In this chapter, the refinement of the design and the technical resolution are addressed. Technification is restricted to the ground floor, where plumbing, escape routes, ventilation, circulation, signage, acoustics, floor finishes and environmental complexity are addressed.

Elements such as the louvers, infusion treatment seat and cell-like wall structure are detailed on the micro scale - revealing the appearance of skin in all its forms. It is in this final chapter where one sees all the interdependent elements working together to create a curing to healing continuum through tangible design. It becomes apparent that basic clinical places have the potential to come alive and be transformed into optimal healing environments.
Diagram 10.1 Oncology centre axonometric (Author, 2016)

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10.6 ELEVATIONS SCALE 1:100

Diagram 10.6 Elevation (Author, 2016)

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10.7 PLUMBING AND FIRE ESCAPES

10.7.1 PLUMBING

Plumbing was not a technical focus within this study, and will need to be refined to specialist specifications and details. Below is a conceptual idea of how the plumbing will work within the building, as water is supplied to water features from the wetland below.

KEY
- Sewage pipe
- Grey water pipe
- Irrigation water supply pipe

- 110 mm diameter uPVC sewage pipe with min. 1.5% fall to connect to main sewage
- 400 x 900 mm sewage duct accessible through access panel on each floor
- Pipes run down the facade hidden by vertical green wall
- Sewage to connect to main sewage
- Water pumped up from wetland to cladded water system to water feature and garden irrigation
- Water pumped between levels to create falling water features
- Grey water is to be lead to filtering system and lead to wetland to be used for irrigation.
- Drip irrigation is used for atrium and balcony plants

Diagram 10.6: Elevation (Author, 2016)
Diagram 10.8: Escape Route (Author, 2016)
Diagram 10.7: Plumbing (Author, 2016)

10.7.2 ESCAPE ROUTES

In accordance with SANS 10400 Part 7. Smoke detection system is to be installed and sprinkler system is not recommended, in accordance with the IUUS pg 22.

Diagram 10.8: Escape Route (Author, 2016)
10.8 VENTILATION

10.8.1 REGULATIONS
The system shall deliver not less than 10 air changes per hour and shall comply with the Deemed to Satisfy Rules 007 Artificial Ventilation of Part O of the National Building Regulations (NBR). Minimum air changes per hour according to SANS 10400, Part O, p.19 and the Infrastructure Unit Systems Support (IUSS) Health Facility Guide. Openable windows in accordance with SANS 10400, Part O.

The IUSS recommendation
Adequate ventilation throughout the health facility is important as poor ventilation affects patients and staff; putting them at risk of nosocomial infections. Spaces must be ventilated so that the quality of the air breathed is improved by diluting the air and removing harmful pollutants. The main aim is to provide ventilation that maintains thermal comfort and indoor air quality that reduces the risk of cross-infection. This can be achieved through natural-, mechanical- or hybrid methods of ventilation.

10.8.2 DESIGN IMPLEMENTATION
The design of the oncology centre employs mostly mechanical ventilation. The importance of natural ventilation has, however, been highlighted by evidence-based theories and recommended in research on optimal healing environments. A crucial factor of natural ventilation is the sensory stimulation it offers such as a breeze felt on skin or the smell of fresh air. This led to the design of frequently placed, openable windows and naturally ventilated exterior spaces into which patients can freely move.

10.8.3 DIAGRAMS
The diagrams below indicate the variation of natural and mechanical ventilation. They show how natural ventilation reaches into the building and where it meets mechanical ventilation. The design enables the building to "breathe" and support the growth of plants.
10.9 CIRCULATION AND WAY FINDING

10.9.1 CIRCULATION

To avoid the maze-like effect usually associated with hospitals, each space has a unique design—different colours and floor finishes (seen in 10.12 finishes palette) are employed. As a result, each space creates unique spatial perceptions and memories. Spaces that happen to be the same, such as secondary passageways, have been designed with distinct visual axes lines to outdoor gardens. Therefore, a unique, memorable view is created for each passage.

This all assists the "place" neurons, which are activated by a combination of features (different for each space) that serve to define internal sense of place. Each place is associated with specific patterns of neural activity. Place neurons are also dependent on a strong sense of orientation. The space thus has a main landmark of orientation (the atrium), two vertical walls and views to the exterior. These elements help the patient orient as to the direction they are facing.

Main circulation spaces (kinetic layers) have been designed with minimal spatial literacy and only indicated "signage points" (Diagram 10.10 below) located at every change of direction. The placement of the receptions at the entrance (on each floor) assists with cognitive responses. The space is designed with inquiry points that are visible from anywhere on the floor (Diagram 10.10 below).

KEY

- PATIENTS
- APPOINTMENT EXAMINATION ROOM
- APPOINTMENT COUNSELLING ROOM
- TREATMENT
- FAMILY
- MEDICAL STAFF

- IMPORTANT SIGNAGE POINTS
- INQUIRY POINTS
- LANDMARKS OF ORIENTATION
- VISUAL AXIS TO GARDEN

REGULATIONS AND REQUIREMENTS

- Circulation in accordance with SANS 10400 Part 5
- The entire Oncology Centre is wheelchair friendly, assessable and complies with and is in accordance with SANS 10400 Part 5.
- Turning spaces
  - The turning space allowance shall be a minimum of 1.5m in diameter, inclusive of any low and low clearance.
  - Space has been designed to accommodate for this, and is demonstrated on plan with the following symbol.
- Obstructions in the path of travel
  - Projecting objects shall not reduce the clear width required for accessible routes. Hanging signs, lights, and objects that protrude into circulation spaces shall have a clearance of at least 2m above the trafficable surface.
- Windows and doors shall not open across a walkway, corridor, stair or ramp. Door stops shall be positioned so that any door will open to its maximum, and that they will not create a hazard.

Diagram 10.10 Circulation routes (Author, 2016)

10.9.2 SIGNAGE

WALL SIGNAGE

The circulation paths lead to solid walls that direct patients (Diagram 10.10 above). The walls will receive signage, which is to be in accordance with regulations.

SIGNAGE ON THE GLASS OF THE ATRIUM

Large numbers of each floor are printed on the atrium glass to be visible from 30 and above, with smaller signage is in addition to the prominent priority wall signage.

REGULATIONS AND REQUIREMENTS

- SANS Health Facility guides pg 21 – Bedroom number shall be shown outside the patient’s bedroom. These shall be one number per bed. The lettering style Helvetica Medium upper and lower case is generally recommended. Upper case only is recommended for the building’s main entrance sign.
- SANS 10400 Part 5 pg 8
  - Signage shall comply with the requirements of SANS 1186-2 and shall have a symbol height of not less than 110mm.
  - Clear legible signs shall include the direction and name of an accessible facility and shall incorporate the international symbol. The height of the lettering shall not be less than 50mm.
  - Where the viewing distance is greater than 10m, the height of the lettering shall be increased accordingly.

Diagram 10.11 Signage (Author, 2016)

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### Material Selection

**Selection Criteria**

In accordance with UEB Health Facility Guide & the General Building Requirements

**Infection Prevention**
- Key
  - The 6 important aspects to be taken into consideration when choosing materials are represented as shown in figures 1 to 8. Each material chosen is ranked in order of its appropriateness as evidenced in Figure 8 (A being poor and E Excellent). This is represented by the number of rings around each material.

**Flooring**
- **Internal Application**
  - Majority of interior flooring is laid in a heterogeneous vinyl sheeting with surface treatment.
  - Silex T 1918 acoustic heterogeneous vinyl sheeting with OVERCLEAN XL surface treatment.
  - Silex Sparkling 1918 acoustic heterogeneous vinyl sheeting with STARKPROTECT surface treatment.
  - Eternal heterogeneous vinyl sheeting with PUR Resin® surface treatment.
- **External Application**
  - Flowcrete: Naturewalk (natural, dark, light natural, dark, light natural, black, giallo).

**Walls**
- **Internal Application**
  - Majority of interior walls are painted with Sterishield Diamond Matt from Dulux Trade.

**Detailing**
- Sound absorption, wall panels.
- Watercolour wall paper murals.

**Other**
- Corian.
- VBA™ (VBA™) Composite Bamboo Louvers with pull, movement, fix to 32mm wide doors, wood, metal, steel, sound absorbing, pipe, motor to technical illustration.

**Diagram 10.12 Material selection (Author, 2016)**

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The material palette (below) reflects a neutral interior selection to convey a soothing atmosphere. The predominant use of light colours is implemented; firstly, for the perception of hygiene and secondly, to contribute to an open, fresh, light-filled environment. Stimulation is provided by the addition of textured pebbles and 3D wallpapers. This is brought into contrast with views of the flowering gardens, which change seasonally as well as detailed mosaic - show different colours, textures and spaces.
The report (above) reflects a score of 3.5. Energy and water scores were of the lowest, as they are not within the scope of the study calculations for them were not performed. It was, however, recommended that the future extension take the same path as the existing building as to the implementation of solar panels on the roof. The landscaping layout also proposes the implementation of a wetland that receives grey water from the future extension but is also provides the future extension with fresh water for the water feature and irrigation purposes. The future extension (as with the main hospital) is to collect water that will connect to the existing water purification system on site.

Access had a low score - looking at internet access, banking, groceries, post office, crèche and primary school and their radius from the future extension. The oncology centre (future extension) is designed to be a space that accommodates the needs of patients, their family members and medical staff with the provision of a café for meals, an information zone with Wi-Fi for research and work, relaxation spaces, gardens and gyms for exercise. So although the rating is low, it does not reflect the accommodation of patients, their families or medical staff.

Health is not a true reflection as it takes into consideration whether fruit and vegetables; beans and pulses; and milk and eggs are produced within the country and are available within 2 000m walking distance of the building. This is not the case and has no direct connection with the health of patients.

Overall, the results were satisfactory. it due to the fact that it was not a focus of this study but still scored a relatively good mark.
10.13 ACOUSTICS

Acoustics are important in a medical space. The negative impact of noise on patient health was elaborated on in Chapter 7.2.4.1 - Noise. Acoustics in the building are addressed in the following ways:
- Space planning: the generation of noise is limited by placing louder, public programmes on the lowest level and quiet patient rooms on the top level of the building.
- Water features on balconies produce the tranquil white noise of trickling water.

**SECTION THROUGH SEMI-PRIVATE INFUSION SPACE**

**SCALE 1:50**

- Sound-absorbing suspended ceiling tiles are used throughout the building.
- The flooring is acoustic heterogeneous vinyl sheeting that prevents noise generation (noise from movement on floors is one of the major sources of noise in hospitals).
- Room dividers are implemented to deflect and block sound from travelling directly between two areas within a bigger space.
- Sound absorbing wall panels prevent reverberation in passages.

**SECTION THROUGH CIRCULATION SPACE AROUND ATRIUM**

**SCALE 1:50**

**DETAIL 1**

**Sound absorption wall panels**

The ecophony hygiene sound-absorbing wall panels, to become sound absorbing sensory勃泌。它们含有的感觉，保护正常人对外界的声音敏感。

**ADDITIONAL FABRIC SENSORY LAYER**

Textile: texture, and in some cases, moving scales activated by touch
Visual: aesthetic quality
Sound: acoustic abilities

Diagram 10.14 Acoustics diagram of semi-private infusion space (Ashton, 2016)

Diagram 10.15 Acoustics diagram of main circulation (Ashton, 2016)

Figure 10.1 Sensory scales (Cernia, Gies, 2016)

Diagram 10.16 Acoustic wall panel and sensory layer (Ashton, 2016)

Diagram 10.17 Pattern of wall panel and sensory layer (Ashton, 2016)

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Diagram 10.13 (below) reflects the different floor finishes of the ground floor. Layers of kinetic and static rings radiate out from the core of the building (as seen in cells on micro level). This contributes to way finding and orientation as each layer has a unique aesthetic. It is followed by a more in-depth study of the various types of flooring used as well as their benefits and specifications.
1.2 Salion Trafic (high traffic)

Description:
Salion Trafic is an acoustic vinyl floor covering available in 2m wide lengths. Manufactured using 100% green electricity, Salion Trafic meets the class T requirement of EN 660-2 for abrasion resistance. Salion Trafic is 15dB acoustic-performance certified to EN ISO 717-2 and offers an indentation resistance of 0.11mm. (Floorworx, 2016)

Benefits:
- Salion Trafic has an anti-grinding surface treatment called OVERCLEAN XL which eradicates the need for sprayed refurbishment throughout its service life
- Salion Trafic is treated with BIOSTATIC treatment
- Salion Trafic contains no restricted substances
- Salion Trafic is made from 50% natural materials

Specification:
Supply and fix 3.4mm thick x 2.0m wide Salion Trafic 15dB acoustic heterogeneous vinyl sheeting with OVERCLEAN XL surface treatment, manufactured in accordance with EN 651 and laid in Floorworx No. 62 acrylic adhesive which has been spread using a trowel fitted with an A2 notched blade at a rate of between 5.5m² and 6.5m² per litre on a previously prepared Class 1 sub-floor in accordance with SANS 10070, using Floorworx Self Leveller when required, including all cutting and waste. The sheeting must be rolled in both directions with an articulated 68kg three-sectional roller immediately after it has been laid into the adhesive. Joints must be butted, grooved and heat welded using the manufacturer’s welding rod, ensuring that the welding rod bonds to more than 70% of the sheet thickness (Floorworx, 2016).

1.3 Eternal (PUR Pearls surface treatment & aesthetic reasons)

Description:
Eternal is a compact heterogeneous vinyl floor covering with a calendared backing in 2m wide sheeting that meets the class T requirement of EN 660-2 for abrasion resistance. Eternal offers a very effective indentation resistance of 0.03mm and an increased slip resistance of R10. Eternal receives the unique PUR Pearl® surface treatment, ensuring remarkable stain resistance, ease of maintenance and eradicates the need for waxing or sprayed refurbishment throughout the lifetime of the product. (Floorworx, 2016)

Benefits:
- Indentation resistance of 0.03mm
- Unique PUR Pearl® surface treatment, ensuring remarkable stain resistance
- Easy maintenance
- Chemical and scuff resistant
- Meet the class T requirement of EN 660-2 for abrasion resistance
- Slip resistance of R10

Specification:
Supply and fix 2.0mm thick x 2.0m wide Eternal heterogeneous vinyl sheeting with PUR Pearl® surface treatment, manufactured in accordance with EN 649 and laid in Floorworx No. 62 acrylic adhesive which has been spread using a trowel fitted with an A2 notched blade at a rate of between 5.5m² and 6.5m² per litre on a previously prepared Class 1 sub-floor in accordance with SANS 10070, using Floorworx Self Leveller when required, including all cutting and waste. The sheeting must be rolled in both directions with an articulated 68kg three-sectional roller immediately after it has been laid into the adhesive. Joints must be butted, grooved and heat welded using the manufacturer’s welding rod, ensuring that the welding rod bonds to more than 70% of the sheet thickness.

Flowcrete: Naturewalk_ Exterior application

2.1 Naturewalk

Description:
Naturewalk, a unique outdoor flooring range designed by Flowcrete South Africa, ensures that outdoor spaces in commercial venues deliver eye-catching surfaces that stay bright whatever the weather. The Naturewalk range sees natural stone aggregates scattered over a clear resin seal to create a unique joint-free gravel finish that is both easy to clean and maintain. Naturewalk has been designed to ensure that walkways and external concourse areas reflect the natural beauty of the outdoors. Naturewalk is ideally suited to outdoor environments subject to heavy footfall such as leisure complexes, theme parks, holiday resorts or other public points of interest. (Flowcrete, 2015)

Benefits:
- Eye-catching seamless stone finish
- Rapid installation available
- Solvent-free formulation
- High impact, abrasion and scratch resistance
- Reduces noise from footsteps
- Aesthetically attractive
- Hard wearing
- Versatile
- Excellent slip resistant profile

Specification:
Natural dark / Natural light naturewalk flowcrete bonded gravel system.
10.16 RAISED WALL A_ TECHNICAL DETAIL 3

Diagram 10.19 Detail 3 (Author, 2016)

10.17 RAISED WALL B_ TECHNICAL DETAIL 4

Diagram 10.20 Detail 4 (Author, 2016)

COUNSELING ROOM 1

COUNSELING ROOM 2

MODULAR PLASTER BOARDS

SKIN LIKE PATTERN MASONITE FLEXIBLE TO FALL AWAY FROM BUILDING

3/4 mm THICK 2 X 5 FT WOOD SQ. SPARKLE HARD, Sanded, UNFINISHED, 80° HANGER HOLLOW SQUARE WITH 1/4 " THICK HARDWARE FOR HANGING THE PANELS TO THE WALL, TREATED TO SUIT THE ENVIRONMENT.

10 mm GLASS FIBERGLASS FABRIC OVERLAY TREATED TO SUIT THE ENVIRONMENT.

180° STAINLESS STEEL BAND ASSEMBLY TO SUIT THE ENVIRONMENT.

LODOCK PEBBLES

2.5 mm THICK 1.2 MM ART EXHIBITION GLASS, TRANSPARENT, 3.2 mm THICK hard 100% SECURITY GLASS, 12 mm THICK SMOOTH SQUARE PINED TO FRAME, COVERED WITH CONVENTIONAL MASONITE FLOORING.

SHADED AREAS

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10.18 RECEPTION_ TECHNICAL DETAIL 8

Diagram 10.21 Detail 8 (Author, 2016)

10.19 DIVIDING WALL_ TECHNICAL DETAIL 9

Diagram 10.22 Detail 9 (Author, 2016)

10.20 CEILING_ TECHNICAL DETAIL 9

Diagram 10.23 Detail 2 (Author, 2016)
10.21 LOUVERS_ TECHNICAL DETAIL

Louvers act as a controllable additional skin to the building. They protect from heat accumulation; control access of natural light; and give patients added control of their environment.

THEREFORE CONTAINS THE FOLLOWING QUALITIES:
- FLEXIBLE
- CONTROLS NATURAL LIGHT
- DIRECT VIEWS
- PROVIDES PRIVACY
- PROVIDES ACCESSIBILITY
- PROVIDES THE PATIENT WITH CONTROL TO CREATE THEIR IDEAL INTERIOR ENVIRONMENT
- LIGHT MANIPULATION

PENUMBRA - A Kinetic Day lighting and Shading System by Tyler Short

An existing mechanical louver system, the Penumbra, is a kinetic day lighting and shading system designed by Tyler Short. It was studied and used as a starting point for the design of mechanical louvers to act as a controllable additional skin to the building. No Penumbra drawings or information (only images and video material) were available at the time of this design. Therefore, new design considerations were applied, which resulted in the development of a similar but new design and working concept for this project. This new concept and basic mechanical aspects are illustrated in Diagrams 10.18 - 10.26.

THREE TYPES OF LOUVERS

1 COMPOSITE BAMBOO LOUVER WITH FULL MOVEMENT
- provides all 4 positions
- on lower ground floor in position 2: louver allow for physical access to outdoor gardens
- allows patient to control and create their ideal interior conditions

2 COMPOSITE BAMBOO LOUVERS WITH 360 DEGREE ROTATION
- allows patient to control and create their ideal interior conditions
- allows one to control views and privacy

3 PERFORATED ALUMINIUM LOUVER WITH FULL MOVEMENT
- located at visual axis point to always allow natural light to filter into the interior. This is fundamental for one’s circadian rhythms.
- this also create lighting effects and stimulation
The design of this window seat originated from the problem infusion patients face – they are trapped in a recliner and there is no space for family to sit. This led to the design of semi-private units with enough space to accommodate family.

The additional seat evolved into a window seat and consequently developed into a combination of window seat and balcony, which also provides a change of position for the patients themselves.

**Chapter 10/ Technical**

**DESIGN ITERATIONS**

1. **MAX. SPACE FOR FAMILY SUPPORT**  
   (design, ergonomics)

2. **PATIENT COMFORT**  
   (materials, ergonomics)
   - Knoll
   - sofa
   - chair

3. **HYGIENE**  
   (materials, detailing)
   - rounded edges
   - wet, wash
   - fire resistant
   - bactericidal
   - moisture proof
   - moisture resistant

4. **ERGONOMICS**

   The design needs to be focused on the patient and their comfort, therefore ergonomics becomes important. By studying of existing chairs and their angles will issue this seat’s comfort. Through this process and considering the requirements, lead to different iterations.

**PRECEDENT STUDIES**

**MATERIALS**

The requirements demand the use of 2 different material layers, each meeting different needs.

**CORIAN**  
(Structural layer)

**FABRIC**  
(Comfort layer)
10.23 CELL-LIKE WALL STRUCTURE

The vertical wall has various physical and metaphysical functions. Its skin-like appearance allows natural and mechanical ventilation and its visual transparency mimics epidermal translucency. It also serves as a physical divider of distinct spaces. The wall, as a landmark of orientation, automatically directs the patient upward while light and air naturally travel through its transparent surface.

REQUIRED EMBODIED CHARACTERISTICS THAT CORRELATE TO THAT OF THE SKIN ITSELF

**BREATHS**

*Provides both*
Natural ventilation
Mechanical ventilation

**SENSORY**

*Tangible*
Natural ventilation

**LIGHTING**

*Provide sufficient artificial light*
Visual transparency
creates privacy aesthetic pattern

**LANDMARK OF ORIENTATION**

*Runs through and connects all 3 floors and is visible from both interior and exterior spaces*
Lighting effects with natural light

**TRANSPARENCY**

*Blur the threshold that separates interior & exterior spaces, to use create healthier interior environments*

**PERMEABLE**

*Allowing interior spaces to connect to exterior gardens*

**NATURE**

*Ability to walk through it*

LAYERS OF THE SKIN

As the human skin is made up of 3 main layers so will this wall, with each layer embodying certain qualities, working together to controlling and achieving required characteristics.

Controller ventilation, allows the building to breath and create pockets of natural ventilation.

Connecting all 3 floors and visible from both interior and exterior spaces, becomes a landmark of orientation.

Being made up of two permeable layers creates a sense that the shadow transform depending on the angle of light and vantage point.

The parametric patterns, layering and characteristics creates a cell-like wall structure that not only resembles a microscopic skin cell but also embodies some qualities.

Diagram 10.41 Wall structure (Author, 2016)
CONSTRUCTION MATERIALS & METHODS

**Unique hexagonal components that have been robotically fabricated from a combination of transparent glass fibre & black carbon fibre**

ARCHITECTURE EDUCATION: NEW ROBOTICS AT UNIVERSITY OF STUTTGART

Computer technology was the driving methodology for this project with digital fabrication used to create component modules that can be re-used by fans for both OFFsite & REsite projects. Simple shapes, created with a single-axle robot (KUKA KR 2700 PRO), were inserted into a brickwork pattern to form elements.

**Figure 10.35 Hexagonal components**
(Mairs, 2016)

**Figure 10.36 Prosobe 370e**
(von Borries & Böttger, 2008)

**Figure 10.37 Milled styrofoam forms**
(Architects, 2009)

**Figure 10.38 CNC cut Corian**
(Williamson, 2015)

**Diagram 10.42 Section through wall**
(Author, 2016)

Prosoloe 370e files a material first seen at the 2009 Venice biennale

Characteristics of CNC and Thermoset (0% resin) structures in the production of complex parts. Created with a single-axle robot (KUKA KR 2700 PRO), a hexagonal metallic structure is assembled with cradles which are then covered with a polyester resin layer. With the robotic arm, the metallic parts are embedded into the polyester resin layer, creating a highly accurate, repeatable and sustainable system for the production of complex parts.

**Figure 10.35 Hexagonal components**
(Mairs, 2016)

**Figure 10.36 Prosobe 370e**
(von Borries & Böttger, 2008)

**Figure 10.37 Milled styrofoam forms**
(Architects, 2009)

**Figure 10.38 CNC cut Corian**
(Williamson, 2015)

**Diagram 10.42 Section through wall**
(Author, 2016)
Chapter 10

10.24 PERSPECTIVES