9.0 TECHNICAL ANALYSIS

There is a long established tradition of a brick aesthetic in Pretoria, which began with the influence of Dutch architects who arrived in Pretoria in the late 1800's. Since then a sense of using brick decoratively and innovatively has been evident in many Pretoria building (Fisher, 1998:129)

The popularity of brick as a building material can be ascribe to its widespread availability and that it has been embedded in building tradition both abroad and locally. The brick has timelessness about it and, because so commonly used, has acquired a democratic character. The modular nature of the brick allows it to be used in many patterns and for many different applications (paving, walls and landscaping). It is also relatively inexpensive compared to other building materials and it requires low maintenance.

Other building materials that typify Pretoria architecture are corrugated steel roof sheeting, glass and reinforced concrete. The influence of the Modern movement on Pretoria architects initiated a culture of reinforced off-shutter concrete structures and wall finishes. Not only do inexpensive materials like rough concrete and infill brickwork fit into the Pretoria aesthetic, but they are also suited to the economic climate and the local labour force. Therefore, the Centre will use the principles of Pretoria in its material selection and construction method.

9.1 STRUCTURE

Open building principles will be used at the Centre to ensure that a large number of people participate in the development of the built environment in order to achieve rich, layered and sustainable environment. The aim of open building is to find principles of ordering and combination to give optimal freedom for design and installation (Dekker 1998: 312). The structure remain constant while building interiors, infill panels and other walling elements are free to change depending on climate, as well as new building technologies developed at the Centre.

Fig.115: In-fill panels developed at the `Green Wall project (Brewis, 2003:17 cited in Araujo, 2004:112).

Structural Requirements

- Low maintenance and cost funding from well wishers
- Simple construction to be done by skilled and unskilled labour
- Large spans in workshop to provide enough workplace
- Readability- able to be a show case of area.
- Adaptability to be able to suit various activities as needed

All buildings will be constructed with three types of structural systems, namely concrete, steel and timber using a contractor:

Concrete structural frame

- Structural vertical support is reinforced concrete column grid of 6000mm x6000mm and 3000mm x3000mm. This will give good workplace for various function and uses.
- All columns are exposed off-shutter concrete as a aesthetics and easy to maintain the surfaces
- All columns will be rectangular to embed well with in-fill walls except at circular columns at the entrance and exhibition hall colonnade for aesthetics purposes.

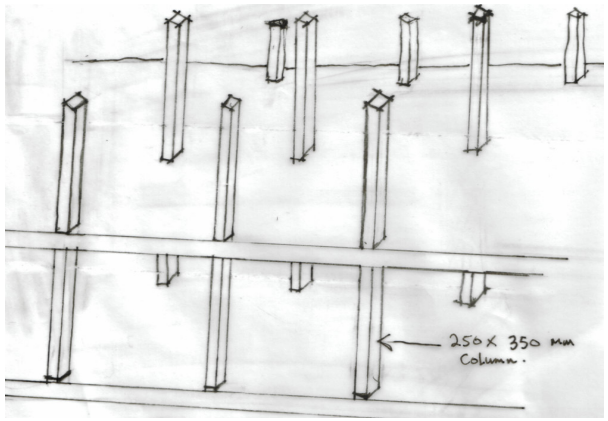

Fig. 116: Concrete frame structure (author).

A. Steel structural frame

- Deliberately left visible inside and outside to contrast materials and as aesthetics.
- Designed as a modular system for easy manufacturing and assembly.
- Made of prefabricated steel elements and assembled on site
- I –profile steel columns and beams

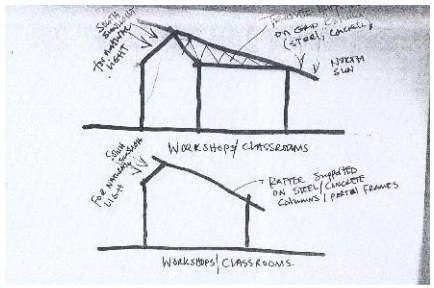

Fig.117: Steel portal frame structure (author).

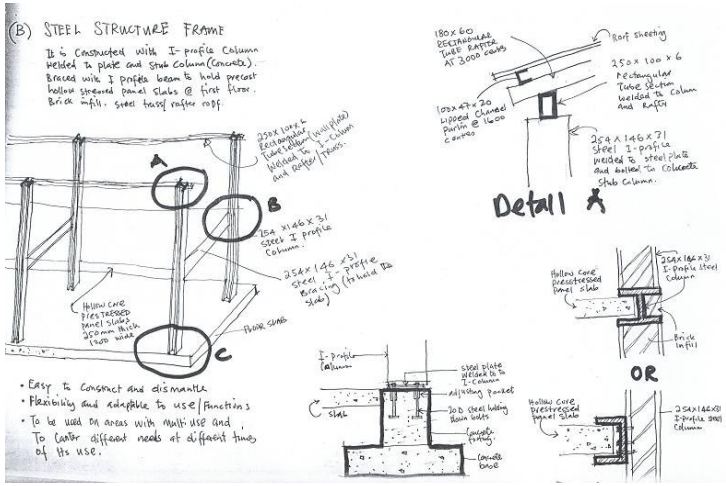

Fig.118: Steel Frame structure exploration (author).

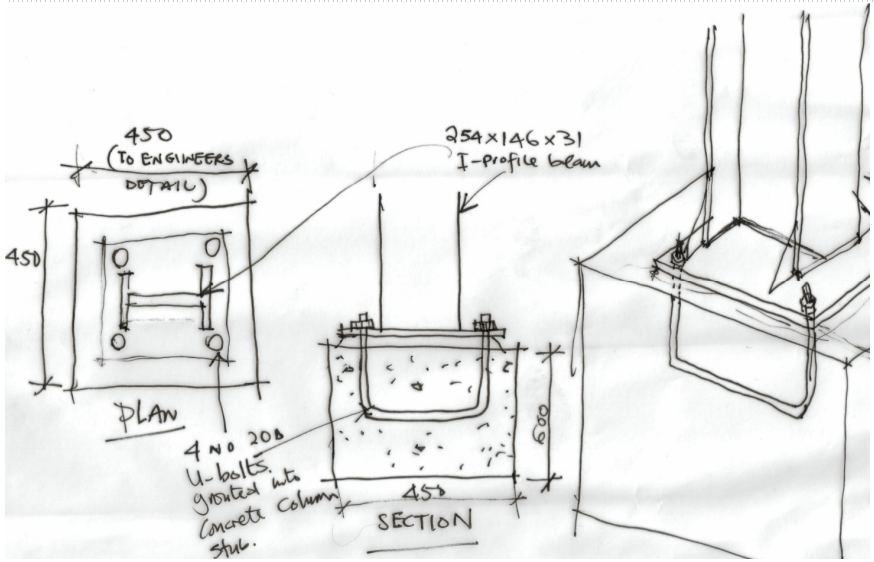

Fig.119: I-beam connection to stub column sketch detail (author).

Timber structural frame

- Timber pergola on courtyards and walkways. Some used in innovative way by combining with steel as structural member and natural timber as shading member.

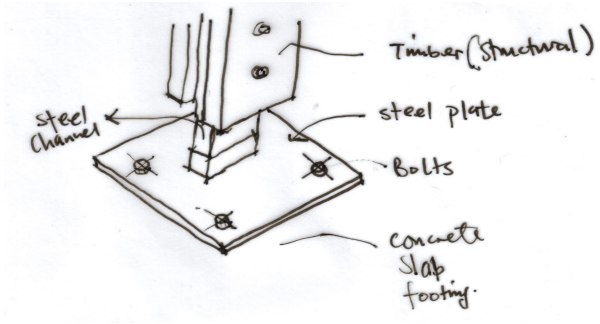

Fig.120: Timber pergola footing detail (author).

All structural and non structural components such as non – bearing walls, steel profiles, partitions and glass sheets will be in modular dimensions. All in-fills will be done by local skilled or unskilled labour.

9.2 ROOF STRUCTURE

The structure of the roof is a conventional I- Beam roof structure for concrete structure and I- Column and I- beam roof structure.

All exposed steel work is coated with one coat zinc phosphate as a prime on clean surface (SABS 1319). It is finish off with one coat grey alkaline enamel paint (SABS 630 TYPE 2)

The roofs will be multifunctional as they are not only designed to provide protection from the elements, but also form covered walkways, help to shade facades and permit rainwater harvesting.

The roofs are either of prefabricated roof sheeting or in-situ casted concrete slabs. Structural concrete roof will be for the southern and exhibition hall.

The use of prefabricated roof sheeting gives reference to the Pretoria Regionalism as it is part of regionalist repertoire of the materials. The workshops will consist of structural steel roof frame and will be made of prefabricated steel roof members that are bolted together.

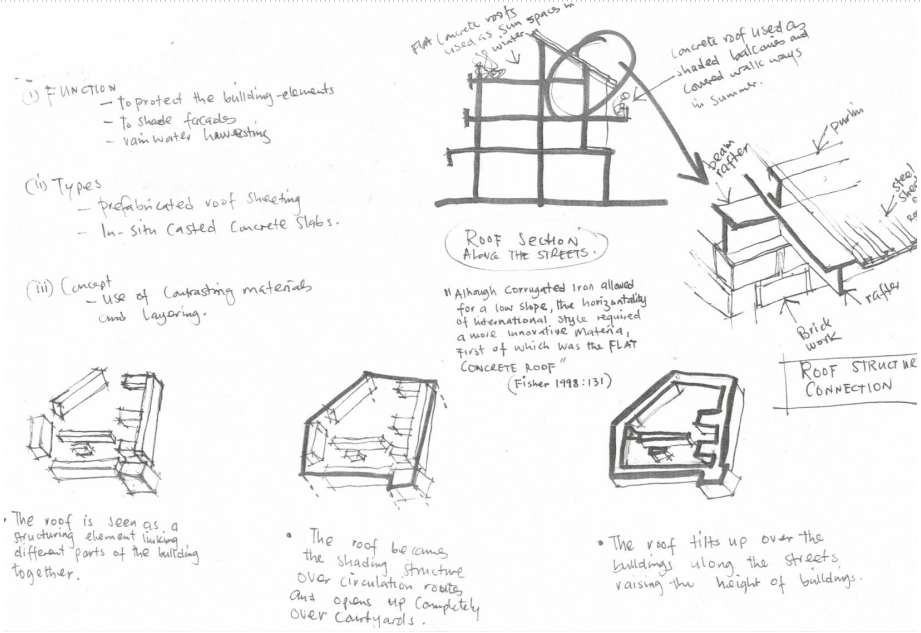

Fig.121: Roof exploration – June 2006 (author).

The roofs will tilt up along the street edges to contribute to the scale of the streets.

9.3 SLAB

The structural reinforced concrete roof slabs expressed as horizontal planes that extends beyond the structural support in multi-storey building structures. Ground floor slab in workshops will be of 150 minimum with expansion joints every 3 metres.

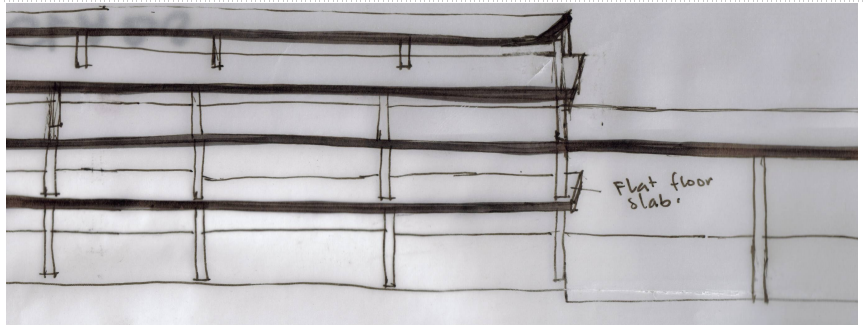

Fig.122: Conceptual slab sketch layout on administration block {May, 2006 (author)}.

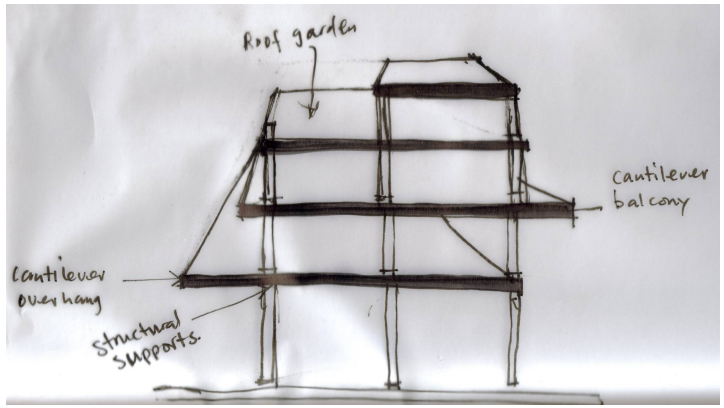

Fig. 123: Conceptual slab sketch layout extending fixed points on administration block {May, 2006 (author)}.

Top roof slabs as roof gardens facing south. Steel roof facing north in administration block.

9.4 MATERIALS

Materials to be used will be the locally available and simplest as it is being proposed that the building will be built by unskilled or semi-skilled labour mostly.

Materials will be limited to steel, brick, timber, board, steel and concrete.

These materials will be used to contrast with each other, as well as to form a contrast in surface, form, light, and function. For example the BAT Centre below.

Fig.124: Façade of BAT Centre.

The use of materials to contrast with each other can be seen where wood is juxtaposed with steel, concrete is contrasted with industrial type I-beams and glass is used next to un- plastered rough bricks. Rich colours and textures can be seen and most of floors consist of a cement screed with ceramic tiles laid in patterns. Mosaics on the floors, against plastered walls, as well as murals done by the students and the community. The building itself becomes a work of art and a hand – made quality to it. The impact of materials used and natural elements such as water and plants are considered to compose a collage of textures stimulating the visual, aural and tactile senses.

A relevant aesthetic can evolve from a good integration of art and architecture, essential in reconnecting to the tradition of indigenous African architecture and continuing the work of modern architects. An integration of art and crafts into the architectural design supports local talents, increases the uplifting character of architecture and provides opportunities for members of the community to become creatively involved in making of murals and mosaic works.

BRICKS

The use of bricks is a labour intensive, but affordable material that weathers well when used correctly.

Bricks to be used on the Centre will be a locally made brick by local people using sand and cement as row materials. The factory made brick will be used where necessary as aesthetic. The bricks will be coloured to match the factory made bricks used on all buildings of the Mamelodi campus.

STEEL

Steel products such s I-sections, angles and roof sheeting will be used in such places as roof, framework, door and window frames. Combining steel and timber elements in walkways and workshops through exposed junction and connections highlights the structural integrity of

materials and enhances the education/learning experience of the Centre.

Standard steel sizes are specified and used because of their availability, ease procurement and erection. The intended future re-uses recyclability, low maintenance and learning value of the material.

Waste steel elements such as rebar, roof sheeting, sections and a variety of steel off-cuts from industries are incorporated into the screening, light framework, building component development, furniture and arts and crafts workshops.

TIMBER

Timber is used I the project mainly the wood workshop as learning tool in use of timber:

- Timber is a renewable resource
- Timber is an ideal material for low –energy buildings
- Timber has good insulating properties
- Timber has good recycling qualities.

Timber floor, external cladding, panelling, walkways and lightweight clip on are incorporated into the overall design of the centre. Large amount of waste timber off-cuts, boards, shavings and panels produced at packaging, cabling and other industries in Pretoria is evident in the construction of informal housing. This timber will be incorporated into the Centre and used as balustrades, fenestration, insulation, screens and furniture.

GLASS

Modular, stackable, interlocking glazed panels are developed and used especially on the northern facades. The intention of this system is based on the disassembly, recycling and re-use of the panels as well as the future flexibility of the Centre. The use, development and experimentation into alternative glazing techniques is demonstrated and investigated as part of activity of the Centre.

WASTE MATERIALS

A vast amount of waste materials including industrial, construction and inorganic waste are relatively available. Waste materials like car tyres, building rubble, timber off-cuts, steel sheeting and old car windscreens will be incorporated into the material development programme involving the manufacture of screens, walling panel, fenestration, furniture, tools, and arts and crafts as fig 125 below.

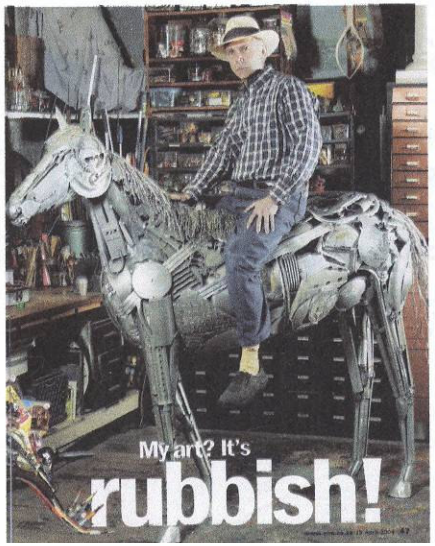

Fig.125: Art using discarded waste (Araujo, 2004:8).

9.5 LIGHTING

The centre will be connected to the municipal electrical supply and through the use of photovoltaic panels. Solar energy will be used for low power applications such as lighting.

The design of the Centre ensures that natural lighting is sufficient for day-time activities. All light fittings are energy efficient. Various areas need different lighting levels. For example: offices- 500 lux , classrooms-300 lux, workshops-300 lux , ablution facilities -150 lux (Tutt, P and Adler, D. 1998:413).

9.6 WATER AND WASTE SERVICES

Water supply to the Centre will be connected to the main municipal water supply. Some rain water will be collected and directed through steel gutters into plastic water tanks in selected building on the centre while in other building it will be left to water the lawns of courtyard or drain it away in storm water drains/channels out of the site to existing drainages along the roads.

9.7 VENTILATION

The centre will be reliant on passive ventilation principles for heating and cooling. A building depth of 10m maximum in offices and 12m depth in workshops will ensure that cross ventilation through manually operated openings is achieved. In summer, air passing through the buildings is first cooled in shaded courtyards, with combination of deciduous Celtis Africana and Acacia Sieberiana trees before it is drawn through and under the buildings.