UNIVERSITEIT VAN PRETORIA
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6



DESIGN INVESTIGATION

6.1 DESIGN INVESTIGATION PHILOSOPHY

6.1.1 Social architecture

"We have built the tallest buildings, the longest expressway, the biggest cities; we have won the game but how did we feel inside, while we were doing it? Did we dance?"

George Leonard

Leonard sees life metaphorically as a game where we dance. (Kok, 1994: 14)

Glover reminds us that there are *"Certain people in the communities whom we have not allowed to join with us in the dance; who have not celebrated life, who have never really been allowed to play in the ultimate game, who have not experienced leisure."* (Kok, 1994: 14)

We are jerked into reality by the Finnish architect, Alvar Aalto, reminding us of social architecture and that responsible architects should design buildings that are of no harm to any user, nor should they be unsuitable for use by people. (Aalto, 1940: 15)

"*The only way to humanize architecture is to use methods which always are in combination of technical, physical and psychological phenomena, never any one of them above the other.*" (Ventre, 1997:11)

How did it happen that we cast our disabled from society and turned our backs on them? Micheline Mason and Richard Rieser outline the argument that show that the original model for dealing with disabilities was a religious one. In terms of this model, the disability was seen as a punishment for evil or the incarnation of evil and that people with disabilities had to be cast out or were subjected to the "casting out of demons". (Holmes-Siedle, 1996: 4)

To this end, through theories like the "social model" and "medical model" (See Appendices 9.3), society has developed its social conscience regarding people with disabilities. It is therefore commonly held that it is the responsibility of society at large to now incorporate people with disabilities into normal life.

Similarly, approximately 15 to 20 years ago scientists started warning us of global warming and the destruction of our planet with our continued "post-World War II" grand scale planning, high energy consumption and urban sprawl.

The Kyoto Protocol of 1997 heralded the turning point of this "Modernist" thinking.

6.1.2 The modernist view

The modernist view was driven by rational thinking based on sound engineering principles. It thereby promoted certain concepts of design and space, ignoring social differences while claiming to be inclusive. Its neutral stand claiming standardization, de-contextualism and a homogeneous public contradicted its claim to inclusiveness as it negated the needs of the disabled.

The modernist movement also did not recognize the limitation of geographic space, energy and natural resources. It concentrated on architecture being an artistic expression (viz. Notre Dame du Haut by Le Corbusier is not used as a church as intended, but a tourist attraction costing €2.00 per visitor). It was therefore a visual art and not a social expression of human needs, this being a problem as buildings are supposed to answer to human needs. This begs the question: "If the power of art lies in its visual perception, does the power of architecture lie in its ability to answer a human sensory need?"

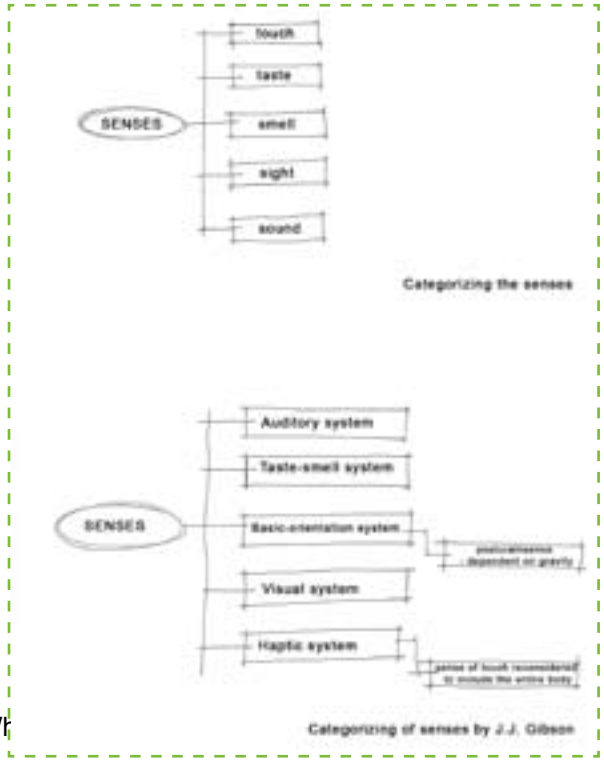
6.1.3 Sensory perception

Papanek states that: "…*architecture has to be experienced by all the senses, rather than just sight. The visual image may provide us with pictorial information, yet beauty is never skin deep*." (Papanek, 1995:76)

Benjamin Mayer lends further clarity by stating that: "*It would appear that today it is designers who are in fact blind, since for them the visual of their work appears so evident that this prevents them from seeing the essential relation which the visual has with non-visual*". (Mayer, 1997:24).

From this we become more aware to plan for our senses.

Synesthesia (the use of senses) sets out to allow us to enjoy an environment through senses that we would necessarily associate with particular information inherent to us which gives confidence. J.J. Gibson characterizes senses as an active detecting system, constantly seeking out information from the environment (Bloomer & Moore, 1997:27). He produced a new compact inventory of senses focusing on the types of environmental information the body receives, instead of the variety of sensory apparatus and responses of the body.



Categorizing the senses

Categorizing of senses by J.J. Gibson

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stimulus in order to gain a better understanding of the source of stimulation. This mobilized orientation involves a total body balance. Total body balance is enabled by our constant knowledge of ground-level due to gravitational pull, making us constantly aware of our postural sense of up and down. Gibson calls this our basic-orientation system.

"A man standing on the earth normally has several sorts of cues available to him, all indicating the direction of the gravitational vertical. These cues can be subdivided into three main classes: visual – from the alignment of planets, buildings and other objects; vestibular – from the sensory canals of the inner ear; kinesthetic – from the pressure and joint receptors in various parts of the body" (Jones, 1994:14).

6.1.4 Orientation

Our senses are used to orientate us within our surroundings.
"We touch, listen and measure the world with our entire bodily existence and the experiential world becomes organized and articulated around the center of the body" (Pallasma, 1996:45).

Kevin Lynch states that *"A good environment image gives its possessor an important sense of ambitional security."* (Lynch, 1983:7)

A sense of security can be experienced when one can easily orientate oneself in the environment, by easily accessing and memorising the environmental image.

People with physical disabilities have a constant fear of the environment. This is created by the inaccessibility of the environment. Environments are often designed in such a way that the disabled use and experience it in a totally different way than able-bodied people. The use of back doors and separate facilities, for example, can create an orientational confusion. The function of a place or space must be accentuated and designed in such a way that the users, being able-bodied or disabled, can orientate themselves in the same manner.

Each individual functions within the community, in a time-space environment, with relative favourable circumstances. Existing constraints can be overcome by executing a choice, which leads to a specific activity pattern, as Thrift explains:
"How time is used is intimately bound up with human physical mental needs, the constraints of the built-environment and accepted societal time tables. Thus each human being traces an ***activity pattern in time and space*** *which uses time and space as resources."* (Thrift, 1977:413)

Wheelchair users and other physically disabled persons cannot always overcome constraints through the execution of a choice. They are trapped within an unfriendly built-environment that does not always provide them with a choice, wanting to escape the constraints that time and space play on their reaction pattern.

Ching wrote: *"Since we move in time through a sequence of space, we experience a space in relation to where we've been, and where we anticipate going."* (Ching, 1942:246). Fundamentally, the physical manifestation of architecture accommodates ***human activity***. However, the arrangement and organisation of the elements of form and space will determine how architecture might promote endeavours, elicit responses, and communicate meaning (Ching, 1942:10).

To communicate meaning in the built-environment, one should be able to orientate and identify with a place. A user must develop a meaningful hold on a specific place, which will enable him/her to truly dwell (Bloomer & Moore, 1997:27).

According to Vischer, a place that consists of different elements has a specific identity which triggers different emotions, giving the user a sense of place and empathy (Bloomer & Moore, 1997:27).

Christiaan Norberg-Schultz believes that *'Place is part of existence'*, meaning that it is difficult to imagine any experience without an association with a specific place. He also states that by *'inhabiting'* a landscape, it becomes recognised and understood. People that inhabit the landscape in turn act as the '*guardians'* of that space and through interaction reveal the *essence of the place* (Quantrill & Webb, 1991:47).

6.1.5 Essence of places

Since the emergence or our species, humans have been making places and spaces. We have been designing them for 30 000 years, making us better at producing cheaper material things at a faster pace.

Advancements in science and technology have provided the knowledge and tools allowing us to shape our world in an utterly frantic way. According to Van Der Ryn (2005:7), *"…we have lost our ability to create places of beauty, comfort and durability that fit both the natural world and our own human nature."*

Architecture speaks about the culture from which it springs and manifests values, ideas, hopes and dreams. According to Van der Ryn (2005:7), architecture is:

"the human habitat, the environment of our own creation, the skin that separates us from the natural world.
It is also a sense of walls – mental and physical – that compartmentalize our perception of the world.
It does not have to be."

Sometime during the last century, architecture lost its soul. Modern culture with its wealth, power and technology created structures once deemed impossible, while the cold post-modern structures inspire a detached sense of awe and wonder. Very few appear to have qualities that truly move us. Beauty and spirit were once an integral part of cultures. When last have we been moved to tears by a building or did not want to leave a place because of the impact it had on us? We travel around the world to experience architecture, but we spend our lives in architecture that makes us feel empty.

Pallasmaa wrote in "The eye of the skin" that '*the authenticity of architectural experience is grouted in the tectonic language of building and comprehensibility of act of construction to the senses'* (Pallasmaa, 1996:43). Spatial qualities are contained in sensations.

Our buildings, our suburbs and our cities are lifeless and cold; disconnected from people. They are uninspiring.

"To inspire is to breathe life into"
(Van der Ryn, 2005:7).

We need to make the buildings of our everyday lives fit our deepest human needs. We can design environments that inspire and nourish our souls.

Buildings and cities must be reconnected to the cycles and flows of the natural world that are the basis for all life on earth. We are still designing and building as though resources are unlimited, without regard to the waste and pollution caused by construction and function of the building as well as designing selfishly, only for able-bodied persons.

Humans are rapidly changing the planet and creating a "handicapped" environment.
Today no place and no ecology on earth are untouched by the consequences of human activities.

Architecture together with urban design can become integrated into the web of life, its cycles and flows. Louis Sullivan, a great 19th Century architect stated that *"form follows function"*, while it is interesting to note that Sim van der Ryn stated that *"form follows flow"*.

Both these views were carefully taken into consideration while designing the ***In-vocational Training Centre***, where a symbiosis of the two must be reached. The Centre must fulfil the practical and functional needs of the disabled as well as fulfil its environmental duties. The building, at its best, can be a physical and environmental enabling product, or at its worst, a handicapping product.

Buildings are not static objects, but organisms. Cities are not mechanical assemblies, but ecosystems (Van der Ryn, 2005:8).

Buildings can become more integrated with nature through ecological design. In the same sense humans can become more integrated with the built-environment by means of inclusive design. In both cases *attitudinal* challenges must be overcome. Nature can live without humans, but humans cannot live without nature. Architecture can make this truth transparent and allow us to experience it at a deep transforming level.

Not enough attention is given to the cost of operating and maintaining poorly designed buildings. This cost, over the lifespan of a building, is four times greater than its initial cost (Van der Ryn, 2005:8). We do not give enough thought to how to design buildings that can adapt and change. We must begin to think about these consequences.

How often have 'expense' and 'fire hazard' been used to sanction the denial of equality to disabled people? There will naturally be expense involved in implementing change.

Buildings need to be made "whole" through commonsense design intelligence that incorporates life-enhancing technologies. Our dominant world view of a mechanical clockwork universe of the machine must be shifted to the intricate interconnected web-like order that underlies the living world at all scales.

What does this shift mean for design and architecture? How can design truly reflect the intricacy, complexity, beauty, consideration and dynamic qualities of the living world?

As Mahatma Gandhi said:
"We must be the change we want to see."
This is the essence of actively living with hope.

6.2 ORIENTATION AND IDENTIFICATION

6.2.1 Orientation

The following are components of orientation:

- Landmarks
- Clues
- Compass direction
- Measurements
- In- and outdoor numbering systems

6.2.2 Landmarks

Landmarks can be any familiar object, sound, odour, temperature or tactile clue that is easily recognised and known within a permanent location.

The following are landmarks in the site context:

a) The Union Buildings to the east
b) The Taxi Rank
c) The Pretoria Zoo
d) The Engen garage on the corner of Boom and Bloed Streets

- **Implementation:**

The building is designed around a central courtyard, becoming the landmark of the building.

6.2.3 Clues

Clues are sensory stimuli determining a person's position or direction.

- **Implementation:**

The handrails, fragrant plants and textural differences in floor surfaces of the building direct a person through it.

6.2.4 Compass direction

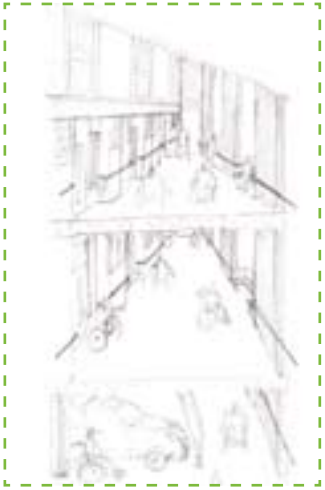
- **Implementation:**

The shape of the building, with its straight internal passages, makes it easy for people to direct themselves within the building. It is easy to direct a new visitor to for example the recreation area from the entrance (e.g. keep straight down the passage past the cafeteria, turn 90˚ right after the stairs, pass the ramp and apartments, turn 90˚ into the recreation area.)

6.2.5 Measurements

- **Implementation:**

Doors are placed at constant intervals in the training facility and accommodation block. This helps to orientate people, especially people with visual disabilities.



6.2.6 Identification

According to Christiaan Norberg-Schultz, identification means to experience a 'total' environment as meaningful. He states that by 'inhabiting' a landscape, it becomes recognised and understood. People that inhabit the landscape in turn act as the 'guardians' of the space and through interaction reveal the essence of the place (Quantrill and Webb, 1991:47).

- **Implementation:**

By designing the building according to inclusive design principles, the 'total' environment will be able to be experienced as meaningful. The building is designed to create interaction between the users of the building. This is created by "spatial pockets" along corridors, where socializing can take place.

6.3 FORM

6.3.1 The form of the Centre

The form of the Centre is determined by:

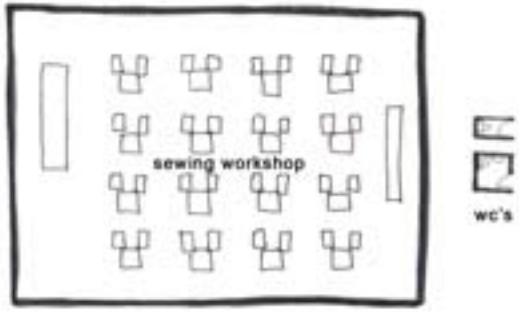
a) Influence of the context
b) Spatial requirements of each space within the Centre
c) Organisation of different spaces

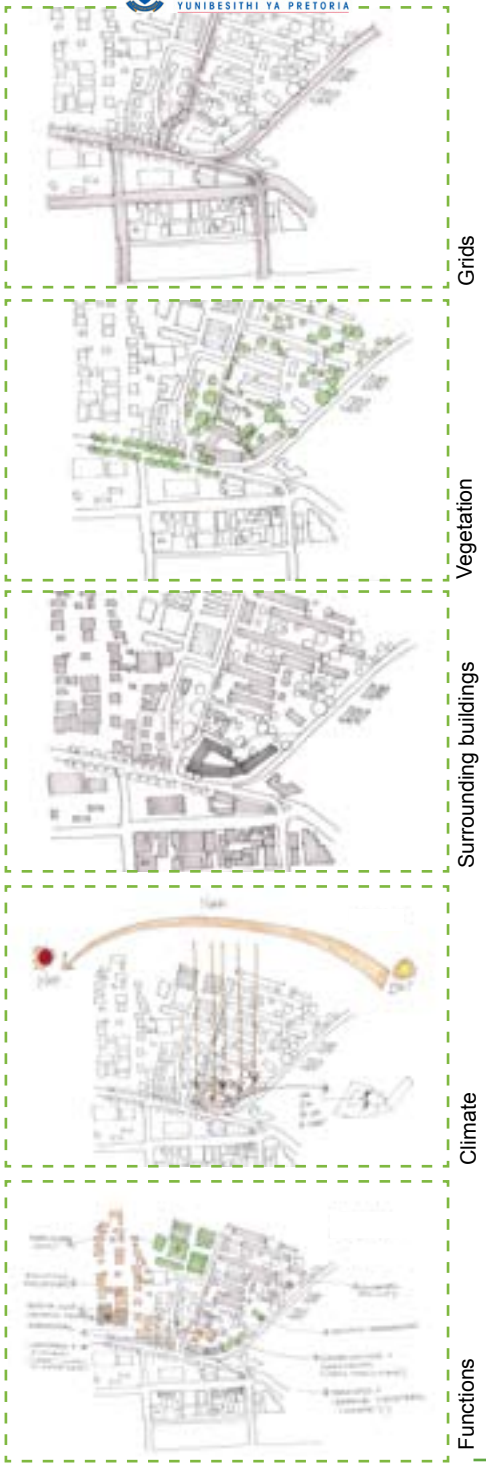
a) Influence of the context

- Grids
- Vegetation
- Surrounding buildings' orientation and shape
- Streetscape
- Climate (sun angles and wind)
- Function

b) Spatial requirements of each space within the Centre

Each space has its own function, and conversely the function or activity that each space accommodates will influence its spatial requirements. All the individual spaces together influence the form of the building.





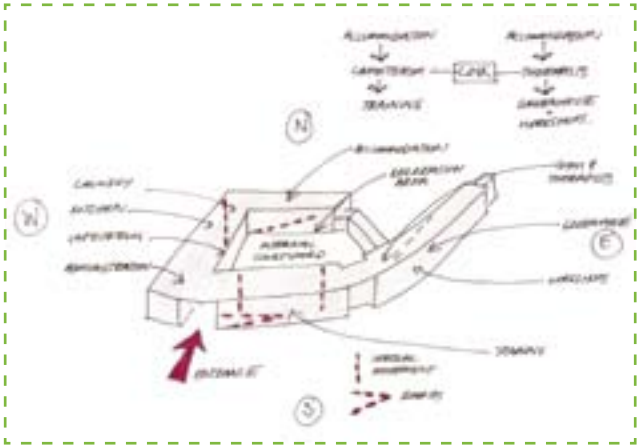
c) Organisation of different spaces

- **Privacy hierarchy:**

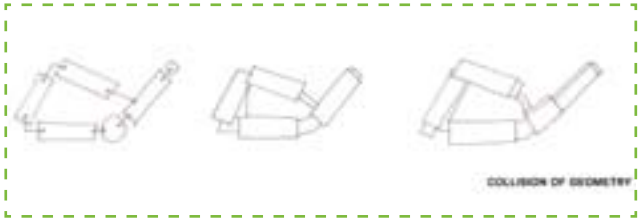
Spaces are arranged according to their privacy levels.

- **Function:**

Spaces are organised in relation to their function. Spaces related to accommodation (e.g. laundry, recreation room, lounge and apartments) are organised together. Training facilities are grouped close to the administration area, whereas the workshops and greenhouse are placed to the eastern side of the building. The building is linked by means of a cafeteria, used by both occupants of the accommodation block as well as trainees from the training facility.



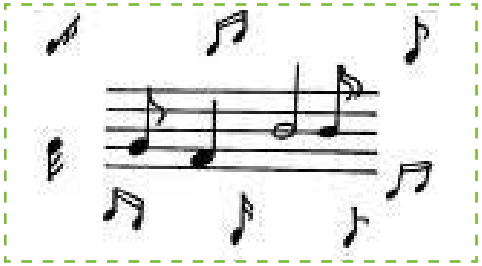
6.4 FORMAL COLLISION OF GEOMETRY



6.5. DATUM

Datum line: "the horizontal base-line from which heights and depths are measured."
(Chambers, 1972)

The lines of a music staff serve as a datum for reading notes and the related pitches of their tones.



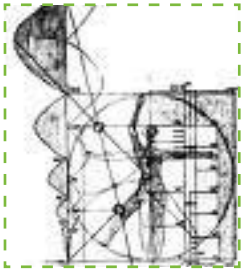
Vasily Kandinsky stated that the straight line in the artwork is the element that gives the artwork order.

Boom Street and Soutpansberg Road serve as the datum line for the shape of the Centre.

6.6 ORDERING PRINCIPLES

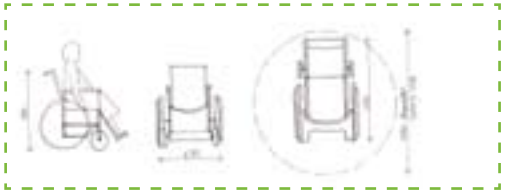
- **Anthropomorphic proportions:**

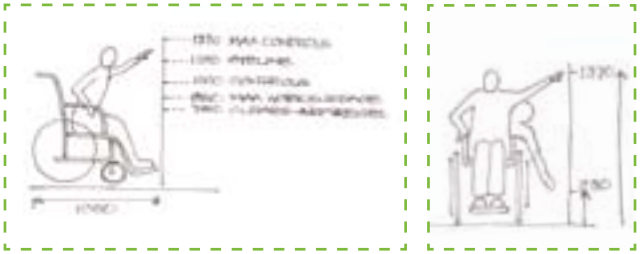
Le Corbusier created a proportional system based on the fact that the average height of a man standing with his arm raised would be 2.2 metres.



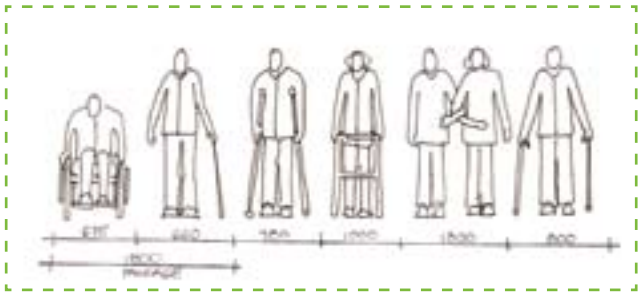
The *In-Vocational Training Centre* is adapted to the proportional system of the average height of a person seated in a wheelchair.

Dimensions and proportions of the human body are used as guidelines. All the volumes of space required for activity, movement and rest are based on the dimensions of the human body and the turning circle diameter of a wheelchair.



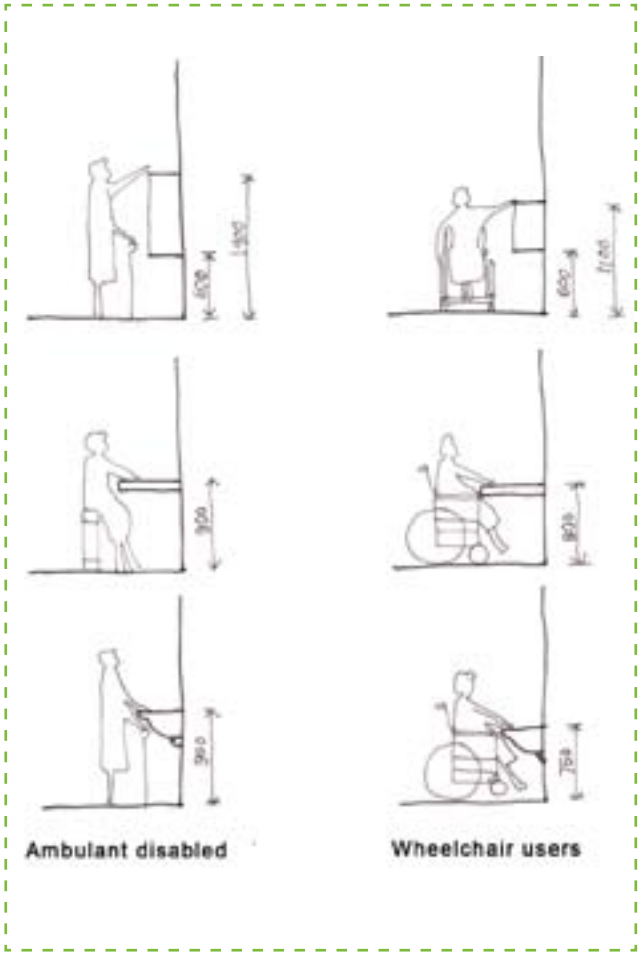


PASSAGES: determined by width and sizes needed for physical disabled people to pass each other (wheelchair users).



HANDRAILS: form and sizes are determined by the size of the average human hand and the height and distance a person can easily reach. The grip of the handrail must also be considered, because many physically disabled people can not grip their hands.

HEIGHT: different heights are needed for ambulant disabled and wheelchair users.



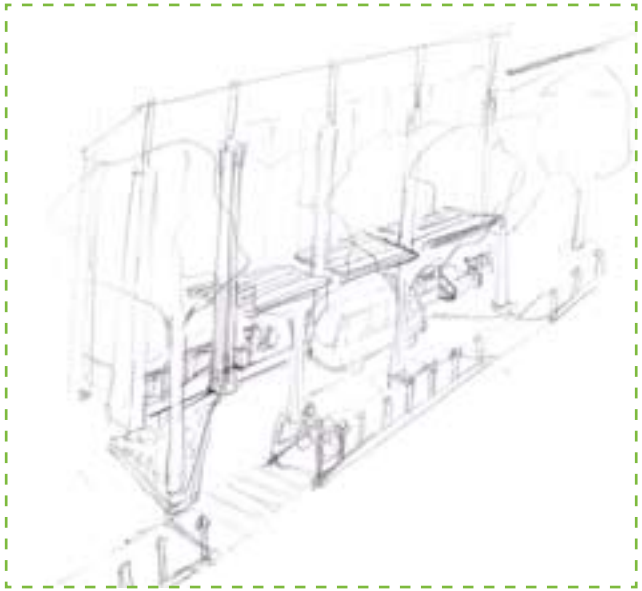
6.7 CIRCULATION

6.7.1 The approach

The building's approach varies, depending on the direction and distance of the onlooker from the building. The building is also experienced at different levels or heights, as wheelchair users experience different sensations of place and space. The building will be experienced from the sidewalk next to the Centre, from across the road (the taxi rank), from the Prinshof School and as far as Du Toit Street. Each view will create a different emotion.

The building will also be experienced as a quiet building, hugging the street edge. The street façade comprises vertical columns placed at different intervals, creating a rhythmic effect. Passers-by will experience the rhythm at different intervals when "exiting" the inner city.

The drop-off area is defined by bollards, different paving, a lowered canopy roof and a raised platform. Zebra-crossings will be needed where the drop-off zone crosses the sidewalk. Benches are provided for waiting. Handrails lead the visitor down a ramp and into the foyer of the building, from where he/she can orientate him/herself.



6.7.2 The entrance

The entrance is level with the sidewalk, making it easily accessible for wheelchair users. A recessed entrance is designed, creating a sheltered atmosphere. Because of this, a portion of the exterior space reads as part of the Centre.

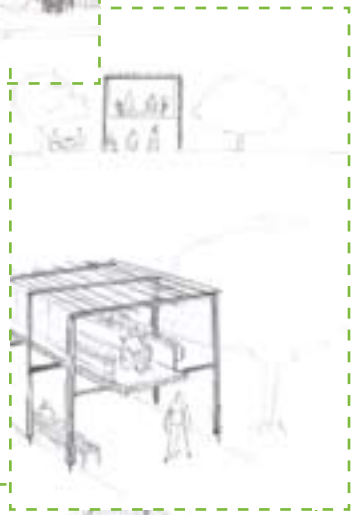
On approaching the building a person passes a water pool, creating a calm, relaxed atmosphere in a busy urban environment. The pool has a sensory effect -- not only does it help orientate a person by its sound, but also has a visual effect by reflecting the building.

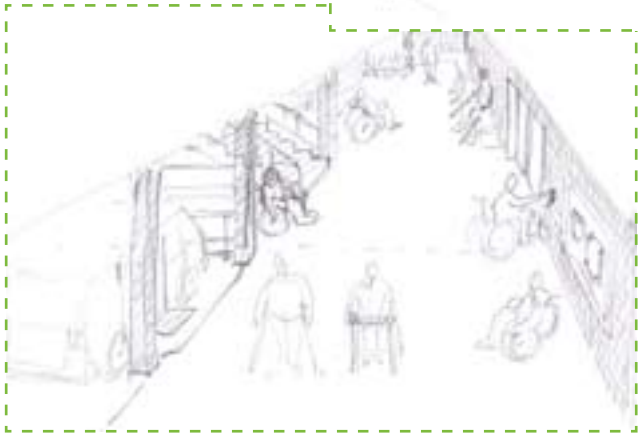
6.7.3 The path

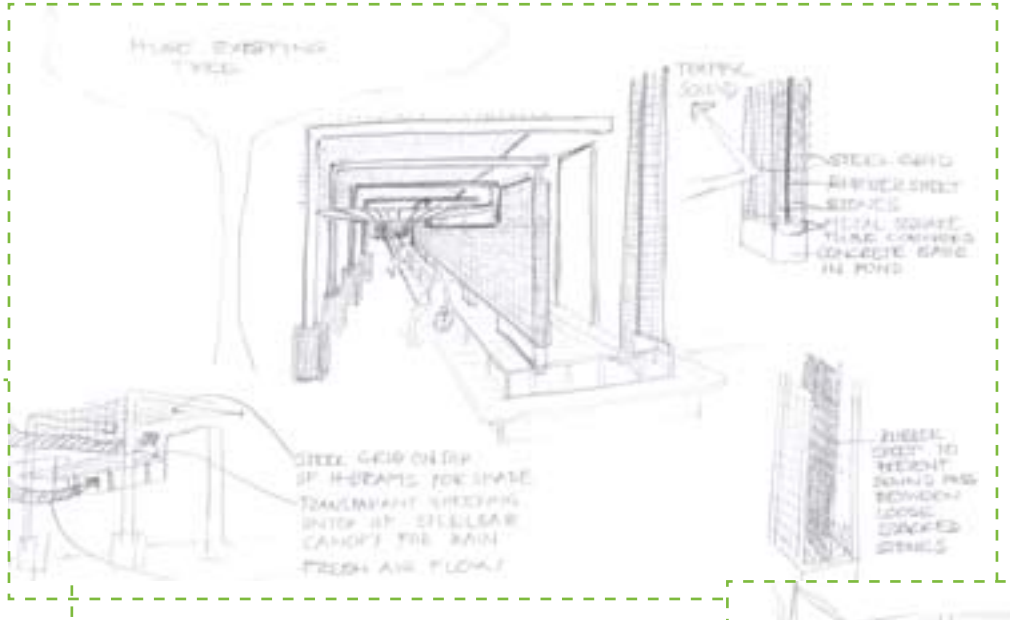
After entering the building, a choice of two directional pathways can be taken. One leads to the cafeteria and accommodation and the other leads to the training halls, workshops and greenhouse.

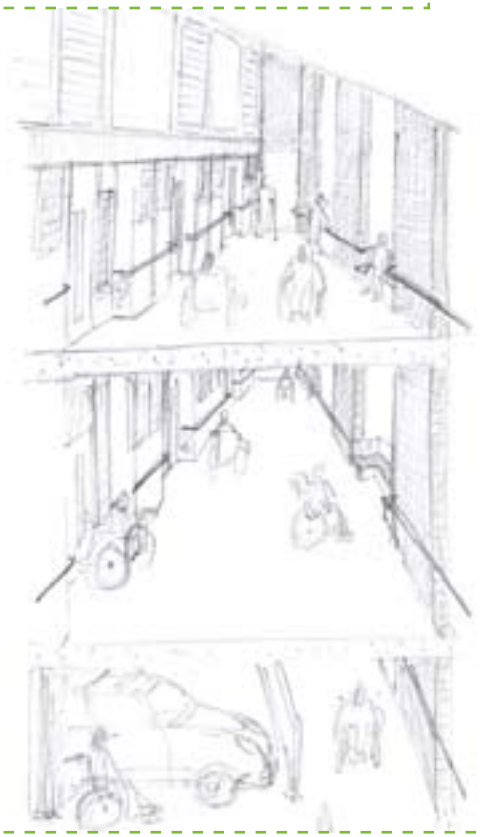
By means of a handrail and differently textured, non-slip floor surfaces, a person is lead through the building.

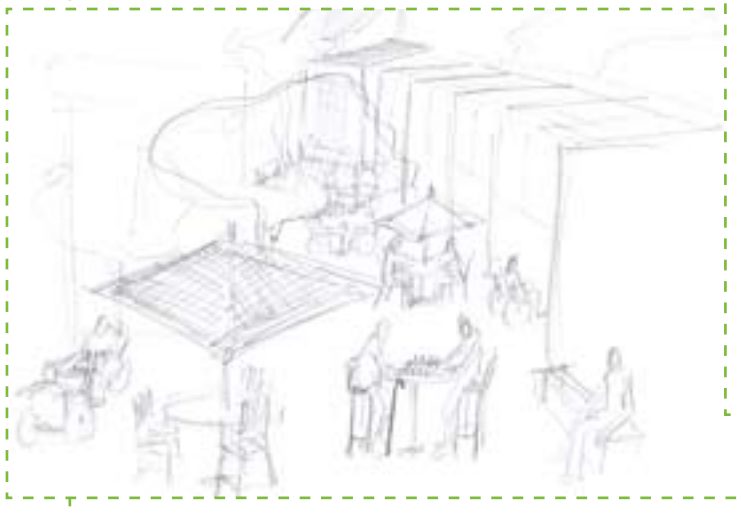
The path has to be easily accessed, as well as being large enough for wheelchair users to manoeuvre in. Wheelchair users prefer straight pathways without any obstacles or barriers. This had a great influence on the design. To accommodate the straight passages (but not have them deadly boring) an atrium was designed where different vantage points can be experienced from passages and balconies. To break the monotony of the long passages, walls are stepped forward and backward, creating individual spaces. Plants are used to soften the harshness of straight passages. This lends perspective and judgement of distance.











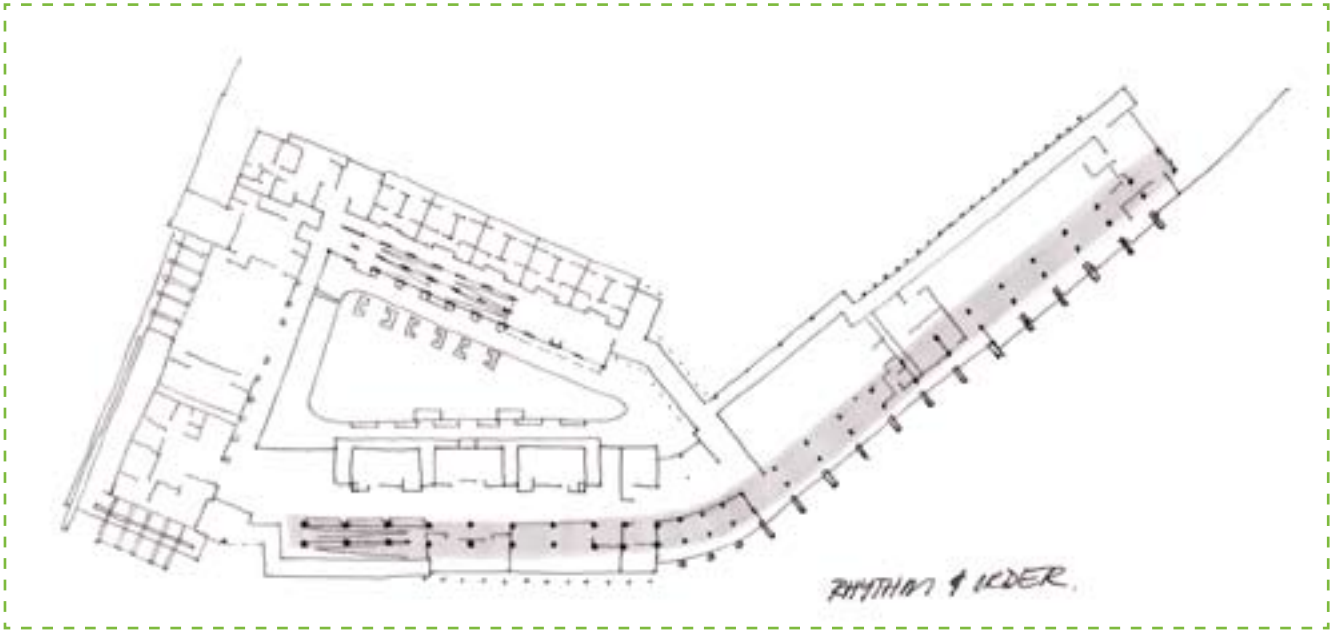
6.8 RHYTHM, ORDER AND TEXTURE

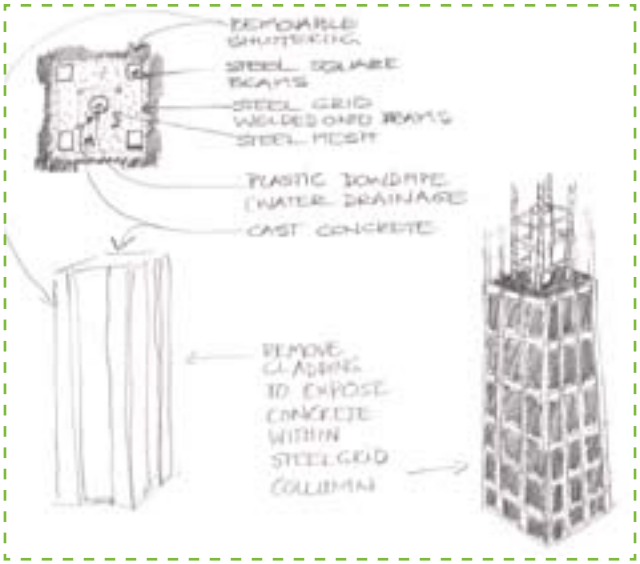
Visual richness is given to the design by different floor and wall finishes. The design started with a spine, in which the services are housed, running through the plan of the building. This developed into a three-dimensional, vertical, structural element with the following functions:

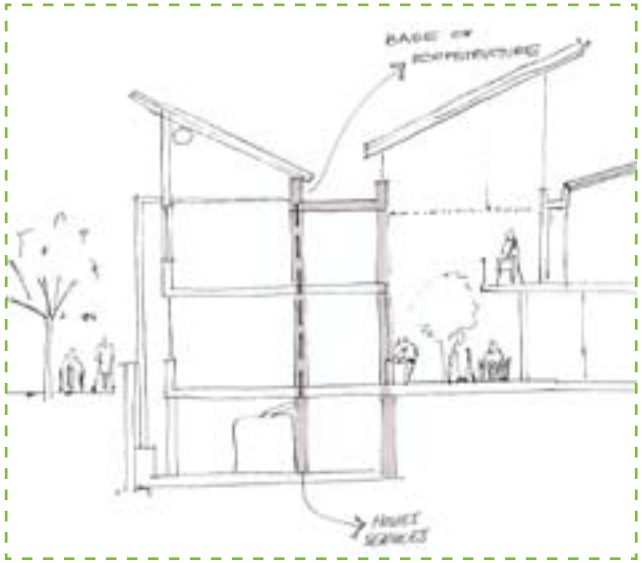
- The base of the roof structure
- Services are housed within the columns
- Vertical circulation (the ramp) is incorporated
- Creates order in the design
- Creates rhythm in the building `

"Space constantly encompasses our being. Through the volume of space, we move, see forms and objects, hear sounds, feel breezes, smell the fragrances of a flower garden in bloom. It is a material substance like wood or stone. Yet it is inherently formless. Its visual form, quality of light, dimensions and scale depend totally on its boundaries as defined by elements of form. As space begins to be captured, enclosed, moulded and organised by the elements of form, architecture comes into being." (Ching, 1989:108)

Architectural form, texture, material, light and shade modulation form part of the quality articulating space.







6.9 DESIGNING FOR PHYSICALLY DISABLED PEOPLE

6.9.1 Sidewalk

Dropped kerb:
An existing dropped kerb is provided next to Prinshof Street. Dropped kerbs can present a significant hazard to a wheelchair user. The waiting user is close to the edge of the pavement and is required to “hold” onto the gradient whilst waiting. For this reason the type of dropped kerb which uses a fall on either side of the crossing is preferred.

Textile surface:
Usually assists disabled people by indicating change of surface and level.

Raised kerb:
Located in front of entrance enabling wheelchair users to easily cross Boom Street.

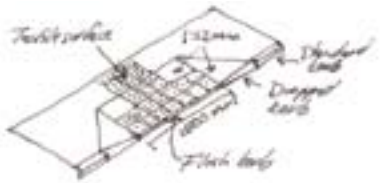
Seating/street furniture:
Located so that wheelchair users do not find it difficult to manoeuvre around obstructions and blind people can walk around safely without colliding with unexpected obstacles.

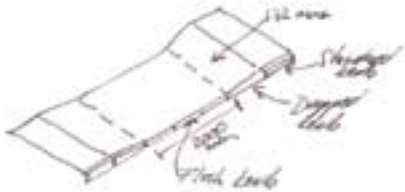
Bollards:
- Protect pedestrians from the vehicular traffic and prevent vehicles (especially all the taxis in the area) from parking on the pavement.
- Should be at waist rather than knee level (1 000 mm high) to prevent them from being a tripping hazard for visually disabled people.
- Should be of contrasting colour to the surrounding area with no horizontal projections on the bollards.

Lighting:
The route from the Centre to parking bays and transport routes should be clearly lit to improve the ability to navigate and the safety of users of the area.

Paving:
- Should be even, firm and well drained.
- Should have a non-slip surface in wet and dry conditions.
- Should avoid sudden or irregular changes in gradient and gaps more than 100 mm wide in the surface of the path.
- Angles at intersections should be splayed or rounded to make turning the corner easier for wheelchair users.

Channel gratings and manhole covers:
- Should have non-slip surfaces.
- Should be flush with pavement.
- Openings in gratings should be no larger than 13 mm in one direction.
- Gratings with elongated openings should be positioned with the long dimension perpendicular to the predominant direction of traffic.





6.9.2 Parking

Kerbside parking (on Prinshof Street):

- In-line parking bays should allow access to the rear of the vehicle where a wheelchair is stored.
- Spaces should be clearly marked at both high and ground level.
- Provide a ramp and dropped kerb access.
- Transfer zones should have yellow cross-hatch road markings.
- Dimensions:
  - Wheelchair users: 6 600 mm long x 3 600 mm wide
  - Ambulant users: 6 600 mm long x 3 000 mm wide
  - Transfer zone: 1 200 mm wide
- It is dangerous for wheelchair users to pass behind cars, therefore a transfer passageway must be provided at the front of the parking bay.

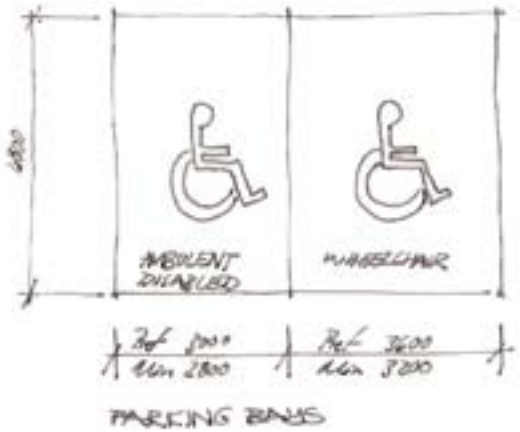
Residential parking:

- Should be as close as possible to accommodation.
- Ramp and lift is provided for vertical movement to apartments.

6.9.3 Public transport

Bus stop:

- Ambulant disabled tend to have great dependence on public transport.
- Bus stop is located next to the Centre.
- Sheltered seating is provided at different heights:
  - 450 mm for able-bodied persons
  - 900 mm for ambulant disabled (suitable for people with stiff hips)



6.9.4 Drop-off

- Raised platform for easy access of wheelchairs into taxis.
- Non-slip surface.
- Maintenance-free seating at different heights to accommodate ambulant disabled.
- A handrail leads people from drop-off area towards the entrance.
- Overall lighting provided as a safety measure.
- The glass façade separating the drop-off area from the ramp and interior space creates a visual link between the interior and exterior, contributing to safety.

6.9.5 Entrance

The route that a disabled person takes in getting into a building is extremely important. The treatment of the site of a building and the relative locations of the entrances, service entrances and points of arrival contribute to the ease of use of a building by disabled people.

Outside seating is provided in such a way as not to create an obstacle.

Automatic sliding doors assist disabled people and remove barriers to others. Sliding doors are preferred for high traffic entrances. Glazed areas should have tinted warning strips at 1 600 mm height to prevent accidental collisions.

Acoustics: The sound coming from the water pool at the entrance helps orientate the occupant and visitor.

Security/ Reception desk is strategically placed and easily identifiable by the general surroundings. Counter-tops should be either 800 mm high or have at least a 1 m long section at 800 mm high with a 500 mm deep x 750 mm high leg space below to allow wheelchair users to approach the counter either from the side or head on. Leg space should be provided at the front for the visitor and at the rear for the receptionist.

Information and labelling: Information boards indicate site plans and maps of the building to help orientate and divert visitors. All information should be printed in large print and lower case, in *sans serif* typeface, for example *Training.*

Light: Contrast in light levels between the outdoors, entrance and passages should be avoided. Large glass windows on the north and south prevent the entrance hall from becoming dark.

- Entrance hall: 200 lux
- Reception desk: 500 lux

Ventilation: Natural ventilation.

Electric: Plugs are located at the security/reception desk as well as in the waiting area.

Materials:

- Colour contrast helps with orientation and movement of occupants
- Reception desk must have rounded edges and corners
- Non-slip floor texture

Size: Large enough to accommodate heavy circulation through the hall. Occupants will pass through the hall, moving between the cafeteria, administration and training facilities. It has the possibility of becoming a gathering space.

6.9.6 Stairs

Ambulant disabled people prefer stairs to ramps.

Dimensions: Should ensure that they are of a shallow pitch

- Treads = minimum 320 mm
- Risers = maximum 145 mm (130 mm preferred)

Nosings:

- Should be splayed or rounded to at least 6 mm radius
- No overhang on the nosing to avoid tripping
- Contrasting colour
- Non-slip nosing

Handrails:

- 900 mm above tread level and 1 000 mm above landings
- On balustrades the bottom rails should prevent a 100 mm spherical object from passing between the treads and guarding

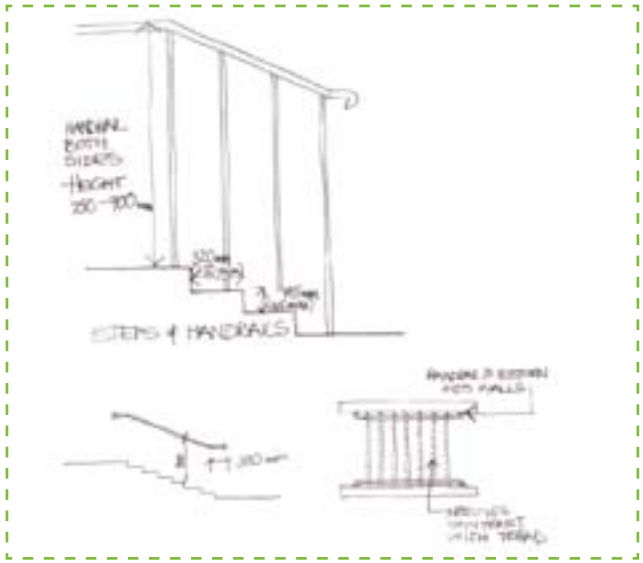
Light:

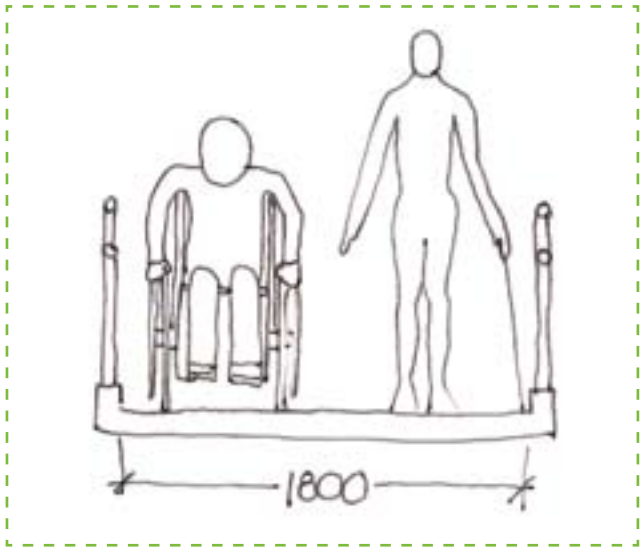
- Minimum: 75-100 lux
- For people with visual disability: 200 lux

Tactile warning strip: Before the beginning of a flight of stairs

Areas of refuge: Refuge area on stairwell indicates a clear fire escape route

Signage: Located consistently within the stairwell





6.9.7 Ramps

Gradient:

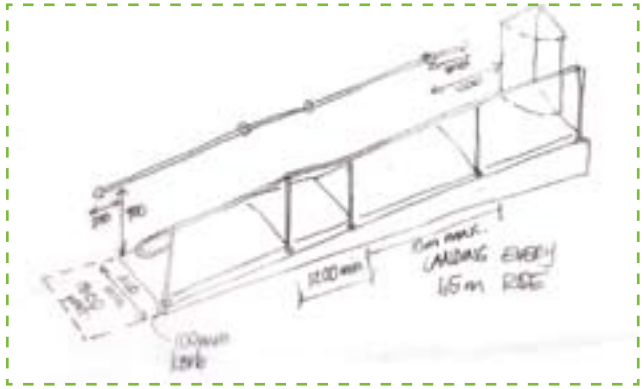
- 1:12 gradient with 9 m (or 1,5 m rise) resting intervals, used at main ramps
- 1:10 gradient used at drop-off ramp
- 1:8 gradient used at parking

Width: A ramp which is 1 800 mm wide allows two users to pass each other on the ramp.

Surface: Non-slip surface to be used.

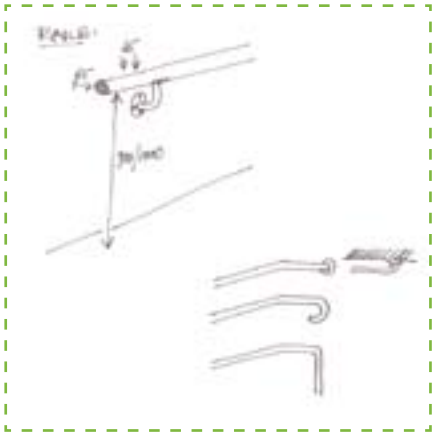
Cross-slopes: The exterior ramp in front of the greenhouse must be constructed to avoid pooling of water. Provide a cross-slope (1:50) across the width of the landings or provide drainage holes.

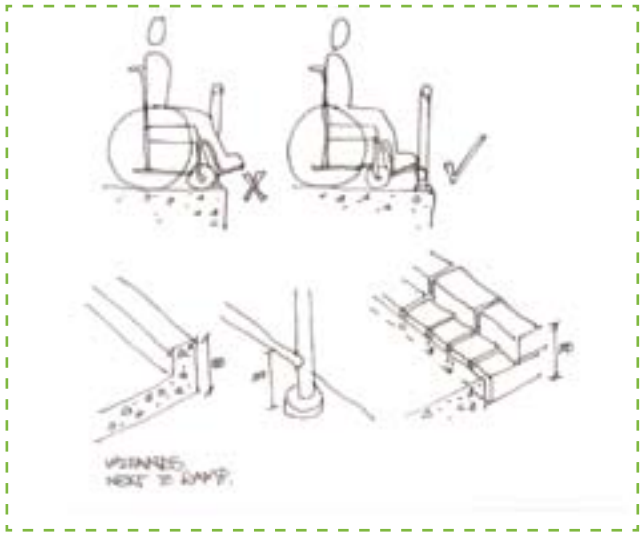
Light: Good illumination achieved by a combination of low-level directional light sources and high-level general or diffuse sources.



6.9.8 Handrails

- Should be easily gripped and supported
- Circular section handrails (40-50 mm outer diam)
- Powder-coated steel tube
- Contrasting colour/hue
- Minimum clearance of 45 mm between wall and handrail
- Continue around corners and across landings





6.9.9 Lifts

Control buttons:

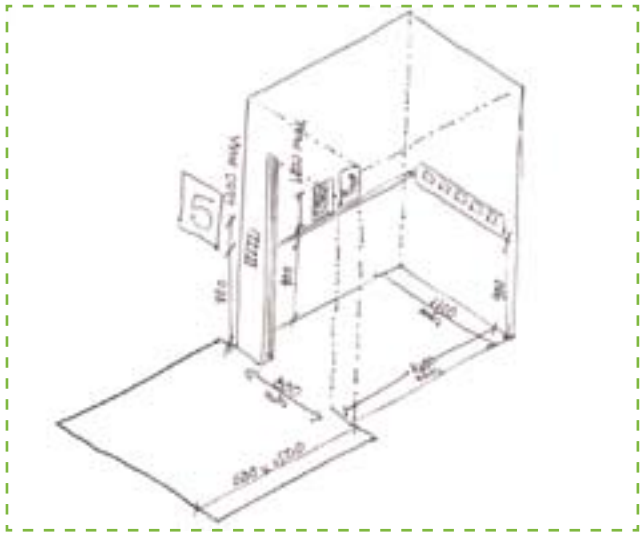
- Call buttons inside and outside the lift must be accessible and visible to wheelchair users
- Must contrast with the background and be engraved for blind persons

Doors: Opening time of 15 seconds is required or the installation of door sensors.

Light:

- 50-75 lux
- Diffused light source

Ventilation: According to suppliers specification.
Acoustics: Audible indication of level change and door closure should be used.



6.9.10 Signage and labelling

Information on signs:

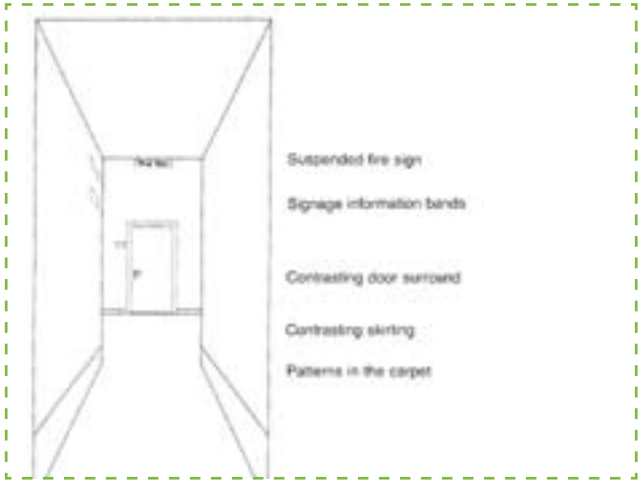
- Typeface should be legible -- lower case is easier to read
- Lettering should contrast signboards

Location:

- Signs should be part of the planning of the building or environment and not added later.
- Consistent sign location/placement bands should be established throughout the building.
- Tactile signs at accessible heights for standing people as well as wheelchair users = 1,15 m and at a forward distance of 0,5 m.
- Door signs: In the centre of the door or 25 mm away from the door at 1 600 mm height.
- Lift and stair floor signs: 100 mm high lettering indicating floor number.

Light levels:

- 100 and 300 lux depending on surrounding light level.
- Minimise glare with mat finishes.



6.9.11 Administration offices

These are located near the visitors' entrance.

Ventilation: Passive ventilation and evaporative cooling.

Light:
- 300 lux
- The western sun is screened.

Acoustics:
- Carpets dampen noise
- Double glazing towards street
- Sound of water can be heard if windows are opened towards the pools
- Stone and mesh wall reflects vehicular noise from the street
- All the spaces are designed to accommodate wheelchair users and a 1,5 m turning circle

Director:
- Convenient to staff and visitors
- Conference room for staff and board meetings is indicated near the director's office
- A waiting area and secretary accompany the director's office

Business manager:
- As the responsibility of the director and business manager is closely related the offices should be near each other
- It must also be close to accounting and clerical staff

Receptionist: Located at a point of control.

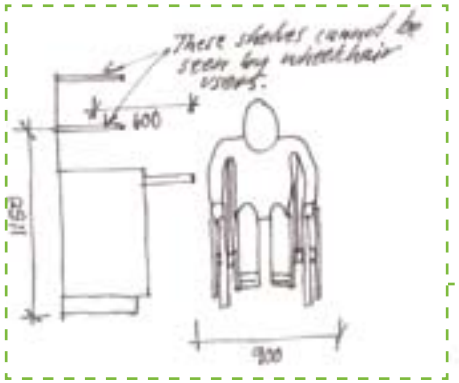
6.9.12 Cafeteria

Light: 100-300 lux

Ventilation: Passive ventilation

Acoustics:
- Sound of water, from outside pool, can have a calming effect
- Sounds from serving area help to orientate people

Other:
- Tables and chairs must be placed for easy passageway for wheelchair users (± 1,5 m passageway between tables)
- Round tables should have a central leg so as to create no obstruction for wheelchair users
- Hooks for walking sticks or canes must be provided
- Serving counter should be at reachable height for wheelchair users (800 mm)
- Sliding tray is:
  – 300 mm wide and the highest reach-over shelf no more than 1 150 mm
  – continuous to till with leg room available no less than 250 mm UFFL
- Where possible, food shall be displayed on a tray, so that this can be dragged forward to reach items at the back
- A clear corridor of 900 mm must be provided in front of the counter



6.9.13 Laundry

Light: 500 lux

Ventilation: Passive ventilation.

Acoustics: Noise made by the washing machines and dryers.

Movement in laundry: Spaces are designed with a 1,5 m wheelchair turning circle in mind.

6.9.14 Training halls

Light: 300 lux

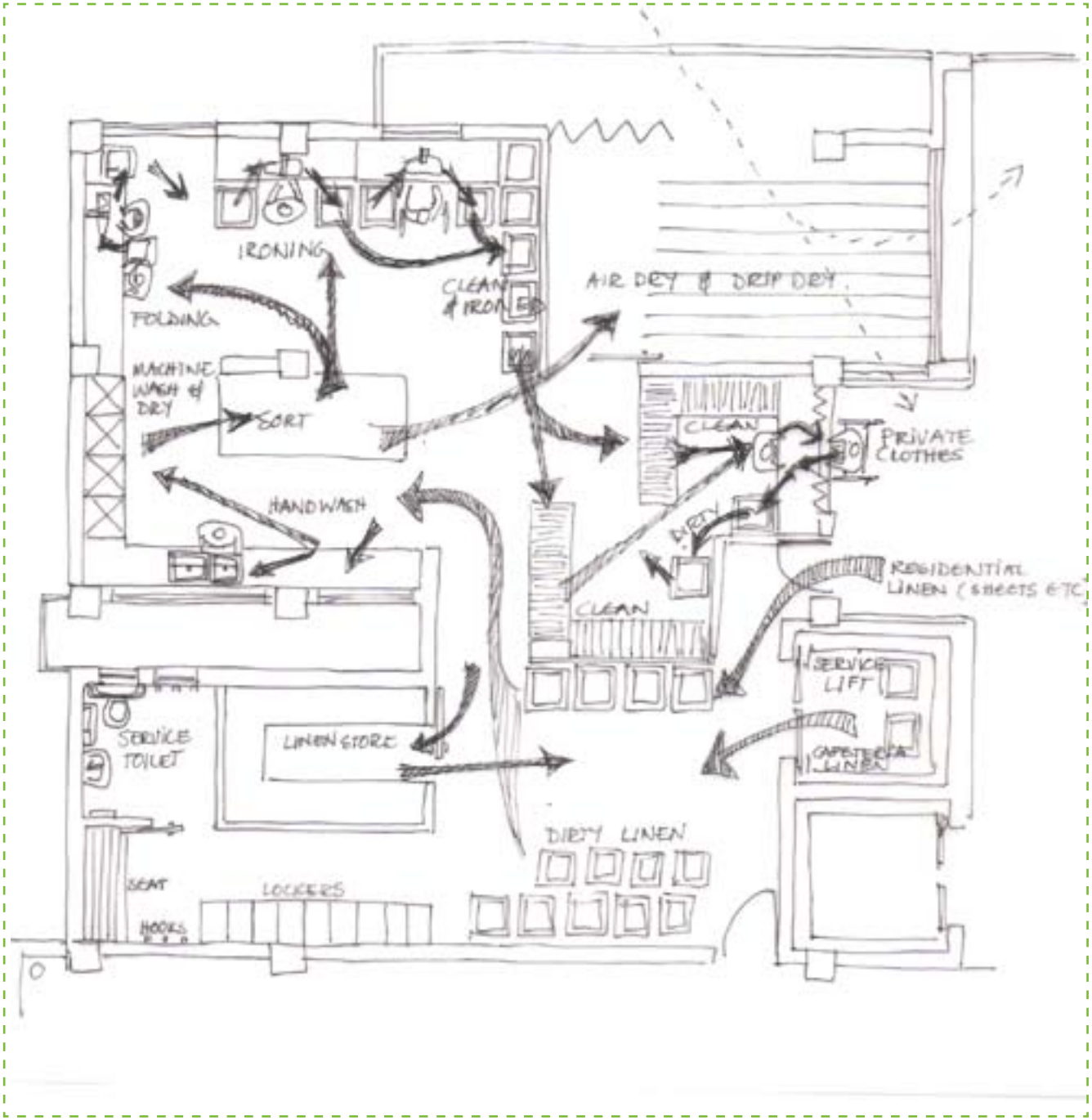
Ventilation: Passive cooling and evaporative cooling.

Electrical: Plugs and counters for the use of electrical equipment such as projectors, laptops and machinery.

Water: Each training room must be fitted with a sink (according to Mrs L Nel, job-coach of "*Building Tomorrow*").

Sizes:

- Small group/individual training rooms.
- Larger training halls where in-service training will take place.



6.9.15 Sewing workshop

Light: 300-500 lux

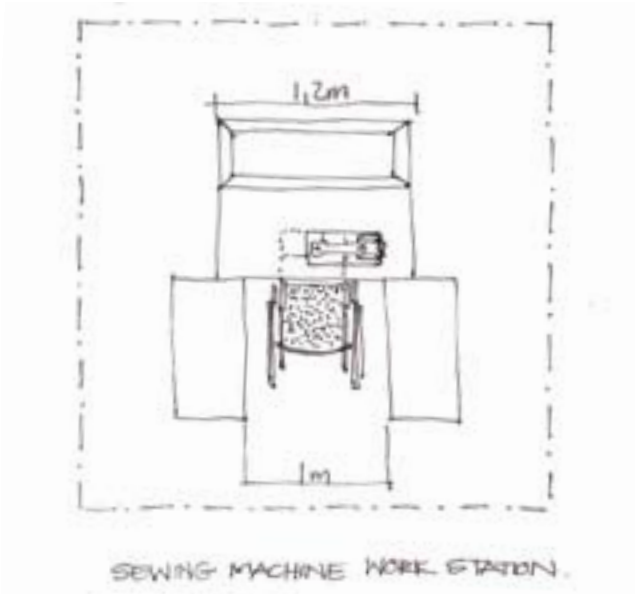
- Natural lighting.
- Task lighting – located at each workstation.
- General lighting – luminaires to provide uniform illumimance.

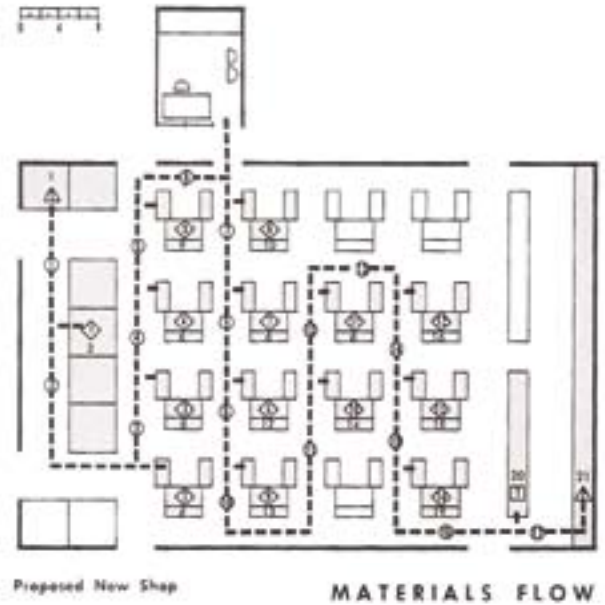
Acoustics:

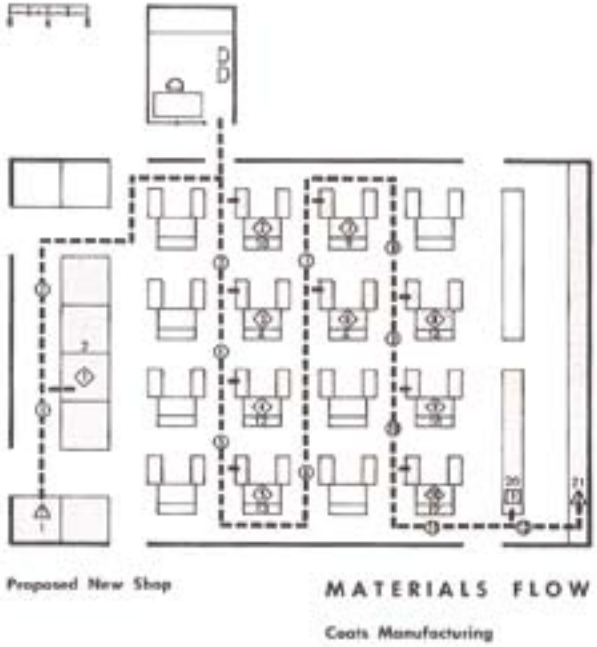
- Carpets dampen noise.
- Double glazing.
- Cavity walls.

Efficiency in material flow is a major concern. Efficiency is achieved by:

- layout and
- use of appropriately selected equipment arranged with aisles with sufficient width for ease of operation.







6.9.16 Kitchens (both in apartments and main building)

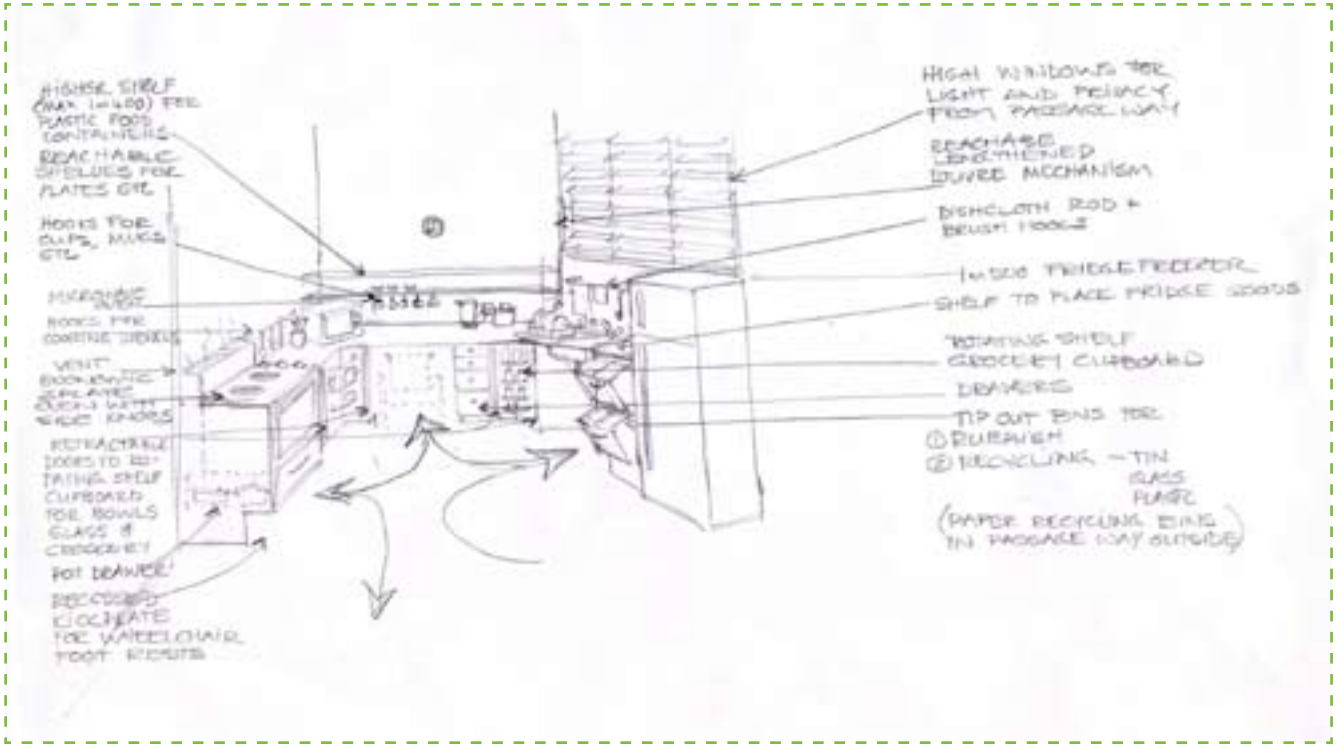
Light:

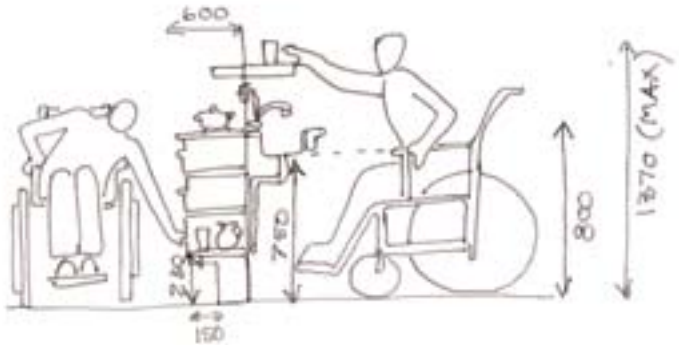
- Task lighting must be provided.
- Natural day lighting takes place.
- Levels of illumination can be adjustable by using louvres. This suits different eye conditions and heights of people either standing or in a wheelchair.
- 150-300 lux.

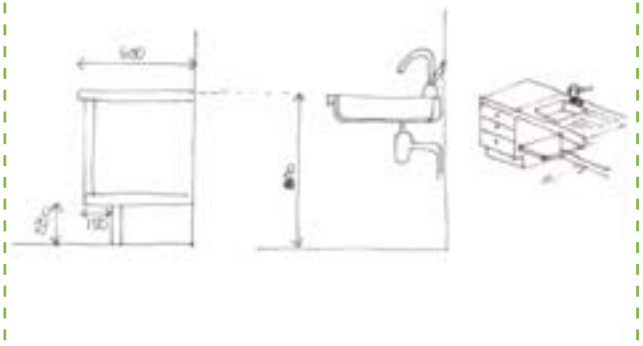
Ventilation: Passive ventilation.
Electric: Ample plugs should be provided.

Other:

- Non-slip floor surface.
- Use a continuous sequence of units – worktop, sink and cooking.







6.9.17 Bedrooms

Light:

- 100-150 lux
- Bed lamps are fixed to walls above beds to prevent residents from bumping over them.

Ventilation: Passive cross ventilation.

Electric: Provide sufficient plugs for radios, TVs, chargers and any additional electrical appliances.

Acoustics: Carpets dampen noises.

Dimensions:

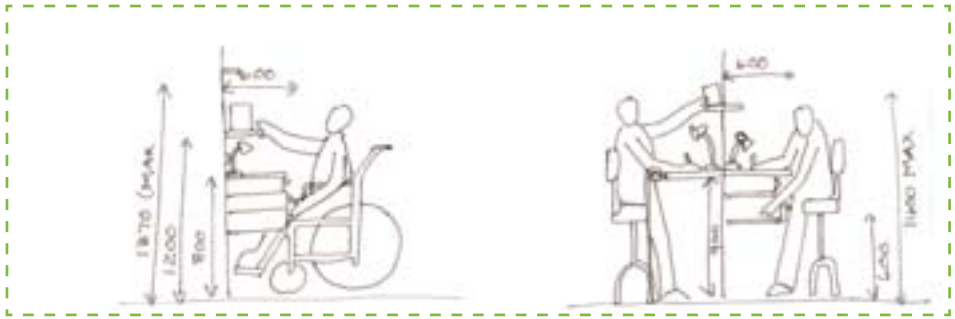
- Bedside space for:
  - Lateral transfer from wheelchair: 1 000 mm preferred (800 mm minimum).
  - Frontal transfer from wheelchair: 1 200 mm minimum.
- Level of mattress for:
  - wheelchair users: 480 mm approx.
  - nursing supervision: 650 mm approx.
- Clear space for footplates of wheelchair beneath the bed: 200 mm minimum.
- Wall-fixed mirrors:
  - Standing position:

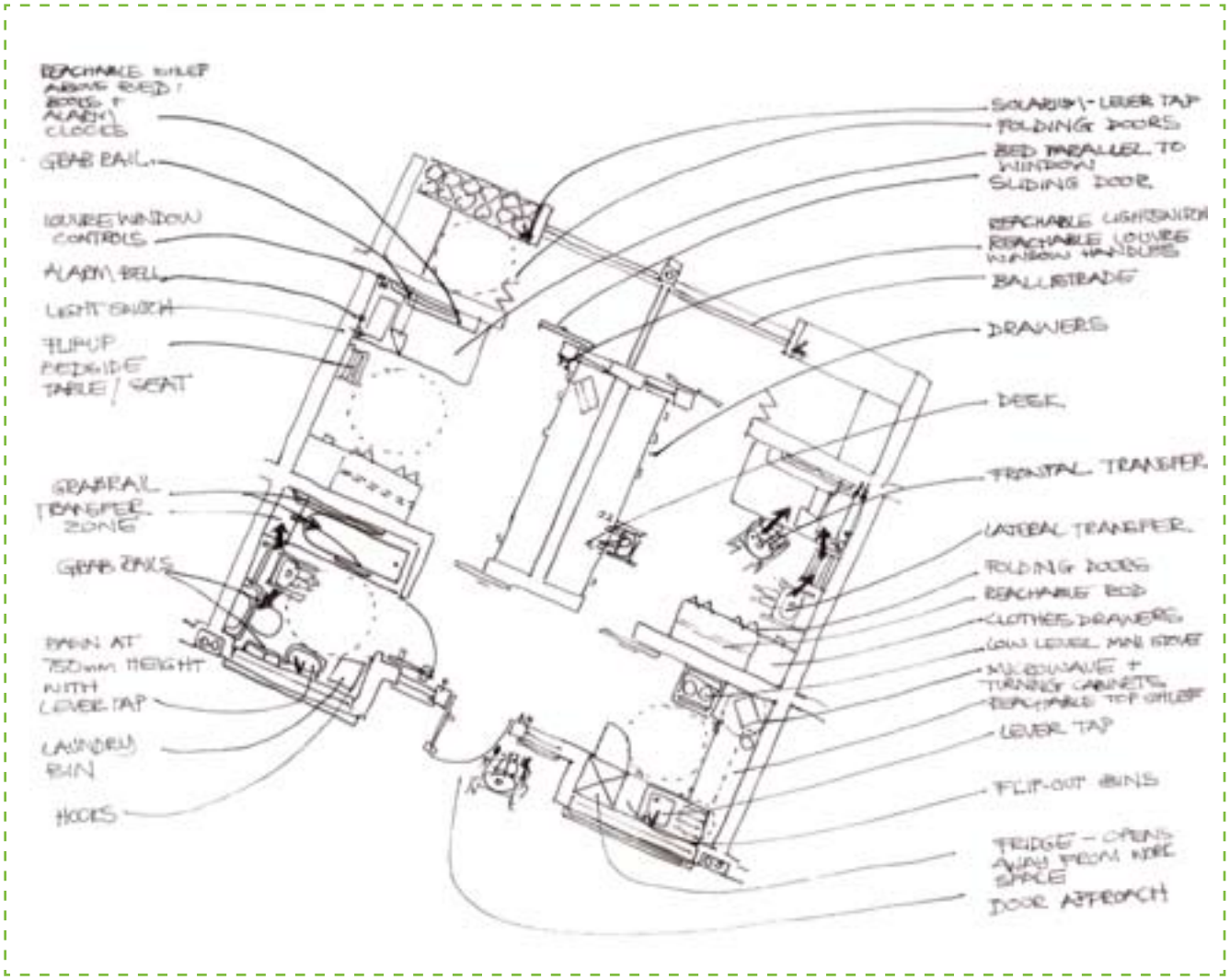
    Upper level of mirror: 1 800 mm minimum from floor.

    Base of mirror: 1 300 (no higher).
  - Wheelchair:

    Base of mirror: 900 (750 mm preferred).

    Attention should be given to positioning the angle of pivoted mirrors.





Other:

- Narrow shelving and drop-down work surfaces.
- Bedside tables to be folded down when not in use.
- The position of the bed is most important. To avoid glare it should be parallel to windows rather than facing them.
- Preferred window sill height = 600 mm high.
- Wheelchair users make either parallel, frontal or lateral transfers from chair to bed and sufficient floor space must be provided.
- The height of the mattress must be level with the seat of the wheelchair.
- Higher levels are more advantageous for some ambulant disabled (650 mm).
- Bed must be stabilised and not move during transfer.
- Adequate foot space for wheelchair footplates should be provided beneath the bed.
- Adjustable beds, allowing different heights, cater for varying types of disabilities.
- Reaching potential of the disabled resident will dictate the level of storage facilities.

6.9.18 Bathrooms

Light: 100-200 lux.

Ventilation: Natural cross ventilation.

Acoustics: No particular adaptations.

Water: Grey water (from washbasins, showers and baths) is drained to tanks, undergoes a reverse osmosis process and is pumped through the building to be used to flush toilets.

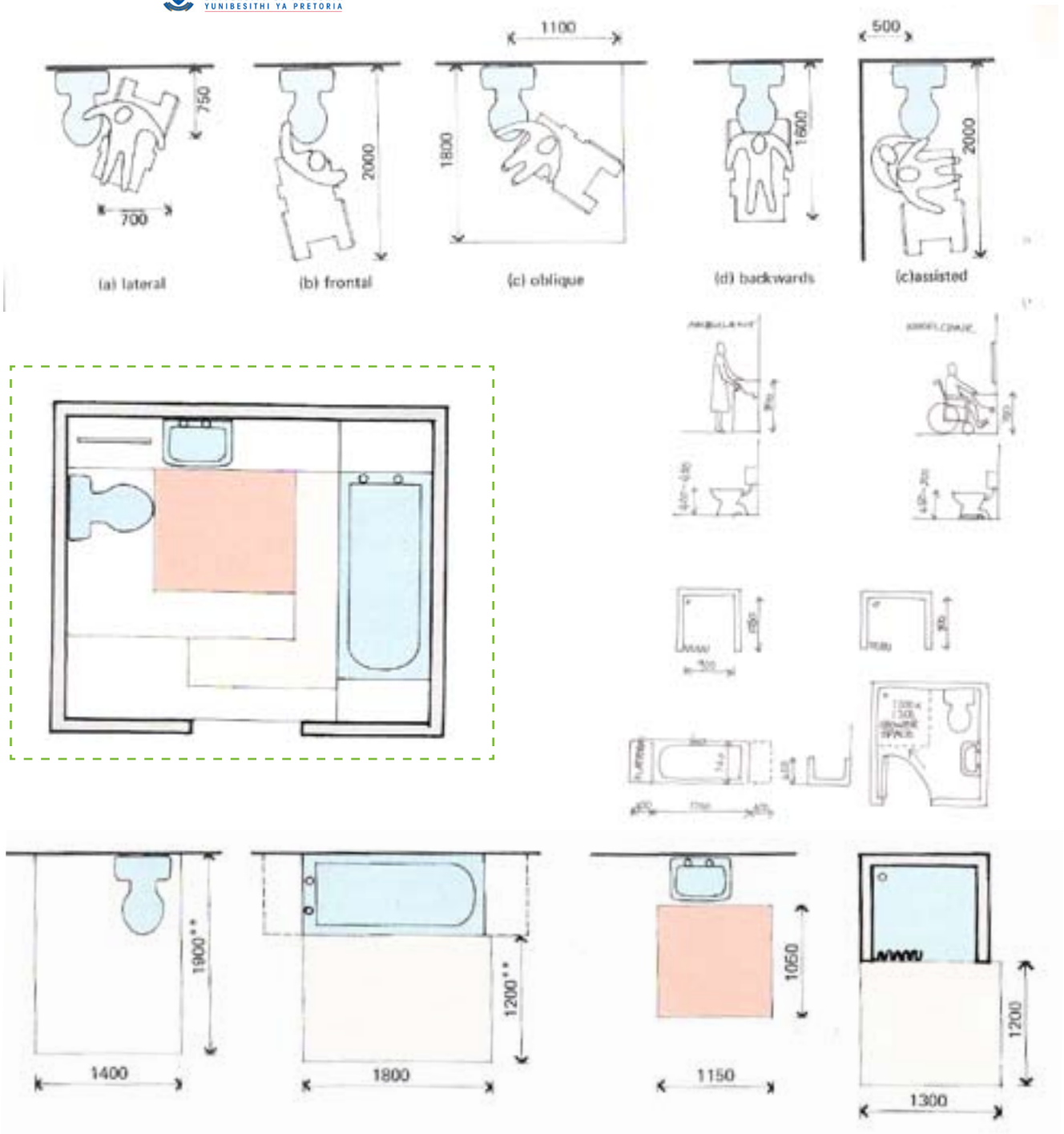
Electric:

- No electrical plugs are provided in the bathrooms.
- Shower plugs are provided at reachable height.

Privacy: Translucent louvred windows are located above eyelevel. A mesh screen is placed in front of the windows in the passageway.

Other:

- Non-slip floor is essential.
- Lift-off hinges on bathroom doors.
- Non-slip mat inside the bath and shower.
- A vanity unit means that all toiletries can be performed in the one place, enhancing economy of movement and effort.
- Hand spray shower fixed to wall next to bath.
- Bath taps to be placed in the wall, central to the bath.
- Vertical, horizontal or diagonal grab rails on adjacent walls.
- Trapeze lift above bath.



6.9.19 Passages

Size: Width of passages and ramps were determined by the standard dimensions in the illustrations shown.

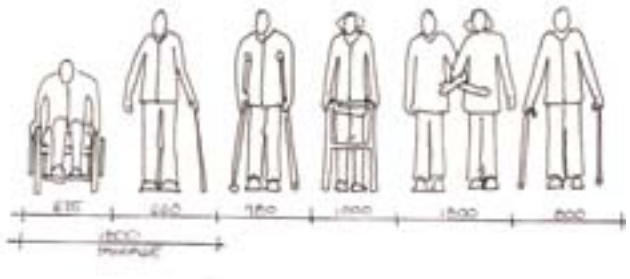
Ventilation: Passive ventilation.

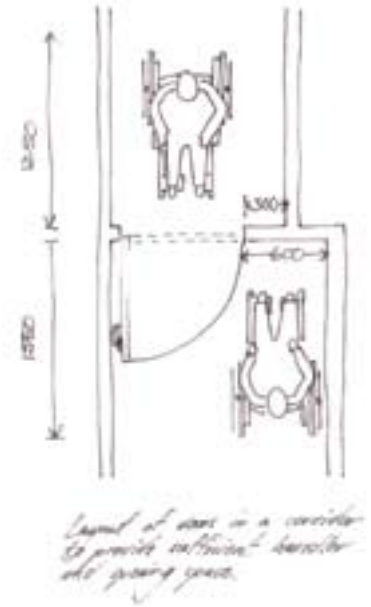
Light: Natural light enters the atrium through the translucent roof, lighting the passageways. A good level of ambient light and light fittings should be chosen to ensure that even light without a glare is distributed throughout passageways.

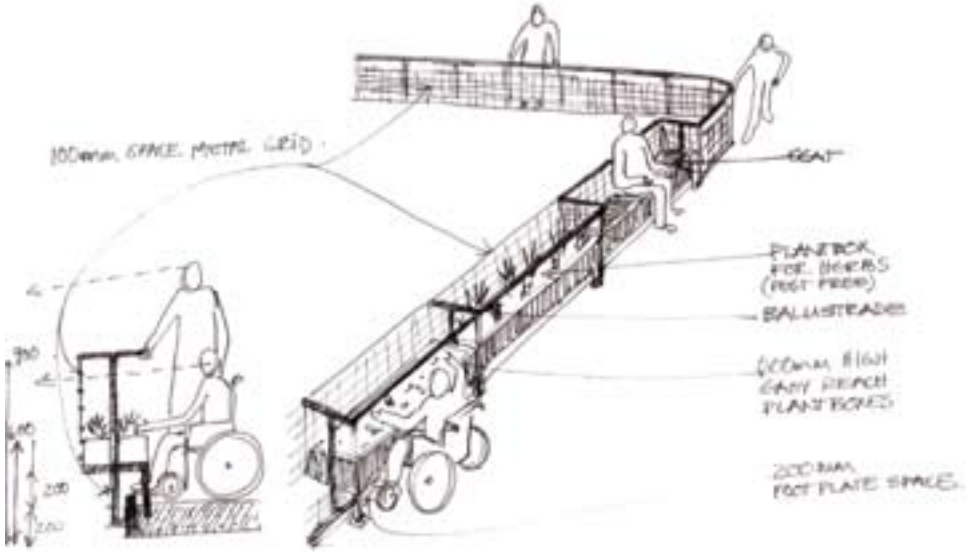
Other:

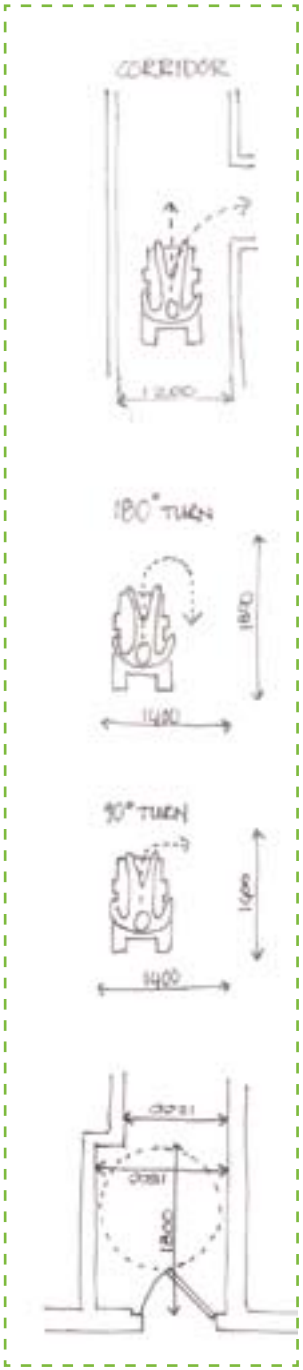
- Non-slip surfaces.
- Handrails must be provided along passageways.
- Signage along passages conveys information and indicates emergency exits.
- Fire hoses should be recessed in walls of passages so as to not create an obstruction.

Vegetation: Planters with a variety of plants, herbs and creepers are located along some passageways. This brings greenery into the building, having a calming and therapeutic effect on the occupants.









6.9.20 Doors

Opening width: It is the clear opening width that is the important factor in the accessibility of a door for people using wheelchairs.

Vision panels: Double-vision and single full-length vision panels allow people approaching a door to see wheelchair users at a lower level.

Door furniture:

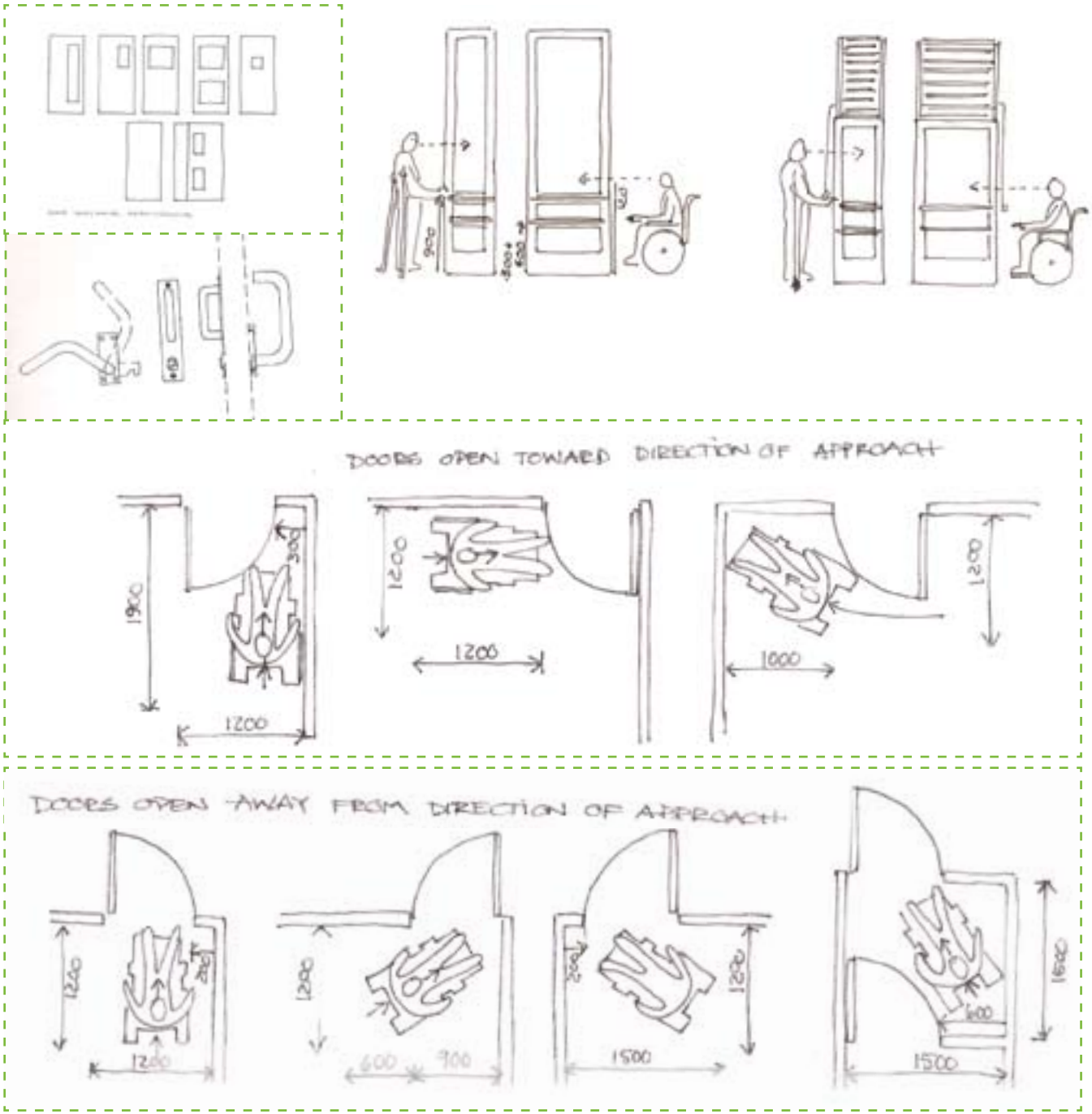
- Incorporate a pull handle, lever latch or a locking mechanism.
- Should provide a good visual contrast with the door and background.
- Should be located at a comfortable height for both ambulant and wheelchair users.
- Lever handles are easier to grip than round knobs.

Kickplates:

- The majority of wheelchair users open doors using the footrests of their wheelchairs.
- Kickplates protect the door as well as make the opening of the door easier by providing a surface that the footrest can easily slide along.
- Fitted across the full width of the door.
- Made of aluminium, 200 mm high above the floor.

Automatic openers can assist disabled people and remove barriers to others.

Sliding doors: Wheelchair users prefer sliding doors and are used within the Centre.



6.9.21 Windows

- Important factors are positioning, ventilation, safety, illumination and control.
- Visual range provided is especially important for those confined to a chair.
- Disabled need to control ventilation and windows should open and close with ease and safety, making louvre windows preferable.
- Thought given to the positioning of windows will make for effective daylight illumination,
- Controls must be able to be used with one hand (safer for those with balance problems).
- Space to sit by a window is an asset. This can be found along the passages between training halls.

Dimensions:

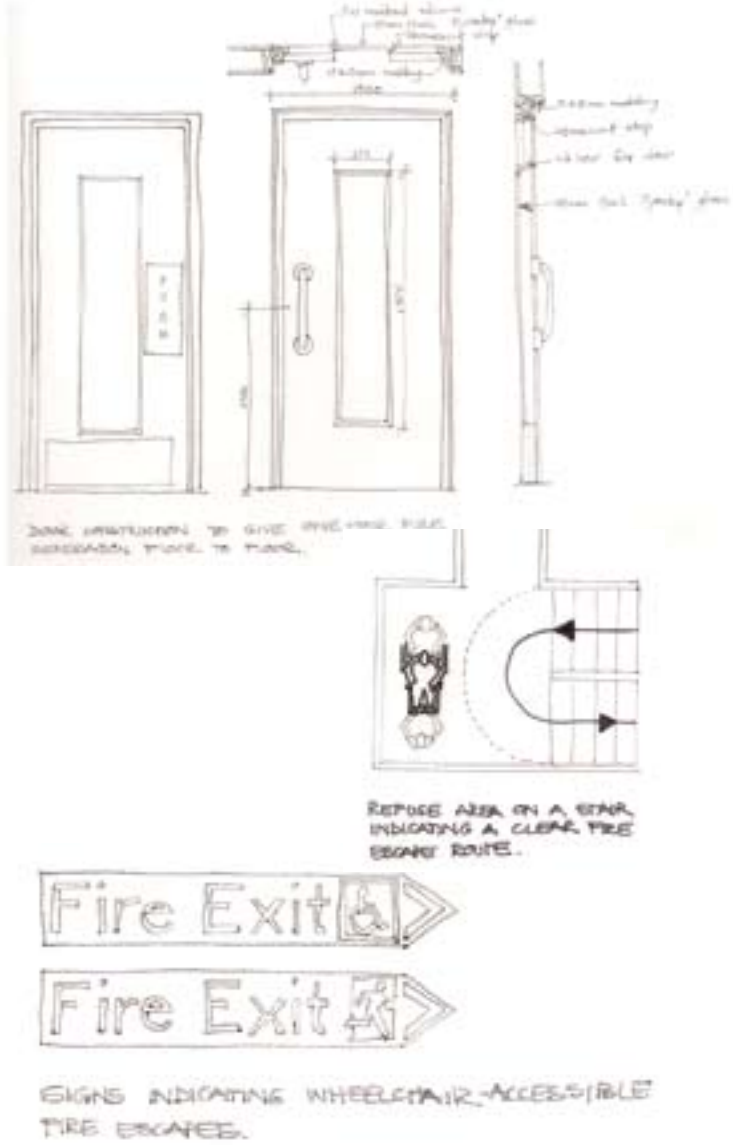
– Height of controls for windows should not exceed:
Ambulant disabled: 1 550 mm
Wheelchair users: 1 100 mm preferred (1 350 maximum)
– Recommended level of sill to allow satisfactory visual range from the sitting position: 600 mm

Louvre windows with reachable control

6.9.22 Fire regulations

SABS 0400 TT16	Escape routes	Less than 45 m to nearest escape door
SABS 0400 TT17	Rooms with + 25 occupants	+ 800 mm escape door
SABS 0400 TT17	Room with + 50 occupants	2 escape doors
SABS 0400 TT18	Feeder routes to escape route	Non-combustible material
SABS 0400 TT21	Minimum of escape routes	1 100 mm
SABS 0400 TT34-35	Hydrant and hose reels are provided at correct intervals	

- Alarm will sound in the case of fire.
- Break-glass alarm points should be a max height of 1 200 mm UFFL (located in the basement garage).
- Stairways provide areas of refuge.

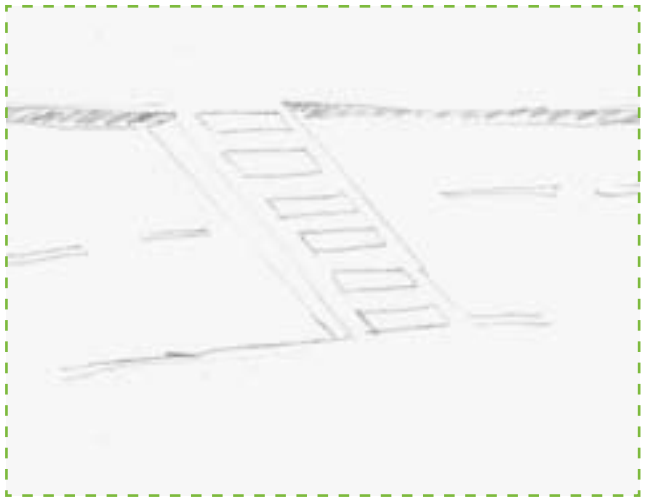


6.9.23 Telephones

To be placed at 1 200 mm height.

6.9.24 Traffic calming devices

The aim of slowing the traffic in Boom Street is to make drivers more alert of their surroundings. Proposed new raised crossings with different surfaces will achieve this.



6.9.25 Gardens

Gardening is a hobby which many disabled enjoy and find therapeutic.

There should be independent access to the gardens with sheltered areas for sitting in privacy and comfort with room to move around safely.

The following basic requirements enhance accessibility:

- Suitable level surfaces, free from obstacles.
- Gentle slopes or steps where difference in ground level is unavoidable.
- Paved or concreted paths of adequate width. Gravel or loose surfaces are avoided.
- Handrails alongside paths, is desired. These will be helpful to the ambulant as well as vision disabled.
- Raised garden beds for wheelchair users and for those who are unable to bend or kneel.

Dimensions:

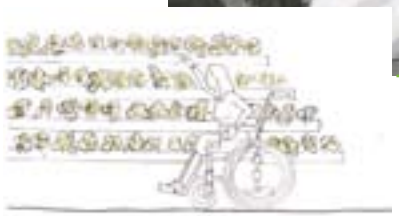
- Raised beds:
  - Convenient height when standing: 750 mm.
  - Convenient height for wheelchair users: 600 mm.
  - Where there is a path along only one side of the bed, the range of bed width allowing comfortable reach is 600-800 mm.
  - Where paths exist on both sides of the bed, suitable width of the bed is 1 200 mm.
  - Construction of a raised bed should allow toe recess for both the wheelchair and standing gardener. Knee recess will give added advantage to the wheelchair user.
  - Width of paths: 1 200 mm preferred (1 000 mm minimum).

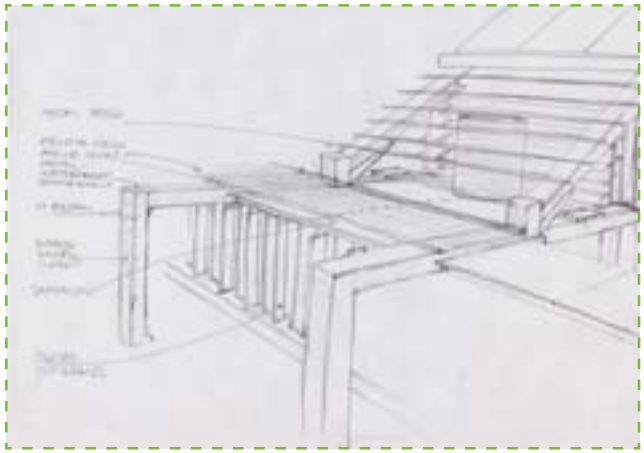
6.9.26 Greenhouse

The greenhouse has been designed to allow enough light to enter through the roof and wall panels.

Lettuces and spinach will be produced by means of hydroponics.

The structures used for planting plants are of such a nature that disabled people can easily reach and harvest production.





6.10 AESTETIC PRECEDENTS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7.1 MOVEMENT, ACCESS AND SECURITY

There are three ways of accessing the building.

Pedestrians enter at the main entrance on Boom Street and are led to the reception / security desk from where surveillance takes place over the main access point and movement routes.

Vehicular access is on the northern side of the site leading into a semi-basement, from where a lift, ramp and stairs provide access to the Centre.

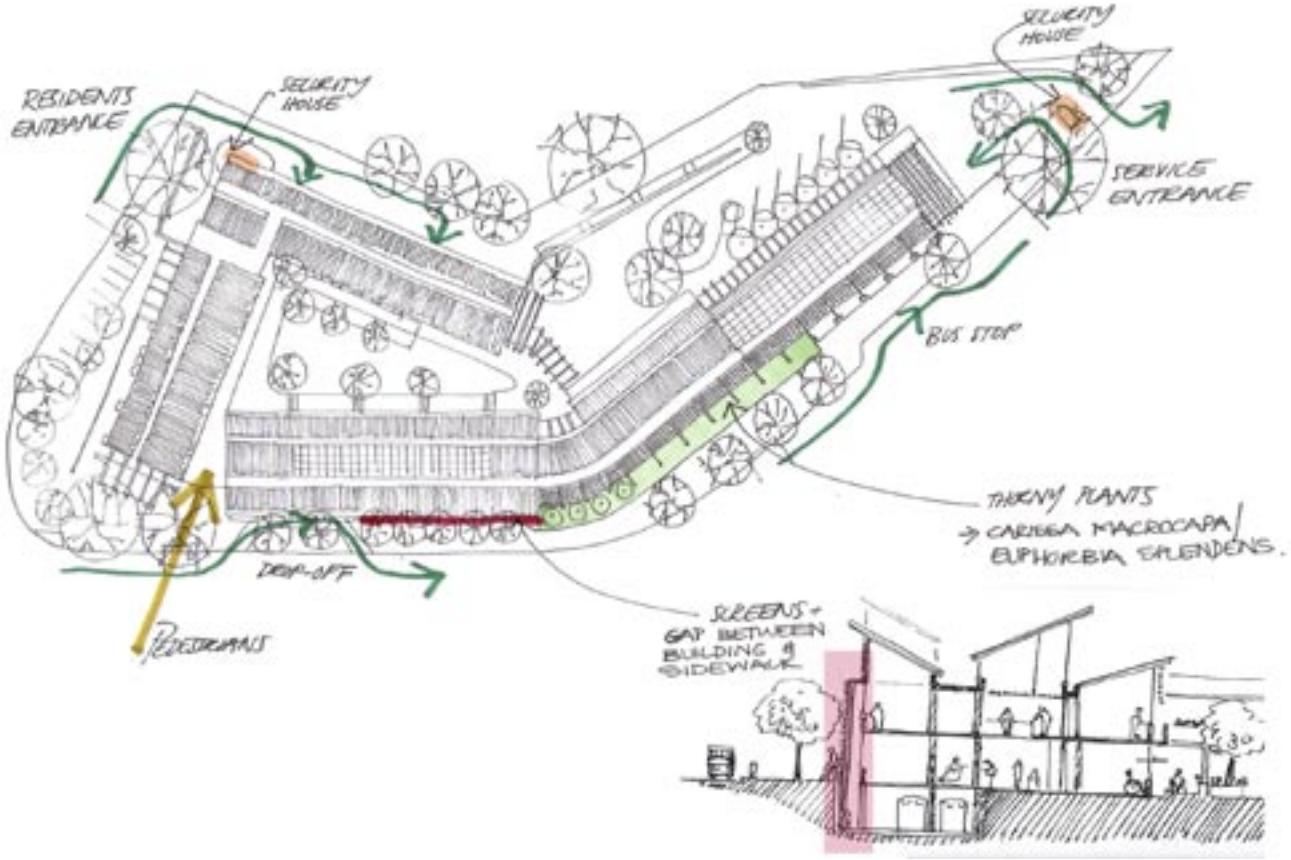
A separate service **drop-off area** is provided. Delivery personnel will be able to use either the service lift or stairs. A security guard at the northern gatehouse will be responsible for the controlling of the deliveries and will have full eyesight over the delivery area.

A **guardhouse** on the eastern side will be responsible for controlling the incoming and exiting of service vehicles to and from the workshops. Existing walls between the site and Prinshof School will remain. New walls will be built on the western and eastern border.

The use of mesh and/or grating for screens form an aesthetical element of the building but also fulfils the role of **security** (as burglar bars would). Transparency of the building is achieved by the use of glass and contributes to security by means of creating passive surveillance.

The water pools not only play a role in evaporative cooling and having a calming effect on occupants but create a barrier between pedestrians and the building. Vegetation (in some cases) is also used for this purpose. Thorny plants such as *Carissa Macrocarpa* and *Euphorbia Splendens* are planted on the southern side of the building between the sidewalk and building. These plants contribute by “greening” the streetscape as well as contributing to safety and security.

Artificial security, for example CCTV surveillance and security doors can be strategically placed in spaces that are most likely to provide a safety threat.

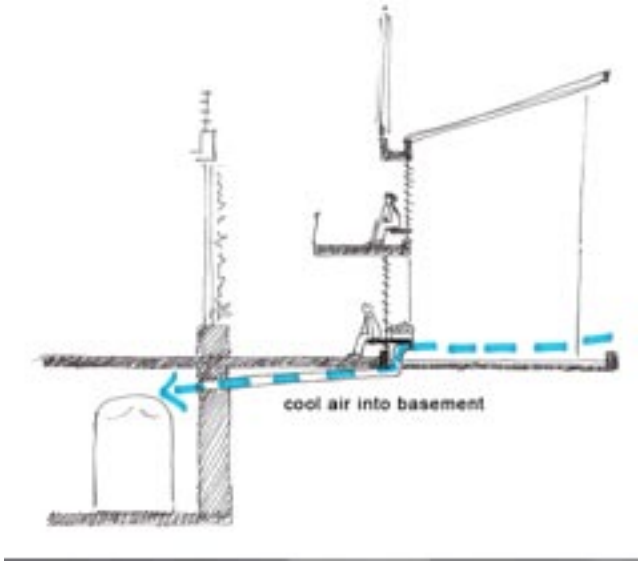


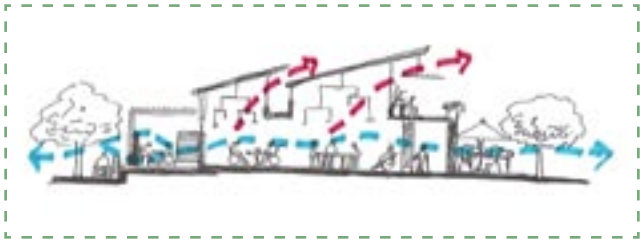
7.2 VENTILATION

Natural ventilation occurs throughout the building and is less maintenance intensive over the lifecycle of the building. As previously discussed, the building is placed and designed as to maximize natural ventilation by means of utilising the existing wind patterns and directions.

The following regarding ventilation was considered whilst designing:

- Training halls are relatively narrow as to have natural ventilation occur easily.
- The atrium between the training halls cause a natural stack effect, resulting in a comfortable interior environment.
- Louvre windows are used, allowing occupants to control the amount of ventilation occurring in the building.





7.3 WATER COLLECTION

Water collection has an ecological as well as a financial impact on the Centre. The rainwater is harvested from all the roofs and channelled to water tanks.

- **Stored water** from the greenhouse roof (east wing) is used in the greenhouse or overflows into the evaporative cooling pond after which it can also be used to irrigate the gardens.

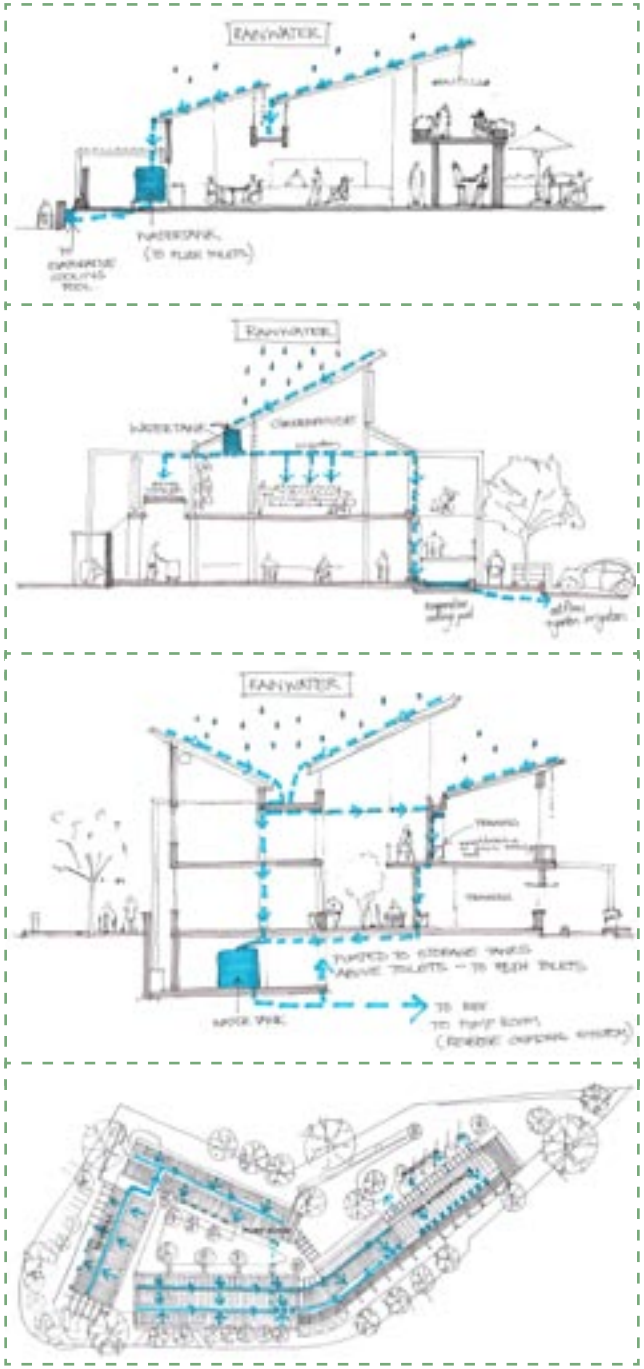
- **Rainwater** from the training facility (south wing) and accommodation block (north wing) are stored together with grey water from the building in tanks in a basement. From there it undergoes a reverse osmosis process (see Appendices 9.7) and is pumped back through the building to be used for flushing toilets, after which it is disposed of in the sewer system.

Pretoria's municipal underground sewerage pipes do not have steep slopes. Grey water is necessary to wash the sewerage pipes clean, therefore all water from baths, basins and sinks are recycled once directly towards toilet flushing.

- **Harvested rainwater** from the cafeteria roof (west wing) will be used for the evaporative cooling pools. The down pipes are located in or attached to columns, integrating them with the respective facades.

Month	Aggregate rainfall in mm/ month for Pretoria	Total amount of water harvested (kℓ)
January	101,3	349
February	108,8	375
March	63,8	218
April	37,5	129
May	48,4	167
June	3,8	131
July	2,3	79
August	2,3	79
September	11,3	389
October	82,5	285
November	168,8	582
December	112,5	388
TOTAL	**745,27 mm**	**3171kℓ**

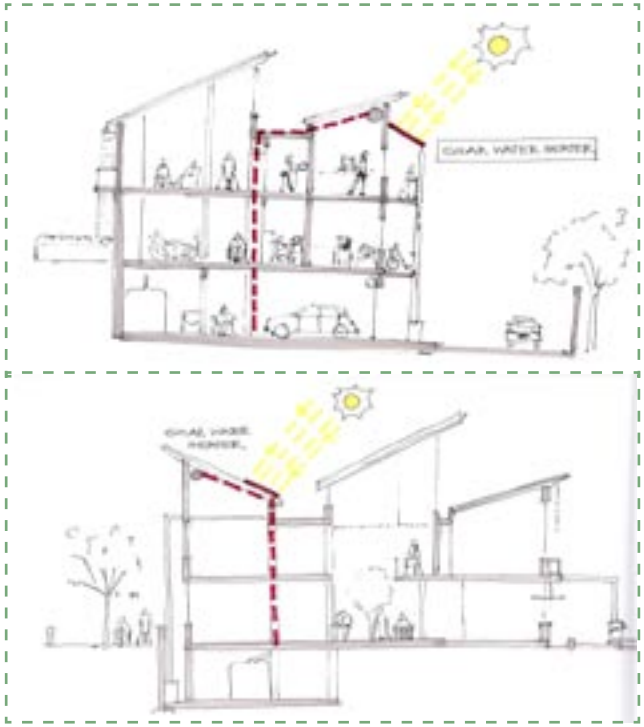
Harvested rainwater volume = 3 171 m^3
Current cost per 1 m^3 = R5
Possible annual savings = R15 855



7.4 SOLAR WATER HEATERS

The solar water heaters on the roofs of the accommodation block, training facility and kitchen roof will provide warm water for use in WCs, kitchens and sinks in training halls. This system will serve a complementary function, working in conjunction with a conventional water heating system that will be used on cloudy days.

Solar heaters are orientated to receive maximum exposure to northern light. Storage tanks should be located higher than the solar heater. Water from these heaters will be distributed to the rest of the Centre by means of additional pipes and are added to the lighting structure piping.



7.5 FIRE

The escape routes are in accordance with section T of the National Building Regulations. An escape route may not exceed 15 m in one direction. Once in an escape route, two escape options exist. The total length of the escape route plus the emergency route to a safe point outside the building does not exceed 45 m.

In case of fire, all building users must evacuate in the direction of the alarms, leading everyone away from the danger. A sprinkler system will be installed throughout the building. The same sprinklers used for irrigating plants in the atrium and greenhouse can also be used in the case of fire. All rooms will be fitted with smoke detectors. Smokers will be forced to use balconies as this will be a smoke-free building.

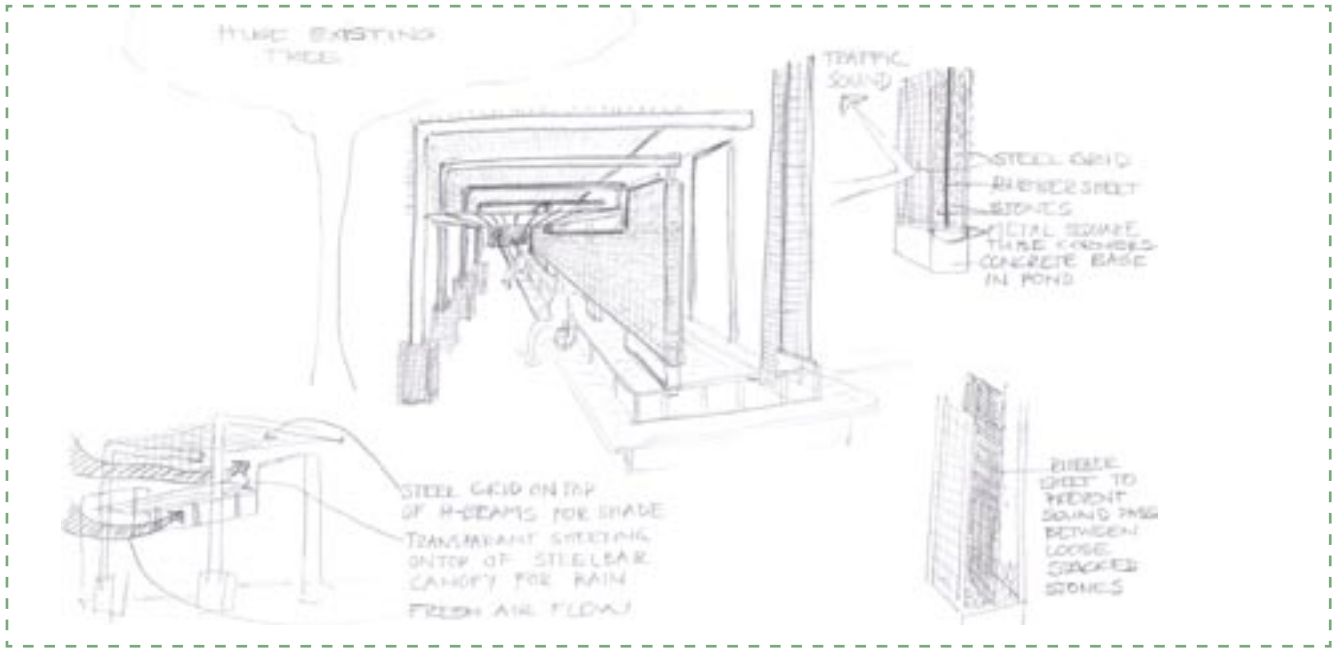
7.6 ACOUSTICS

7.6.1 Sound level recommendation

	DB
Training facility	
• Lecture rooms	30-35
• Workshops	35-40
Administration	
• Private offices	35-40
• Boardroom	30-35
Atrium	40-45
Reception	45-55
Cafeteria	40-50
Kitchen	45-50
Apartments:	
• Living quarters	25-30
• Lounge	30-40

The main source of noise originates from the traffic in Boom Street and the Bloed Street taxi rank across the road. 330 mm cavity walls filled with polystyrene panels and double glazing are used on the street façade. The ceilings for these areas consist of acoustic panels. Grate screens on the southern façade will act as a noise reflector. The stone and steel mesh wall on the outside of the administration offices also serves as a noise barrier.

The objective is to achieve best possible acoustic qualities by the least expensive means. Wheelchair users moving past a wall can easily damage the materials on it, thus insulating materials need to be robust.

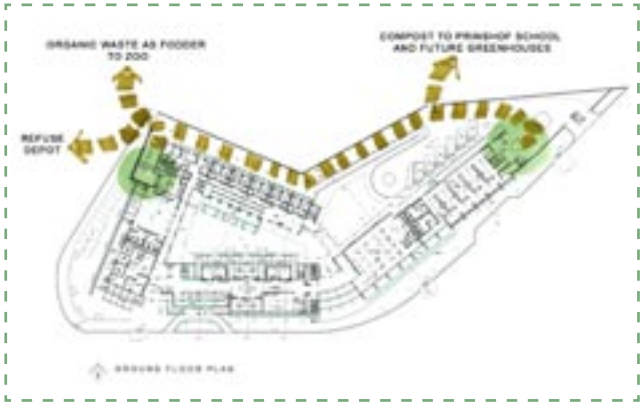


7.7 RECYCLING

7.7.1 Waste

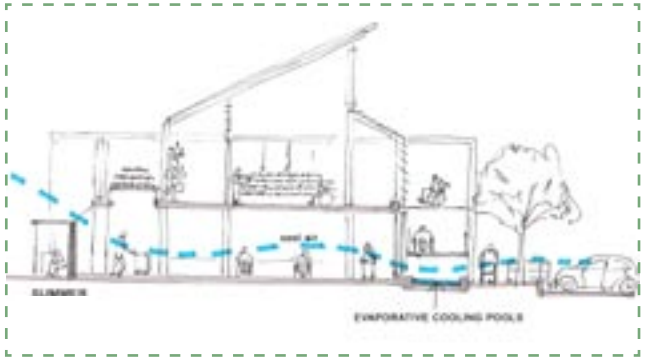
Organic waste from the kitchen and vegetable packaging workshop (for example peels and leaves) will be sent to the zoo daily as fodder. Organic waste that cannot be used as fodder together with seasonable plant material produced by deciduous plants will be added to the neighbouring Prinshof School's existing compost plant.

Each of the apartments will be fitted with sufficient recycling bins. Recycling bins for glass, tin, plastic and paper will be located on the western border of the property, in close proximity to the municipal recycling depot.

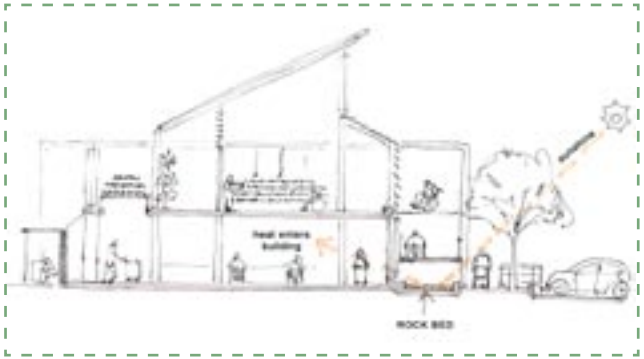


7.8 EVAPORATIVE COOLING POOLS AND ROCK BEDS

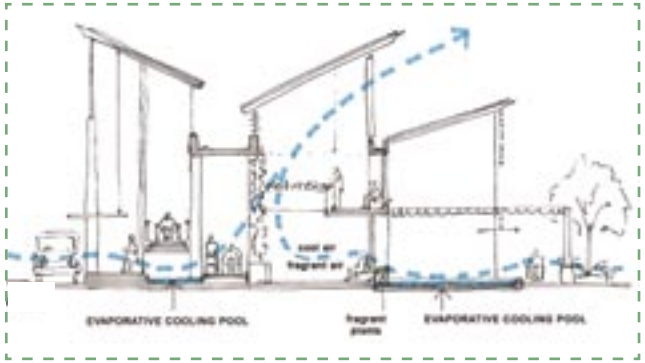
In summer, wind is channelled over the water pools in front of the building, creating evaporative cooling within the building. During winter the water is drained, leaving rock beds that absorb solar heat and transmit it into the building.



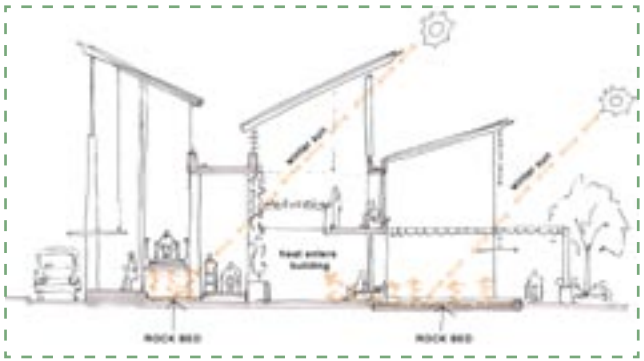
Summer



Winter



Summer



Winter

7.9 MATERIALS

Materials give richness to space and act as informative tactile and visual devices. The materials used to construct the Centre must also be found in the surrounding buildings. The building, as an educational centre, must be able to visually link with the Prinshof School's character as well as the city's aesthetics. The challenge is to design a building that can link these two different characters while still have a character of its own. Most of the surrounding roofs in the residential area and the Prinshof School are corrugated pitch roofs. On the other hand, the city character across the road is more cube-like with horizontal and vertical concrete shapes dominating.

7.9.1 Concrete

Concrete is used to construct the floor slabs and columns of the building, as it provides sufficient versatility to enable puncturing. It also acts as an effective energy storing device.

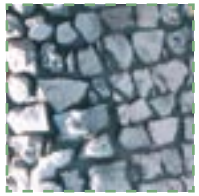
7.9.2 Steel

Steel is easy to construct and adds extra versatility.

7.9.3 Brick

Utility bricks form a part of the area's character and must be respected.

7.9.4 Stone



The western wall wrapping around the building, leading to the entrance, is made of a steel mesh frame filled with stone (like gabion walls) through which soft light and air flows freely. Evaporative cooling pools are drained in winter leaving a rock bed. These rock beds are a theme carried throughout the Centre.

7.9.5 Timber

Timber is used as screens.

7.9.6 Corrugated iron sheets

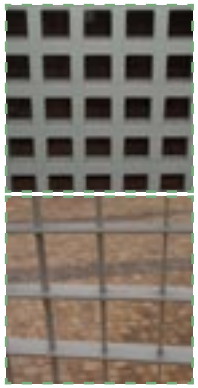
Corrugated iron is the preferred roofing material for reasons of:

- Workability
- Low cost
- Fast to construct
- Relates environmentally to the surrounding buildings.

7.9.7 Translucent plastic sheeting

Dampalon is a glazing system with light-diffusing and insulating qualities. It provides a combination of superior quality transmission, thermal performance and shading factors.

7.9.8 Grating/Mesh



Grating/mesh is used for roofing, screening, security bars, seating as well as over stormwater channels.

7.9.9 Clay tiles

Clay tiles act as an effective energy storing device.

7.9.10 Fibre cement boards

Fibre cement boards are used to close off service ducts.

7.9.11 Glass

Glass gives the building a transparency, visually linking the able-bodied world with the disabled world. Tinted glass will reduce glare and heat gain in the building.

7.9.12 Plaster finishes

Different textural finishes can be achieved by dragging different objects over stucco plaster. By adding coarse river sand to plaster a coarser finish can be achieved, where stucco plaster floated with a wooden trowel can yield a finer texture.

7.9.13 Carpets

Carpets of synthetic fibres are more viable than natural fibres. Polypropylene fibre carpets will not shrink, are hostile to microbes and stains can easily be removed. The under felt must be chosen to increase resilience, improve durability and reduce sound transmission (Matthews, 2003:111).

7.9.14 Non-Slip Flooring

7.9.15 Canvas

7.9.16 Paving

7.9.17 Water

7.10 FAÇADES – THERMAL AND LIGHT REGULATION

7.10.1 Training facility – South wing

South façade

Training halls:
The training halls are insulated by double glazing and a cavity wall, having more of an acoustic than a thermal impact. During summer a small amount of sunlight will enter the south facing training halls, leaving them comfortably cool. During winter the south facing training halls will receive light and heat from the atrium. The roof pitch is designed in such a way that sunrays will enter south facing training halls.

Atrium:
During summer the louvre windows are opened to create a natural stack effect. The south-eastern wind enters through the southern louvers, accelerating and pushing the hot air out through the northern louvre windows. This creates a negative pressure on the south and a positive pressure on the north.

During winter the northern louvres are shut. Due to the translucent roof, this leads to a greenhouse effect heating the building from within.

North façade

This façade forms the one edge of the courtyard. The following elements have an effect on the façade's thermal and light regulations:

Vegetation:
Deciduous trees are planted in front of the building, filtering the northern sun and providing shade in summer. Vegetation within the atrium has a calming as well as cooling effect on occupants.

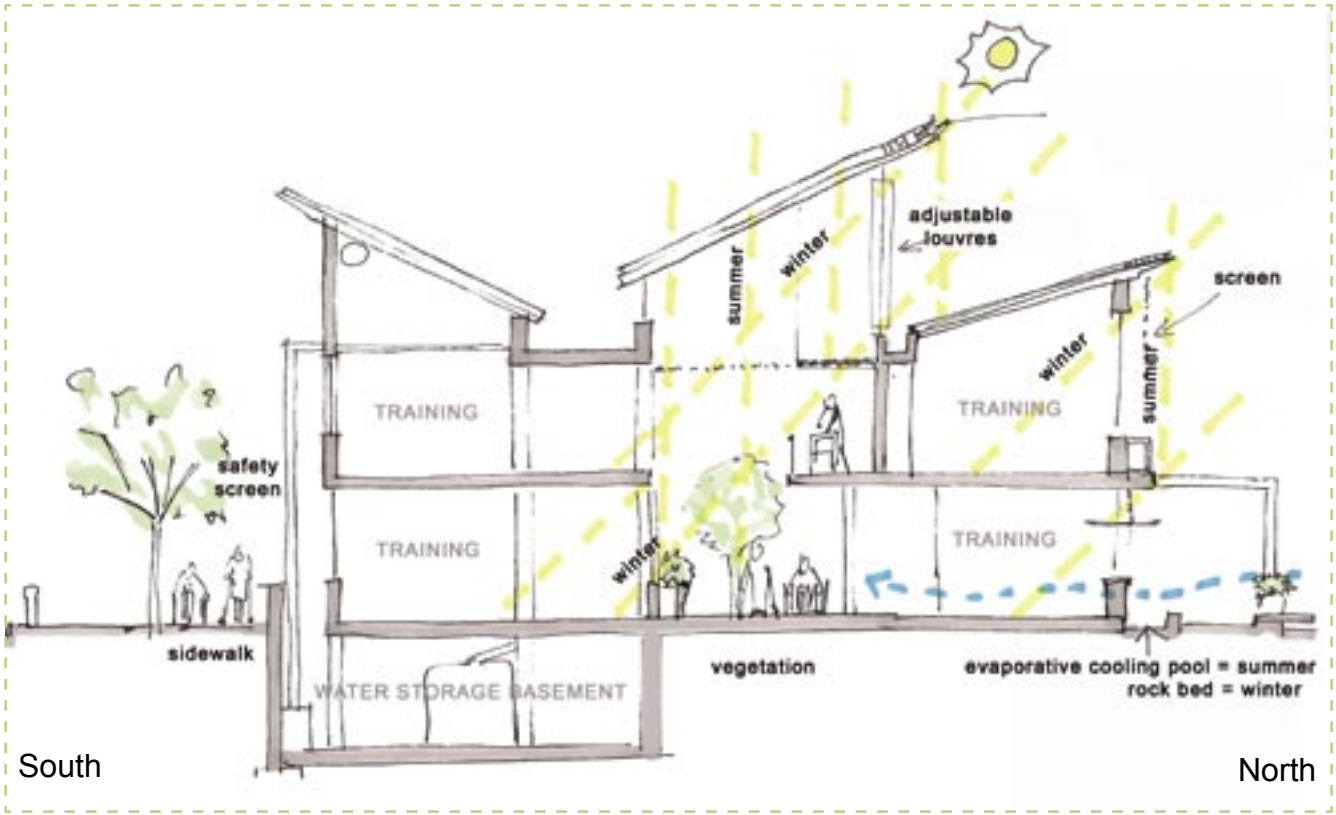
Rock beds:
During winter months solar energy is captured by the rock beds. The heat energy is transferred into the building, creating a temperate internal environment.

Sunscreens:
Horizontal slatted screens provide shading.

Louvres:
Adjustable glass louvres and glass panels allow light to enter the building. Hot air rising freely in the atrium exits freely. The louvres can either be automatic or used manually by using a long hooked stick (akin to opening school windows). The long window strip gives the illusion of a floating roof.

Overhangs:
Attached to the roof beams are steel grids preventing excessive light from entering the building.

Due to the incorporation of these functional systems the building is very energy efficient. The free flow from interior and exterior buildings and the utilisation of organic growth (gardens and greenhouses) creates an image that the building is not fully developed and conveys the ideal that a building is not existing in contrast to nature, but as part of nature.



7.10.2 Cafeteria and offices – East wing

West façade

The roof is slanted upwards towards the east, protecting the building against the fierce western sun.

A vertical timber screen acts as a shading device in front of offices and WCs.

The western wall not only acts as a noise barrier, but also protects the offices and cafeteria from the western sun.

The water pool not only has a soothing effect on the cafeteria users, but has a cooling effect into the building.

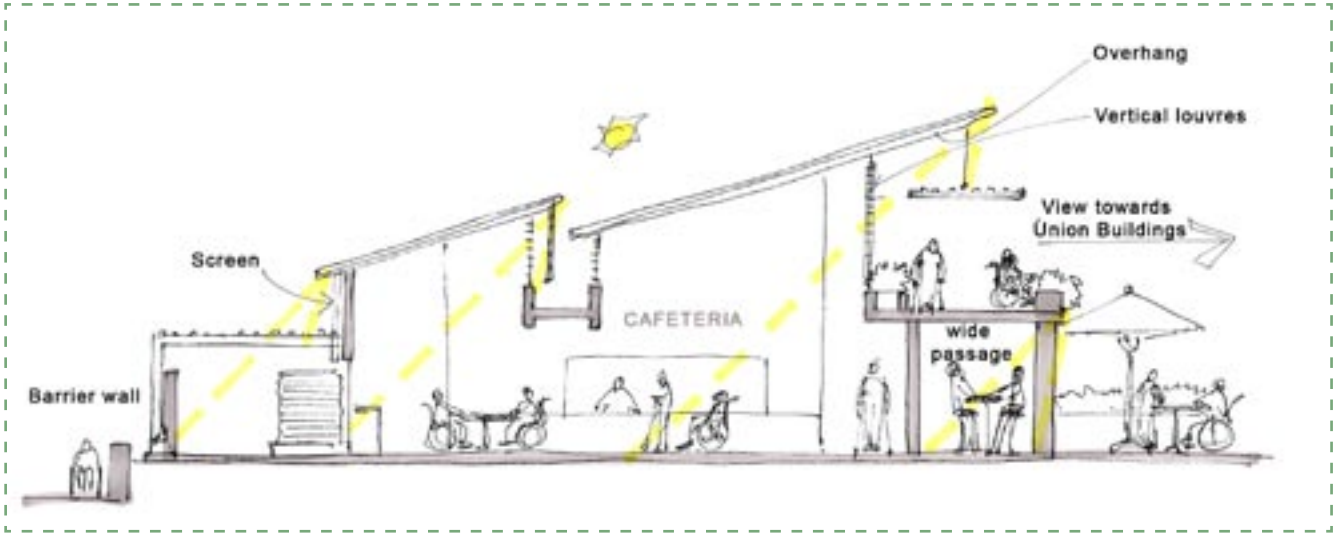
East façade

Overhangs, vertical louvres and deep passageways all contribute to the light and thermal regulation of the Centre.

Waiting areas are designed along the passageways.

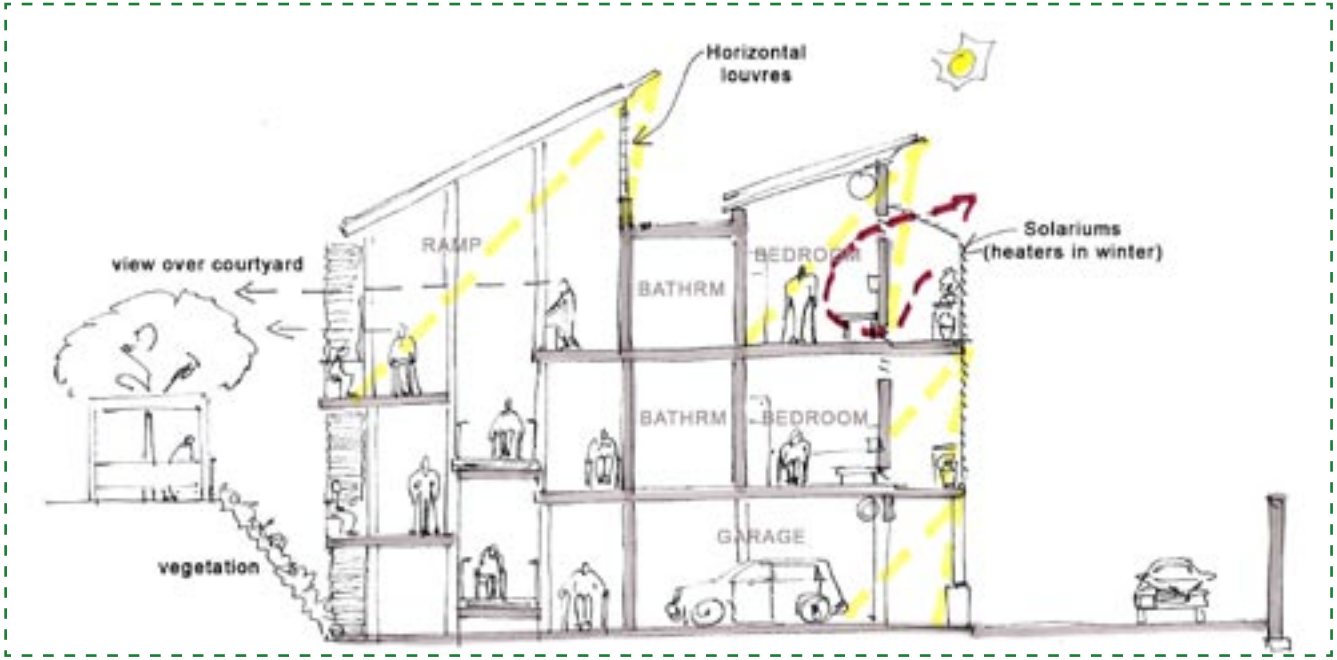
A view of the Union Buildings can be enjoyed from the passageway towards the eastern side.

To the north a view of the Magaliesberg can be enjoyed as well as to the south a view of the cityscape.



Cafeteria

Accommodation



7.10.3 Accommodation block – North wing

South façade

Bathrooms and kitchenettes of all the apartments are located on the southern side.

The open ramp is located on the south of the building, making it an active focus point when viewed from the courtyard.

The building is separated by two separate pitched roofs. This maximises sunlight and air entering the building.

In winter the southern ramp hall receives northern light through the northern opening between the steel and concrete roof.

North façade

In summer overhangs and screens prevent too much light from entering the rooms. During winter sunlight falls on the balcony's clay tiles. Tiles absorb heat, which is released into rooms at night. The solariums also work as natural heaters. At night windows can be opened to let heated air flow into the rooms.

As an added bonus, the plants in the solarium not only have a calming effect and provide a pleasant fragrance, but also absorb CO_2 and release O_2.

7.10.4 Workshops – East wing

South-east façade

The greenhouse makes use of vertical louvre windows on the south-eastern façade.

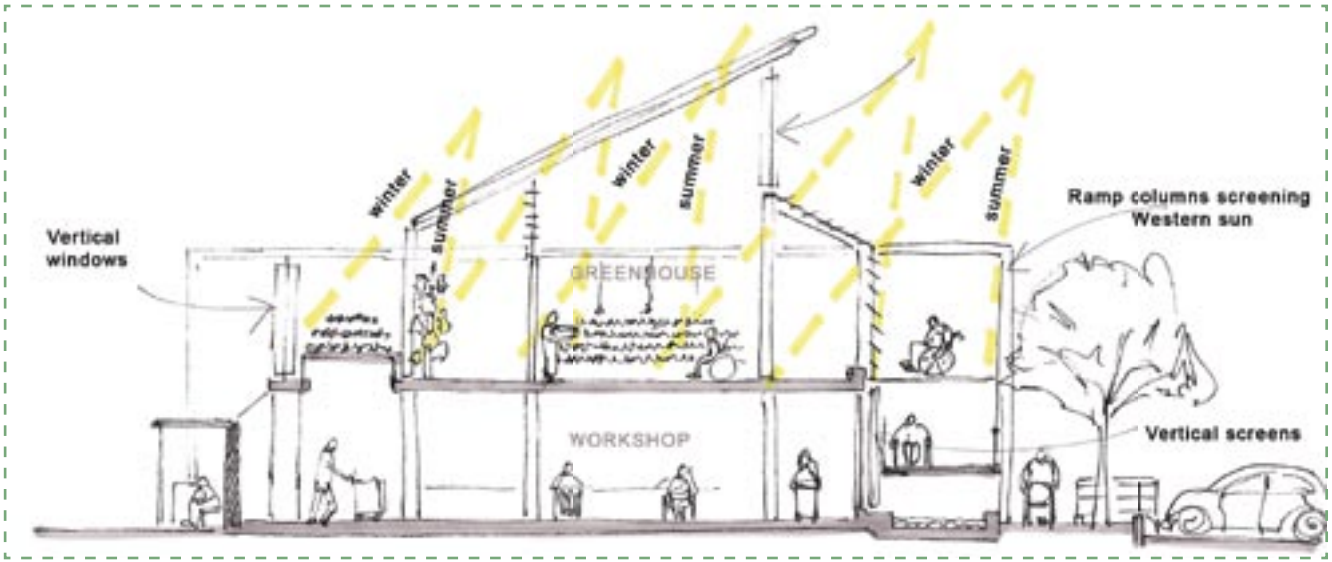
Roll-down canvasses are used in the sewing workshop. Occupants can regulate sunlight in the mornings.

North-west façade

In the vegetable packaging workshop (factory) vertical timber beams are installed at an angle to only allow northern sun to penetrate.

The greenhouse is designed to allow as much sunlight as possible to enter.

Workshop



7.11 LANDSCAPING

Plants have a very therapeutic effect on people. Disabled people's senses are extremely sensitive and thus find plants especially pleasing. Fragrant plants are often used to orientate the visually disabled.

The plants used in and around the Centre have the following benefits:

- Provides a calm, soothing, pleasant atmosphere
- "Greens" the city
- Provides a financial income. The herbs grown in and around the Centre can be harvested and sold. Herbs have a high monetary value, whereby the Centre can benefit financially.

All the plants are planted in specific areas to fulfill a specific function.
The functions can be categorised as follows:

- Fragrant plants: serves to better the air quality and smell of the city
- Thorny plants: serves as security barrier
- Herbaceous plants: Makes the air fragrant and can either be used by the occupants of the building or packaged and sold. Currently, the pupils at Pretoria School package and sell herbs as a funding method. Not only is it very successful but also has a healing and therapeutic effect on the pupils.(Nel, 2007)

Geraniums
– fragrant
-Pelargonium
odaratissimum
= geranium scent
- Pelargonium
tomentosum
= peppermint scent
- Pelargonium crispum =lemon scent

Lavendula
dentate
– fragrant
-hardy

Tropaeolum majus (Nasturtium)
– fragrant & edible
- good for window boxes

Artemisia dracunculus
(Tarragon)
– herbaceous

Salvia officialis
(Sage)
– herbaceous

Organum heracleoticum
(Majoram)
– herbaceous
-hardy

Jasminum officiale
fragrant
semi-climber
or semi-shade

Mentha spicata (Mint)
– herbaceous
hardy,
semi-shade or sun

Rosmarinus officinal
i (Rosemary)
– herbaceous
-semi-hardy,
evergreen, fragrant

Lemon tree
(Eureka)
– Edible

Foeniculum vulgare (fennel)
herbaceous
-medicinal plant

Origanum vulgare
– herbaceous
-hardy

Allium
schoenoprasum (Chives)
– herbaceous

Ocimum basilicum (Basil) – herbaceous
-in-doors as well as out-doors

Carissa Macrocarpa – thorny – used as security hedge
-attractive foliage and white flower

Euphorbia Splendens – thorny - used as security hedge
-low hedge with flowers in winter

GROUND FLOOR PLAN

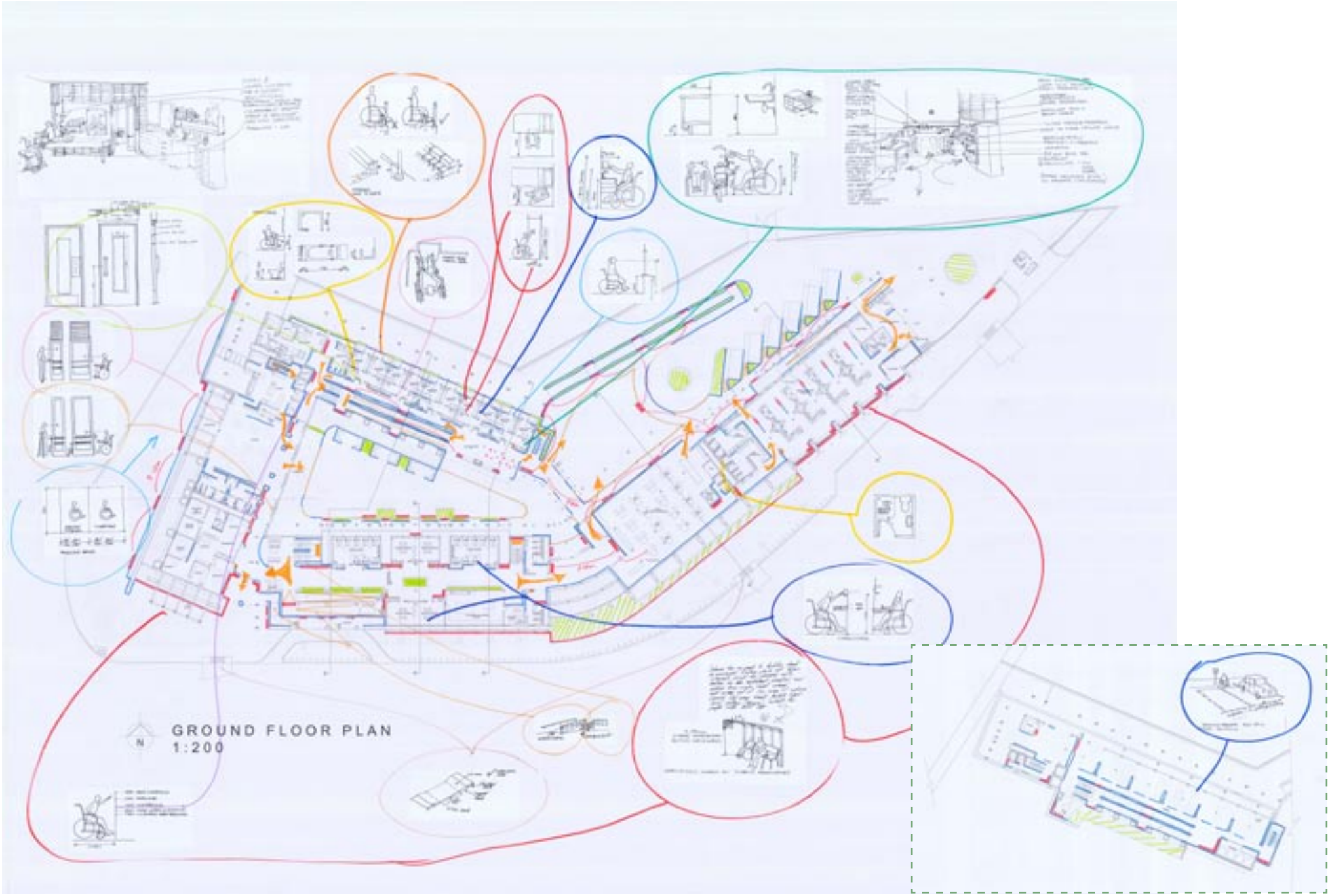
Petroselinum Crispum (Parsley)
– herbaceous
- good in-doors

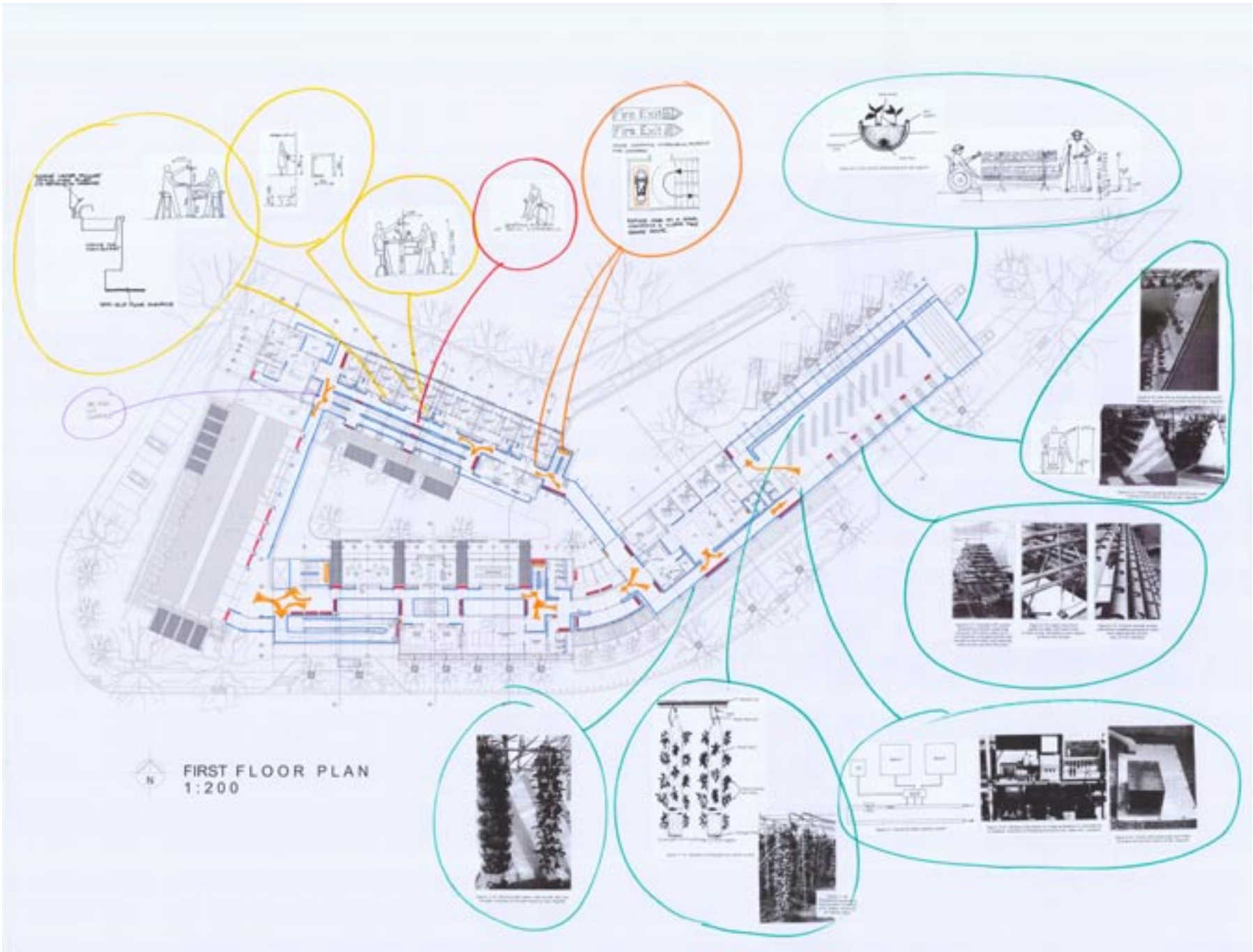
Passiflora edulis (Granadilla) – edible plant
-non-fussy vine; needs supports at 1.5-1.75m intervals

Thymus citriodorus (Lemon Thyme)
– herbaceous

Thymus vulgaris (Thyme) –
herbaceous

TECHNICAL INVESTIGATION




FIRST FLOOR PLAN
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