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CHAPTER 7

technical report

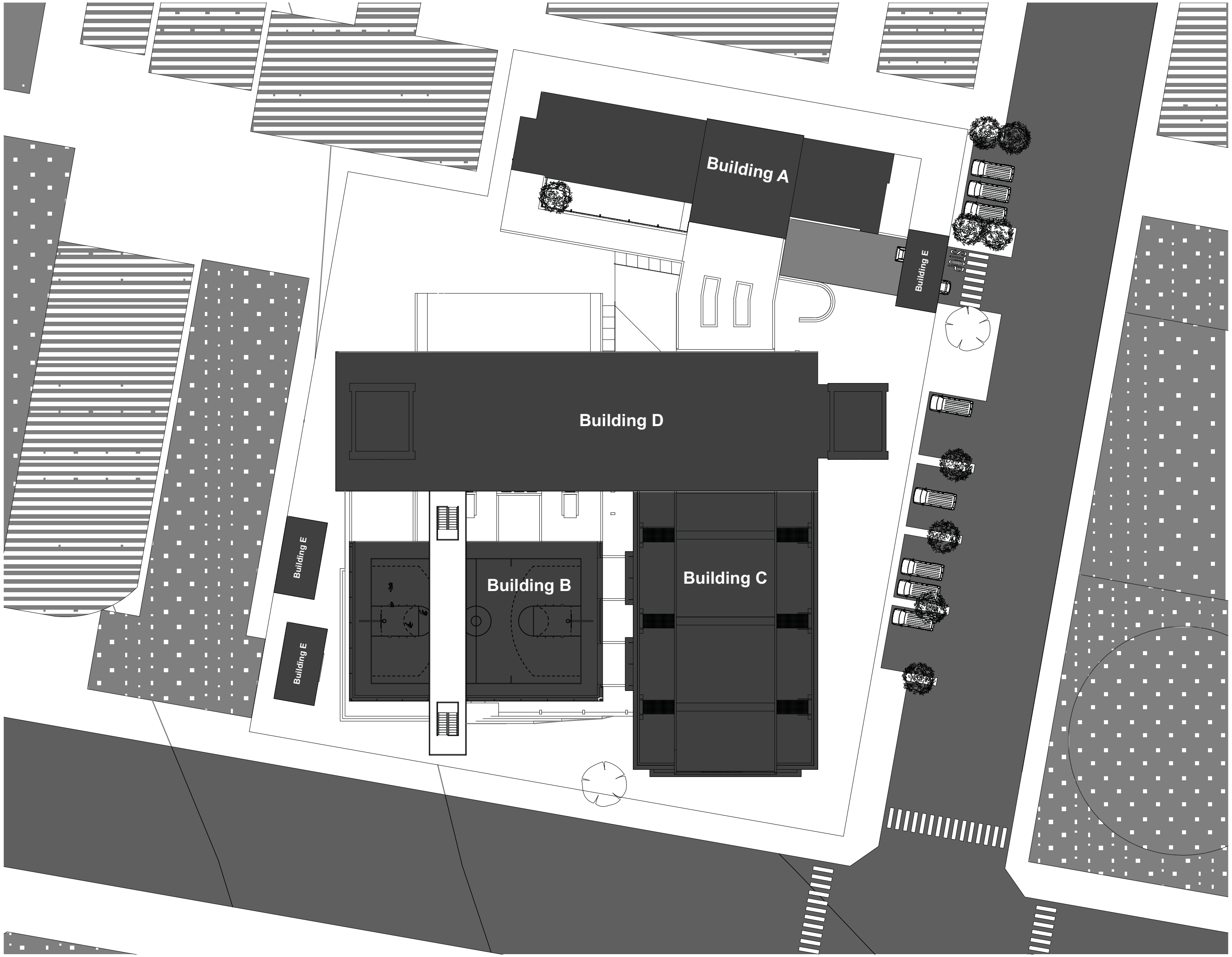


Figure7-1 . Simplified Site Plan

7-1 Report

In order to explain the various structural systems found in the centre, the buildings are broken up into their various entities and explained individually.

A structural overview can be summarized as follows:

- Basement - Reinforced concrete retaining walls, columns and slabs.
- Building A - Load bearing brick walls and reinforced concrete columns and slabs with lightweight cladding and glass infill.
- Building B - Reinforced Concrete columns and roof with brick interior walls and glazed shop fronts.
- Building C - Reinforced concrete columns and slabs with lightweight walls. Roof consists of Sawtooth structure.
- Building D - Reinforced concrete tower structures with Vierendeel Truss in between (Ching 2001; 2.16). The structure is filled in with lightweight walls and floors.

For the tectonic development of the Youth Centre to form an extension of the design the technical aspects were approached with the same principals as the design. The visible structure helps to establish a sense of reality to the otherwise surreal elements of the building.

A continuous structural grid was established by the position of the circulation tower structures of building D, the column grid of the basement and the access to the basement. The column spacing determine the structure for the rest of the buildings.

Cost, thermal and construction methods are factors that were also taken into account while choices were made regarding construction.

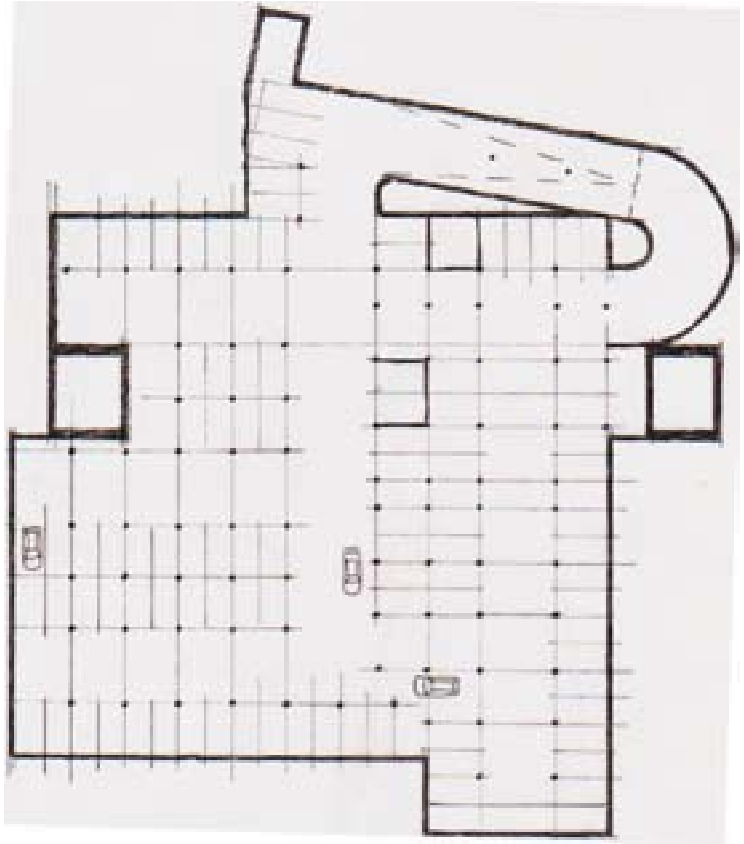


Figure 7-2. Basement column grid

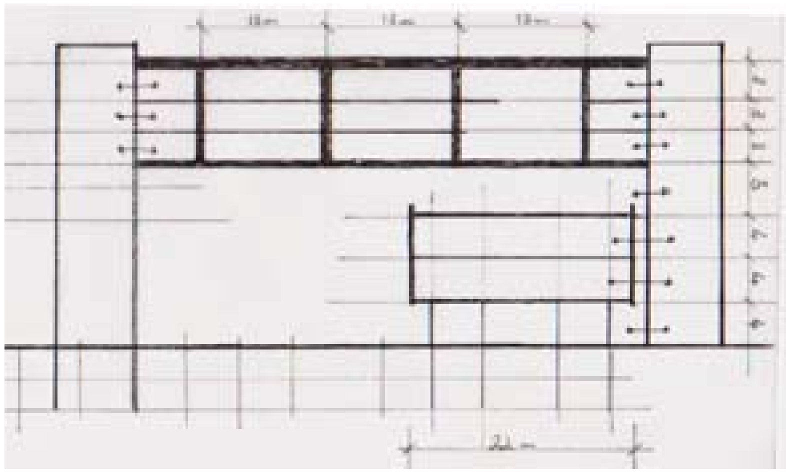


Figure 7-3. Conceptual section

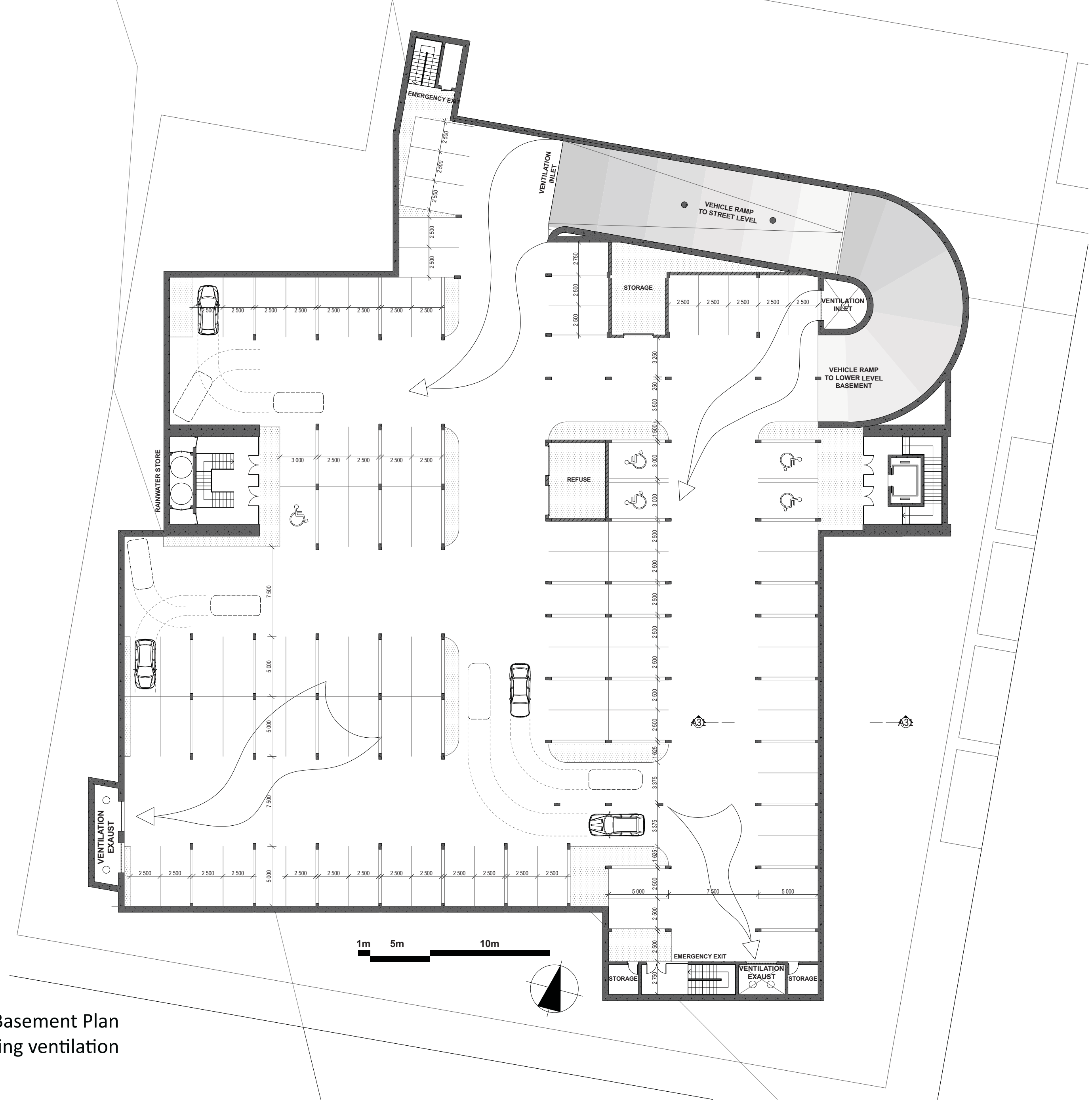


Figure 7-4. Basement Plan showing ventilation

7-2 Basement

The basement is arranged over two levels making it a super basement.
The total depth is 6,5m.

The vehicle access ramp has a gradient of 1:10 making it possible for pedestrians to walk up and down the ramp as well.

The predominant pedestrian circulation happens through the main tower structures of building D. The basement has two additional emergency exits. One in the north-western corner connecting the basement with the day-care facility and one in the south-eastern corner linking the basement with the sidewalk on Schoeman street.

Because of the depth of the structure it will have to be mechanically ventilated. Two exhaust ducts are placed in the southern half of the basement drawing in clean air through the ramp opening and the intake duct located in the northern half of the structure.

The structure of the basement consist of reinforced concrete columns arranged and distributed according to parking bay sizes.
The columns are connected with 550mm deep reinforced concrete beams that are integrated with the floor slabs. The beams reduce the span of the slabs to 5m.

Size of columns and slabs:

Column width	=	Height / slenderness ratio	
	=	3000mm / 15	
	=	200mm minimum	

A nominal size of 250 x 500 mm is used.

Slab thickness	=	Span / slenderness ratio	
	=	5000mm / 30	(span between beams)
	=	166	

A nominal depth of 200 mm is used.

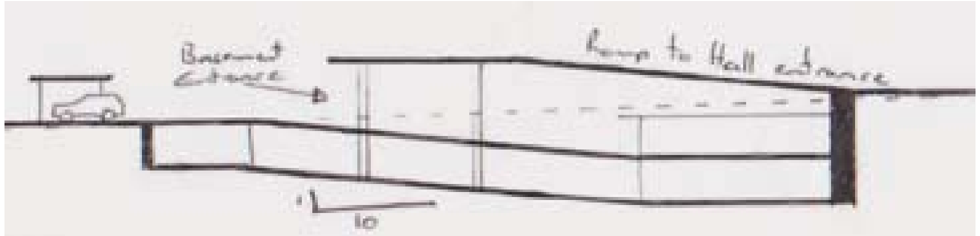


Figure 7-5. Section through vehicular access ramp

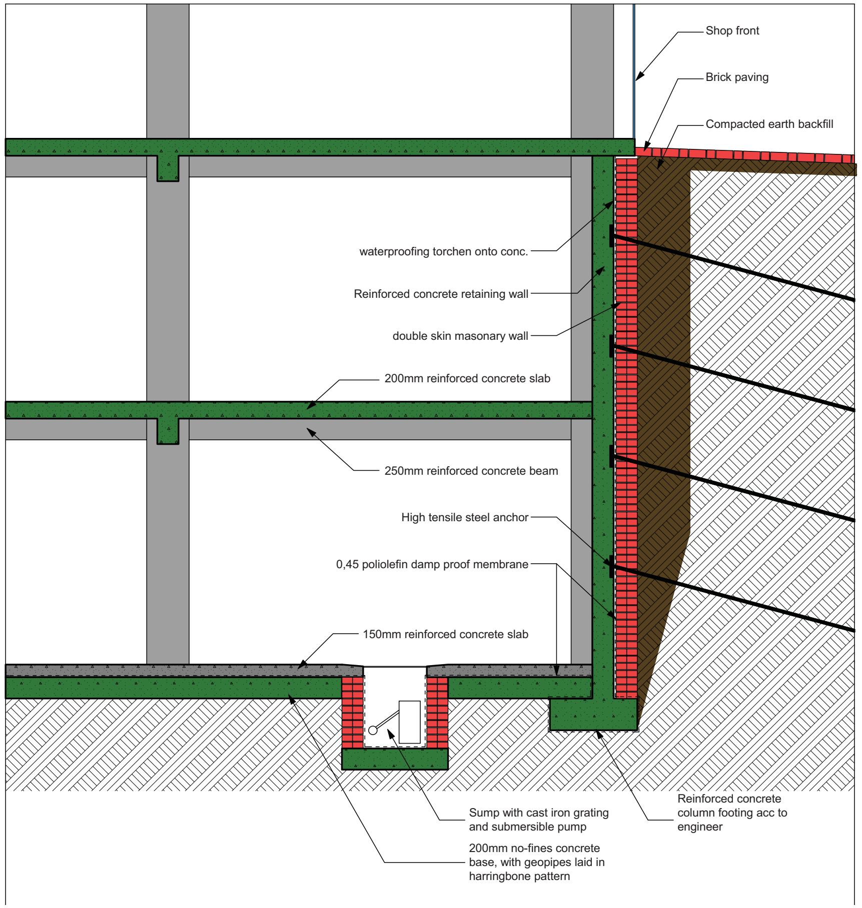


Figure 7-6. Section through basement retaining wall

Figure 7-7. Floor diagram of Building A.

7-3 Building A Day-care

The building is predominantly arranged over 3 floors. Load bearing brickwork constructed of double skin brick would be used to support the floors. The floors are constructed of in situ cast reinforced concrete slabs.

Where the span is too wide or the height increases, concrete columns and beams are added for support.

The width and properties of the brick walls will provide enough acoustic insulation between the classrooms.

Interior walls are plastered and painted. The wall exposed to the outside are cladded with either copper or siding.
The exposed concrete structural walls are to be left as untreated off shutter concrete.

The building is naturally ventilated with windows on the northern and southern side of the building creating adequate cross ventilation.

Passive solar heating through the northern glass facades will heat the spaces in cold winter months.

The roof construction is a combination of usable concrete roof gardens and low pitch lightweight steel roofs with chromadeck sheeting.

Size of columns and slabs:

Column width	=	Height / slenderness ratio	
	=	3000mm / 15	
	=	200mm minimum	

A nominal size of 250 x 500 mm is used.

Slab thickness	=	Span / slenderness ratio	
	=	7000mm / 30	(max. span)
	=	233mm minimum	

A nominal depth of 250 mm is used.

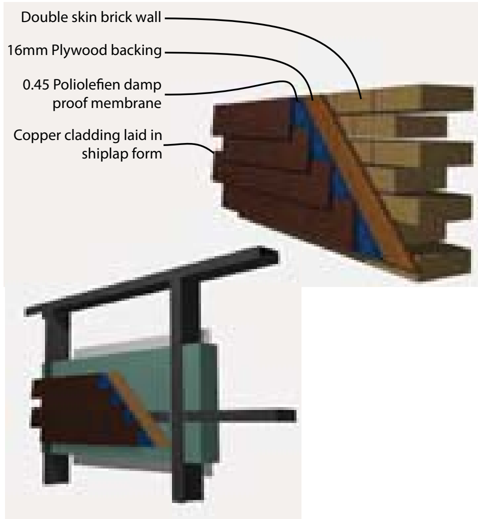


Figure 7-8. Wall construction 3d's

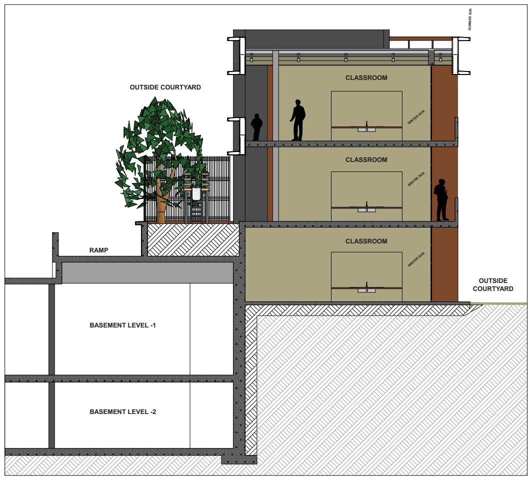


Figure 7-9. Section through day-care facility

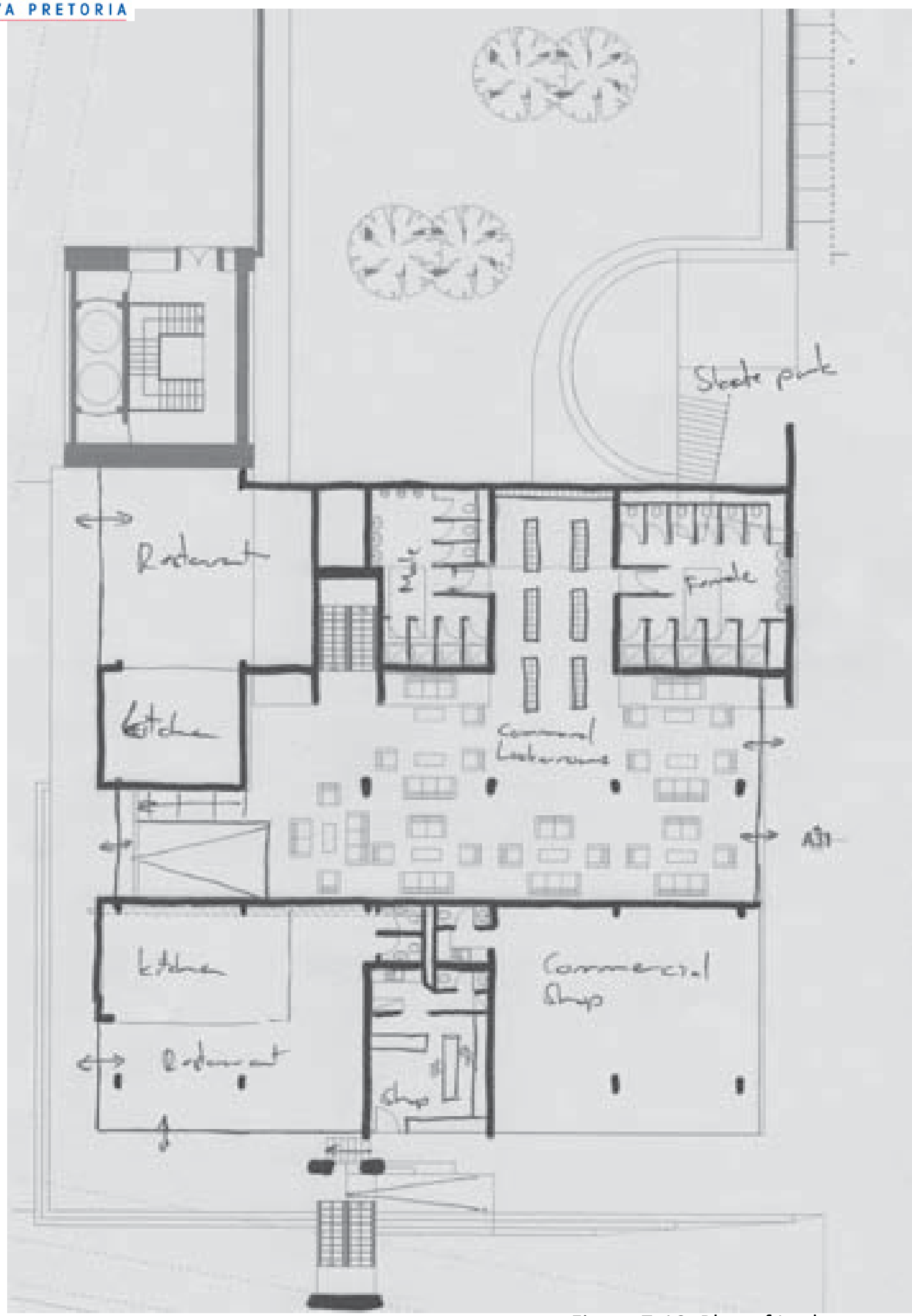


Figure 7-10. Plan of Locker rooms

7-4 Building B Commercial / Basketball Court

The building was conceived as a concrete roof with a basketball court on top. The Roof is supported by columns offset from the centre creating a plinth on which the court is placed. A vegetated screen surrounds the basketball court to prevent balls from disturbing traffic on Schoeman street.
A landscaped ramp connects the pedestrian corridor on the northern portion of the site with the basketball court. The Ramp is also constructed of concrete. Corresponding with the columns in the basement for support, planters for trees are added to the ramp.
The mouldable characteristic of concrete made it the ideal material choice for the construction of a practice skate park's half pipe within the sloped ramp.

Ventilation of the commercial spaces may are predominantly natural, with mechanical extraction in kitchens and bathrooms.

Size of columns and slabs:

Column width	=	Height / slenderness ratio
	=	4200mm / 17 (small load capacity)
	=	250mm minimum

A nominal size of 250 x 500 mm is used.

Slab thickness	=	Span / slenderness ratio	
	=	7000mm / 30	(max. span)
	=	233mm minimum	

A nominal depth of 250 mm is used.
The exterior screed, waterproofing and floor finishes increases the floor thickness to 350mm.

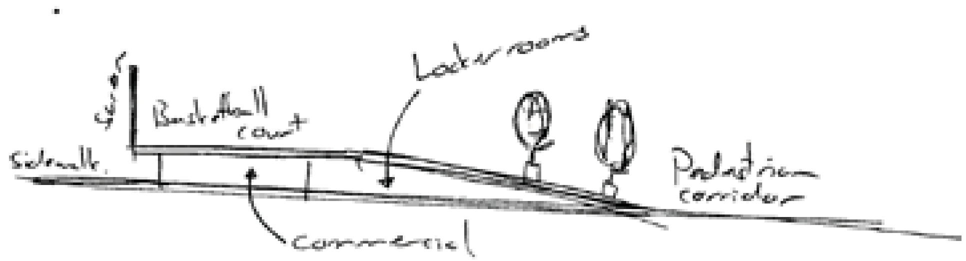


Figure 7-11. Concept Section

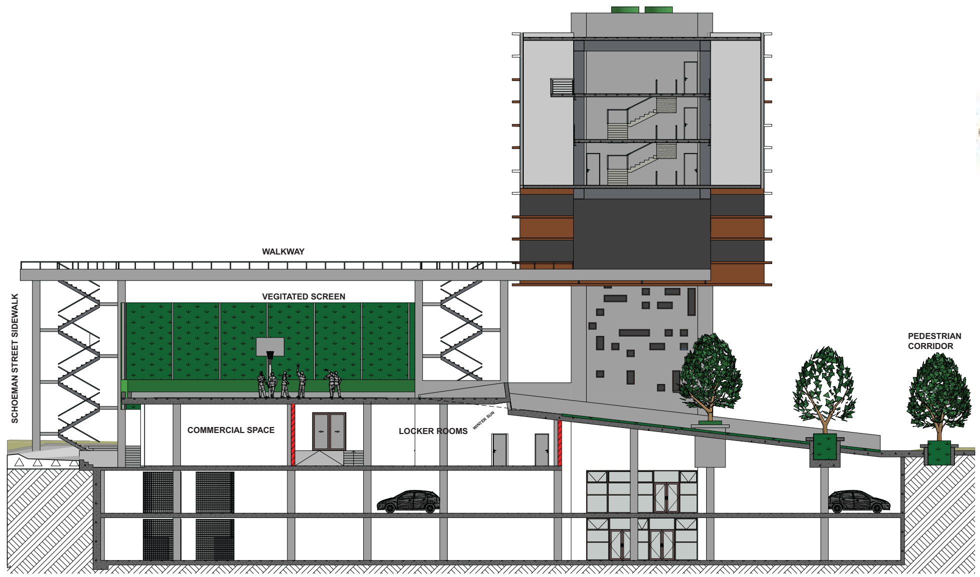


Figure 7-12. Section

7-5 Building C Multipurpose Hall

Centered around the main space on the first floor the structure differ from one level to the next.

The ground floor commercial is constructed of concrete columns with double skin brick infill and glazed shop fronts.
The wall layout and structural grid is imposed by the column grid of the basement and the floor layout above.

The Hall space on top of the commercial consist of a laminated timber floor on top of the concrete structure. The walls are constructed of reinforced concrete with glazed infill panels.
The movable interior partition walls are constructed of a lightweight honeycomb structural timber product. The walls are suspended from rails fixed to the roof structure.

The roof consist of usable concrete surfaces and lightweight sloped roofs that provide ventilation and light to penetrate the space from above.

A system of concrete box gutters span the width of the hall space. These gutters form the support structure of the lightweight roof structure as well as the partition walls in the hall.

Size of columns and slabs:

Column width	=	Height / slenderness ratio	
	=	4200mm / 15 (small load capacity)	
	=	280mm minimum	

A nominal size of 300 x 500 mm is used.

Slab thickness	=	Span / slenderness ratio	
	=	7000mm / 30	(max. span)
	=	233mm minimum	

A nominal depth of 250 mm is used.
The interior floor finishes increases the floor thickness to 450mm.

7-6 Building D Indoor entertainment

The Building is constructed with a fixed hinde vierendeel truss. The structure of the building span 52m and is bolted to the concrete towers. The sections consist of 700x700 square tubes manufactured to a length of 13m. The different sections are welded in place on site.

The floor is constructed of 250 I-sections that span across the width of the building. Lightweight Q-deck concrete floors are placed between the I beams to create a level floor.

The roof is also constructed of Q-deck concrete. There are water tanks placed on the building to provide the building with enough water pressure. There are also solar water heaters placed on the roof the minimise the need for electricity to heat water.

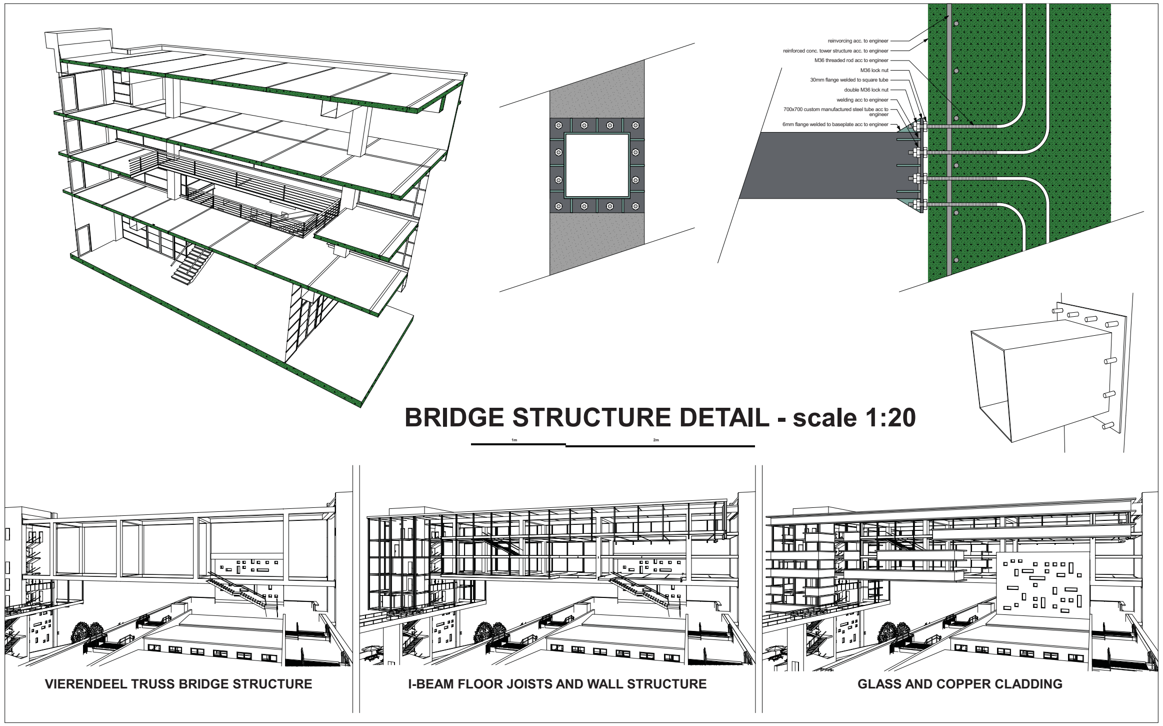


Figure 7-13. Structural system of indoor entertainment

7-7 Materiality

Reinforced Concrete:

Reinforced concrete will be the predominant structural material for the majority of the building. Only the bridge structure (building D) is not constructed of concrete.

Off-shutter concrete is a robust material that requires little to no maintenance, therefore, the visible concrete surfaces like the balustrades, walls and columns will be left unfinished off shutter concrete.
Concrete has the ability to portray the construction process. The use of timber shuttering will give the concrete a distinctive texture, providing a tactile human quality to the otherwise sterile and mundane surfaces.
The plasticity of concrete makes it the ideal material choice to construct the complex forms of the pedestrian ramps and skate park found in the exterior spaces.

Figure 7-14. Example of concrete constructed in timber casting shutters.
http://fazyluckers.com/

Steel:

Steel is used throughout the complex as support structures for skins and walls.

The steel elements found inside the structure consist mainly of the lightweight infill walls. The walls consist of a cladding system comprising of either an I-beam substructure with lipped channel infill panels or a complete lipped channel substructure, depending on the application.
The substructure is cladded on the inside with gypsum dry walling, and copper plate on the outside. The internal cavity is filled with fibre wool insulation.

The lightweight roof found on the hall and day-care centre is also constructed of a steel substructure

The characteristic of steel structural design makes it possible to adjust the structure on site if necessary. The steel portions may even be disassembled and re-configuerd in the future if the building needs to adapt.

Figure 7-15. Tree House by Architects Van Der Merwe-Miszewski Architects.
Showing Qualities and properties of steel.
http://cybercapetown.com/TreeHouse/

Copper:

Copper has been used in the construction industry for centuries. The material require very little maintenance and it is vey durable. The design and installation need to be verified by a specialist to ensure high quality, durability and a long lasting installation.

The copper is fixed to a 16mm plywood timber backing by either cleating, nailing or screwing. The timber panels are fixed to the substructure. Copper panels can be pre-manufactured on the timber panels with minor adjustments and alterations done on site to construct the building.

All fasteners like screws and nails should be constructed of copper, a copper alloy or another neutral metal alloy to prevent chemical reactions.

The majority of buildings surrounding the youth centre consist of dark brown face brick. The colour and weathering characteristic of copper fits in with this context. Initially the copper will appear to be shiny, therefore large surfaces of cladded copper was avoided. If left unprotected the metal will oxidize to create a dark brown colour blending in with the context nicely.
The Pretoria climate is ideal for copper since copper will weather slowly and keep its dark brown color for decades to come. When the copper starts to turn green the decision should be reviewed to leave the copper unprotected or to cover it with a protective coating.

Copper is mined relatively close to the site. Phalaborwa, reducing transportation costs, making a suitable sustainable material when compared to stainless steel and aluminum wall cladding.

Figure 7-16. Aged dark brown Copper cladding.
http://www.roofer.co.nz/photos_-_architectural.html

Figure 7-17. Newly installed shiny copper. h
ttp://www.socketsite.com/17th_and_clayton.html

Figure 7-18. Photo's of dark concrete buildings surrounding the site.
Source Author

Glass, glazing and frames:

When the choice of glass was made the context was considered.
The most prominent use of glass in Pretoria is probably the Reserve bank with its black glass facade

The private spaces of the Youth centre is glazed with a dark tint glass. The dark glass aids in the reduction of glare on electronic devices used in the internal spaces. The characteristic of dark glass to be translucent only from the inside during the day provides privacy for the internal spaces.

The expansive use of glass creates visual connections that merges the inside of the building with the outside. When outside the building forms a backdrop for activities to occur.

The ground floor commercial will use fully translucent glass panes for visibility into the spaces. The lack of a visual barrier aids in the attempt to make the building float or hover above the ground.

New technologies in glass manufacturing has produced new high performance glass products that aid in the energy efficiency of a building.
Glass still needs to be protected form harsh sunlight conditions.

Aluminum window frames will be used throughout the scheme. The material has a long life span and requires a lot less maintenance that other window frame material options. The design options when using aluminum are wider than when using steel. Doors, could be hinged, sliding or sliding stacking depending on the application. Aluminum frames and mullions are easy to manufacture in custom sizes and can be fitted on site to ensure accurate installations.

Figure 7-19. Photo of Reserve Bank. Prominent glass structure close to the site.
Source Author

Floor finishes:

Throughout the project different floor surfaces are used. The materials create separate spaces and define the difference between movement routes and interior spaces.

The commercial spaces on ground floor are to be tiled according the tenant's specifications.
The public areas leading to the commercial are subject to heavy foot traffic and needs to be robust.
The exterior pathways are finished with a combination between a 50mm power floated in situ casted concrete screed and brick pavers. The concrete finish may be pigmented in certain areas.

The Hall needs to have a seamless floor surface that provides enough friction to be used for sporting activities. The surface needs to be robust to withstand the wear and tear of furniture being moved around on the surface. A laminated timber floor placed on the concrete slab was chosen. The final specifications and installation needs to be done by a specialist.
The indoor entertainment centre require a lightweight floor finish, ruling out concrete or tiles. A combination between a laminated timber floor and carpets are used to reduce noise reverberation in the space.

Figure 7-20. Examples of concrete paving bricks

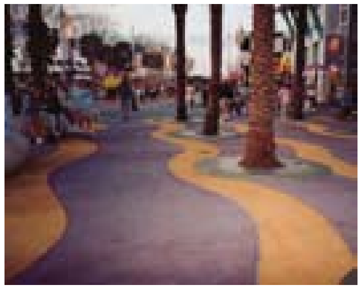


Figure 7-21. Example of colour stained concrete.

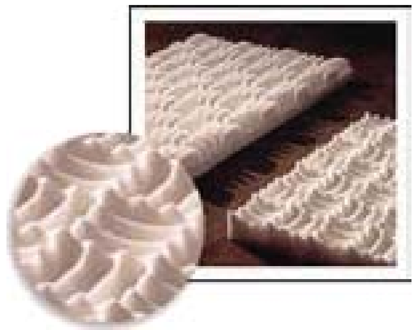
Brick:

Brick is one of the most used materials in the South African building industry. The construction process does not require high skilled labour making it an ideal choice for a building in the South African context.
It is a relatively sustainable material manufactured locally with a low embodied energy and long lifespan. Brick provides good thermal massing ideal for the South African Climate.
The brick walls used throughout the scheme are to be plastered and painted.

Sound Proofing:

Where nessasery Sonex sound proofing foam will be installed. This is a high density foam that both dissipates and absorbs sound energy. The lightweight walls in the hall will be filled with the foam. the spaces below the floor board are also to be filles with the foam to reduce sound transmition between the hall and the commercial spaces below.

The walls of the indoor entertainment centre may also be filled with a layer od Sonex foam.



7-8 Security

Security is one of the biggest concerns faced in a building of this type. The central courtyard is surveilled by people in all the surrounding buildings. Although direct access in case of emergency is not always possible a visual connection prevents unwanted behavior.

Fencing off the entire complex would prove difficult and impractical since there is a pedestrian corridor running through the site.

The smaller children housed in the day-care centre are the most vulnerable to security treats. Therefore the day-care centre's courtyards are to be fenced off. These courtyards are also surveilled by teachers in the adjacent class rooms.

The commercial spaces on ground floor is open to the public. The security of these enterprises are to be handled privately. The more private interior spaces of the youth centre would be accessed by passing a reception desk or an electronic access door. The security guard manning the desk is responsible for preventing uninvited attendants.

7-9 Fire Strategy

As the Youth center is a open public building, a fire strategy needs to be implemented. In the case of a fire all occupants need to exit the building easily, and if possible the fire should not spread throughout the building.

A fire strategy specialist will have to be appointed to ensure that an adequate fire plan is developed and implemented.

The National Building Regulations (NBR) contains guidelines on how to design a building for fire safety. These regulations were analyzed and implemented, but the fire strategy specialist needs to confirm that these principals are adequate.

Travel distances to escape doors are to be less then 45m. The portions of the complex that is more than 3 floors high must have at least 2 emergency escape routes. The materials framing the escape routes are to have a fire resistance rating of more than 120 minutes.

The bulk of the structure is constructed of reinforced concrete and steel. Concrete has an adequate fire rating, but the steel element will have to be covered with a coat of intumescent base paint.

The basement has four emergency exits as well as the vehicular ramp. The fire extinguishing system will make use of a water sprinkler system. The water tanks located in the western tower of building D (figure---) will provide enough water and water pressure. A minimum amount of water will always be required for the functions in the facility therefore water will always be available.

The hall space also has 4 emergency exits. A sprinkler system should be adequate to extinguish a fire. The addition of dry chemical and fire hose reels should prevent fires form burning out of control.

The day-care centre has 2 escape routes. In addition most of the classrooms and indoor spaces have direct access to an open courtyard, where the children may gather safely.

The indoor entertainment center contains a lot of electronic equipment like computers and video game consoles. The use of sprinkles are not ideal, as this may cause electrical shortages and damage to property.
A carbon dioxide system will be used. The system flushes out the oxygen in a room extinguishing a fire without the need to clean up water, foam or dry chemicals afterwards. The size of tank required needs to be calculated by a specialist.

While the system is deployed people in the space my experience shortness of breath. The rooms need to be well ventilated before they may be used again.

Figure 7-22 - Sprinkler

Figure 7-23- Fire Hose Reel

Figure 7-24- Fire extinguisher

Figure 7-25- CO_2 fire extinguisher

7-10 Water Usage

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Water requirement within centre.

Catchment:
Roof area of Indoor Entertainment: 850m2
Precipitation average annual in PTA: 674mm
Run off Coefficient: 85%

Calculation:
Harvest Area x Monthly rainfall x run off coefficient = harvested water per month.

Fixture	Amount	Use (L)	Avg. Usage	Total
Toilet	51	9	5.5	2524.5
Urinal	11	3	6	198
Wash basin	44	3	10	1320
Shower	9	40	10	3600
Cleaning	-	5	20	100
				7742.5

850	catchment
365	days per year
30.4	avg days per month
7750	L per day required
235600	L per avg month

	Rain (mm)	Harvested water (L)	Requirement	Difference
Jan	136	115600	235600	-120000
Feb	75	63750	235600	-171850
Mar	82	69700	235600	-165900
Apr	51	43350	235600	-192250
May	13	11050	235600	-224550
Jun	7	5950	235600	-229650
Jul	3	2550	235600	-233050
Aug	6	5100	235600	-230500
Sep	22	18700	235600	-216900
Oct	71	60350	235600	-175250
Nov	98	83300	235600	-152300
Dec	110	93500	235600	-142100

Supply for all the plumbing fixtures in the centre

The conclusion can be drawn that the centre will not be able to supply its own water. The rain water is not suitable for consumption if left untreated.
The harvested water may be filtered and used for flushing the toilets. The building should be able to provide enough water for the summer months, but the system will need to be filled with municipal water during winter months.
This is not the ideal but it will reduce the pressure on the municipal system.

Jan	136	115600	76760	38840
Feb	75	63750	76760	-13010
Mar	82	69700	76760	-7060
Apr	51	43350	76760	-33410
May	13	11050	76760	-65710
Jun	7	5950	76760	-70810
Jul	3	2550	76760	-74210
Aug	6	5100	76760	-71660
Sep	22	18700	76760	-58060
Oct	71	60350	76760	-16410
Nov	98	83300	76760	6540
Dec	110	93500	76760	16740

Supply for all the toilets in the centre

7-11 Solar Gain and Incidence

Solar radiation consists of short wave or high frequency energy. When this energy hits a surface the properties of the material will determine if the radiation is absorbed or reflected. When the energy is absorbed it needs to re-radiate after a while. The thermal mass and density properties of the material determine how long after absorption occurred, re-radiation occurs. (Givoni 1969:208)

New and shiny copper cladding will reflect a great portion of the energy radiated on it, but as copper weather and becomes darker and matte the material will absorb most of the energy radiated on it. The thickness or mass of the material cause it to radiate energy outward almost immediately.

Concrete absorbs a lot of the energy radiated on to it. The mass cause the material to retain the energy for a fairly long period and then radiate it. This is called thermal lag. As a general rule the heat gained during the day would be radiated during the colder temperatures found at night.

Glass is a unique material, it reflective, transparent , but it also has mass. When the above mentioned high frequency energy hits a glass surface, some of the radiation is reflected. The mass absorbs some energy, while the most energy travels through the glass and is transformed form short wave to long wave energy.

Long wave or low frequency energy can not pass through glass. The energy is trapped inside the space resulting in the 'green house effect'. Different glass types has different properties regarding reflection and transparency, but as a general rule it is important that the glass should be protected from direct sunlight.

There are three simple techniques for reducing heat gain on surfaces. They all relay on the idea that the surface should be shaded during the critical parts of the day:

1. Building or roof overhang
2. Placement of horizontal louvers on the northern facade.
3. Placement of vertical louvers on the eastern and western facades.

The building predominantly makes use of overhangs created by the wall structure. There is situations where vertical louvers are necessary to protect the glass.

7-12 Orientation

The proposed site for the Youth Centre is not ideal when solar orientation is concerned. The site is predominantly in a north-south direction creating large east and west facades.
The building is designed to minimise the east and wet facades, by breaking the building up into different elements.

The Day-care centre is orientated correctly with large openings on the northern side and concrete walls on the eastern and western sides to absorb the unwanted morning and afternoon sun.

The Multi-purpose Hall is orientated wrong, therefore the building has small openings on the eastern and western sides. The building will also benefit form the built up form surrounding the site. The low morning and afternoon sun will be obscured for large portions of the morning and afternoon by adjacent buildings.
The roof of the building opens up to the south with a sawtooth roof structure.

The indoor entertainment centre is placed in a predominant east west direction. The cladding structure of the building provides shading on the facade for the greater portion of the day. The ends of the building is characterized by structural concrete towers. This mass of these towers will absorb the energy and radiate it to the inside during the cooler temperatures.

The outdoor basketball court receives solar radiation from above since it is in the shadow of the indoor entertainment centre.

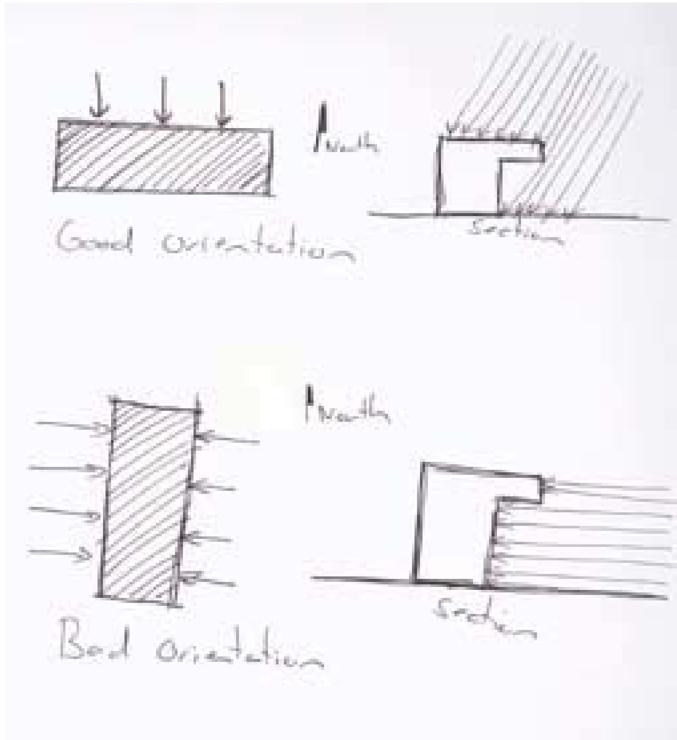


Figure 7-26 Good vs. Bad Orientation

7-13 Ventilation

The centre consists of a combination of different buildings, each with its own function and different ventilation requirements. Therefore each space would be heated or cooled in a manner that is best suited to create an optimal indoor micro-climate for each particular space. This should reduce the energy consumption of the building.

The basement as discussed earlier will be using mechanical ventilation pumps to ventilate the air. The pumps are there primarily to ventilate exhaust gasses out of the space and to draw in fresh air. The temperature in the space do not need regulation as this is not a habitable space. If extremely high temperatures do occur the intake ventilation pumps may use evaporative cooling radiators to cool the incoming air.

The Day-care centre will not be using mechanical ventilation. The spaces are only 7,5m deep at most. The space will be cross ventilated and large windows on the northern side should provide enough solar heat gain during winter months.

A mechanical ventilation system will be installed in the ceiling space of the commercial spaces on ground floor. These will consist of split air conditioning systems to control the spaces individually. However, the spaces should have enough natural ventilation to minimise the use of the air conditioners.

The Locker rooms and bathrooms will need mechanical ventilation. The spaces will be ventilated by extracting the hot air. The skylights that protrude the concrete ramp will accumulate the hot air naturally. An extraction fan inserted in the glass will provide sufficient extraction. This induced stack effect will lower the pressure inside the space encouraging fresh air to enter the space. During colder months the extraction may be halted for portions of the day to allow the spaces to heat up naturally.

The function of the Hall will lead to a large number of people to gather in the space during different times of the day. The space is quite large will not heat up easily, but the size and volume justifies the use of a mechanical ventilation system.

The system will be housed on the roof of the hall and feed the conditioned air into the space through vents placed in the roof space. The intake vents should be positioned to prevent the accidental intake from the basement's exhaust ducts. The air conditioning units must be isolated from the concrete roof structure to prevent the vibration and sound resonance from penetrating the space.

For safety reasons it has been decided that the Indoor entertainment centre will be mechanically ventilated. The space have openable windows, but these are only to manipulate the air movement in extreme circumstances. The ventilation plants are situated on the roof and provide ventilation directly to the space below. Due to the use of several electronic devices in the space, evaporative cooling could not be used. The humidity has to be controlled and kept at a minimum to prevent damage to equipment.

7-14 Sustainability

The building was design and evaluated repeatedly. The standard against which the building was measured is based on the Sustainable Building Assessment Tool (SBAT) rating system.
The assessment tool was developed by the CSIR and it relates very well to the South African context and promote or encourage issues of sustainability.

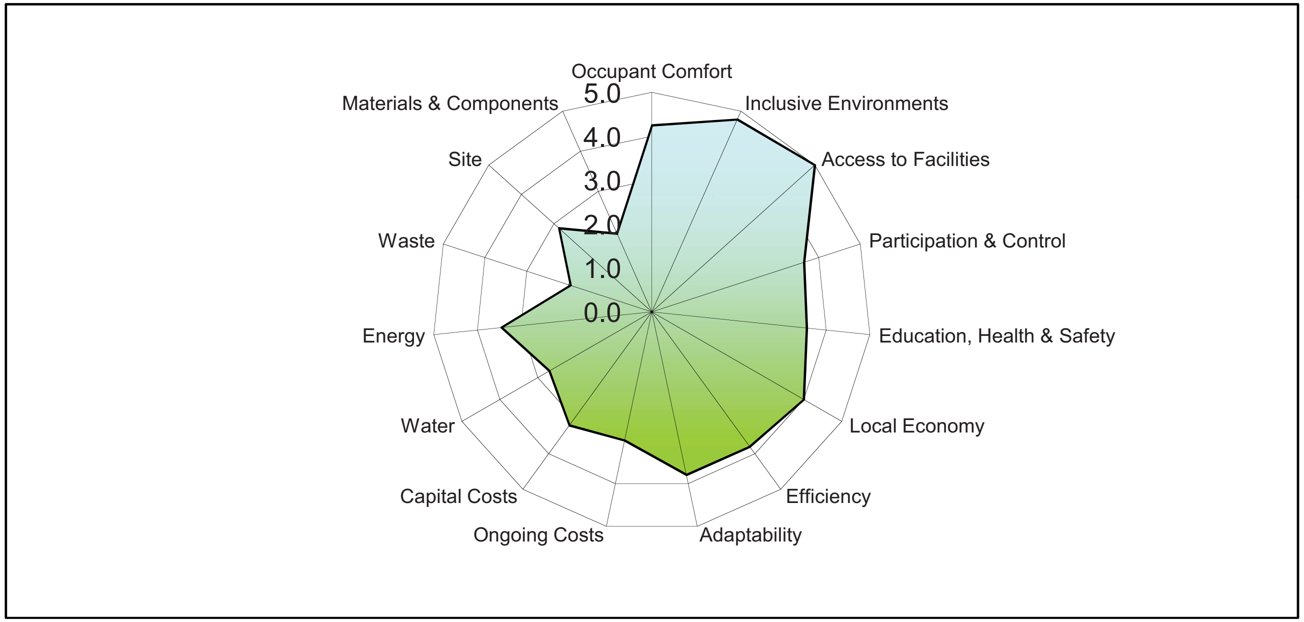
The system is based in 15 sets of objectives under the main themes of sustainability: Economy; Environmental and Social.
The system works by evaluating the successfulness of each category with a percentage or relative value scale and displayed on a chart (figure__).

Economic:
Local Economy; Efficiency of use; Adaptability and Flexibility; Ongoing cost, Capital cost.
Environmental:
Water; Energy; Waste; Site; Materials and components.
Social:
Occupant comfort, inclusive environments; access to facilities, Participation and control; Education, Health and safety.

The building achieved a rating of 3.5. It is considered good if a building achieve more than 3.
The social and economic objectives are easily met, but the environmental rating is less than satisfactory. This is because the objectives like renewable resources and sewerage treatment is very costly and space consuming.

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

PROJECT		ASSESSMENT	
Project title:	Game On Youth Centre	Date:	25-Oct-10
Location:	Pretoria CBD		
Building type (specify):	Community/Commercial		
Internal area (m2):	6500		
Number of users:	1500		
Building life cycle stage (specify):	Design		



Social	4.3	Economic	3.6	Environmental	2.6
		Overall	3.5		

Figure 7-27 SBAT graph

Building Performance - Social

	Criteria	Indicative performance measure	Measured	Points
SO 1	**Occupant Comfort**	Explanatory notes		4.3
SO 1.1	Daylighting	% of occupied spaces that are within distance 2H from window, where H is the height of the window or where there is good daylight from skylights	80	0.8
SO 1.2	Ventilation	% of occupied spaces have equivalent of opening window area equivalent to 10% of floor area or adequate mechanical system, with upolluted air source	90	0.9
SO 1.3	Noise	% of occupied spaces where external/internal/reverberation noise does not impinge on normal conversation (50dbA)	80	0.8
SO 1.5	Thermal comfort	Tempreture of occupied space does not exceed 28 or go below 19oC for less than 5 days per year (100%)	75	0.8
SO 1.5	Views	% of occupied space that is 6m from an external window (not a skylight) with a view	100	1.0
SO 2	**Inclusive Environments**	Explanatory notes		4.8
SO 2.1	Public Transport	% of building (s) within 400m of disabled accessible (20%) and affordable (80%) public transport	100	1.0
SO 2.2	Information	Comprehensive signage provided (50%), Signage high contrast, clear print signage in appropriate locations and language(s) / use of understandable symbols / manned reception at all entrances (50%)	100	1.0
SO 2.3	Space	% of occupied spaces that are accessible to ambulant disabled / wheelchair users	80	0.8
SO 2.4	Toilets	% of occupied space with fully accessible toilets within 50m along easily accessible route	100	1.0
SO 2.5	Fittings & Furniture	% of commonly used furniture and fittings (reception desk, kitchenette, auditorium) fully accessible	100	1.0
SO 3	**Access to Facilities**	Explanatory notes		5.0
SO 3.1	Children	All users can walk (100%) / use public transport (50%) to get to their childrens' schools and creches	100	1.0
SO 3.2	Banking	All users can walk (100%) / use public transport (50%) to get to banking facilities	100	1.0
SO 3.3	Retail	All users can walk (100%) / use public transport (50%) to get to food retail	100	1.0
SO 3.4	Communication	All users can walk (100%) / use public transport (50%) to get to communication facilities (post/telephone/internet)	100	1.0
SO 3.5	Exercise	All users can walk (100%) / use public transport (50%) to get to recreation/excercise facilities	100	1.0
SO 4	**Participation & Control**	Explanatory notes		3.7
SO 4.1	Environmental control	% of occupied space able to control their thermal environment (adjacent to openable windows/thermal controls)	75	0.8
SO 4.2	Lighting control	% of occupied space able to control their light (adjacent to controllable blinds etc/local lighting control)	50	0.5
SO 4.3	Social spaces	Social informal meeting spaces (parks / staff canteens / cafes) provided locally (within 400m) (100%)	100	1.0
SO 4.4	Sharing facilties	5% or more of facilities shared with other users / organisations on a weekly basis (100%)	90	0.9
SO 4.5	User group	Users actively involved in the design process (50%) / Active and representative management user group (50%)	50	0.5
SO 5	**Education, Health & Safety**	Explanatory notes		3.6
SO 5.1	Education	Two percent or more space/facilities available for education (seminar rooms / reading / libraries) per occupied space (75%). Construction training provided on site (25%)	75	0.8
SO 5.2	Safety	All well used routes in and around building well lit (25%), all routes in and around buildings visually supervised (25%), secure perimeter and access control (50%), No crime (100%)	50	0.5
SO 5.3	Awareness	% of users who can access information on health & safety issues (ie HIV/AIDS), training and employment opportunities easily (posters/personnel/intranet site)	100	1.0
SO 5.4	Materials	All materials/components used have no negative effects on indoor air quality (100%)	80	0.8
SO 5.5	Accidents	Process in place for recording all occupational accidents and diseases and addressing these	50	0.5

Building Performance - Economic

	Criteria	Indicative performance measure		Measured	Points
EC 1	**Local economy**		Explanatory notes		4.0
EC 1.1	Local contractors	% value of the building constructed by local (within 50km) small (employees<20) contractors		25	0.3
EC 1.2	Local materials	% of materials (sand, bricks, blocks, roofing material) sourced from within 50km		100	1.0
EC 1.3	Local components	% of components (windows, doors etc) made locally (in the country)		100	1.0
EC 1.4	Local furniture/fittings	% of furniture and fittings made locally (in the country)		75	0.8
EC 1.5	Maintenance	% of maintenance and repairs by value that can, and are undertaken, by local contractors (within 50km)		100	1.0
EC 2	**Efficiency**		Explanatory notes		3.8
EC 2.1	Capacity	% capacity of building used on a daily basis (actual number of users / number of users at full capacity*100)		80	0.8
EC 2.2	Occupancy	% of time building is occupied and used (actual average number of hours used / all potential hours building could be used (24) *100)		75	0.8
EC 2.3	Space per occupant	Space provision per user not more than 10% above national average for building type (100%)		50	0.5
EC 2.4	Communication	Site/building has access to internet and telephone (100%), telephone only (50%)		100	1.0
EC 2.5	Material & Components	Building design coordinated with material / component sizes in order to minimise wastage. Walls (50%), Roof and floors (50%)		75	0.8
EC 3	**Adaptability**		Explanatory notes		2.9
EC 3.1	Vertical heights	% of spaces that have a floor to ceiling height of 3000mm or more		85	0.9
EC 3.2	External space	Design facilitates flexible external space use (100%)		30	0.3
EC 3.3	Internal partition	Non loadbearing internal partitions that can be easily adapted (loose partioning (100%), studwall (50%), masonary (25%)		50	0.5
EC 3.4	Modular planning	Building with modular stucture, envelope (fenestration) & services allowing easly internal adaptaptation (100%)		70	0.7
EC 3.5	Furniture	Modular, limited variety furniture - can be easily configured for different uses (100%)		50	0.5
EC 4	**Ongoing costs**		Explanatory notes		3.0
EC 4.1	Induction	All new users receive induction training on building systems (50%), Detailed building user manual (50%		0	0.0
EC4.2	Consumption & waste	% of users exposed on a monthly basis to building performance figures (water (25%), electricity (25%), waste (25%), accidents (25%)		25	0.3
EC 4.2	Metering	Easily monitored localised metering system for water (50%) and energy (50%)		100	1.0
EC4.3	Maintenance & Cleaning	% of building that can be cleaned and maintained easily and safely using simple equipment and local non-hazardous materials		100	1.0
SO 4.5	Procurement	% of value of all materials/equipment used in the building on a daily basis supplied by local (within the country) manufacturers		75	0.8
EC 5	**Capital Costs**		Explanatory notes		3.2
EC 5.1	Local need	Five percent capital cost allocated to address urgent local issues (employment, training etc) during construction process (100%)		90	0.9
EC5.2	Procurement	Tender / construction packaged to ensure involvement of small local contractors/manufacturers (100%)		75	0.8
EC 5.3	Building costs	Capital cost not more than fifteen % above national average building costs for the building type (100%)		75	0.8
EC5.4	Technology	3% or more of capital costs allocated to new sustainable/indigenous technology (100%)		80	0.8
EC 5.5	Existing Buildings	Existing buildings reused (100%)		0	0.0

Building Performance - Environmental

	Criteria	Indicative performance measure		Measured	Points
EN 1	**Water**		Explanatory notes		2.7
EN 1.1	Rainwater	% of water consumed sourced from rainwater harvested on site		50	0.5
EN 1.2	Water use	% of equipment (taps, washing machines, urinals showerheads) that are water efficient		100	1.0
EN 1.3	Runoff	% of carparking, paths, roads and roofs that have absorbant/semi absorbant/permeable surfaces (grassed/thatched/looselaid paving/ absorbant materials)		15	0.2
EN 1.4	Greywater	% of water from washing/relatively clean processes recycled and reused		25	0.3
EN 1.5	Planting	% of planting (other than food gardens) on site with low / appropriate water requirements		80	0.8
EN 2	**Energy**		Explanatory notes		3.5
EN 2.1	Location	% of users who walk / cycle / use public transport to commute to the building		95	1.0
EN 2.2	Ventilation	% of building ventilation requirements met through natural / passive ventilation		85	0.9
EN 2.3	Heating & Cooling	% of occupied space which relies solely on passive environmental control (no or minimal energy consumption)		60	0.6
EN 2.4	Appliances & fittings	% of appliances / lighting fixtures that are classed as highly energy efficient (ie energy star rating)		85	0.9
EN 2.5	Renewable energy	% of building energy requirements met from renewable sources		20	0.2
EN 3	**Waste**		Explanatory notes		2.0
EN 3.1	Toxic waste	% of toxic waste (batteries, ink cartridges, flourescent lamps) recycled		100	1.0
EN 3.2	Organic waste	% of organic waste recycled		20	0.2
EN 3.3	Inorganic waste	% of inorganic waste recycled.		75	0.8
EN 3.4	Sewerage	% of sewerage recycled on site		0	0.0
EN 3.5	Construction waste	% of damaged building materials / waste developed in construction recycled on site		0	0.0
EN 4	**Site**		Explanatory notes		2.9
EN 4.1	Brownfield site	% of proposed site already disturbed / brownfield (previously developed)		100	1.0
EN 4.2	Neighbouring buildings	No neighbouring buildings negatively affected (access to sunlight, daylight, ventilation) (100%)		100	1.0
EN 4.3	Vegetation	% of area of area covered in vegetation (include green roofs, internal planting) relative to whole site		35	0.4
EN 4.4	Food gardens	Food gardens on site (100%)		0	0.0
EN 4.5	Landscape inputs	% of landscape that does not require mechanical equipment (ie lawn cutting) and or artificial inputs such as weed killers and pesticides		50	0.5
EN 5	**Materials & Components**		Explanatory notes		2.0
EN 5.1	Embodied energy	Materials with high embodied energy (aluminium,plastics) make up less than 1% of weight of building (100%)		50	0.5
EN 5.2	Material sources	% of materials and components by volume from grown sources (animal/plant)		10	0.1
EN 5.3	Ozone depletion	No materials and components used requiring ozone depleting processes (100%)		50	0.5
EN 5.4	Recyled / reuse	% of materials and components (by weight) reused / from recycled sources		10	0.1
EN 5.5	Construction process	Volume / area of site disturbed during construction less than 2X volume/area of new building (100%)		75	0.8