11. BASIC CONCEPT DEVELOPMENT

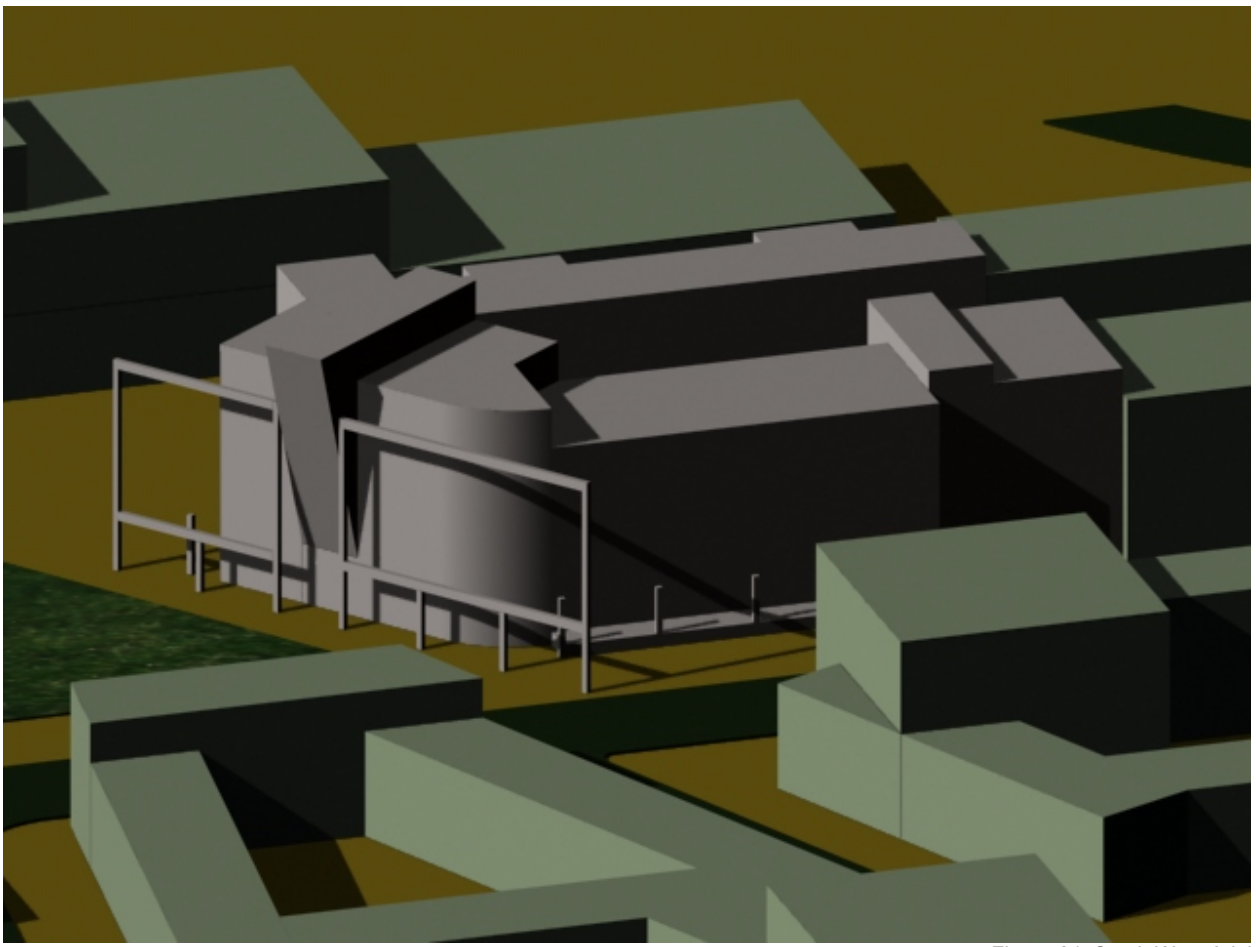


Figure 64. South West Arial

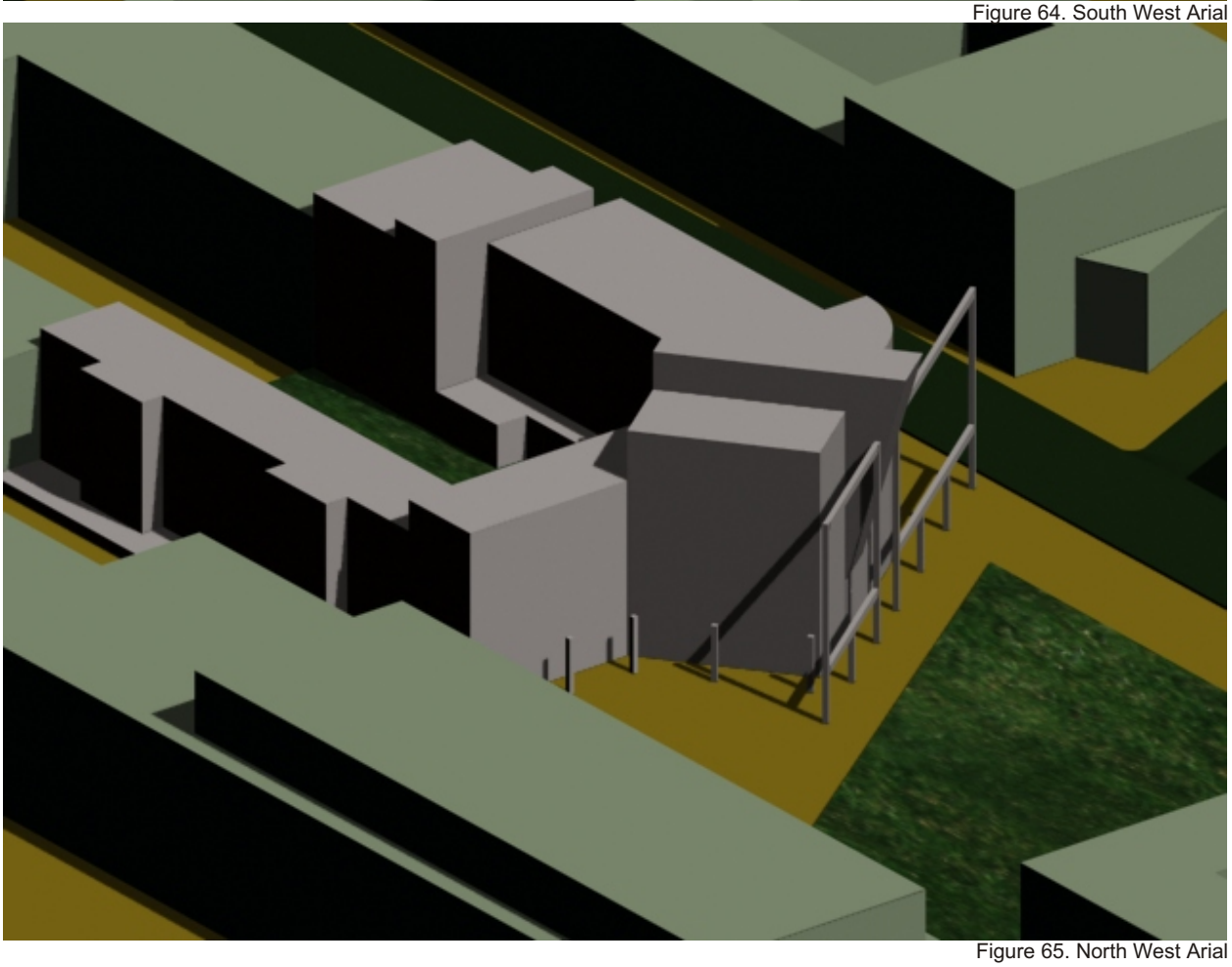


Figure 65. North West Arial

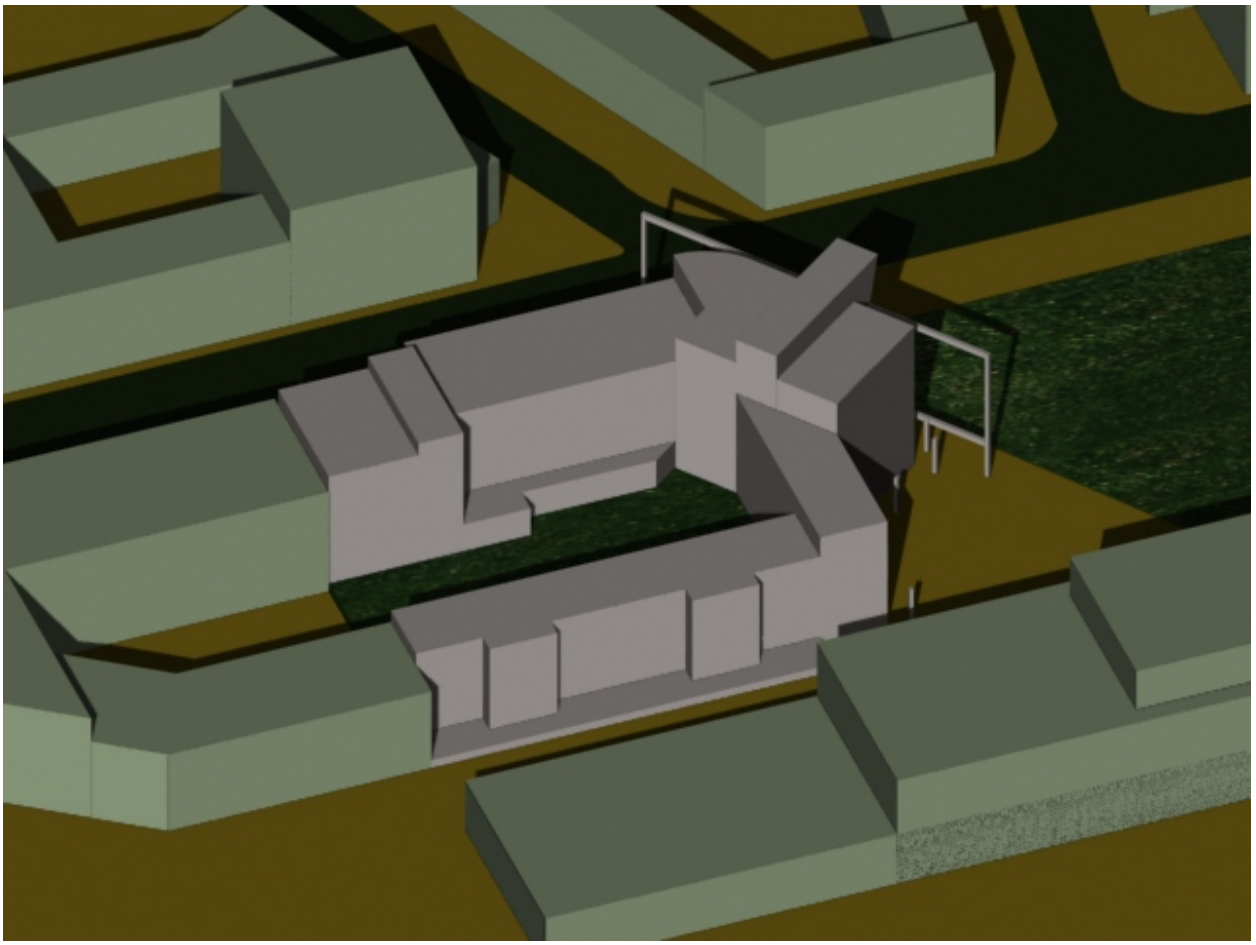


Figure 66. North East Arial

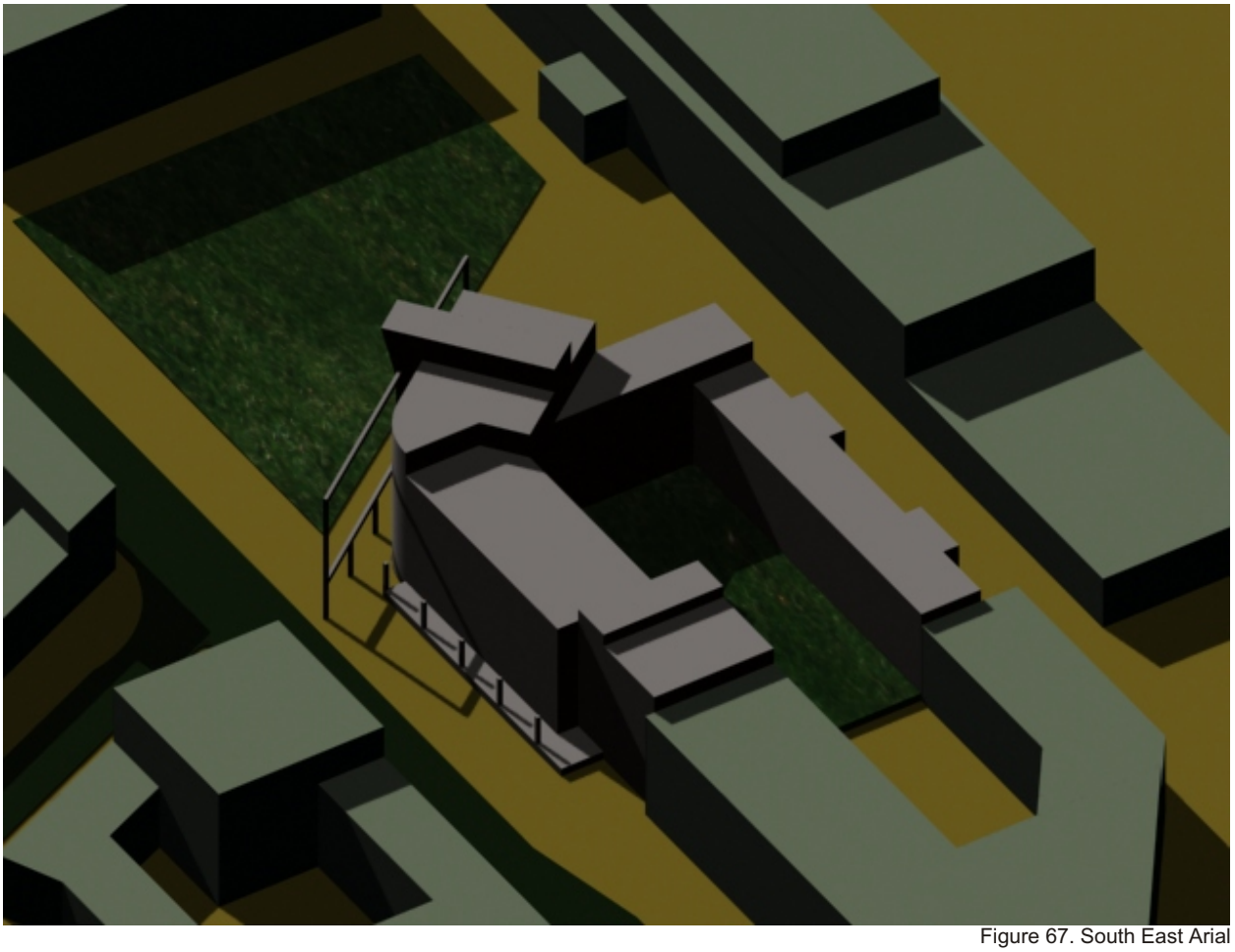


Figure 67. South East Arial

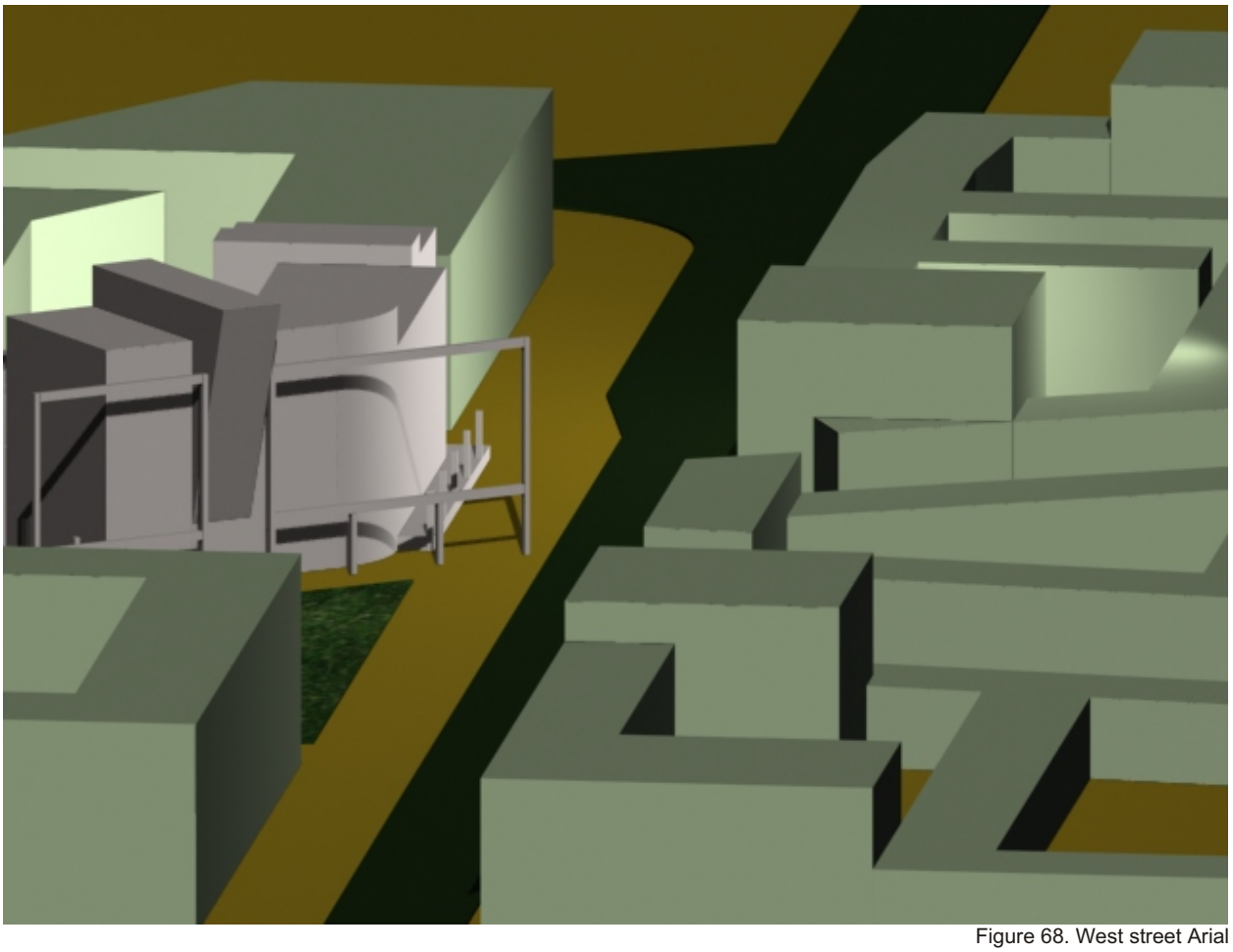


Figure 68. West street Arial

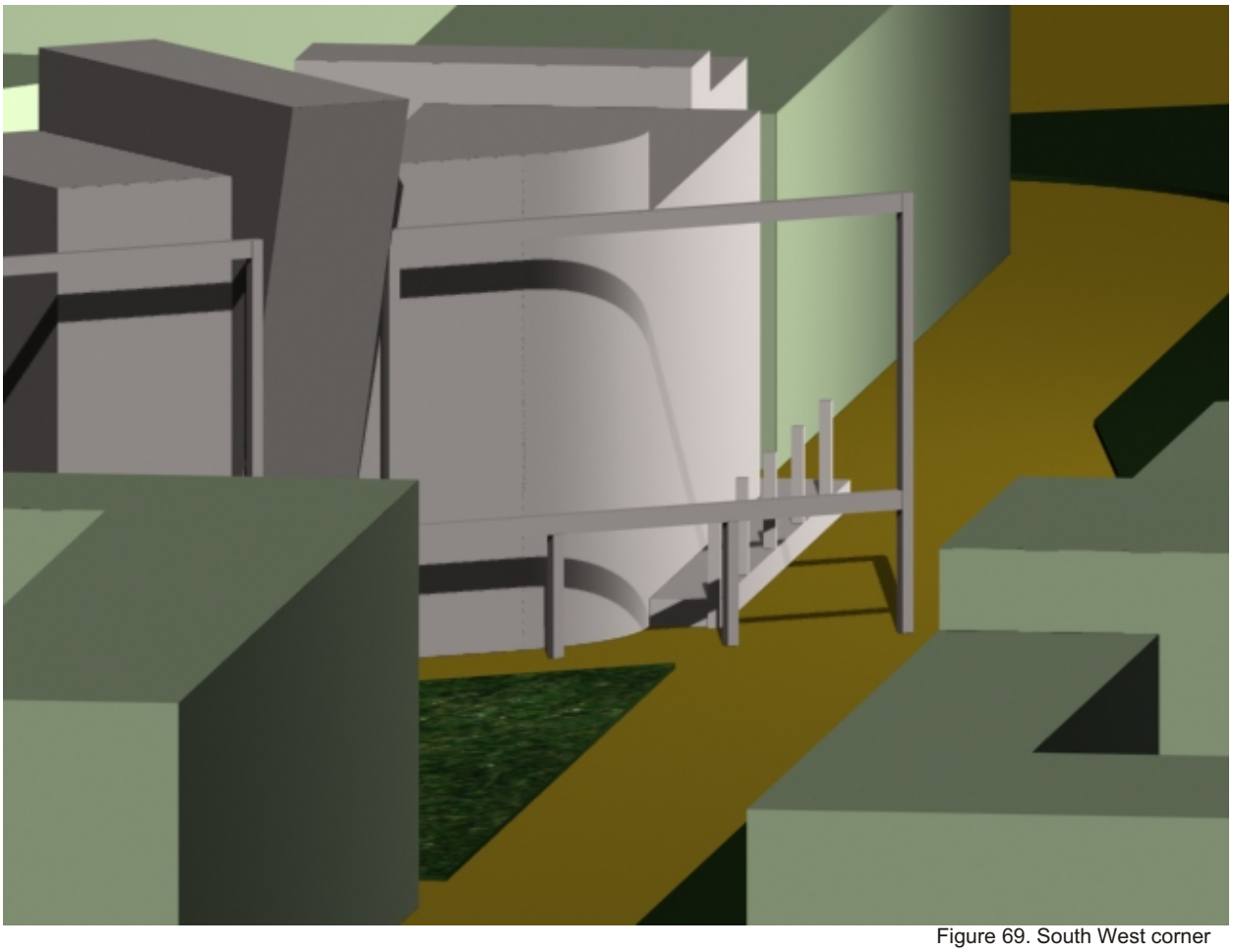


Figure 69. South West corner

12. TESTING AND GUIDING SUSTAINABILITY

This section follows class notes compiled from a lecture series presented by Mr Jeremy Gibbert of the CSIR. While it explains the interpretation and analysis of it, it also quotes verbatim in certain sections.

Figure 70. Landscape

INTRODUCTION

As a result of increased environmental damage from human activities and the depletion of natural resources it is increasingly important that this matter be addressed. It becomes essential that sustainability becomes a key issue in our everyday activity.

It is possible for buildings to play an important role in supporting sustainability. This can be achieved through careful planning in which design decisions and specifications can be carefully evaluated for its impact on social, environmental and economic aspects of society and the natural environment. Individually and collectively the impact of these decisions in the design of buildings is significant.

Figure 71. Plants

12.1. SOCIAL ISSUES

12.1.1. Lighting

The building should maximise usage of the suns predominant movement pattern to minimise dependancy on daytime electrical lighting. All work and living environments should be well day lit. No spaces within the building should require constant electrical lighting. Day lighting control should be possible for users to suit individual demand; glare should be minimised. Day lighting control should be made especially possible on the west wing to cope with extreme winter and summer conditions. Accessibility of usable space to solar movement should be given preference over non usable space such as toilet facilities.

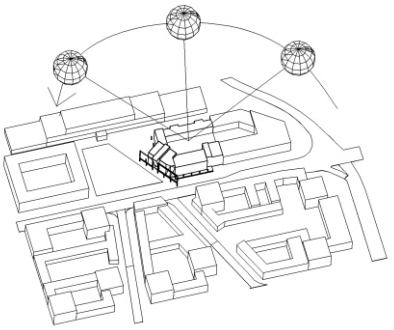


Figure 72.
Solar movement pattern 21 June 2003

The average day lighting requirements for various spaces within the facility shown in appendix D falls well within the municipal bylaws. The SABS code of practice specifies that a minimum of 10 % day lighting should be applied to all spaces. All living spaces within the building should therefore have a minimum of 10% day lighting. Careful analysis of the solar movement pattern is necessary for the facility to cope with Johannesburg's extreme summer and winter conditions shown in appendix A. Analysis of the predominant solar movement is shown in the accompanying diagrams.

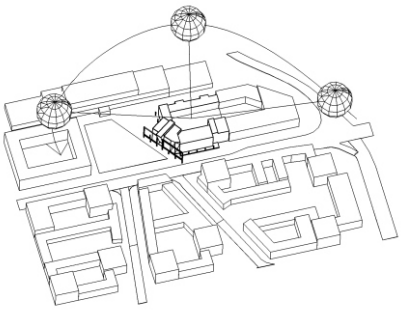


Figure 73.
Solar movement pattern 21 December 2003

WINTER SOLAR ANALYSIS

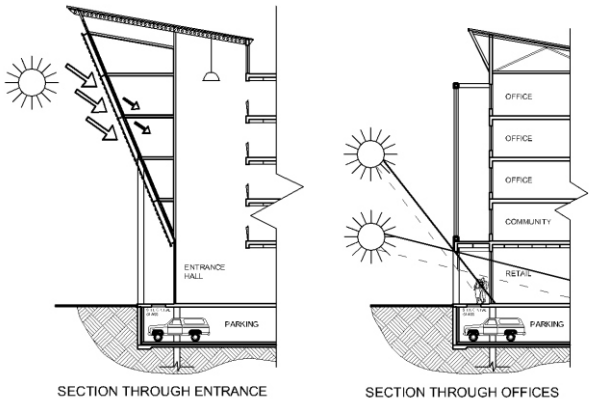


Figure. 79. Section through west facade

The above diagram illustrates solar positions on the west wing at 1 pm and 4 pm respectively on the 21 June 2003. At 1 pm the retractable sun shading device in closed position cuts out solar penetration from the restaurants and shops however in open position the device allows solar penetration into the building from 1 pm. This creates a comfortable environment for pedestrians and outdoor eating. At 4 pm the building would receive deep solar penetration. This significantly warms interior environments and if desired, this solar penetration could be limited by use of the retractable shading device (shown in dotted). Day lighting control in the upper floors should be individualised by means of blinds in conjunction with the proposed shading device. Morning sun penetration from the east should be maximised where possible.

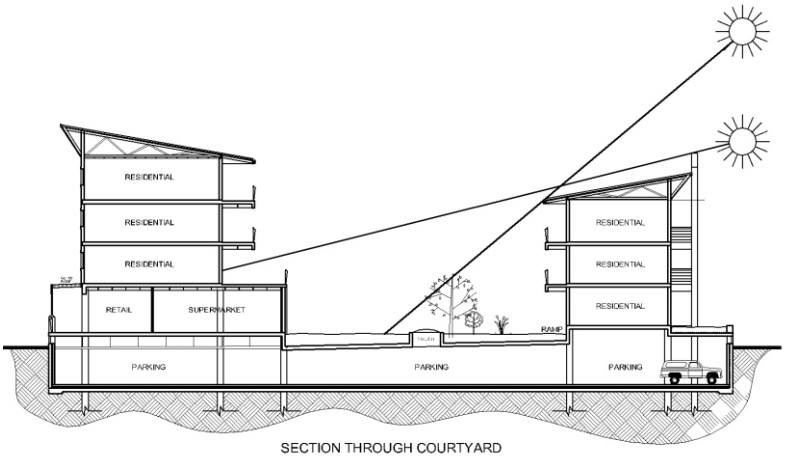


Figure. 80. Section through courtyard

The above diagram illustrates solar positions through the proposed courtyard at 8 am and 12 am respectively on the 21 June 2003. Although the courtyard day lighting is low in winter, all living and working spaces are given access to morning sunlight. The north facing windows should allow adequate solar penetration and living/ working spaces should be positioned here where possible. The parking facility below should utilise roof lighting to eliminate the need for electrical lighting. The possibility of light scoops should be considered for basement lighting between 7am and 8am.

Figure. 74. 8 am sun on 21 June 2003

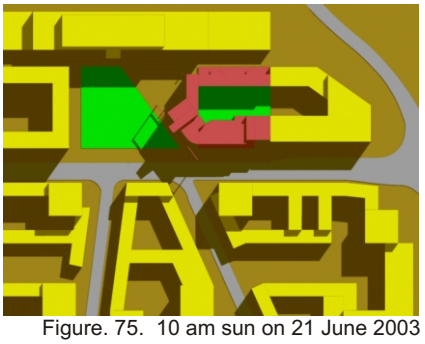


Figure. 75. 10 am sun on 21 June 2003

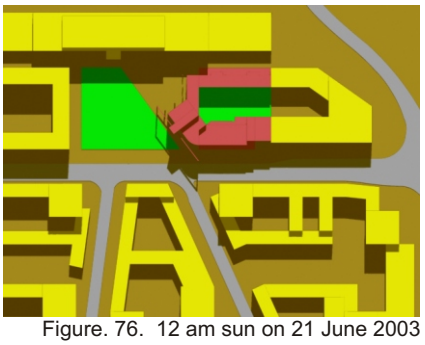


Figure. 76. 12 am sun on 21 June 2003

Figure. 77. 2 pm sun on 21 June 2003

Figure. 78. 4 pm sun on 21 June 2003

SUMMER SOLAR ANALYSIS

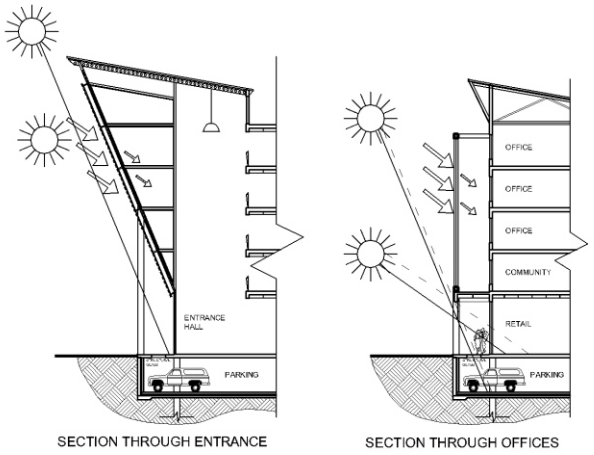


Figure. 86. Sections through west facade

The above diagram illustrates solar positions on the west wing at 1 pm and 4 pm respectively on the 21 December 2003. At 1 pm the sun shading device in closed position cuts out summer sun creating a comfortable outdoor eating and pedestrian environment. This could be adjusted as desired by means of the adjustable shading device. After 1 pm sunlight access into the restaurant/ retail space is possible if desired by means of the adjustable device. Day lighting control on the upper floor western side of the building should be possible by means of adjustable blinds in conjunction with the proposed sun shading device for individual desired comfort levels. Although, not as critical as the west elevation, the eastern side of the building should incorporate some form of daylight control for individual users to control morning sun.

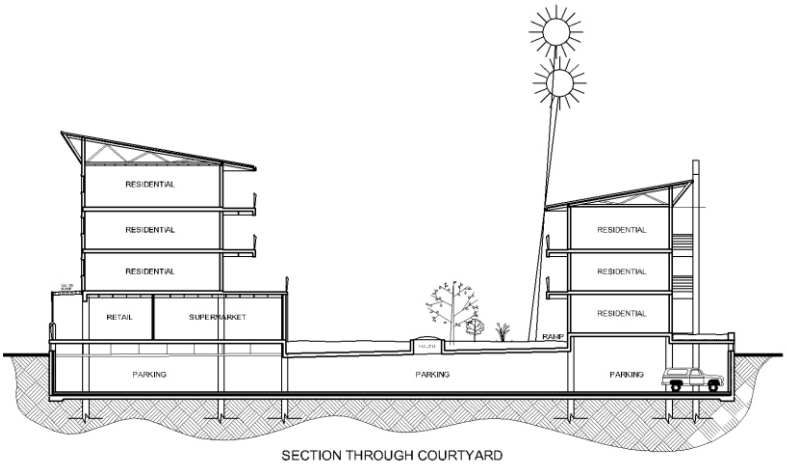


Fig. 87. Section through courtyard

The diagram above illustrates solar positions through the courtyard at 8 am and 12 am respectively on the 21 December 2003. The courtyard receives good summer day lighting all day to support various forms of activity as shown in the accompanying diagrams. It is envisaged that the courtyard would be characterised with high usage in summer due to good sunlight access. North facing rooms should also incorporate some form of solar control for summer. The Use of landscaping in the courtyard would generated desired shade.

Figure. 81. 8 am sun on 21 December

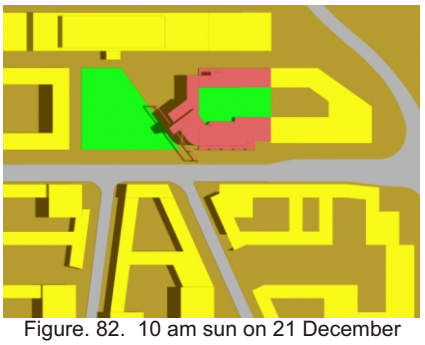


Figure. 82. 10 am sun on 21 December

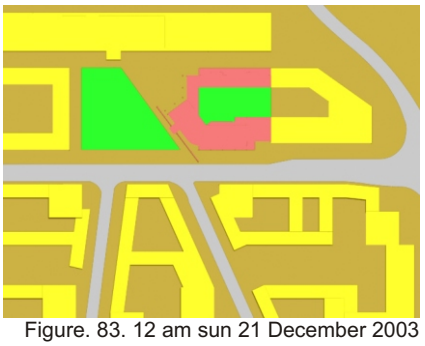


Figure. 83. 12 am sun 21 December 2003

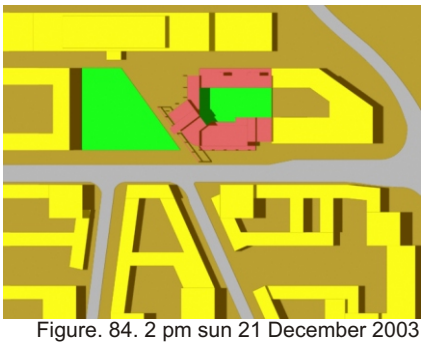


Figure. 84. 2 pm sun 21 December 2003

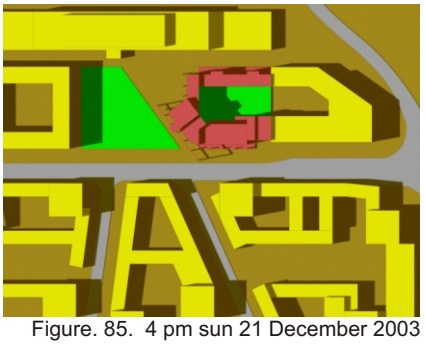


Figure. 85. 4 pm sun 21 December 2003

12.1.2. Ventilation

Required ventilation should be provided by natural means. No mechanical ventilation should be used in the facility other than in the toilets and kitchens if necessary.

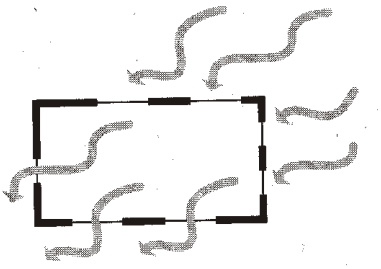


Figure. 88. Cross ventilation through rooms

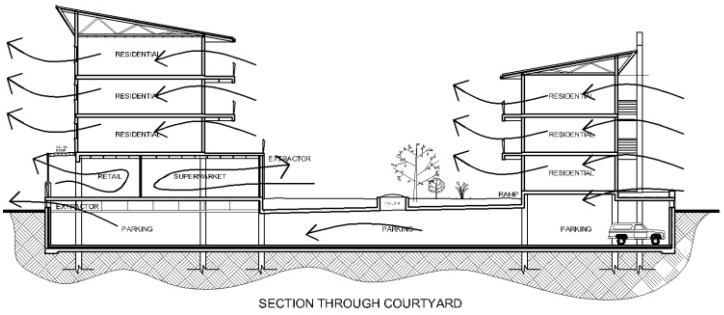


Figure. 91. Cross ventilation

Appendix E stipulates the SABS air requirements within the facility that should be achieved. Window opening sections should allow for the required ventilation to all components of the proposed facility, utilising the prevailing wind direction . Roof ventilation openings on the southern side of the parking facility are necessary to facilitate cross ventilation.

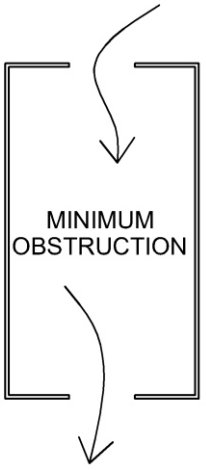


Fig 89. Minimum obstruction to ventilation

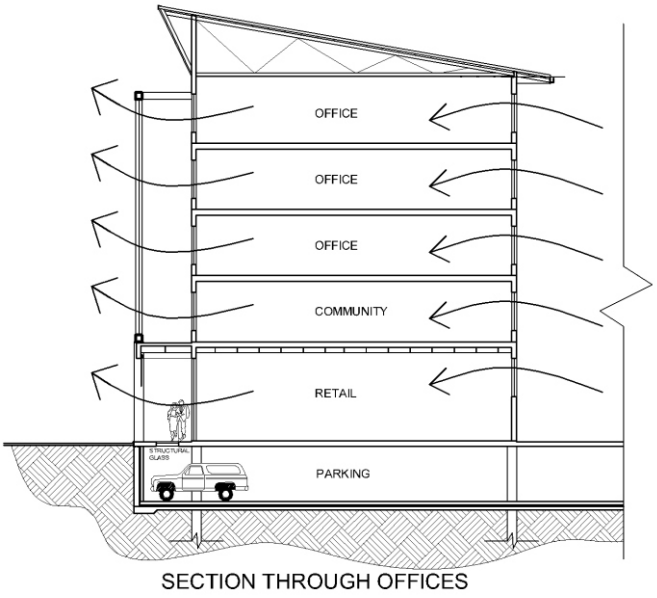


Figure. 92. Cross ventilation through offices

The proposed passive ventilation system for the west wing of the building utilises the predominant wind pattern. It is envisaged from climatic responses that extensive usage of this system would proceed in summer. This system is simply implemented by adjustable window openings. The distance between window openings should be minimised with minimum obstruction.

Preference on ventilation control should be given to individuals rather than group control allowing individuals to personalise living and working environments. This is implemented by the installation of individual window openings.

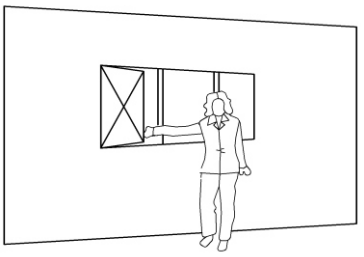


Fig. 90. Individual ventilation control.

12.1.3. Noise

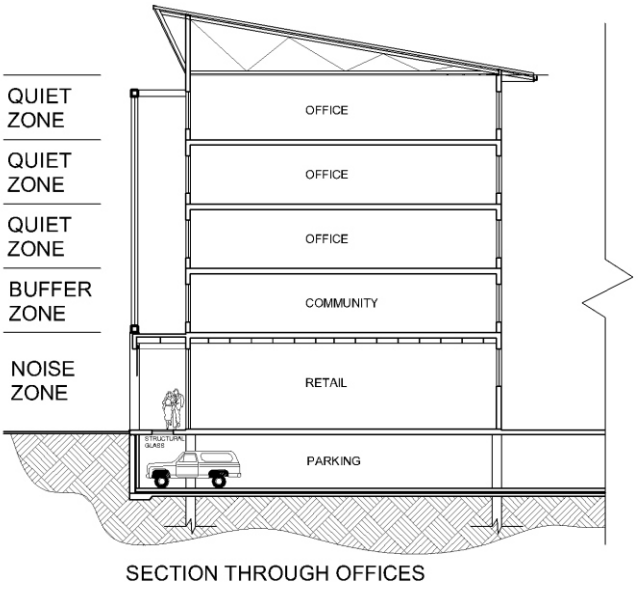


Figure. 96. Noise buffer

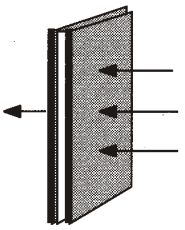


Figure 93. Double glazing

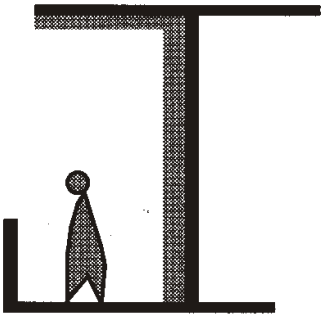


Figure 94. Sound absorbing material

Noise levels should be limited in work and living environments to acceptable levels. The SABS desired noise levels for spaces are to be utilised in achieving optimum noise levels. The choice of appropriate building material as well as design layout should be utilised in order to achieve these levels.

Appropriate intermediate buffer zones should be allocated in order to help achieve the desired noise levels. Desired quieter zones should be separated from high noise zones. In areas where this is not possible, material with high sound adsorption levels should be used; as well as the provision of double glazing to window opening sections.

Where possible landscaping should be utilised to buffer noise from the outside public environment to the inside.

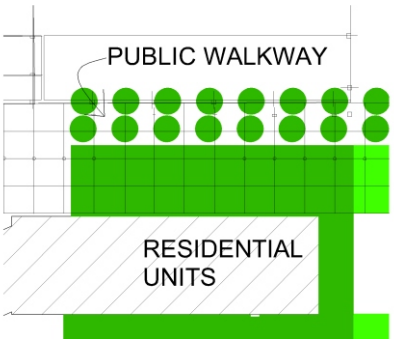


Figure. 95. Planting used as sound barrier

12.1.4. Views

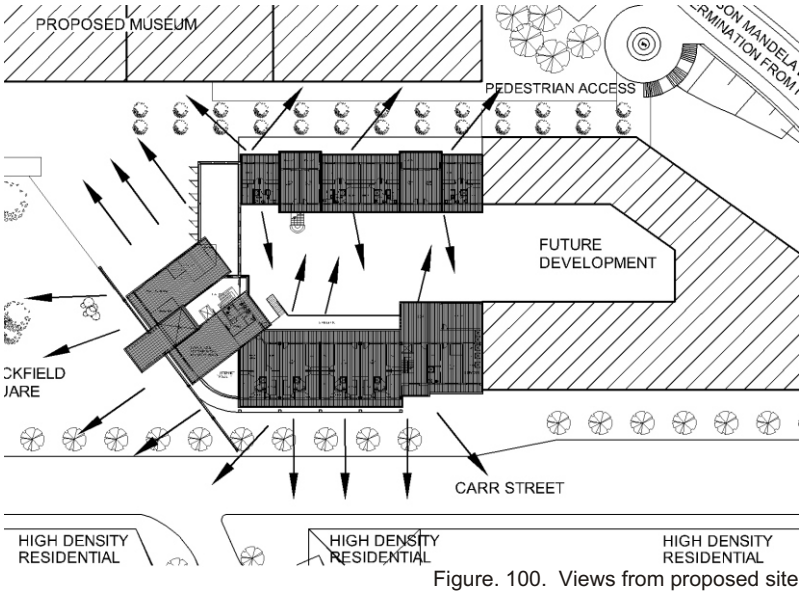


Figure. 100. Views from proposed site

Figure. 97. View of the proposed museum

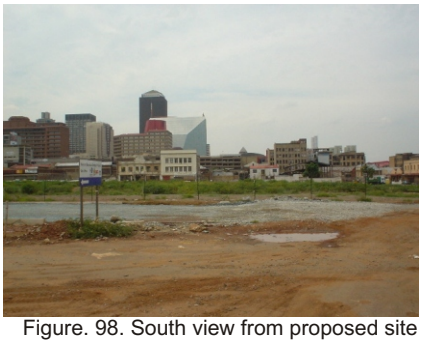


Figure. 98. South view from proposed site

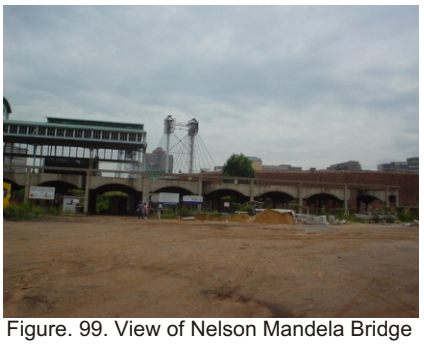


Figure. 99. View of Nelson Mandela Bridge

All living and work areas should be given access to outside views. A series of potentially aesthetically pleasing views have been identified in the site analysis phase. The building should maximise the use of these views by way of layout orientation. Care should be taken as views should take thermal comfort by solar movement pattern into design consideration. All users of the building should be situated six metres or less from a window and given access to outside views.

Privacy to living and working environments should not be compromised in favour of views.

12.1.5. Access to green outside spaces

Access to green outside spaces should be provided for all users. Controlled access to internal green areas should be provided for office and public users to allow for privacy within the residential component. The proposed extensive landscaping to Brickfield square should be utilised for public access.

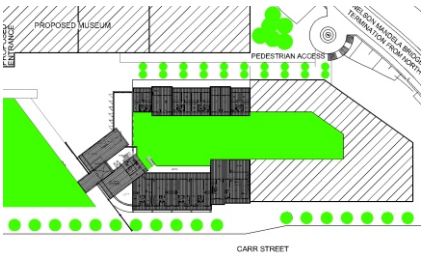


Figure. 101. Proposed Landscaping

12.1.6. Circulation

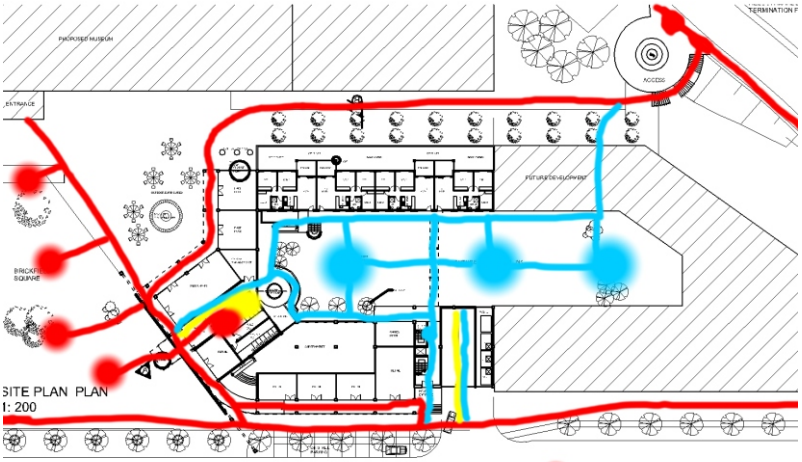


Figure. 107. Building circulation

The circulation system should be self explanatory for first time visitors and should provide for its users a clear sense of orientation. The circulation paths should be as direct as possible to destinations. The facility should provide some form of shelter for the public environment circulation. Various appropriate circulation aids such ramps and stairs are to be utilised to aid for ease of circulation. Circulation paths should evoke a sense of excitement to the user, they should run directly through different spaces of the building.

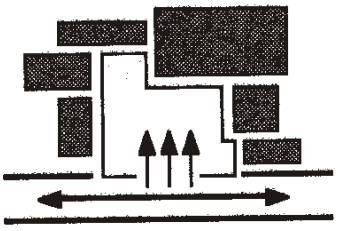


Figure. 102. Views from circulation areas

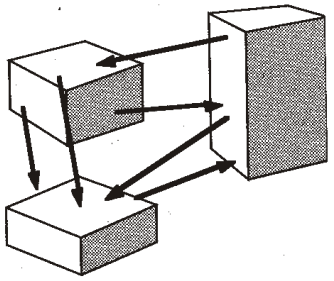


Figure. 103. Identifiable paths

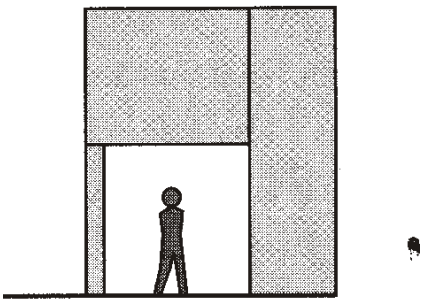


Figure. 104. Covered walkways

Figure. 105. Various circulation modes

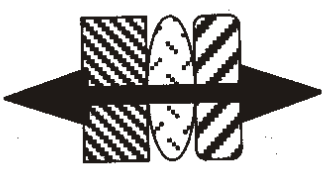


Figure. 106. Circulation through spaces

12.1.7. Inclusive environments

The proposed facility should be designed to accommodate people with all forms of disability. The public environment, access to offices and the community centre should allow 100% access to disabled persons to ensure that the building is inclusive and supports sustainability.

Facilities should be provided for disabled persons drop off, parking and access to the main circulation spine. In accordance with the SABS standards at least two undercover parking bays should be reserved for the use of disabled persons. All routes between and within the buildings should be a smooth and of an even surface (ie easily navigable by wheelchair). Routes should accommodate all forms of disabled transport. All changes in level within the building should have appropriate ramps of 1:12 fall, or lifts to allow disabled access. Edges between walls, floors and stair nosings should be clearly distinguished through the use of contrasting colour for visually impaired persons.

At least two disabled toilets for male and female use must be provided to the public sector in accordance with SABS standards. Changes in texture should be provided with choice of building materials to appropriate areas for the blind. Clear signage should be used to identify facilities for disabled use.

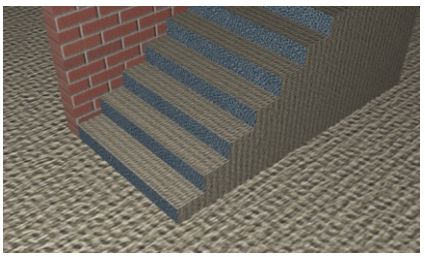


Figure 108. Contrasting colour

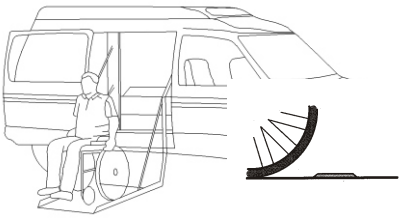


Figure 109. Disabled transport facilities.

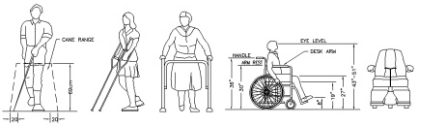


Figure 110. Disabled modes of transport.

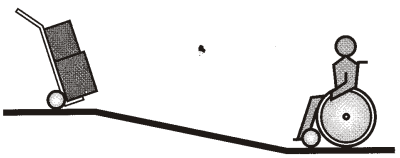


Figure 111. Ramps.

12.1.8. Access to facilities

Conventional living and working patterns requires regular access to a range of services. Ensuring that these services can be accessed easily and in environmentally friendly ways supports sustainability by increasing efficiency and reducing environmental impact.

Temporary childcare should be provided within the community facility. This facility should cater for short term users of the building. It is envisaged that long term childcare would be catered for, within the immediate proposed residential community. There will be no provision for an ATM as the building is located close to public amenities.

Grocery items required on a day to day basis should be accommodated within the ground floor uses. This should be easily accessible to the immediate community as well as visitors. Provisions should be made on the western public facade of the building for the installation of public telephones. Computer and e-mail facilities should be made available for community use within the community centre.

Figure 112. ATM machine.

Figure 113. Computer Access.

Figure 114. Information assistance.

12.1.9. Participation and control

Ensuring that users participate in decisions about their environment helps ensure that they care for, and manage this properly. Control over aspects of their local environment enables personal satisfaction and comfort. Both of these support sustainability by promoting proper management of the building and increasing productivity.

As mentioned earlier users of the building should have reasonable control over their environmental conditions, this should include opening windows and adjustable blinds. This allows for some degree of personalisation of space.

Furniture and fittings ie tables, chairs, internal partitions designed or specified should allow for arrangement and rearrangement by the users. Provision must be made for personalisation of spaces if desired. This includes choice of colours, places for plants and personal storage.

Design of spaces must accommodate informal and formal social interaction. This includes comfortable seating along regularly used routes. Spaces shared between occupants and users must be large enough to allow for comfortable social interaction.

Access to amenities including refreshments is to be made available on ground floor to all building users as well as the immediate community and visitors.

The community centre should be made available to the local community and should strive to evoke a sense of belonging. Apart from health care facilities the community centre should provide access to computers, teaching, learning, and leisure facilities stimulating community upliftment.

Figure 115. Community involvement.

Figure 116. Furniture arrangement.

Figure 117. Health care assistance.

Figure 118. Technology access.

12.1.10. Education health and safety

The building must cater for the well being, development and safety of the people that use them. Awareness and environments that promote health must be promoted. Safe environments should be created limiting the incidence of accidents. Learning and access to information is a necessity in today's population and must be catered for.

Figure 119. Learning spaces.

Access to support for learning must be provided within the community centre. This can be in the form of Internet access, structured courses, or the provision of learning material such as books, journals and newspapers. Awareness on health issues, especially aids must be provided within the community centre. Information must be readily available on health, education, and career development issues. This could include a well serviced notice board located in a central position.

Figure 120. Information.

Measures should be taken to ensure that areas of the buildings and routes to and from the building create a safe environment. Measures taken could include well lit routes, routes and spaces overlooked by occupied areas and clear visual links to the public environment.

In the event of injury, appropriate signage should direct all injury casualties to the health care facility for treatment. A secondary first aid kit must be provided with security for after hour usage in the event of an emergency. Security personnel must be trained to use the first aid kit effectively. The building must comply with all health and safety regulation prescribed by the SABS code of practice.

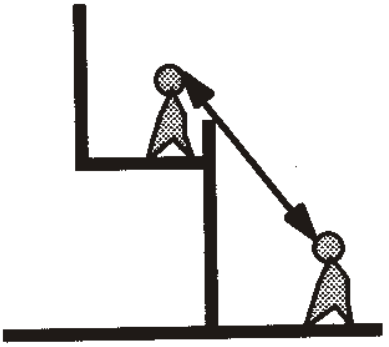


Figure 121. Passive surveillance.

In accordance with legislation no smoking should be allowed within the building. The office users should be provided with designated smoking areas on each floor to promote efficiency.

All of these factors contribute to sustainability by helping ensure that people remain healthy and economically active, thus reducing the 'costs' (to society, the environment and the economy) of unemployment and ill health.

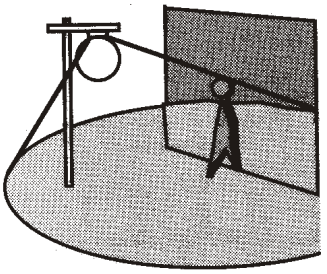


Figure 122. Lighting on corners.

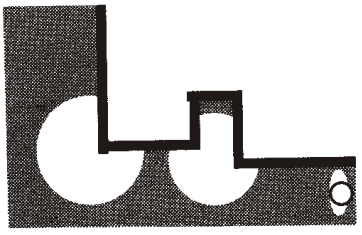


Figure 123. Lighting of nooks and corners.

12.2. ECONOMIC ISSUES

12.2.1. Local economy

The construction and management of the building will have a major impact on the economy of the area. The economy of an area can be stimulated and sustained by utilising local resources and developing local skills.

At least 80% of the construction must be carried out by contractors based within 40km of the building site. This adds a significant contribution to the local economy. Choice of at least 80% of construction materials and components used must be produced within 200km of site. This minimises environmental damage by transportation and furthermore stimulates market demand for products simulating the local economy.

Small emerging businesses should be given preference for utilisation of opportunities created within the facility. This includes outsourcing catering, cleaning services and security as well as making space and equipment available for businesses to use for retail, education and offices. Support facilities for small emerging businesses must be catered for within the facility. Repairs and maintenance required by the building including servicing of mechanical plants must be carried out by contractors within 200km of site. Preference should be given to emerging contractors where possible creating opportunities for developing businesses.

12.2.2. Efficiency of use

The investment in the facility must make effective use of resources. Effective and efficient use of the building supports, sustainability by reducing waste and the need for additional buildings.

Non useable space such as plant, toilets and circulation must be minimised. This should not exceed 20% of the entire facility. Maximum utilisation of spaces must be made. This includes the provision necessary for multipurpose usage. All spaces within the facility should be occupied for an average equivalent minimum of 30 hours per week. In order to ensure the effective management of space on an ongoing basis, utilisation of space should be reported to management for constant revision. Where possible the shared use of space must be allowed.

12.2.3. Adaptability and flexibility

It is likely that within the lifespan of the building the use of the building will change, or that the feasibility of this will be investigated. The buildings should accommodate change easily supporting sustainability by reducing the requirement for change (energy, costs etc) and the need for new buildings.

The structural dimension (Floor to underside of roof, or slab of the floor above) of the retail, community centre and office uses must be a minimum of 3m. This dimension supports change to a variation of uses. Ensuring that the internal partitions between these spaces are non-load bearing (ie non-load bearing brick / block or plasterboard partitions) supports the rearrangement of internal spaces. Given the projected population increase in the CBD it is foreseen that factoring in adaptability into the residential component is not necessary. Some allowance for rearrangement of space must however be made here.

Easy access must be provided to electrical, communication and (HVAC, where appropriate) services in each useable space. Provision must be made for enabling easy modification of the proposed system (ie addition and subtraction of outlets)

12.2.4. Ongoing costs

Preference should be given to specification and material with low maintenance and or low cost maintenance. All plant and fabric must have a maintenance cycle of at least 2 years. Low or no maintenance components (i.e. windows, doors, plant, ironmongery etc) should be selected. Maintenance must be carried out cost effectively. All light bulb positions should be easily reached.

Measures must be taken to limit the requirement for cleaning. Hard wearing solid flooring with limited or no carpeting should be specified. Windows must be easily accessible for cleaning.

Measures must be taken to limit the requirement and costs of security. This should include spaces overlooked by occupied neighbouring buildings. Two access control points are specified. The western access point should be manned by one personnel while the southern access point should utilise electronic access control with intercoms to residential units.

12.2.5. Insurance, water, energy and sewerage

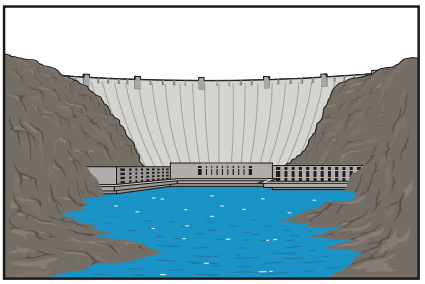
Costs of insurance, water, energy and sewerage must be reported to management and monitored. Policies to reduce energy consumption should be formulated and implemented. This includes switching off lights on leaving building spaces and the awareness on water conservation. Services including electrical, communication, HVAC and plant must be located at the core where they can be easily accessed with minimum disruption to occupants of the building. Access to this should be from circulation areas rather than work areas. Easily accessible lift off panels at regular intervals to vertical and horizontal ducting should be used.

12.2.6. Capital costs

Buildings are generally one of the most valuable assets that people, and often organisations and governments own. Money spent on buildings is not available for other uses such as health and education. Often, the high cost of buildings results in the services (ie. health and education) and the accommodation (for work and living) being beyond the reach of people with the lowest incomes. The proposed building must be cost effective to support sustainability by helping provide access to accommodation and services for low income groups and enabling money to be spent on other areas that support sustainability.

Incentives should be provided to consultants to reduce capital cost and ongoing costs of the facility rather than fees based on total costs of the building. This encourages the design of a cost effective building. The facility should be designed to be easily and cheaply built. Building form should be simple and the replication of elements and components should be used. Arrangements should be made for the sharing of parking and residential space with the proposed neighbouring facility. Access control points of the neighbouring building must strategically positioned to work in conjunction with the proposed facility. Costs of maintenance of the square should be shared with neighbouring buildings.

12.3. ENVIRONMENTAL ISSUES



12.3.1. WATER

Water is required for many activities. However, the large-scale provision of conventional water supply has many environmental implications. Water needs to be stored taking up large areas of valuable land and disturbing natural drainage patterns with associated problems from erosion, it also needs to be pumped through a large network of pipes that need to be maintained and repaired. Having delivered the water, parallel efforts is then required to dispose of this after it is used, i.e. sewerage systems. Reducing water consumption supports sustainability by reducing the environmental impact required to deliver water , and dispose of this after use in a conventional system.

It is estimated that about 24 million litres of water annually would be consumed using conventional water systems for the proposed facility as shown in appendix F. This enormous consumption rate could be dropped to about 10 million litres annually by employing water efficient devices as shown in appendix F. Further reductions can be achieved by utilising rainwater harvesting. The proposed roof area projects a rainwater harvesting capability of 1128000 litres annually as shown in appendix G. The use of rainwater and recycling of water to appropriate uses further reduces water consumption from the municipality to about 7 million litres annually. This system significantly reduces an enormous demand from the municipality and supports sustainability. Furthermore excess irrigation water could be utilised for irrigation of landscaping on the square.

Run off must be reduced by using pervious or adsorbent surfaces. Hard landscaping should be minimised to reduce run off. Extensive use of indigenous planting should be applied due to a low water requirement.

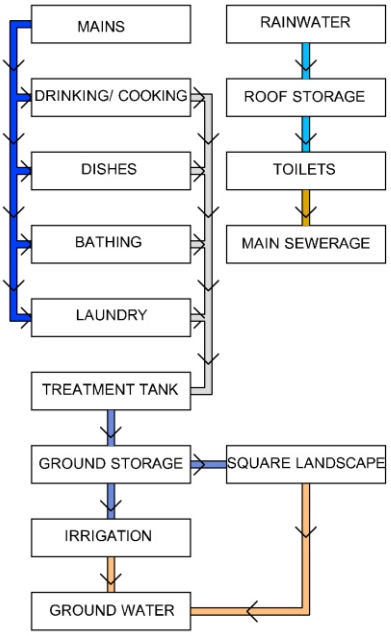


Fig. 124. Proposed water reticulation

12.3.2. Energy

Buildings consume about 50% of all energy produced. Conventional energy production is responsible for making a large contribution to environmental damage and non-renewable resource depletion. Using less energy or using renewable energy in buildings therefore can make a substantial contribution to sustainability.

The building is located along an activity street and public square. Provision should be made for public transport drop off and pick up. This reduces the necessity for private vehicle ownership supporting sustainability.

As mentioned earlier the building utilises a passive system for ventilation, cooling and heating. This significantly reduces resource consumption. Energy efficient fittings and devices must be specified. Light fittings with low energy consumption should be specified where possible. The use of electricity generated from renewable sources such as wind and sun should be maximised.

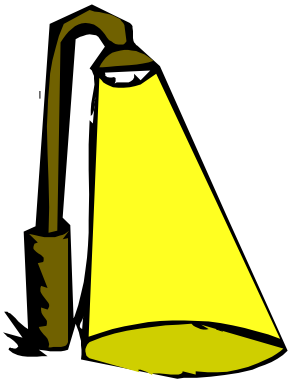


Figure 125. Energy.

12.3.3. Recycling and reuse

Raw materials and new components used in buildings consume resources and energy in their manufacture and processes. Buildings accommodate activities that consume large amounts of resources and products and produce large amounts of waste. Reducing the use of new materials and components in buildings and reducing waste by recycling and reuse supports sustainability by reducing the energy consumption and resource consumption.

Figure 126. Refuse

Arrangements must be made for the safe disposal of medical waste generated in the community centre. Separate waste bins are to be provided for paper, glass, steel and conventional waste. This eliminates the need for sorting at an added expense. Storage and pick up of recyclable waste should be provided according to municipal regulations. Contribution to the main sewerage should be minimised through reuse of grey water for irrigation purposes.

Construction waste must be minimised through design and careful management of construction practices. Designing to comply with modular dimensions of materials used in the construction process limits wastage.

12.3.4. Site

The building should not have harmful affect on neighbouring buildings ie. over shading; where access to sunlight is important.

Provision must be made on the northern side for residents to grow vegetation. Opportunities in car parking areas, and in and around buildings must be utilised for vegetation. Care should be taken that the landscape does not require heavy artificial input ie. fertilizer, insecticide and pesticide.

12.3.5. Materials and components

The construction of buildings usually requires large quantities of materials and components. These may require large amounts of energy to produce. Their development may also require processes that are harmful to the environment and consume non-renewable resources.

80% of the building materials and components must be made from materials and components with low embodied energy. Low embodied energy materials include: locally (within country) made and sourced timber, concrete, concrete block timber windows and doors. 90% of materials and resources should be from renewable resources.

Material choice preference should be given to materials with limited environmental damage during product component development ie: no green house gases released, no pollution caused. 10% of building materials and components should be specified from renewable sources. Building and construction process must be designed to minimally impact on the environment.