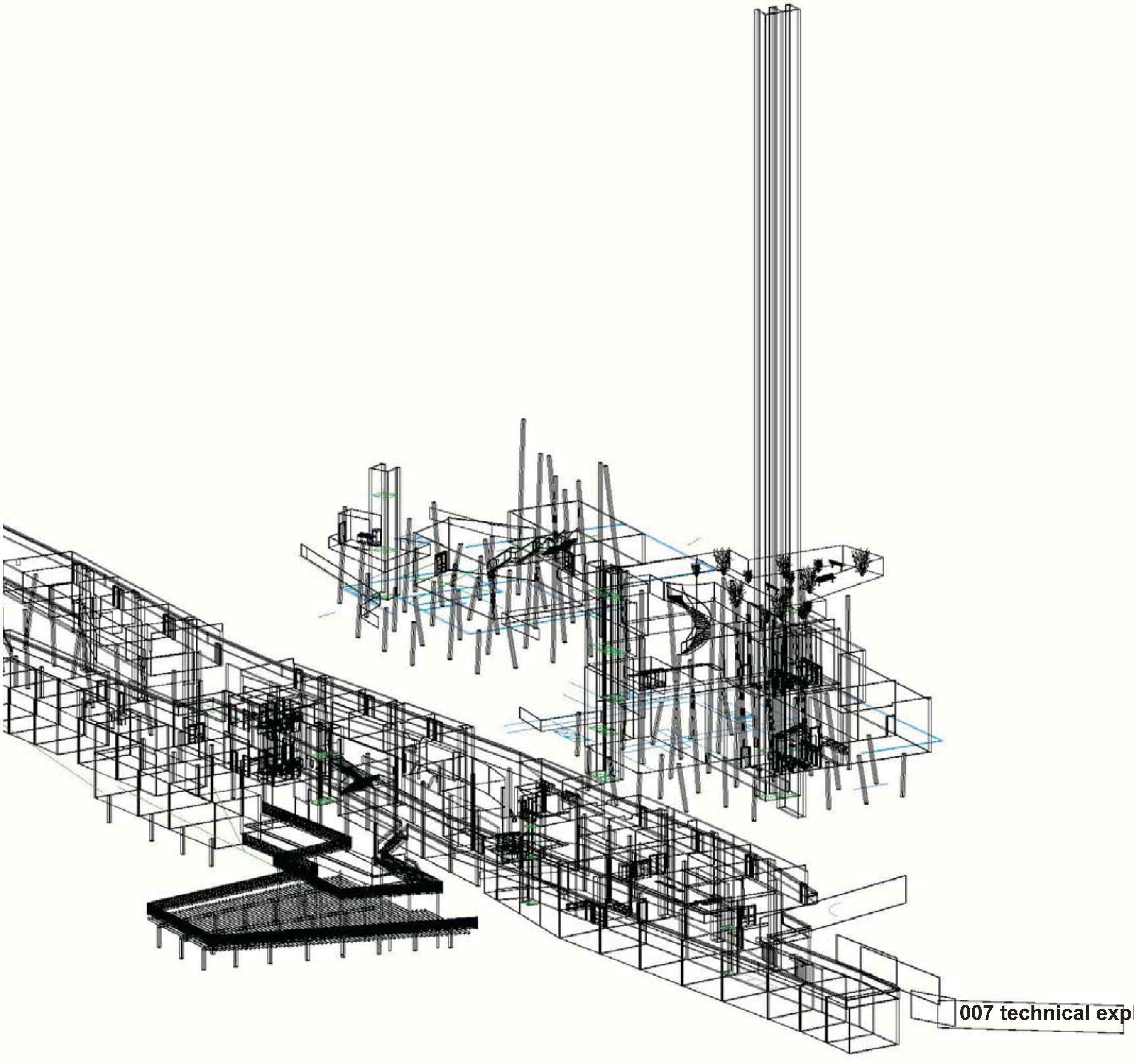


007 technical exploration

0071 Structure

The structural system used in the intervention comprises primarily of steel and concrete, with concrete being the primary building material used throughout the intervention as it accentuates and emphasize a dialogue between the building and the towers. Concrete is used as the permanent grid material, as ORGANIZATIONAL ARCHITECTURAL ELEMENTS, around which evolution of the building programme may take effect.

The service cores situated along the length of the building, form part of the permanent, non-programmable spaces that will remain static in its configuration over the buildings life span.

Column and beam construction is used throughout the building, being stiffened by slabs as well as the vertical cores. Reinforced off-shutter concrete columns of 305mm x 305mm in size are used throughout the intervention. Inside both the cooling towers housing the conference facilities and the events centre, the columns are arranged on a 5m x 5m grid. A total of 33 columns are used inside the tower accomodating the events facilities and the outlook platform. The lift shafts and wet cores provide additional vertical support inside the towers. A sum of 39 columns are used in the tower housing the conference facilities and exhibition spaces.

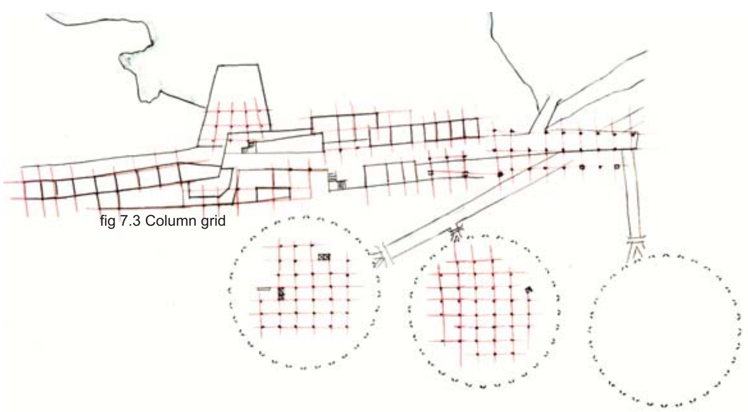


fig 7.3 Column grid

The concrete columns supporting the building are arranged on a 6m x 6m grid, and all the concrete columns used in the design are **slanted at different angles**, bearing reference to the columns supporting columns of the cooling towers.

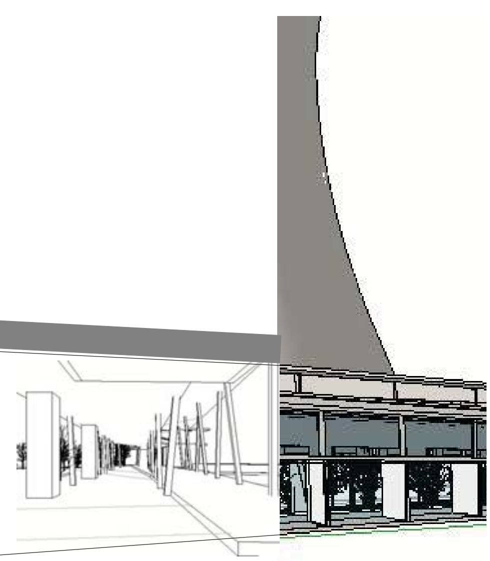


fig 7.2 Structural stability provided by service cores and slanted columns

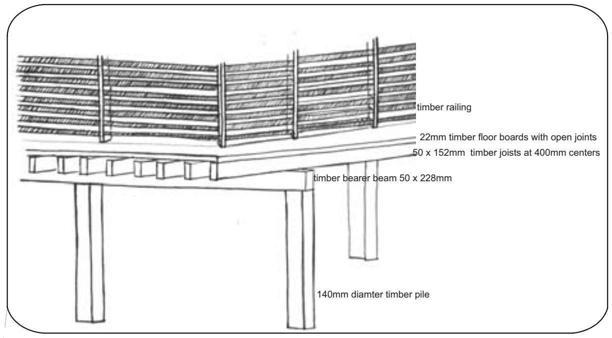


fig 7.6 Wooden deck and pile construction

Concrete driven piles form the foundation for a section of the building where it appears to be suspended in mid air. These piles anchor the north facing shops overlooking the lake. Timber piles are used for the wooden deck which serves as the public place upon arrival at the western entrance of the building.

Piling into the lake is made possible due to the fact that the building's placement is along the water's edge. During the construction period, the water's edge is manipulated and pushed back whilst the piles are placed in position. Once the construction and placing of these piles has been completed, the water's edge is manipulated back to its original position.

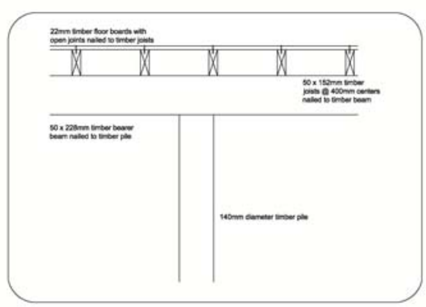
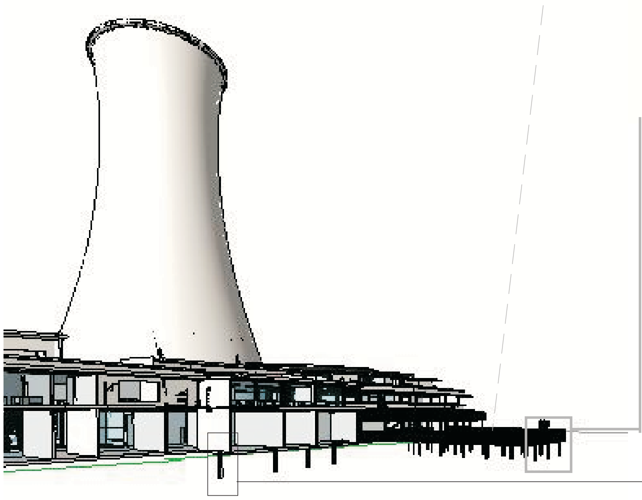


fig 7.4 Detail of wooden deck and pile



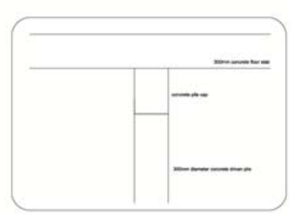
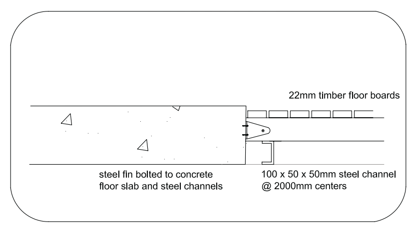


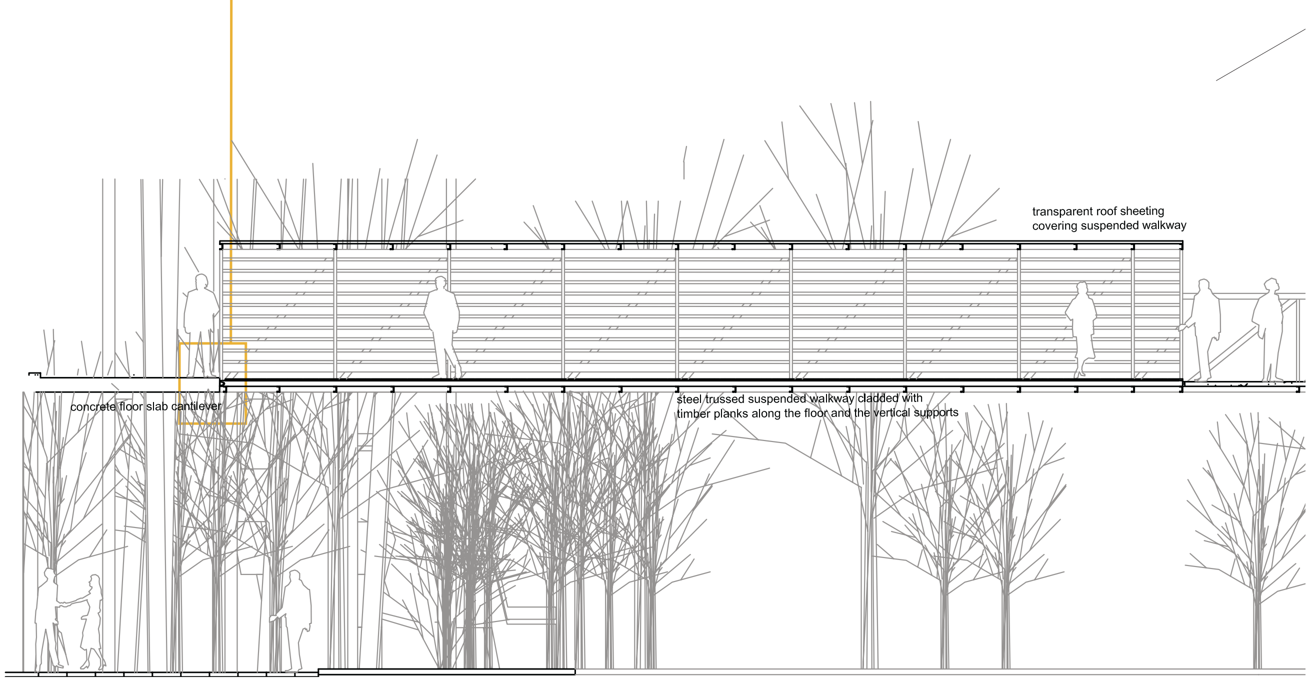
fig 7.5 Detail of concrete pile

Steel is used in areas where the structural requirements of concrete do no meet those required. In many instances throughout the intervention, the design requires that certain structures span distances of up to 30m in some cases with no vertical support. As in the case of the suspended walkways spanning and bridging the building and the towers, the truss systems used here are able to span the required distances between two anchored supports. The vertical structural members of the truss system provide an edge or railing reaching heights of up to 2 meters.

Steel is used more extensively inside the towers due to its structural advantages such as its ability to span large areas with minimum supports. Lightweight steel floors are inserted in both the towers, which are vertically supported by concrete columns. The steel trussed floors speak of an architectural language that heightens the differences between the mass of the outer shell and the lightweight structures within it. This can only be recognized and experienced once inside the towers.



connection of floor slab to truss walkway



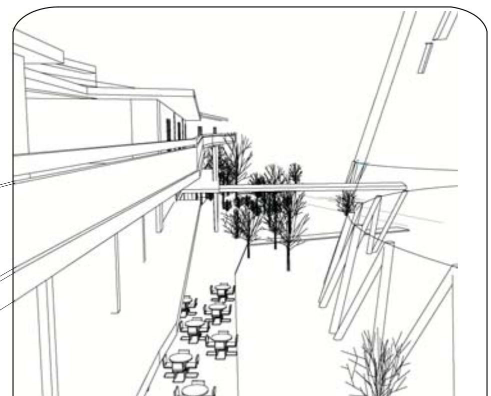


fig 7.7 Suspended steel trussed walkway

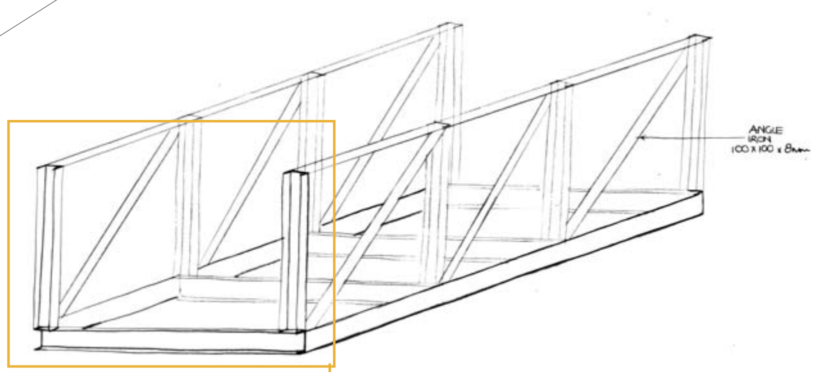


fig 7.8 Truss structure

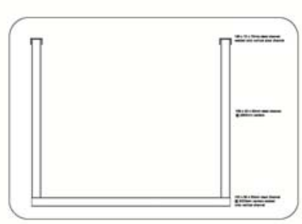
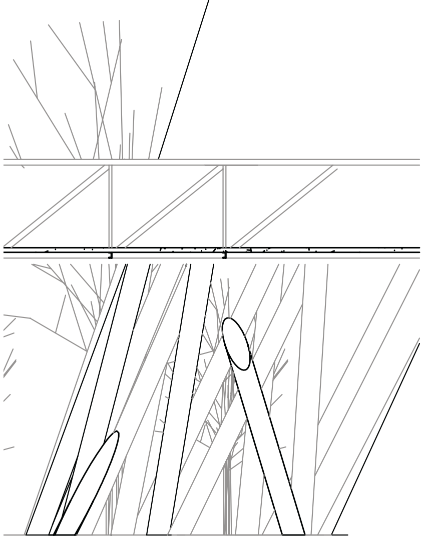
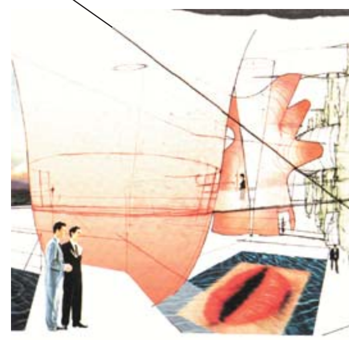


fig 7.9 Truss system components



00711 Precedent: Diller and Scofidio, Blur building

Diller + Scofidio operate differently than traditional organizers of space and materials and they refuse to accept the myth that art and architecture are simply the production of functional elements. They do not start from the premise that the aim of architecture should be the production of an object that houses a defined function and that behaves in a responsible fashion. They are not concerned, at least not primarily, in modulating environmental inputs to produce an efficient and sensible place to live, work, or play. And they do not make the way in which the building continues or contributes to the context in which it appears the focal point of their design activities. Their work is not consumable bits of cultural commentary that lives on white walls or on museum pedestals. Rather, it has the character of art as a concentrated form of value, the form of architecture, and the function of providing a self-conscious form of display.



The objects they make have a seemingly effortless grace and appropriateness that we do not have a proper critical language to assess.

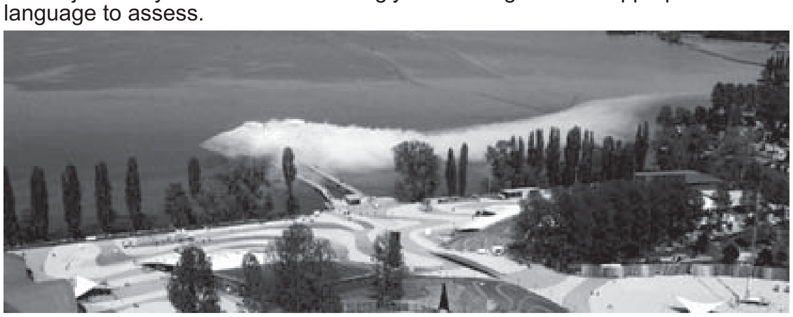


fig 7.10 Blur building

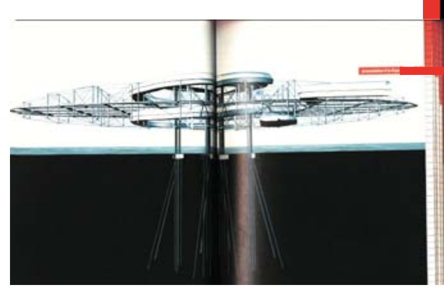


fig 7.11 Steel elevated structure

(Diller & Scofidio 2002:80)

00711 Roof construction

The roof is constructed of cast-in-situ concrete slabs. The roof overhangs provide the necessary shading needed for the northern facade openings.

The roof designed to allow light in slopes in a eastern direction. With various pitches each sloping in the same direction, light filters through the glass skylights of raised surfaces of the roof. These openings at the roof level are perceived as slits IN THE ROOF, flooding the guest rooms with natural daylighting.

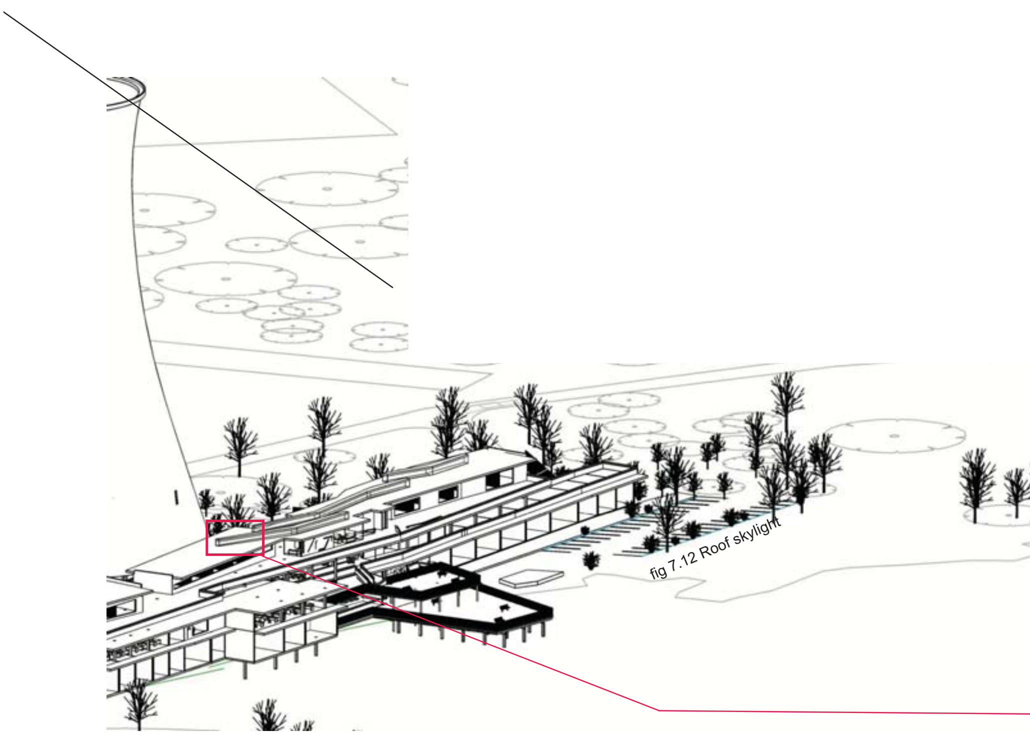
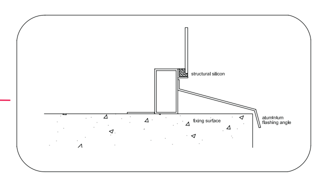


fig 7.12 Roof skylight



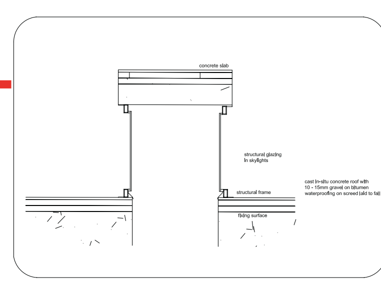


fig 7.13 Detail of roof skylight

0073 Human comfort

00731 Ventilation

A combination of mechanical and passive ventilation systems is used throughout the project. Passive ventilation is explored and used in as many instances throughout the design with the intention of saving energy over the buildings life cycle. Where passive ventilation could not create the comfortable environment the users require, mechanically assisted passive ventilation became the solution, as in the instance of ventilating the towers.

Natural ventilation is only efficient if proper cross ventilation can occur, and the cross ventilation is dependant on the path of the air flow as well as its distance. Throughout the building, the designing of rooms, whether offices or guest rooms, is kept to an average depth of 7 meters in order to create opportunity for cross ventilation to occur. The depth of rooms not only contributes to the ventilation but also the natural daylighting of the spaces.

When dealing with the issue of ventilating the towers, the assumption was initially made that the stack effect would be ideal in ventilating the towers. The exploration of this assumption proved that in order for stack ventilation to occur, a considerable difference in temperature needs to occur in order for the air to flow freely from a high pressure to a low pressure. Because of the vastness of the space inside the towers and the lack of direct sunlight, it became apparent that the temperature inside the towers will almost always be cooler than the temperature of the air outside the towers. In order for the stack ventilation system to work, it is required that the temperature of the air inside the towers needs to be hotter than that outside the towers in order for the cool air outside the towers to be drawn in, heats up and is exhausted through the opening at the top of the tower. Various methods were explored as to how the air inside the towers could be heated up in order to facilitate this stack ventilation, and though in theory painting the skin of the tower black should work, in reality it proves to fail, for the vastness of space is too large, and the surface area that will heat up is not sufficient for the requirements.

It was later discovered that the stack ventilation system will not be successful in ventilating the towers, and therefore a mechanically assisted stack ventilation system needs to be addressed. Four ducts will be used to draw air into the towers and exhaust the air out again.This mechanically assited passive ventilation proves to be the most successful option in solving the ventilation of the towers.

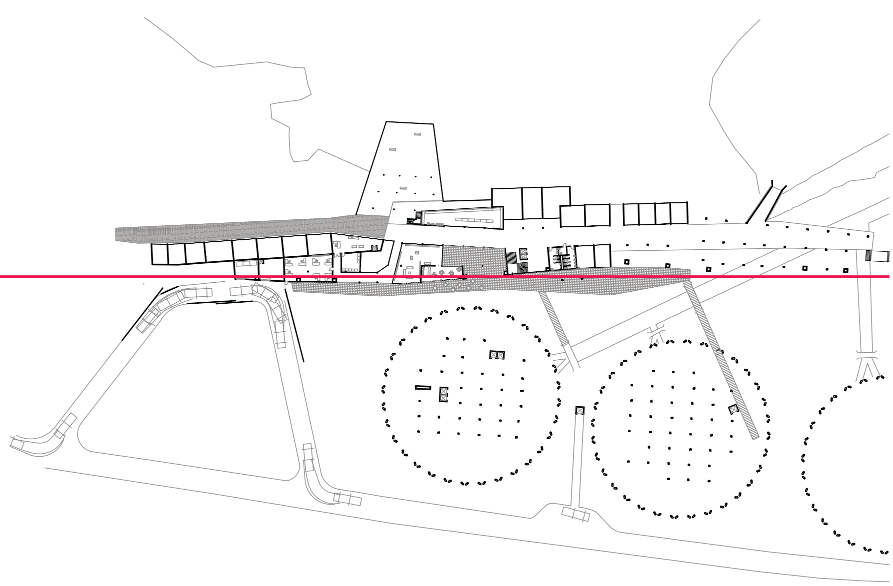
fig 7.14 Section showing shading overhangs

00732 Form and orientation

The building, linear and narrow in form facilitates natural ventilation and lighting, and allows all occupants to individually control their micro climate by opening a widow.

The building is orientated around an east-west axis with the largest facades facing north and south. The orientation of the building allows for all guest rooms and offices to be north facing to capitalize on the natural daylighting of the site.

The form of the building evolved around optimizing on natural daylighting and passive ventilation with the emphasis placed on cross ventilation. Long and narrow in its appearance, the buildings form stretches out across the entire length of the three towers in order that it may have a direct relationship with all three towers.



00733 Thermal mass

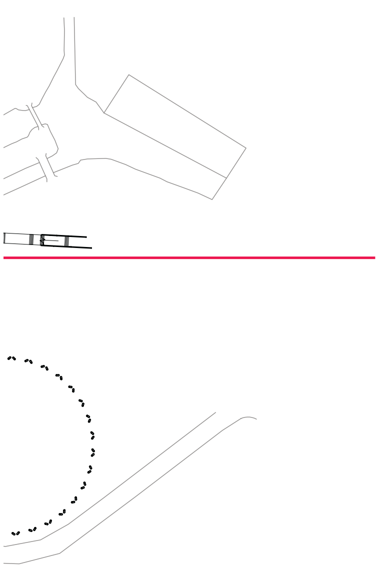
The thermal mass provided by the concrete roof and exterior concrete walls absorbs the heat from direct and indirect solar radiation during the day, and after a delay period which is determined by the density and thicknesses of the absorbent surfaces, radiates the heat energy to the internal spaces. With the thickness of the roof and wall surfaces ranging between 230mm to 400mm, a sufficient delay period is created to ensure that internal temperatures are effectively lowered during the day and raised during the evening.

00734 Fenestration

Northern and southern facade fenestration are filtered by sunscreen components. These facades are adjustable in terms of openable windows and sliding doors. Horizontal shading devices are used on the northern facade in order to shade the glass openings from direct sun, such as roof overhangs. In a building such as the one proposed, it is important to note that against the backdrop of the towers, windows are not used, rather, the building is cut into with gaps in some instances, allowing light and air in and at other instances this is done with little slits carved into the facade.

Twice the light intesity of artificial light is required to achieve the same visual quality as that afforded by natural daylighting, therefore designing for the optimmization of natural daylighting is far more sustainable and energy efficient. Good daylighting is achieved by firstly, avoiding direct sunlight on critical tasks which can cause glare and visual disability, and secondly brining daylighting in through clerestories and skylights. This allows a deeper penetration of the light and a better distribution throughout the space.

The interior surface of the towers shall be painted **white** in order that the light penetrating the tower from the open top is distributed deeper and diffused throughout the interior of the towers, capitalizing of the little natural daylighting that is present in the towers.



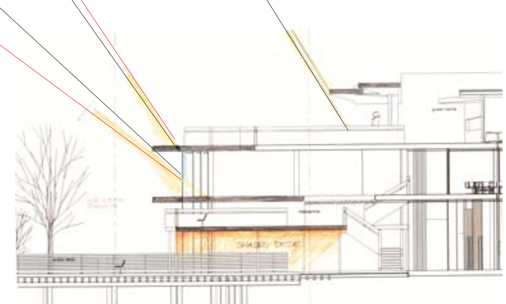


fig 7.15 Shading over public deck, shops and offices

0074 Vertical circulation

The veritcal circulation routes comprise of lifts as well as concrete staircases. Upon arrival on the eastern entrance of the building, one is faced with a stairway which **elegantly** RISES AND LANDS. This route of vertical circulation along with all the others throughout the building suggest that the movement and circultaion routes should become inhabitable. They should provide places where waiting and gathering is possible without hindering the flow of other users. This circulation throughout the building becomes a social act within itself.

The concrete ballustrades **frame the edges** of the building. With slits in their appearance, the ballustrades speak of the same architectural language as that of the rest of the building and the towers.

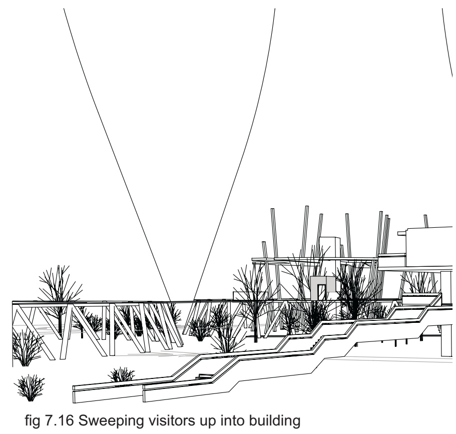
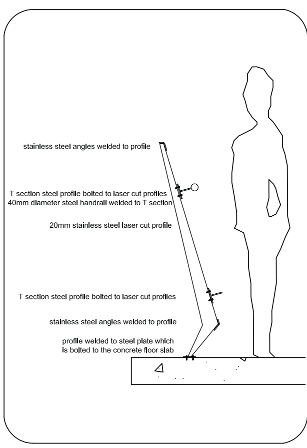


fig 7.16 Sweeping visitors up into building



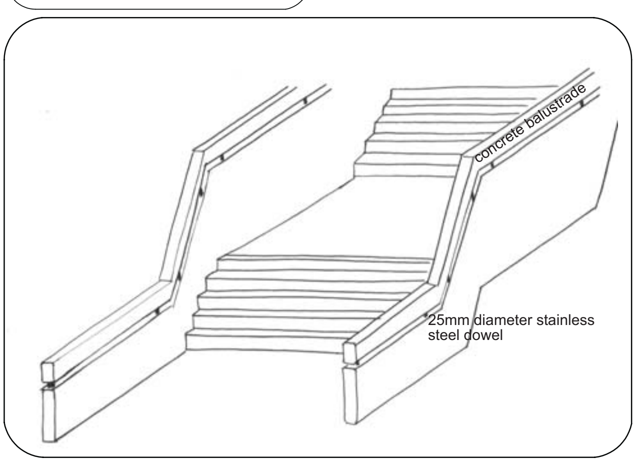


fig 7.17 Pre-cast concrete staircase

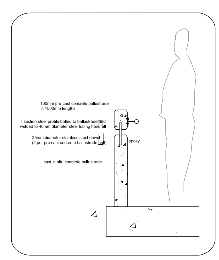


fig 7.18 Detail of concrete railing

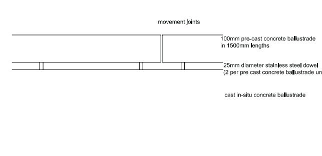


fig 7.19 Elevation of concrete railing

0075 Curtain wall system

The decision is made to use steel as the structural material for curtain wall construction. Because structural steel members are generally smaller than aluminium, a lighter appearance is insured, complimenting the elegance of the building. These curtain walls, made up of steel frames which are factory-made, are fixed to the concrete structure.

The control of heat flow is achieved through the use of insulation. Although it is not apparent from the exterior, the curtain wall system uses considerable insulation behind spandrel glass. Because of the materials used in the structure, glass and metal, which are highly conductive, the system must also contend with potential condensation on the interior surfaces. To curtail this effect, the curtain wall system incorporates two distinct features: first, a sealed double glazed window and second, a thermally broken mullion, with a foamed-in-place polyurethane connection.

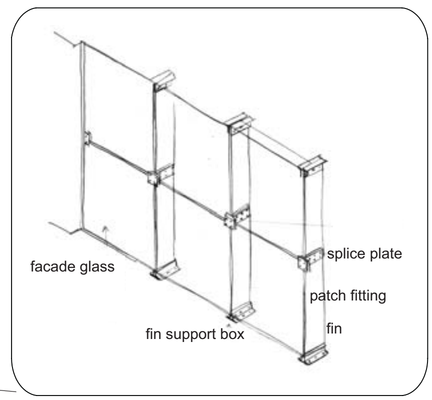


fig 7.20 Curtain wall system

fig 7.21 Main entrance lined by shop fronts

0076 Rain water drainage

The drainage systems are incorporated into the building skin or floor finish.

The concrete roof sloping in a eastern direction with three sloping concrete slabs raised above the concrete roof also sloping in the same direction. The water is channelled and collected in 9 areas of the roof. For a roof area of 2176m² with a fall of screed of no less than 1:70, 9 downpipes are sufficient for the discharge of rainwater if the downpipes are of 150mm x 150mm measurements.

These downpipes are then taken down the wet cores or columns and the water is then fed back into the dam.

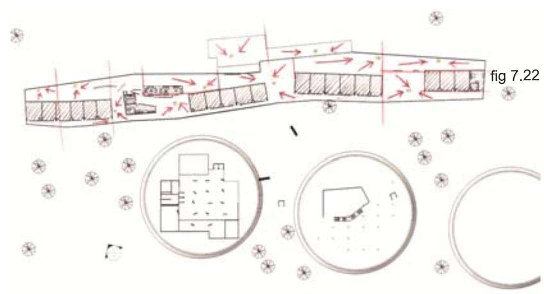


fig 7.22 Rain water drainage