chapter 05

T E C H N I C A L   D E V E L O P M E N T

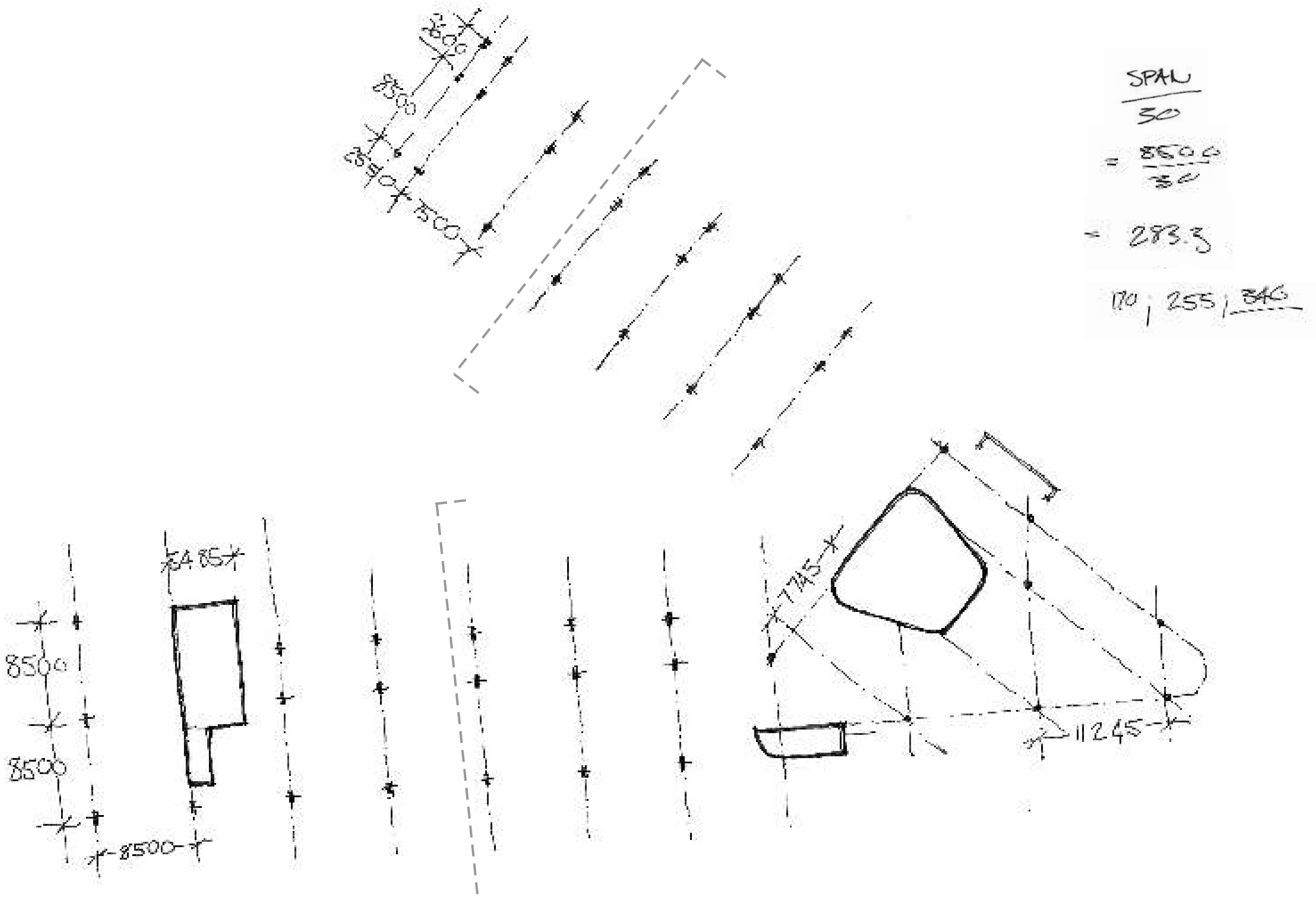


fig 5.1 The structure.

5.1_THE STRUCTURE

The proposed design uses a robust reinforced cast in-situ beam and slab structure. The design follows the basement grid of 8 500 x 8 500 in the southern wing and on the eastern edge the grid is 7500 x 8500.

From the interview with the structural engineer, off-shutter reinforced concrete columns on the ground floor are to be 330 x 850 in size. The large size is due to the column shape. The large size also allows for the cast-in galvanized steel rainwater pipes. From the third floor and up the interior column sizes decrease to 330 x 680.

The chamfered corners of the columns protect the edges and add to the visual complexity of the building.

The one-way 340mm deep reinforced concrete slabs span 8,5m supported by 340mm deep reinforced concrete beams.

Other load-bearing elements in the structure are to be constructed of load-bearing brick and cast in-situ concrete walls.

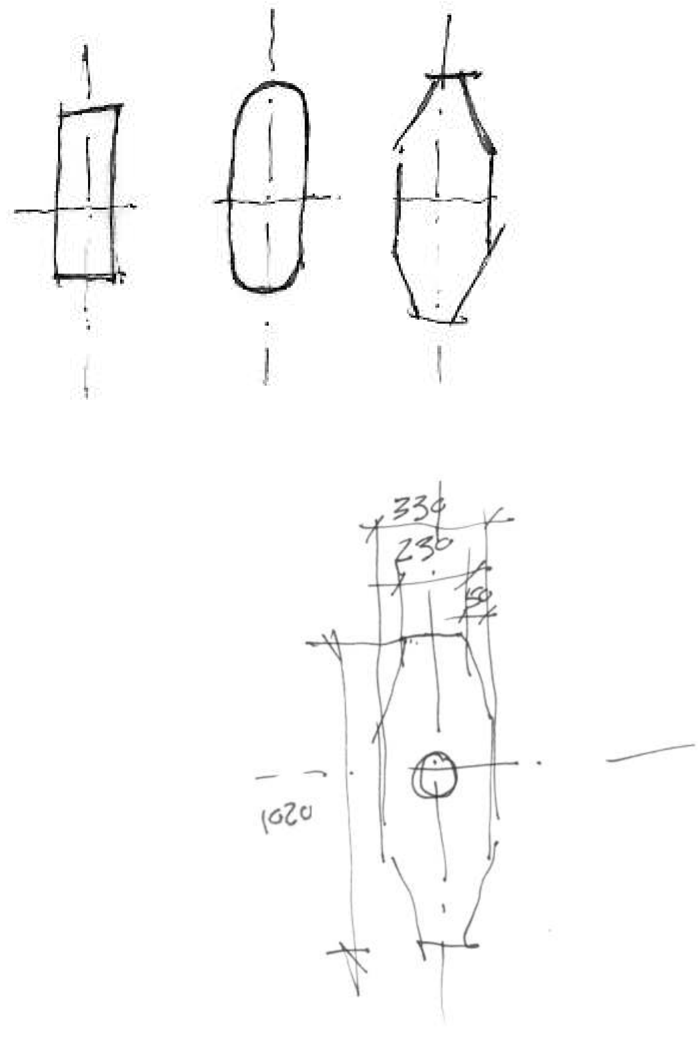
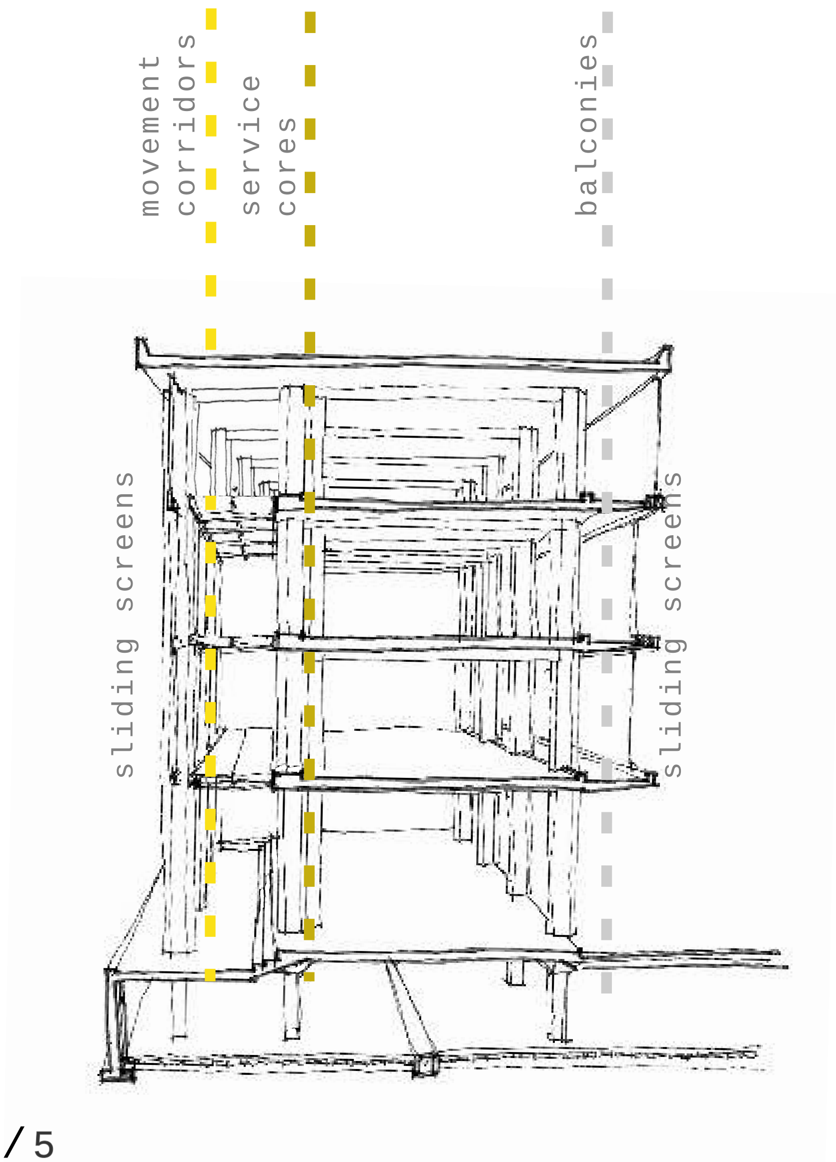


fig 5.2 Concrete column shape investigation.



A 340mm cast in situ concrete roof is used over the eastern wing as concrete roofs have good thermal qualities. Parapet walls are to be 255mm high, with torch-on waterproofing over a 1:100 gradient screed.

The double skin facade system offers sun protection, enhances the use of natural daylight and acts as an acoustic buffer. On the eastern side steel walkways frame the public side of the building, while concrete balconies offer more private spaces on the western side.

fig 5.3 The eastern wing.

Metal sheet roofing is used over the residential areas in the southern wing. The angle of the light weight roof allows space for the construction of clerestory windows that allow light to penetrate the space. The roof angle also adds to the spacious qualities of the small residential flats.

Different balcony cantilevers shape a protected outdoor area and shape its spatial qualities. The cantilevers offer sun protection during the summer and allow the sun to penetrate the space during the winter. The vertical concrete fins offer a sense of privacy for the upper levels and lend a rhythm to the facade.

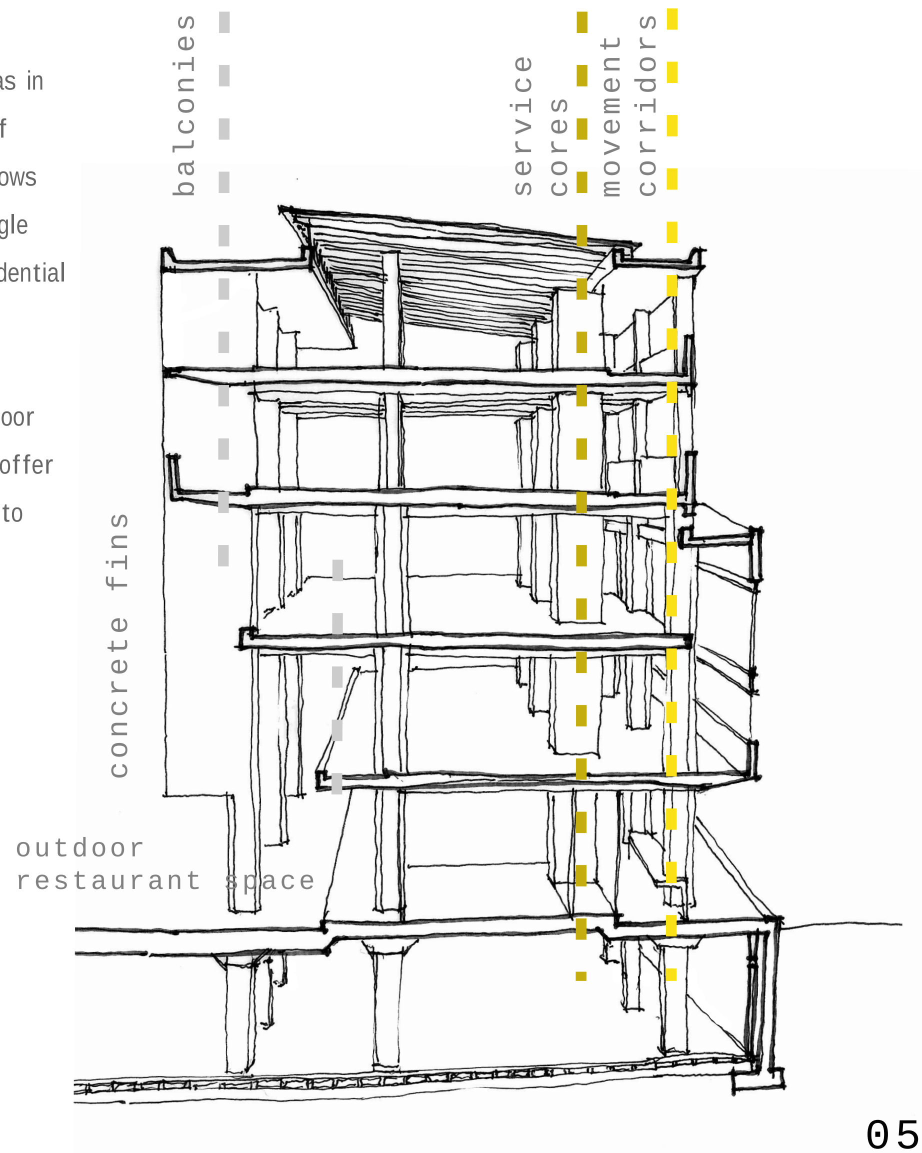


fig 5.4 The southern wing.

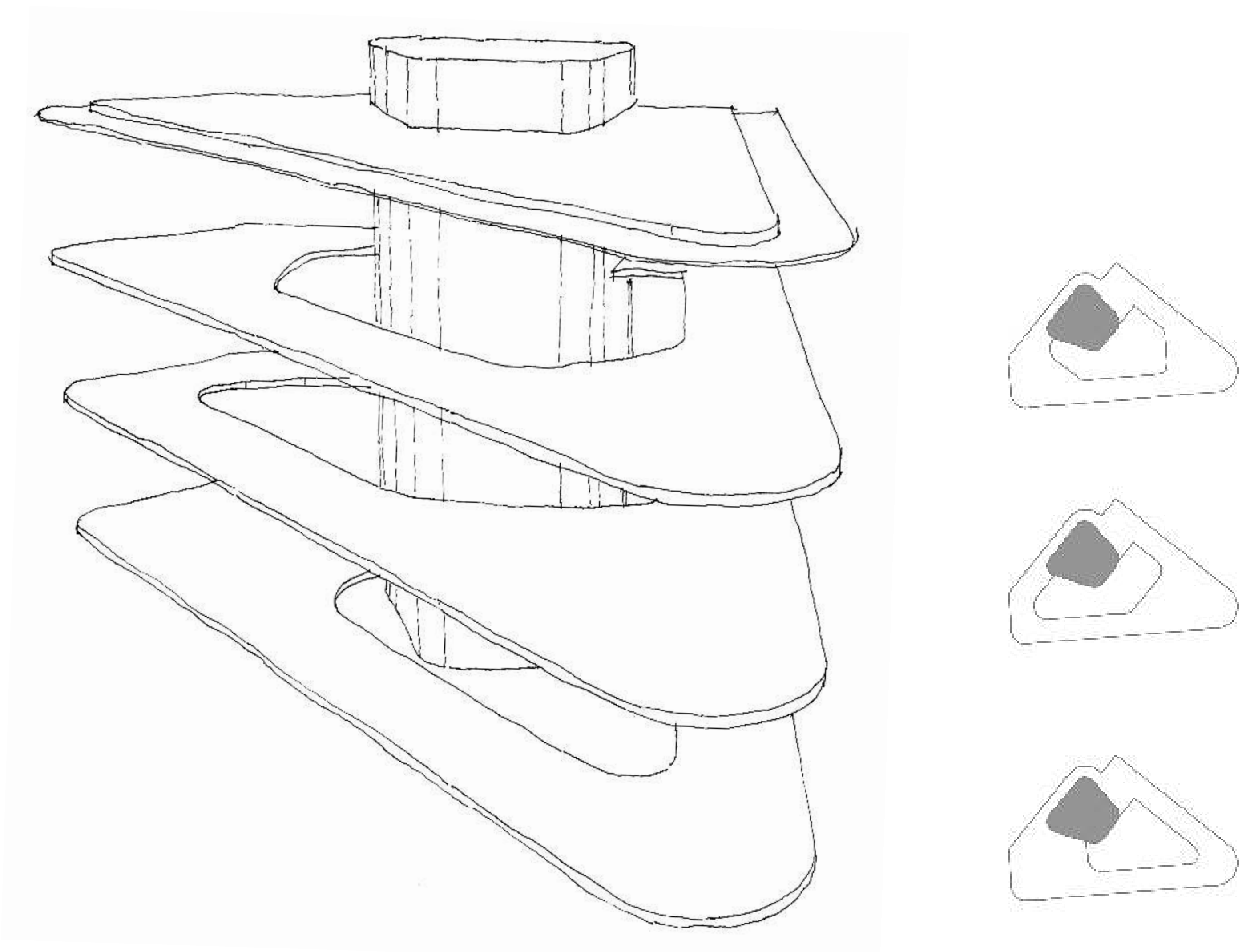


fig 5.5 The floors of the corner building.

The proposed corner building supports the main vertical movement through the building and consists of three floor levels which form a central open atrium. The fluid form of the floors provide different experiential qualities on each level while the various balconies offer different views of the internal space.

The floors are constructed of cantilevered cast in-situ concrete slabs supported by a continuous ring-beam, thereby expressing the fluid qualities of concrete. The 1020 deep ring-beam is supported on 680 diameter round concrete columns and the central service core.

The tectonic mass of the concrete walkways is surrounded by a light stainless steel mesh screen, while a light composite roof construction covers the internal space.

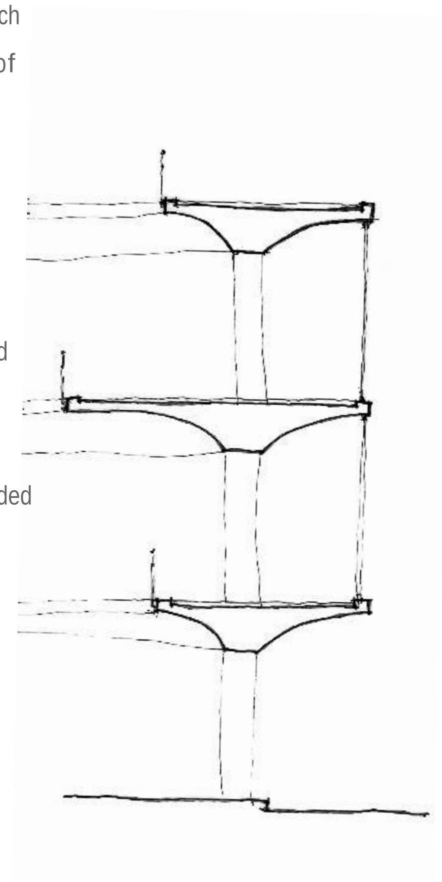


fig 5.6 Cantilevered concrete walkways.
fig 5.7 Exhibition hall of Congrexpo, France by Office for Metropolitan Architecture.

fig 5.8

Reinforced **concrete** is the main structural material for the proposed design. Floors, columns and roofs are constructed of reinforced concrete as a concrete structure offers various advantages. It is robust and requires minimal maintenance. Off-shutter methods for the cast in-situ concrete walls provide tactile textures to surfaces, and iron oxide pigments add colour to the surfaces. The plasticity of concrete also makes it possible to mould it into the complex forms required for the cast in-situ walkways of the main circulation space.

fig 5.9

Brick is a vernacular building material in South Africa and it forms part of the Pretoria aesthetic. Brickwork is a sustainable building material with low embodied energy and good thermal mass. It is a durable material that requires less skilled labour than cast in-situ concrete work.

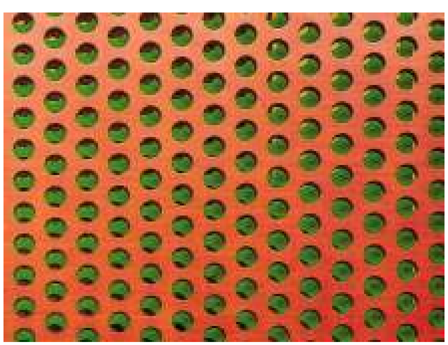


fig 5.10

Plywood panels are used as suspended ceilings. Different ceiling heights improve the legibility of spaces and perforated plywood panels improve the acoustic qualities.

5.2_MATERIALS

Boundaries between inside and outside are dissolved with the use of **glass,** while natural light is introduced into the building. Most glazing is fixed in aluminium frames, as aluminium has a long life span and requires less maintenance than steel. To link the interior to outdoor areas in a seamless manner, sliding or stack doors are used that can open up completely. This gives the user control over his or her immediate environment. Shading devices on the northern façade and screens on the eastern and western façades reduce the disadvantages associated with the use of glass.


fig 5.11

Steel is used as lightweight intervention in the concrete structure. Galvanised steel is used to construct the screen frames and the walkways between the building clusters. Steel structures can be adjusted or removed and recycled if necessary.


fig 5.12

fig 5.13

Different **floor surfaces** are used to mark different movement routes and interior spaces. Edges and thresholds are marked to guide movement.

Ground level floors are subjected to heavy traffic and need to be robust. The concrete basement roof slab is covered by a cast in-situ concrete floor along the main pedestrian routes, while brick paving is used to mark quieter areas within the square.

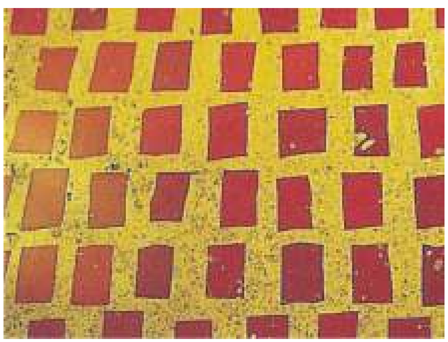


fig 5.14

Interior concrete surfaces are powder floated and sealed with polyurethane to produce a hard-wearing floor finish. Mosaic inlays in the concrete floor mark certain spaces and movement routes within the building on the ground floor.

Light walkways frame the eastern wing and form a contrast to the concrete surfaces. The walkways are constructed of steel mesh floors on steel substructures.

fig 5.15

A low profile **access flooring system** is used in the proposed design. Access floors make the adaptable services available and easily accommodate change. They are user and environmentally friendly, require little maintenance and are easily reconfigured. The proposed TecCrete System uses a concrete-and steel composite design. It has a low profile of 85mm, thus minimizing the level differences between indoor and outdoor spaces. It has a finished concrete surface and does not need a vinyl or carpet covering like conventional systems.

Screens form the main facade elements on the eastern wing and on the corner building. Stainless steel mesh screens require little maintenance, can be recycled and can be applied in various ways. They can appear opaque or totally transparent.

On the eastern wing sliding mesh screens offer sun protection and can be adjusted according to users' needs. On the corner building a fixed mesh screen is applied, as the individual control over the environment becomes less important.

Mesh screens offer the possibility of digital projections. Mediamesh and Illumesh systems are applied in the proposed design.

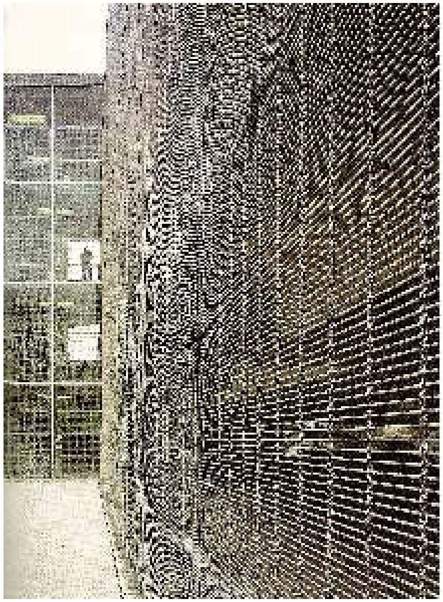


fig 5.16 (top) Fixed mesh screen.
fig 5.17 (bottom) Sliding screen facade.

fig 5.18

Mediamesh screens consist of stainless steel mesh screens with interwoven LED profiles, which are built into sleeves and inserted at predetermined intervals. Control units are easily hidden in ceilings or under access floors. Images can then be controlled from any internet connection point, making the system interactive and accessible to different users. The system can be used during night and day times to display images, messages, art-graphic animations and even direct video displays.

fig 5.19

In **Illumesh screens** the screen reflects images outwards from the inwards facing LEDs. This system is suitable for larger surfaces, which are viewed from a greater distance. Illumesh screens are also more cost effective than Mediamesh screens.

The proposed digital screens can function together to display a large image, or they can function in isolation, breaking the facade up into smaller units. The facade units thus act as larger 'pixels' of an entire image.

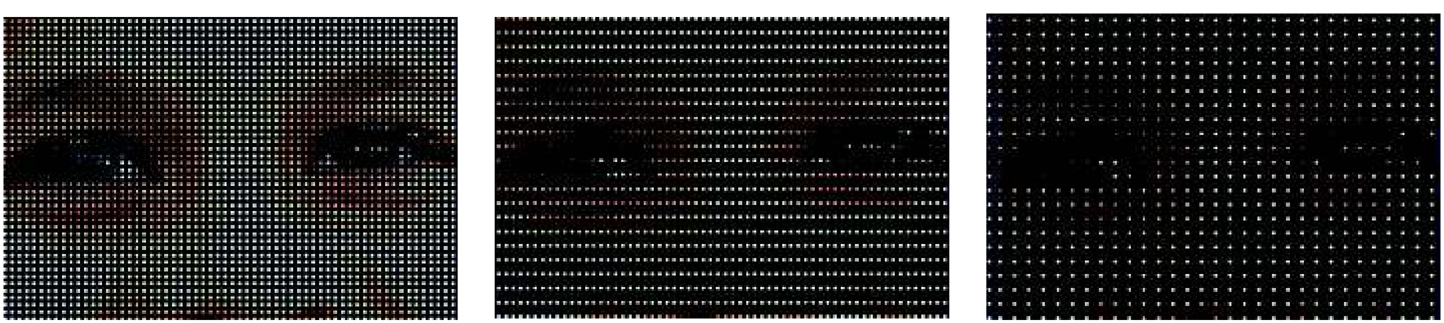


fig 5.20 Images fragmented into pixels.

Inclusivity:

This is a public building and therefore has to be easily accessible. All public areas and public amenities are accessible to people with disabilities. Lifts within the building ensure easy access to all areas and disabled restroom facilities are provided on each floor level.

Ramps that are located around the building have a maximum gradient of 1:12, as required by the building regulations.

Security:

All areas will be observed through passive surveillance during the day time. On ground floor level all edges are active. Informal activity is encouraged along the edges at the street side, where users can monitor the sidewalks. The offices, flats and studio spaces have good viewing angles over the public square, thereby establishing a relative degree of control. Additional measures may be required at night to ensure the safety of the residents.

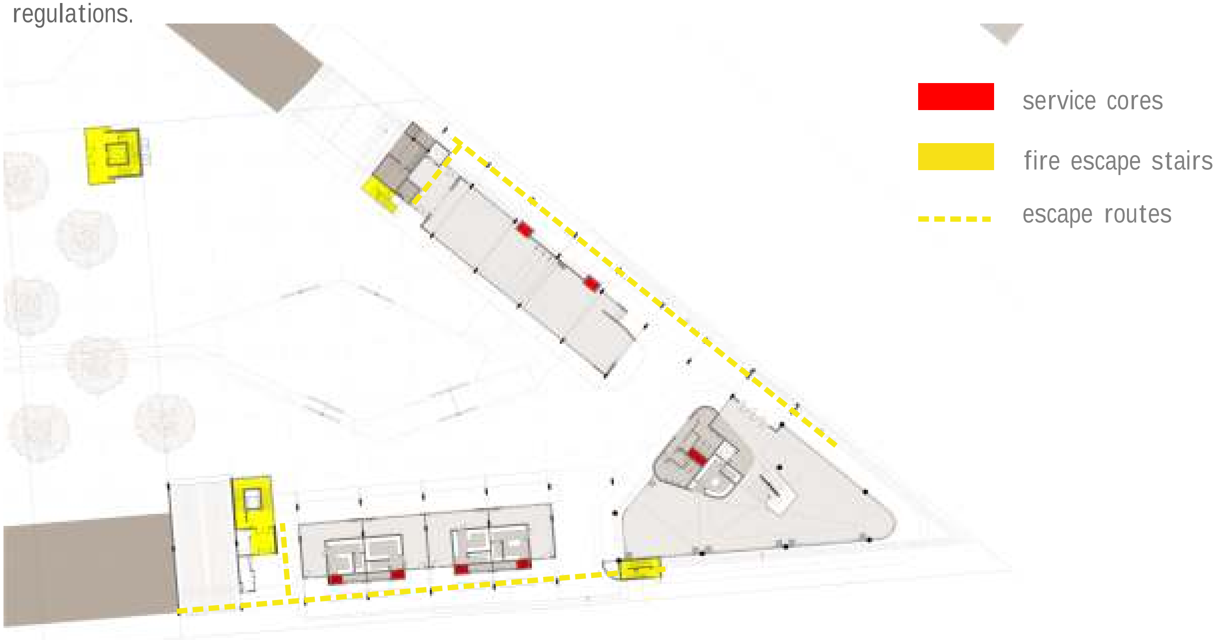


fig 5.21 Circulation through building.

5.3_CIRCULATION

Fire strategy:

The public nature of the building requires a high degree of safety in the event of a fire. The National Building regulations were followed in the proposed design.

According to NBR TT 16, all travel distances in the building to escape doors are to be kept below 45m. A three story building shall be provided with at least two escape routes and an emergency route is required in a building of a height of more than three storeys. Building materials in an emergency route shall have a fire resistance of not less than 120 minutes.

The concrete structure will provide sufficient fire resistance. All structural steel elements are to be coated with an intumescent base coat to provide adequate protection in the event of a fire. Sizes of steel members are increased to improve the fire resistance properties. A specialist will be required to ensure that all appropriate design measures are used.

The basement shall be served by at least two separate emergency route stairways, according to NBR TT 22. The main lift to the square is to be a fireman's lift.

Orientation:

The building clusters are orientated on two different angles. The southern wing faces towards the north. This is ideal for the residential flats and the offices. The facades of the eastern wing face east and west and therefore require sun protection. Movable metal mesh screens are used, giving the users control over their interior environment. This also strengthens the transparent aesthetic of the eastern wing; in contrast to the 'heaviness' of the formal southern wing.

Throughout the design a double skin is used, with walkways and balconies shaping the 'in-between', event space between the building structure and building skin.

Thermal massing:

Thermal mass is provided by the flat concrete roof and exterior walls. Direct solar radiation is absorbed during the day and the accumulated heat is radiated into the interior spaces at nigh time. The density and thickness of the material determines the delay period and the effectiveness

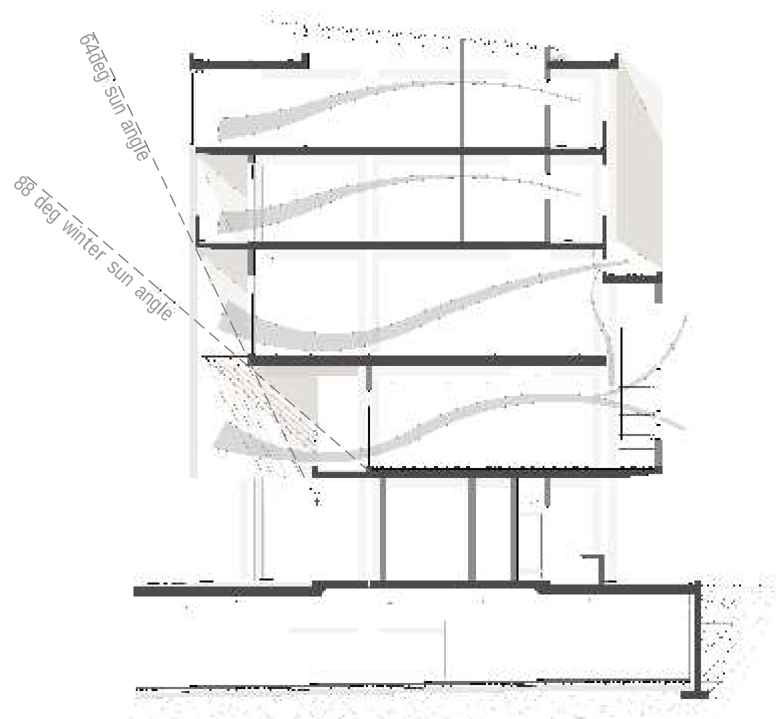


fig 5.22 Ventilation and lighting in south wing.

5.4_CLIMATE CONTROL

Ventilation:

The building dimensions allow it to rely on passive control systems, thereby reducing the amount of energy used. Pretoria has a dry and warm climate where the prevailing summer wind direction is from the north-east while it is from the south-east in the winter.

Natural ventilation through a building is generated by differences in air pressures. A building's form and orientation are important factors when relying on natural ventilation. The glazed openings in the proposed building face the summer winds. Low openings direct the air flow at occupants and roof overhangs increase the incoming airflow. Larger outlets allow the rising warm air to escape.

Mechanical ventilation will be necessary in the basement and in the screening room.

Lighting:

Diffused natural lighting provides light for the interior activities during the day time. Direct lighting is not optimal, as it causes glare and does not contribute to a comfortable indoor temperature. It is important that users have control over their environment, especially the in the studios. This increases the flexibility of the building, allowing different activities to take place. The double skin façade is therefore applied, whereby natural light is diffused by individually movable screens.

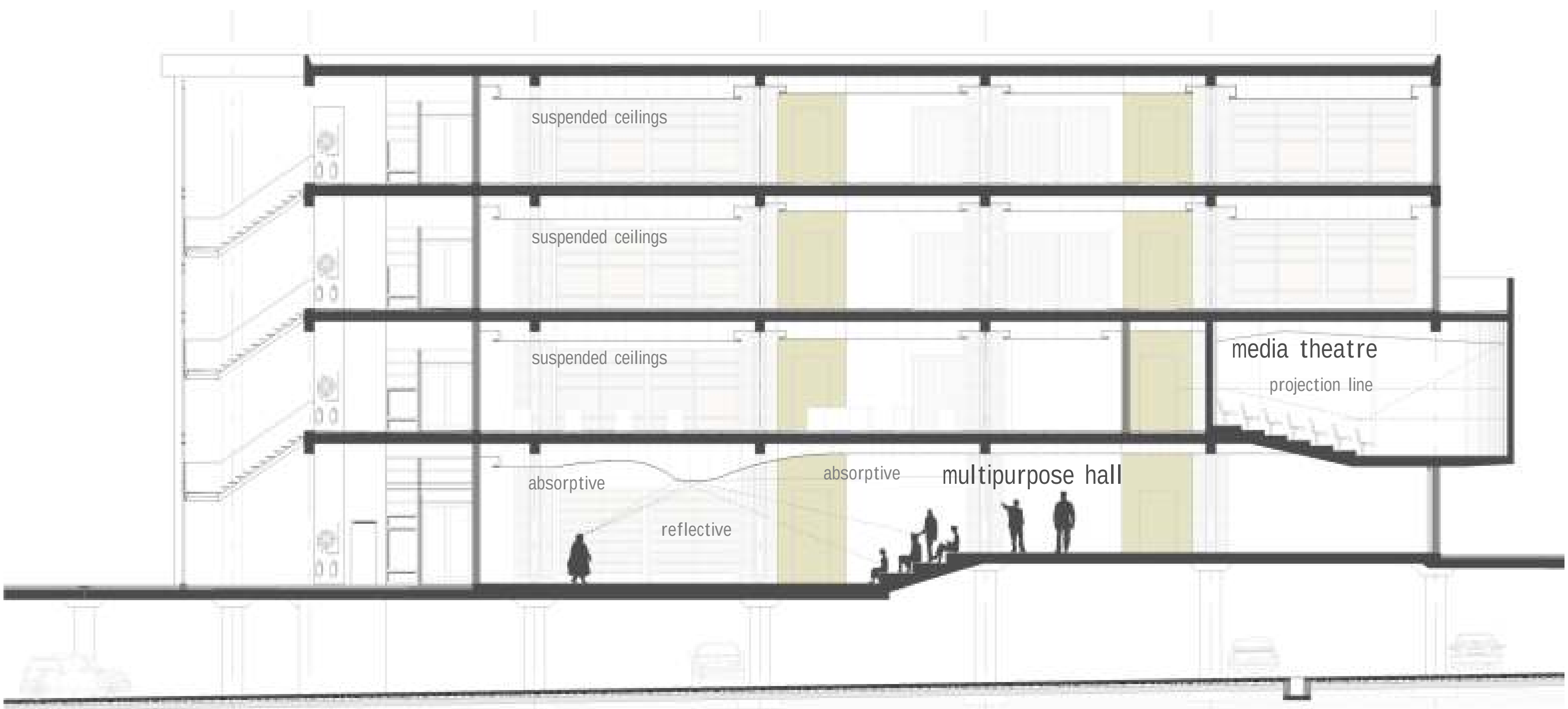


fig 5.24 Acoustics in the media theatre and multipurpose hall.

5.5_ACOUSTICS

Media theatre:

The walls are constructed of 200mm reinforced cast in-situ concrete. To prevent flutter echoes the floor and ceiling surfaces are not parallel. The reflection of sound at the back, i.e. reverberation is prevented by using highly absorptive materials on the wall and ceiling.

To get the best acoustic isolation, the wall has to be as airtight as possible; an absorptive cavity should be used with a cover which is fixed to the wall with a minimum number of mounting strips. In the proposed design a 50mm mineral wool blanket is fixed to the walls and perforated plywood panels on a suspended timber structure form a cavity.

Openings in the walls have to be kept to a minimum. Access to the screening room is therefore through a sound lobby with double wooden doors.

Multi-purpose hall:

A suspended perforated plywood ceiling is used to improve the acoustic qualities in the space. The ceiling is profiled in order to reflect or absorb sound in required areas, and prevent standing waves (see fig 5.24). The sound absorption depends on the angle of incidence.

The front and back of the ceiling should be absorbent, while a reflective ceiling at the center reflects sound into the audience.

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