baseline study

"The biggest problem is that we architects have been using too narrow a balance sheet to evaluate our decisions. That sheet is not complete; it doesn't include total efficiency and environmental costs. A building may be cheap and pretty, but will it go on to become an environmental and financial burden to those who occupy and maintain it?"

(Randolph Croxton, The Croxton Collaborative Architects)

A sustainable facility should do the following:

- Use land wisely
- Use energy water and materials efficiently
- Enhance human health and well-being
- Be economical to operate
- Promote recycling

Sustainable development is simply about ensuring a better quality of life for every one, now and for generations to come.

Sustainability:
"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Brundland 1987)

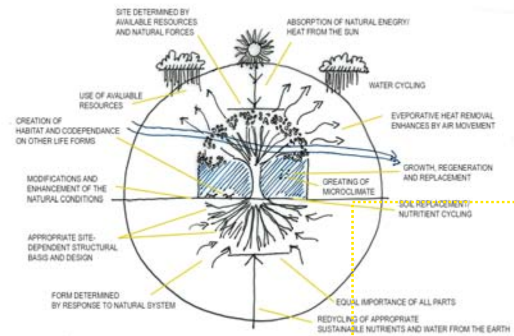
The over arching goals of Sustainable Facility Design are to create buildings that are warm in winter, cool in summer, and comfortably illuminated; that promote the health and well being of occupants; and that are resource efficient to build and operate.

Sustainable (or green) buildings cost about the same as conventional buildings and reduce costs in the long run. For example, increased insulation can reduce the cost of mechanical systems. Smaller mechanical systems can use smaller ducts; smaller ducts can reduce the size of a ceiling cavity, thus reducing the overall size of a building.

The simple decision to increase insulation can have a significant impact on the overall cost of a building if the designer follows the implications of that decision. Another example is choosing energy efficient, high-quality lighting. If lighting quality is good, it requires less energy to provide the same level of visibility. Sustainable buildings are less expensive to heat, cool, and light. Because they use less energy, they produce less pollution. What is more important, sustainable buildings are healthier places in which to work and live.

Sustainable design is the thoughtful integration of architecture with electrical, mechanical, and structural engineering. In addition to concern for the traditional aesthetics of massing, proportion, scale, texture, shadow, and light, the facility design team needs to be concerned with long term costs: environmental, economic, and human.

Sustainable design requires an integrated-systems approach to creating the built environment. In addition to realizing the programmatic goals for the facility, the term A/E should coordinate sitting and landscaping decisions; mechanical, electrical, and structural engineering; thermal envelop, delighting, and fenestration design; materials selection; indoor air quality considerations; and life cycle costs to create a cost effective, energy efficient building.



5 _ 1

Understanding Place

Sustainable design begins with an intimate understanding of place. If we are sensitive to the nuances of place, we can inhabit without destroying it. Understanding place helps determine design practices such as solar orientation of a building on the site, preservation of the natural environment, and access to public transportation.

Connecting With Nature

Whether the design site is a building in the inner city or in a more natural setting, connecting with nature brings the designed environment back to life. Effective design helps inform us of our place within nature.

Understanding Natural Processes

In nature there is no waste. The by-product of one organism becomes the food for another. In other words, natural systems are made of closed loops. By working with living processes, we respect the needs of all species. Engaging processes that regenerate rather than deplete, we become more alive. Making natural cycles and processes visible this brings the designed environment back to life.

Understanding Environmental Impact

Sustainable design attempts to have an understanding of the environmental impact of the design by evaluating the site, the embodied energy and toxicity of the materials, and the energy efficiency of design, materials and construction techniques. Negative environmental impact can be mitigated through use of sustainably harvested building materials and finishes, materials with low toxicity in manufacturing and installation, and recycling building materials while on the job site.

Embracing Co-creative Design Processes

Sustainable designers are finding it is important to listen to every voice. Collaboration with systems consultants, engineers and other experts happens early in the design process, instead of an afterthought. Designers are also listening to the voices of local communities.

Understanding People

Sustainable design must take into consideration the wide range of cultures, races, religions and habits of the people who are going to be using and inhabiting the built environment. This requires sensitivity and empathy on the needs of the people and the community.

site design

Site design is a process of intervention involving the location of circulation, structures, and utilities, and making natural and cultural values available to visitors. The process encompasses many steps from planning to construction, including initial inventory, assessment, alternative analysis, detailed design, and construction procedures and services. Site design requires holistic, ecological based strategies, these strategies should help to repair and restore existing systems.

Recognition of Context

A site cannot be understood and evaluated without looking outward to the site context. Before planning and designing a project, fundamental questions must be asked in light of its impact on the larger community.

Treatment of Landscapes as Interdependent and Interconnected

Typical development increases the fragmentation of the landscape. This results in islands of landscapes, which are surrounded by fabric of development. These landscapes are incapable of supporting a variety of plant communities and habitats. Reconnecting fragmented landscapes and establishing contiguous networks with other natural systems both within a site and beyond

The Integration of the Native Landscape with Development

Areas should be redesigned to support some component of the natural landscape to provide critical connections to adjacent habitats.

Promotion of Bio-diversity

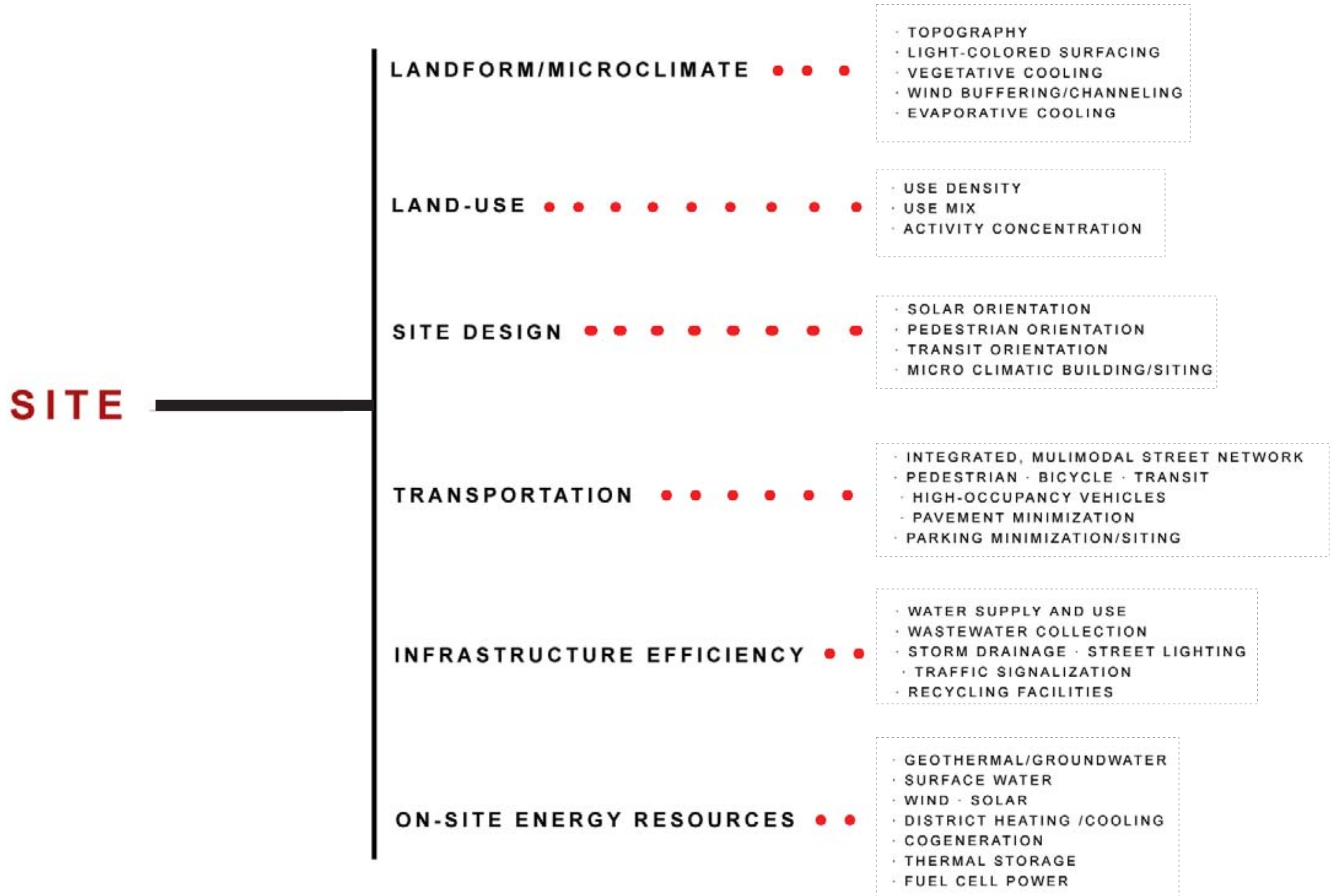
Site design must be directed to protect local plant and animal communities, and new landscape plantings must deliberately re-establish diverse natural habitats in organic patterns that reflect the processes of the site.

Making a Habit of Restoration

As most of the ecosystems are increasingly disturbed, every development project should have a restoration component. When site disturbance is uncontrolled, ecological deterioration accelerates, and natural systems diminish in diversity and complexity. Effective restoration requires recognition of the interdependence of all site factors and must include repair of all site systems soil, water, vegetation, and wildlife.

The Following Considerations Apply to Sustainable Site Design:

•Promote spiritual harmony with, and embody an ethical responsibility to, the native landscape and its resources.
•Plan landscape development according to the surrounding context rather than by overlaying familiar patterns and solutions.
•Do not sacrifice ecological integrity or economic viability in a sustainable development; both are equally important factors in the development process.
•Understand the site as an integrated ecosystem with changes occurring over time in dynamic balance; the impacts of development must be confined within these natural changes.
•Allow simplicity of functions to prevail, while respecting basic human needs of comfort and safety.
•Recognize there is no such thing as waste, only resources out of place.
•Assess feasibility of development in long-term social and environmental costs, not just short-term construction costs.
•Analyse and model water and nutrient cycles prior to development intervention - "First, do no harm."
•Minimize areas of vegetation disturbance, earth grading, and water channel alternation.
•Locate structures to take maximum advantage of passive energy technologies to provide for human comfort.
•Provide space for processing all wastes created on site (collection/recycling facilities, digesters, lagoons, etc.) so that no hazardous or destructive wastes will be released into the environment.
•Determine environmentally safe means of on site energy production and storage in the early stages of site planning.
•Phase development to allow for the monitoring of cumulative environmental impacts of development.
•Allow the natural ecosystem to be self-maintaining to the greatest extent possible.
•Develop facilities to integrate selected maintenance functions such as energy conservation, waste reduction, recycling, and resource conservation into the visitor experience.
•Incorporate indigenous materials and crafts into structures, native plants into landscaping, and local customs into programs and operations.


SITE
LANDFORM/MICROCLIMATE
· TOPOGRAPHY
· LIGHT-COLORED SURFACING
· VEGETATIVE COOLING
· WIND BUFFERING/CHANNELING
· EVAPORATIVE COOLING
LAND-USE
· USE DENSITY
· USE MIX
· ACTIVITY CONCENTRATION
SITE DESIGN
· SOLAR ORIENTATION
· PEDESTRIAN ORIENTATION
· TRANSIT ORIENTATION
· MICRO CLIMATIC BUILDING/SITING
TRANSPORTATION
· INTEGRATED, MULIMODAL STREET NETWORK
· PEDESTRIAN · BICYCLE · TRANSIT
· HIGH-OCCUPANCY VEHICLES
· PAVEMENT MINIMIZATION
· PARKING MINIMIZATION/SITING
INFRASTRUCTURE EFFICIENCY
· WATER SUPPLY AND USE
· WASTEWATER COLLECTION
· STORM DRAINAGE · STREET LIGHTING
· TRAFFIC SIGNALIZATION
· RECYCLING FACILITIES
ON-SITE ENERGY RESOURCES
· GEOTHERMAL/GROUNDWATER
· SURFACE WATER
· WIND · SOLAR
· DISTRICT HEATING /COOLING
· COGENERATION
· THERMAL STORAGE
· FUEL CELL POWER

Premises

What makes the site suitable for a prison development? First and foremost, it must be in an area where the prison can draw prisoners. It must be located close to family and friends of the prisoners to enable easy visitation. The site needs to be secure

The site selection process asks a series of questions:

1. Can development impacts on a site be minimized?
2. What inputs (energy, material, labour, products) are necessary to support a development option, and are required inputs available?
3. Can waste outputs (solid waste, sewage effluent, exhaust emissions) be dealt with at acceptable environmental costs?

The programmatic requirements and environmental characteristics of sustainable development will vary greatly, but the following factors should be considered in site selection:

Capacity

Every site has a carrying capacity for structures and human activity. A detailed site analysis should determine this capacity based on the sensitivity of the site resources and the ability of the land to regenerate.

Density

Concentration of structure leaves more undisturbed natural areas.

Climate

The characteristics of certain climates should be considered.

Slopes

Building on steep slopes predominantly require special sitting of structures and costly construction practices. Building on slopes can lead to soil erosion, loss of hillside vegetation and damage to fragile ecosystems.

Vegetation

It is important to maintain as much of the natural vegetation as possible to secure integrated site design.

Site Access

Site access refers to the means of physically entering a sustainable development.

Road design & Construction

A curvilinear alignment should be designed to flow with the topography and add visual interest; crossing unstable slopes should be avoided.

Steep grades should be used as needed to lay road lightly on the ground, and retaining walls should be included on cut slopes to ensure long-term slope stability. The road should have low design speeds (with more and tighter curves) and a narrower width to minimize cut-and-fill disturbance. Over engineering of roads should be avoided

Many soils are highly susceptible to erosion. Vegetation clearing on the road shoulders should be minimized to limit erosion impacts and retain the benefits of greenery. All fill slopes should be stabilized and walls provided in cut sections where needed. Exposed soils should be immediately replanted and mulched. Paved ditches are frequently used to stem erosion along steep road gradients.

Utilities and Waste Systems

With the development of a site comes the need for some level of utility systems. Even the smallest human habitat requires sanitary facilities for human waste and provisions for water. More elaborate developments have extensive systems to provide electricity, gas, heating, cooling, ventilation, and storm drainage. The provision of these services and the appurtenances associated with them sometimes create substantial impacts on the landscape and the functioning of the natural ecosystem. Sustainable site planning and design principles must be applied early in the planning process to assist in selecting systems that will not adversely affect the environment and will work within established natural systems.

Night Lighting

Night lighting should be efficient in accordance with the percentage of lux needed in a prison facility.

Storm Drainage

In undisturbed landscapes, storm drainage is typically handled by vegetation canopy, ground cover plants, soil absorption, and streams and waterways.
The main principles in storm drainage control are to regulate runoff to provide protection from soil erosion and avoid directing water into unmanageable volumes. Removal of natural vegetation, topsoil, and natural channels that provide natural drainage control should always be avoided. An alternative would be to try and stabilize soils, capture runoff in depressions (to help recharge ground water supply), and re-vegetate areas to replicate natural drainage systems.

Irrigation Systems

Low volume irrigation systems are appropriate in most areas as a temporary method to help restore previously disturbed areas or as a means to support local agriculture and native traditions. Captured rainwater, recycled grey water, or treated effluent could be used as irrigation water.

The concept of sustainability suggests an approach to the relationship of site components that is somewhat different from conventional site design. With a sustainable approach, site components defer to the character of the landscape they occupy so that the experience of the landscape will be paramount. More ecological knowledge is at the core of sustainable design. Instead of human functional needs driving the site design, site components respond to the indigenous spatial character, climate, topography, soils, and vegetation as well as compatibility with the existing cultural context. For example, all facilities would conform to constraints of existing land forms and tree locations, and the character of existing landscape will be largely maintained. Natural buffers and openings for privacy are used rather than artificially produced through planting and clearing.

Natural Characteristics

The greatest challenge in achieving sustainable site design is to realize that much can be learned from nature. When nature is incorporated into designs, spaces can be more comfortable, interesting, and efficient. It is important to understand natural systems and the way they interrelate in order to work within these constraints with the least amount of environmental impact. Like nature, design should not be static but always evolving and adapting to interact more intimately with its surroundings.

Wind

The major advantage of wind in development is its cooling aspect.

Sun

Where sun is abundant, it is imperative to provide shade for human comfort and safety in activity areas (e.g., pathways, patios). The most economical and practical way is to use natural vegetation, slope aspects, or introduced shade structures. The need for natural light in indoor spaces and solar energy are important considerations to save energy and showcase environmental responsive solutions.

Rainfall

Many settings must import water, which substantially increases energy use and operating costs, an makes conservation of water important. Rainfall should be captured for a variety of uses (e.g. drinking, bathing) and this water reused for secondary purposes (e.g., flushing toilets, washing clothes). Waste water or excess runoff from developed areas should be channelled and discharged in ways that allow for ground water recharge instead of soil erosion. Minimizing disturbance to soils and vegetation and keeping development away from natural drainage ways protect the environment as well as the structure.

Topography

In many areas, flatland is at a premium and should be set aside for agricultural uses. This leaves only slopes upon which to build. Slopes do not have to be an insurmountable site constraint if innovative design solutions and sound construction techniques are applied. Topography can potentially provide vertical separation and more privacy for individual structures. Changes in topography can also enhance and vary the way a visitor experiences the site by changing intimacy or familiarity

Geology and Soils

Designing with geologic features such as rock outcrops can enhance the sense of place. For example, integrating rocks into the design of a deck or boardwalk brings the visitor in direct contact with the resource and the uniqueness of a place. Soil disturbances should be kept to a minimum to avoid erosion of fragile tropical soils and discourage growth of exotic plants. If limited soil disturbance must take place, a continuous cover over disturbed soils with erosion control netting should always be maintained.

Construction Process Program

This required program will be a primer for developers, construction contractors, and maintenance workers. The plan covers materials, methods, testing, and options. A careful organization and sequencing of construction is emphasized. Examples include building walkways first, then using them as access to the site. Also it is important to plan material staging for areas in conjunction with future facilities. A knowledgeable construction supervisor must be involved, and all new construction methods should be tested in a prototypical first phase. Maintenance and operations staff should also be involved in this construction program and should participate in the development of an operations manual.

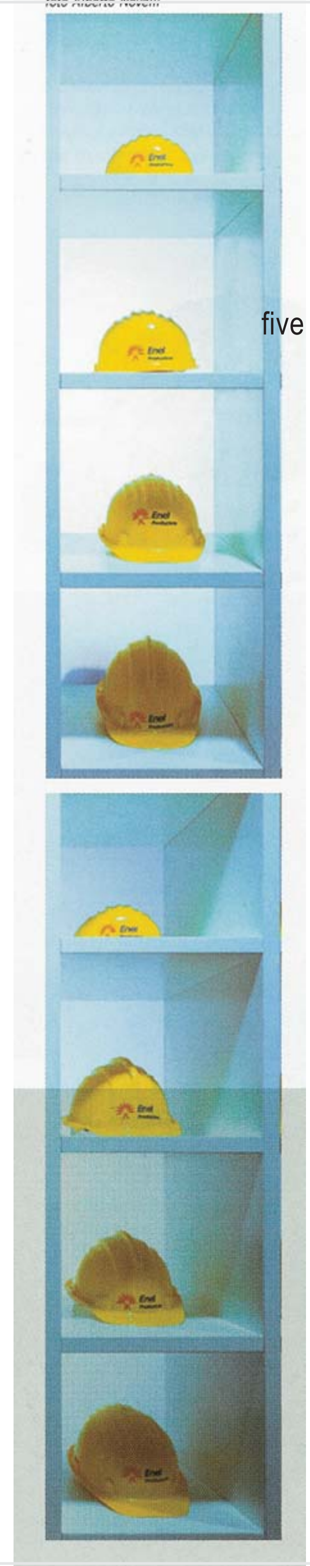


foto Alberto Novelli

5 _ 2

building design

accomodation shedule

ACCOMMODATION SCHEDULE

FUNCTION	SPACE REQUIRED
PRE-PROCESSING	
WAITING AREA	40m²
CONTROL ROOM	30m²
FEMALE WC	15m²
MALE WC	10m²
PARAPLEGIC WC	5m²
PROCESSING AREA & SECURE COUNTER	6m²
PLAY AREA	20m²
PUBLIC PARKING	
PARKING BAYS FOR VISITORS	3315m²
PARKING BAYS FOR STAFF	2380m²
ADMINISTRATION	
LOBBY AND WAITING AREA	35m²
OFFICE: HEAD OF PRISON	24m²
OFFICE: RECEPTIONIST - INCLUDING WAIT AREA	8m²
OFFICE: ASSISTANT HEAD OF PRISON	15m²
OFFICE: PERSONNEL MANAGEMENT	15m²
OFFICE: PERSONNEL ADMIN & REGISTRATION	20m²
MAIL ROOM	10m²
OFFICE: HEAD OF PRISON MANAGEMENT	15m²
OFFICE: PSYCHOLOGICAL/;SOCIAL WORKER	12m²
FINANCE ADMIN & SERVICES	30m²
ADMIN SUPPORT AND TYPIST	20m²
OFFICE: CHAIR OF INSTITUTIONAL COMMITTEE	15m²
INVESTIGATIONS OFFICER	10m²
STAFF ABLUTIONS	8m²
STORE ROOM	6m²
STAFF REST AND TEA	15m²
ADMISSIONS	
VEHICULAR SALLY PORT	50m²
GROUP HOLDINGS ROOM IN	24m²
INDIVIDUAL HOLDING CELLS	6m²
GROUP HOLDINGS ROOM OUT	22m²
STRIP SEARCH ROOM	8m²
CONTROL ROOM	8m²
RECORDS ROOM	11m²
STAFF WC	4m²
NON-CONTACT VISITING BOOTHS	10m²
ARCHIVE/DEAD RECORDS STORE ROOM	32m²
PHOTO ID ROOM	8m²
INTERVIEW ROOM	12m²
MEDICAL EXAMINATION ROOM	5m²
HEAD OF ADMISSIONS	8.5m²
PRIVATE EFFECTS PROPERTY STORAGE	100m²
CLOTHES ISSUE	73m²
WAITING ROOM	23m²
PROPERTY STORAGE ROOM & VAULT	44m²
TUCK SHOP & SERVICE CENTRE	59m²

CENTRAL VISITORS FACILITIES	
Control room	6
Visitors post processing lobby and waiting room	20
Outside visiting yard	15
2 Toilet facilities for visitors: Each 12m²	24
Contact visiting room	120
30 Non contact visit cubicles: Each 6m²	180
4 Inmates processing and strip search rooms: Each 3m²	12
X-ray and metal detector area	8
EDUCATIONAL & VOCATIONAL FACILITY	
Office: Education Supervisor	15m²
2 Offices: Staff: Each 12m²	24m²
Control office	10m²
Workroom	20m²
Conference room	30m²
8 Classrooms: Each 40m²	320m²
Library W/Carrels	40m²
Store room	30m²
Chapel / multipurpose hall	180m²
2 Offices: Chaplain: Each 12m²	24m²
2 Study rooms: Each 15m²	30m²
2 Store rooms: Each 5m²	10m²
Staff toilet	4m²
Inmates toilets	4m²
Toilet facilities: Inmates	8m²
Toilet facilities: Personnel	4m²
3 Shaded exercise areas: Each 280m²	840m²
3 Offices: Recr Supervisor: Each 10m²	30m²
3 Store rooms: Equipment: Each 6m²	18m²
2 Soccer play fields	NAA
3 Outdoor exercise areas	NAA
3 Toilet facilities for inmates: Each 4m²	12m²
8 Vocational training and handcraft development rooms: Each 40m²	320m²
Toilet facilities: Personnel	4m²
Toilet facilities: Inmates	8m²
Office: Voc Train Supervisor	15m²
2 Offices: Staff: Each 12m²	24m²
Control office	10m²
Work room	20m²
Conference room	30m²
Store room for item 14.16b	40m²

Sense Of Place

The concept known as bioregionalism is based on the idea that all life is established and maintained on a functional community basis and that all of these distinctive communities (bio-regions) have mutually supporting life systems that are generally self-sustaining. Human civilization is an integral part of the natural world and is dependent on the preservation of nature for its own perpetuation.

More specifically, sustainable development should have the absolute minimal impact on the local, regional, and global environments. Planners, designers, developers, and operators have an opportunity and a responsibility to protect the sanctity of a place, its people and its spirit

Sustainable design balances human needs (rather than human wants) with the carrying capacity of the natural and cultural environments. It minimizes environmental impacts, importation of goods and energy as well as the generation of waste.

The ideal situation would be that if development was necessary, it would be constructed from natural sustainable materials collected onsite, generate its own energy from renewable sources such as solar or wind, and manage its own waste.

Sustainable design is an eco-systematic approach that demands an understanding of the consequences of our actions. As a tool to understanding this principle, a metaphoric example is drawn using an organism to symbolize functional appropriateness, habitat harmony, and survival based on adaptation and cultivation

The organism makes use of immediately and locally available materials to construct itself, and does so with economy and efficiency. The same strategies when used in development can minimize global and local impacts on resources.

The organism maintains a harmonious relationship with its environment by establishing a balance between its needs and available resources. Similarly, the ecologically sensitive design adjusts demands, lifestyles, and

A Sustainable Building

- Use the building (or non-building) as an educational tool to demonstrate the importance of the environment in sustaining human life
- Reconnect humans with their environment for the spiritual, emotional, and therapeutic benefits that nature provides
- Promote new human values and lifestyles to achieve a more harmonious relationship with local, regional, and global resources and environments
- Increase public awareness about appropriate technologies and the cradle-to-grave energy and waste implications of various building and consumer materials
- Nurture living cultures to perpetuate indigenous responsiveness to, and harmony with, local environmental factors
- Relay cultural and historical understandings of the site with local, regional, and global relationships
- Be subordinate to the ecosystem and cultural context; respect the natural and cultural resources of the site and absolutely minimize the impacts of any development.
- Avoid use of energy intensive, environmentally damaging, waste producing, and/or hazardous materials. Use cradle-to-grave analysis in decision making for materials and construction techniques and renewable indigenous building materials to the greatest extent possible.
- Consider “constructability” . . striving for minimal environmental disruption, resource consumption, and material waste, and identifying opportunities for reuse/recycling of construction debris.
- Allow for future expansion and/or adaptive uses with a minimum of demolition and waste
- Materials and components should be chosen that could be easily reused or recycled.
- Make it easy for the occupants /operators to recycle waste.
- Interpret how development works within natural systems to effect resource protection and human comfort and foster less consumptive lifestyles
- Use the resource as the primary experience of the site and as the primary design determinant
- Enhance appreciation of natural environment and encourage/establish rules of conduct.
- Use the simplest technology appropriate to the functional need, and incorporate passive energy-conserving strategies responsive to the local climate.

target setting

1. Lighting

• Use special sun control devices
• Allow maximum daylight to penetrate the entire building
• Avoid glare
• Block direct sun rays into building
• Daylight - the coolest colour (Security entrances, Exhibition area , Canteen)
• White light - the intermediate colour (entrances, waiting areas)
• Warm light - the warmest colour (non-contact and contact areas to create moods)

2. Ventilation

• Cross ventilation
• Stack ventilation system (Stack-effect)
• Ventilation system (Rock bin-system)
• Flexibility, adaptability
• Openable windows on South facade
• Extractor fans at the top of the stack (Removes excess hot air & creates a negative pressure inside)
• Requires no maintenance and louvre can be closed in winter
• Allows for minimum fresh air supply of 4.72 litres/person

3. Noise & acoustics

• Minimize amount of openings leading from one area into another
• Cavity wall and isolation material, mineral wool
• Allow for acoustic control in visiting area (contact and non-contact) & security boxes

4. Disabled

• WC compartments for the disabled
• Requirements for handrailings and support
• Ramps and access to and from the building
• Ramps to fall @ 1:12 or lifts
• Edges - between walls and floors well defined

5. Security

• Highest possible level of security
• Security staff on site as well as in building
• Entrances and exist and control points all checked by electronic detection device
• External windows and doors are all protected from external and internal vandalism and illegal entry and exit
• "Camera eyes" 24 hour activated at all possible hiding places and movement areas
• Entire site is surrounded by a double fence, a 4.6 meter Bekaert Bastion high security fence and a taut wire detection system
• Only one vehicle entrance to entire site
• Vehicle control sally port system and security staff at the entrance
• Sufficient lighting must be supplied at these points

6. Fire regulations

• No smoking inside the building
• Fire escapes according to SABS 0400
• Sufficient outside space provided
• Escape routs in case of fire will not exceed the maximum of 45m²
• 8 exits doors for the visitors centre the width of the door not beening less than 800mm
• SABS 0400: TT16.2 & TT17.1
• Two escape routs minimum at a width not less than 800mm
•Stairs in canteen area will have a max rise of 200mm and tread minimum 250mm, hand railings 900mm high
• Fire extinguishers will be provided on every level and every excluded area. (exhibition area, canteen, contact visiting area, non-contact visiting inmate side and visitor side and security box (control facility)
• Smoke exhaust fans provided in the building.

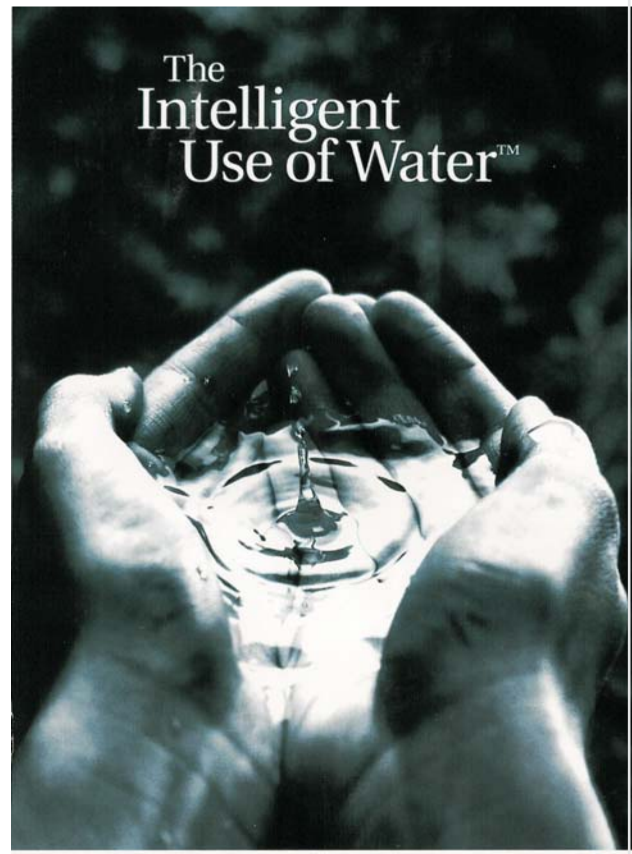
target setting

7. Vertical dimension

• Main structural system are concrete walls, maximum span is 6m
• 170mm floor slab, the height varies according to different spaces from 3000mm to 7000mm (double volumes)
• 200mm concrete roof slab carrying a green roof system

8. Water

• 30% of the rainwater from the green roof system is harvested and stored and reused
• 53m3 water/month harvest (1230m²x0.65x0.9)
• Water for the usage of fire fighting is available from the Green reservoir @ a pressure of 500Kpa
• The Green reservoir has the capacity for storing 14 days of water requirements



5 _ 3

social issues - inclusive environments

An essential criterion for a sustainable development is that the building is designed to accommodate everyone otherwise specially designed buildings need to be provided. Ensuring that buildings are inclusive, supports sustainability as replication is avoided and "change of use" supported. (Gibberd, 2000: SBAT)

Criteria:

Approach

Distance from communities
Public transport
Public access

Youth prison facility

Routes
Edges
Change in levels
Ablutions

When the site for the youth prison facility was chosen it was clear that the public transport route (which carry mainly taxis and cars) to the northwest of the site was main connection to the site form the north as well as from the south.
The staff as well as the visitors to the facility rely dominantly on public transport (taxis) to and from the facility.

The taxis stop is at the main entrance of the main Leeuwkop Prison Facility. Pedestrians access at the main entrance from where they are then transported by shuttle to the youth prison facility which is 5Km away.

Private vehicle access to the main leeuwkop prison ground is allowed and parking is allocated outside the Youth Prison Facility for staff as well as visitors.

Disabled people are adaptable and often because of necessity extremely determined to manage for themselves in buildings for able-bodied people.
For ambulant disabled people, it is mostly easier to move around a building which does not have a disabled environment. For wheelchairs users it is a more serious problem for if areas are not accessible by a wheelchair, the user is prohibited from entering. Unlike other disabled people, who can make their way through existing architecture, wheelchair users need spacial environmental safety measures, and certain architectural elements have to be provided for them.

5 _ 4

design requirements

Walls

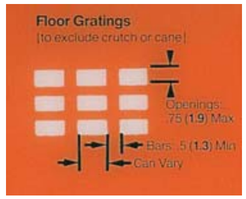
1.Rough walls can cause hand abrasions
2.Textures are useful in identification and creating interest and can help with orientation.
3.Objects projecting from walls should be kept to a minimum.

Floors

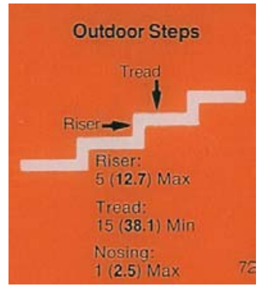
1. Steps and curbs should be eliminated. Maximum threshold or curb height is 2.5cm.
2. No scatter rugs and rugs.
3. Floor gratings may interfere with wheel travel.
4. Slippery floor should not be used.

Doors

1. Sliding doors are an obstacle to a wheelchair user unless they are automatic and have no obstructing track
2. Revolving doors may not be used.
3. A spacing of 198.1cm between two sets of doors (one set behind the other) avoids a wheelchair trap.
4. Doors must be easy to open. The maximum force is 3.6kg.
5. Lever handles on all doors and water facets are preferred.
6. Automatic doors are the preferable.
7. Kick plates must be 40.6cm high for wheelchair users; they are normally 33cm high.
8. Door widths must have a 81.cm minimum clear opening.
9. Bathroom doors must swing outwards but be places so that they do not interfere with traffic


Floor Gratings
(to exclude crutch or cane)
Openings:
.75 (1.9) Max
Bars: .5 (1.3) Min
Can Vary

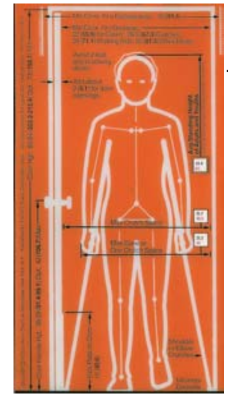
5 _ 5


Outdoor Steps
Tread
Riser
Riser:
5 (12.7) Max
Tread:
15 (38.1) Min
Nosing:
1 (2.5) Max

5 _ 6


Indoor Steps
Handrail Dia.
1.5 (3.8) Opt
2 (5.1) Max
18 (45.7) Min
36 (91.4)
32 (81.3)
30-35°
18 (45.7) Min
Riser:
7 (17.8) Max
Nonskid
Rad
Tread:
11.2 (28.4) Min
No Abrupt
Square Nosings
Nosing:
1.2 (3) Max

5 _ 7



5 _ 8

design requirements

Space

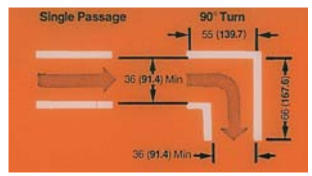
1. Wheelchair parking space is required in theatres, auditoriums, stadiums, prisons and other public gathering places.
2. Increased aisle space and parking space is required in cafeterias, restaurants, and libraries.
3. Public toilet stalls, and phone booths need to be large enough to accommodate a wheelchair.
4. For the blind brail can be used. But only 10% of blind people know brail.
5. Space should be uncluttered for the use of blind people, and should be organized in grid patterns.
6. Visual signals and displays can be used to reinforce audible signals red lights along with a fire alarm.
7. Good illumination facilitates lip reading.

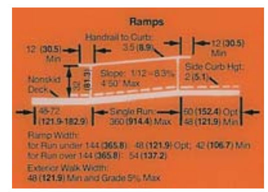
Reach

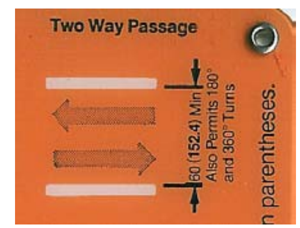
1. Phones, drinking fountains, vending machines, light switches, and fire alarms must be within easy reach. The handy reach zone is 91.4 - 121.9cm, measured from the floor.

Walkways and ramps

1. The maximum recommended grade for walkways is 3%.
2. Walkways with a 3% grade requires rest areas. The minimum width is 121.9cm.
3. Ramps generally have a 5 - 8% grade. They require rest areas every 9.1m, restricting curbs 5.1cm high, and handrails on both sides.
4. The maximum grade for ramps is 8 - 10%. Such as ramps require rest areas every 4.6m restricting curbs 76.2cm apart, and handrails on both sides.
5. rest platforms have a minimum lenght of 137.2cm.
6. handrails on stairs should have horizontal extensions at the top and bottom or be knurled at the ends to indicate the last step.
7. amps should be textured to provide a non skid surface.
8. Stairs are better for crutch users than long ramps


Single Passage
90° Turn
55 (139.7)
36 (91.4) Min
66 (167.6)
36 (91.4) Min
5 _ 9


Ramps
Handrail to Curb:
3.5 (8.9)
12 (30.5)
Min
12 (30.5)
Min
Side Curb Hgt:
2 (5.1)
Nonskid
Deck
Slope: 1/12 - 8.3%
4'50" Max
48-72
(121.9-182.9)
Single Run:
360 (914.4) Max
60 (152.4) Opt
48 (121.9) Min
Ramp Width:
for Run under 144 (365.8) 48 (121.9) Opt; 42 (106.7) Min
for Run over 144 (365.8): 54 (137.2)
Exterior Walk Width:
48 (121.9) Min and Grade 5% Max
5 _ 10


Two Way Passage
60 (152.4) Min
Also Permits 180°
and 360° Turns
parentheses.
5 _ 11

design requirements

Bathrooms

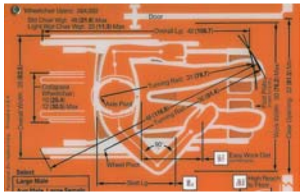
1. A 360deg turning circle is desirable in a bathroom; an 180deg turn is acceptable
and requires a space of 152.4cm².
2. Lavatory height from the rim to the floor is 82.6cm maximum.
3. Lavatory bowl depth over 15.2cm interferes with leg room.
4. The maximum knee well width under the lavatory is 71.1cm.
5. Pedestals and leg supports on lavatories should be avoided. Counters or wall mountings are preferred.
6. Exposed drain and hot water pipes must be isolated.
7. Bath height is 40.6cm minimum, 48.3cm maximum.
8. An adjoining tub seat is 45.7cm wide, sloping to drain.
9. Nonskid material should be provided for the bath bottom.
10. No slip grab bars are necessary as assists near the bath and toilets.

Showers

1. Shower stalls are 91.4cm² for wheelchair users.
2. A folding seat should be hinged on the side wall opposite the shower head.
3. The seat size is 35.6 x 91.4cm and is 48.3cm high.
4. Horizontal grab bars are recommended along the three sides of the stall 83.8 cm above the floor.
5. Water controls and soap trays should be 106.7 cm above the floor.
6. Shower curd height is 5.1cm maximum.

Furniture

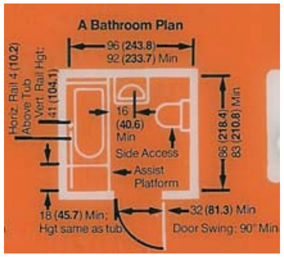
1. Surroundings should be pleasant, not institutionalooking.
2. Special consideration should be given to shelves and storage areas to acknowledge
the limited are reach in all directions due to the wheelchair dimensions.
3. Tables must be clear armrests.
4. Clearance must be provided for the hand while operating the driving rims.
5. Increased toe space must be provided.
6. Access spaces are needed around the bed. Allow 137.2cm between bed and furniture and 121,9cm at the foot of the bed.
7. Furniture should be steady and sturdy with well rounded edges and corners.



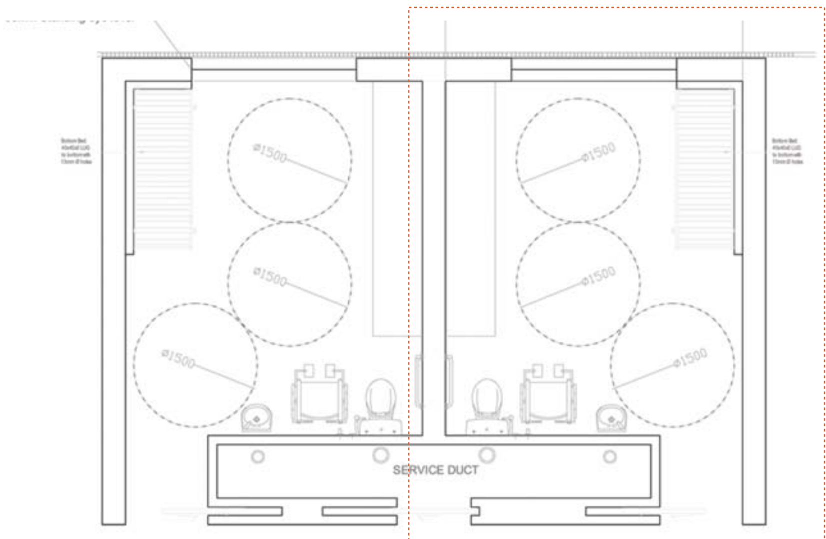
5 _ 12


Min Toilet Room
42 (106.7)
25 (63.5) Min
Handrail Hgt: 33 (83.8)
Clear.: 1.5 (3.8)
Seat Hgt: 20 (50.8)
60 (147.3) Min
75 (190.5) Prefer
Opening: 32 (81.3) Min

5 _ 13


A Bathroom Plan
96 (243.8)
92 (233.7) Min
Horiz. Rail 4 (10.2) Above Tub
Vert. Rail Hgt: 41 (104.1)
16 (40.6) Min
Side Access
Assist Platform
86 (218.4)
83 (210.8) Min
18 (45.7) Min; Hgt same as tub
32 (81.3) Min
Door Swing: 90° Min

5 _ 14

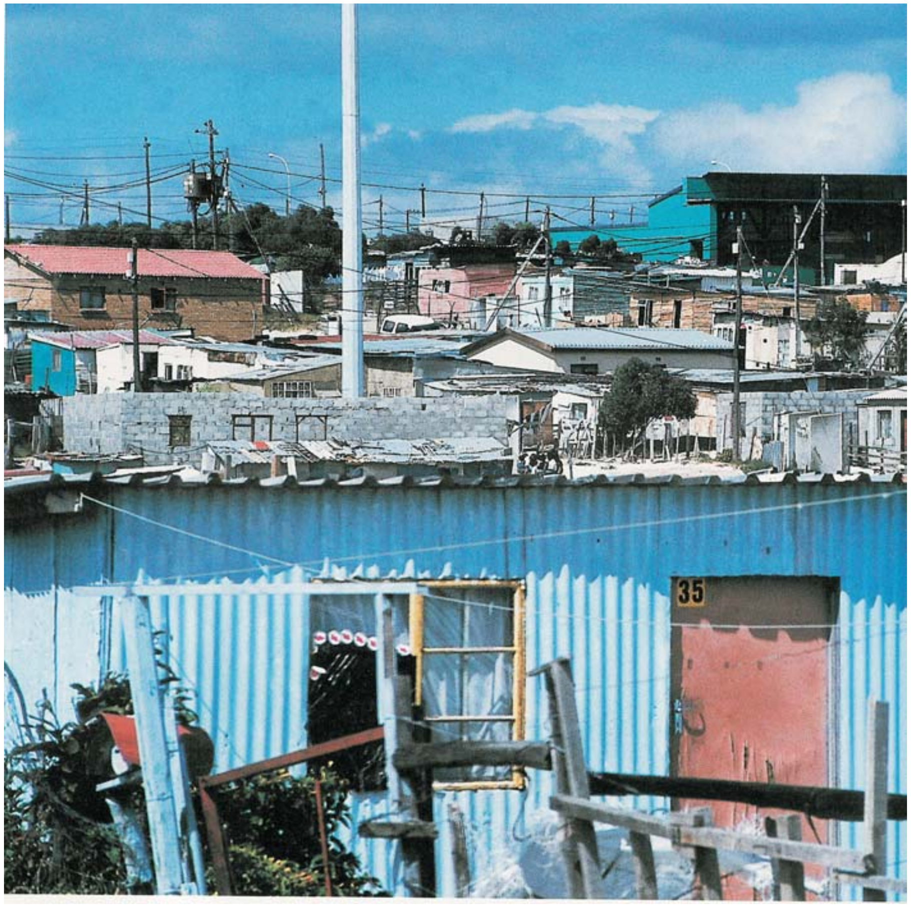


5 _ 15

Accommodation units and Ablution facilities are designed according to SABS0400: Part S. There are very few steps in the Youth Prison Facility, where there are steps such as in the contact visiting area, there is a ramp which caters for the disabled with a 1:12 fall. Access to all facilities is easy, edges between walls and floors are well defined and clearly marked

The proposed conceptual youth prison facility, Convention living and working patterns of the average South African, It 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.

(Gibberd, 2000: SBAT)


35

social issues - access to facilities

The proposed conceptual youth prison facility, Convention living and working patterns of the average South African, It 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.
(Gibberd, 2000: SBAT)

Childcare
Childcare provided in building or close by (within 3km)

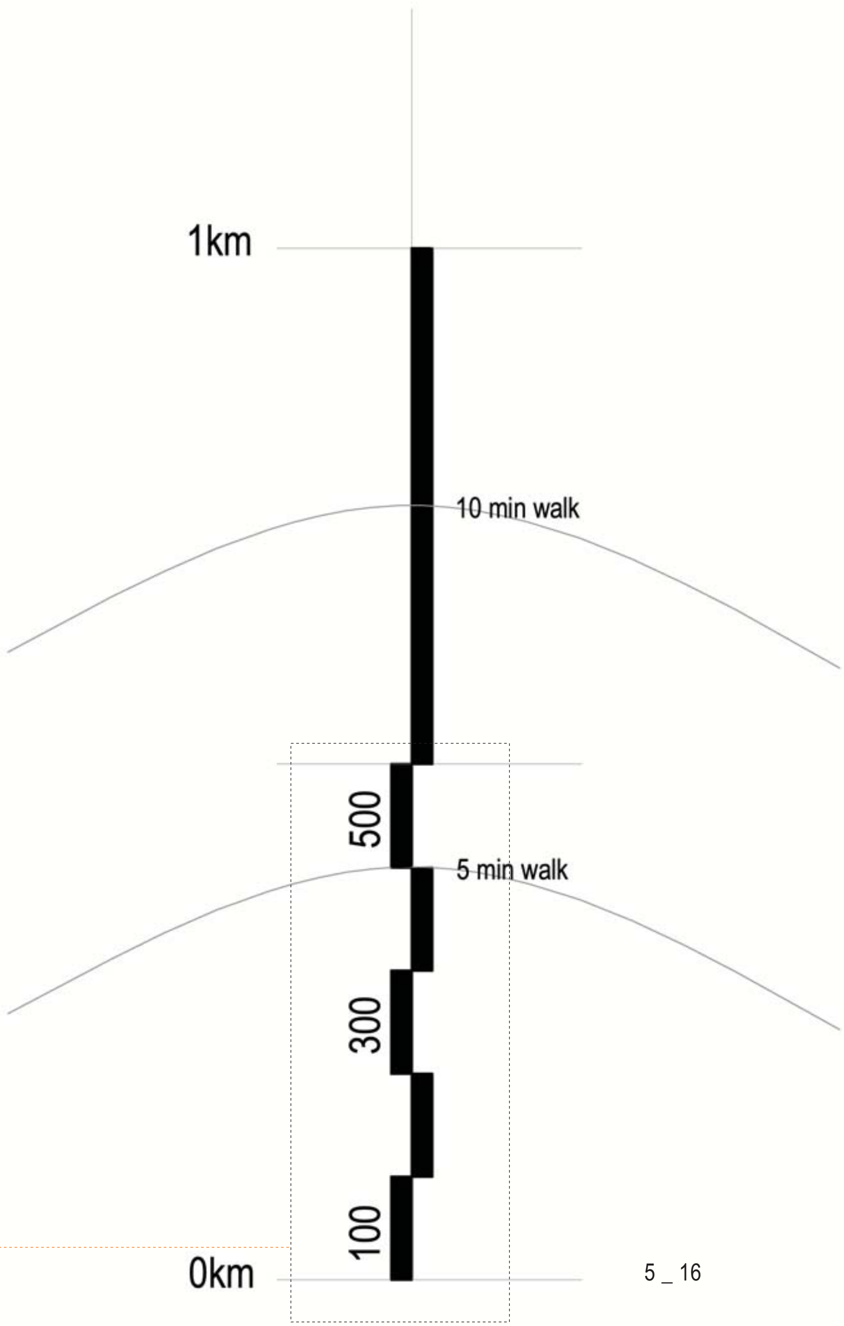
Banking
Banking services close by (within 3km)

Retail
Grocery, items required on a day to day basis available in building or close by (within 3km)

Communication
Postal, telephone or email facilities provided in the building or close by (within 3km)

Residential
Home, for occupants of the building is within 2km.

All of these facilities are located in the Leeuwkop residential village 2km in distance from the Youth Prison facility



5 _ 16

Within the conceptual design of the Youth prison facility it is important to 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 buildings and increasing productivity.

(Gibberd, 2000: SBAT)

social issues - participation & control

Within the conceptual design of the Youth prison facility it is important to 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 buildings and increasing productivity.
(Gibberd, 2000: SBAT)

Environmental control

Users of building have reasonable control over their environmental conditions; this should include opening windows and adjustable blinds

.

User adaptation

Furniture and fittings i.e. tables, chairs, internal partitions designed or specified allow arrangement/rearrangement by user. Provision made for personalisation of spaces if desired. This may include provision for pin boards, choice of colours, places for plants and personal storage. In the areas where prison inmates are, furniture and fittings will be vandal proof and to a certain extent adaptable

Social spaces

Design for easy informal / formal social interaction. This could involve a tea room with comfortable seating. Seating provided along regularly used routes. Spaces shared between occupants/users (i.e. photocopying rooms etc.) large enough to allow for comfortable social interaction. These spaces will allow for interaction between staff, inmates and visitors. (i.e. contact visiting area and the exhibition area)

Amenity

Easy access to refreshment facilities (tea point, kitchen, vending machines, canteens), green spaces and WCs for all users of the building,

CommunityInvolvement

The community should be involved to a certain extent with supporting the youth prison facility, by funding sport functions, exhibitions and concerts. A shop will be allocated in the Leeuwkop residential village where fresh produce and articles made by the prisoners will be sold to the community.

Education, Health and Safety

Buildings need to cater for the well being, development and safety of the people that use them. Awareness and environments that promote health can help reduce the incidence of diseases such as AIDS. Safe environments and first aid can help limit the incidence of accidents and where these occur, reduce the effect. Learning and access to information is increasingly seen as a requirement of a competitive work force. 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. (Gibberd, 2000: SBAT)

social issues - participation & control

Education

The Youth prison facility assist in assuring that the environment in which the staff, inmates and visitors find themselves in offer support for learning, through the possibility of internet access, structured courses for the staff, inmates, visitors and the community, reading material such as books, journals and newspapers. (The Star newspaper delivers newspapers to the education centre every morning)

Health

First aid kit provided in a central location. Policy to ensure that this can be used effectively. Information readily available on health, education, and career development issues. This could be in the form of a well serviced notice boards located in a central position.

Smoking

No smoking in public spaces, Space allocated for smoking where it will not affect other users, i.e. away from air intakes etc.

Security/Safety

Building complies with all health and safety requirements. Policy/regular checks in place to ensure that these are complied with.

The security and the safety of the staff, inmates and visitors are of great importance. Measures are taken to ensure that the transition from one secure area in to another is well managed and supervised, walkways, corridors and rooms are well lit, the risk of illegally breaking in or out of a building is minimized through designing openings and details in such a way as to prevent it from occurring. Routes and spaces are always under surveillance by cameras and are also visually linked.

5 _ 17

The construction and management of buildings can have a major impact on the economy of an area. The economy of an area can be stimulated and sustained by buildings that make use and develop local skills and resources. The conceptual Youth Prison facility is sited in the already existing Leeuwkop prison land parcel.

(Gibberd, 2000: SBAT)

economic issues - local economy

The construction and management of buildings can have a major impact on the economy of an area. The economy of an area can be stimulated and sustained by buildings that make use and develop local skills and resources. The conceptual Youth Prison facility is sited in the already existing Leeuwkop prison land parcel. (Gibberd, 2000: SBAT)

Local contractors

80% of the construction has been carried out by contractors based within 40km of the building/refurbishment

Local building material supply

80% of construction materials: cement, sand, bricks etc. produced within 200km of site

Local component manufacturer (Furniture?)

80% of building components i.e. windows and doors produced locally (within 200km)

economic issues - efficiency of use

Buildings cost money and make use of resources whether they are used or not. Effective and efficient use of buildings supports sustainability by reducing waste and the need for additional buildings. (Gibberd, 2000: SBAT)

Useable space

Non useable space such plant, WCs and circulation does not make up more than 20% of total area.

Occupancy

Building and all working/living spaces are occupied for an average equivalent minimum of 30 hours per week.

Space use

Use of space intensified through space management approach and policy such as shared work spaces i.e. 'hot-desking'.

Use of technology

Communications and information technologies used to reduce space requirements i.e. video conference, teleworking etc.

Space management

Policy to ensure that space is well used. This may include regular audits, or space management system that charges space to cost centres.

The high efficiency of use of the proposed work will ensure high performance of useable space according to the floor area provided. The buildings are designed for natural means of environmental control such as orientation for natural ventilation, lighting and thermal gains this all aids in allocating the unusable spaces as circulation routes and ablutions.

The occupancy of the Youth prison facility will stretch far beyond the benchmark of average equivalent minimum of 30 hours per week for the design houses mixed functions. The occupancy within the design concept will require an intensive design management approach to accommodate the mixed functions:

1. Access to the Youth prison facility by staff, inmates and visitors.
2. Security and control of access and movement
3. Ensure access, security and control to other functions of the concept.
4. Delivery access
5. Strict vehicular access

social issues - ongoing costs

Maintenance

Specification and material specification for low maintenance and or low cost maintenance. All plant and fabric have a maintenance cycle of at least 2 years. Low or no maintenance components (i.e. windows, doors, plant, ironmongery etc.) selected. Maintenance can be carried out cost effectively (i.e. replaceable items such as light bulbs can be easily reached and replaced). The most important consideration in this design is that the material has to be vandal proof i.e. light fitting, benches, windows and bathroom fittings

Cleaning

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

Security / Care taking

Security is most of the most important aspects in the design therefore it is important to design the facility in such a way that the means of escape is decreased.

Insurance / Water / Energy / Sewerage

Costs of insurance, water, energy and sewerage monitored. Consumption and costs regularly reported to management and users. Policy and management to reduce consumption (ie switching off lights on leaving building spaces) implemented.

Disruption and 'downtime'

Electrical and communication services, HVAC and plant located where they can be easily accessed with a minimum of disruption to occupants of building. This should maximising access to this from circulation areas (rather than work/living areas) and lift off panels at regular intervals to vertical and horizontal duckting.

"Qualities of light have profound responses within us: they are the wellsprings of feeling… with light as the palette, architecture can be supreme in the arts. It is a source of expression that we tend to ignore and the one aspect of architecture that we cannot divorce from meaning in our determined nihilism as long as night and day and the sun and moon work their pattern upon us. It is with light that we can bring soul and spirit back into architecture and perhaps find our own souls in the process."

(Erickson, Arthur.1975: 33)

environmental issues - lighting

"Qualities of light have profound responses within us: they are the wellsprings of feeling… with light as the palette, architecture can be supreme in the arts. It is a source of expression that we tend to ignore and the one aspect of architecture that we cannot divorce from meaning in our determined nihilism as long as night and day and the sun and moon work their pattern upon us. It is with light that we can bring soul and spirit back into architecture and perhaps find our own souls in the process."
(Erickson, Arthur.1975: 33)

Light is fundamental to our existence and to our perception of the world. Light is a life-giving force fuelling processes such as photosynthesis that allows flora and fauna to survive and thrive. It reveals our environment to us; it warms us; it affects our moods and senses of well-being Light is the medium by which we directly experience our surroundings, without light it would be impossible to comprehend and appreciate colour, depth, space and volume

Climate is also a very important aspect in the element of genius loci. The use of light in a building affects our feelings of comfort in relation to the thermal variables in each climatic zone. Light is connected to time in our experience and can express or stifle the expression of changing time in buildings. Light does not only provide us with illumination for visual activities, it also enriches our experiences.

There are thermal realities associated with the introduction of light into a building that cannot be avoided.

- The introduction of heat along with direct sunlight.

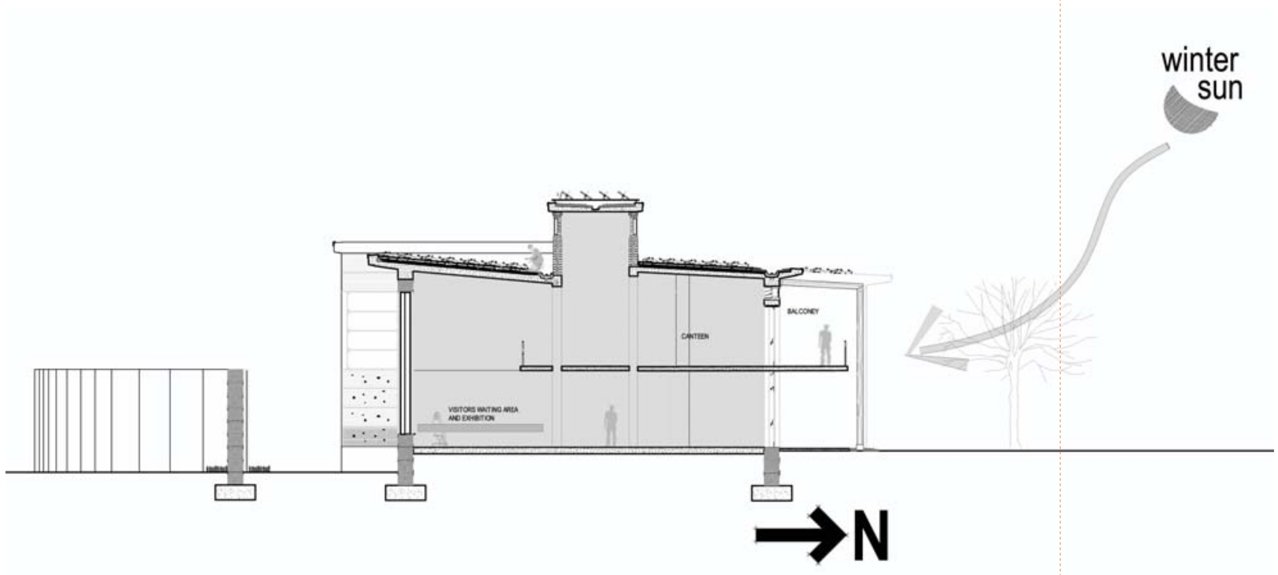
- Heat loss through glazing when the temperature outside is lower than the temperature inside.

- The addition of heat to the interiors when electric lighting fixtures are operating.

Any building that wants to provide both comfort and delight must respond to there realities.

The connection with light and heat is evident in small rooms with large windows that are facing south. The occupants are unable to escape neither the dazzling light nor the high temperatures produced by the trapped heat from sunlight.

Based on the basic requirements for lighting, conceptual details have been set-up to give a basic understanding of the design approach specific to the Youth prison facility concept.


winter
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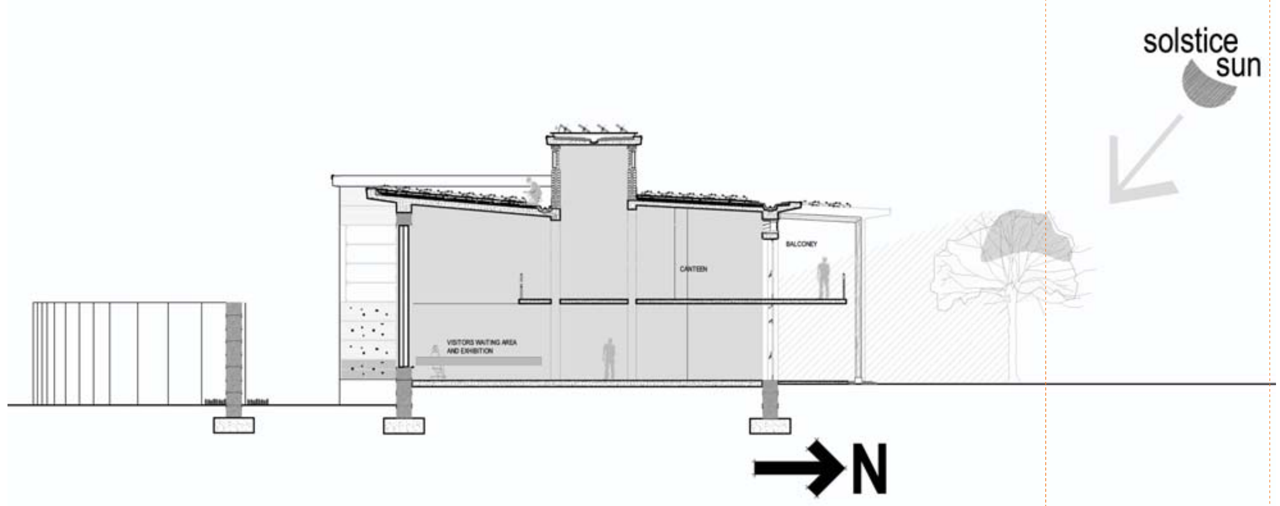
5 _ 18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5 _ 19

environmental issues - lighting

Visual Comfort

Lighting is required for the functional purpose in the building to enable the completion of visual tasks and for human safety. The principles for satisfying these requirements are climate independent.

The climate dependant issues come from the quality and quantity of the day lighting found in different climates. This in turn is related to the sky conditions and the levels of solar radiation, which vary in the different types of warm climates. Hot humid climates are fairly cloudy during the year, with 60 – 90% cover. Luminance from the clear sky is high but is reduced with overcast conditions to approx. 12% of the clear sky conditions.

The clear sky conditions in both the moderate and hot dry climates give high levels of light and solar radiation. Form the table it is evidently show that there is enough daylight for interior lighting, but the larger amounts of solar radiation admitted into the building is the main concern. Particularly in the moderate climates where there are long periods of clear sky conditions. this is a difficult problem for with the light there is also a release of heat, with a $1m^2$ skylight 1000w heat is released this is the equivalent of to the sensible and latent heat load of 6 to 7 occupants. In moderate climates there is an abundance of natural light; the challenge for the designer it to utilize the natural light without the heat gain.

The climate responsive design issues concerned with day lighting are:

1. Diffuse light: the use on diffused light where possible, rater that direct sunlight, to avoid heat gain and ultraviolet degradation of the interior materials and furnishings.
2. Heat gain form glazing: the provision of external shading to reduce direct solar gain but allow sufficient lighting for natural lighting; optimize the glazing ratio to provide appropriate natural lighting conditions and provide ventilation to remove the heat gain associated with the glazed areas.
3. Glare: use of materials and colors to avoid high contrasts in the external and internal lighting conditions; elements such as landscaping, frosted or colored glass and screens are of use as buffers to moderate internal and external conditions
4. Light transmission and thresholds: in situations where contrasts occur, avoid sharp contrast in light levels to avoid disabling glare; set electrical lighting threshold to smooth transition from natural light.

Other consideration to take into account when designing:

- Provide environments that are visually stimulating. Humans respond well to variations in lighting levels, comfortable contrasts and pleasant changes in light and shadow.

- Provide as much natural light as possible. Coordinate supplemental light sources with available daylight.

- Consider creative integration of daylight, energy efficient lighting options and effective control strategies. Include daylight as a factor when trying to meet industry standards for lighting.

- Optimize the spaces being illuminated with the appropriate colors, surface treatments, room proportions and ceiling heights for the tasks involved.

	HOT HUMID	HOT DRY	MODERATE
TYPICAL SKY LUMINANCE, LUMENS			
Clear skies	7500	10800	100000
Overcast, obscured	9000	9000	20000
TYPICAL SOLAR RADIATION, Wm^2			
Clear skies	750	1080	1000
Overcast	90	90	200

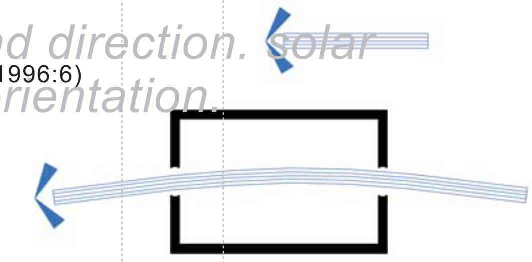
5 _ 20

This ventilation system for the non-smoking/filtered building will be sufficient according to SABS 0400. Lobbies - 5.0 litres/s Show room – 7.5 litres/s Cafeterias – 5.0 litres/sThe minimum air which needs to be supplied is 5.8litres/s Will have a maximum of 200 people in the visitors' facility 5.8litre/s x 200 people = 1160 litres/s of fresh air required per person = 1.16m3/s of fresh air required per person (500litre/s = o.5 m3/s) The minimum fresh air required in the building is 1.16m3/s. Calculations: Interior floor area of Lobby and Exhibition space (double volume) = 1088m²=108.8 m² rock bin to be provided=l x b x h=22 x 2 x 2.5=110m²

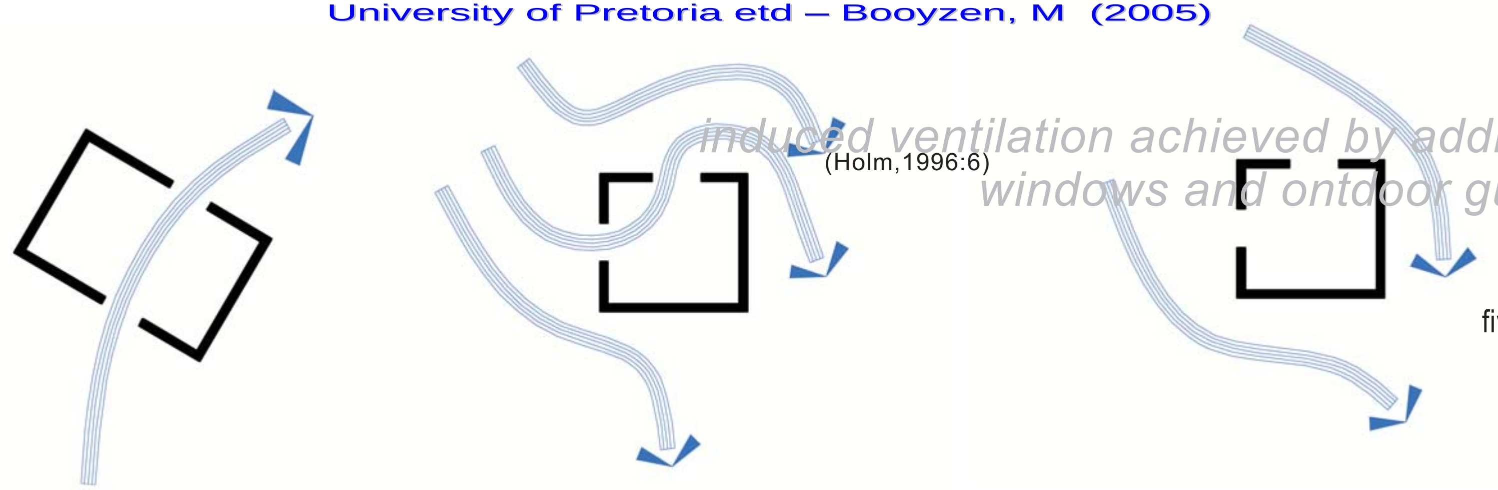
SABS 0400.

position of windows relative to ruling wind direction. solar orientation is less forgiving than aeolic orientation.

(Holm,1996:6)



environmental issues - ventilation



induced ventilation achieved by additional windows and outdoor guides.

(Holm,1996:6)

Ventilation comes from the word 'ventus' in Latin, and means the movement of air.

The buildings envelope separates the indoor and outdoor environments.
In the winter ventilation should be minimized to prevent heat loss. In the summer the building can be cooled by the removal of heat by convection.

Air movement is especially important in climates which are hot and humid for occupants' comfort. The prevailing wind creates characteristic air flow patterns around buildings or obstructions in general. Positive pressure zones occur on the windward side and suction on the leeward side.

environmental issues - ventilation

Air movement through a building depends on difference in air pressure. The required changes in air will be achieved through different passive systems

Solar passive system

This system allows for the optimum design of the building envelope. In most climates the optimum design may still need an additional heating and cooling system, to keep an indoor environment with in the comfort zone. This can achieved through passive solar collection and heat loss strategies.

Heat can be store in elements with a high thermal mass like concrete, rock, brick and water. These devises are usually fixed and part of the building.

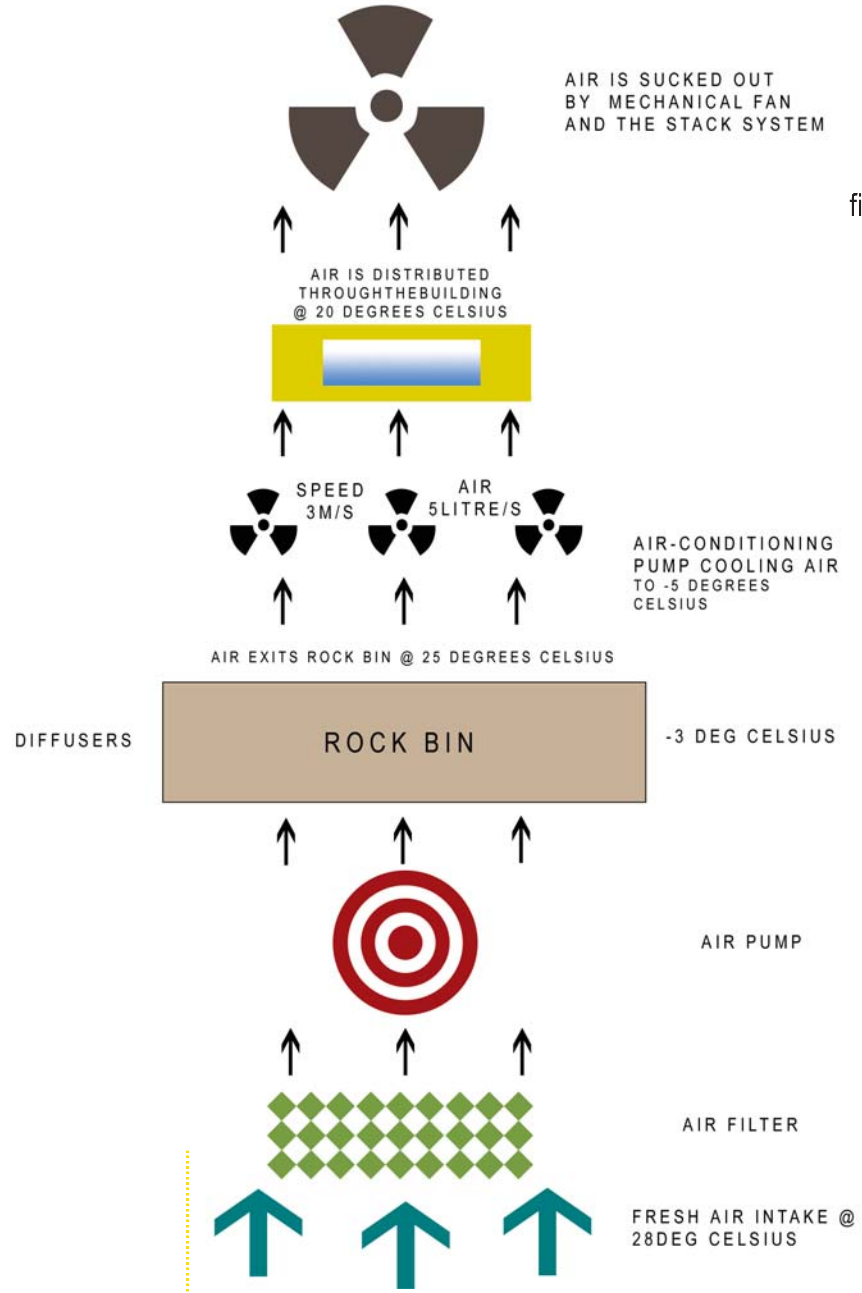
Rock bin

The rock bin system will be implemented to keep the building cool during the hot summer month.
A rock bin is a bin filled with rocks. The air is drawn through the openings between the rocks and cooled. The ground has a constant temperature of 15 – 20 deg Celsius therefore a good place for the rock bin would be under the building. There is a main gabion wall running along the south façade of the building and rock bin would run along the same line

The air reached the interior of the building at an average of 20 degrees Celsius therefore it is necessary to cool the air even further with the help of an air-conditioning system which will further cool the air another 5 degrees. Using this system will degrease the operating cost and size of the air-conditioning system.

For every 10m² of floor space you need 1m3 rock bin.
The maximum flowing distance if the rock bin air is 2m.
Airflow rate must be between 3 – 8 m/s otherwise it becomes to noisy.

Section area (m²)
Flow rate (m3/s)
Formula: Flow rate = Speed x area
Ventilation rate: 2 x volume of room m3/3600s


AIR IS SUCKED OUT
BY MECHANICAL FAN
AND THE STACK SYSTEM
AIR IS DISTRIBUTED
THROUGHTHEBUILDING
@ 20 DEGREES CELSIUS
SPEED
3M/S
AIR
5LITRE/S
AIR-CONDITIONING
PUMP COOLING AIR
TO -5 DEGREES
CELSIUS
AIR EXITS ROCK BIN @ 25 DEGREES CELSIUS
DIFFUSERS
ROCK BIN
-3 DEG CELSIUS
AIR PUMP
AIR FILTER
FRESH AIR INTAKE @
28DEG CELSIUS

5 _ 22

environmental issues - ventilation

Cross ventilation

In this systes openings are orientated directly towards the ruling wind direction will receive greater air speed that openings oblique to the direction of the wind. No air flows into the building through openings situated parallel to the direction of the wind.

Different types of window openings also affect the amount of air flow:

- Top hung windows direct air flow up.

- Horizontal pivot windows direct air stream downwards.

- Vertical pivots and casement windows catch wind blowing from other directions.

The building will be ventilated through cross ventilation, rock bid and the stack system. Spaces are designed to allow maximum cross ventilation and the atrium will act as a stack system to ensure that unwanted warm air during the summer will escape through windows at the top.

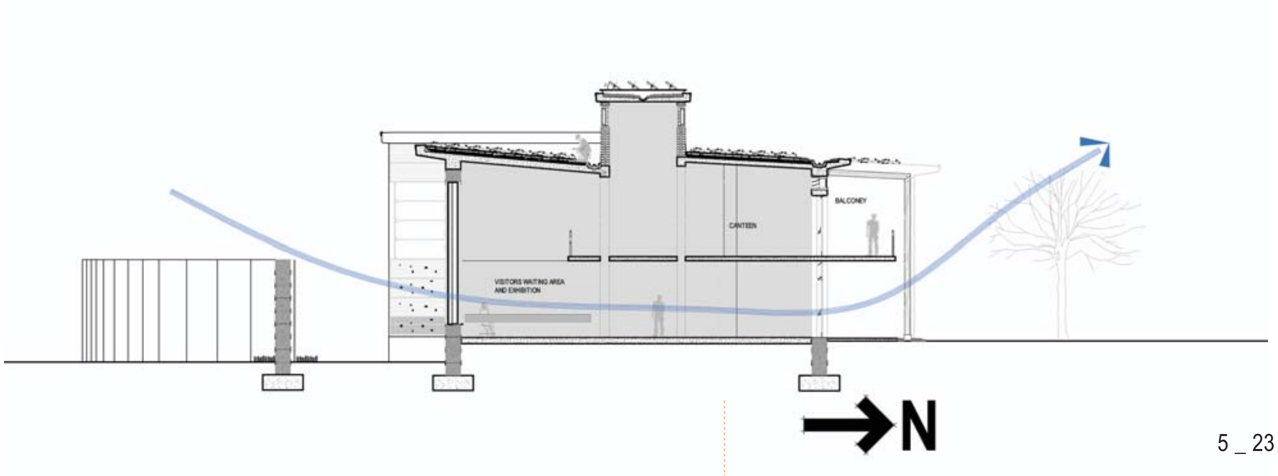
Stack effect (atriums)

Stack ventilation is achievd through the process of buoyant warm air rising upwards in a building and exiting through high-level openings. The air is replaced by cooler air drawn into the building through low-level openings such as louvres/doors. The main benifit of the stack effect is that the temperature between the indoor and the outdoor air is the driving force for the ventilation and will be effective on days when there is no or little wind.

The stack effect is particulary effective for night time cooling when there is the greates difference between internal and external temperatures.

It is only effective when outside air is cooler than internal air and if the path is reletively clear from obstructions so that the air can travel from a low-level openings to high-level openings.

All rising air will be removed through the stack system; this system will be supported by an extractor fan mechanical system which will suck the hot air out. These fans will be closed during the winter months and will require no maintenance; if maintenance is required they are easily accessible from the roof. All cold air will move through the louvered floor gaps into the building, up through the stack and out through the clerestory louvers at the top.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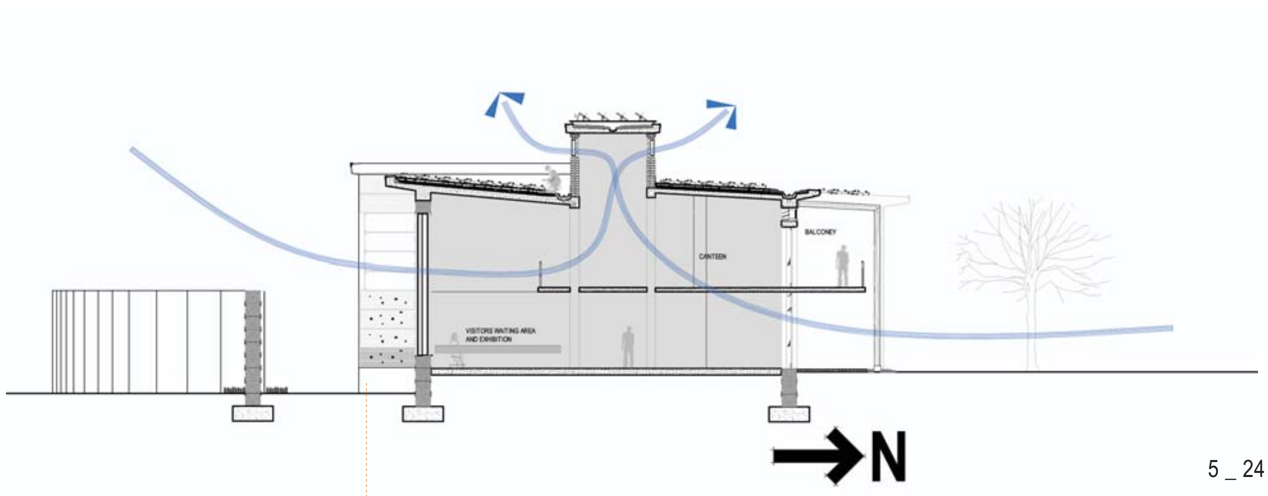
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AND EXHIBITION
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5 _ 24

environmental issues - ventilation

Other consideration to take into account when designing:

-Evaluate the site and surrounding area for potential sources of interior air pollution. Carefully consider the impact of traffic, transit drop offs, parking lots, dumpsters and other pollutants that can readily enter a building.

-Avoid materials and furnishings comprised of petrochemicals and volatile organic compounds to reduce harmful off gassing.

-Give special attention to ventilation requirements and system configuration and controls.

-Perform cleaning and maintenance with nontoxic cleaning products and procedures.

-Pesticides and herbicides should be used sparingly and only when necessary. Benign, natural methods

·Optimize the thermal envelope before relying on building space conditioning systems for environment control

·Use available computer modeling whenever possible to investigate the performance of various thermal envelope materials and configurations.

·Understand the relationship between radiant surface temperatures and comfort. High performance glazing and enclosure systems that provide acceptable interior surface temperatures can reduce the need for expensive perimeter conditioning systems.

·Recognize the influence of site and building orientation when designing building enclosure systems. Select wall and glazing materials that respond to variations of wind and solar loads associated with orientation.

·Understand the role of building mass in controlling thermal comfort, especially in interiors. High mass buildings have an inherent ability to stabilize temperature swings and can contribute to cooling strategies using nighttime air.

·Bring the outdoor into the building. Designs that incorporate atriums, light wells or connections to patios and terraces can also integrate natural light and ventilation.

·Choose enclosure systems that perform well in varying seasonal conditions. Exterior rain screens with vented voids behind, such as brick cavity walls or pressurized curtain walls perform better that solid masonry or low quality window mullion and glazing combinations.

·Select enclosure materials and detail building assemblies to limit uncontrolled infiltration.

The room temperature for load calculations will be based on 24 deg Celsius in the summer and 20 deg Celsius in the winter months with a maximum humidity of 57%Rh. The required ventilation in a building should be provided by natural means. No mechanical ventilation should be used in the building other than in toilets and kitchens.

(Gibberd, 2000: SBAT)

·Depend on thermal envelope performance and natural space conditioning and ventilation strategies before engaging mechanical systems

·If outside conditions are acceptable, design the structure to take advantage of prevailing breezes to maximize natural ventilation.

The quality of environments in and around buildings has been shown to have a direct impact on health, happiness and productivity of people. When an environment is healthy it contributes to sustainability by being more efficient and therefore reducing resource consumption and waste. The quality of this environment needs to be achieved at minimal cost to the environment.

(Gibberd, 2000: SBAT)

environmental issues
- thermal comfort

"..... architecture, beyond providing physical forms for human activities, also interprets to human beings their place in nature and society "
(Harries, Karten. 1984: 51)

The thermal performance of buildings is the process whereby design, layout and orientation as well as the construction materials of a building, adjust the existing outdoor climate to create the indoor climate. There is a need to account for the amount of heating and cooling required in creating thermal comfort of occupants.

Thermal performance is measured in degrees Celsius and the information evaluated can be used to establish the maximum indoor temperature in the summer and the amount of energy required to maintain a minimum temperature throughout the winter months. This is expressed in kWh/m2.

When designing a building it is very important to take into consideration the two major influences of thermal performance:

- The buildings heat absorbing capacity.

- The thermal resistance of its shell.

The values of each of these vary according to their material usage and the way in which these materials are used. (Burnt clay bricks, timber, steel, concrete, and corrugated iron.) The heat absorbing capacity also depends on the building mass and the density of the materials, which it is constructed from. The greater the density and the mass of the external and internal walls, the more heat can be absorbed. The insulating properties of a material or building element depend on the extent to which it limits the transmission of heat through it. The ability of a building component such as a wall to transmit heat is expressed as the U-value of the component.

The U-value of building components is defined as the amount of heat transmitted in watts per square meter per degree Celsius difference in temperature between air on one side of the component and air on the other side of the component. The U-value, therefore, takes into consideration the thermal transmittance of both surfaces of the component as well as the thermal transmittance of individual layers and air spaces that may be contained within the component itself.

Each materials heat absorbing capacity and insulation property, determines the heat storage capacity of the building.
The siting of the building is very important when there is a need to create a comfortable thermal interior environment.

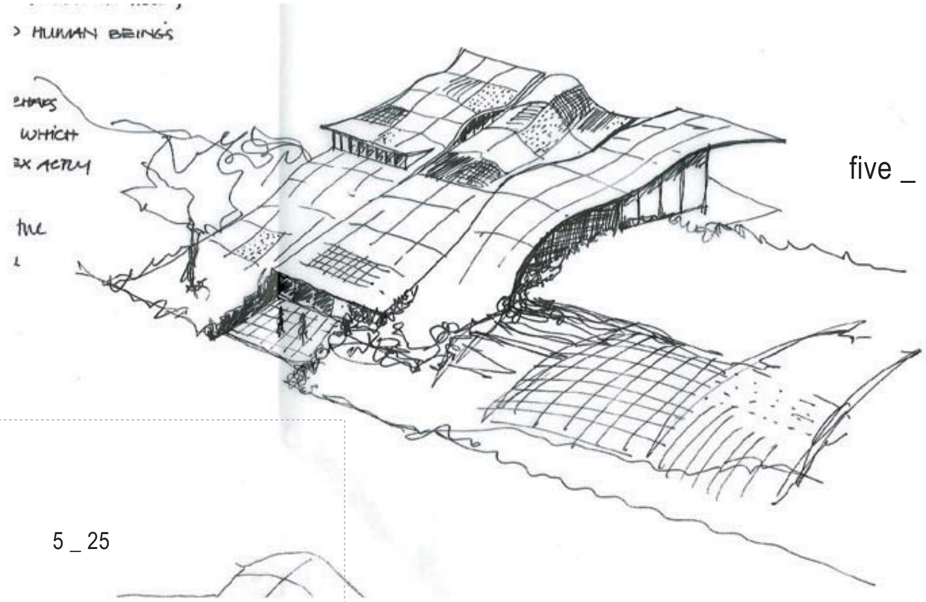
The youth prison facility is sited in a dry area with wide diurnal variations in outdoor temperatures, the buildings have a greater heat storage capacity and therefore will tend to even out the effect of the outdoor fluctuations in temperature by absorbing and storing heat during the day without passing much of the heat to the inside of the building, but gradually losing heat to the indoor and outdoor environment at night.

environmental issues

- thermal comfort

Roof tops have played a very unglamorous role in modern construction. The top surface of typical buildings is a very necessary component that is technically addressed in the design and construction of the building and then goes unnoticed by everyone except the maintenance crew. The horizontal surface that once defined the building site, which was full of life and rejuvenating processes is replaced by a single one-dimensional plane several stories in the air. The solution for this problem would be a green roof, a waterproof protection layer with a top layer of plants embedded in a growing medium. It this way the new vegetation replaces the ecology destroyed by the footprint of the new building the plants can be simple grass carpet or a lusciously elaborate garden.

The main benefit of a green roof is that it is environmentally beneficial and it helps with storm water management, a green roof slows down, reduces and even cleans storm water runoff. This permeable layer absorbs and retains water which allows allot of avapotranspire and only a very slowly releasing the rest to the ground this gives chance of reaching an aquifer rather than simply disappearing down a pipe. A green roof with low-growing vegetation can absorb up to 70% of the rainwater it receives and air pollution that is swept up by precipitation like nitrogen and phosphorous are filtered out by the vegetation before they can pollute the ground water systems.



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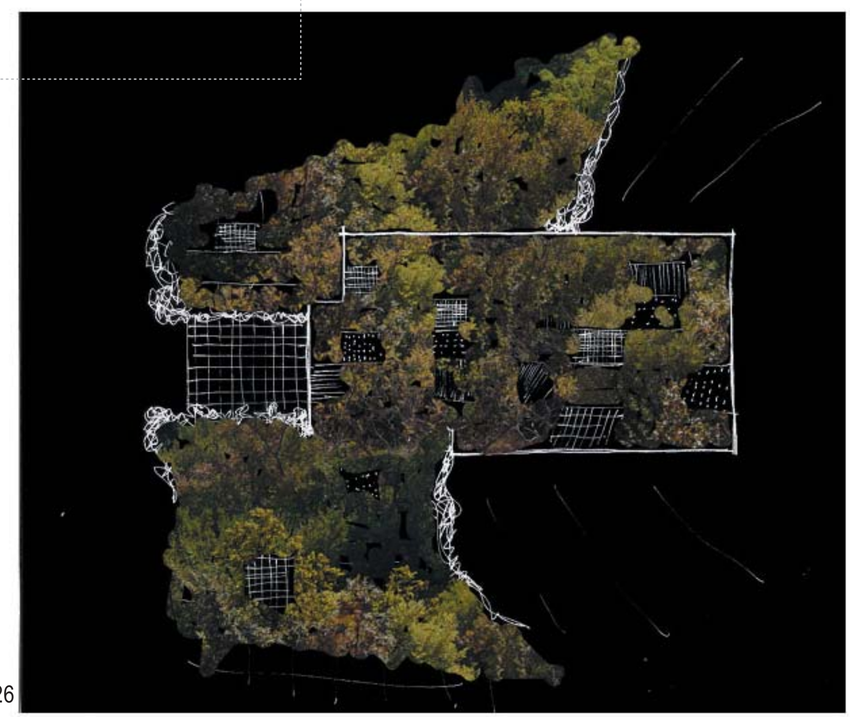


5 _ 26

environmental issues
- thermal comfort

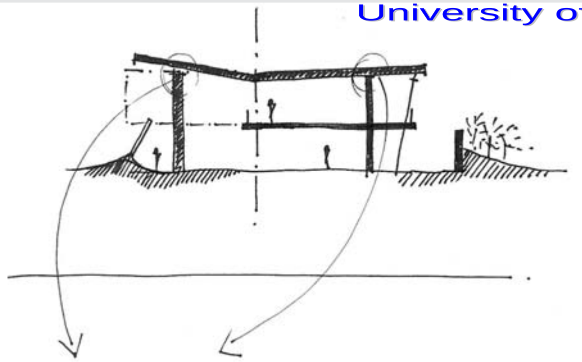
Although green roofs are upfront more expensive, in the long run the operational savings in terms of energy consumptions and the maintenance cost with off set the construction premium associates with a simple green roof with low-growing vegetation. In addition to all these benefits, the living roof provides aesthetic and psychological relief to a concrete and asphalt urban jungle.

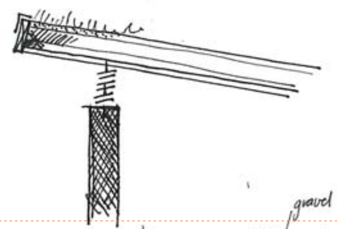
There are three conditions which damage a typically black membrane roof; brittleness caused by the sun's UV radiation, thermal shock due to temperature differences between the top and the bottom layers and the punctures resulting from pedestrian traffic of dropping of tools. The vegetation and soil layers of a green roof protect the membrane against all three. Assuming that the membrane was installed properly the first time it should last far longer than a normal exposed roof membrane. The estimate life span is around 20 to 40 years.

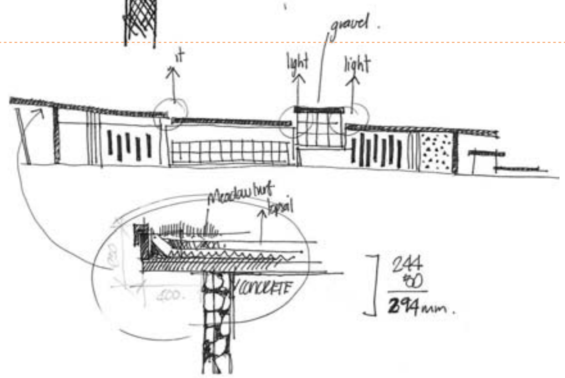
The most important purpose of a green roof is to keep water out of the building it does this with several protective layers: waterproof membrane, drainage system, fabric filter, growing medium and vegetation. Depending on the system an insulation layer may be place below the membrane.

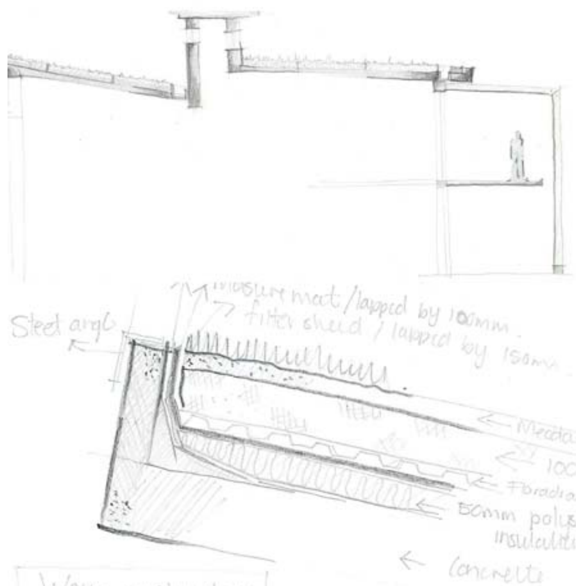
The waterproofing membrane is the most crucial, vegetation can be replanted. You do not want a leaking roof.

A drainage system is required below the soil layer to handle the excess water due to heavy rains. The system consists of elevated airspace through with the water can run once it reaches a certain level it flows off the roof through interior drains. The drains can be designed so that it collects water which can be saved and used in the dryer seasons. A very fine cloth filter is place between the growing medium and the drainage system so that only water can pass through.





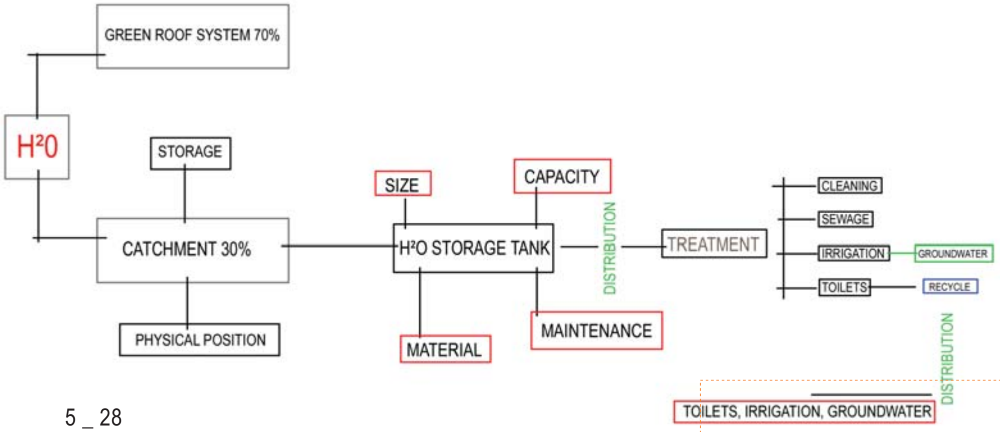

gravel
light
light
Meadow turf
topsoil
CONCRETE
244
50
294mm.


Steel angle
Concrete

5 _ 27

Water is required for many activities. However the large-scale provision of conventional water supply has many environmental implications. Water needs to be stored (sometimes taking up large areas of valuable land and disturbing natural drainage patterns with associated problems from erosion etc), it also needs to be pumped (using energy) through a large network of pipes (that need to be maintained and repaired). Having delivered the water, a 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.

(Gibberd, 2000: SBAT)



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environmental issues - water

Rainwater

The roof is a green roof structure which absorbs 70% of the rain water the other 30% is gathered and stored in storage tanks below the building.

Water storage

Area of the roof = 1120m²
Harvested rain water = 30% of 833.36kl = 250kl
Current cost = R3/kl
Possible annual savings on only the visitors centres roof = R750
For storage only one 9000 litre tank will be necessary

Water use

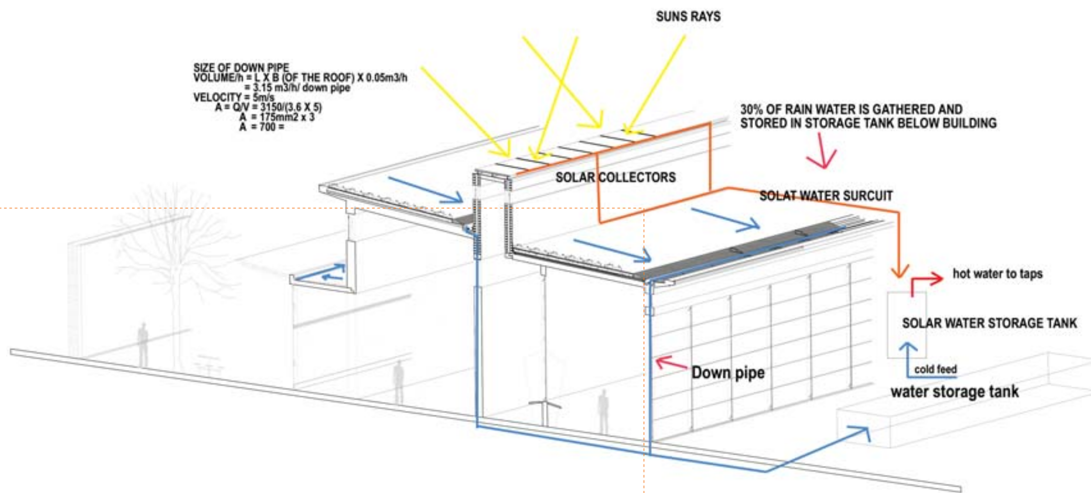
All water devices should minimize water consumption and encourage efficiency of use.
Use efficiency:
Toilets - below 6 litre of water
Taps – below 0.03 – 0.07 litres per second (specify low flow taps)

Grey water

Grey water (water from washing etc) recycled (to flush toilets or water plants)

Runoff

Run off reduced by using pervious or absorbent surfaces. Hard landscaping minimised, previous surfaces specified for car parking and paths.



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	Average rainwater in mm/month for Johannesburg	Total amount of water falling visitors centre roof = 1000m²
January	101mm	113.2kl
February	109mm	122.08kl
March	64mm	71.68kl
April	38mm	42.56kl
May	48mm	53.76kl
June	4mm	4.48kl
July	2mm	2.24kl
August	2mm	2.24kl
September	11mm	12.32kl
October	83mm	92.96kl
November	169mm	189.28kl
December	113mm	126.56kl
TOTAL	744mm	833.36kl

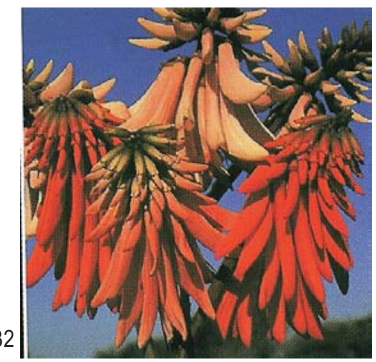
5 _ 30

environmental issues - planting

PLANTING ***All planting specified has a low water requirement. (Indigenous species) Hard surface paving will be restricted(even through the materials need to vandal proof and hardy); landscaping will aim towards water-permeable hardening for it enlarges the water collecting area, which favours micro-climates. Run-off will reduce when soft landscaping is used. Trees and lawn (soft landscape) will filter and absorb water.***

5 _ 31

[Arcacia xanthophloea]

5 _ 32

[Erythrina iysistemon]

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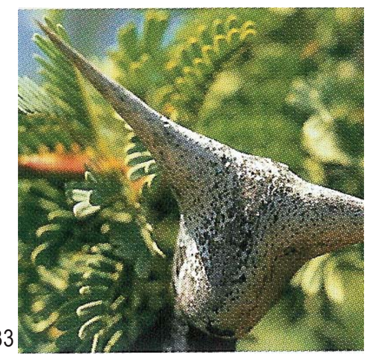
[Arcacia erioloba]

THE INDIGENOUS PLANTING WILL INCLUDE: ***Indigenous trees (planted on the northern side of the building for sun (winter) and shade (summer). All the trees are thorn trees as to prevent inmates from climbing and hiding in them:Erythrina iysistemon, Arcacia xanthophloea, Arcacia erioloba. Other plants will include: Aloe angelica, Aloe arborescenes, Aloe cryptopada, Aloe ferox. Roof planting will include: Aptenia cordifolia, Carpobrotus andulis.***

5 _ 34

[Flowers. Visi, 2002]

5 _ 35

[Aloe ferox]

5 _ 36

[Aloe]

[Aptenia aordifolia]

5 _ 37

5 _ 38

[Carpobrotus andulis]