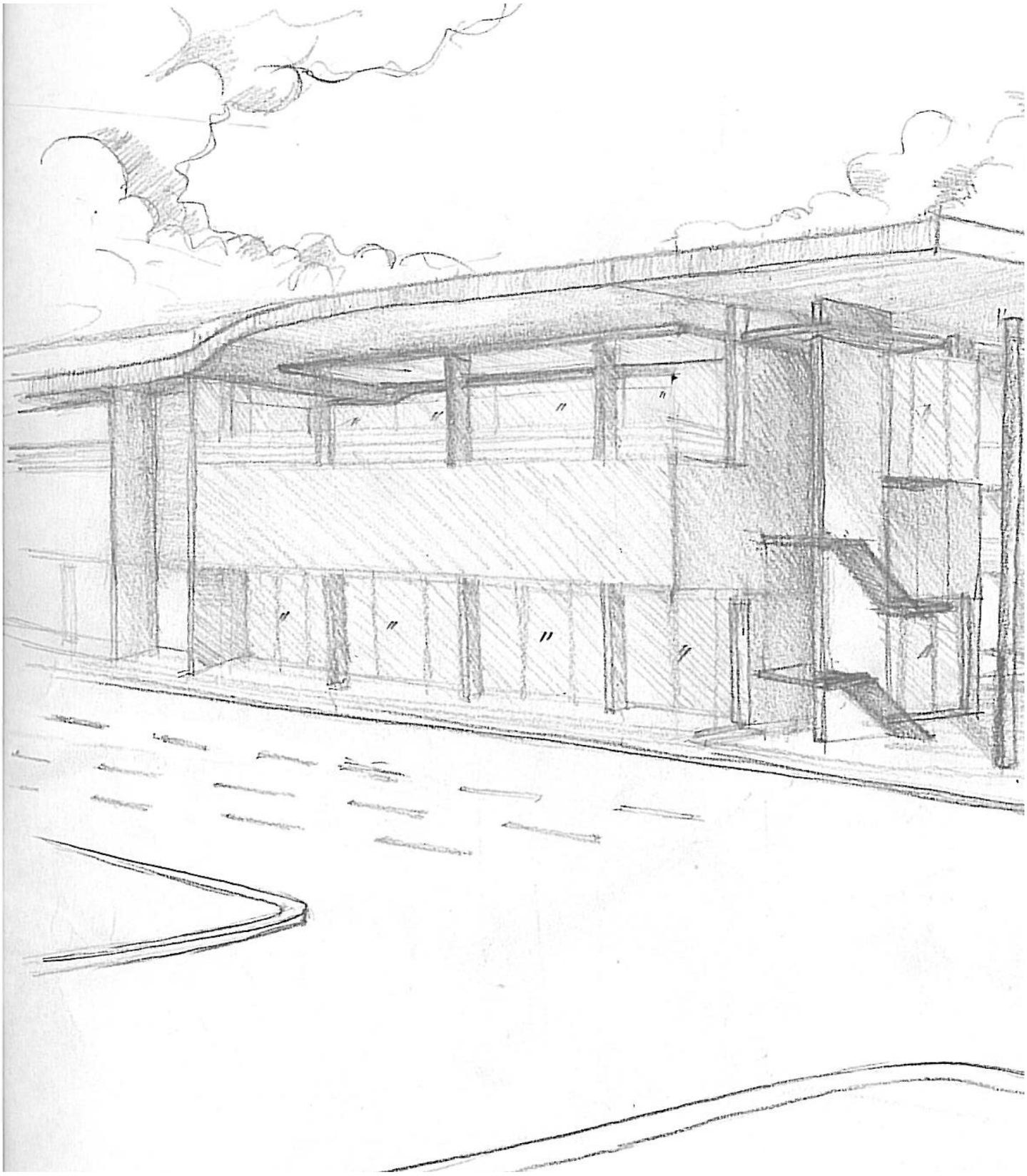
CHAPTER EIGHT

TECHNICAL INVESTIGATION

DESIGN SYSTEMS

PASSIVE SYSTEMS

MATERIAL STUDY



DESIGN SYSTEMS

Services, Circulation, Ducts and floor area

FIG152-Basement Plan

1 2 10 20

Floor Area
Service Rooms
Foyer Space
Water Storage/ catchment
Vertical Circulation
Service Ducts

FIG 153- Ground Floor

DESIGN SYSTEMS

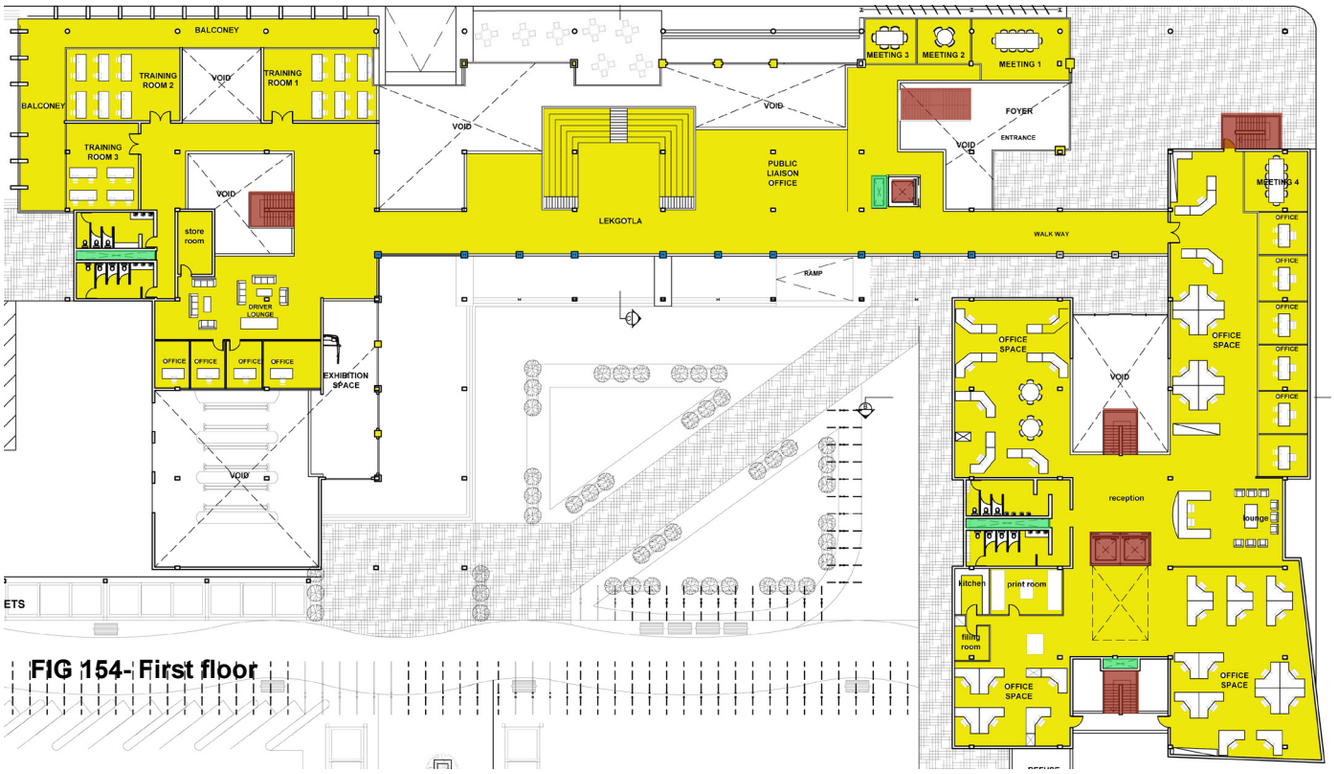


FIG 154- First floor

FIRST FLOOR

FIG 155-Thrid Floor

SECOND FLOOR

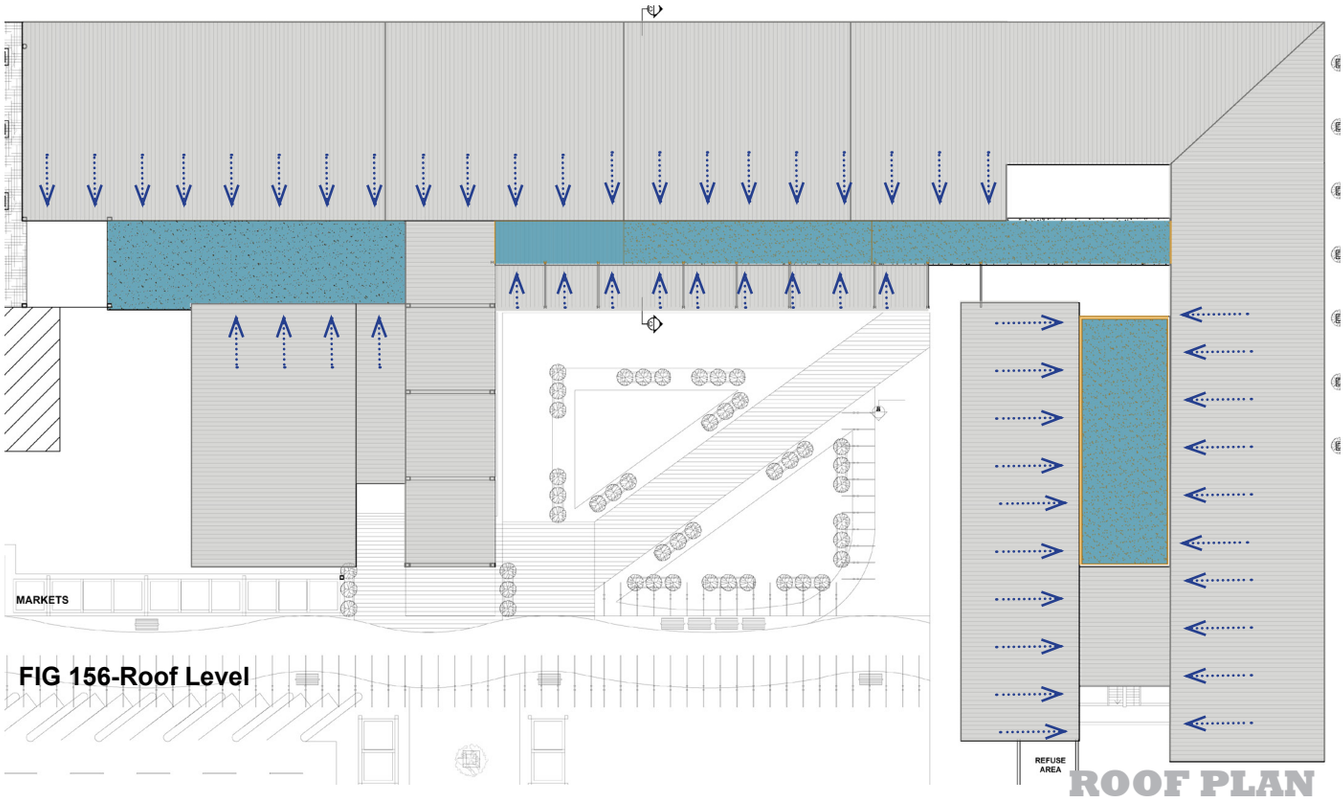


FIG 156-Roof Level

ROOF PLAN

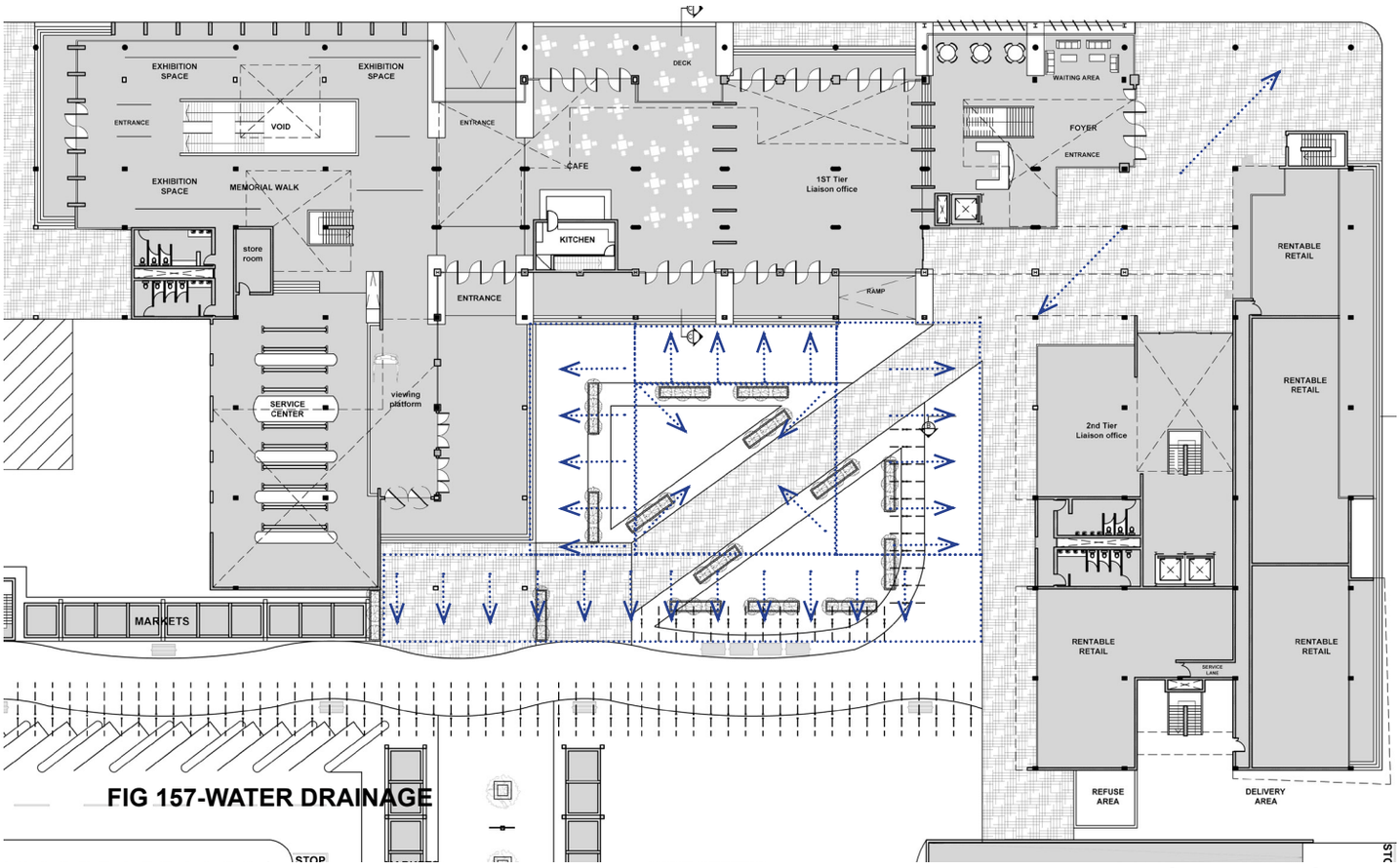


FIG 157-WATER DRAINAGE

WATER DRAINAGE LAYOUT

WATER SYSTEMS

Rainwater harvesting

Output: Roof Area X average rainfall

= 4615m2 X 0.674m (Weathersa, 2009)

=3110.5m3

Comments: The basement structure is fitted with two water storage compartments which are attached to a pump system, thus the collected water could be used for two purposes.

1). The water could be pumped to a filtration system and used in the ablution facilities

- Dual flush system uses 3l (light setting) or 6l (heavier setting)
- Conventional toilets use 11-15l per flush

2).The unfiltered water could further be used to irrigate the site and adjacent buildings in time of plenty.

Water Storage

The water harvested from the roof will be stored in two storage rooms in the basement. The storage tanks (hydrodynamics nel range) will be joined together by un underground gravity pipe, in order to regulate the levels of both tanks. The tanks will further have a pump system, attached to a filtration systems, that will pump the water to the needed areas, (ablutions, irrigation).

Rainwater harvesting

Capacity	Type	Diameter	Height
14 000 L	Water	2525mm	3180

Estimated usage

Average hot water consumption:

Hand basin 1 liters

Kitchen sink (per wash-up) 6 liters

Dishwasher 14 liters

1 person + household 120l

Washing of floors/sores: 50l

Toilet: 8L per flush.

Showers: 36l per person

Building usage

Toilets/ urinals: 8L/ per flush X 37 toilets/urinals X 8 uses/D

= 2368L

=71040 L/ month

1mm of rain x 1m2 of roof surface

= 1 liter

4615m2 X 674mm (weather SA)

=3,110,510 L (potential collection/ year)

3,110,510/ 12 months

=259,209 L/month

The basement has sufficient space to hold 12 14000L storage tanks, with total storage capacity of 168000 L per month.

Radiant cooling

Radian cooling systems are energy and material efficient systems (Cunniff, G, 2009). Compared with air systems, radiant-cooling hydronic systems use approximately half the horsepower and materials to move heating and cooling energy within a building. The system consists of Low-flow injection-pumps, which deliver heating and cooling energy to terminal units.

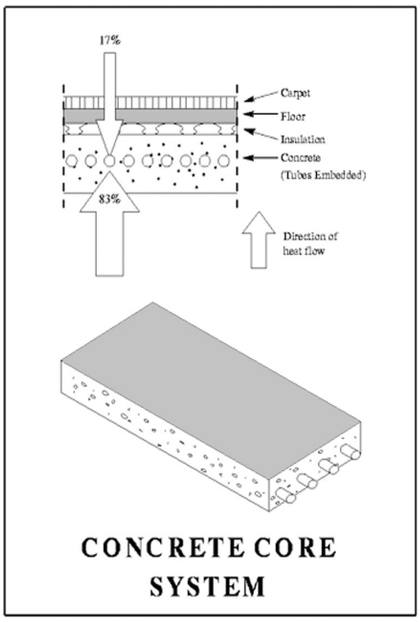


FIG 158-Radiant system

Pros:

- Radiant chilled ceilings consist of metal panels with hydronic tubing attached, where chilled water is circulated through the panels to produce radiant and convective cooling. (Cunniff, G, 2009).
- Approximately 50 to 60 percent of the heat transfer from a radiant chilled panel is radiant, while 40 to 50 percent is convective.

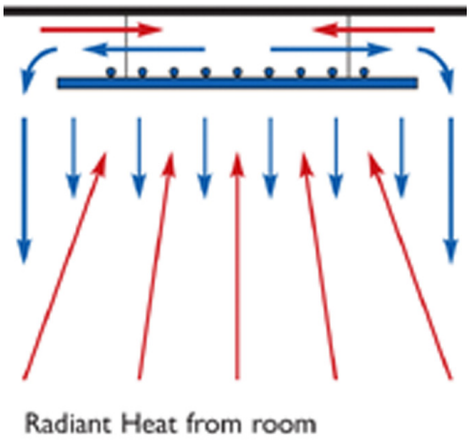


FIG 159-Radiant system

COOLING

From a central pump system, cold water is pumped through coils to the top of the ceiling panel. The underside of the ceiling panel is cooled which in turn cools the air against it. The panels then absorb the heat, which radiates from the room. The air above the panel is cooled and cool air moves around the edges to the rest of the room

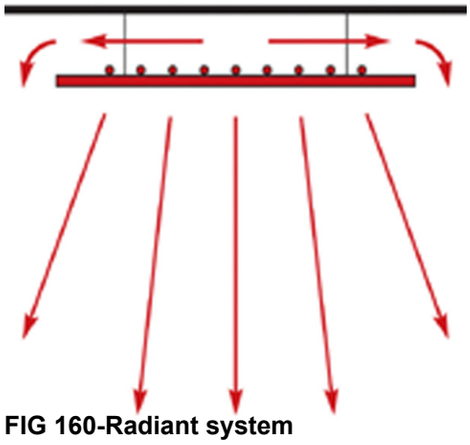


FIG 160-Radiant system

HEATING

The warm water that is pumped through copper coils to the top of the ceiling panels enables the ceiling sail to act as a radiant heater. The panels heat the air above and below the panels, and circulate it around the room. The system is very effective over large areas, and thus reduces heating and cooling energy consumption.

RADIANT COOLING

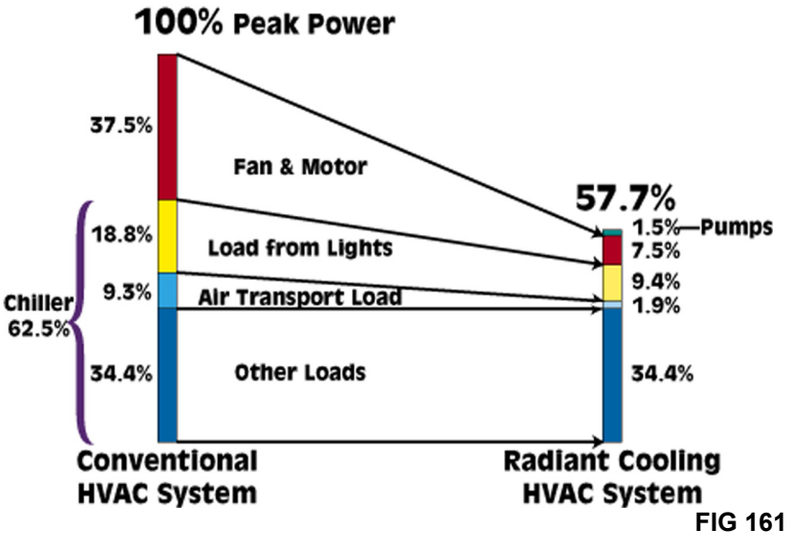


FIG 161-Radiant system

Sun Control

The building uses a series of cantilevers from the roof, to the slab, in order to minimize direct sun penetration in to the building. Recessing the building facades on the lower floors compounds this system, as it takes into consideration the sun angles during summer monthes.

FIG 162-GKD mesh

FIG 163-GKD mesh

GKD steel mesh is used in the exterior and interior of the building for a number of reasons. These include: its excellent corrosion resistance, long-term durability, high fire resistance, and low maintenance. The material also works well as a sunscreen device as it is able to keep out harmful UV rays depending on the density of its weave. While keeping out harmful rays, it also enables an unhindered view out of the building

PASSIVE SYSTEMS

The public component of the building uses passive heating, cooling, and ventilation systems to regulate its climate. The following principals are adopted in the design.

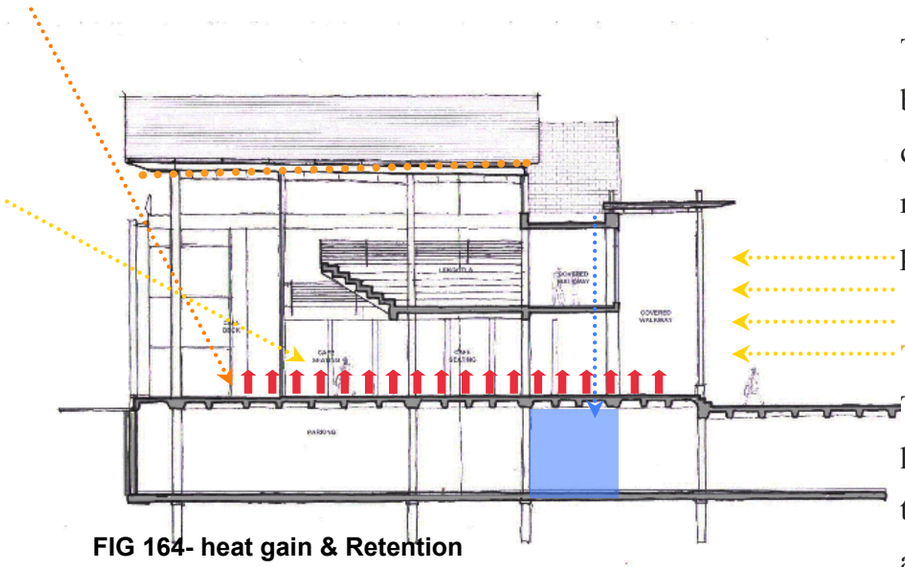


FIG 164- heat gain & Retention

Thermal mass:

The building design exposes the hard mass of its structure in order to increase heat gain during the day, and radiate it off during winter, and at night.

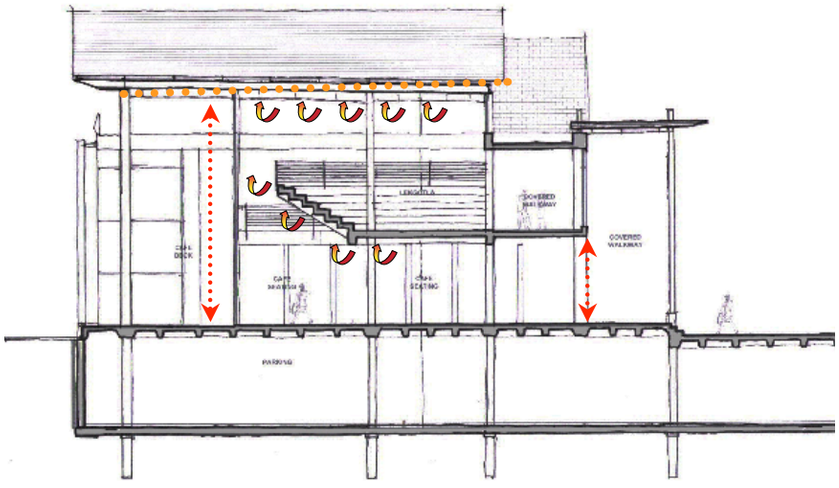


FIG 165- Radiant cooling system

Recessed façade:

The faced sits under an extended roofline, in order to protect it against harsh north light, but allows for heat penetration in winter due to its lower angle of entry

Natural ventilation:

The south façade is open to the courtyard where wind is able to permeate and move through the building

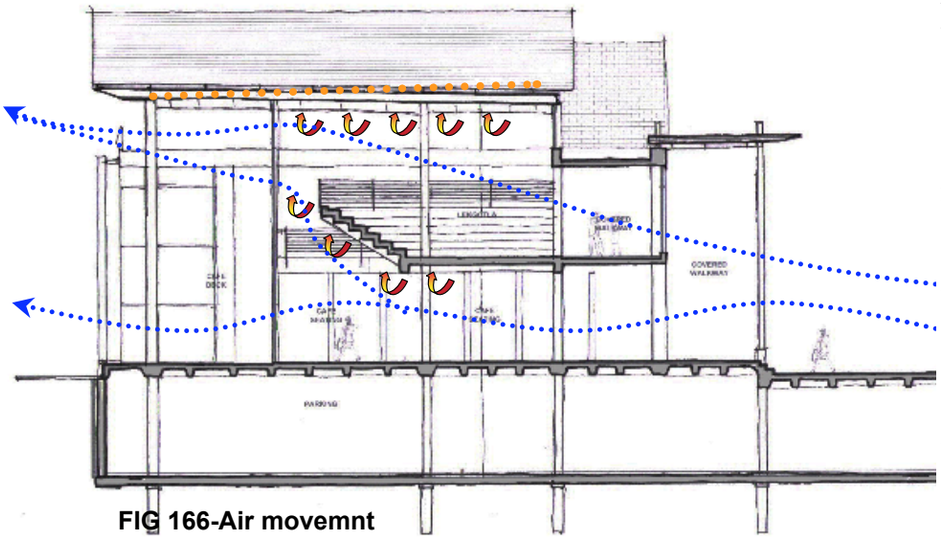


FIG 166-Air movemnt

High floors:

The design uses high floor to ceiling ratios, in order to allow all the warm air to collect above head hight, and thus disperse through openings

Insulation:

The building envelope is insulated to reduce drastic heat gain and loss

FIG 122- Roof Plan

CLIMATIC SYSTEMS

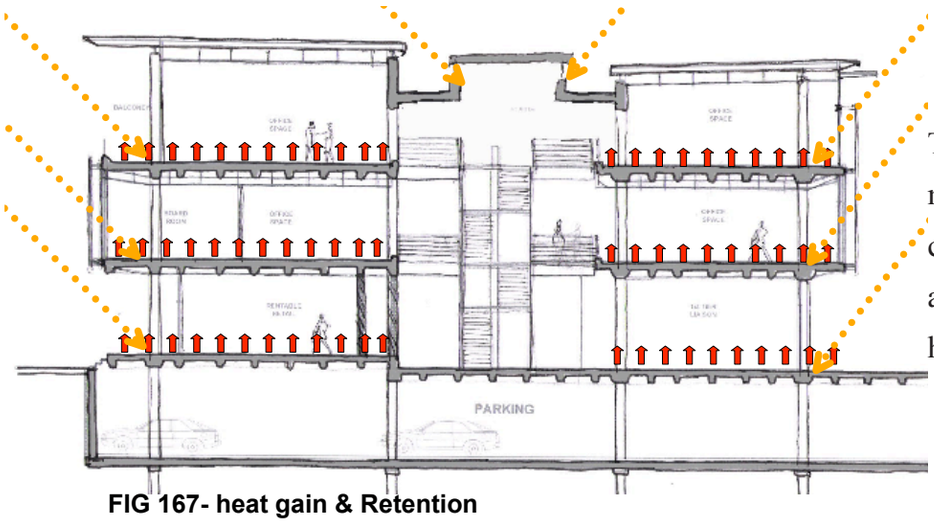


FIG 167- heat gain & Retention

THERMAL MASS

The building uses thermal mass to radiate off heat on cold winter days, the depth and thickness of the slab help in heat retention

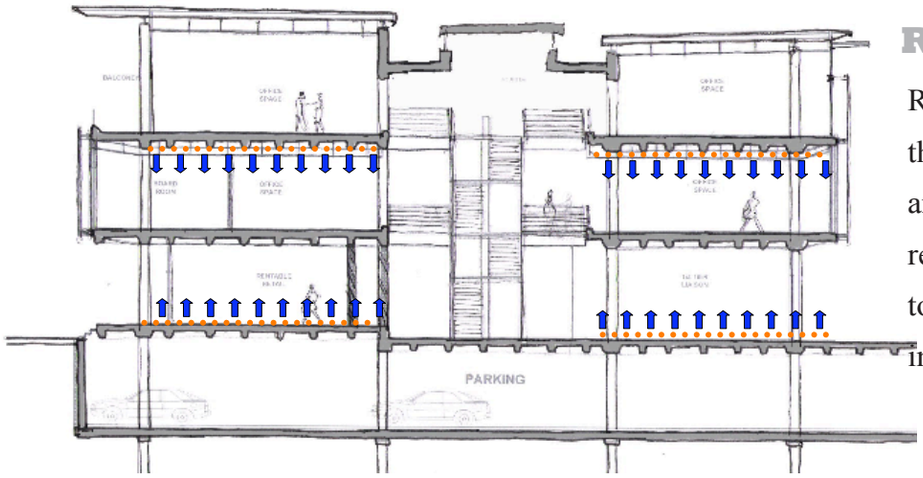


FIG 168- Radiant cooling system

RADIANT COOLING

Radiant cooling is used in the ceilings of the office areas and in the floors of the rentable offices. It is used to cool down the building instead of the air

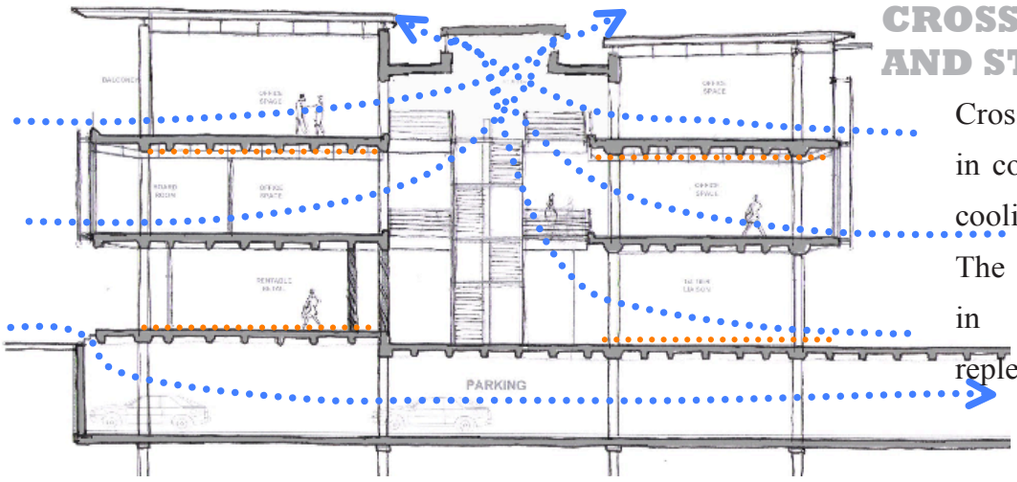


FIG 169-Air movemnt

CROSS VENTILATION AND STACK EFFECT

Cross ventilation is used in conjunction with radiant cooling for climate control. The stack effect also helps in air circulation and replenishment.

In light of the precedence and typology, study conducted through out the body of this thesis, the materiality of the building should not only be indicative of the taxi industry, it should also be adaptable enough to express all three facets of the industry. In consequence, to the identity of the industry being formulated by the articulation of both formal and informal attributes of the industry, there is a need for the use of a combination of materials. This will ensure that both parties receive their thermal, acoustic and durability requirements. The intention however is not to create a cacophony of materiality, but rather to have base materials that are expressive of the industry which are in part complimented by a second layer of materials that supplement their function

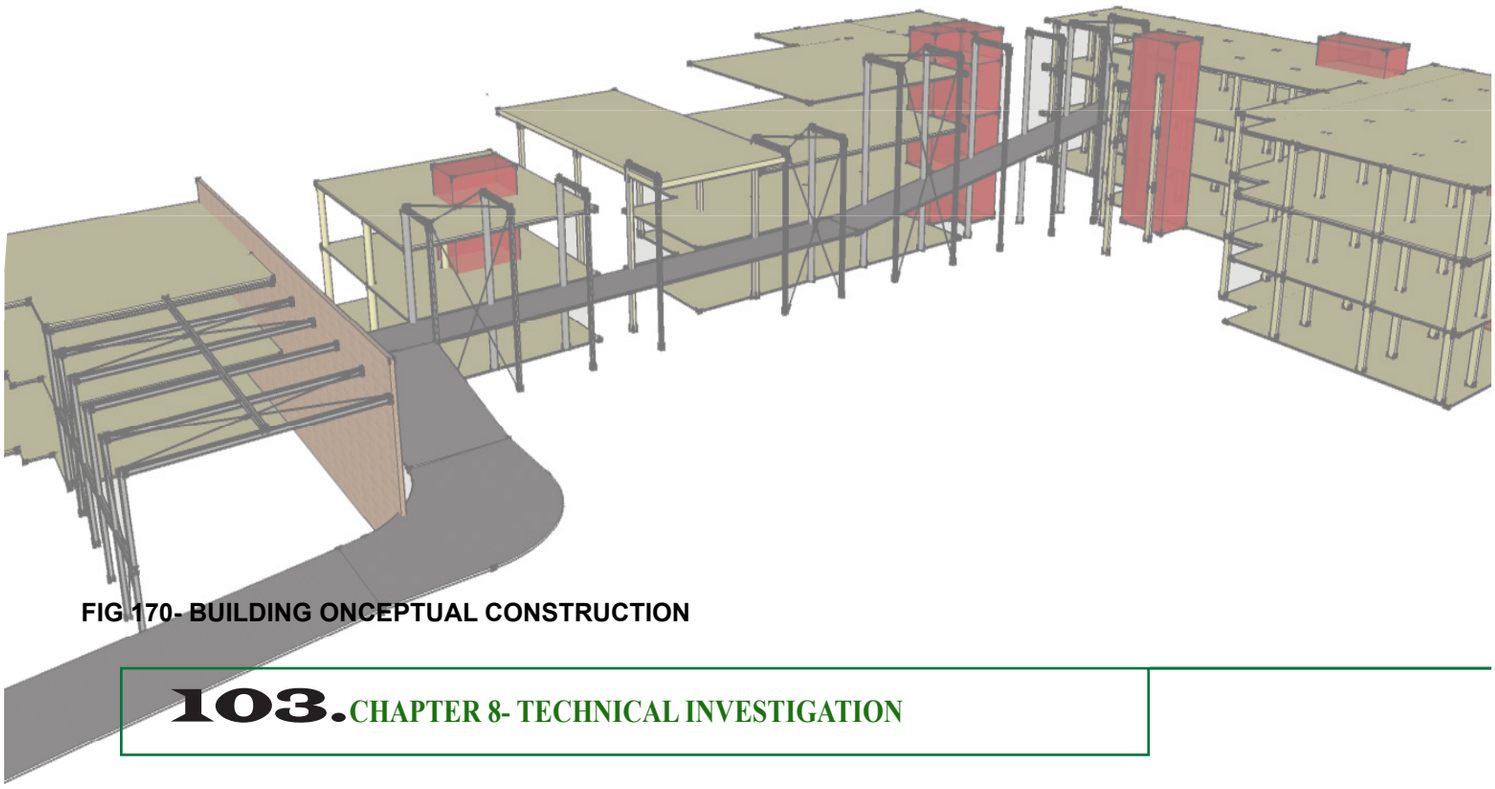


FIG 170- BUILDING ONCEPTUAL CONSTRUCTION

MATERIAL STUDY

STRUCTURE

In light of existing typologies associated with the taxi industry, the base structure will compromise primarily of concrete columns, beams and composite concrete floors. Secondly and in response to the conceptual notion of transport architecture being articulated as primarily roof and floor architecture, the roof structure will also be part of the primary structure. The material to be used for this will primarily be constructed of steel, with steel support structures.

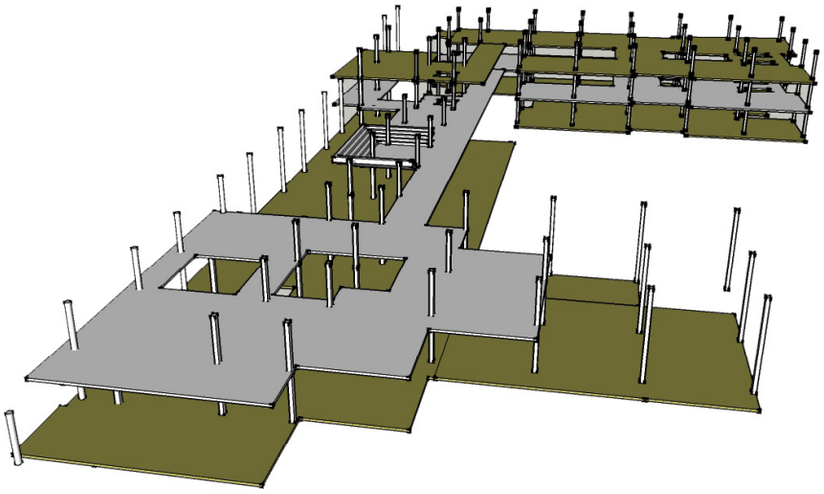


FIG 171- Slab & colum

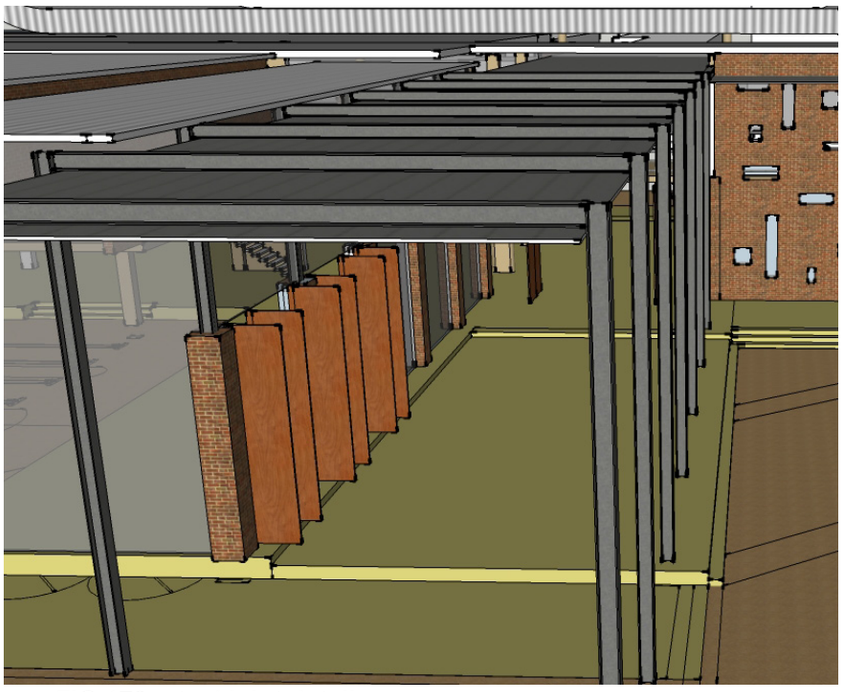


FIG 172- steel joint detail

A steel frame structure will be attached on to the base concrete structure, and will serve as the secondary structural system. This system is indented to represent the fluidity and lightweight nature of the public facet of the industry. The incorporation of both systems is intended to further represent the existing typologies, thus further instill the sense of identity. A third layer of materials will be used in the office component of the structure, and in order to respect, the formal conditions need to run an office appropriately.

PRIMARY STRUCUTRE

Slab and column

In light of existing typologies associated with the taxi industry, the base structure will compromise primarily of concrete columns, beams and composite concrete floors. Secondly and in response to the conceptual notion of transport architecture being articulated as primarily roof and floor architecture, the roof structure will also be part of the primary structure. The material to be used for this will primarily be constructed of steel, with steel support structures.

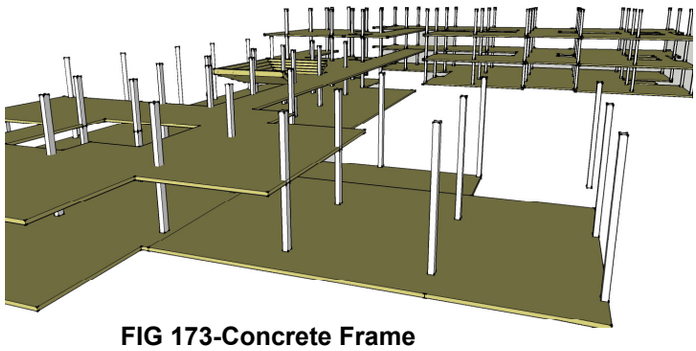


FIG 173-Concrete Frame

Slab and column

Concrete with a screed finish is commonly used in the construction of most transport structures, for its durability and low maintenance properties. It is for this reason that the material will be used in the construction of this structure. It will form part of the primary structure as to further enforce the notion of typology and thus play into the creation of identity. By in large the concrete will be exposed, as a truth to materiality is an important facet to maintaining the perception of fluid architecture.

FIG 174- Concrete Structure

Structural infill

In Staying, true the concept of truth to materiality, exposed brick, or face brick will also be used in the construction of the building. The fact that no plaster or paint is required to finish of the product also adds to its sustainability and low construction costs. Other advantages include: low water absorption, naturally fire-resistant, excellent acoustic properties, superior thermal insulation, Environmentally friendly, (low carbon footprint), (www.ocon.co.za: 2010)

FIG 175- Colonial Red

Specification

Brick Strength	Average 30 MPa
Water Absorption	Approximately 11%
Efflorescence	Nil to slight
Dimensions	220mm x 100mm x 70mm
Mass	Average 2.6 kg

MATERIAL STUDY

Steel

A steel frame structure will be attached on to the base concrete structure, and will serve as the secondary structural system. This system is indented to represent the fluidity and lightweight nature of the public facet of the industry. The incorporation of both systems is intended to further represent the existing typologies, thus further instill the sense of identity. A third layer of materials will be used in the office component of the structure, and in order to respect, the formal conditions need to run an office appropriately.

Steel I sections are used in the construction of the walkways and pergola areas; they are also compliment by GKD mesh, which is used as a screening device, as well as a media screen. As the usage is primarily in the square area, the device could be used to supplement the income of the building. The I beams are coated with a fire proof paint, and further with a dark grey paint, as to reduce heat gain.

In parts of the design, steel is used as floor covering and as a shading device. For this purpose, steel grating is used, in order to give of the sense of a floating lighter structure. Other advantages are that the it is permeable allowing for visual, air and light penetration. Because it only allows partial light in, it can also be used as a screening device

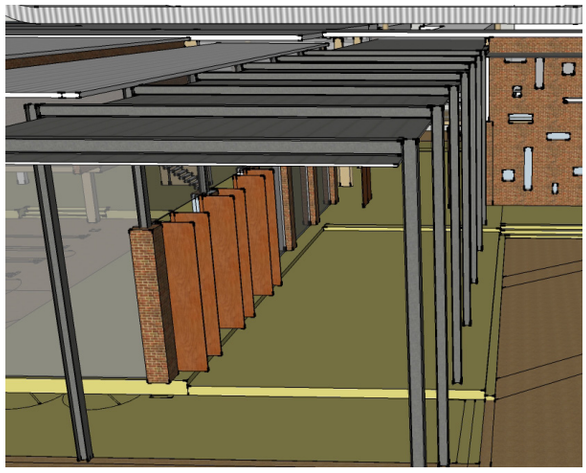


FIG 176- Steel Grating

FIG 177- Steel I-sections

FIG 178- GKD stell mesh

INTERIOR MATERIALS

Metal mesh

Not only will the mess be used out side due to its sun shading - reducing heat load, cooling requirements and ultimately energy consumption. But will also be used in the interior of the building. The mesh will be used as cladding on the walls and as part of the ceiling. The aim is to create a robust industrial feel, which is synonymous with the transport industry

Cmabridge Solucent metal fabrics deliver striking visual appeal, increased comfort, and most importantly, energy savings. (Archiexpo, 2010)

FIG 179- GKD stell mesh

Polished screed

Benefits:

- Smooth finish
- Durable material
- Thermal properties

FIG 180- Polished Screed

UV RESISTANT GLASS

Smartglass Solarshield is a glass with a metallic coating and a clear or tinted PVB (polyvinyl butyral) interlayer that is designed to reduce solar heat gain. This glass type also prevents up to 99% of harmful UV radiation from entering the building. Solarshield is a laminated safety glass that is widely used in sky/ roof-light applications.

Its U-value is 5.8 in all available colours. Heat gain can be further prevented by applying a white perforated film layer to the glass, which allows light to permeate through the penetrations while reflecting the rest of the light.

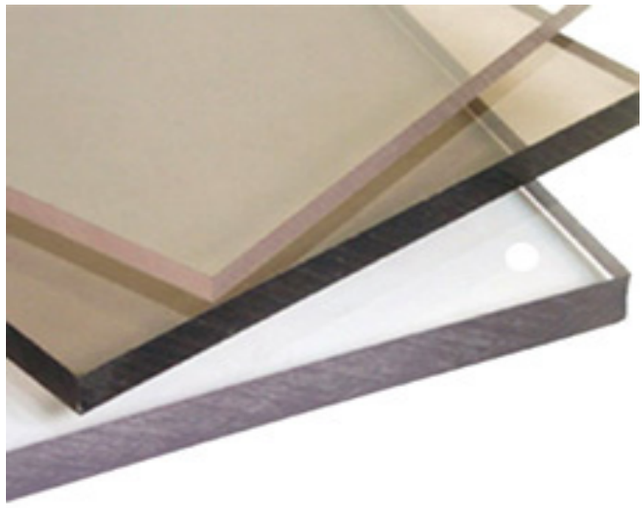


FIG 181-UV GLASS

MATERIAL STUDY

FIG 182-GRANITE FLOORS

Granite finish

Granite will be used in the courtyard area, due to its durable nature.

Standard Sizes: 600x300, 800x400, 900x450, 400x400

Standard Thicknesses: From 15 to 80 depending on requirements

Finishes: Sawn, Flamed, Honed, Bush Hammered, Antique, Polished, Split

FIG 183- IRB roof sheeting

IBR sheet metal roofing is the primary material used as roof covering. This is due to its flexible and lightweight nature. The material enables the design to manifest its concept of having a lightweight structure flowing over the building, unifying all elements of the building.

Pitch 1,5 degrees

Made of zincalume or Calvanised coated steel

Klip lock porfile

FIG 184- Sandblasted Concrete

SANDBLASTED CONCRETE

Sand blasted concrete is also used in the out door spaces, for ts decorative and durable properties.