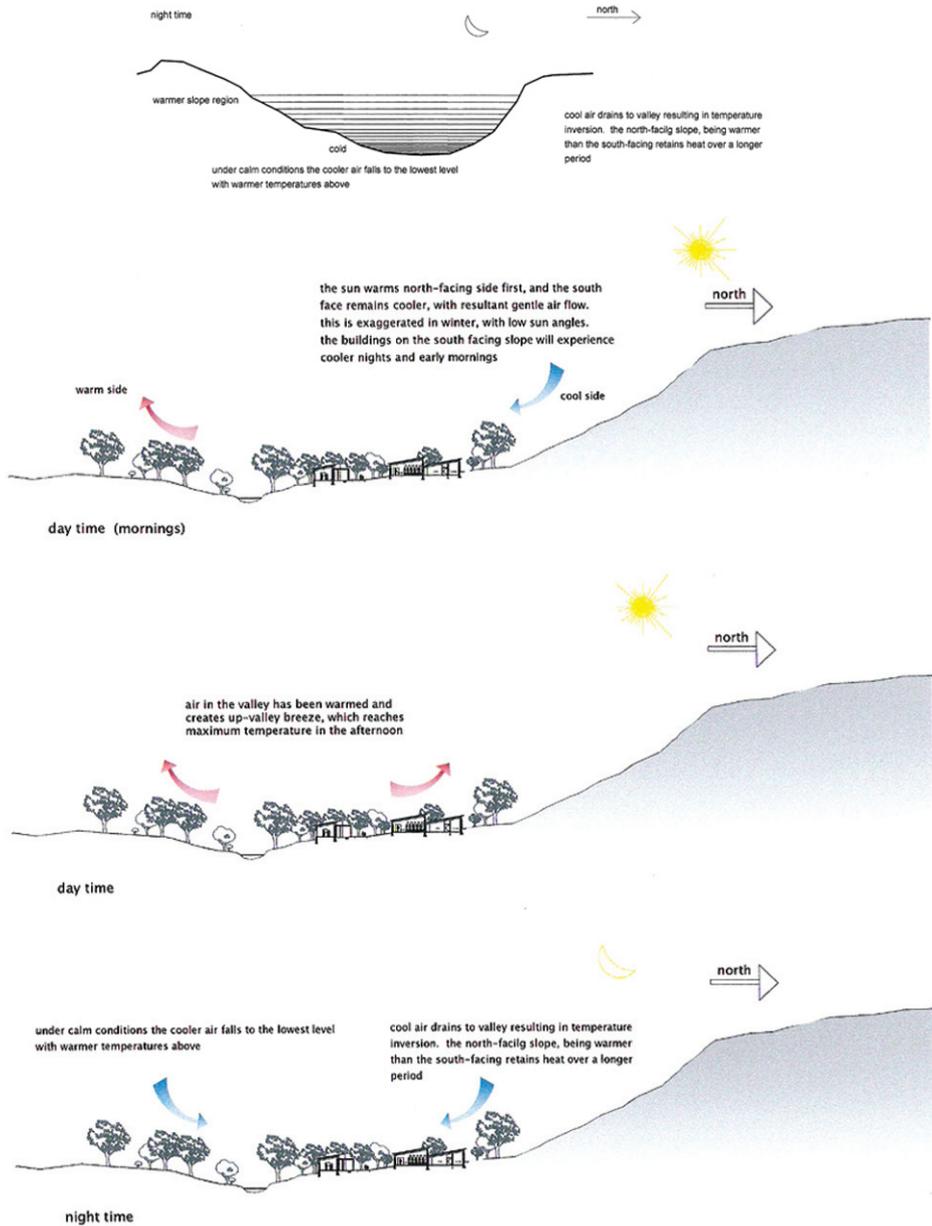
thermal comfort

5.3.1 Climate control and thermal comfort

The building must be used to positively modify the thermal environment, so as to make it as comfortable as possible for its users. Passive systems of heating, cooling and ventilation are used to achieve this. Mechanical assistance is only employed in extreme temperatures.

On the South African Highveld, buildings need to be designed mainly to remain cool. The highveld is predominantly grassland with scattered trees in the wetter parts. Summers are warm to hot, with fairly dry air, relieved by thunder storms generated from thermal air movement. Hail is not uncommon. Winter days are sunny with cold to very cold nights. High mass structures are better suited this region. During the few short months of winter, passive heating principles can be applied.

The microclimate of the site is affected by the valley and river that runs through the site. The main thermal consideration is heating in winter, as most of the buildings lie on a south facing slope. At night cold air flows downhill and fills depressions to create cold air pockets in low-lying areas. In the morning, the sun warms the northern-facing slope first, while the southern slope remains cooler, with a resultant gentle air flow. This is exaggerated in winter with low sun angles, with the south facing slope being cooler in the mornings and the evenings. For this reason the accommodation is located on a north facing slope, and the buildings on the southern slope are positioned far enough away from the ridge so that they are not shaded in winter.



microclimate on site 5_06

In a building, heat transfer happens in the following ways:

- Radiation – direct admission of sunlight, infrared heat being radiated from warm surfaces. Sunlight should not be allowed to penetrate at overheated times (e.g. summer afternoons) but should be admitted at under heated times (e.g. winters day). Dull surfaces radiate heat best.
- Conduction – through ceiling panels, roof panels, walls, windows and floors. Heat flow is prevented by materials with mass insulation that rely on trapped air pockets.
- Convection – Air circulates in a room as warm air at the ceiling cools and falls along the window surfaces and warms up again by drawing heat from occupants and thermal mass.
- Evaporation – a mist spray applied to a warm roof, cools the surface of the roof, the roof supplies the heat necessary for evaporation.

The thermal flywheel effect is the principle applied to the building to control temperatures as it can help to passively assist temperature control within a building. For a climate which has warm summers and temperate sunny winters, heavier mass materials are used to help control the temperatures, with good heat storage capacities and suitable absorptive and emissive qualities.

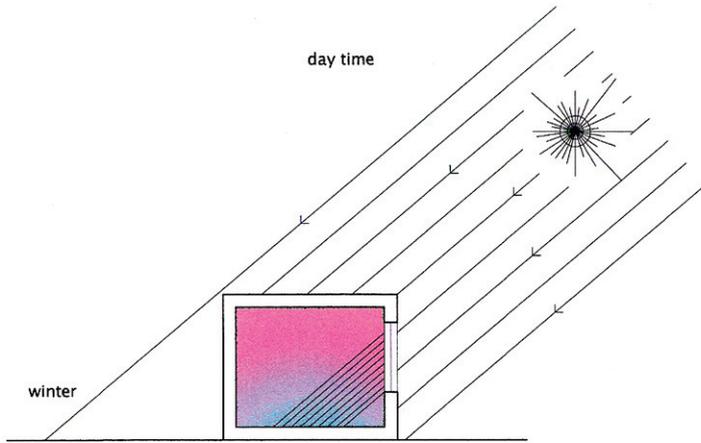
The roof is well insulated to prevent heat gain in summer and loss in winter. A 75mm layer of mineral fibre insulation is placed in the roof.

The green house principle allows glazed rooms to heat up quickly. The sun's infra-red rays are short waves and able to penetrate glass. Once inside the rays are reradiated and become long wave, which are not able to penetrate glass, thus the interior heats up. Solar gain is controlled by a timber trellising shading device so that overheating does not occur. Fresh air intake and stale or warm air is again expelled through windows located near roof level. On very cold days passive heating is supplemented with electrical space heaters in smaller rooms, such as consultation and treatment areas, and in the main lounges and dining room by fire places. On winter nights the windows are closed to keep in any warmth. Heat from the structure is partially radiated to the interior, and keeps temperatures from dropping too low.

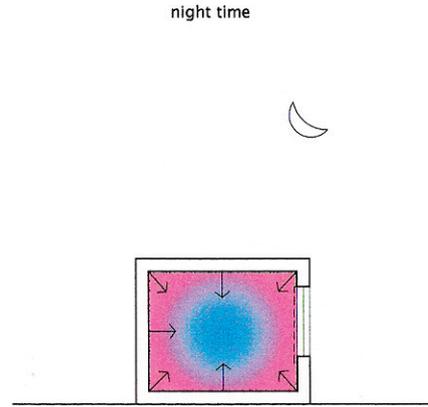
On hot summer days the thermal mass of the rammed earth walls keeps temperatures down by absorbing the heat from the interior. The walls of the buildings are shaded by roof overhangs and trellising during peak summer months, keeping them cool, and enhancing their cooling abilities. Fresh air enters the room via shaded, open windows. Stale and warm air are expelled through windows located near roof level. Window fans near roof level facilitate air removal. Temperatures are further lowered by passing fresh air over water features (evaporative cooling) and shaded paving before it enters a room.

At night time windows are left open and window fans left on, which allows cool night air to enter the room and cool the interior. Heat stored in the structural mass of the earth walls is radiated into space, and their temperature drops.

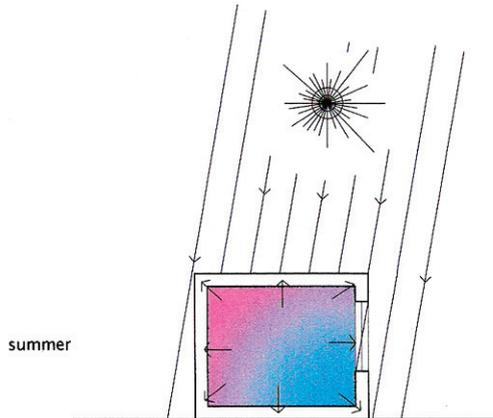
In winter the rammed earth act as a thermal store and absorbs heat from the sun. Direct sunlight falls onto the walls due to lower sun angles and solar gain is maximised. Heat stored in the structural mass is reradiated to the interior of the room. Window positioning allows some direct solar gain.



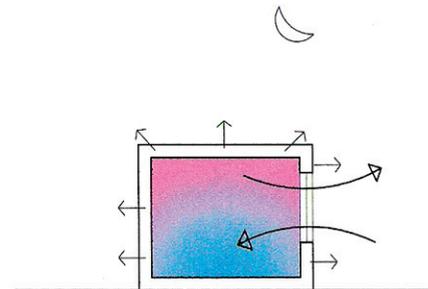
structural mass absorbs heat from the sun



heat stored in structural mass is partially radiated to the interior. curtain drawn conserves heat



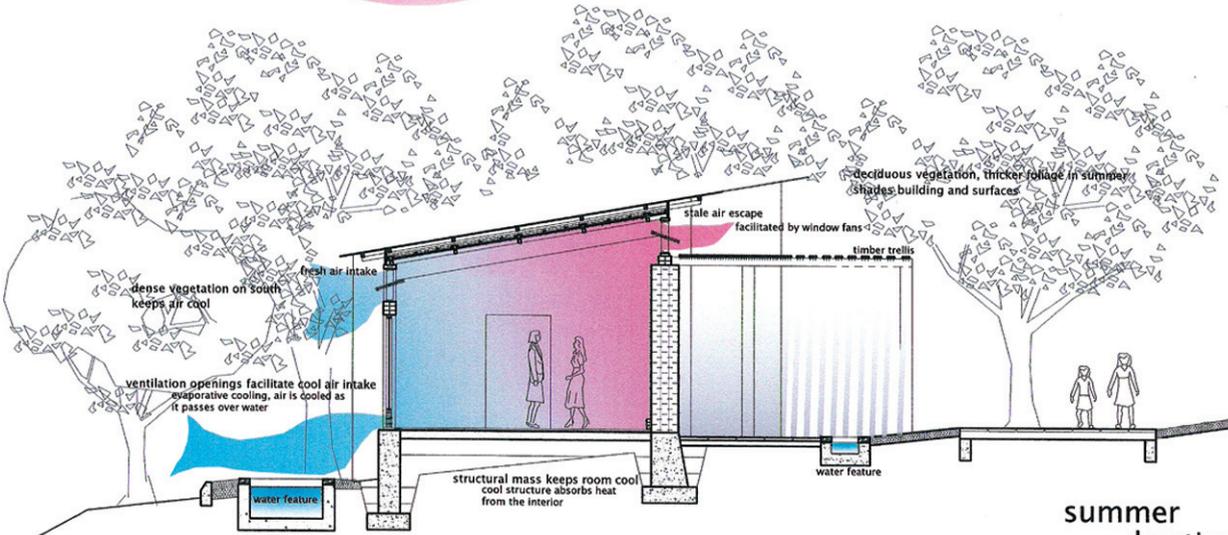
cool structural mass absorbs heat from interior.



heat stored in structural mass is radiated to space. open windows allow night air to cool interior mass

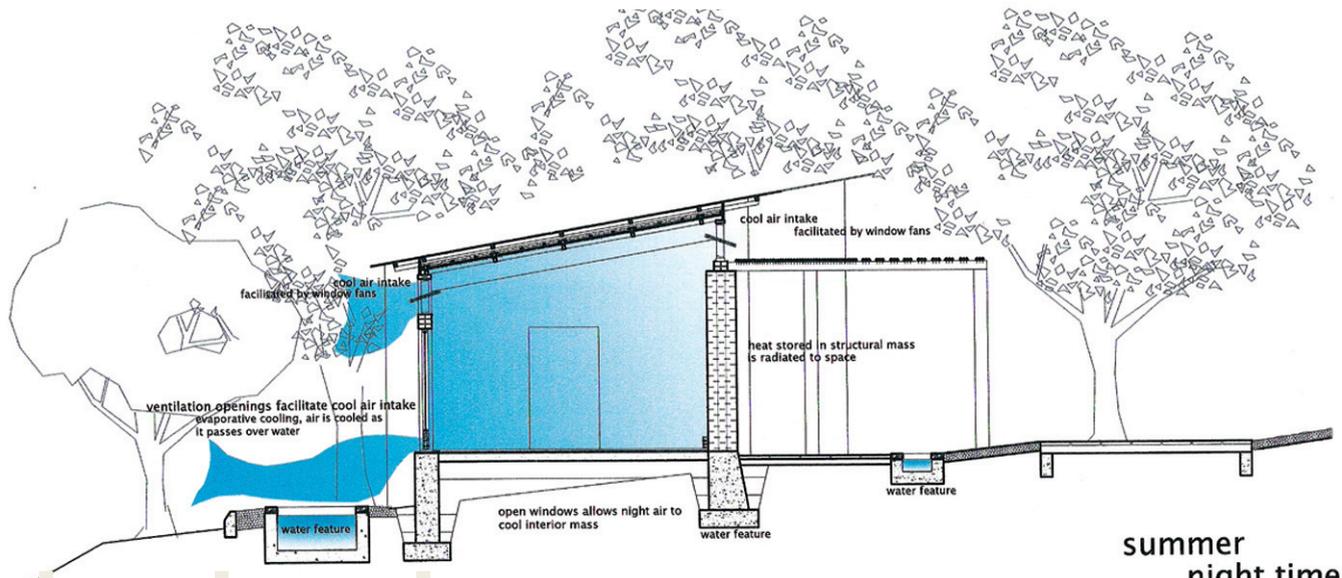
flywheel effect

5_07

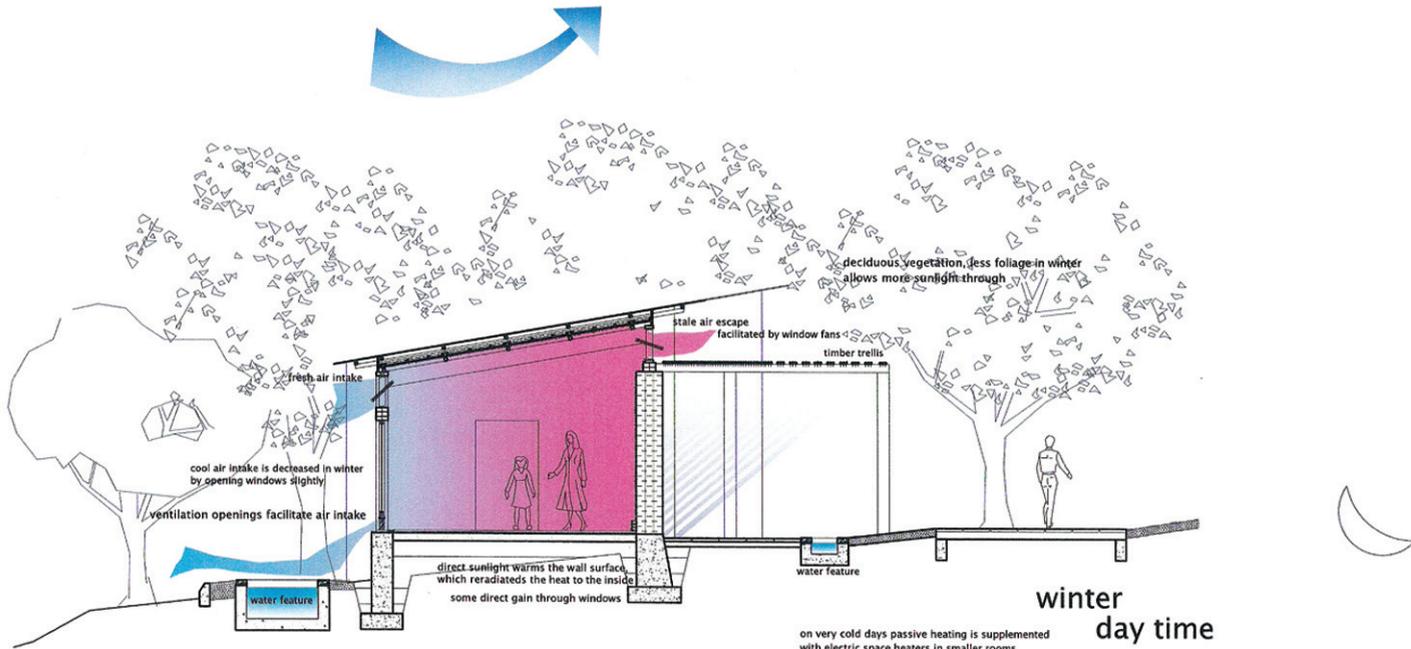
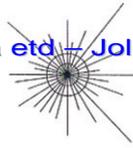


summer day time

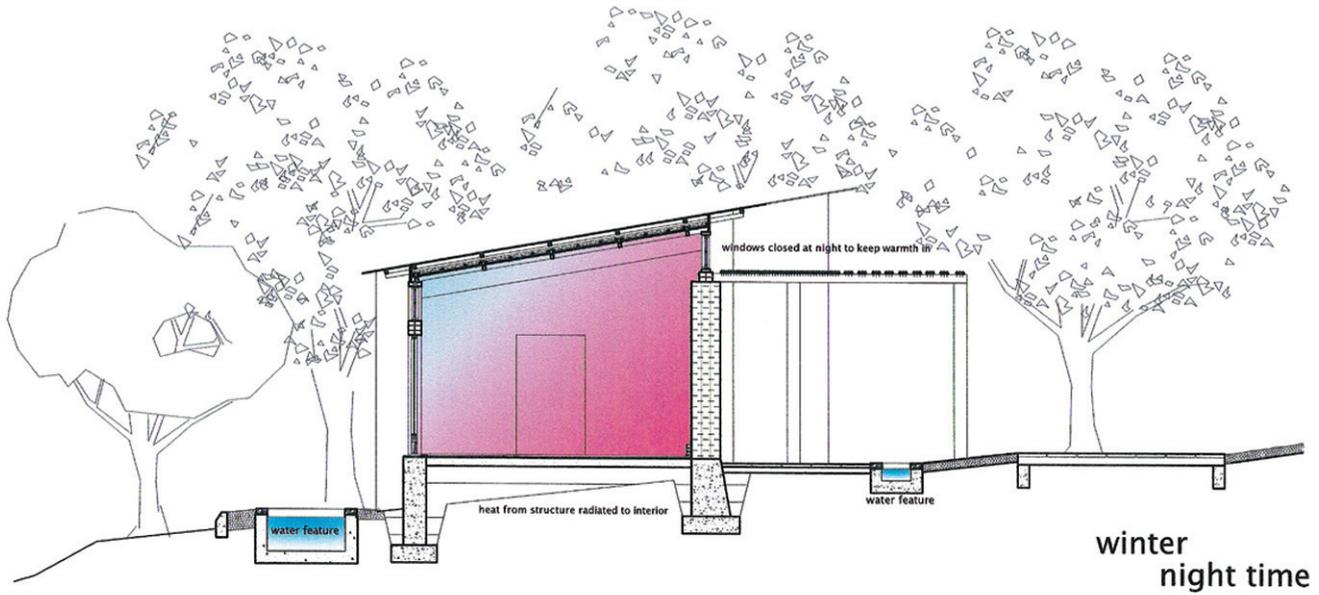
In areas where evaporative cooling is not used, air passes over cool shaded surfaces before being drawn into the building



summer night time



on very cold days passive heating is supplemented with electric space heaters in smaller rooms and fires in fire places in the dining room, lounge etc



5.3.2 Ventilation

Natural ventilation is necessary to provide fresh air, to provide movement for connective and evapoartive cooling from the human body and to dissipate heat from the building. The prevailing winds on site are from the NE and NW. The wind effects on site are modified by the microclimate. The ridge to the north of the site and the tall trees deflect unwanted breezes, creating wind shadows and calm areas. The trees and other vegetation further help to cool down areas and provide shade

In a passive building, air flows due to the stack effect and wind pressure on the surfaces. Pressure differentials at openings cause air flow through rooms. Multiple openings are positioned to allow maximum cross-ventilation. The shape and orientation of openings are positioned to align with prevailing breezes. The narrow footprints of all the buildings allows for cross ventilation to be achieved easily. Maximum room depths of 12m are found in the main dining areas, with other facilities having an average room depth of 7m. Most openings can be easily opened or closed by users. Windows located close to roof level are used in many rooms to induce the stack effect and expel stale air.

In summer air flow is maximised to keep temperatures down. Ventilation is achieved by passive means, through open windows and gaps under doors. Windows located near roof level allow stale and warm air to escape. In winter ventilation is kept to a minimum to prevent cold air from flushing out rooms.

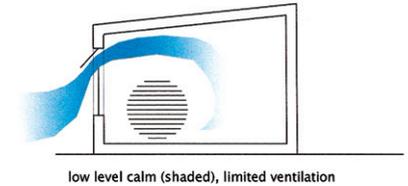
Good ventilation is necessary to avoid condensation. Extractor fans are used in areas where moisture is likely such as bathrooms and kitchens. This is important be keep rammed earth walls from absorbing moisture and disintegrating.

5.3.3 Lighting

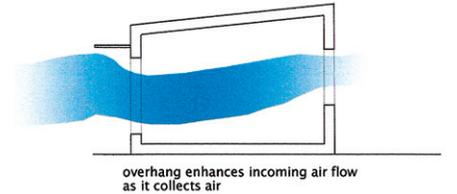
The north-south orientation of the buildings allows for natural lighting into most rooms. Areas where natural lighting may need to be supplemented with electrical lighting are kitchens, store rooms and the ablutions. Sufficient window area is provided in other rooms to allow a good level of natural light into rooms. Southern light is maximised and northern light controlled to prevent excessive heat gain and glare. In studios glass curtain walls allow maximum light penetration. These glass facades are located on the southern side of buildings. Where large glass openings are located on the northern side of a building a timber trellis is used to shade the glass. The openings for light and ventilation take advantage of the views on site, and integrate the user into the landscape, even when indoors.

Electrical lighting can account for the largest single primary energy load in buildings, thus natural lighting can make significant energy savings.

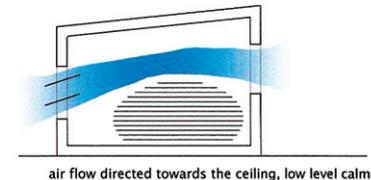
Building depths are limited to allow for natural lighting. windows are positioned so that there is an even distribution of light. High level windows give good daylight penetration, and are used in most rooms along with other openings.



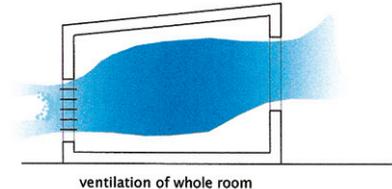
low level calm (shaded), limited ventilation



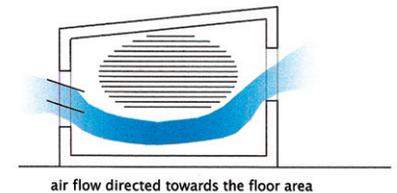
overhang enhances incoming air flow as it collects air



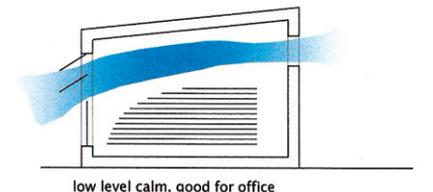
air flow directed towards the ceiling, low level calm



ventilation of whole room



air flow directed towards the floor area



low level calm, good for office

5.4 Services

Services are accommodated in skirting boards and run along the top of the wall into service ducts as making grooves into earth walls to accommodate services must be avoided. Switches and sockets are fixed to the timber ducts and skirting boards.

Plumbing and pipe work is centralised, and integrated into the floor to the maximum extent. Where soil water pipes pass through the wall, a 220 burnt brick wall is used. The walls in the bathrooms and kitchens near water fittings are protected from water damage with splash backs. Floor drains are provided in bathrooms and kitchens.

5.4.1 Water

Water is a visible feature of the site in the form of a stream and constructed water features. These form important elements for healing and the aesthetics of the site. Water features on site draw water directly from the stream, and redeposit it there. This water flows due to gravity, and does not need to be supplemented by pumps. In dry seasons, filtered grey water can be pumped into water features when the stream level is low.

Water is a precious resource that must be conserved and re-used where possible. Water is obtained from a municipal connection, as well as by means of a bore-hole. Rain water harvesting is ideal, but due to the layout of the buildings and small roof areas this becomes impractical. Water conservation is encouraged through the installation of dual-flush WC's and showers in the accommodation instead of baths. Water efficient fittings, appliances, washing machines, dishwashers etc, are used. Grey water from washing is filtered and reused to flush toilets and for irrigation.

Black water is disposed of on site. Septic tanks and French drains are used to break down the effluent, and return the liquid to the ground. The septic tanks and french drains are located a minimum of 50m away from the stream to prevent pollution.

5.4.2 Energy usage

Roof mounted solar panels are used to heat water to 60°. In kitchens and the hydrotherapy centre this will have to be supplemented with electrical water heating, due to the quantity of hot water used. Natural lighting is supplemented by electrical lighting at night and in areas with poor natural light levels. Energy efficient light fittings, appliances and equipment are used to keep energy expenditure low.

Electricity

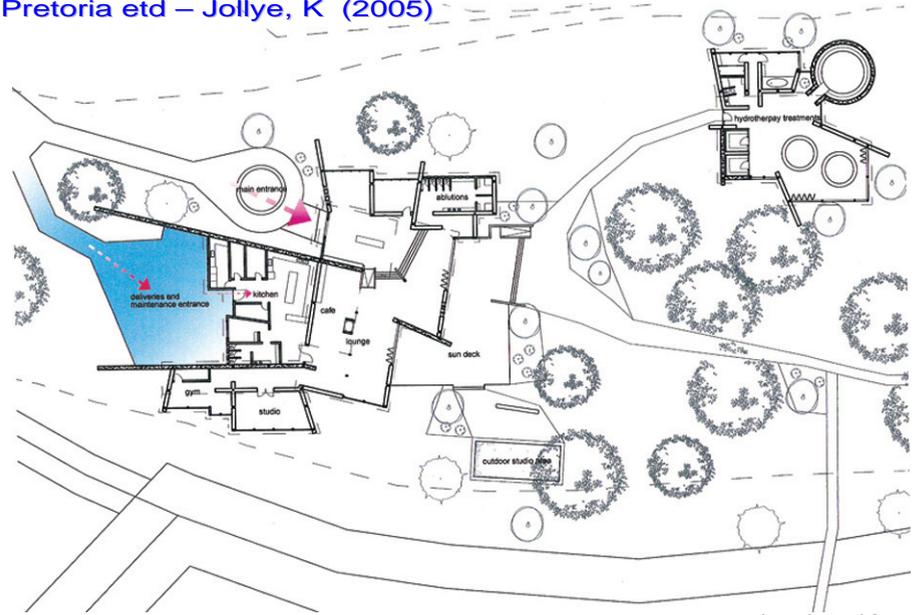
Cables to buildings may not be trenched with other cables or pipes, must be 500mm deep, backfill material must not contain sharp edged objects and should be marked with danger tape at a depth of 300-400mm. All buildings must have their own power supply cable, distribution boards and circuit breakers. Electrical equipment must be accessible for replacement, testing, examination, maintenance and repair, not be easily damaged, not gather dust or moisture on live parts and not be exposed to corrosion or heat and cold. Wiring is installed in plastic conduits, built into floors, in service ducts or on ceilings and must be properly supported if exposed.



5_11

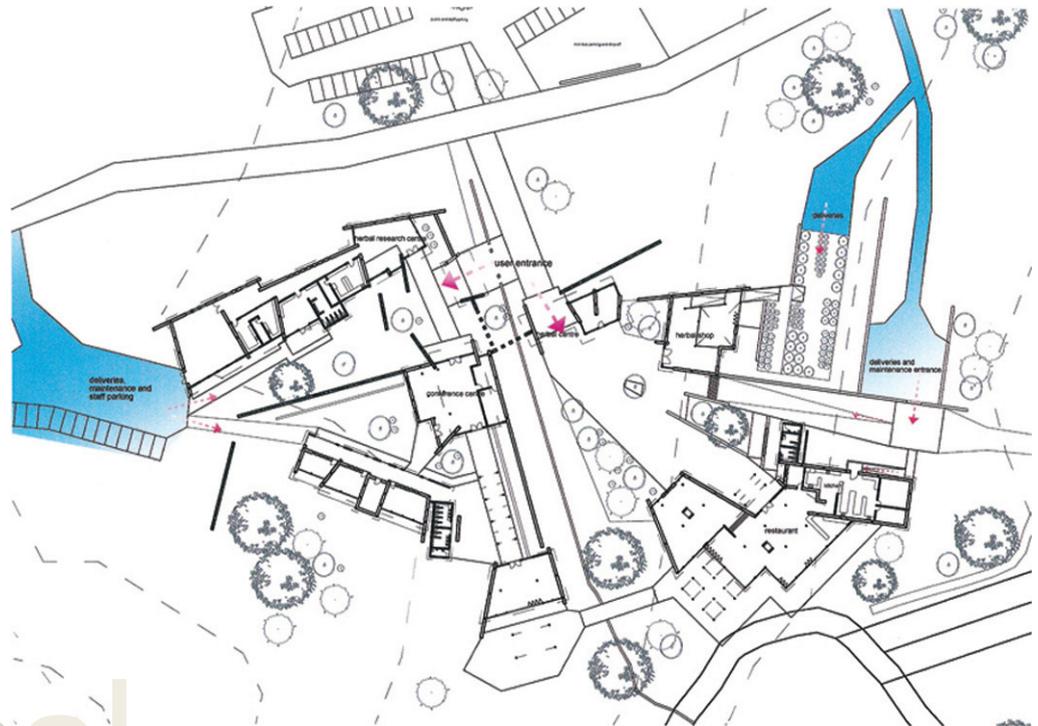
5.4.3 Maintenance

Separate services areas are provided that prevent maintenance and deliveries from interfering with the functioning of the building complex. The Healing Centre has a large parking and delivery area located next to the kitchen. Maintenance and repairs can be conducted from here without disturbing activities. The accommodation has a back road that allows maintenance and delivery vehicles up to the building, without disturbing users. The Spa has a service entrance located adjacent to the kitchen and staff facilities. The Herbal Centre has two delivery areas that service the restaurant, nursery and research laboratory. This prevents deliveries from being transported through main circulation and public areas.

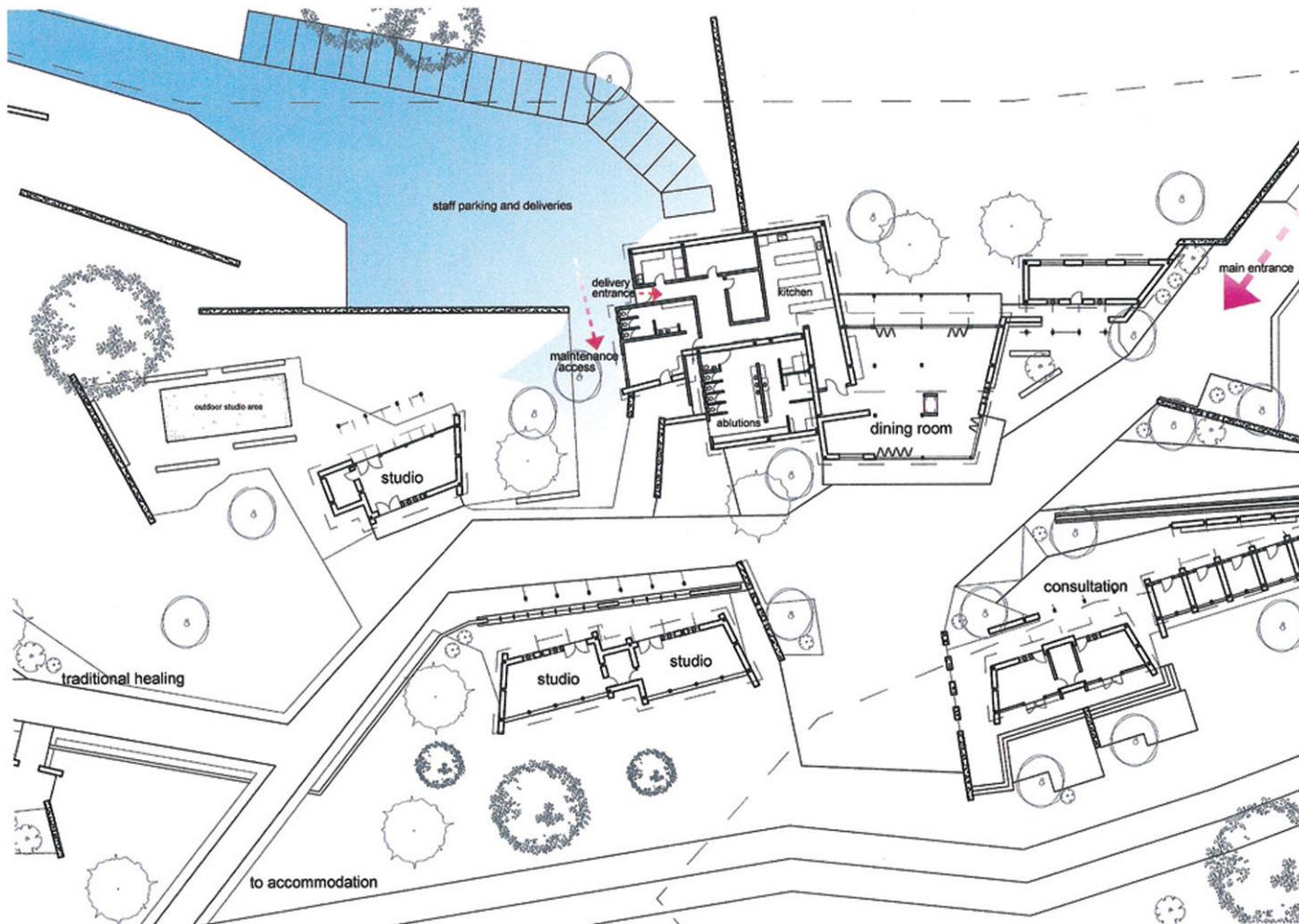


maintenance plan (spa) 5_12

Service ducts are fitted with removable timber panels that allow easy access for repairs and maintenance. Soil water pipes are positioned facing away from main areas, to hide maintenance operations.



maintenance plan (herbal centre) 5_13



maintenance plan (healing centre) 5_14

Key

- blue - main delivery and service area
- large red arrow - main user entrance

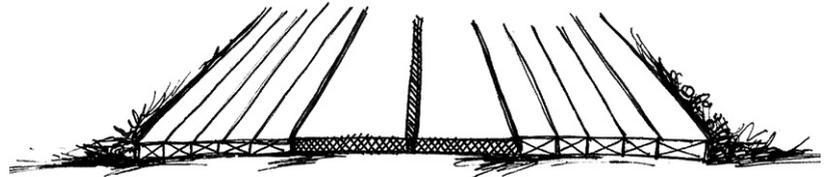
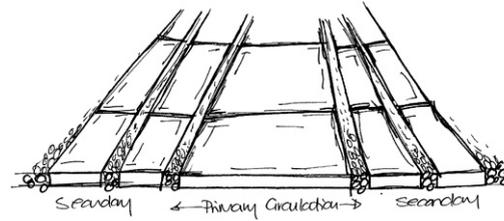
5.5 Landscaping

Landscaping is an important element on site, as the building complex is made up of a series of smaller buildings, connected through landscaping and outside areas. The landscape helps to protect against unwanted prevailing winds, using tall trees for wind deflection and to create a wind shadow. Prevailing winds are channelled and modified through landscaping. Deciduous trees are used to shade the structure to the north, to provide shaded outdoor living areas in summer and allow sun penetration in winter.

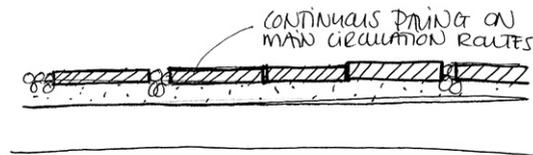
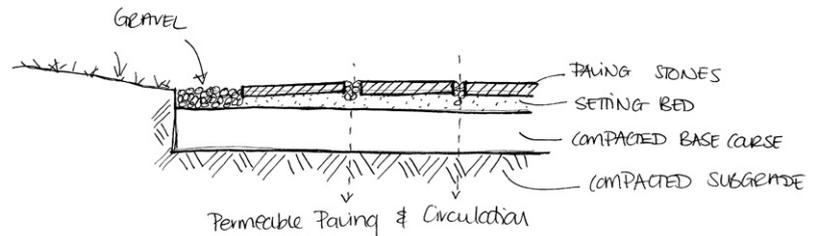
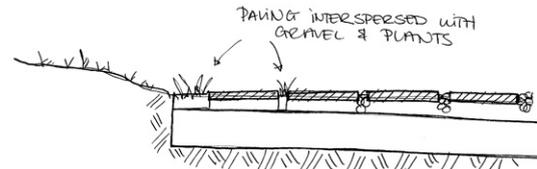
The landscaping cools down the environment in summer. Surface materials are used that do not store too much energy from the sun and create hot surfaces. This means that hard paving is only used where necessary, a permeable surface used else where. This also aids the prevention of excess water runoff during thunderstorms.

Circulation is emphasised by surface materials; where main circulation and secondary circulation routes have different surface textures. This adds to the quality of the environment. Main routes are continuously paved, while secondary circulation has paving in strips interspersed with gravel and small plants. Pathways in the landscape, such as those leading through the gardens to treatment rooms use timber surfaces. All pathways are wide enough and have a suitable surface so that they are wheelchair accessible.

Water features are used to create visual axes, emphasis threshold and features, as well as to some extent for their cooling and emotional qualities.



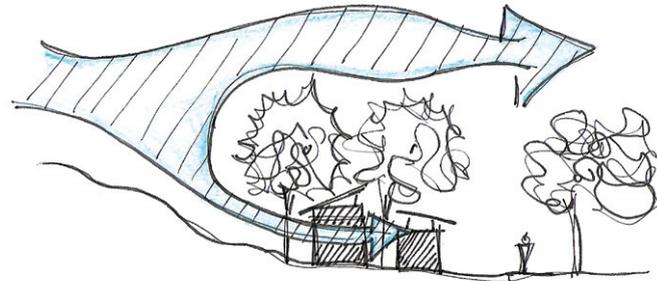
examples of circulation surfaces, concrete pavers and timber planks



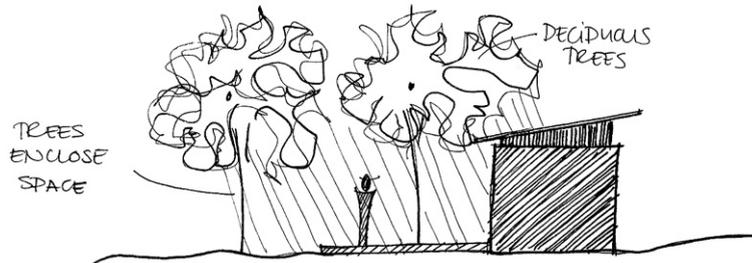
circulation surfaces 5_15



BUILDINGS CONNECTED THROUGH
LANDSCAPING & OUTSIDE AREAS



TREES DEFLECT WIND



TREES
ENCLOSE
SPACE

DECIDUOUS
TREES

WALKWAYS & NORTHERN FACADES OF
BUILDINGS SHADED IN SUMMER.

concepts 5_16



COMFORT ENHANCED THROUGH
EVAPORATIVE COOLING

evaporative cooling 5_17

5.6 Materials

5.6.1 Rammed earth

Soil

Soil used in rammed earth walls is available in virtually unlimited quantities almost everywhere (McHenry 1984:47). Ideally soil used in earth construction must contain four elements: coarse sand or aggregate (23%), fine sand (30%), silt (32%) and clay (15%) (McHenry 1984:48). The aggregate provides strength; the fine sand is a filler to lock the grains of aggregate, and the silt and clay act as a binder to glue the other ingredients together. To determine the soil quality on site simple field tests can be conducted. The durability and waterproof qualities of the wall are dependant on the clay content, which is ideally 15-18%. The soil on site consists of the following:

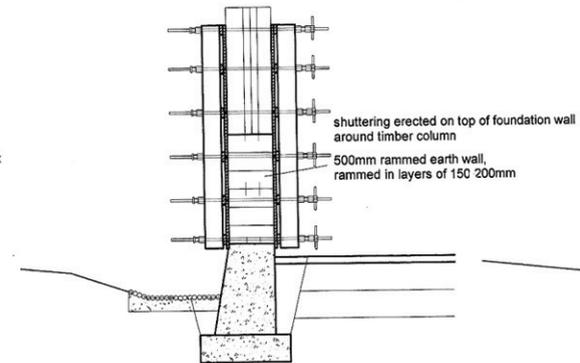
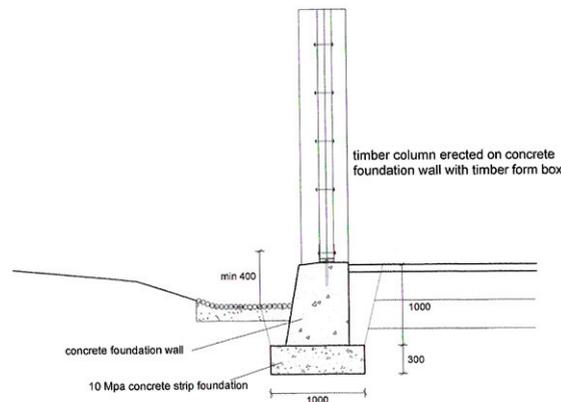
1. Red structured sandy loam / sandy clay loam, eutrophic on rock with rock outcrops.
2. Deep (1200+mm) dark grey moderate / weak structured clay, on grey hydromorphic clay, calcareous.
3. Brownish / grey structureless loam sand on sandstone or quartzite outcrops.
4. Moderate deep (600-1200mm) yellow brown apedal sandy loam / sandy clay loam, mesotrophic on soft plinthite.

The soil found on site must be mixed to the correct quality for rammed earth walls.

Soil from a ground source frequently has adequate moisture for its use directly in rammed earth walls. The soil should be damp but not wet. Stabilising agents such as Portland cement or lime may be added to the soil source to provide ultimate moisture proofing or additional strength qualities. 5% Portland cement is added to the soil on site.

Stability

Earth construction has good compressive strength, but poor tensile strength. For thermal mass properties a wall thickness of 25-60cm is advised (McHenry 1984:105). The rammed earth construction is used as non-load bearing infill panels, with a timber frame construction making up the structural element. For a 500mm thick wall a wall height of 4 - 7.5m is acceptable.



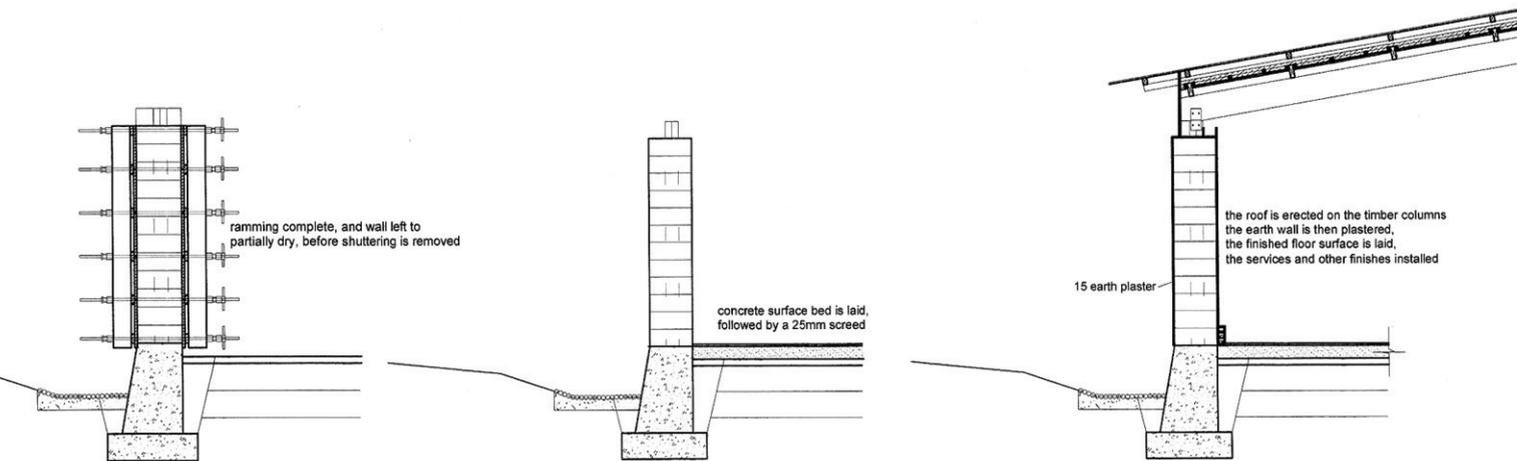
Foundations

All strip foundations and foundation walls are constructed out of 10Mpa concrete. Footing sizes under earth walls are 1000x300. Strip foundations under interior and exterior 220 brick walls are 600x200. Foundation walls are the same thickness as the walls they support. Foundations walls and footings are constructed from reinforced concrete. Foundation walls are waterproof below grade, and strong enough in compressive strength to support the weight of the wall and other expected loads. A waterproof DPC is placed between the top of the concrete foundation wall and the rammed earth wall. Drainage, capillary rise, planting, standing water and water splash back is addressed in foundation design. The top of the base layer wall is at least 400mm above ground level to prevent moisture problems. Foundation walls are slanted away from the wall to aid runoff. In addition a concrete swale will remove water from the wall swiftly.

Formwork, filling and compaction

A simple plywood and brading formwork system is used, with clamps to hold the form in place. Special attention must be paid to corners, ends and openings when form work is being used.

When the form work is securely in place, the cavity is filled by hand, with a shovel or bucket, or by mechanical equipment. The earth is placed in depths of 150-200mm before compaction. The compaction is done by hand or mechanical means. When the wall is compacted and the forms removed, the wall is stable enough for further construction, but the corners and surface are fragile. Full curing will occur after several months to years, depending on climatic conditions.



rammed earth construction method

5_18

Openings

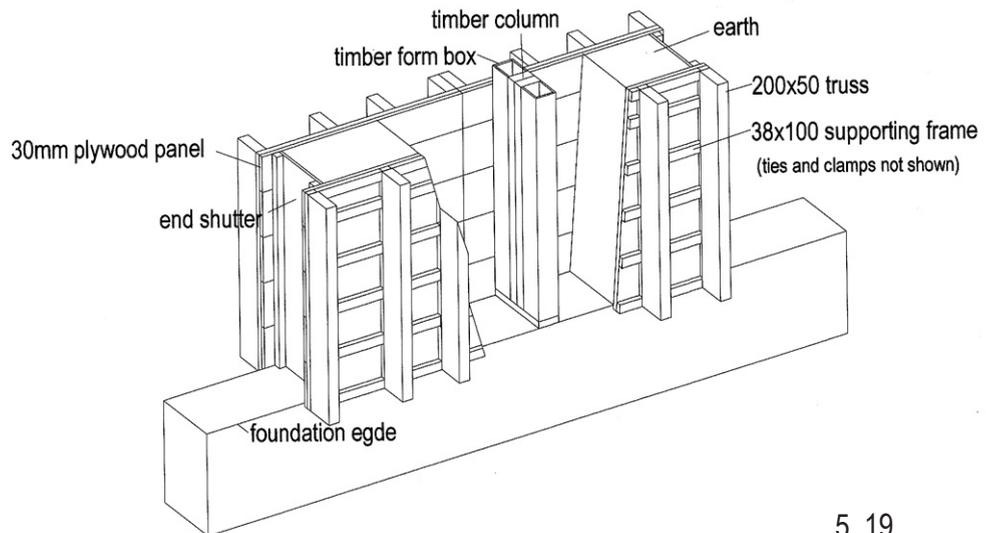
Openings can weaken the structure of a wall. To prevent this overall length of openings does not exceed 35% of the length of the wall. For openings wider than 1,2m lintels are used with 250mm deep anchorage in the wall. Lintels are as wide as the wall and made up from 25x225 softwood timber planks placed above the opening.

100x38 softwood timber rough frames are used as anchoring devices for window and door frames. The rough frames are installed as the wall is rammed, and secured to the earth walls with galvanised ties. A rough frame provides easy door frame and window attachment at any point along the frame. Drip grooves must be provided on all window heads, and on sills.

The rammed earth walls are not built up to roof height. The top of the wall stops short of the roof, and tongue and groove timber planks are used to bridge the gap. In some rooms windows are placed in the void between the wall and the roof.

Roofs

To prevent rainwater from damaging the wall the roof overhang is 500mm. Roof construction is made up of a 100x300 laminate softwood beam at maximum 4500mm centres. The beam is bolted to the top of the timber columns by means of a 1,2mm galvanised mild steel bracket. A 50x150 softwood timber purlin is nailed to the beam, with a 50x76 timber common rafter and 50x76 softwood timber purlin laid at right angles. A 0.6mm galvanised steel, S-profile roof sheeting, laid at a 10° slope, and is fixed to the purlins with 65mm galvanised steel roof screws. 22mm tongue and groove ceiling boards are nailed to the common rafters with 38x38 brandering. A 75mm mineral fibre insulation layer is laid in the roof cavity to enhance desired thermal conditions.



5_19

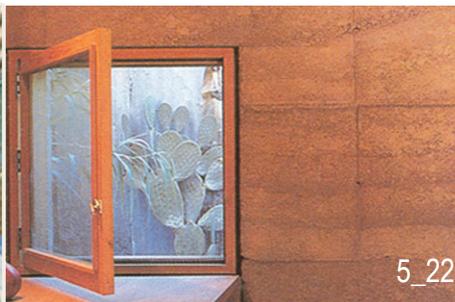
Floors

Concrete surface beds must be minimum 100mm thick, of 10Mpa minimum strength concrete, on suitable ground fill compacted in layers of 300mm. The surface bed must be cast on a 0,25mm polyethylene damp proof membrane. Because the floor slab is cast continuously over the full building area, it should be reinforced against shrinkage, cracking, a two-way mesh with a steel area of 0,15% of the cross-section area of the concrete (e.g. 200x200x4mm). The mesh should be placed 20-30mm from the top of the slab. The floor should be finished smooth, ready for the laying of the floor finish. A 25mm trowelled cement screed and tiles or 22 timber tongue and groove flooring is laid on top of the surface bed. 45mm concrete floors are laid directly on the surface bed.

Earth floors, when properly finished and sealed, are reasonably waterproof. The substrate must be properly compacted, and the plaster mixture laid in several thin layers approximately 5cm thick. The soil mixture should be slightly higher in clay than the wall mixture, with enough water added to mix thoroughly and provide a trowelable consistency. Minimum floor thickness is 10cm. The surface is sealed with an oil varnish waterproofing material. Earth floors are not suitable for high traffic areas and are used only in the traditional healing compound.

Renders

A suitable render must be used depending on climate, and internal conditions of the building. Using an incorrect render may lead to render damage or deterioration, and so result in water infiltration into the wall, wall weakening due to attack by micro-organisms and plants, rain and wind erosion of the wall structure. Cement slurry is made up of 2-3 volumes of sandy or clayey soil mixed with 1 volume of cement, diluted with water is used to seal the wall surface. Coats are brushed on in at least two coats 24 hours apart. Colouring (mineral oxides) and water repellents (2% calcium stearin) can be added.



5.6.2 Timber

Timber is a commonly used building material. Advantages of timber construction is that wood is an organic, non-toxic material using up less energy and causing less pollution than any other construction material during production; new trees are planted in place of those that have been felled; waste wood is efficiently used for fibre board and paper; wood is biodegradable; wood has a great strength-to-weight ratio and is easily worked; wood is light to transport and handle, cheaper foundations can be used; wood construction can easily be knocked down and re-erected.

Disadvantages are that commercial forests use large quantities of water causing water tables to drop; untreated wood has a limited life span, even treated wood weathers and must be regularly protected with paint, varnish and/or water repellent agents (2002:3 Build, timber frame buildings, University of Pretoria).

Timber has high moisture movement, but little thermal movement. All timber members need to be protected against moisture and adequate ventilation to prevent decay. External timber columns are treated with preservative and water a repellent. Only dried wood, with a moisture content below 15% is used. Sites are well drained and free of termite infestation. Timber columns and base plates are separated from foundations by means of a damp proof course.

The earth walls provide lateral support for the timber columns. The timber columns are connected to the earth walls with 400x30x1,2 galvanised mild steel ties, 300mm deep at 500mm centres. Movement joints are not necessary as the earth contracts on drying leaving a small gap that will accommodate any expansion of the timber.



5_25



5_26



5_27



5_28



5_29

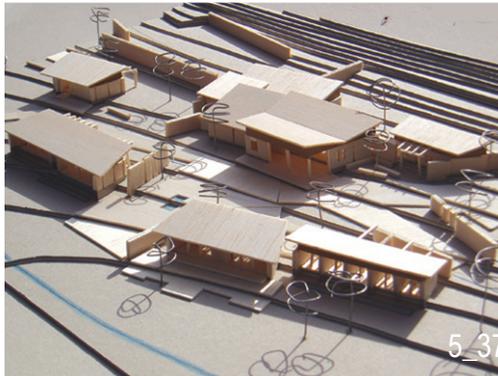
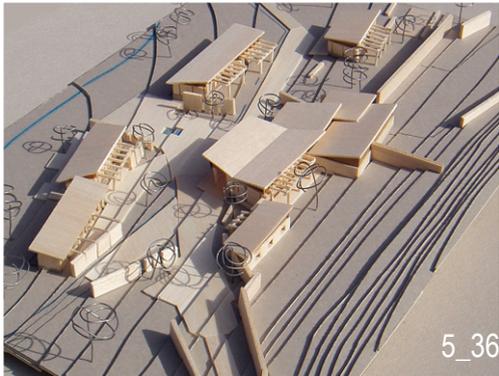


5_30

Foundations, walls and footings for the timber columns are shared with the rammed earth walls. The base plate between the foundation wall and the timber column provides a level surface, and a convenient fixing member for anchoring the column to the floor. This base is a 75mm thick, pressure treated softwood member. The base plate is fixed on a plastic damp course to the foundation wall by means of 8mm bolts. Timber columns are anchored to the base plate and foundation walls with galvanised steel angles and the bolts cast into the foundation walls.

Outdoor timber structures, walkways, decks, screens and fences are exposed to water, sun and soil. Proper preservation and surface treatment is necessary on these timber elements. The following precautions will prolong the life of an outdoor structure: prevent wood from being constantly in contact with wet soil; promote the shedding of water, by sloping and drainage; limit hard contact between parts where water can be caught; protect end grain with metal caps or nail plates; treat cuts and grill hole with preservative before assembly; joints must accommodate larger movement than is required indoors; improve stability of wood with water-repellent penetrating oil-preservative dressing; treat surfaces before assembly; metal shoes, plates, screws, bolts and other fixings should be of galvanised steel.





5.7 Technical Drawings

5.7.1 Main Drawings

1. Master plan 1:2500
2. Healing Centre plan 1:1000
3. Spa and Herbal Centre plan 1:1000
4. Section c & d1 1:250 (Healing Centre)
5. Section e & g 1:250 (Healing Centre)
6. Section k1 & k2 1:250 (Spa)
7. Section n & o 1:250 (Herbal Centre)
8. Detailed plan 1:250 (Healing Centre)
9. Section detail c 1:100 (Healing Centre)
10. Section detail d1 1:100 (Healing Centre)
11. Section detail d2 1:100 (Healing Centre)
12. Section detail e 1:100 (Healing Centre)
13. Section detail k1 1:100 (Spa)
14. Section detail o 1:100 (Herbal Centre)
15. Elevation 1:200 (Healing Centre)
16. Elevation 1:200 (Spa and Herbal Centre)

5.7.2 Supplementary Drawings

5.7.2 Supplementary Drawings

17. Section a & b 1:250 (Healing Centre)
18. Section f & m 1:250 (Healing Centre and Herbal Centre)
19. Section h & i 1:250 (Accommodation units)
20. Section p 1:250 (Herbal Centre)
21. Section j 1:250 (Spa)
22. Section l 1:250 (Spa)
23. Roof plan 1:500 (Healing Centre)
24. Detail (Timber column construction)
25. Detail (Service ducts)
26. Detail (Foundation)
27. Detail (Roof construction)
28. Detail (Roof edge and gutter)
29. Detail (Roof insulation)
30. Detail (Window and Door)
31. Detail (Timber trellis)