Site development
Detail 2 (façade roof)
Scale as shown
Figure 8.48
Site development
Detail 3 (steel lattice column)
Scale as shown
Figure 8.51

Site development
Detail 4 (steel to existing structure; principle shown, all sizes according to specific application and based on chosen modulor)
Scale as shown
Figure 8.49

Site development
Detail 5 (steel to steel; principle shown, all sizes according to specific application and based on chosen modulor)
Scale as shown
Figure 8.50
8.3.1. Site development function/programme

Reinforced concrete is used in most cases to illustrate the function/programme. This corresponds to the bulk mass of the function/programme in the parti-diagram and fits easily with the cantilevering landings of the escalator spaces and beam-and-slab structure of the parking levels.

8.3.2. Site development form/beauty

For the form/beauty elements, a light, yet strong material was needed. Although a composite structure, consisting of a steel frame and cladding, was considered, the construction and waterproofing joints proved too complex. Therefore Ductal Concrete was chosen, “a cementitious material consisting of cement, sand, silica fume, silica flour, superplastisizer and water” (Cavill and Chirgwin). The product is manufactured by Lafarge and thus available in Gauteng (www.lafarge.co.za). Steel fibres are added to the mixture to create a material, which is six to eight times stronger in compression and has ten times more flexural strength than conventional concrete (Lamarre 2009:3). It is also waterproof (Vosloo 2009), nullifying the need for an additional layer. The span:depth ratio (s/d) was determined by looking at two built examples:

- Road bridge (fig.8.54), Shepherd’s Gully Creek, designer unknown, consists of
a single 15 m spanning structure with pretensioned beams of 600 mm depth (Cavill and Chirgwin), thus:
15000 / 600 = 25 s/d
and formwork panels with a depth of 25 mm and a span of 1100 mm, carrying a 170mm thick reinforced concrete slab, thus:
1100 / 25 = 44 s/d;
- Villa Navarra (fig.8.55), Provence, by Rudy Ricciotti, which has a roof that cantilevers for 7390 mm with ribs having a depth of 515 mm (Lamarre), thus:
7390 / 515 = 14,3
14,3 x 3 (for cantilever to span) = 42,9 s/d;
Therefore, the average s/d is:
(25 + 44 + 42,9) / 3 = 37,3 s/d
The longest span for the roof over the escalators is 9582 mm, thus:
9582 / 37,3 = 256,9 mm

rounded up to 276 mm thick ribs according to the chosen module (230 + 46). A 23 mm thick skin is structurally sufficient (based on the thickness of the formwork panels used for the above mentioned bridge) and corresponds to the module. Precast panels were consequently designed for assembly with the steel supports on site (fig.8.48). All other applications of Ductal concrete were designed using the same principles.

8.3.3. Site development tectonics/structure

Steel is used throughout the project, as the tectonics/structure component, because of the slenderness ratio and ease of connection to an existing structure. Most of these are mechanically fixed, increasing the robustness of the components to be re-used on other structures if the need arises in the future. All steel is painted grey, including a
fire protection layer. Iscor distributes the steel, being sourced from their production facility in Vanderbijlpark (www.iscor.co.za).

8.3.4. Circulation elements

The escalators are 35˚ Schindler units with 800 mm wide steps. Details are provided by the manufacturing company (www.schindlerdraw.com).

The vehicular elevator’s size is based on those available from Wöhr, a German company that specializes in parking solutions (www.woehr.de).

8.3.5. Service ducts

The services ducts (fig.8.47; also see section 6.3.6) contain all necessary piping and ventilation ducts. They are composed of steel angle frames fixed to the existing structure with chemical bolts and clad with 1 mm thick galvanized steel sheets. Most are located on the northern façades of the building.

The ventilation system was designed after consultation with Vosloo (2009), Scheepers (2009) and Vos (2009). It works on the following mechanisms (fig.8.55):
- air in the warm-air duct moves upward to pull stale air out of the interior spaces at ceiling level;
- cool air is then pulled into these spaces, because of negative pressure;
- this air is pulled through a cool-air duct before entering the space;
- air in the cool-air duct moves downward, to push fresh air into the space.

Upwards movement of the air in the warm-air ducts is achieved by applying the following
measures:
- these ducts are positioned in the northern part of the service ducts, so as to be heated by the sun;
- the galvanized steel sheet cladding is painted matt black on the exterior surfaces where it covers these shafts to increase heat absorption;
- the ducts taper towards the top to increase the upward air speed (based on the Venturi-effect; www.spiritus-temporis.com);
- precast Ductal concrete panels on top of the outlets are aligned to the main wind directions for summer to create negative pressure beneath them, thus pulling the warm air out.

The downward movement of the air in the cool-air ducts is attained by implementing the following measures:
- the ducts are positioned in the southern part of the service ducts to be shielded from the sun;
- the ducts taper towards the bottom to increase the downward air speed (based on the Venturi-effect; *ibid.*);
- water mist is sprayed into the ducts at the top to decrease the temperature;
- precast Ductal concrete units are positioned at the top facing east (according to the main wind direction during summer), ‘scooping’ air into the cool-air ducts and forcing it down.

The cool-air duct is insulated from the city climate by means of:
- a 100 mm polystyrene insulation layer which is inserted between the warm-air and cool-air duct;
- the area dedicated to piping serves as a second insulation layer on the southern side.
of the cool-air duct;
- the side has a double layer of galvanized steel cladding, with a 50 mm polystyrene layer in-between.
An ultraviolet lighting unit is installed just beneath the water mist sprayer to prevent any bacteria from entering the new ‘sites’.

8.3.6. Vegetation

Modular turf (fig.8.57) is used for the main open spaces’ grassed areas, a lightweight growing medium manufactured by Fytogreen, an Australian company (www.fytogreen.com.au). It consists of an aminoplast resin foam, laid on top of geo-fabric, a Fyonop drainage cell layer and a Low Density Plastic liner (fig.8.58; ibid.). Irrigation pipes are placed between the panels and an LM-lawn layer is added onto this.

Paper bark thorn trees (Acacia sieberiana var. woodii, fig.8.59) were chosen for the main open spaces for their wide canopies, providing shade for the users of the existing and new spaces. Their placement coincides with existing column positions on the floor below, negating the addition of structural supports. Each is planted within a Ductal concrete planter box, since the material strength creates less loading than conventional structures.

8.4. Second phase: the MINI Space Gallery

Figs.8.60-8.75 show all plans, elevations, sections and details for this phase of the project.
Again, the parti-diagram was used as the guiding principle for solving the design and final details.
Structural sizes are all based on calculations from Orton (1988:22-54; see Appendix B), as with the previous phase.
MINI Space Gallery

Lower floor plan
Scale as shown
Figure 8.61

MINI Space Gallery
South elevation
Scale as shown
Figure 8.62
New exhibition panel
heavy cotton canvas fixed to galvanised steel frame
(similar to detail 9)

New rotatable and stackable exhibition panel
heavy cotton canvas fixed to galvanised steel frame in sliding channel
(see detail 8)

Existing floors
255 mm reinforced concrete slabs with new 50 mm polished screeds

Existing floor
255 mm reinforced concrete slab

New secondary exhibition space

New primary exhibition space

New offices

New walkway and bridge

New bridge ramp
90 mm cast in situ reinforced concrete slab on steel H-joints on 254 x 254 x 11 mm steel H-beams fixed to existing floor
(see details 5 and 6)

New sliding glass doors
by Hlafardan
(see detail 2)

MINI Space Gallery
Section A-A
Scale as shown
Figure 8.65

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