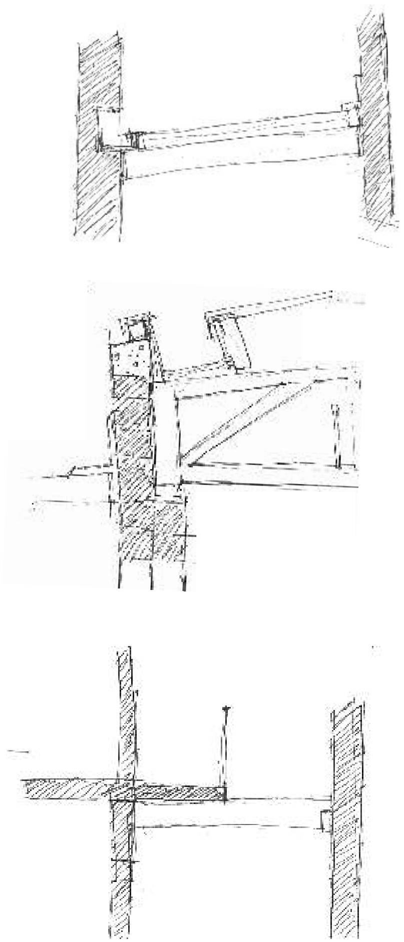
Technical report

Introduction

The following text is supplement to a set of drawings, to enrich and motivate decisions made on a technical level. The aim is not to repeat any information, but only to display how an idea should extend to the finest level of detail when making architecture. The technical report further does not address all issues raised but only a selection of the most important elements. The ideas expressed here can however be extended throughout the entire project.

Response to the surrounding fabric



Interior passages

The connection between the red face-brick wall and the intervention (the southern edge of the site) makes a clear distinction between new and old. In the courtyard the face-brick wall remains an exterior wall, but in the passages it becomes an interior wall. The interior passages leading to the cells on the first floor are set back 1200 mm from the existing boundary walls. On the first floor a glass balustrade with timber handrail runs the length of the passage. The roof connection is made with a skylight, bringing light into the back part of the structure. The face-brick wall is topped with a new concrete cornice that conceals a box gutter (SEE FIG. 68).

Courtyards

All the courtyards are situated directly adjacent to the existing urban fabric. In each courtyard the fourth edge is defined by an existing boundary wall.

In the design the building's volume is fragmented by a series of courtyards. This layout allows for natural ventilation and daylighting, with ample outside views. The courtyards form part of the passive climate control in the design. Courtyards are specifically not shaded to address winter conditions and force visitors to move between courtyards; a ritual of diurnal rotation is followed from one courtyard to the next as the day progresses.

The courtyards on level 0 are finished in open timber decking, creating an abstracted or architecturalised nature. On level 1 the courtyard is finished in Cor-ten steel strips welded to a Cor-ten steel frame. This allows light to filter trough a skylight which illuminates the reading section of the library. The change in material further indicates a difference to the lower courtyards, this one is dedicated for the use of permanent or religious members. The use of these two finishes allows for an edgeless transition between interior and exterior spaces as floors are finished on exactly the same height.

75_ Concept sketches of the detail connection between the new and existing fabric.

Screens

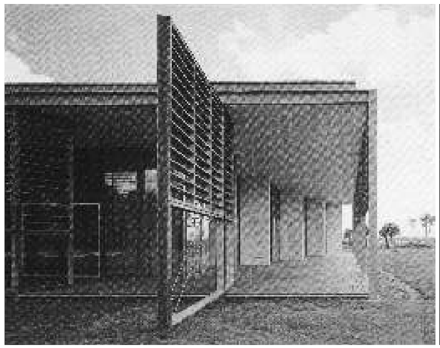
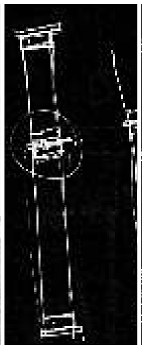
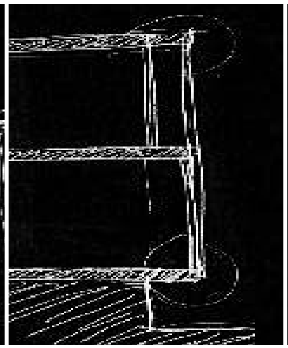
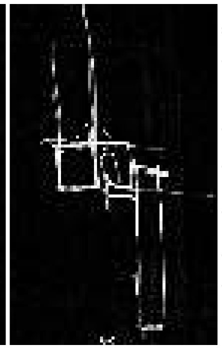
Screen devices will be used for both visual and sunlight screening. The screens read as solid surfaces when viewed from a distance, and disintegrate on visual approach, to where they only filter light to the inside. Two different screen designs are used throughout building.

A timber and steel screen covers the whole length of the western walls of the audience room and the chapter room. This screen acts as an abstract element that relates to the elevation of the massive off-shutter concrete wall of the Old Mutual Building. It starts to visually disintegrate the concrete wall down to a more human scale. Both this screen and the one on the western edge of the site consist of the same configuration of timber slats as the chapel. Only here the slats are spaced further away from each other and instead of a cladding material become ascreen.

The built-up edge around the site makes larger openings on the eastern and western sides of the building possible. In the common room the western facade is pushed back to form small balconies, which consist of floor-to -ceiling stacking doors in wooden frames. The entire western facade is screened with a perforated Cor-ten steel element. Individual screens on sliding tracks allow the facade to open up even more, depending on the time of day.

Intervention in the pan-handle

The 2,8 m slope of the site from south to north was maximised to create changes in levels throughout the design. The slope furthermore made it possible to insert a structure into the pan-handle. The close proximity of buildings force a dialogue between the existing buildings (NLSA and Noordvaal offices) and the new structure. A ramp leads visitors from the lower level of Vermeulen Street to the entrance on the mid-section of the Noordvaal Thoroughfare. A 500 mm slit between the new structure and the NLSA allows for ventilation and daylight to reach the lounge area of the intervention (SEE FIG. 51).

76_ Pivoting door forming a shading device. 77_ Concept sketch of detail of pivoting door. 78_ Concept sketches of the western facade of the Common Room and sliding shading devices.

Chapel and multi-use hall

Intervention and structure

The chapel and multi-use hall will be inserted into the existing National Library of South Africa (NLSA). The existing concrete column and beam structure, roof structure and exterior skin will be retained. The existing floor slabs will be removed and the ground floor excavated to provide the height needed in the multi-use hall. The existing ceiling will be removed, revealing the roof trusses and existing skylights.

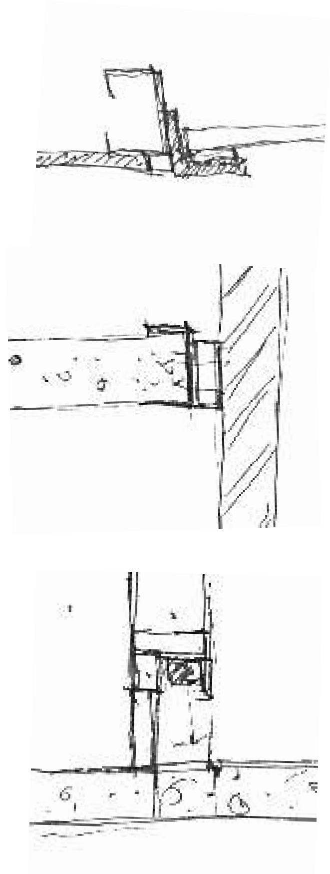
The chapel and multi-use hall will be inserted as a box with various ramps spiralling around it, which form the cloister. The multi-use hall is constructed of 200 mm off-shutter reinforced concrete. The chapel is constructed of a stiff light-weight steel structure and connected with steel braces to the concrete structure of the exterior skin. This, together with the ramps and retained roof structure, provides lateral stability to the exterior skin.

A continuous movement route is formed by a single floor finish which leads from the reception area, up the ramps, and into the chapel. In this manner an urban carpet extends from the exterior into the most sacred space. Floor slabs and ramps are constructed from fine- aggregate reinforced concrete which is brushed to allow for a better mechanical grip.

The intervention will be distinguished form the existing structure through a shadow line running at the edge of the connection between new concrete work and the existing skin. For this, a steel channel is welded to a 50 mm steel plate which is then bolted to the existing structure, and the concrete slab cast into this channel (SEE FIG. 64). This type of connection is easily reversible.

The sacristy and eastern wall of the chapel is formed by a translucent glass and steel wall. This wall is constructed from double-glazed panels with their frames concealed in hollow stainless steel sections. These section are fixed to vertical 20 mm stainless steel fins.

The exterior of the NLSA will stay unchanged except for the refitting of windows with safety glass and two elements which announce the intervention. The first is new windows and timber shading devices on the western side, and the second is a Cor-ten steel-clad protruding box that acts as a threshold before entering the “retreat space”.



79_ Isometric view of the chapel and multi-use hall seen form the cloister. 80_ Concept sketches of connection details

Acoustic and thermal treatment

In the chapel, members of the congregation will be no further than 10 m from the altar, so there is no need for extra sound reflection. The walls are acoustically treated for sound absorption in the chapel and sound insulation from the cloister. From the interior to the exterior a typical wall will consist of 50 mm mineral wool fibre board under open spaced timber battens (20% openings), a 75 mm cavity and a layer of timber strips glued to a particle board base. Ramps in the cloister are furthermore specifically solid (reinforced concrete slabs) to deliver acoustic protection from the entrance area and multi-use hall.

All widows in the chapel are double-glazed for acoustic protection from activity in the cloister. Windows inserted into the existing skin on the western side will also be double-glazed to address disturbances and activities from the route in the pan-handle. This is further done for thermal protection from heat radiated from the blank eastern wall of the Noordvaal Office Building.

Both the chapel roof and existing roof of the NLSA are insulated with a 40 mm mineral wool fibre board.

Ventilation

Both the chapel and multi-use hall require mechanical ventilation to obtain the required air change rate of 7,5 l/s per person. Fresh air is drawn from the base of the building on the southern side and carried through shafts concealed in the suspended roof of the multi-use hall. From there fresh air is distributed through two separate cycles. The cloister, lounge and foyer areas will be naturally ventilated.

Lighting

Natural lighting will not be sufficient in this part of the NLSA; the chapel and multi-use hall have specific lighting requirements, while the cloister area north of the chapel has limited exposure to natural light.

This is addressed by removing the existing ceiling to reveal existing skylights. New skylights will be inserted higher up on the southern side.
The new ceiling constructed between the existing roof trusses will be painted white, light is reflected off the ceiling by concealed tubular fluorescent lamps.

Concealed tubular fluorescent lamps are further used to light recessed handrails. These lamps follow the incline of the ramps to wrap around the chapel and multi-use hall. They furthermore function as route indicators. Concealed tubular fluorescent lamps are also used in the chapel to fulfil the minimum daylight requirements.

81_ Images of a concept model indicating the insertion of the chapel and multi-use hall into the National Library of South Africa Building.

Cells

Structure and shell

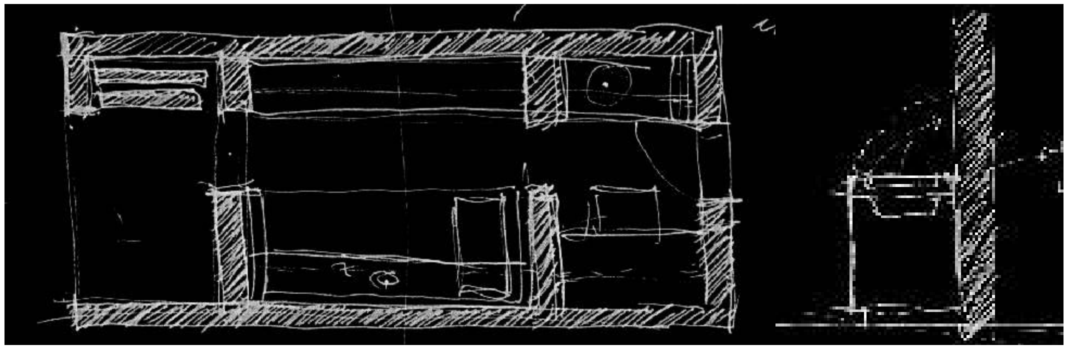
The cells are grouped together on the southern side of the site and have north facing facades. The cells and ablution facilities consist of modular units of 2,4 x 5,6 m that are divided by 200 mm off-shutter reinforced concrete fins. The fins, together with a 200 mm off-shutter reinforced concrete slab (260 mm in the cantilevered walkways), form the structural system, which carries all loads and frees up facades.

The northern edge of the cells is formed by a sun space. The outer facade consists of full room-height glass stacking doors in a timber frame. The inner layer is formed by a glass door in a timber frame, and a window with a concealed frame in a stainless steel section above a 110 mm painted brick wall. The southern edge is also formed by a 110 mm brick wall that is painted on the cell side and tiled (with white mosaic) on the walkway side. A stainless steel lintel runs above the door and conceals the frame of the glazing unit.

A timber shaft conceals and gives access to a 150 mm oPVC rainwater down pipe and a 40 mm oPVC water pipe for the handwash basin.

Finishes

The floor of the cells will be finished in 22 mm timber tongue and groove floor planks, and in the sun porch the concrete slab is given a direct-finish. The ceiling consists of plywood boards fixed to steel z-sections and finished with a stainless steel cornice to create a shadow line around the edge of the space. The ceiling continues out into the sun space and into the walkway, interrupted only by small slits that conceal window frames. This creates a indoor-outdoor connection.



82_ Concept sketch of cell layouts and fold-open handwash basin.

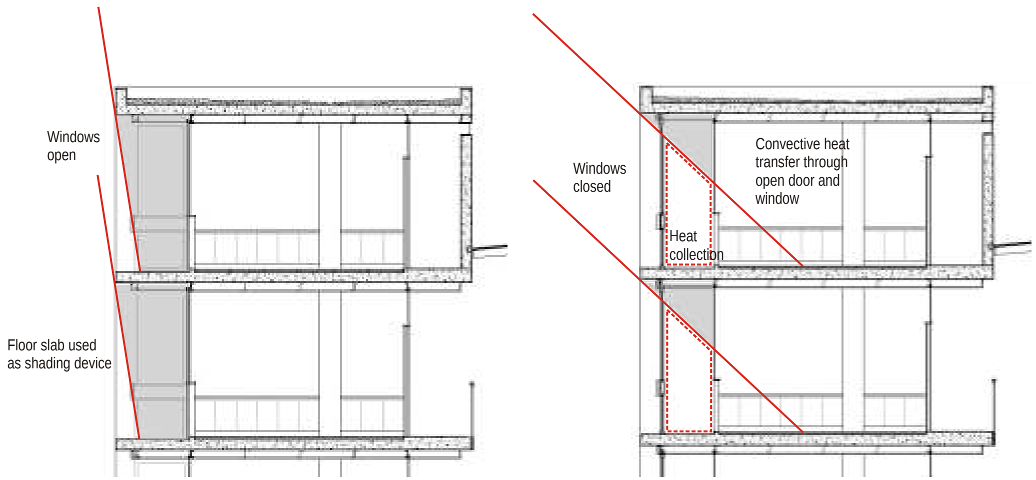
The base for the bed consists of a cantilevered off-shutter reinforced concrete slab. The remainder of the cell is fitted with timber cupboards and furniture. In one of the cupboards a handwash basin is concealed by a timber covering that opens up to reveal the basin (SEE FIG. 66).

Sun spaces

The sun porch will be indented into the building between the concrete fins. Heat loss through the end walls is minimised without reducing solar exposure, thereby increasing the thermal efficiency of the sun space. The connecting wall is a thermally conductive, massive wall with large openings, leading to the inner room where heat is needed. The convective heat transfer is higher than the conductive flow across the wall.

To be effective in winter, the outer facade must be kept closed and the windows and door of the inner facade kept open during the daytime and closed at night (SEE FIG. 67). The thermal mass of the concrete slab moderates the diurnal temperature fluctuations to make the porch habitable. The slab, furthermore, acts as a shading device during summer when the outer facade is completely open (SEE FIG. 67).

The fact that each cell has a separate sun porch means that occupants can easily control their own environments.



83_ Diagram of a section through a cell indicating first the summer and then the winter functioning of the sun porches.

Concrete

Concrete is the material of choice for all the structural and most of the solid envelope construction. Its flexibility in terms of its properties means that most structural, thermal and fire performance requirements may be achieved through variation of the basic elements of the material. Concrete structural frames free the facades from load bearing, and so make floor to ceiling glass walls possible; the result is a dynamic flow of space from inside to outside. Concrete as a mass element creates thermal mass which is beneficial for passive climate control.

Free-standing exposed concrete, linked to nature, is remarkable for its lightness and weightlessness [Blaser, 2001; 33]. The natural quality of the material encourages human interaction. Furthermore, in the proposed design the quality of processional change through continual environmental exposure will reveal an ongoing process that relates to the continuous ritual process.

In-situ concrete will be used as a structural and sculptural element. All concrete will be off-shutter, with finishes varying from smooth, using steel form-work, to rough, using wooden boarding. The use of timber shuttering reveals the truth of the construction process and the influence of other materials. The texture of the surfaces will be used to differentiate the tactility of the surfaces where applicable.

Tadao Ando uses standard size concrete blocks throughout his designs. These blocks measure 900 x 1800 mm, with six tie-rod holes each arranged in a grid of 400 x 600 mm. The tie-rod holes have a diameter of 25 mm. The resulting pattern, which is consistent on both the exterior and interior, is in measured, agreeable proportion to the human scale. The wall becomes a readable surface [Blaser, 2001; 52].

In the design a smaller block of 600 x 1200 mm will be used. This is a readily available standard steel wall panel size, which will lower the cost and environmental impact of manufacturing shuttering [Wegelin, 2002, 15]. The composite board sizes are made up of multiples of 300 mm, implying a compatible building system. Tie-rod holes will be left exposed like the concrete, establishing an interior-exterior connection. The wall formation will awaken curiosity about the activities within [Blaser, 2001; 85].

Concrete walls and columns are made with a white concrete mixture, which lends a sensual quality to the structure. This is done to further create a clear distinction between new and existing concrete structures. Where concrete is used as interior flooring, it is power floated and smoothed with a steel trowel before setting (direct-finished floor). The smooth concrete finish can be polished, giving the it an aquatic feeling.
Movement routes are constructed from 30 MPa reinforced concrete; interior routes are brushed and exterior routes sand-blasted to reveal the aggregate and allow for a better mechanical grip.

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Wood

As a natural material, wood is the perfect expression of our intimate connection with the world in which we live. It was the first, and remains the most important, of the plants used by humans. Grown and harvested in a sustainable manner, timber is a renewable resource, and thus the ultimate environmentally friendly building material. Well built and tested timber structures are energy efficient, flexible to receive later additional structures, and respond organically to external conditions [Fox, 1989; 123, 130]. In terms of indoor comfort and health aspects, timber is one of the most acceptable materials [Stulz, 1993; 101].

Wood will be used extensively throughout the project, as construction material and for both indoor and outdoor elements. All purpose-made (non-modular) shuttering will be constructed of timber. External elements include timber shading devices, while interior elements include composite boards as cladding material, wooden slats as privacy screens, and timber flooring. Furniture throughout the building will consist primarily of locally produced timber units.

Only timber from sustainable managed sources will be specified. The production and processing of timber requires less energy than most other building materials. Demolished timber structures can be recycled as building materials or burned as fuel (and the ash used as fertiliser) [Stulz, 1993; 109]. When disposed of through rotting or burning, it is returned to nature without any further energy input.

Today, environmentalists are concerned about the toxic contents of pesticides in wood preservatives. Using chemically treated wood can be avoided, however, by following basic rules; (i) eaves can protect the facade if extended far enough, (ii) when using vertical battens, water drips on horizontal boards will ensure that water runs off more quickly, and (iii) timber could rest on metal shoes, rather than come in direct contact with the ground. Alternatively, finishing wood with beeswax or repeated layers of approved wood oil, sanded in between applications, will suffice.

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Glazing

Glass manufacturing is a high-energy industry, but glass is easily recycled when separated from other materials [Fox, 1989; 51]. The high-energy demand of glass manufacture and its ability to increase the cooling load of the interior by solar heat gain, should be considered.

The specific climatic condition of the site implies that larger fenestration on the east and west facades of the building is possible. It will be possible to control solar heat gain during the summer months through simple shading devices. During the winter months a system based on direct gain and sun porches will create comfortable environments.

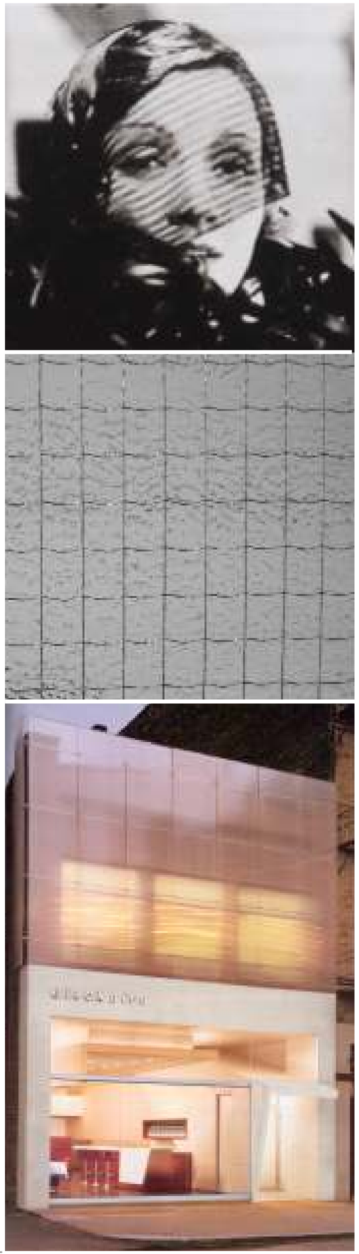
Low emissivity glass will be used where there are large glazed surfaces and where heat gain could be a problem. Laminated glass will improve the thermal and security aspects of glazed areas. Double glazing is needed for satisfactory acoustic protection of the multi-use hall and chapel.

In this design glass acts as a gauze veil, simultaneously concealing and revealing; a metaphor for the segregation or inclusiveness of the ritual act.

Steel

Nearly all metals are derived from non-renewable resources, the extraction of the raw material is destructive, and large amounts of energy is used in the refinement and transport of metals [Fox, 1989; 67]. The environmental impact of metals can be reduced by using larger amounts of recycled metals and designing components to be demountable and re-useable.

Steel has a high strength-to-cost relationship, but has poor fire performance qualities and poor resistance to corrosion. Steel elements should be galvanised after all cutting and forming has been done.



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Composite boards

The use of open building systems reduces the need for wet construction and subsequently the damage that the extraction and manufacture of lime and cement has on the environment. These systems demand structures that can be erected or dismantled with the minimum use of energy and waste of materials.

An dry-walling system will be used in the public and storage component of the project to divide spaces internally. This adds to the flexibility of these spaces, taking into consideration possible future changes in use. The system is made up of three layers; the inner and outer layers consist of a 12mm composite flat sheet connected to a timber framework, and the 50mm cavity is filled with glass fibre blankets or mineral wool insulation. The use of materials with inherent decorative qualities(i.e. Chipboard or plywood) is encouraged.

The standard size of these composite boards is 1200mm x 2400mm. They will be used in a horizontal direction creating strong horizontal lines. This connects to the idea of the design quietly existing in amongst the surrounding urban fibre, with only a few vertical elements standing out.