



CHAPTER FOUR

Design development and technical investigation

Fig. 23 Design development





4. INTRODUCTION

The hotel industry is extremely competitive. Occupancy rates, profitability and financial margins are the key business issues for this industry. Earnings are largely dependent on the highly personal way in which guests experience their stay and whether it met with their expectations for the price they paid. Every hotel guest has numerous hotel choices. Therefore, the identity of a hotel is important to distinguish it from its competitors as per normative position.

Hotels are complex facilities requiring building control and security solutions that accommodate a wide range of needs during fluctuations in occupancy rates. Hotels traditionally have very high operational costs due to the various environmental and security requirements necessary for operation. The traditional hotel in South Africa does not address change or adaptability in the design of the building. Most hotels are traditionally built to a specific theme with a life span of thirty years or less. Change to the building to suit current trends and technology means costly addition or rebuilding of the structure to facilitate change. A design approach to open building as a model on which to base a hotel could address this issue of changeability, without incurring the major cost of remodelling the building.

This discourse investigates hotel systems as a model that is based on an open building approach where the design can be classified in two parts: the service shell or base building and the infill.

A. The service shell or base building

This is the design tied to the site and is the permanent part of the whole building. The completed structure should be energy efficient and provide accommodation capacity for a range of interior layouts over a period of time.

B. The infill: This is the changeable part of the building. This includes fixtures, finishes, cabinets, interior partitions, consumer electronics and IT systems. Generally the infill is the technology that changes in a cycle of five to twenty years.

An open building approach means that the interdependencies between the two major subsystems - shell and infill - are reduced to a minimum and those that remain are well organised with open positioning and interface standards. But this principle also addresses interfaces between parts in the shell and in the infill. Thus, a change of one part will cause fewer disturbances than in a conventional building, where, because of excessive interdependencies, change in one part requires changes to many other parts.

Notably, this discourse investigated this systems approach to 'open buildings' specifically with regard to a hotel design to create a choice of hotel system models which accommodated a variety of room layouts in one base building. The investigation did not explore the possibility of the open building models with the aim of becoming an office building or a residential building. It is assumed that it will be possible for the model to accommodate these types of interior layouts.

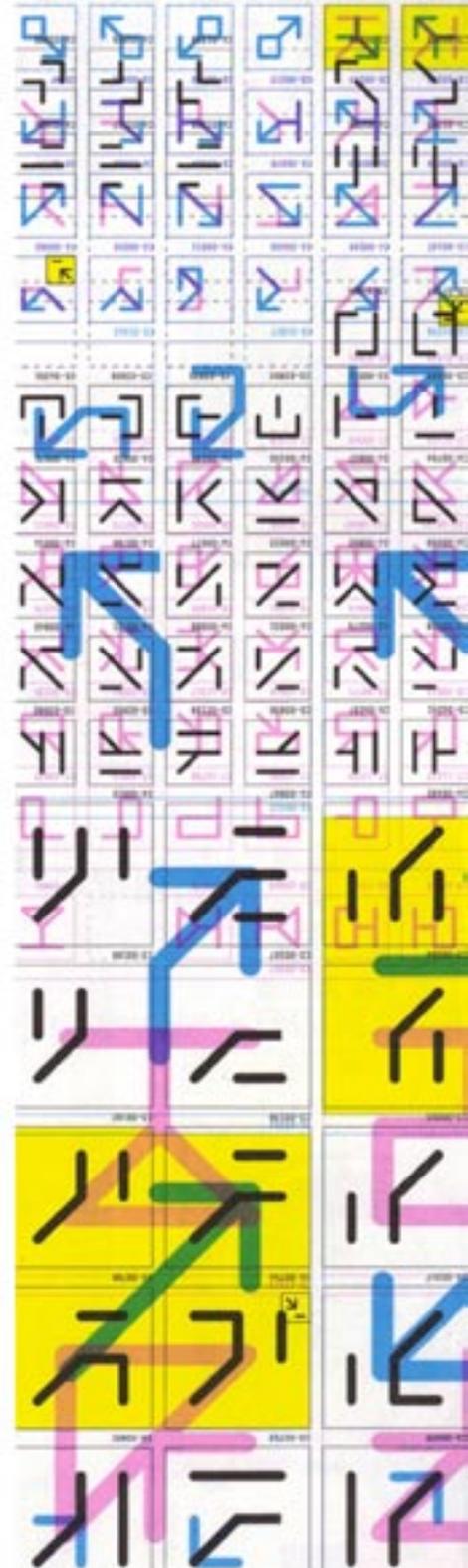


Fig. 24 Change

Creating a hotel's identity

Hotels evoke certain nostalgia and memories in the guest from past experiences, both pleasant and unpleasant. Yet no two hotels are similar. In general they are similar to urban parks as noted by the Spanish artist, Jean Munoz: 'They become spaces of transition, of passage, to be used and then abandoned, no-one stays for longer than they need to. No-one seems to own them, there is no sense of responsibility for them, no desire to make them more than they are'.(Munoz, 2002: 57)

To generate an identity of an urban hotel in order to personalise it as to capture and retain customers through a unique identity, it should reflect the immediate context where it is located, while also acknowledging the needs of the guest. Guests to an urban hotel do not expect the same hotel identity as that of a leisure or resort hotel. Leisure and resort hotels reflect the nature of their core business: to create a themed indulgence as a form of mental relaxation coupled with external activities.

To understand how a guest would interpret a space in order to formulate an identity for the hotel the study of hermeneutics was investigated. Hermeneutics in general refers to the philosophical study of interpretation. It consists of three working assumptions: situational interpretation, the primacy of perception and the 'happening' of tradition.

Originally hermeneutics was the field of biblical interpretation, but has become the study of the interpretation of not only texts but also human existence. The word originates from the Greek god, Hermes, who was the mediator between the gods and mortals. Friedrich Schleiermacher and Wilhelm Dilthey were important forerunners of contemporary hermeneutics and some important contemporary hermeneutic thinkers include Paul Ricoeur and Hans-Georg Gadamer. Essentially, hermeneutics involves cultivating the ability to understand things from somebody else's point of view and to appreciate the cultural and social forces that may have influenced his or her outlook.

Interpretation

According to hermeneutics, each individual interprets a space by using his or her own frame of historical reference based on experience and his or her 'library' of visuals. Creating an identity for a hotel where the client's historical frame of reference is interpreted in the architecture is challenging, virtually impossible.

Perception

Hotels should not seek to become temporary homes where the core identity of the hotel changes constantly to suit the guest's personal identity or perception of contextual identity but should rather facilitate his or her current frame of reference to become a metaphor of experience. Immediate personalisation of the hotel could be achieved in a variety of rooms, where the space and the amenities address the needs of a guest. Architectural elements could be introduced which form part of the hotel but can be manually manipulated or adjusted by the guest. If there are changeable elements, the guest participates in generating an identity of the hotel that is truly a once-off for the individual.



Fig. 25 A search for comfort

Tradition

The hotel's identity should be unique but not static. Themed hotel identity becomes static as the remodelling cost is very high. An urban hotel must create multiple experiences in keeping with the current trends as well as with that which could become and reflect traditions. By doing this the hotel keeps up what is taking place and the creation of contemporary culture. But it should be possible to introduce change at minimal cost to keep up with current trends hence the use of open building approach.

The hotel should evoke a belief in the spirit of the place (context) within the social constraints by remaining true to its core function of providing a service to a guest who should leave the hotel with a new experience to add to his or her frame of reference. A hotel and its articulation of walls, steps and spaces in the urban context become an element of memory giving the urban landscape an orientation of the culture and in doing so creating a unique hotel identity.



Fig. 26 Guests identity



4.2 HOTEL, MODEL ONE

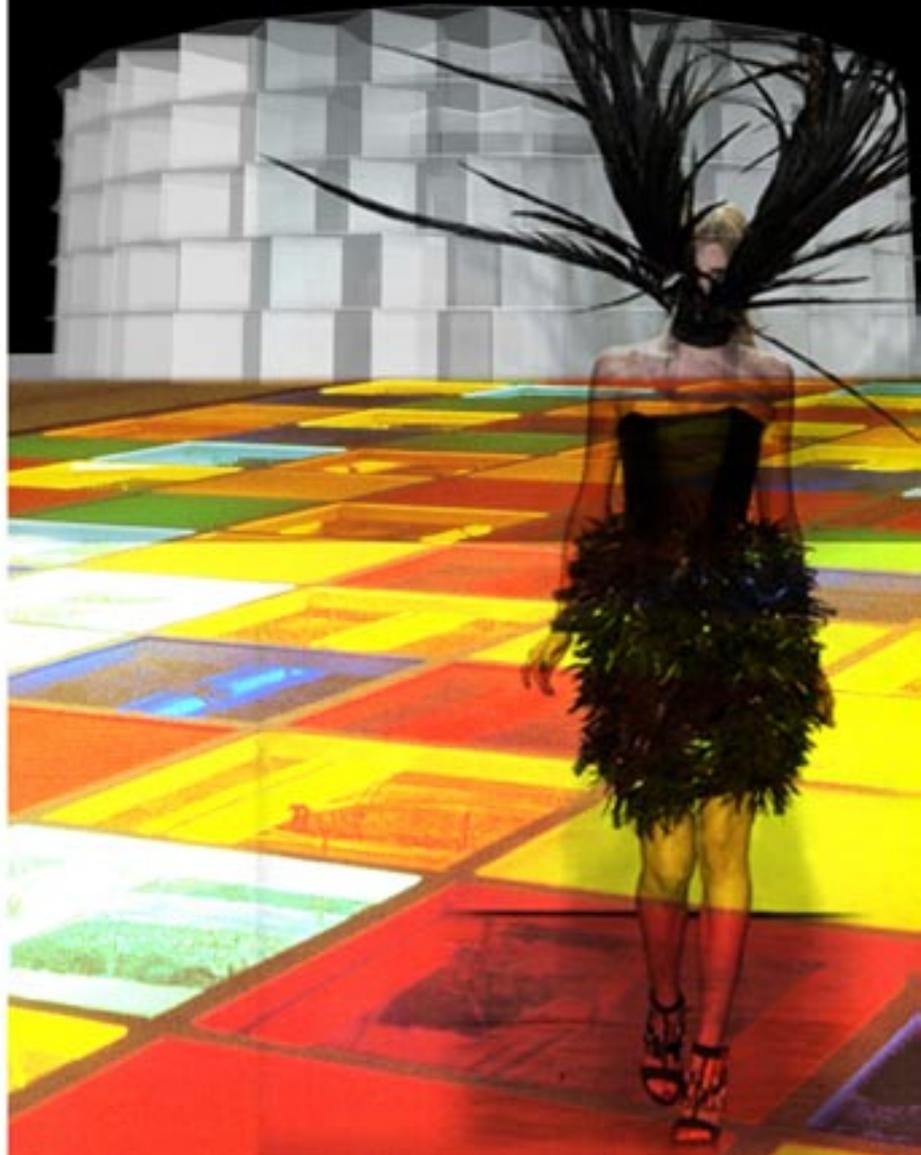


Fig. 27 Hotel, model one

This model investigated a circular service shell or base building with a central service shaft into which prefabricated rooms plug. A similar building constructed internationally is a proposed spinning skyscraper in Dubai (Name not published). A central service core would be constructed using traditional building techniques, but the components of each floor would be factory-created in the manner of prefabricated homes and then assembled like building blocks on the core.

This building model proved not to be feasible in a South African context due to the following reasons:

-The double floor which will host the services is an expensive construction system and is not feasible for a seven-storey building. To be cost effective, the building would have to be more than fifty stories as the building proposed in Dubai. Urban design parameters prevent the building from being more than fifteen stories high in the current context.

-The circular form of the design provides a limited room variety to slot into the base building. The prefabricated rooms should be assembled on site; the question is what would constitute a comfortable room layout which also provides the necessary facilities that could be prefabricated and comfortable enough to suit the South African market.

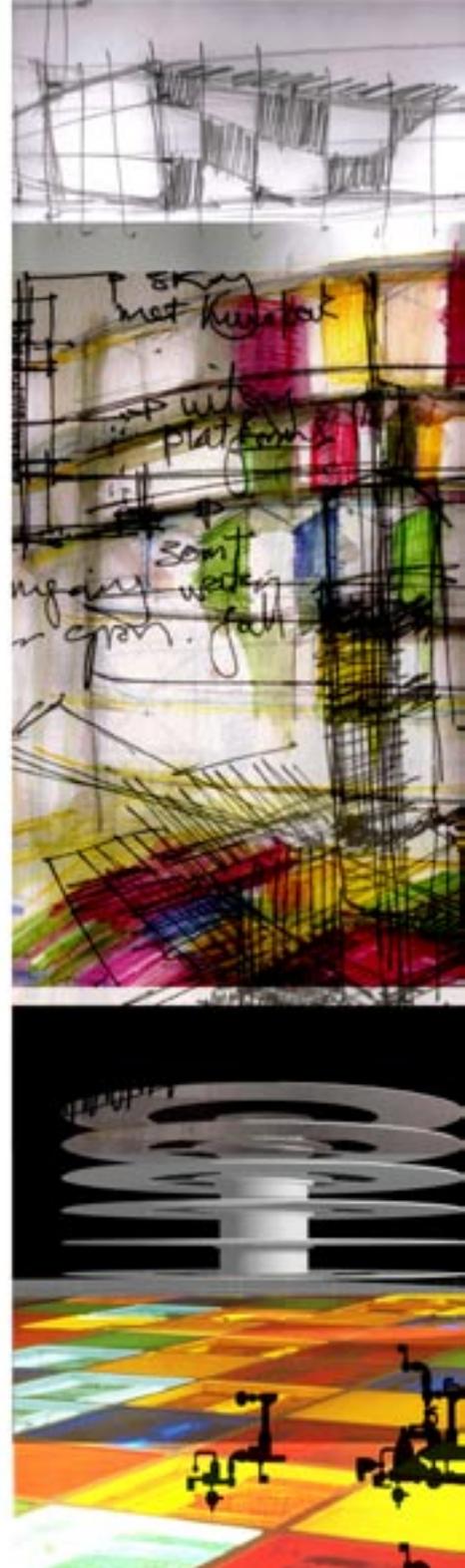


Fig. 28 A spinning skyscraper
in Dubai

A similar hotel made from prefabricated rooms is the Capsule Hotel in Japan. Guest space is reduced in size to a modular plastic or fibreglass block roughly 2 m by 1 m by 1.25 m, providing room to sleep in and little more, although facilities usually include a television and other electronic entertainment. These capsules are grouped and stacked, two units high. Luggage is usually stored in a locker away from the capsule. Privacy is maintained by a curtain at the open end of the capsule but noise pollution can be high. This style of hotel accommodation was developed in Japan and has not gained popularity outside of the country, although Western variants with larger accommodations are being introduced (such as the Yotel and the Pod Hotel in London and New York respectively). Capsule or prefabricated hotels will not work in an African context, as most people are used to bigger sleeping units in hotels.

- Circulation and ventilation proved to be challenging due to the circular design of the building. With a central core that hosts the main circulation lifts and fire escapes, security became problematic. It must be noted that for the open building model to work effectively more than one function should theoretically be accommodated in the building. This model proposes a commercial usage and office space on the lower levels and hotel accommodation on the upper levels. This implies more than one user to the building, thus making the distinction of a variety of schedules, circulation and security problematic.

Fig. 29 Design development, model one





4.3 HOTEL, MODEL TWO

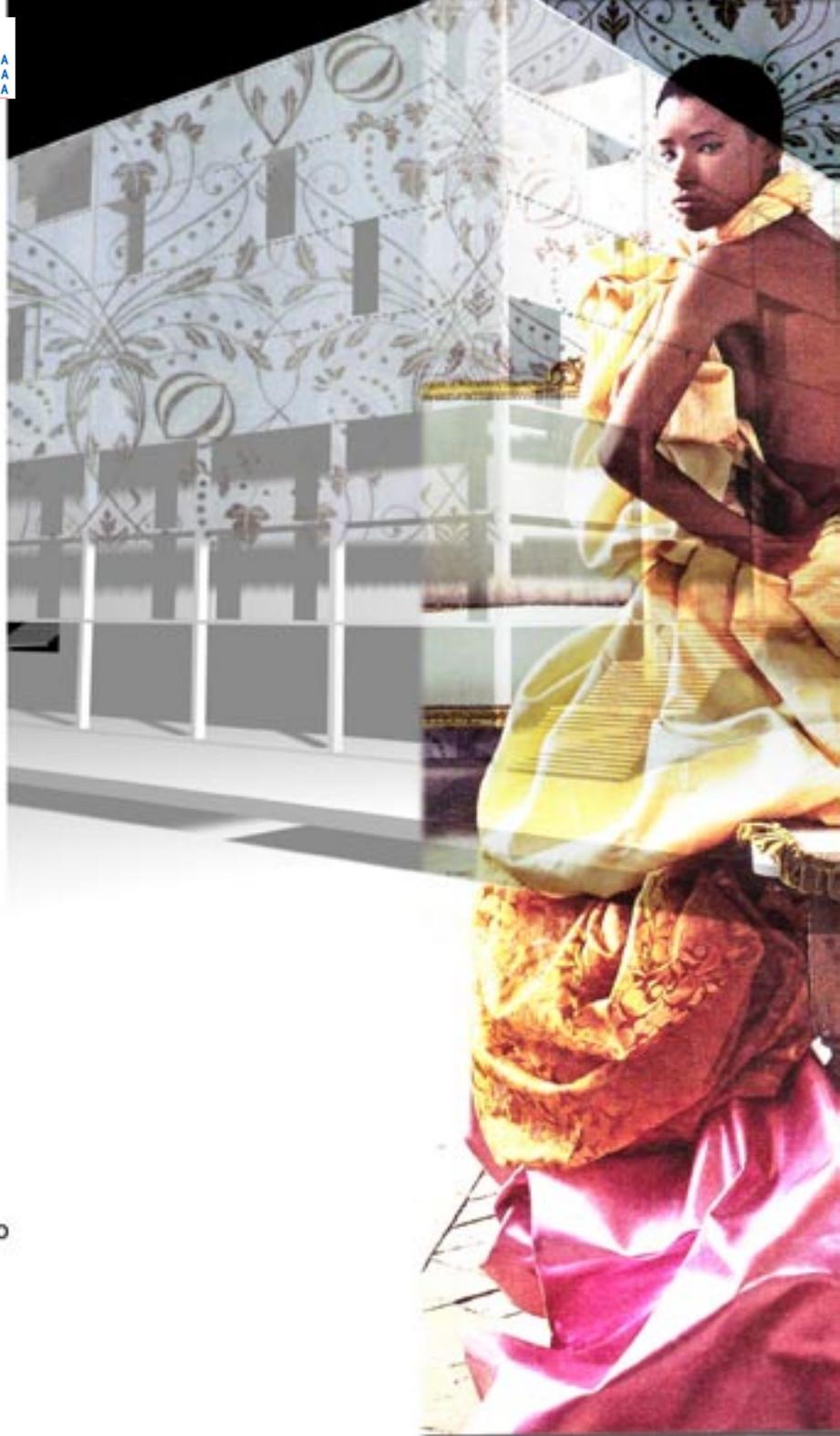


Fig. 30 Hotel, model two



From the first model where only a single service shaft was proposed in the base building the second model utilises additional service shafts. Multiple service shafts were organised on a square grid to organise the base building. This proves to be more feasible as the multiple service shafts gave a bigger distinction in the variety of room layouts in the base building where the wet core of each room is adapted into the respective service shaft.

The building had the same proposed multifunctional use of space where commercial use was concentrated on the ground level and rentable office space was introduced on the first and second floor. The hotel functions were situated from the third floor upwards. In this model the hotel utilised the commercial ground facility (restaurant and takeaways) to cater for the needs of the guests. In doing this a restaurant facility was omitted of the programme schedule of the hotel.

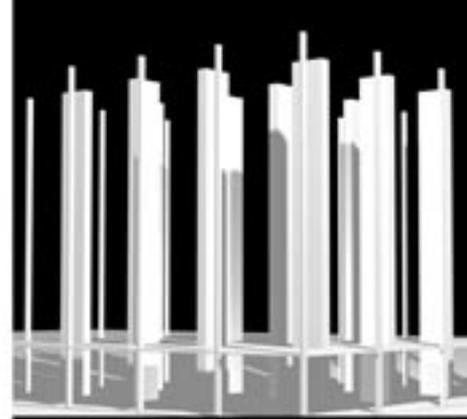


Fig. 31 Multiple service shafts

The ~~even side square~~ design proved not feasible due to the following reasons:

- It became clear in a multifunctional building that there are problems with the definition of the hotel's entrance and security with regard to the other functions, while utilising the same circulation lifts and staircases.
- Circulation space in the building became uneconomical with small rentable space and larger open space due to:
 - Ventilation, as the rooms were located on the edge of the base building. These rooms were designed to the maximal depth that allows natural ventilation into the room. Ventilation to the core of the building became problematic.

From this model it was clear that the specific programme (hotel, office, commercial) had to be able to function separately from the other building schedules to have a feasible security and circulation system.

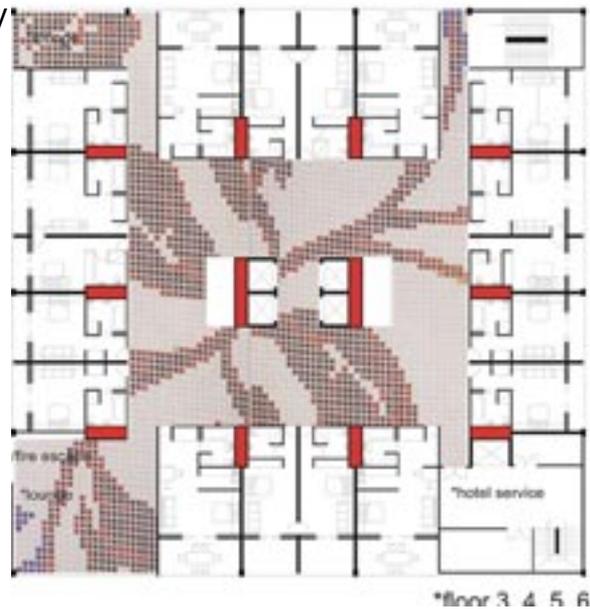
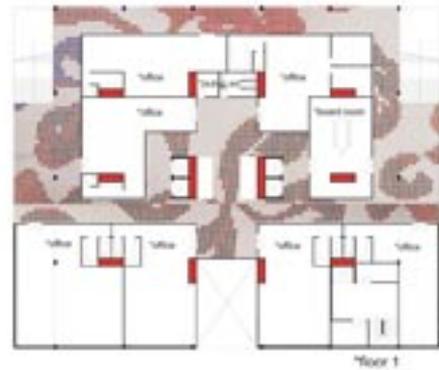
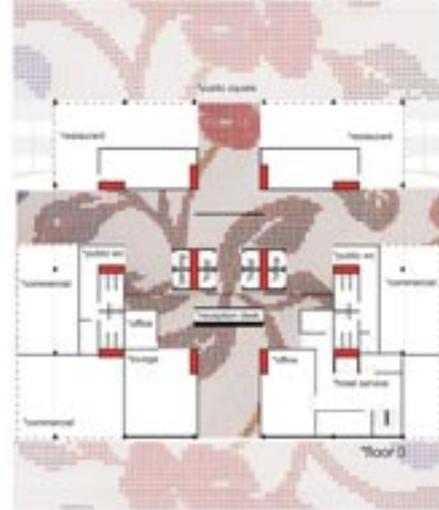


Fig. 32 Plan development of model two

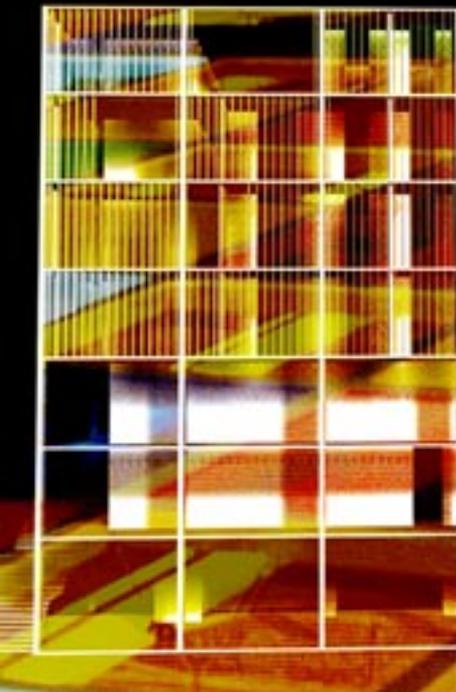
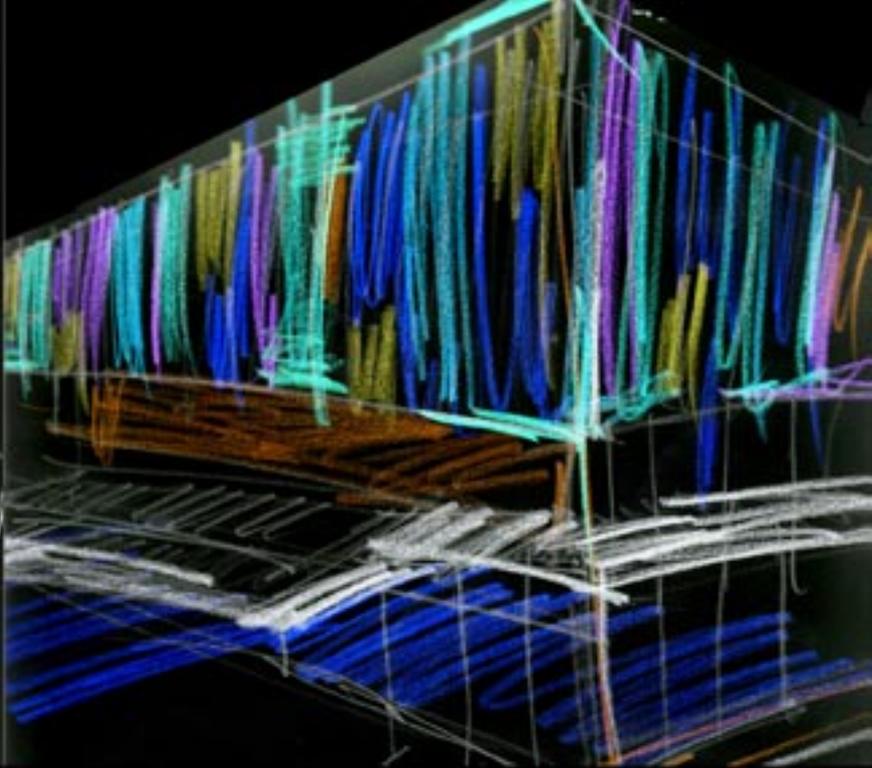


Fig. 35 Hotel three concept
development



4.4 HOTEL, MODEL THREE

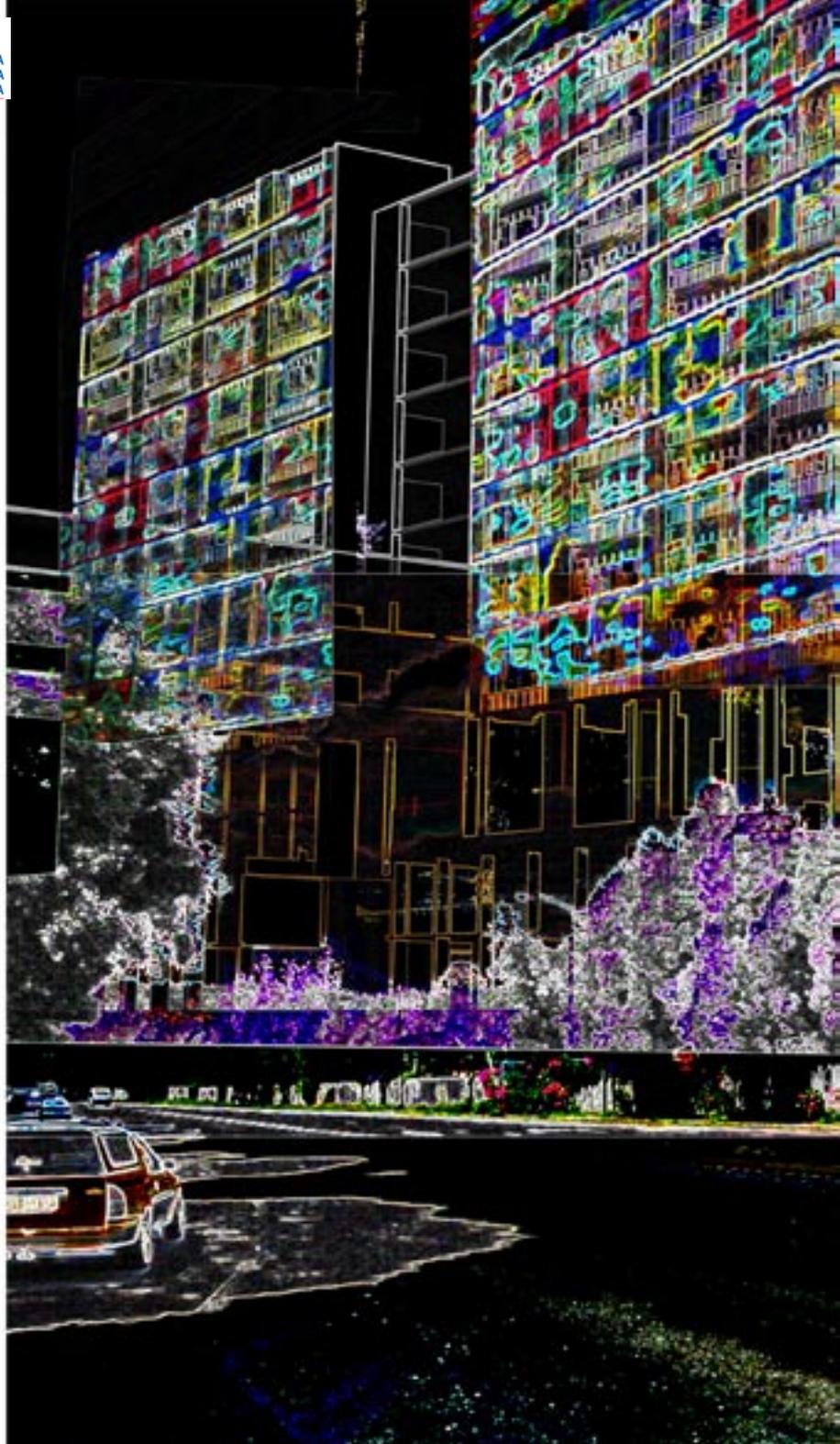


Fig. 34 Hotel, model three

This model is a combination of both previously mentioned models where several room layouts and infill functions are organised in a set base building. As illustrated before, traditional hotels are less capable of adaptability due to formalised architecture. One would be tempted to propose a hotel that is similar to those seen in Dubai where glass towers dominate the landscape but this will not be feasible in the immediate context. With the development of the design, it became clear that a simplified approach adapts more easily to more variety whilst adhering to the urban design parameters set. The building seeks to be true to its immediate context, use of material and capability to facilitate service functions. All materials proposed for the hotel construction are locally available, determined by the skills available.

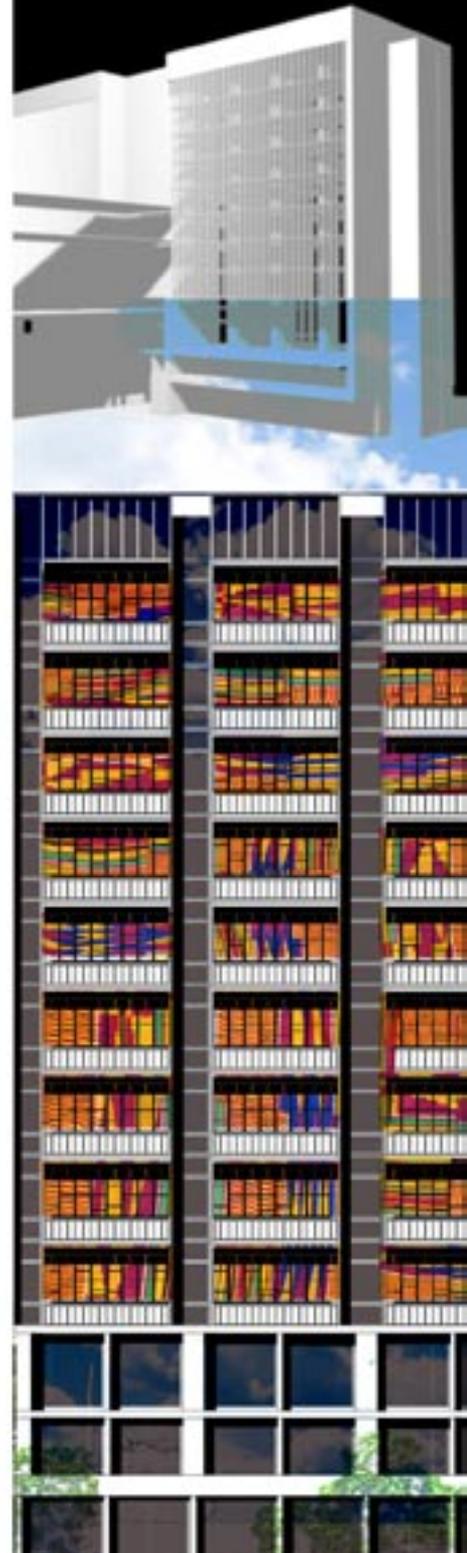


Fig. 35 Hotel three concept development





Fig. 37 East elevation (not to scale)

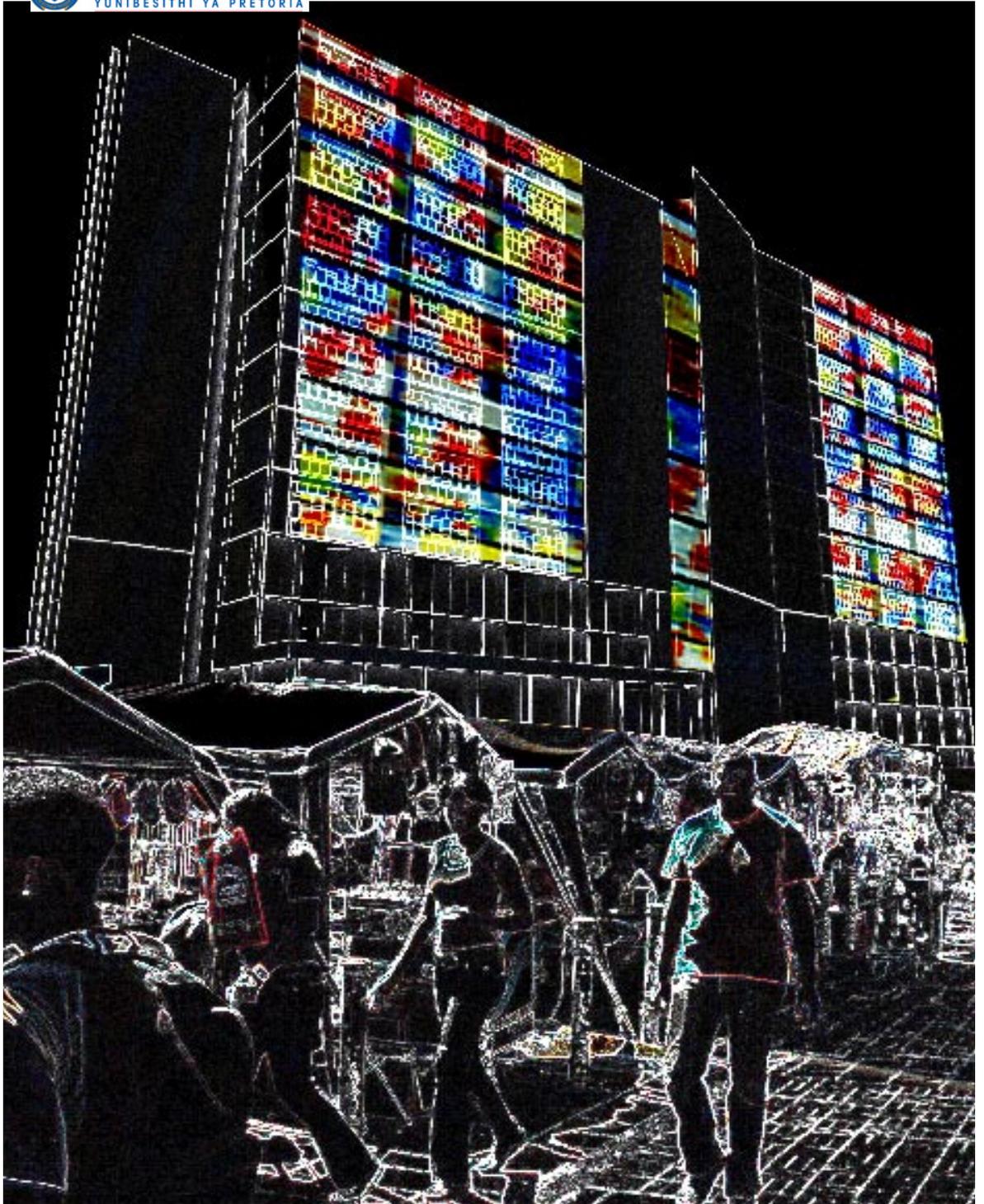




Fig. 39 North elevation (not to scale)



Fig. 40 Perspective North(top), West (bottom)



Fig. 41 Ground floor indicating Orientation building

Base building

The base building consists of the following elements:

- Basement
- Service shafts:
- Structural system
- Precast concrete floor slabs
- Roof



Basement

Fig. 42 Hotel basement

The basement design forms part of the proposed block basement. The entrance of the basement is in Paul Kruger Street. Responsibility for the hotel section of the basement becomes that of the hotel management.

The basement will be constructed with a concrete cavity retaining walls system secured with rock anchors to engineer specifications where the concrete columns support the piers. The basement will be mechanically ventilated.

The layering system of the basement is as follows:

- Dorken Dimple Sheeting water proofing system
- 200mm reinforced concrete slab
- 75mm screed
- Drainage to sumps with steel grill covers
- Concrete columns to engineering specifications
- Column foundation to be reinforced by pad foundation to carry load of piers to engineering specifications

-Foundation

Reinforced pad foundation according to engineering specification

-Service shafts

From model 2, multiple service shafts were organised on a linear grid form where similar variety in interior room layouts is possible.

The service shafts (3 000 mm X 1 000mm) are made from off shutter concrete to comply with SABS standards regarding 'design of structural systems' (SABS 0160) and structural concrete (SABS 0100). The service shafts accommodate all electrical, mechanical and plumbing system services as needed. They are accessible for maintenance by doors.

-Structural system

Shutter concrete walls and service shaft are the primary structural system.

Steel construction is to be used as a secondary system, supporting the concrete floor slabs and the maintenance roof. All primary elements are to be hot rolled H profiles and must to grade 300 W to comply with SABS 1431. Steel structure geometry and sizing must comply to SANS 10160 for loads and SANS 10162 for steel structure. Structural steel needs must comply with SABS 1200H or 12004 and SABS 0162 (Wegelin:1998:59) All surfaces must be primed by brushing and blast cleaning according to SABS 064 and painted with two coats of zinc phosphate primer to comply with SABS 1319.

-Pre cast concrete floor slabs

200m Post tension flat slabs with steel reinforcing to be 20-30 MPa to comply with SABS 1024 requirements.

-Roof

The roof consists of steel I beam as supporting elements and steel c-sections purlins to be used with steel cleats. Steel IBR profile sheeting to be fixed with hook bolts and spaced no more than 1.5 meter.

This is the changeable part of the building. Generally the infill is the technology that changes on a cycle of five to twenty years. The infill of the building has to be adaptable while accommodating the necessary amenities of the rooms. The material or system has to provide acoustic qualities, be fire resistant and provide thermal comfort to the rooms.

The infill consists of the following elements:

- Skin
- Spatial organisation
- Interior walls
- Electrical components
- Drainage
- Safety and security

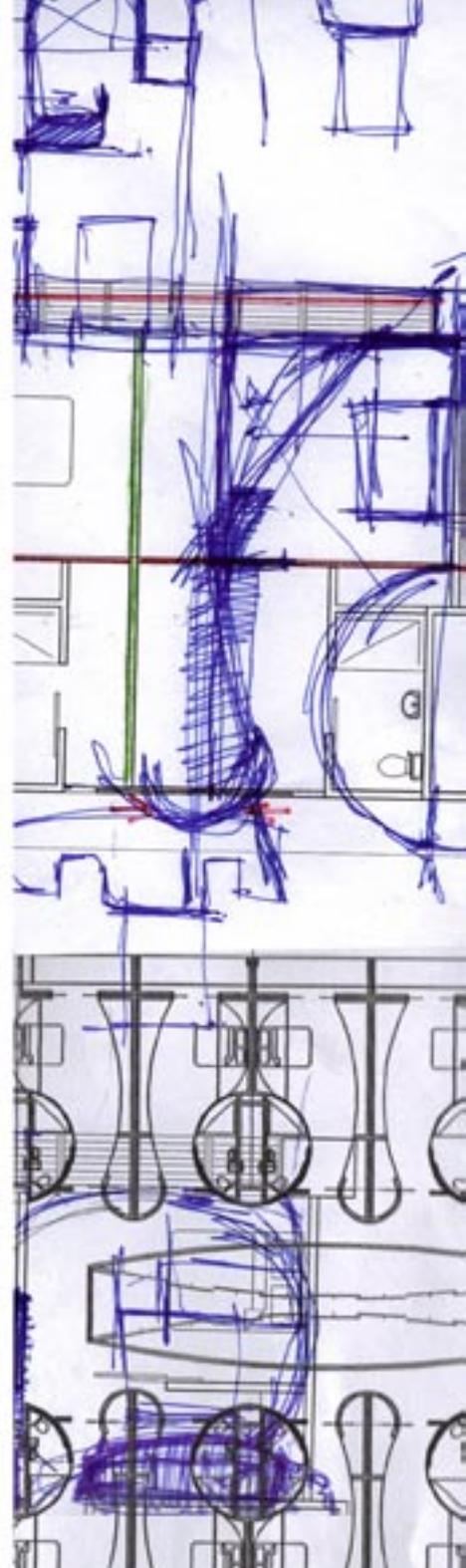


Fig. 43 Infill design development

The skin or envelope of the building is designed to facilitate climate control in the building. These optimal solutions are essentially theoretical. The proposed hotel is a multi storey building where mechanical climate control is coupled with natural climate control systems that are introduced to lower the operational cost.

For the proposed hotel, several climate control interventions are introduced to reduce the cost of mechanical ventilation systems in the building. These are:

- Louver system attached to facade
- Natural ventilation
- Stack ventilation
- Mechanical ventilation

Climatic condition of Pretoria

Temperature

For the months of November to March the temperature falls within the thermal comfort zone that ranges from 16 degrees C to 32 degrees C with an optimum temperature being around 22 degrees C (Holm, 1996, p 69).

Wind

In summer the wind direction is from east-north-easterly and east-south-easterly and in winter it is mainly south-easterly (Holm, 1996, p 69).



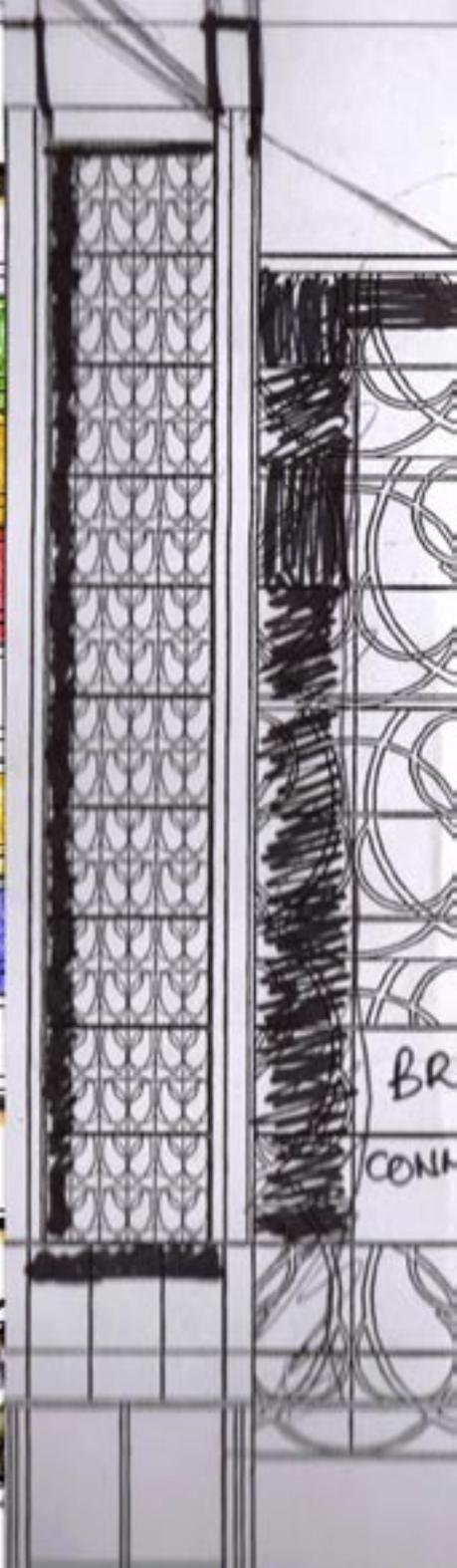
Fig. 44 Visual case study for façade system

Pretoria receives a very high sunshine percentage with annual maximum of 80% and minimum of 67%. This reads as 4.5 Whr/m²/Day in mid-winter and 8Whr/m²/day in mid-summer. Much of this is radiation. More diffused radiation takes place in the morning than in the afternoon, due to clouds and pollution.
(AAL 310, 2002, p19)

-Louver system attached to facade

To prevent excessive heating and glare to the building from the sun, louvers on the east and west façade control the daylight levels. During the day the angle of the louvers can be manually manipulated by the guest to the preferred infill of sunlight into the rooms. The louvers also act as 'light shelves', reflecting light off their surface into the room. This reduces the amount of artificial light that is needed in the rooms. The louvers will prevent overheating, avoid thermal discomfort and prevent glare.

The visual case studies indicated that most louver systems attached to the façade are static systems. In the proposed hotel design a static louver system will limit the immediate changeability to adapt to the needs of the client. The proposed louver system (refer to detail) can be, as noted, manipulated by the guest. In doing so, the facade of the hotel becomes an interactive membrane between the client and the building's street front. Prior to the louver system, other facade systems were investigated as to achieve this interactive membrane. There were other facade systems that could be applied, but in keeping with the building's goals of changeability, the louver system proved more feasible. It must be noted that the louver system can be removed to make the building more adaptable in future.



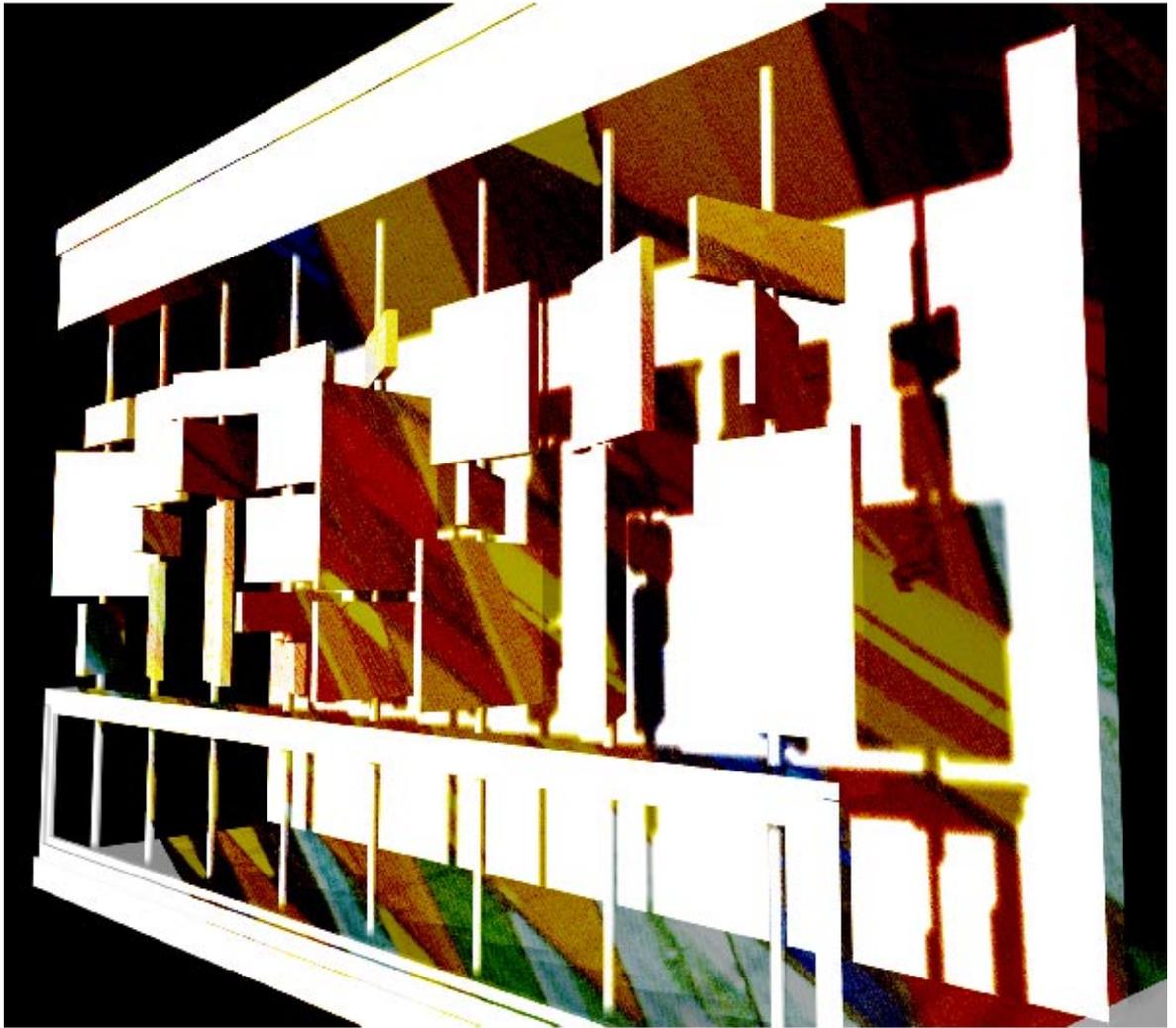


Fig. 46 Balustrade perspective

The word “ventilate” is defined as “to let fresh air into (a room or building)” and a “ventilator” is defined as “an opening or device, such as a fan, used to let fresh air into a room or building.

A room or building needs ventilation for one or more of the following reasons:

- Trapped air accumulates heat.
- Trapped air becomes contaminated with toxic fumes, particles and odours .
- Trapped air becomes saturated with water vapour.
- Trapped air becomes depleted of oxygen, causing stuffiness.
- Smoke and fumes from fire choke inhabitants and cause the fire to spread.

The hotel has doors that open onto balconies facilitating thermodynamic forces in a building to draw in fresh air and discharge waste air. Air inlet systems are positioned at floor level to maximise the stack height and provide incoming air at the level of the building’s occupants.

Stack ventilation

Glass chimneys are located on the east and the west facade of the hotel. Temperature differences between the inside of the chimney (heated from the sun) and indoor room temperature cause air density differences. This creates pressure differences that draw the hot air out of the room into the chimney. The rate at which this air rises in the chimney depends firstly on the temperature difference between the rising column of warmer air and the surroundings’ cooler air and secondly, on the height of the chimney.

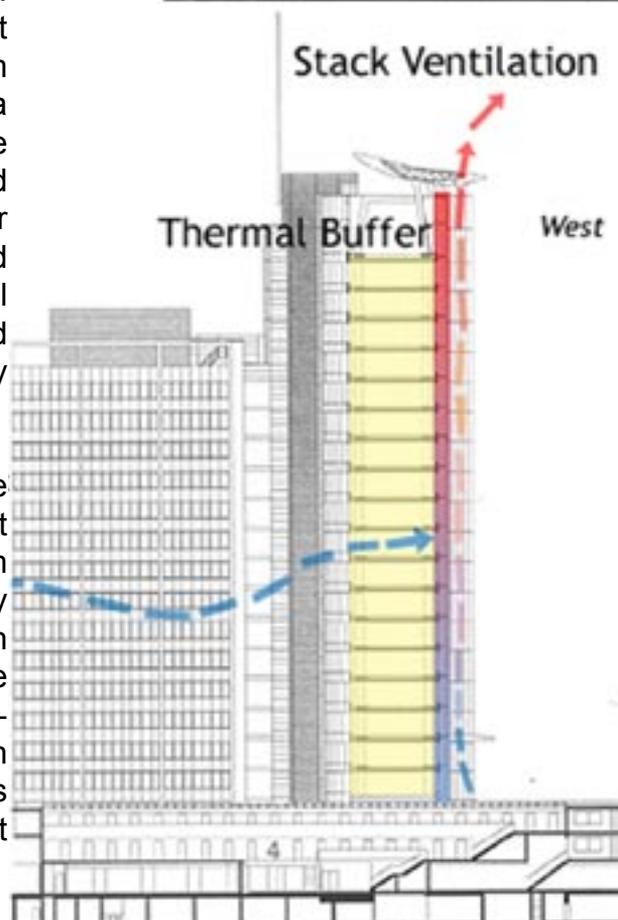
Hot air is exhausted through the vent at the top of the stack taking into consideration that the wind predominantly comes from the east. Detailing will prevent back drafting that would cancel the effect of stack ventilation.

The following case study is one of a few high rise buildings that uses a natural ventilating system. This model informed some of the detail design.

Gemeinnützige Siedlungs-und
Wohnbaugenossenschaft mBH (GSW)
Headquarters Location: Germany
System: Double-skin façade
Architect: Hutton Architekten

This 11-m wide office building allows for cross ventilation. The east façade consists of automatically and manually-operated triple-glazed windows with between-pane blinds. Louvered metal panels also occur on the east façade to admit fresh air independently from the windows. The west façade consists of a double-skin facade with interior double pane windows that are operated both manually and automatically and a sealed 10-mm exterior glazing layer. Wide, vertical, perforated aluminium louvers located in this interstitial space are also automatically deployed and manually adjustable. The louvers can be fully extended to shade the entire west façade.

Outside air admitted from the east facade provides cross ventilation to the opposing west facade. The prevailing window direction is from the east. The west facade acts as a 20-storey high shaft inducing vertical airflow through stack effect and thermal buoyancy. During the heating season, the air cavity between multi-layer facade acts as a thermal buffer when all operable windows are closed. Warm air is returned to the central plant via risers for heat recovery.

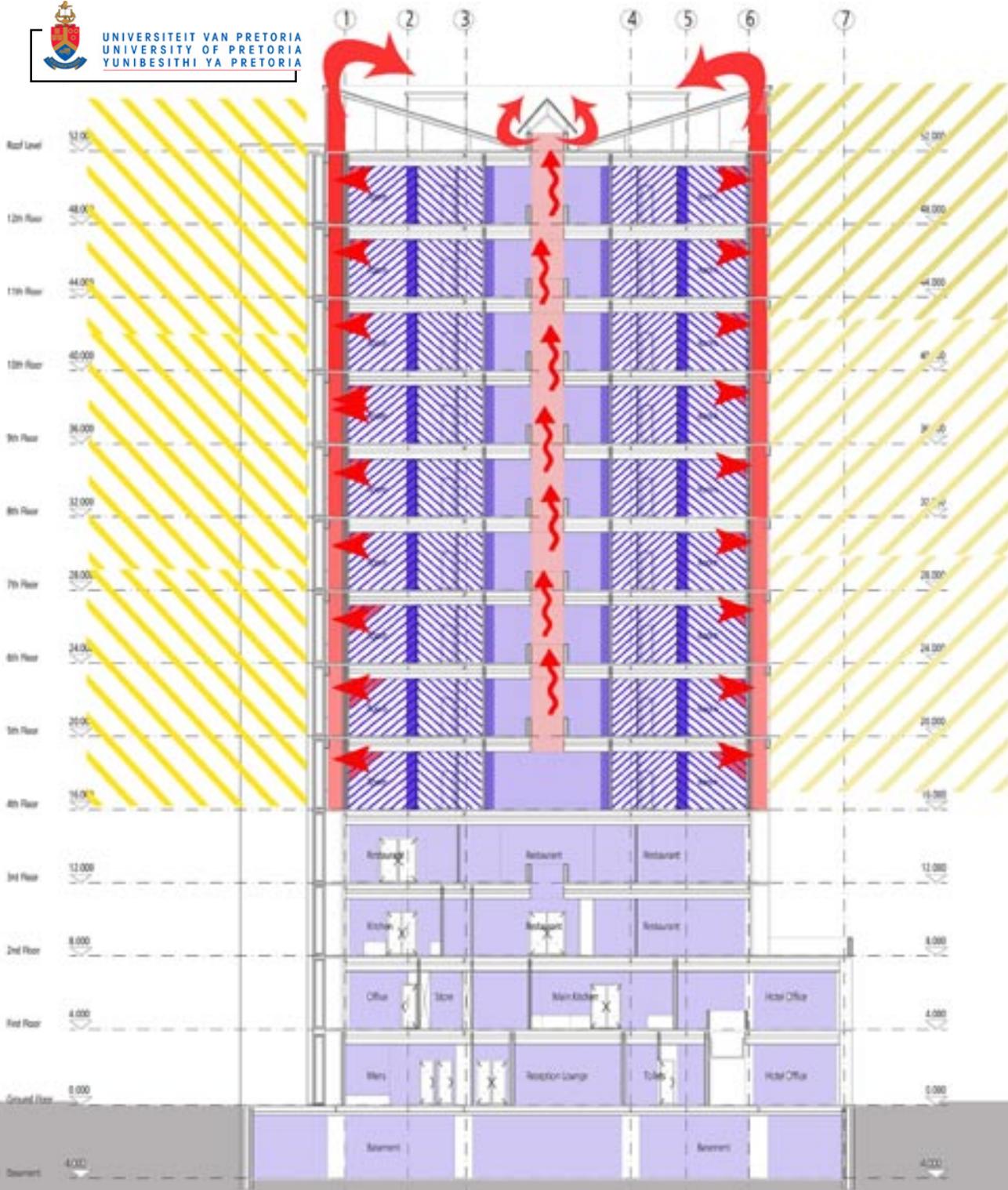




-  Stack ventilation
-  Natural ventilation
-  Mechanical ventilation



Fig. 48 Ventilation systems in hotel



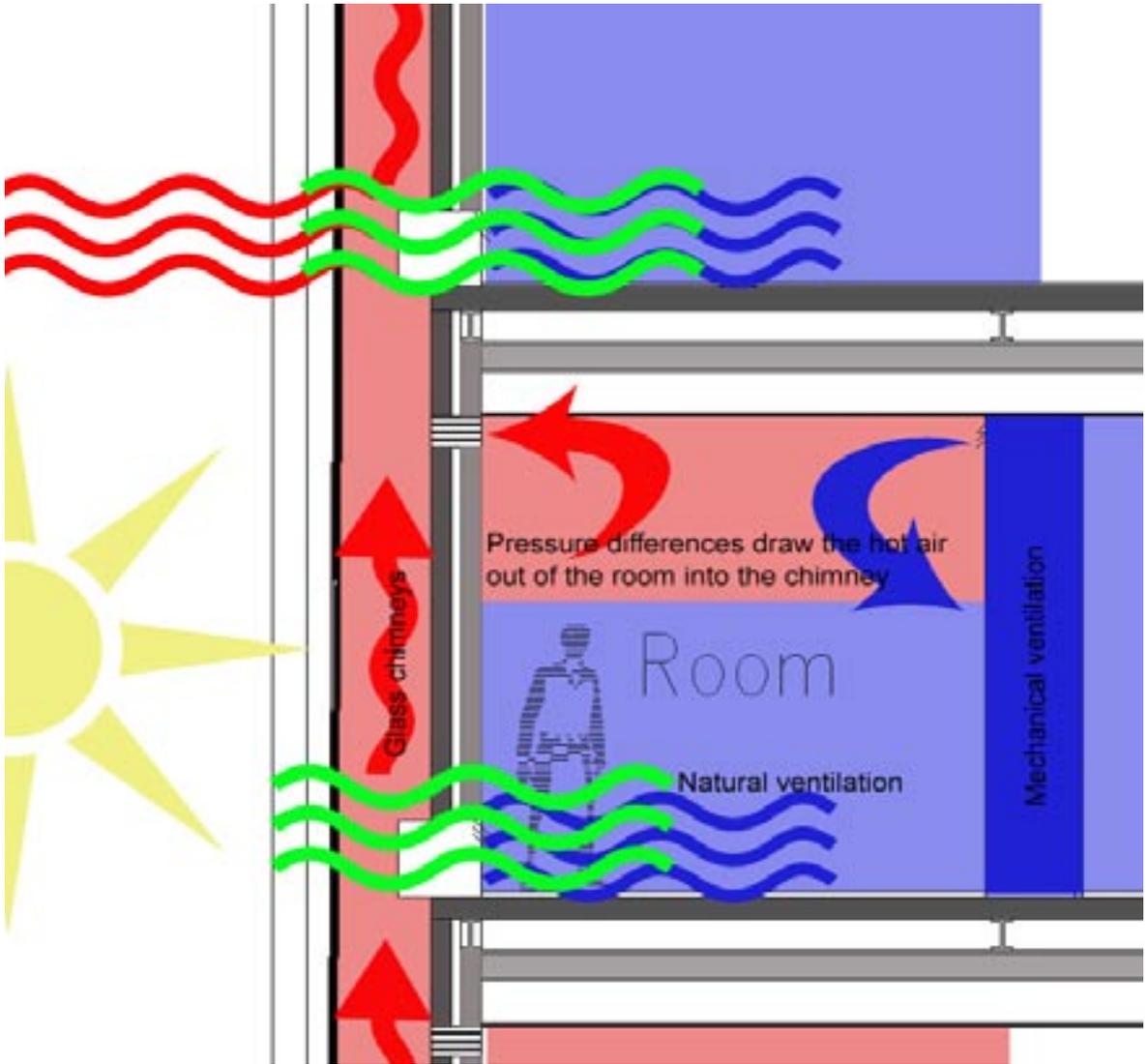


Fig. 50 Stack ventilation system as per room

-Spatial allocation

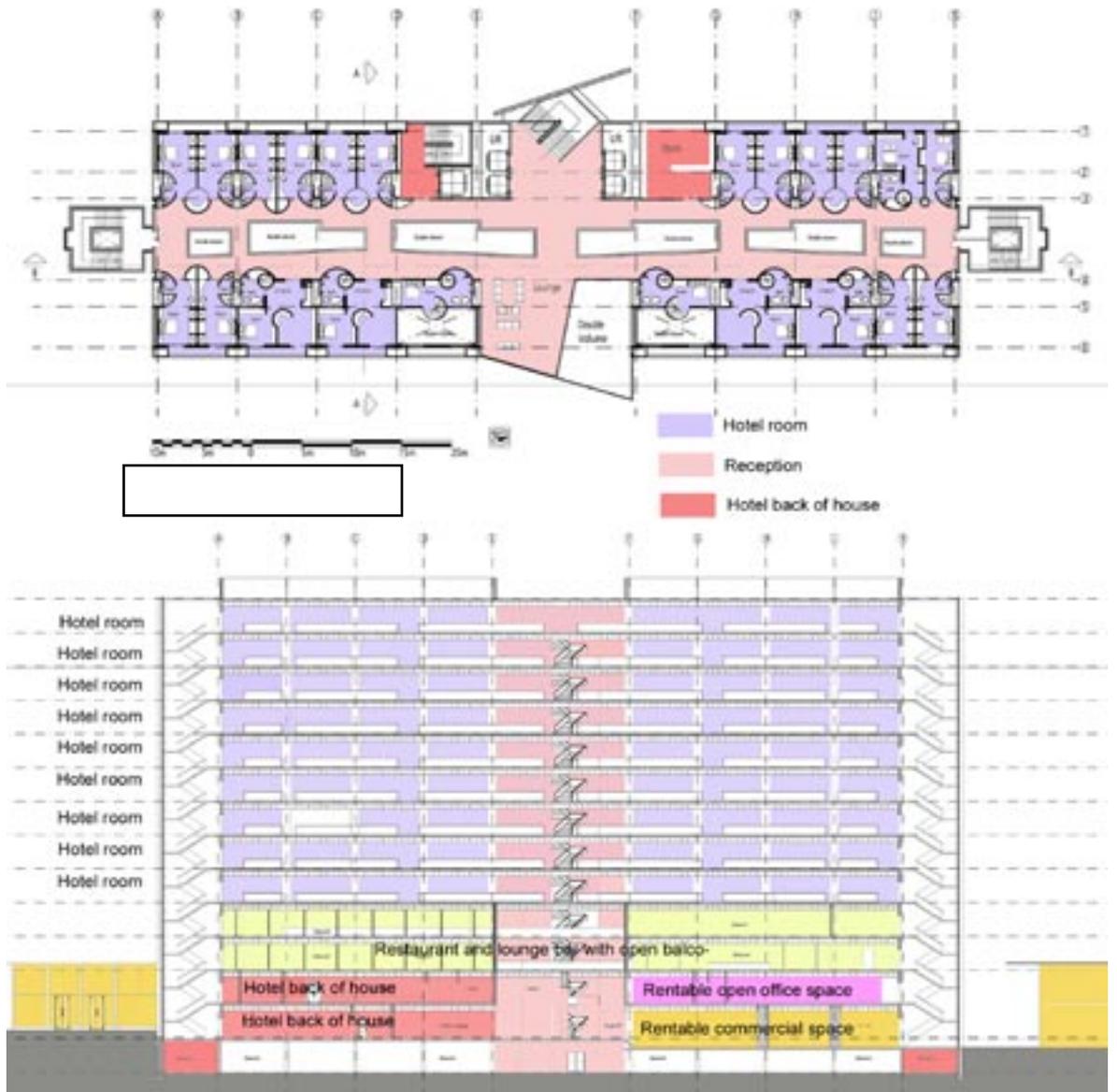


Fig. 51 Spatial allocation



- Hotel back of house
- Reception
- Rentable commercial space
- Rentable open office space

Fig. 52 Ground floor



Fig. 53 First floor



Fig. 54 Second floor

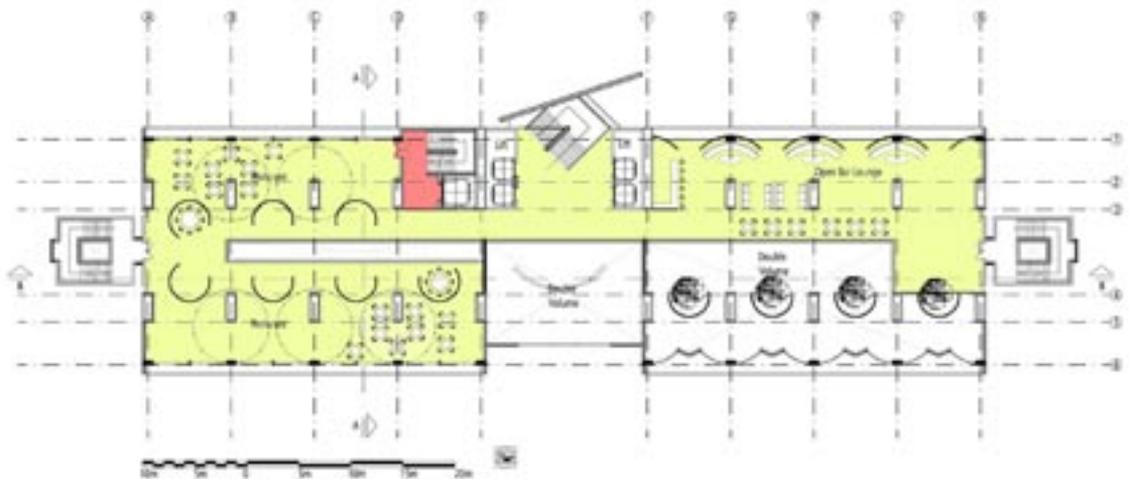


Fig. 55 Third floor



Floors four to thirteen are Hotel room with various floor layouts.

Unit A, STAR 1/2

Two rooms with dividing door that open onto a central kitchen. Market as single room or as double room. Each room with a bathroom that has shower, hand wash basin and toilet.

Unit B STAR 2

Two rooms with built in desk, a bathroom that has a shower, hand wash basin and toilet.

Unit C STAR 1 and 3

One room with a bathroom that has a shower, hand wash basin and toilet.

One room with a study, bathroom that has a shower, bath, double hand wash basin and toilet.

Unit D STAR 3

One room with lounge, built in kitchen and a bathroom that has a shower, bath, double hand wash basin and toilet.

Unit D STAR 4

One room on mezzanine level with double volume lounge, study, guest bathroom, built in kitchen and a bathroom that has a shower, bath, double hand wash basin and toilet.

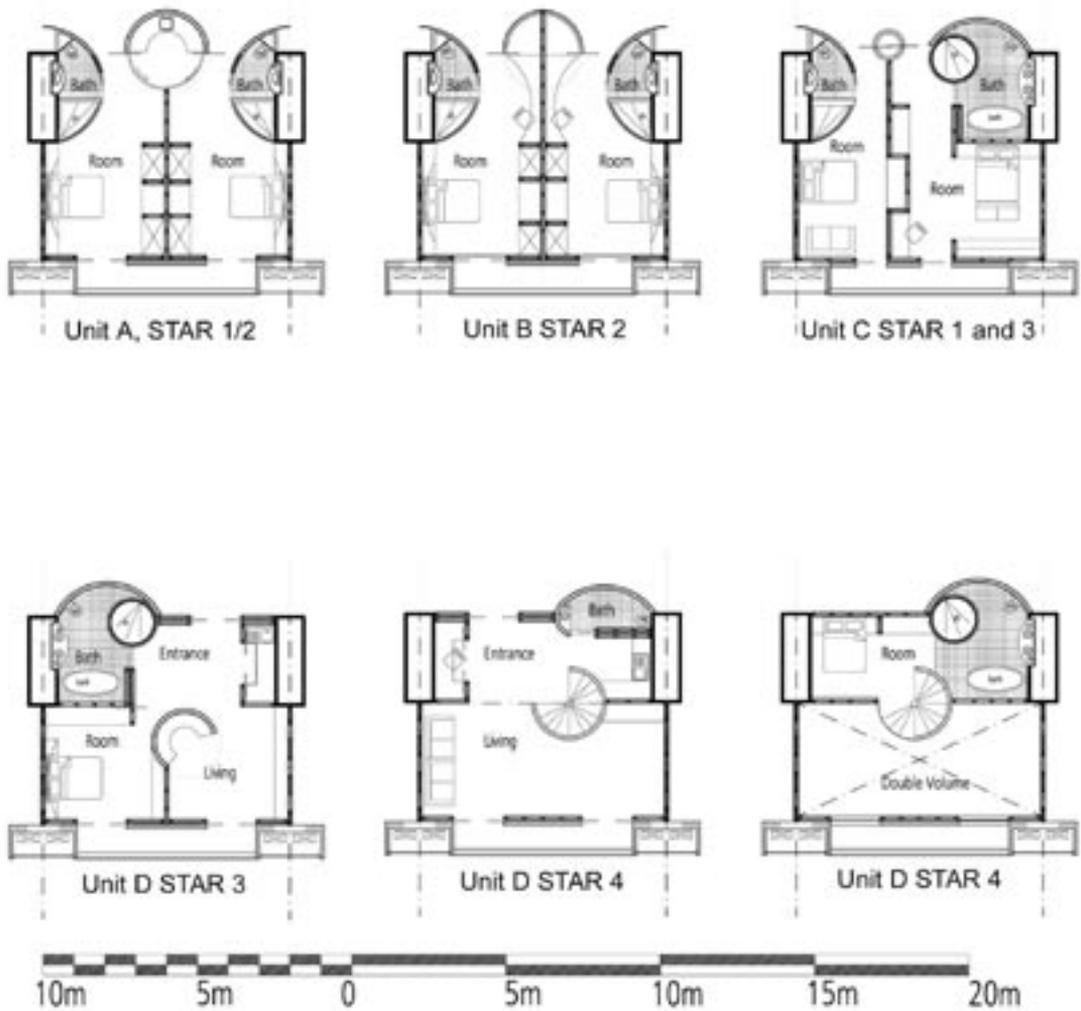


Fig. 56 Room Layouts

Interior walls' wall.

Rhinowall™ HiStrength™ System will be used for the interior infill of the rooms.

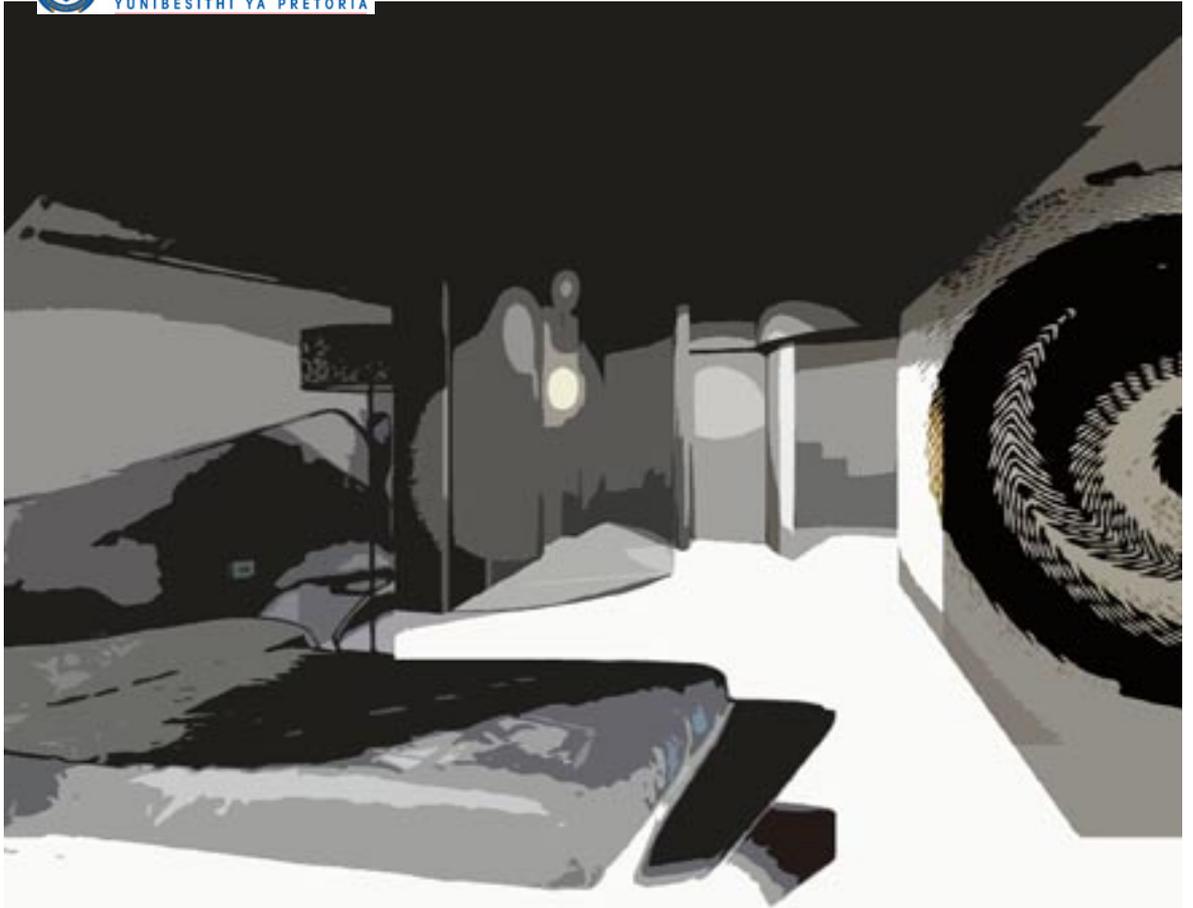
Acoustic Installation: >43db

Fire Rating: 60 minutes

Approximate mass: 30kg/m²

The wall system consists of the following construction:

- 58mm Ultrasteel™ Drywall steel studs inserted at 600mm centres in 58mm Ultrasteel™ Drywall track.
- Sound Seal™ is inserted under tracks and wall studs for enhanced acoustic and moisture insulation.
- Cladding on both sides of frame with a single layer of Rhinoboard™ branded 15mm Firestop™ taper edge board.
- Inner and outer joints to be staggered.
- Rhinoboard™ is fixed at 220mm centres using 25mm Rhino Drywall screws.
- Jointing is to be done with RhinoTape™ and RhinoGlide™ jointing plaster.



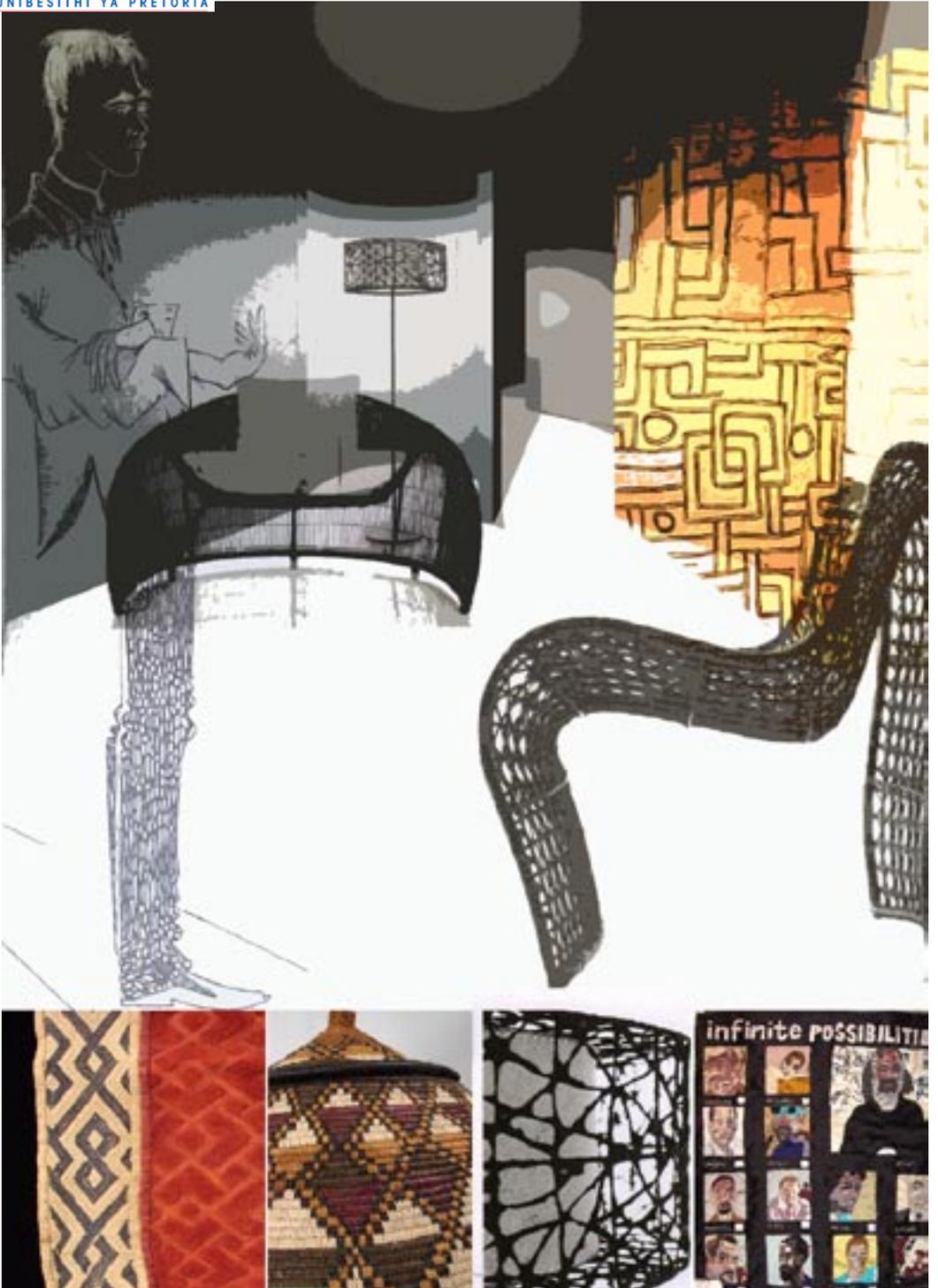


Fig. 58 Interior room perspective

-Safety and security

Separate entrance to different function in building, as per example: hotel with separate entrance from basement that opens into reception.

Integration of surveillance cameras, door locks and entrance controls, reservation and financial systems.

-Electrical

To maintain the electrical, mechanical and plumbing system and equipment of the engineering department, a periodic performance monitoring and measurement of the system is required. This benchmark tool will thus provide a system in place, thereby the hotel can monitor their resources (energy, water) consumption, wastewater generation, Green House Gas (GHG) emission and their financial performance.

The following is the percentage break-up of energy consumption by various utility areas:

- Lighting 30 – 40%
- Kitchen 10 – 15%
- Lobby 10 – 15%
- Elevators 02 – 04%
- Others 10 – 25%

-Lighting

Guest lighting accounts for 30% to 40% percent of hotel electricity consumption.

Energy-efficient lighting can save 20% to 75% percent in energy use by using:

- Occupancy-controlled lighting in one area, daylight-controlled in another.
- Occupancy-controlled lighting connected to an alarm system or access control.

-Power supply

External transformer

Three phase power supply

Distribution boards

Db maintenance room

Emergency back up generator

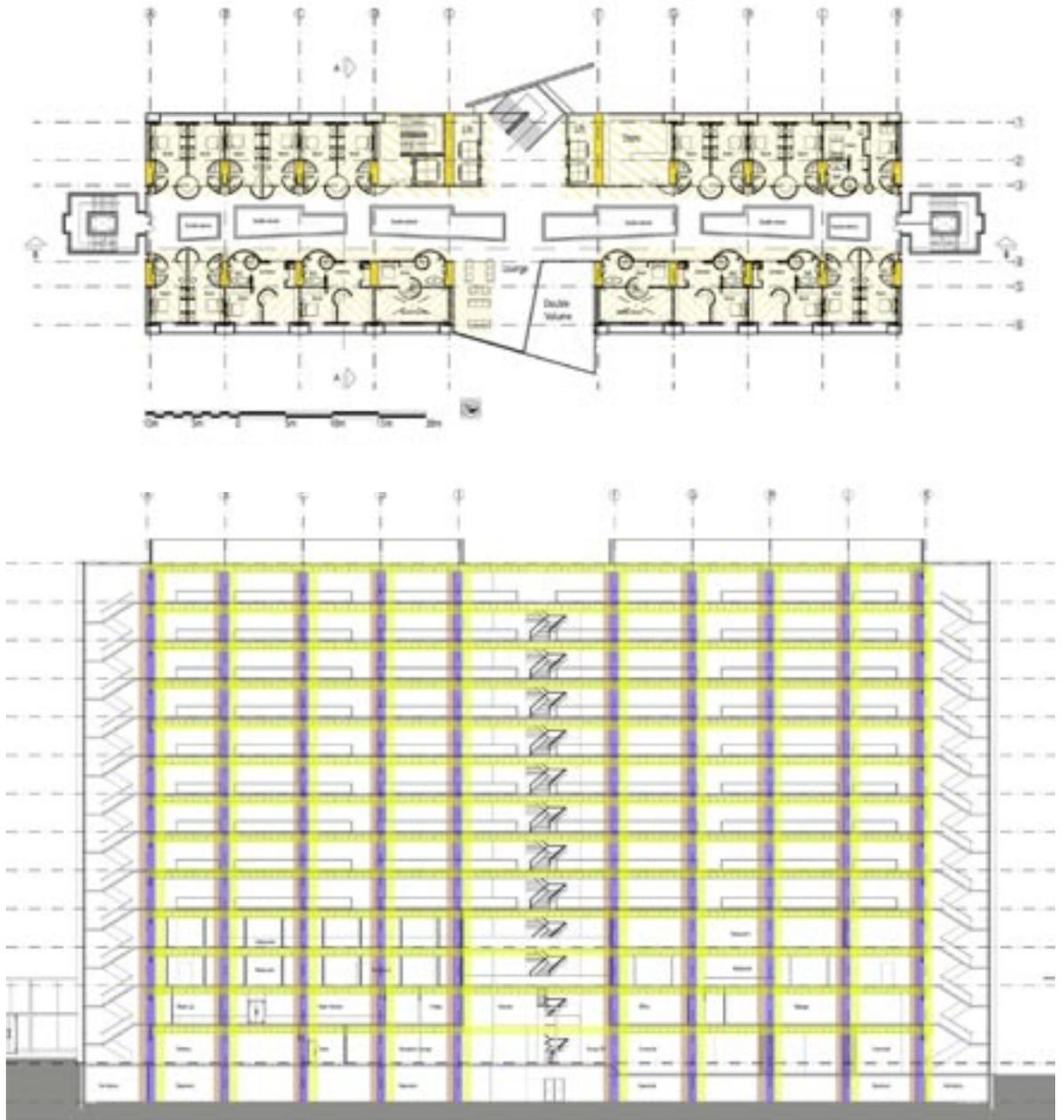


Fig. 59 Electrical layout

-Drainage

All waste and soil pipes are located in service shaft which drain into municipal drain system.

Storm water pipe connects to municipal storm water system.

-Fire protection

All steel is to be finished in intumescent paint as to create insulating foam during a fire. A coating of 1mm gives fire protection of approximately 60 minutes.

Escape routes are via stairways as per national building regulations and follow general circulation routes that exit at street front. Signage will be as per national regulation and direct people to exit and to indicate location of fire hose and extinguisher.

Two 30 meter hose reels and four 4.5 kg fire extinguishers will be located on each floor. All fire protection equipment to be sealed of in locked glassed cases with keys located in recessed glass fronted boxes to be broken in case of emergency.

Sustainability program

-Establish recycling programs in common areas, guest rooms, and administrative areas.

-Incorporate food scrap and yard waste composting programs where cost effective.

-Participate in donation programmes for food, surplus furniture, electronics, and other items.

- Install energy and water efficient fixtures, lighting, and other equipment.

-Minimise use of disposable items.

-Use nontoxic (or less toxic) alternatives for cleaning supplies, paints, etc.

-Adopt an environmental purchasing policy for preferable products such as recycled-content office paper, tissue and napkins.

-Develop annual environmental improvement goals.

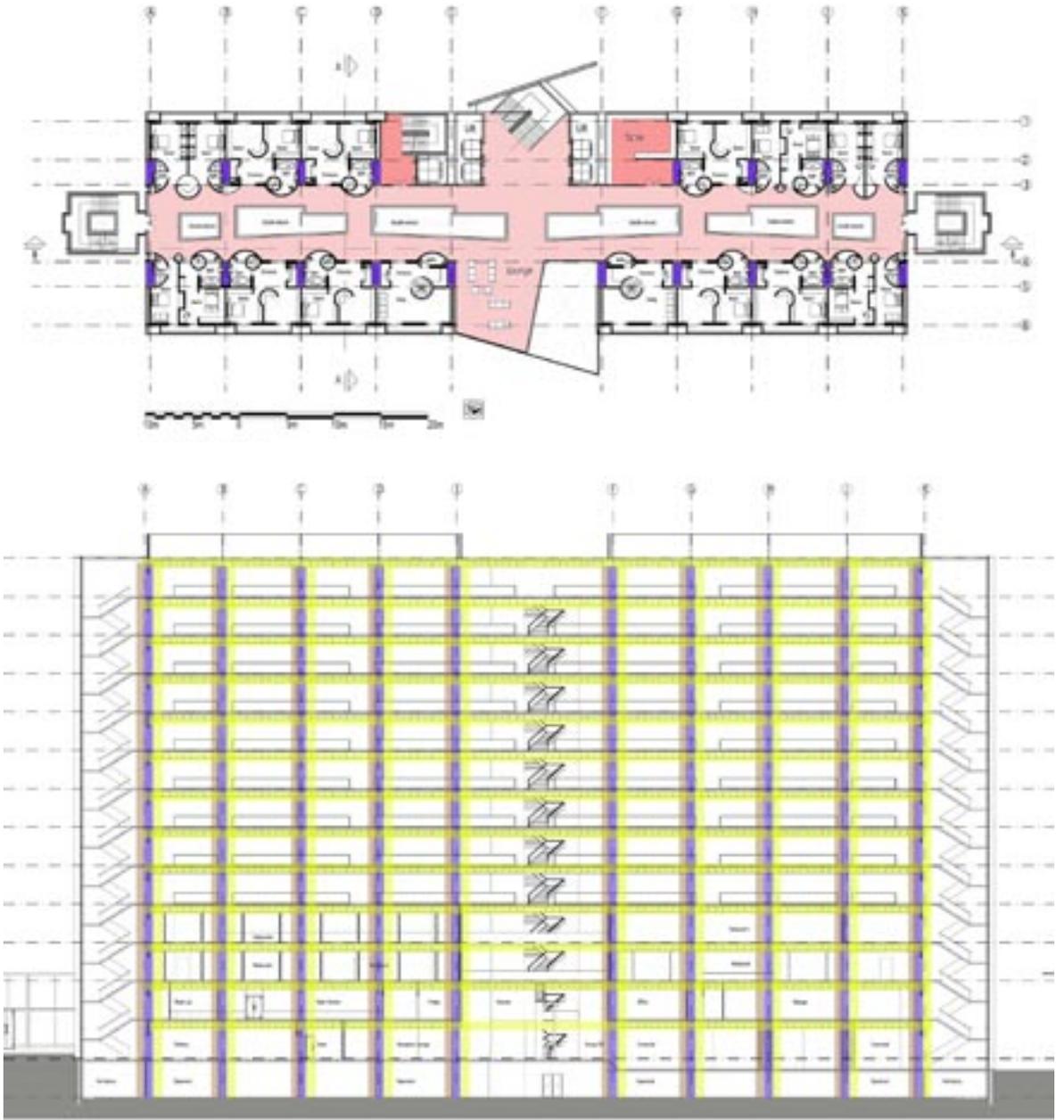


Fig. 60 Water

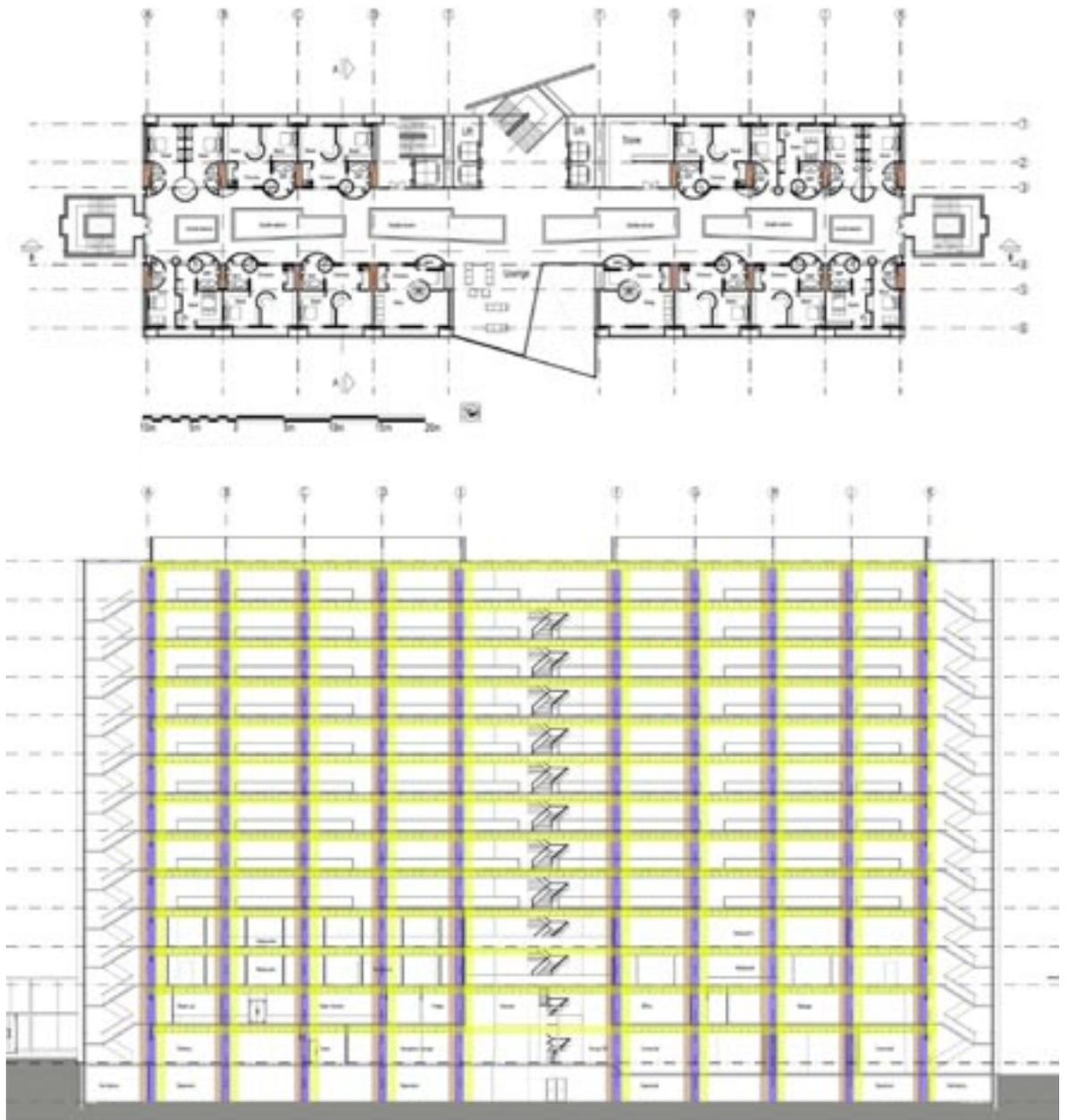


Fig. 61 Brown water

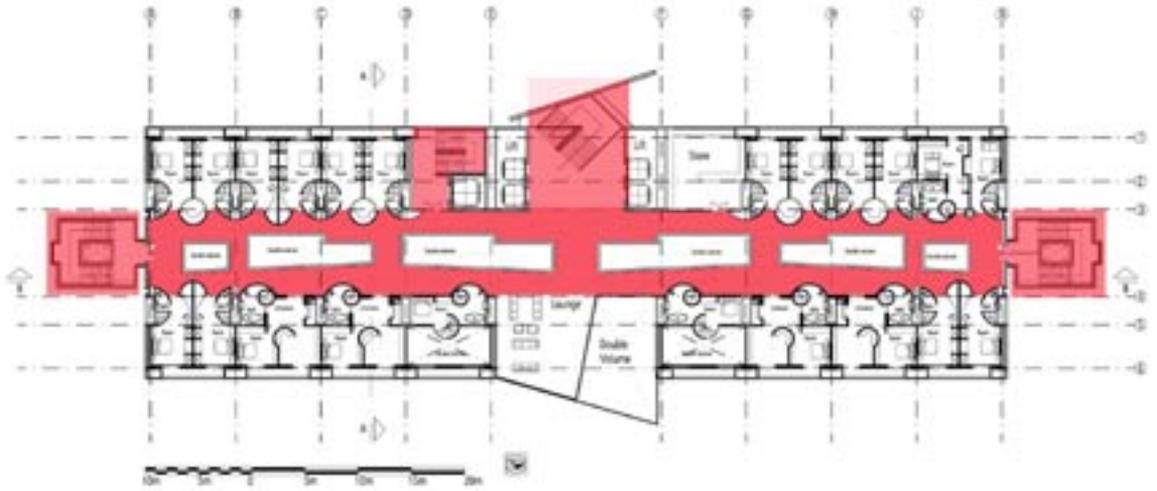


Fig. 62 Fire escape routes

This discourse investigated a hotel system for the possibility of multiple room stars in one building whilst reflecting the immediate identity of the context. The third model with multiple service shafts on a linear grid form did provide the possibility of a range of room layouts, making the building adaptable to future change.

It is a feasible model that could be utilised in hotel design in South Africa because it is easily adaptable to facilitate current hotel trends (local and international). It is thus not a reflection of a certain time period (style or theme) that could become static and expensive to remodel in order to accommodate a future market. The model also proves that it is possible to have more than one star classification in the room design if the international grading guidelines are utilised. South African hotel grading standards should be more specific in their grading methodology, by so doing the international and national guests know precisely what to expect when they book into a hotel.

The design resolution became programmatically orientated, to accommodate the rigorous service demands. This limited the possibility of an investigation in to a unique identity because the focus was placed on the facilitation of services and the operation of the hotel. The external identity became the façade system, which is an interaction between the guest and the building. It was further successfully expressed in the infill of the building, where room layouts become individual designs. For this specific hotel, emphasis was placed on five different room layouts that could randomly slot into the base building. It is assumed that only one of the room layouts would provide a successful hotel with one singular star grading. The identity of the hotel model is thus dictated by the context and the need set by the hotel development. This means that model three could possibly have a different identity in Cape Town, where the brief for the infill could be for that of a specialist hotel where 16 artists work on the room layouts of each floor. If the base building is successfully designed, the infill could adapt to any particular need or style.

Although the open building approach was successful in the room layout-design, it proved to be problematic in other areas. With multiple functions (hotel, commercial and rentable office space) security and circulation systems in the building had to be defined. It was not successful to have one entrance accommodating the strict hotel schedule and those of other functions. It would be advisable to treat the hotel schedule as a primary function and the other schedules as secondary. For example, delivery zoning should be different to that of the commercial delivery, as this will eliminate confusion at delivery whilst keeping the delivered goods safe.

For this building model to be feasible it had to have more than seven stories. The chosen model has fourteen stories, which means that the construction is more feasible, and makes adaptability to other functions possible. Ventilation systems however become more challenging but the current model has a system that is the optimal design resolution where natural and mechanical systems are combined.

It is clear that for a hotel to be truly adaptable, the design and the identity of the hotel has to be simplified so as to create the possibility of future change and to accommodate more than one function in the building. If this is not the desired result, the hotel system should not consist out of more than one function, and should be designed according to traditional standards and themes of the past.