7.1//
TECTONIC
CONCEPT

By introducing a sense of continuity, the tectonic approach is based on the key aesthetic parameter of new meets old. Whilst preserving the integrity of the old fabric, the new interventions should be clearly differentiated and represent a new architectural language.

This method of contrast or juxtaposition favors the programmatic interpretation of respecting our past whilst contributing towards the future. The success of differentiation not only relies on the degree of contrast between old and new but an acute understanding of connecting the latter.

There are different variations of contrast ranging from subtle to apparent or extreme interventions. Bloszies (2012:12) suggest that although extreme contrast encourages an appreciation for both old and new, a restrained or referential approach is equally effective. The technical exploration will be based on a combination of different degrees of contrast depending on the experiential requirements. The effective use of materials will be the key determinant in the process of differentiation.

Although the fort has not been declared as a national monument, it remains under the protection of the 1999 Heritage Act. Alterations and additions is therefore possible if motivated accordingly. The ICOMOS Charter for conservation and restoration (1964: Article 5) suggests that the repurposing of historic monuments for social use is acceptable and should not adjust the layout or decoration of the building. Modification that change the function may be permitted if it is within the limits of the latter.

Adaptive re-use projects is therefore a sustainable method of ensuring the conservation of historical sites given the new intervention respect the integrity of the old. The intention is to preserve all existing structures and ensure that new additions do not compromise the stability or integrity of the latter.

The excavation and levelling of floor levels should be facilitated under the supervision of the required experts such as environmentalists and archaeologists. Any archaeological findings that has been discovered during the excavation phase of the project will be exhibited in the new additions to amplify the narrative experience. All excavated soil is re-used on site for new construction and remains sensitive to the existing ridge line.

Figure 7.1: Conceptual collage of tectonic approach (Author 2016)
7.3//
STRUCTURAL SYSTEMS & MATERIALITY

In support of the tectonic approach the method of contrast is illustrated through a combination of three inter-dependent structural systems, each contributing to the narrative experience.

Substructure
Apart from the structural integrity of this system, it should also resemble the endurance and protection of our collective heritage. Given the submerged existence of the Fort, the natural condition of the ridge forms the basis of the transitional process of contrasts. To retain the soil of all the excavated floor levels the reinforced retaining walls are finished off with either a board formed concrete or a double coated white Rhino wall plaster finish.

Structural walls will support the lateral imposed loads of the secondary structural system and allow for the alignment of wet and electrical services. The interpretation of the stereotomic quality of the substructure will complement the new tectonic additions of the superstructure which represents the versatility of our future heritage.

Connections
The success of the tectonic approach is largely subjected to the detail connections between the suggested contrasting structural elements. One of the major concerns is the connection of the new additions to the existing structures without compromising the integrity of the heritage fabric. The intention is to elevate the experience and uniqueness of each structural component whilst connecting them to form part of the greater whole.

Superstructure
In response to the original design of the fort, the dismantled structural and decorative steel components will be reintroduced in a combination of primary and secondary structural support frames. These steel components are valued for their versatility in form, their compatibility with other materials and structural stability. Pre-oxidised structural steel beams and columns are also valued for their potential to be dismantled and re-used in future additions. A lightweight steel roof construction is explored as temporary construction to allow for future renovations, additions or demolition of the site.

Connections
The success of the tectonic approach is largely subjected to the detail connections between the suggested contrasting structural elements. One of the major concerns is the connection of the new additions to the existing structures without compromising the integrity of the heritage fabric. The intention is to elevate the experience and uniqueness of each structural component whilst connecting them to form part of the greater whole.

Recycled materials
As a product from the ruination at Westfort Village, the original timber floors was stripped and replaced with new materials. These original oak timber planks will be reused in the temporary exhibition rooms. All excavated soil are utilised on site by a well balanced cut and fill construction plan. Recycled steel components are implemented in construction process. The use of Corten steel plates as cladding is valued for it’s weathering capacity and unique character as it changes over time.

Figure 7.2: Extrusion of all Structural systems at the Fort (Author 2016)
**MATERIAL PALETTE**

### ROOF CONSTRUCTION
1. Copper roof ([www.freedompark.co.za](http://www.freedompark.co.za))
   (Local manufacturer: Copalcor trading)
2. Gravel-Ballested roof
3. Green roof ([www.liveroof.com](http://www.liveroof.com))
   (Liferoof LITE SYSTEM over conventional roofing assembly with moisture portals)

### FLOOR FINISHES

#### exterior circulation
1. 13mm grey stone aggregate on compacted soil
2. Lafarge Artevia with exposed aggregate ([www.lafarge.co.za](http://www.lafarge.co.za))

#### indoor circulation
3. 32mm Recycled SA Pine t&g timber planks
4. Power floated screed on concrete surface bed

### INFILL
1. Corten steel cladding
   (Local manufacturer: ArcelorMittal)
2. Danpalon-polycarbonate sheeting
   (Local manufacturer: Danpal)
   (1 & 2 is fixed to a light weight steel frame)

### STRUCTURAL SUPPORT
1. 300-600mm white plastered structural walls
2. 300mm reinforced concrete retaining walls
3. Structural steel portal frames (NJR)
4. Basement construction (Tanking)
5. Raft foundations

### EXISTING CONDITION AT SITE
600-1,2m dressed stone walls
Rocky ground conditions
Soil erosion
Vandalism

---

**Figure 7.3:** Exploration of the material application (Author 2016)

**Figure 7.4:** Existing and proposed material palette (Author 2016)
7.4/ ENVIRONMENTAL STRATEGIES

<table>
<thead>
<tr>
<th>Function</th>
<th>m²</th>
<th>WATER DEMAND Litres/day</th>
<th>RAIN WATER HARVEST CONTRIBUTION</th>
<th>ENERGY DEMAND Watts/day</th>
<th>SOLAR ENERGY HARVESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research &amp; validation</td>
<td>108</td>
<td>we - 8L (4x4 flush) hwb - 2L (8x4) urinals - 1L (4x4) kitchens - 4x30L TOTAL = 328L/day</td>
<td>Roof catchment 117 m² Surface catchment 187 m²</td>
<td>Lighting 1 856 W/day Office Equipment 13 952 W/day</td>
<td>Solar panels Stand alone system PRODUCT Sunmodule SW80 Poly RNA PV Panel size 958x680x34mm Weight 7.6kg Energy (Wh/day) 270Wh Cost R4650 / panel Total panels installed 40 Total energy generated / day 10800 Wh/day</td>
</tr>
<tr>
<td>Library &amp; Documentation</td>
<td>345</td>
<td>we - 8L (20x4 flush) hwb - 2L (40x4) urinals - 1L (20x4) TOTAL = 1200 L/day</td>
<td>Roof catchment 450 m² Surface catchment 306 m²</td>
<td>Lighting 2 035 W/day Office Equipment 18 034 W/day</td>
<td></td>
</tr>
<tr>
<td>Portal Restaurant</td>
<td>235</td>
<td>we - 8L (30x1 flush) hwb - 2L (60x1) urinals - 1L (30x1) kitchens - 60L (60 seat) TOTAL = 4290L/day</td>
<td>Roof catchment 168 m² Surface catchment 376 m²</td>
<td>Lighting 2 807 W/day Office Equipment 7 500 W/day</td>
<td></td>
</tr>
<tr>
<td>Events &amp; Exhibitions</td>
<td>1334</td>
<td>we - 8L (300x1 flush) hwb - 2L (600x1) urinals - 1L (300x1) shower - 40L (2x2) TOTAL = 4060L/day</td>
<td>Roof catchment 432 m² Surface catchment 766 m²</td>
<td>Lighting 3 920 W/day Office Equipment 12 342 W/day</td>
<td></td>
</tr>
</tbody>
</table>

Sources:
http://ecotechenergy.co.za/calculator/EnergyCalculator.xlsx
GBC SA-Energy-Water-Benchmarking-Tool-v1-20112014.xls

BUILDING METRIC

<table>
<thead>
<tr>
<th>GLA</th>
<th>1839.41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average occupancy hours p/month</td>
<td>110.69</td>
</tr>
<tr>
<td>Average daily occupants</td>
<td>180</td>
</tr>
<tr>
<td>Water demand p/day (2 events/month)</td>
<td>9876L/day</td>
</tr>
<tr>
<td>Water demand p/day (excluding events)</td>
<td>6368L/day</td>
</tr>
<tr>
<td>Average water demand p/day</td>
<td>6602L/day</td>
</tr>
<tr>
<td>Total rain water harvested annually</td>
<td>1689774L/y</td>
</tr>
<tr>
<td>Total rain water harvested daily</td>
<td>4691 L/day</td>
</tr>
<tr>
<td>Potable water supply (municipal reservoir)</td>
<td>42 kW/day</td>
</tr>
<tr>
<td>Total energy consumption p/month (18)</td>
<td>808 kW</td>
</tr>
<tr>
<td>Solar energy generated p/day</td>
<td>846 kW</td>
</tr>
</tbody>
</table>

AVERAGE MONTHLY PRECIPITATION FOR PRETORIA (mm)

- January: 136mm
- February: 5mm
- March: 82mm
- April: 51mm
- May: 13mm
- June: 7mm
- July: 3mm
- August: 6mm
- September: 22mm
- October: 77mm
- November: 98mm
- December: 118mm

AVERAGE HARVEST PER MONTH (90% of surfaces)

- January: 273696m² x 0.136m = 380,256 L
- February: 273696m² x 0.005m = 13,980 L
- March: 273696m² x 0.082m = 229,272 L
- April: 273696m² x 0.051m = 142,596 L
- May: 273696m² x 0.013m = 36,348 L
- June: 273696m² x 0.007m = 19,572 L
- July: 273696m² x 0.003m = 8,388 L
- August: 273696m² x 0.06m = 16,776 L
- September: 273696m² x 0.022m = 61,512 L
- October: 273696m² x 0.071m = 198,516 L
- November: 273696m² x 0.098m = 274,008 L
- December: 273696m² x 0.110m = 307,660 L

Source: http://www.climatetemp.info/south-africa/pretoria.htm

© University of Pretoria
7.5//
TECHNICAL RESOLUTION

Services
Given its remote location and the current conditions of the site, the fort and the Village has no connection to formal services. It is therefore critical to implement environmental strategies that accommodates the energy and water requirements on site.

The water management plan includes the effective harvesting of rain water which is directed to either 5000L JOJO tanks or a built in steel reservoir with a 120 000L capacity. Potable water is supplied by the adjacent municipal water reservoir with a 126 000L reinforced concrete water reservoir and a booster pump that ensures that the water is under constant pressure and always readily available.

Grey water is transferred to the grey water purification system which circulates through three different treatment stages. The first stage is the sedimentation pond (primary treatment), water is then filtered through a aerobic pond (secondary treatment) which leads to the maturation pond (tertiary treatment). All filtered greywater is then pumped back for reuse in waterclosets, urinals, scullery and for irrigation purposes.

The kitchen roof is ideal for solar panel installation as it exposed to maximum sunlight and not visually obtrusive. A battery room below the kitchen allows for central distribution, accessible storage, adequate insulation and natural ventilation.

As part of a larger system, all waste is recycled and sorted on site and black water is connected to a larger system of sewage treatment that accommodates the entire Westfort heritage village.

Natural Daylight
The method of contrast could also be explored in the effective use of natural light juxtaposed to the deep shadows of the submerged structures of the fort. This juxtaposition is therefore a mediator to another world of perception which allows for the experiential to take lead in the expression of place.

It reveals people, places, emotion and fosters the connection to the ethereal. Bille et al. (2007:266) considers light as a critical element in our social life through its reflection on identity, cultural heritage, our morality and need to feel safe or rather visible in our environment.

The use of natural light and ventilation is essential to the experiential qualities of place. It is a physical phenomenon which is measurable, quantifiable and influential in the construction of social space (Bille et al. 2007:265). As an extension from the exploration on contrasting materials, the use of natural light as a respected building material will be utilized to further elevate and manipulate the experiential qualities of place.

Using Richard Kelly’s three main elemental qualities of light as a basic framework, it is possible to identify the intended spatial experience in accordance with a specific light intensity (Kelly 1952:24). The quantity of light is the natural first concern and needs to be assessed in support of software modelling to ensure that the amount of natural light within the building is sufficient according to the suggested programme and intended experiential qualities.

The effective use of natural light as an alternative building material resembles the very idea of phenomenology. By first returning to the essence of the spatial experience, it is possible to establish the quality of the sensory engagement and then designing for the correct light application to enhance the human experience of that particular space.

Figure 7.6: Diagrammatic exploration of natural light as a spatial agent (Author 2016)
### CONDITION 1
**FOCAL GLOW**
- Draws attention
- Highlights

### CONDITION 2
**AMBIENT LUMINANCE**
- Safe and reassuring
- Graded washes

### CONDITION 3
**PLAY OF BRILLIANCE**
- Stimulates the spirit
- Sharp detail

#### INDOOR APPLICATION
- Research office
- Meeting rooms
- Exhibition rooms

#### REQUIREMENTS

<table>
<thead>
<tr>
<th>Light intensity</th>
<th>700 - 1000 Lux</th>
</tr>
</thead>
</table>

#### REQUIREMENTS

<table>
<thead>
<tr>
<th>Light intensity</th>
<th>300 - 700 Lux</th>
</tr>
</thead>
</table>

#### REQUIREMENTS

<table>
<thead>
<tr>
<th>Light intensity</th>
<th>700-1000 Lux</th>
</tr>
</thead>
</table>

### DAYLIGHT SIMULATION
- Revit daylight analysis

**Exhibition rooms**
- 10:00

**Library**
- 10:00

**Digital storytelling**
- 10:00

**Analysis 1**
- Exhibition rooms

**Analysis 3**
- Digital archives

**Analysis 5**
- Digital archives

---

Figure 7.7: Daylight simulations to test the desired daylight requirements (Author, 2016)

© University of Pretoria
Figure 7.8: Detailed section development of courtyard and exhibition rooms

© University of Pretoria
Figure 7.9: Detail exploration temporary roof structure (Author 2016)
DETAIL ONE
NEW EXHIBITION ROOMS

ROOF
- Copper roof assembly (see next detail)

WALLS
Existing stone retaining wall with 40mm rough plaster interior finish
6mm safety glass in aluminium frame nail fixed to existing dressed stone facade and sealed with silicone

FLOOR
32mm recycled 16g SA PINE® timber planks nailed to
228x76mm SA PINE® timber joists spaced at 400mm c.t.c. suspended on an existing floor slab

FINISHING
LED strip lighting glued to 50x50x2mm steel angle fixed to timber posts

Figure 7.10: Detail illustration of new exhibition rooms (Author:2016)
Figure 7.11: Detail resolution of the copper roof construction (Author: 2016)

600mm roofing copper sheets overlapped with 25mm standing seams and copper flashing at end connections with 8mm DELTA®TRELA spacer membrane on a MONIER® slip sheet laid on 20mm Pine OSB Shutter board.

1200x1000x20mm clear translucent DANPALON® microcell polycarbonate glazing panels in aluminium frame all fixed with cleats to 150x50x3mm steel lip channels bolted to 150x90x12mm steel angle cleats welded to 305x165x40mm structural steel I-PE beam welded to 200x200x10mm steel base plated with bolts and adjustable nuts to holding down rods chemically fixed to existing stone wall.
Figure 7.12: Detail exploration of elevated walkways (Author: 2016)

STRUCTURAL SUPPORT

**Floor**
- 100/50mm pre-oxidised steel sheeting welded to 76x50x4mm rectangular hollow steel sections bolted to 203x133x25mm steel I-beams

**Balustrade**
- 50x50x3mm square hollow section for vertical bracing welded to 75x75x5mm square hollow section bolted to 65x50x6mm unequal angles bolted to steel I-beam

**Infill**
- 4mm welded Corten steel cladding
- 12mm Danpalon Multicell seamless polycarbonate sheeting fixed to basic frame fixed to steel angles
- 120 Pure white LED lighting strips glued to steel angles
Figure 7.13: Detail resolution of elevated walkways (Author:2016)
Figure 7.14: Detail section of the beacon of hope (Author: 2016)
Figure 7.15: Detail exploration of the beacons (Author:2016)
MEGARAY® rotating Searchlight fixed to battery base and screw fixed to
20mm steel base plate welded to IP-E steel columns
1200x1000x20mm clear translucent DANPALON® microcell polycarbonate glazing
panels in aluminium frame fixed with cleats to steel purlins
2400x1200x6mm Corten weathering cassette steel panels screw fixed (stainless
steel) with rubber washers to allow for expansion and prevent corrosion
305x165x40mm structural steel I-PE beam with end cap bolted to
305x165x40mm structural steel I-PE columns with 600x600x20mm steel base plates
threaded to concrete footing
150x50x3mm steel lip channels welded to steel columns

© University of Pretoria