Chapter 3

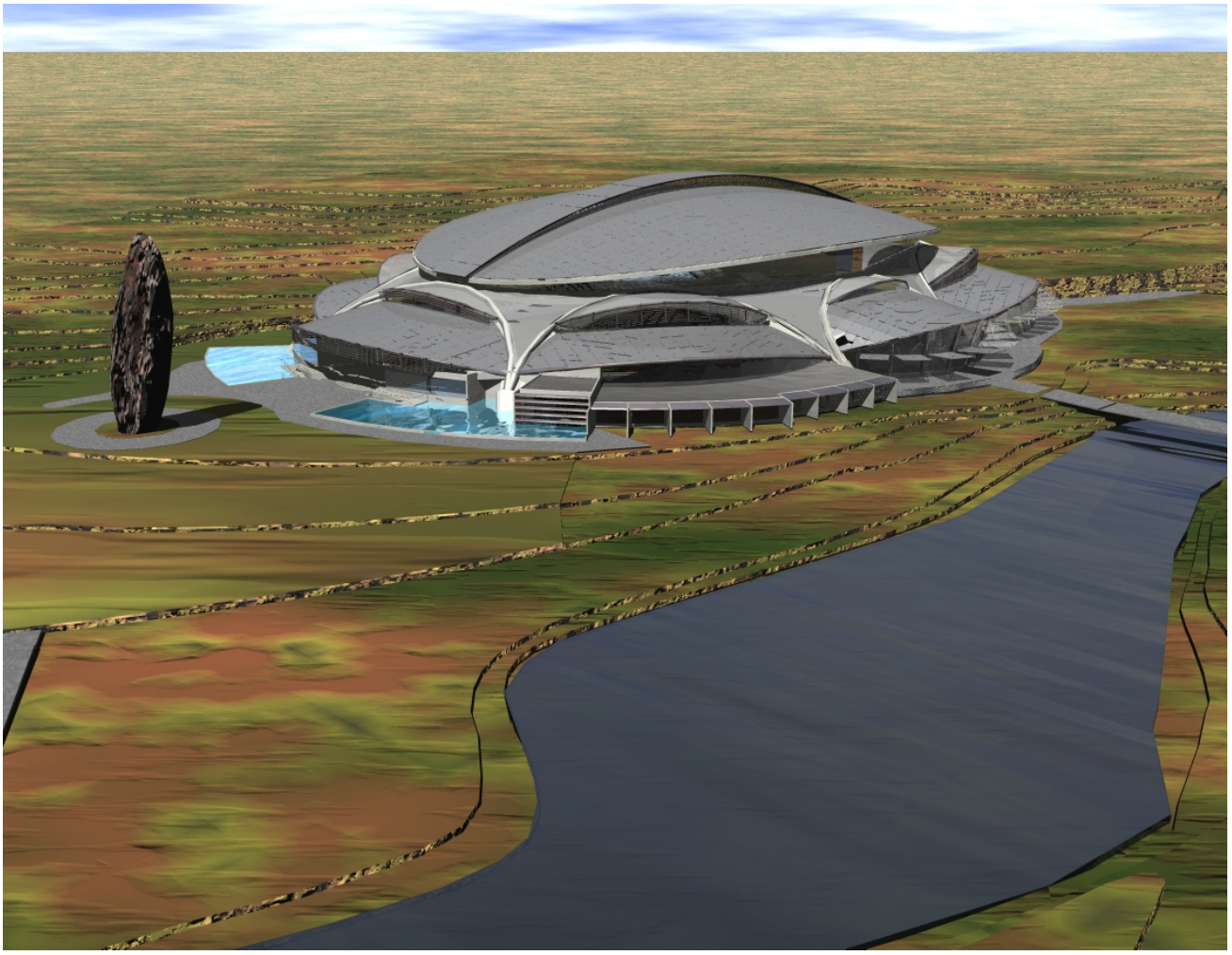
Design discourse

3.1 Hi-Performance sport centre

The Hi-Performance Sport Centre introduces a way of thinking about the profession of sport development that transcends the practical considerations of training and performance by refining them into a way of life. The Hi-Performance Sport Centre in Centurion will be the manifestation of this philosophy.

This landmark of sport will signal the culmination of extensive research into the sports industry, consideration trends and forecasts worldwide and the beginning of a long-term investment into the expertise, infrastructure and branding under the banner of the Sports Institute of South Africa.

Against the backdrop of a fragmented and subjective Sport Science Industry, the HPC aims to provide an objective and unbiased sport science product that will serve high performance athletes, the professional sports market, corporate markets and the public. The HPC will provide a holistic and integrated approach that embraces a fusion between advanced technology and a philosophy backed by science, and the support of exceptional service, dedication, personal attention and extraordinary hospitality.



View of the HPC from SuperSport park cricket stadium Fig.111

3.2 Site selection

The site selection and location for the HPC was a complex and important decision requiring extensive research. Criterion were set up to select a unique site for the HPC:

The HPC should be:

In a province that will benefit from the facility and will support its function

In a radius of 50 km from an airport

Visible from main public routes but still private

In a radius of 10 km of retail facilities

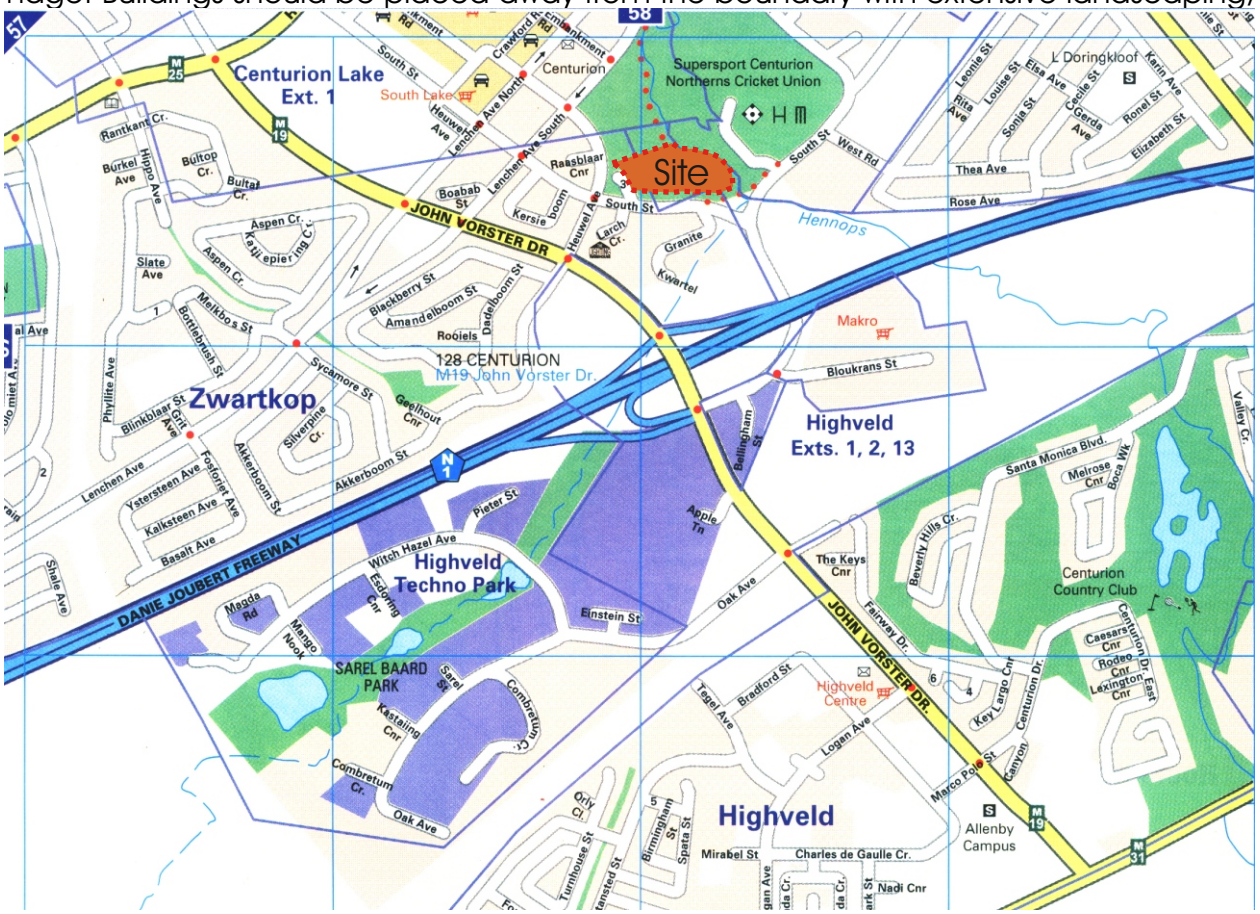
In a radius of 1 km of public transport

In area with existing sports facilities which will support the HPC's function

On a site which is easily accessible for the public

In area with a tranquil environment

According to these criteria the site next to the SuperSport park cricket stadium in Centurion was ideal. The IDP of Centurion proposed that this zone should focus on sporting activities and facilities(indoor and outdoor, formal and informal, competitive and leisure). A recreational destination supporting the pedestrian network should be established in this zone. Large sport facilities should ensure an appropriate interface on the waters edge. The IDP also propose that the strip along the N1 conveys a hi-tech image. Buildings should be placed away from the boundary with extensive landscaping,



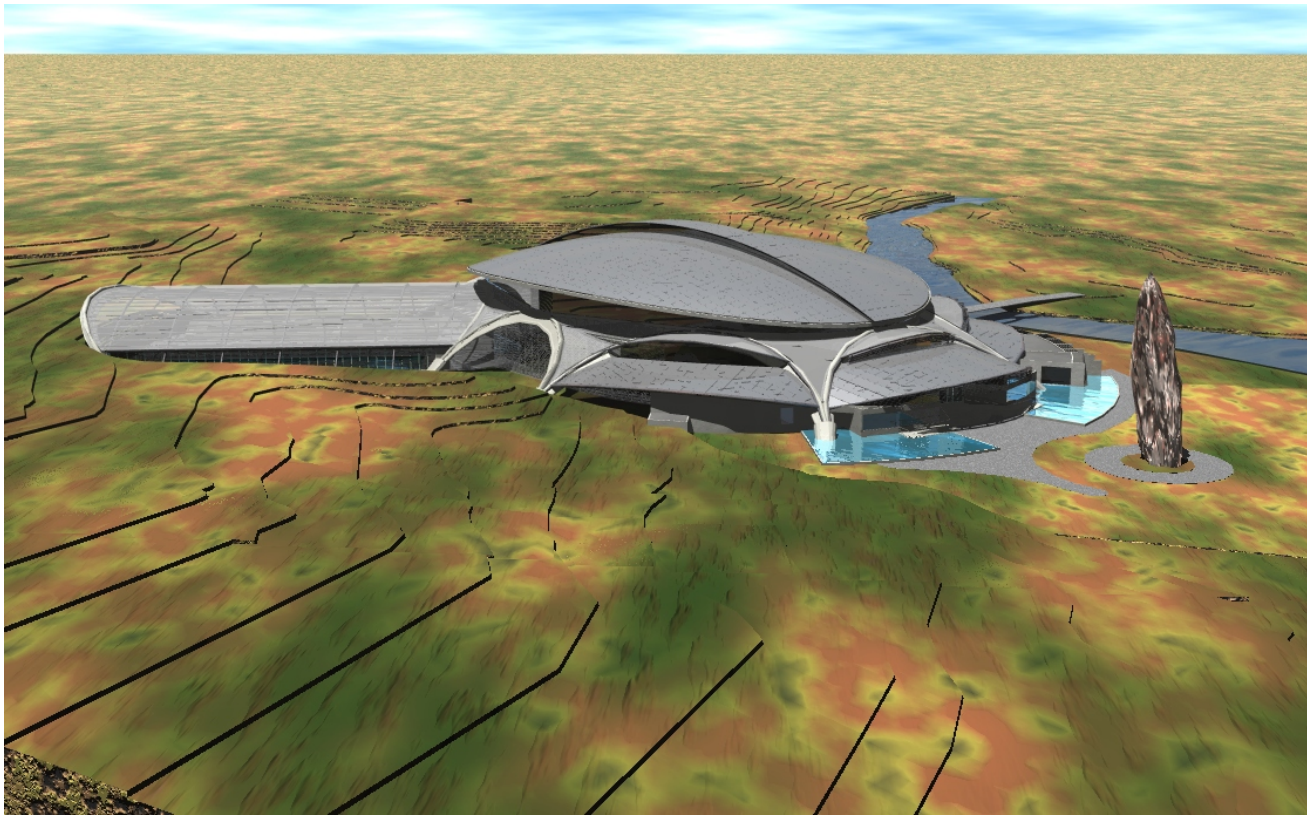
Centurion map with site indication Fig.112

establishing a strong park like character through well landscaped soft open spaces adjacent to the N1. This will also produce low coverage's and a coarse grain of building. Exploit the potential for the establishment of unique precincts enhancing legibility, but also marketability, with potential precincts such as the agglomeration of sport fields and other outdoor and indoor recreational activities around the Centurion Cricket Stadium could promote the establishment of a "fitness Precinct."

The site is 45km from Johannesburg International Airport and adjacent to the N1 highway. A public transport node for taxis is situated on the site with the Centurion CBD 1.5 km from the site. The site will be part of a sports hub development in Centurion that will host a wide variety of sports. A wide variety of sport facilities already exist in the sports hub such as a karate club, gymnastics hall, action cricket courts, cricket stadium, rugby club and netball courts. Rietvlei Dam is situated 11km northeast of the site that will be used for rowing and canoeing. The Centurion country club is situated 3.5 km from the site with golf and tennis facilities which will be used by the HPC. This unique site was the ideal location where high performance athletes have access to a wide variety of sport facilities with the Hennops River as a tranquil backdrop.

3.3 The HPC as landmark

Due to the high traffic on the N1 there is an opportunity to create a landmark, increasing legibility to the road. The HPC with its sculptural concrete structure molded into the sloping landscape, dressed with a lightweight membrane and aluminum cladding roof panels are a landmark that will fit into the prestige corporate and high tech use along the N1.

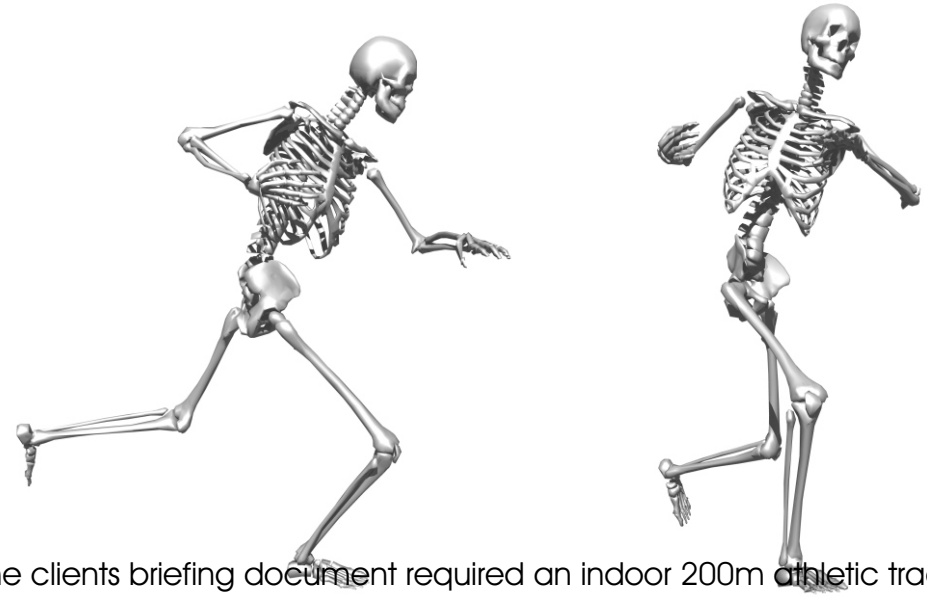


View of HPC from N1 highway Fig.113

3.4 Athletic structure of HPC

Architecture not only fulfills a function, but also carries social meaning which is conveyed by its formal and structural properties. The architecture used in the HPC produce an sensual environment in a place designed for bodily activities. The HPC presents itself aesthetically ambitiously and clinically clean, thus corresponding to the concepts of perfection and purity conveyed by the staging of the female body in this sport.

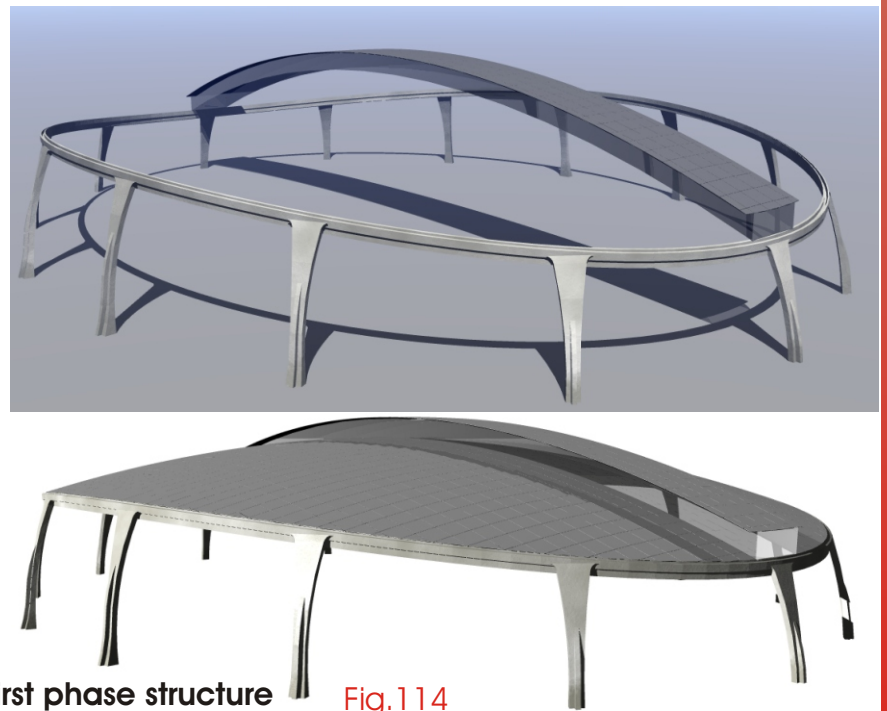
The sculptural structure of the HPC is based on the human skeleton. The bone structure of the human body is formed according to its function, thicker and stronger bones where impact is higher.



The clients briefing document required an indoor 200m athletic track that spans approximately 100m. The only way that this span could be achieved is through an arch structure. The HPC's structure went through three phases of structural refirment.

First phase

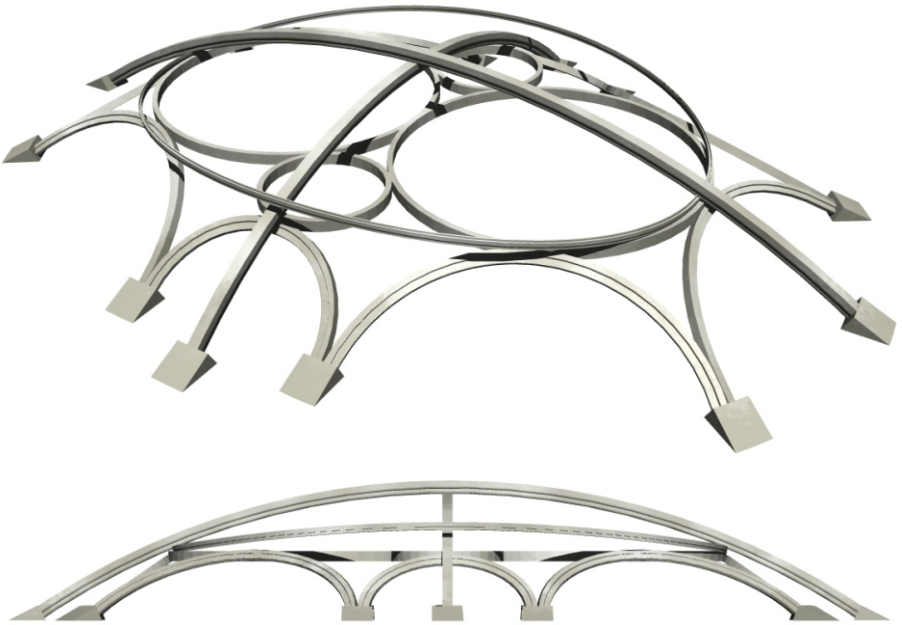
The fist attempt was aesthetically a success but structurally unsuccessful. The slightly angled columns will not be capable of transmitting the horizontal structural loads of the dome structure safely to the ground. The columns have to be angled with the same angel of the axial forces of the dome structure so that forces will be transmitted in a straight line.



First phase structure Fig.114

Second phase

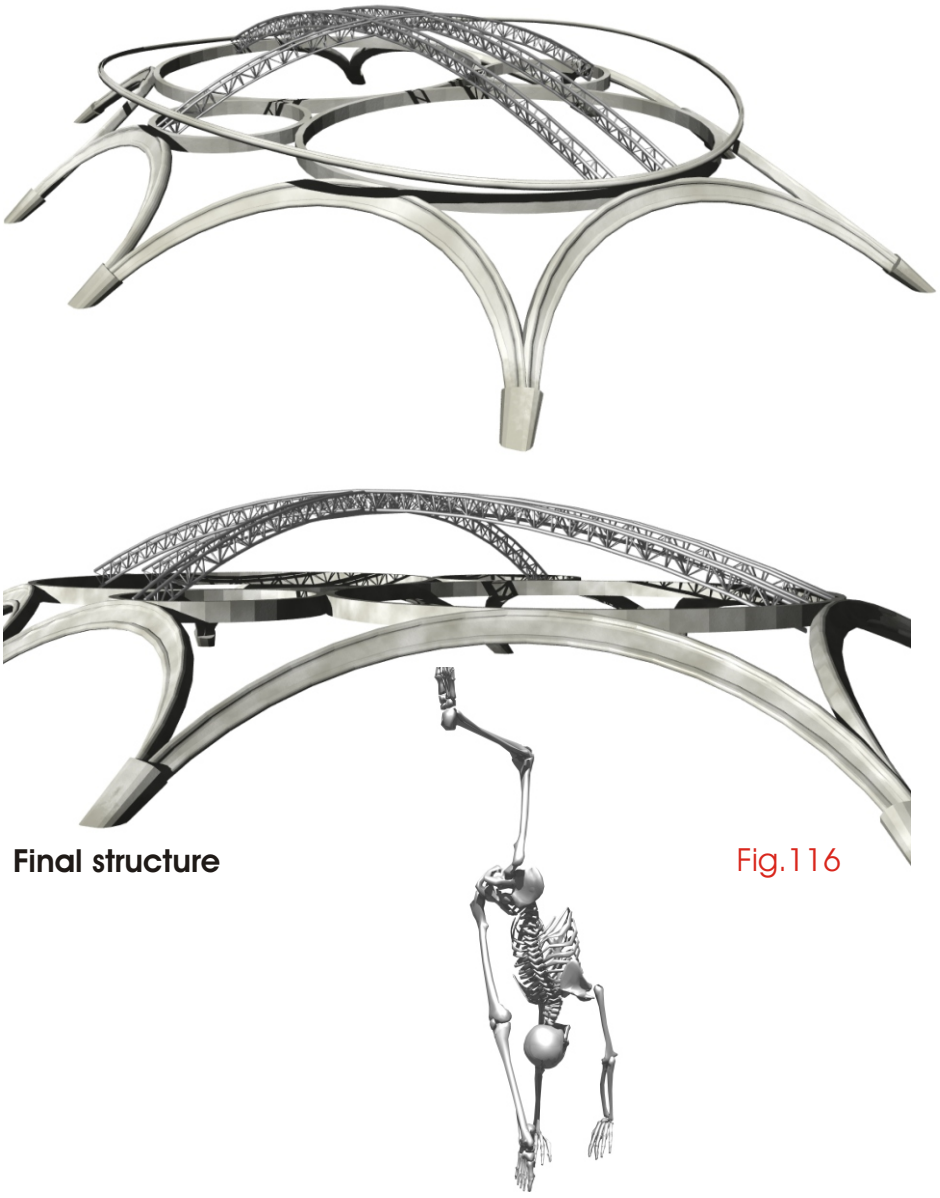
The forces of the dome structures are transmitted directly to the ground in a straight line. The structure consists of eight concrete vaults that are in compression with four concrete ring beams which obey simple geometry. The structure is a combination of compression forces working against each other to achieve a state of equilibrium.



Second phase structure Fig.115

Third phase

In the third and final phase the vault and footings are sculptured in a more elegant, athletic and functional form to perform as an athletic structure. A lightweight space frame structure replaces the concrete arch as thbackbone for the sculptural structure. The concrete structure is made visible from both the inside and the outside of the building and symbolizes the bone structure of an athlete with the lightweight space frame as backbone. The combination of the concrete and space frame structures become a high performance structure that contributes to the function of the buildings athletic feeling.

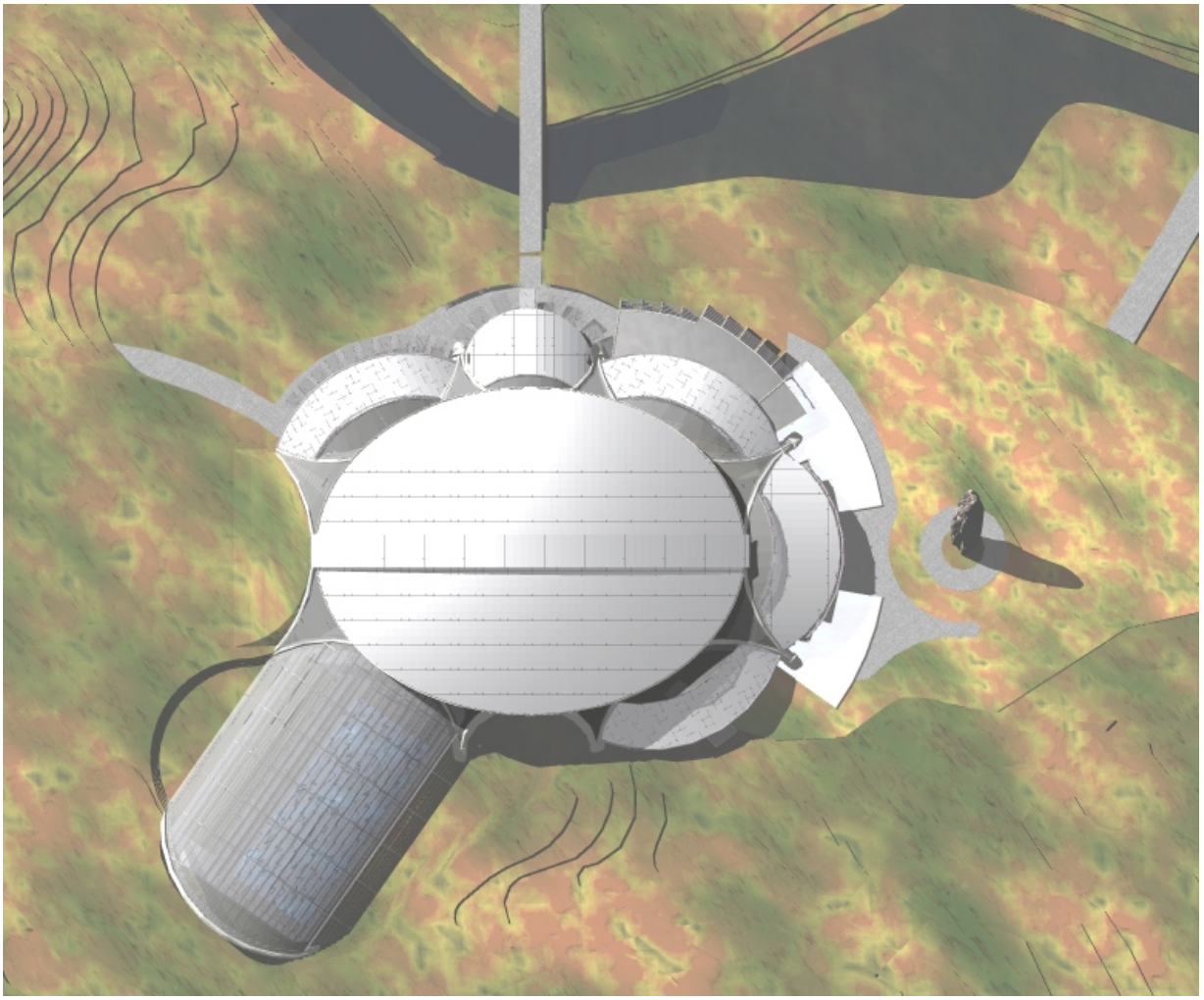


Final structure Fig.116

3.5 Function and form of the different facilities in the HPC

3.5.1 Indoor open space

The 5312 m² indoor open space underneath the dome structure links all the surrounding facilities to an environment of sport, training and assessment. This space with its tartan finish

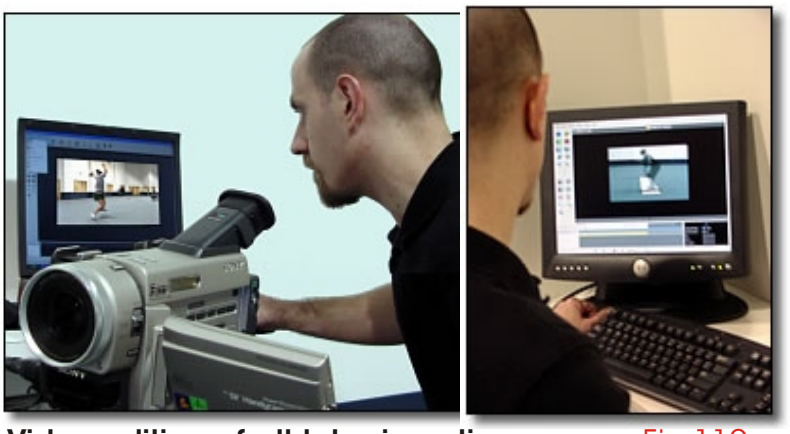


Arial view of HPC Fig.117

is there for high performance athletes; analysing the athlete in motion- running, kicking, bowling, jumping, throwing etc. Motion sensors will be attached to the athlete, these actions will be recorded with video cameras that will follow the movement of the athlete. These cameras that run on a rail system are fixed to the roof structure as well as rails on the ground. This video footage is then edited and analysed which will indicate the cause of an injury or what part of specific motion in the action must be worked on to perform on a higher level etc. This facility will also be used by the CSIR Sports Technology Centre for research on athletes.

Some video editing showing athletes in action Fig.118

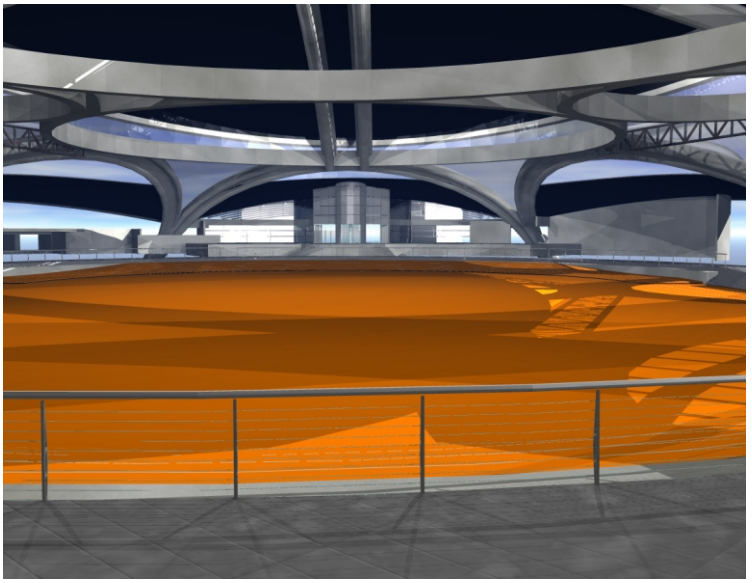
All the video editing takes places in the video editing room situated underneath the pavilion. All video footage is edited and analysed where it is then played in the auditorium to assist the athletes on their performance. These video assessments will takes place on a regularr bases to see how the athletes are improving.



Video editing of athletes in action Fig.119

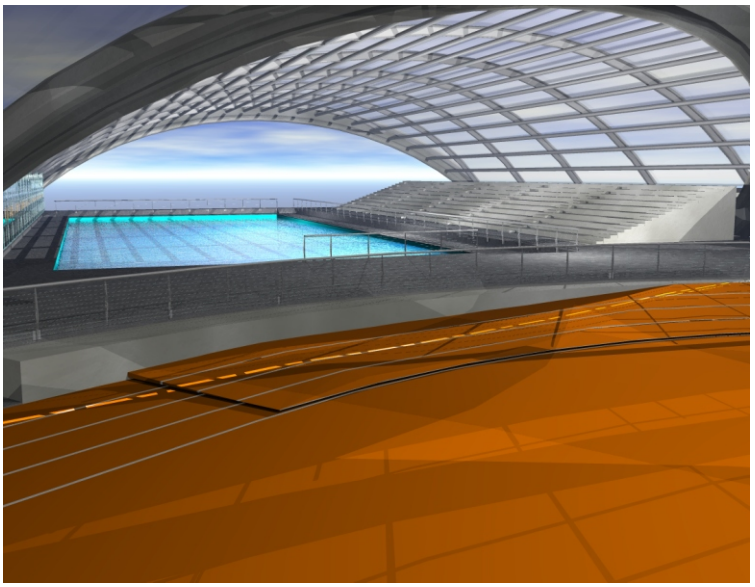
The main purpose of the indoor open space is where high performance athletes can train in an environment that is naturally ventilated but is still protected from the sun and rain to prevent overheating, dehydration and injuries. This indoor facility gives the athlete a training facility that could be used 24 hours a day all year regardless of the weather conditions.

The indoor open space with its 12.8m high structural clearance is a multipurpose area where all indoor Olympic events can take place ranging from basketball, hockey, volleyball, tennis to five-a-side football, gymnastics, athletics and a lot more. The floor finishes will be changes according to the sports requirements. The pavilions situated on the western side of the indoor open space can cater for 3200 people. Temporary pavilions will be put up on the southern side of the HPC when big event's take place.



Indoor open space Fig.120

The open link between the indoor open space and the swimming pool enhance the feeling of integration between the different spaces that flowing into other spaces. This open link also contributes to the visual link between different spaces that bind it all together as a sports environment with integrated functions.



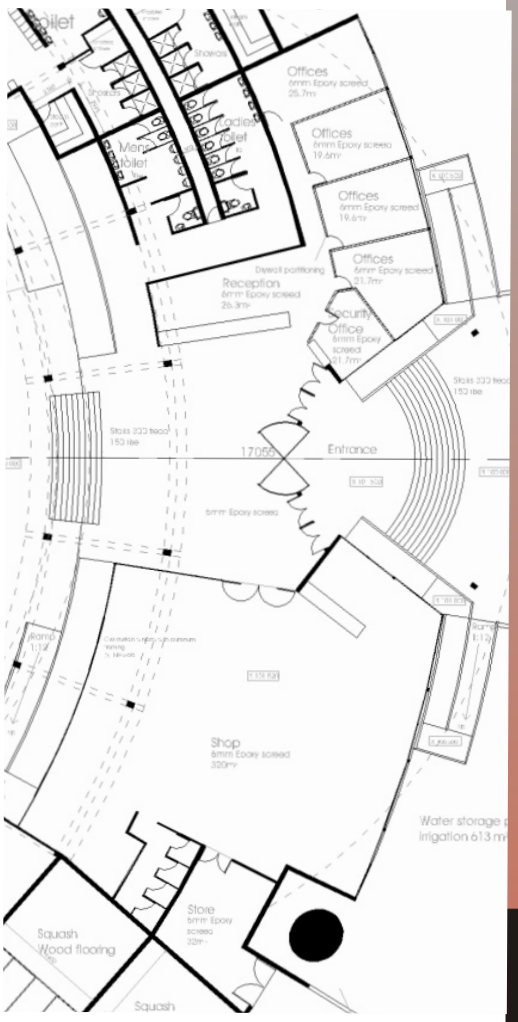
Indoor open space showing connection between swimming pool and indoor open space Fig.121

3.5.2 Administration and sports shop

The main entrance of the HPC situated on the eastern side of the HPC divides the administration area and the sports shop. The entrance is clearly visible from the N1 highway as well as South Street passing the site. The entrance foyer that is 1.5m above the ground level steps down into the indoor open space which is provided with adequate ramps and stairs. The active cardiovascular bridge suspended over the entrance foyer is clearly visible when entering the HPC which will convey the atmosphere of fitness and training. The main vision of the administration offices is to be a state of the art leader in revolutionizing the management of sport performance and sport development in the HPC.

The sports shop will supply sport accessories from rugby balls to studs, clothing and all other sports gear. This wholesale business will be accessible to the public giving students and visitors direct access to their supplies.

The main entrance on the eastern side of the HPC is provided with touchscreen computers for the public. These computer facilities will have all the latest sports news, results, statics events and history of sports legends as well as sports entertainment for children. This space will become an important social gathering space especially for children.



Plan of administration, entrance Foyer and sports shop Fig.122

Outside view of the main entrance with administration and sports shop Fig.123

3.5.3 Gymnasium

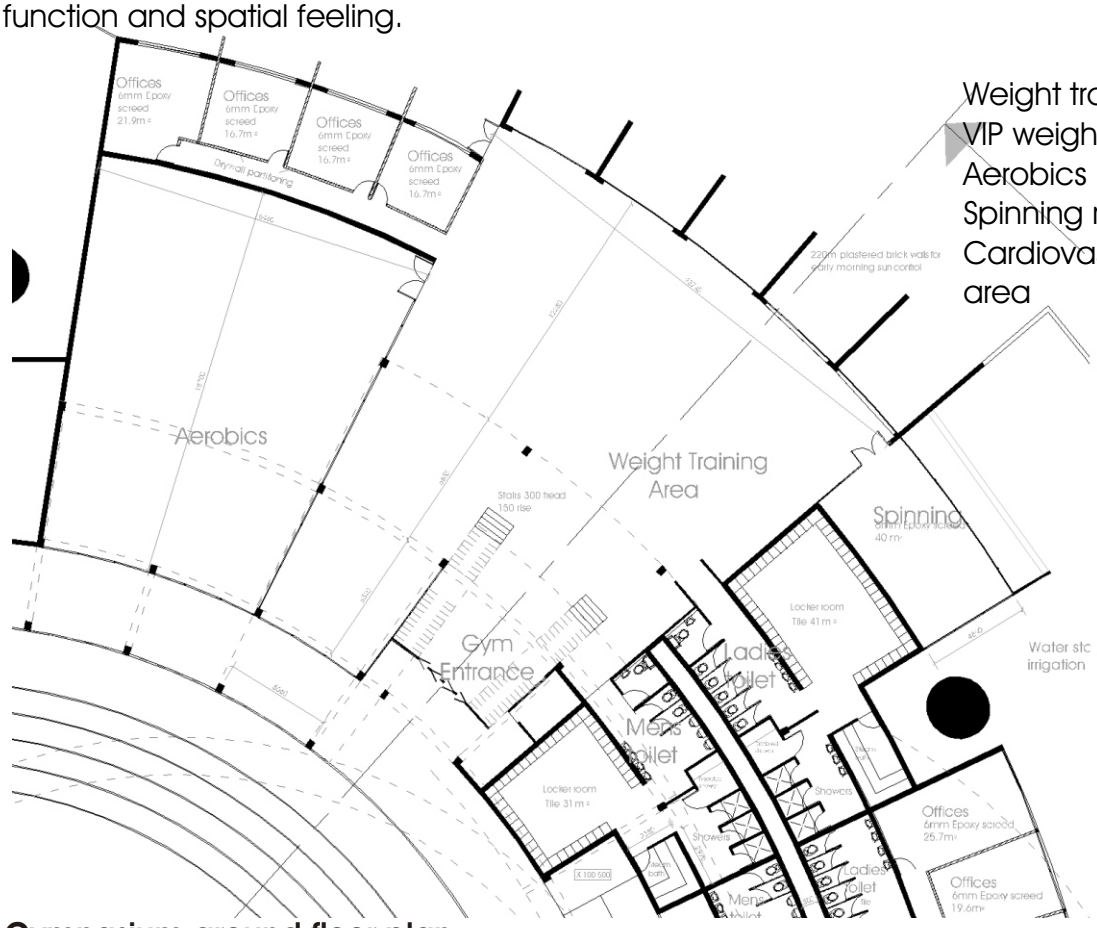
The sport science gym is set to revolutionize the health and fitness industry in South Africa by:

Using advanced training technoloy
Outcomes-based measurement and reporting on multi disciplinary intervention strategies
Networking and initiating synergistic relations with other role players in the Industry

Sport Science Gymnasium uses the most advanced equipment and technology currently available in the fitness industry using SmartTechnology®, which provides an outstanding way to manage exercise and training. This is integrated with other software programs to provide a comprehensive member management system.

The Smart Key® is a computerized key that is assigned to each member once they have been through a health and fitness assessment. The key stores all personal data and is used to log training sessions. For each training session it is inserted into the control panel of the TechnoGym®System equipment, where it directs and controls the workout intensity and records all the information from the session. The Wellness Expert® is an interactive touch screen computer console providing feed for members to view work-out details for the day, test results, previous training results and performance indices, and to download the information saved from a completed workout onto the central database.

The 1707 m^2 gymnasium situated on the northern side of the HPC has a spectacular view over the Hennops river. The gymnasium is divided into four areas, each with a different function and spatial feeling.



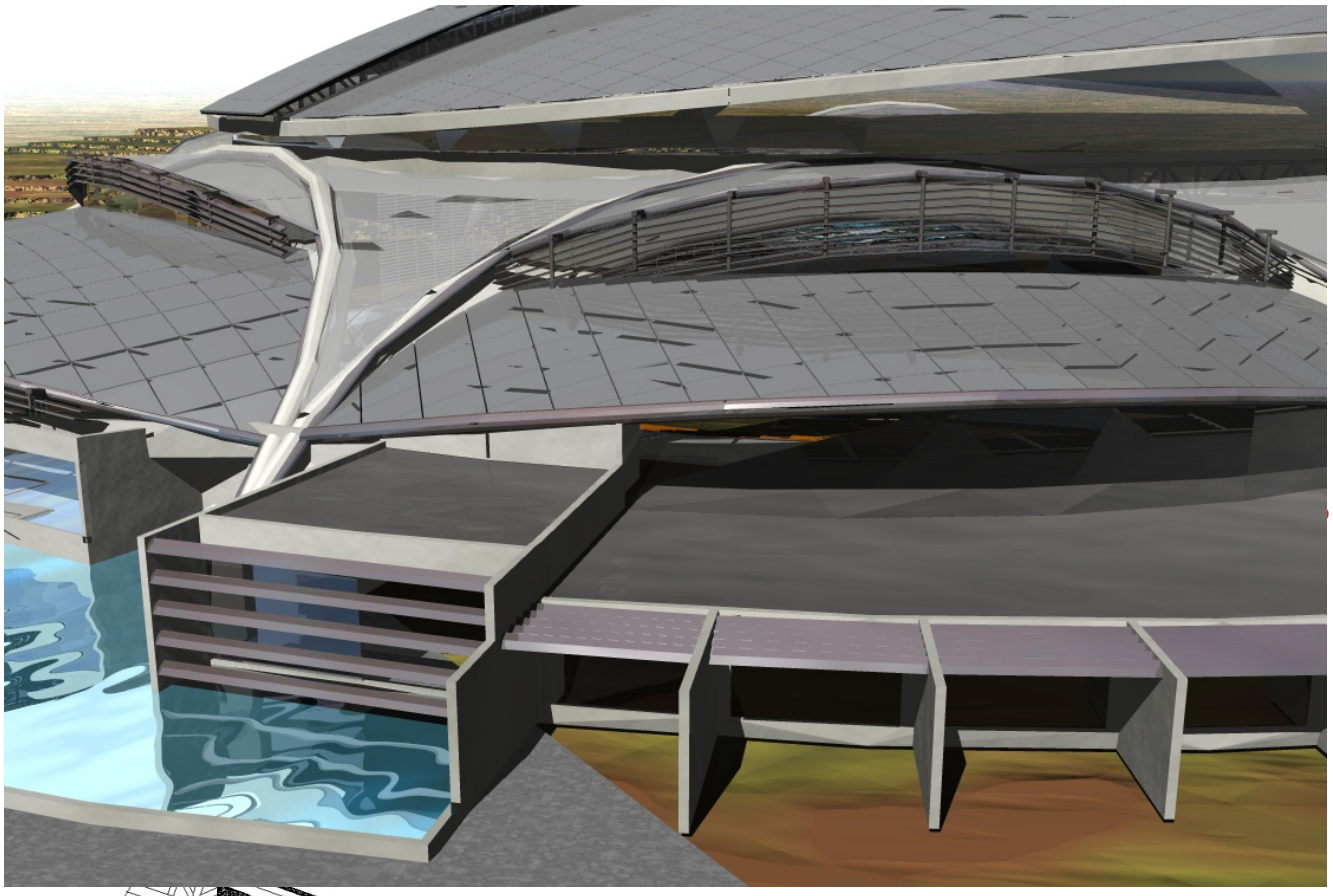
Weight training
VIP weight training
Aerobics hall
Spinning room
Cardiovascular training area

Gymnasium ground floor plan

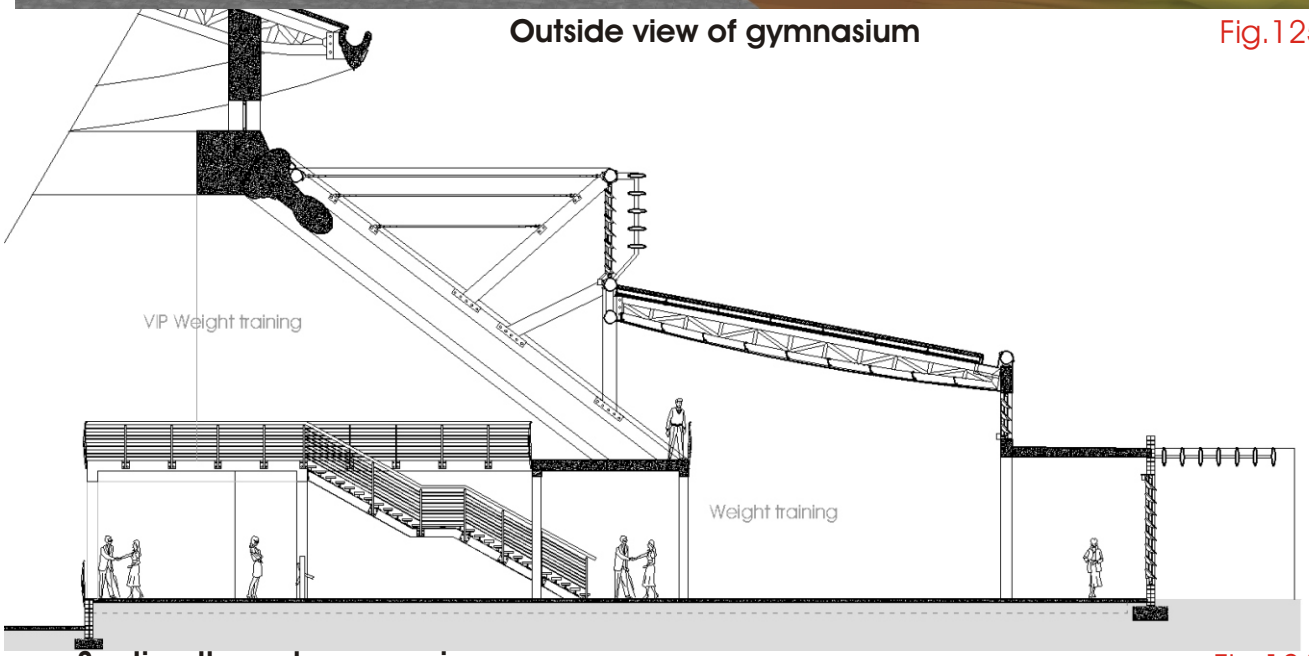
Fig.124

Weight training

The 362 m^2 weight training facility situated on the ground floor will mainly be used by private. This open plan layout with its large northen windows overlooks the Hennops river and is visually linked with the aerobics hall, spinning area, and indoor open space through glass curtain walls. This visual interaction between the different spaces gives this area a much more dynamic feeling. The fin walls that extrude from the gymnasium facade are controlling the sun movement to block the early morning sun which will be crucial for the temperature management in the gymnasium. The adjustable horizontal louvers between the fins will control the northen sun movement.



Outside view of gymnasium Fig.125



Section through gymnasium Fig.126

VIP weight training

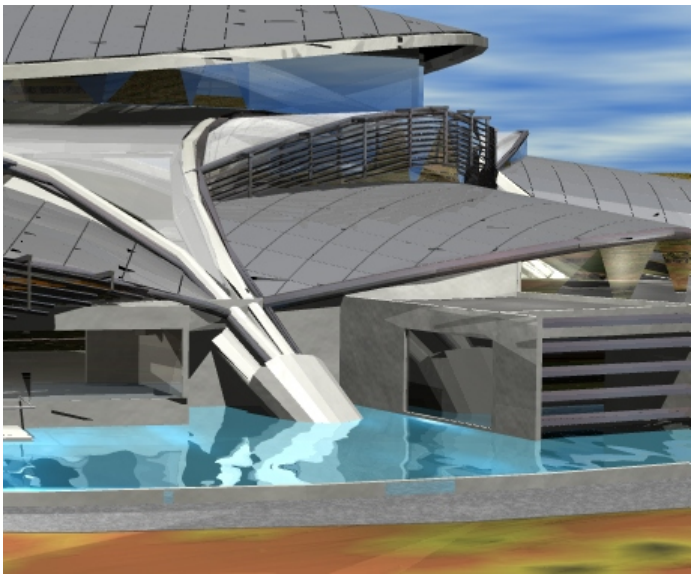
The 275 m² VIP section situated on the first floor is for sportsmen who stay in the hostels. This area overlooks the Hennops river, weight training area, aerobics hall and the indoor open space which makes it a focal point in the building where high performance athletes can be seen in action. The VIP section has a balcony overhanging into the indoor open space which contributes to the visual and interactive link between the indoor open space, restaurant and the VIP section. The VIP area is provided with a clerestory window with a transparent membrane covering for addition light infiltration and ventilation in the VIP section.

Aerobics hall

The aerobic hall situated on the ground floor has a transparent wall between the indoor open space and the aerobics hall that contributes to the visual link between the different facilities. Its double volume makes it a multi-functional hall that can be used for a variety of activities.

Spinning facility

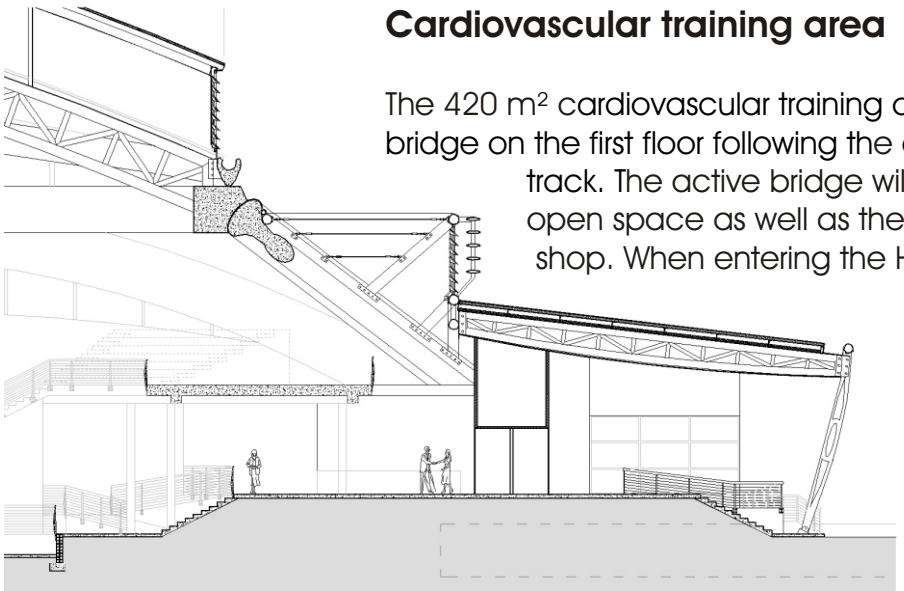
The spinning facility situated on the north-eatern side of the HPC has a glass facade that opens up onto the rainwater catchment pond. A spinning room is usually airconditioned so that cool air is blown into the room from the ceiling. This Cool air could cause injuries to the spinners if not correctly controlled. The pond will therefor cool down the spinning room with airconditioning that is blowing cool air slowly from the floor surface. The Eastern facade is provided with horizontal Louvers that will control the early morning sun.



Outside view of spinning room Fig.127

Cardiovascular training area

The 420 m² cardiovascular training area is a eight metre wide bridge on the first floor following the curve of the 200m athletic track. The active bridge will be visible from the indoor open space as well as the entrance foyer and sports shop. When entering the HPC the spirit of training would be enhanced by this cardiobridge with it's active vibe. This area of the gym will be used by a variety of people because of it's cardiovascular

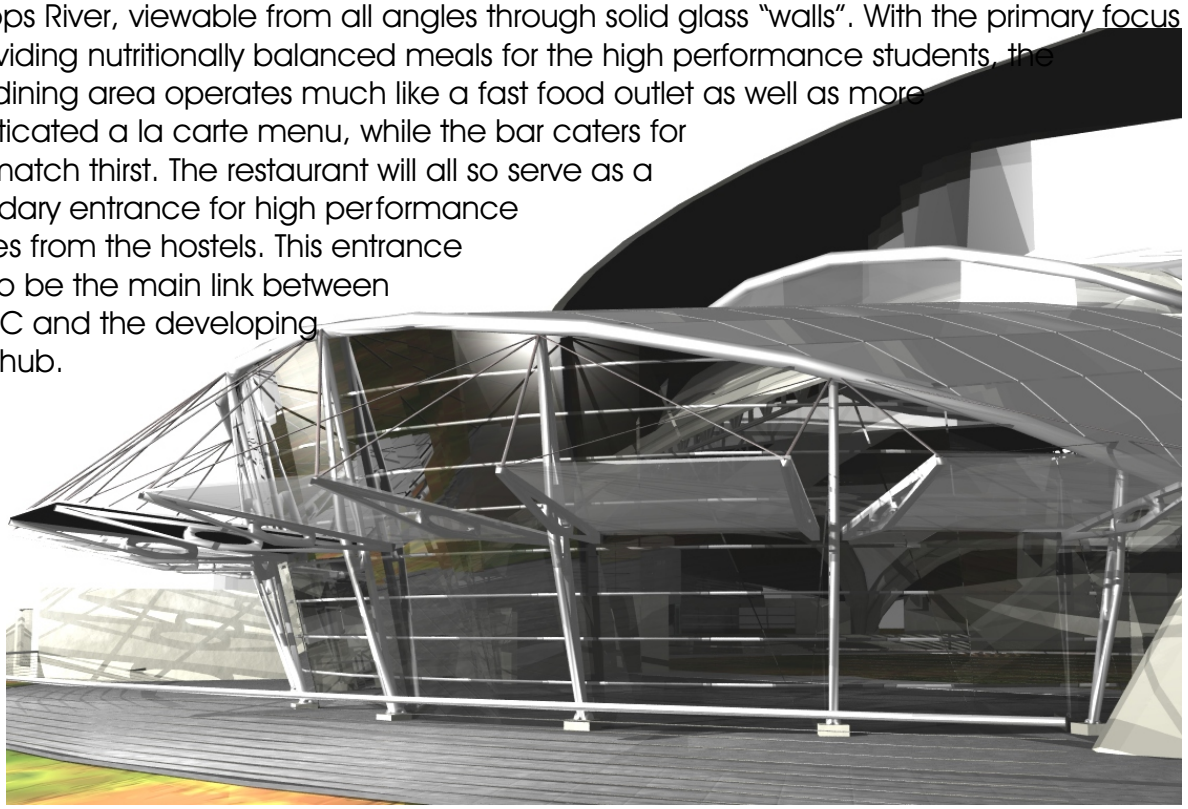


Section through entrance foyer showing cardiovascular bridge Fig.128

equipment. This area is also provided with a clerestory window covered by a transparent membrane roof cover for additional lighting and ventilation.

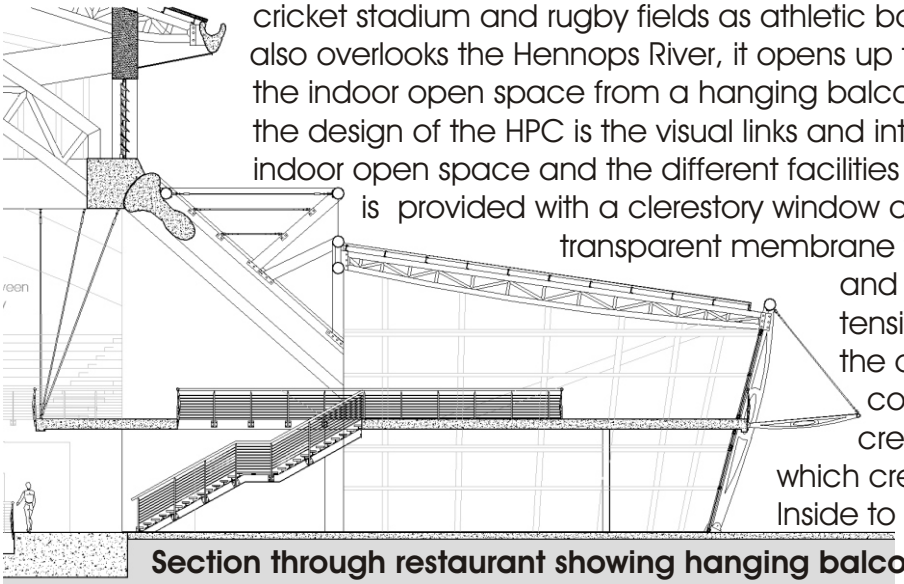
3.5.4 Restaurant

The high performance centre challenges the traditional view of residential dining facilities, and combines the fine dining experience with that of a refined canteen. Situated on the northern side of the building, the dinning facility has an idealistic view opening on to the Hennops River, viewable from all angles through solid glass "walls". With the primary focus of providing nutritionally balanced meals for the high performance students, the main dining area operates much like a fast food outlet as well as more sophisticated a la carte menu, while the bar caters for after-match thirst. The restaurant will all so serve as a secondary entrance for high performance athletes from the hostels. This entrance will also be the main link between the HPC and the developing sports hub.



Outside view of the restaurant overlooking the Hennops River Fig.129

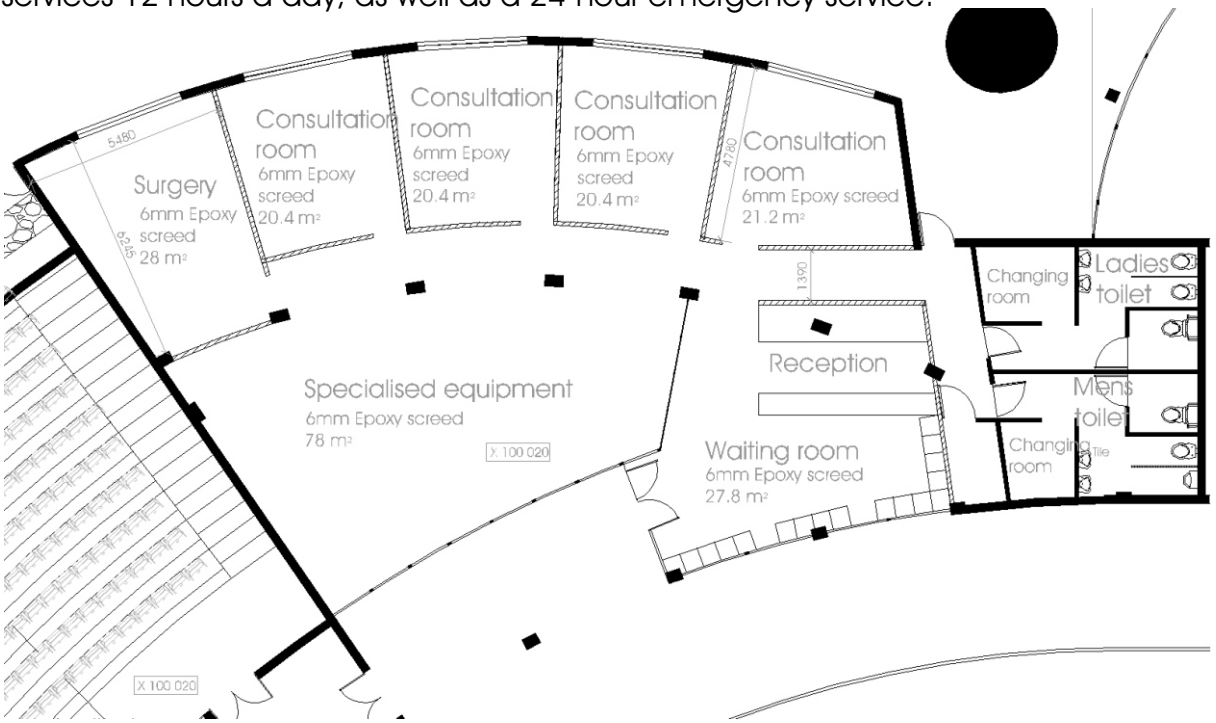
The restaurant is situated in the middle of the HPC which will serve as a central social area where athletes relax with a nutritional meal after practice. The 462 m^2 restaurant which can cater for 330 people consists out of two floors. The ground floor opens up to a patio overlooking the Hennops River with the stimulating sound of the rippling water and the cricket stadium and rugby fields as athletic background. The first floor also overlooks the Hennops River, it opens up to the inside overlooking the indoor open space from a hanging balcony. A strong concept in the design of the HPC is the visual links and interaction between the indoor open space and the different facilities around it. The restaurant is provided with a clerestory window covered with a transparent membrane for addition light infiltration and ventilation. Transparent tensile structures are fixed onto the outside of the restaurant covering the patio and creating a sense of place which creates a transition from the Inside to the outside.



Section through restaurant showing hanging balcony Fig.130

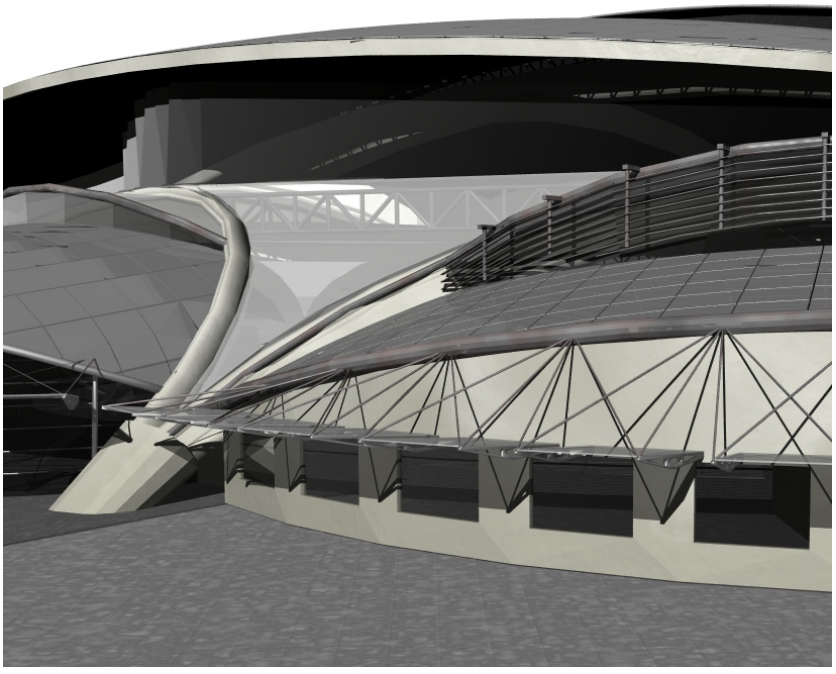
3.5.5 Medical centre

The medical centre will provide an all-encompassing medical service specialising in sports medicine. A variety of doctors will be brought together to form an unusual pool of talent - including a physiotherapist, chiropractor, sports dentist, a number of sports physicians, an orthopaedic surgeon and a radiologist, all focussed on the world of sports medicine. Students, guests and members of the public will all have access to their services 12 hours a day, as well as a 24-hour emergency service.



Medical centre layout Fig.131

The 308 m² medical centre situated on the northern side of the HPC is an open plan layout with internal partitioning. The consultation rooms overlook the Hennops River while the specialised equipment area has a visual link with the indoor open space through the glass wall. The specialised equipment area together with the indoor open space will be used for scientific analysing and measurement of athletes potential in specific sports and sports rehabilitation. The consultation rooms windows have a transparent tensile structure above it to control the northern and western sun movement.

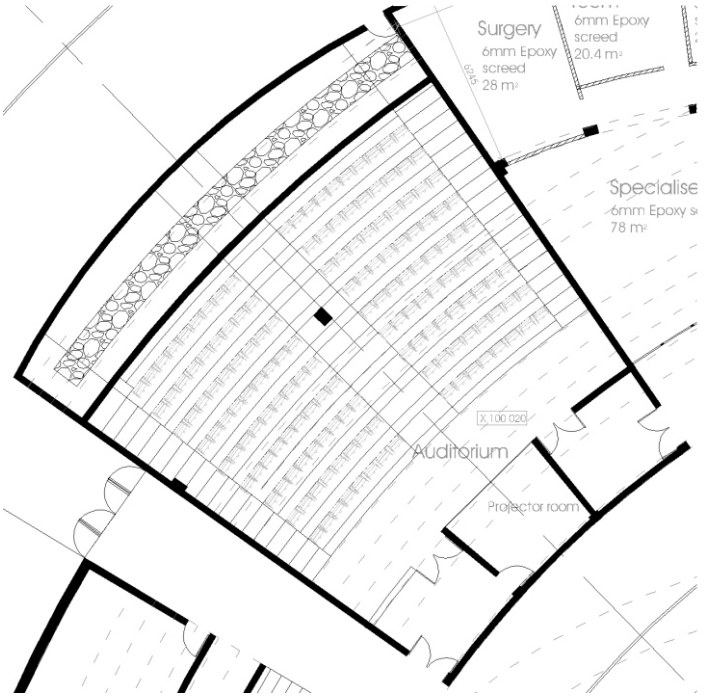


Outside view of medical centre Fig.132

3.5.6 Auditorium

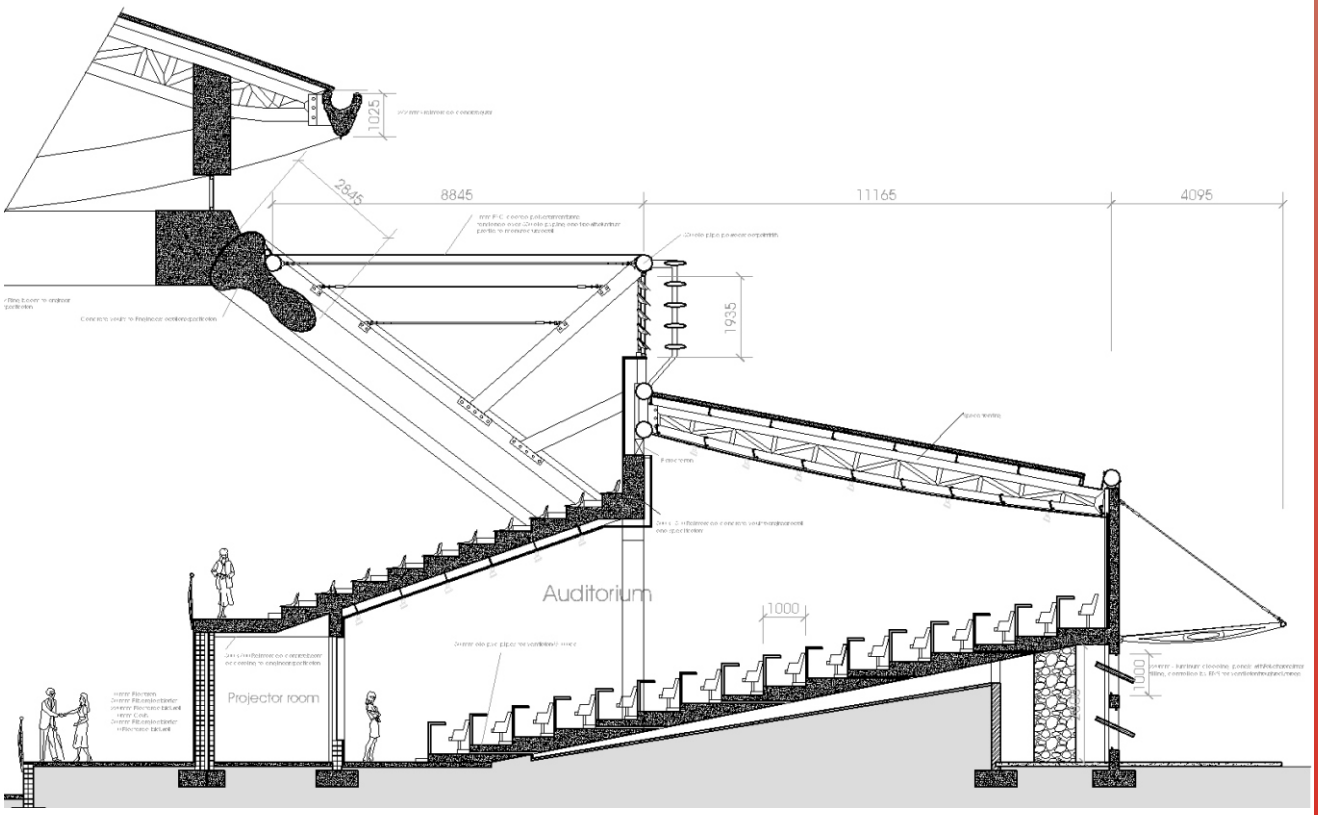
The 192 seater auditorium provides a high-tech environment focussing on comfort with ergonomically designed chairs, and is enhanced by state of the art audiovisual equipment.

The auditorium is available for hire to groups and also screens movies and sporting footage at regular intervals for individuals and groups to enjoy. The auditorium is also available for hire for conferencing and lecture purposes. Opening out onto the indoor open spaces, this facility also offers alternative catering and function facilities as well as being vital to the education of high performance athletes.



Plan of auditorium Fig.133

The auditorium situated on the north-western side of the HPC is naturally ventilated with a rock storage system. The cool air of the night enters the building through the openings on the north western side which cools down the rocks. In winter time the transparent tensile structures are pulled up so that the warm afternoon sun heat up the rocks for the next day. The openings in the wall will be controlled by the building management system according to the requirements. The space above the auditorium is used for a pavilion for the indoor open space.



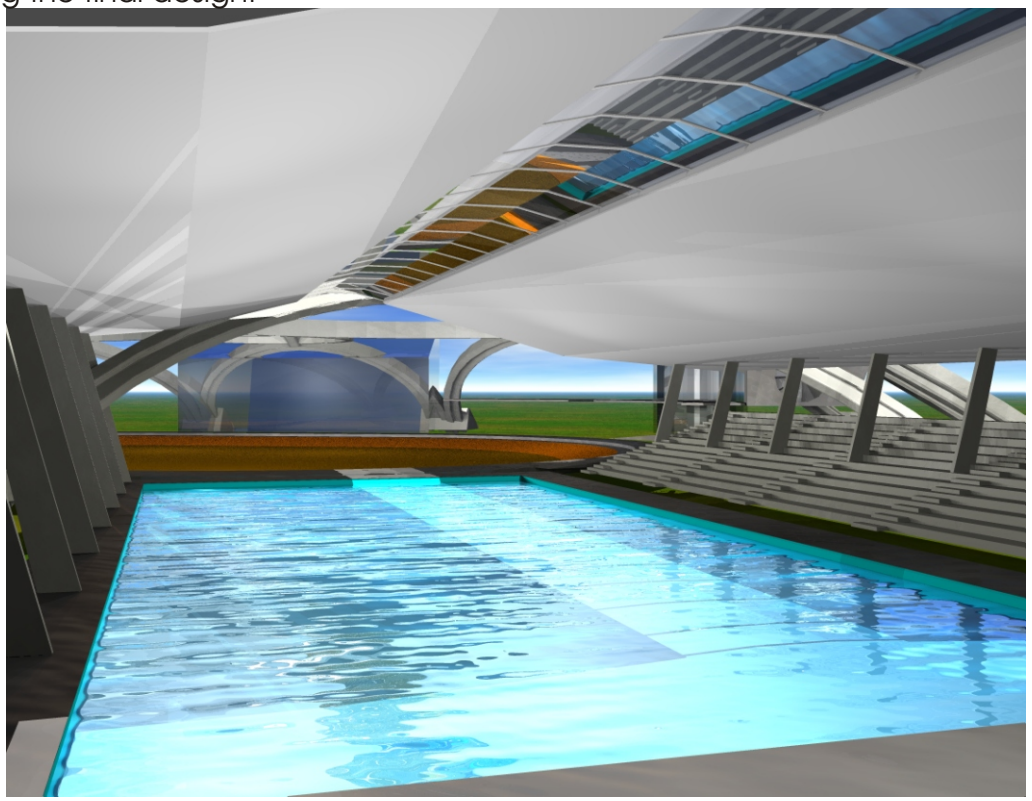
Section trought the auditorium showing part of pavilion on top Fig.134

3.5.7 Swimming pool

According to the clients brief an indoor Olympic size swimming pool where athletes could train in perfect conditions. The swimming pool will be used for training, gala events, water treatment rehabilitation, lifesaving and scuba courses. The swimming pool will be provided with under water and roof mounted cameras that run on a rail for reacher on athletes in action incorporation with the CSIR. The Olympic size swimming pool went through three design phases before reaching the final design.

First phase

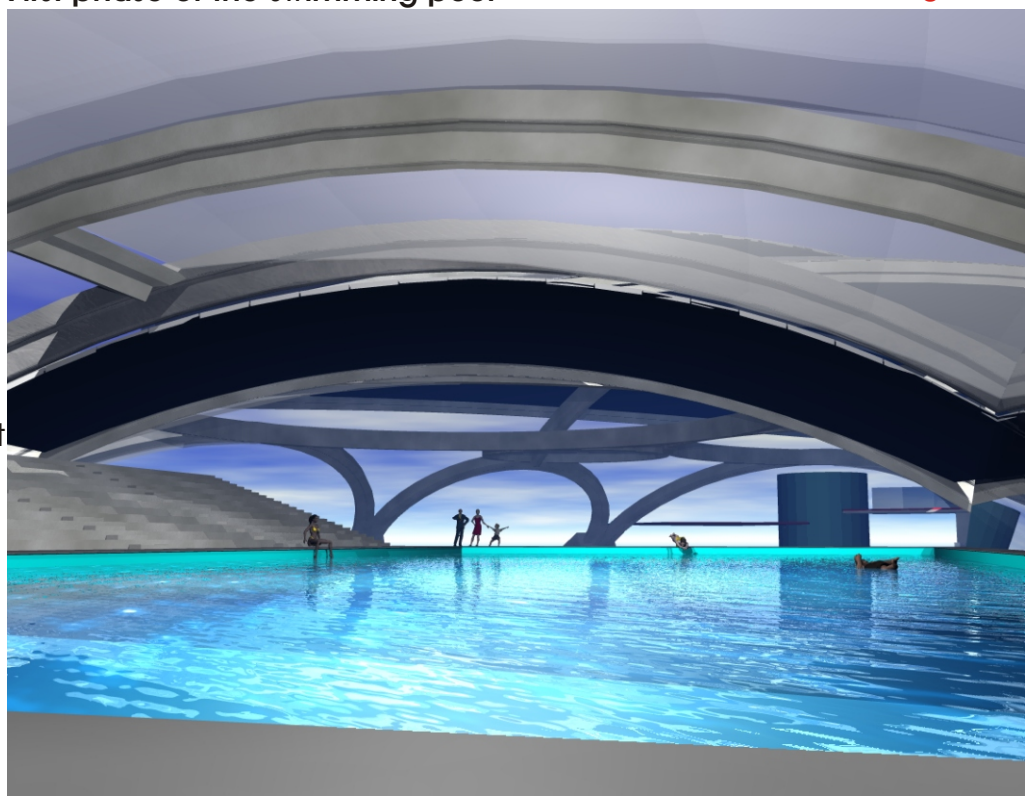
In the first phase the swimming pool situated on the southeastern side of the HPC had a solid roof cover with a skylight for light infiltration. The square form of the roof construction did not fit into the organic design of the HPC. The light requirement also did not live up to the expectation.



First phase of the swimming pool Fig.135

Second phase

In the second phase the swimming pool was moved to the southwestern side of the HPC where the pavilion will form part of the embankment. The roof structure becomes a concrete structure suspended over the width of the pool with a transparent roof cover. This structure was too heavy for its function and the structural connection between swimming pool roof structure and dome became too complex and expensive.



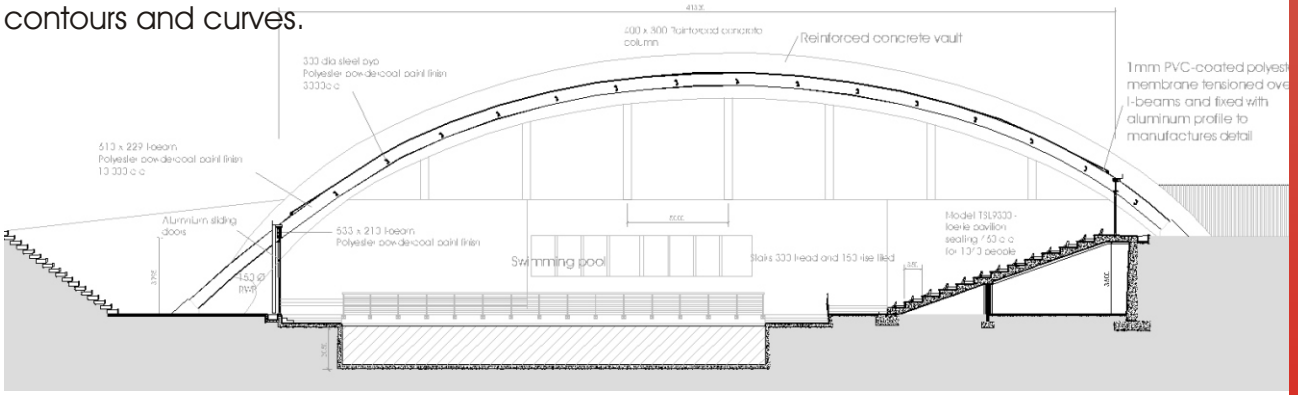
Second phase of the swimming pool Fig.136

Third phase

The final solution was an elegant lightweight steel construction suspended over the swimming pool. This lightweight transparent roof cover encloses the indoor swimming pool that creates an all year round training facility. The open connection between the indoor open space and the swimming pool creates a visible link between theses two dynamic training facilities that are accessible to high performance athletes and the

Third and final phase of swimming pool with lightweight roof construction Fig.137

The indoor swimming pool is naturally ventilated with glass facades that slide open in the length of the pool. The swimming pool area is sunk into the ground so that the pavilion could open up on ground level at the top of the pavilion. The elegant lightweight steel construction that is partly moulded into the ground became part of the landscape with its contours and curves.



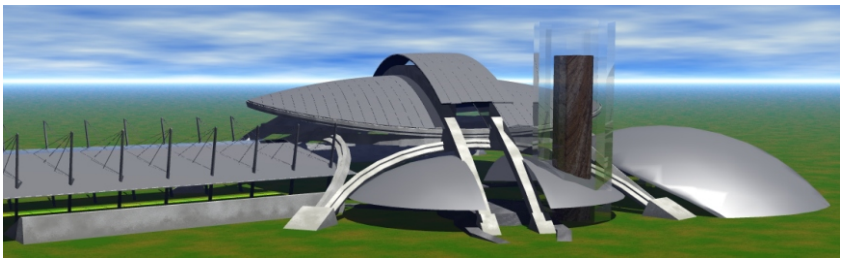
Section through swimming pool Fig.138

3.6 Final development

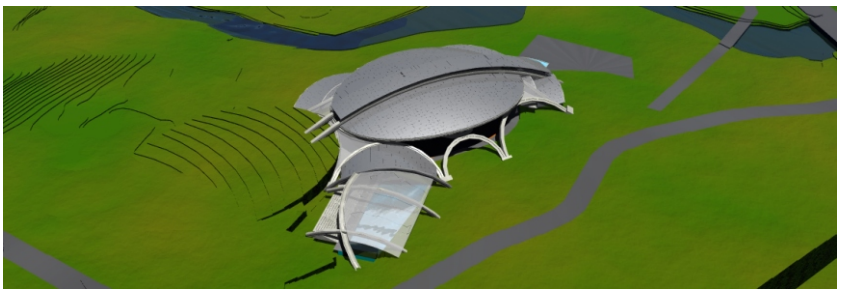
The Hi-Performance Sport Centre is a functional design that must be appealing to the high performance athletes who belong to the higher echelons of their national, provincial, club or school structure. These performance enhancers who want to improve their performance, health and fitness enthusiastic, and patients requiring rehabilitation and intervention who are required by virtue of an injury or illness to frequent a curative service before returning to one of the above customers group. The design went through a few design decisions and phases before a final product could be finalised.

The elegant dome structure covering the indoor open space was the form to work from. All the facilities that are attached to this structure must form an integrated whole that will complement the dome structure. An option was to design smaller buildings around the dome with connections between the dome structure and these buildings around it. This approach was called because of the decision that the HPC must have integrated facilities that could interact with one another, visually and functionally. In the first attempt the dome structure was not structurally effective and the facilities around did not integrated with the dome structure. The structure changes to a high performance structure with facilities that became more integrated with the dome structure but still not efficient enough. To design the facilities around the dome structure as an integrated whole was quite a complex process. A solution was to fill the openings between the vaults with a transparent membrane for additional lighting in the indoor open space and to create a simple elegant transition between the dome structure and roof structures that will be attach. The smaller aluminium roof structure grew out of the vaults that are aesthetic more acceptable and legible.

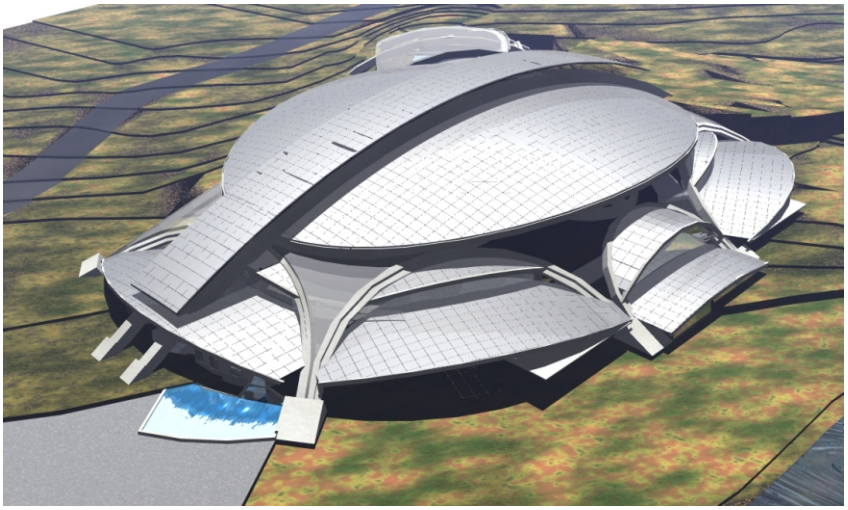
First attempt for HPC design Fig.139



Second attempt for HPC design Fig.140

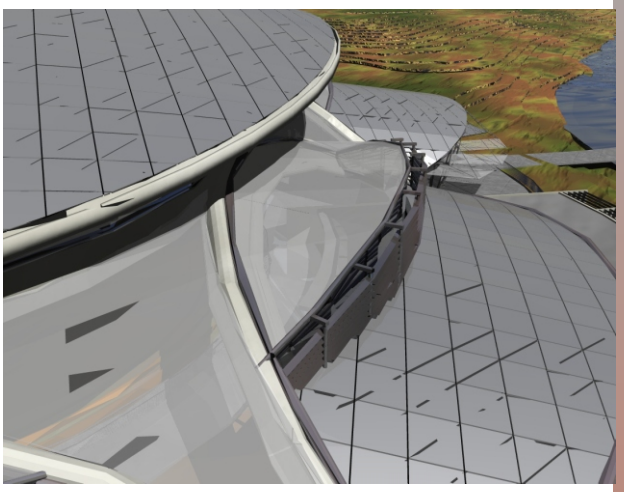


Third attempt for HPC design with southern view Fig.141



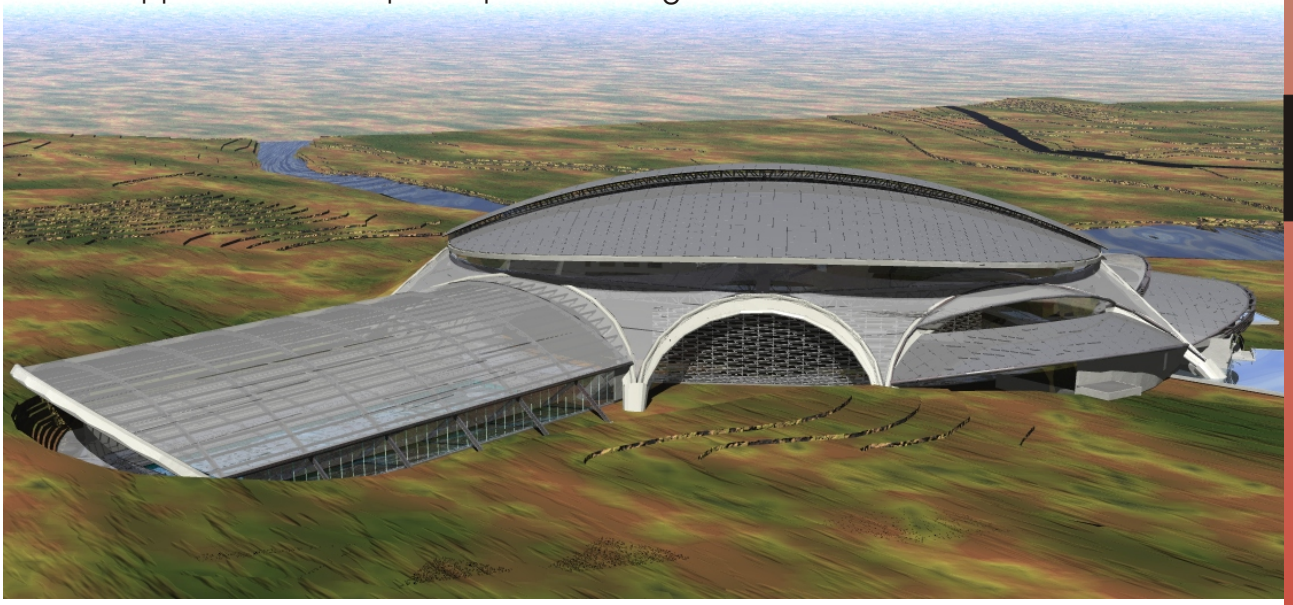
Third attempt for HPC design with norteast view Fig.142

The clerestory windows on top of each roof structure are provided with a transparent membrane roof cover for additional lighting in the HPC. This roof cover is also used as an elegant transition tool between the dome structure and the additional smaller roof structures. The smaller roof structures have become much more integrated with the dome structure and still it provides the interactions between the different facilities in the HPC.



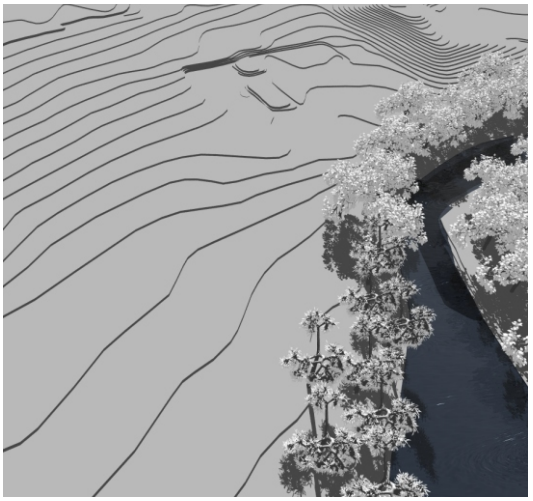
View of transparent membrane roof covers Fig.143

The indoor open space approach is an indoor facility that can open up to the outside and that is naturally lighted and ventilated. The high roof, transparent membrane roof covers, and southern facade with its roller shutter doors, opens the building up as an indoor outdoor space that is an all year round training facility. The louver windows situated between the dome and sub roof structure are controlled by the building management system according to the ventilation requirements of the indoor open space. This louver windows contribute to the indoor outdoor approach which opens up the building.



Southern view of HPC showing the translucent roller shutter doors Fig.144

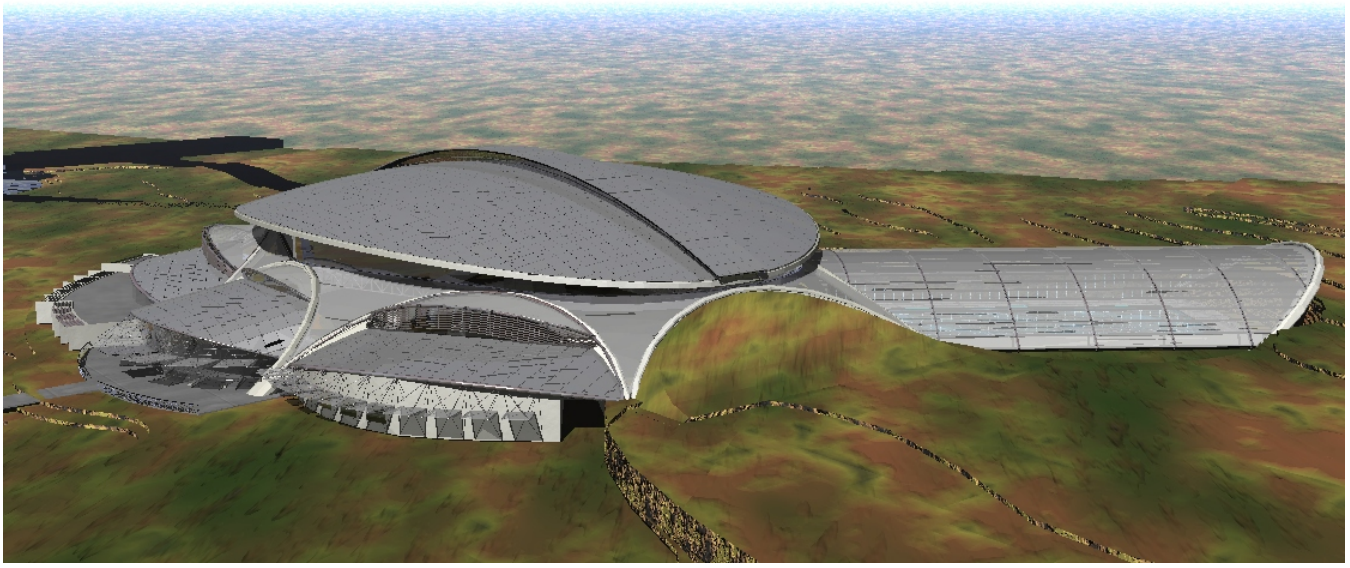
The HPC is designed and paced into the site according to the flood line and the landscape's topography. The underground water tank fits into the site without major excavations. All excavated soil will be used to fill the site up in the western site of the HPC to mould it into the site. The flowing lines of the landscape become part of the HPC's flowing forms that make it part of the site as well as part of the integrated environment and habitats. The flowing lines of the HPC that moulds it into the site contribute to the flowing spaces in the building.



Site contours Fig.145

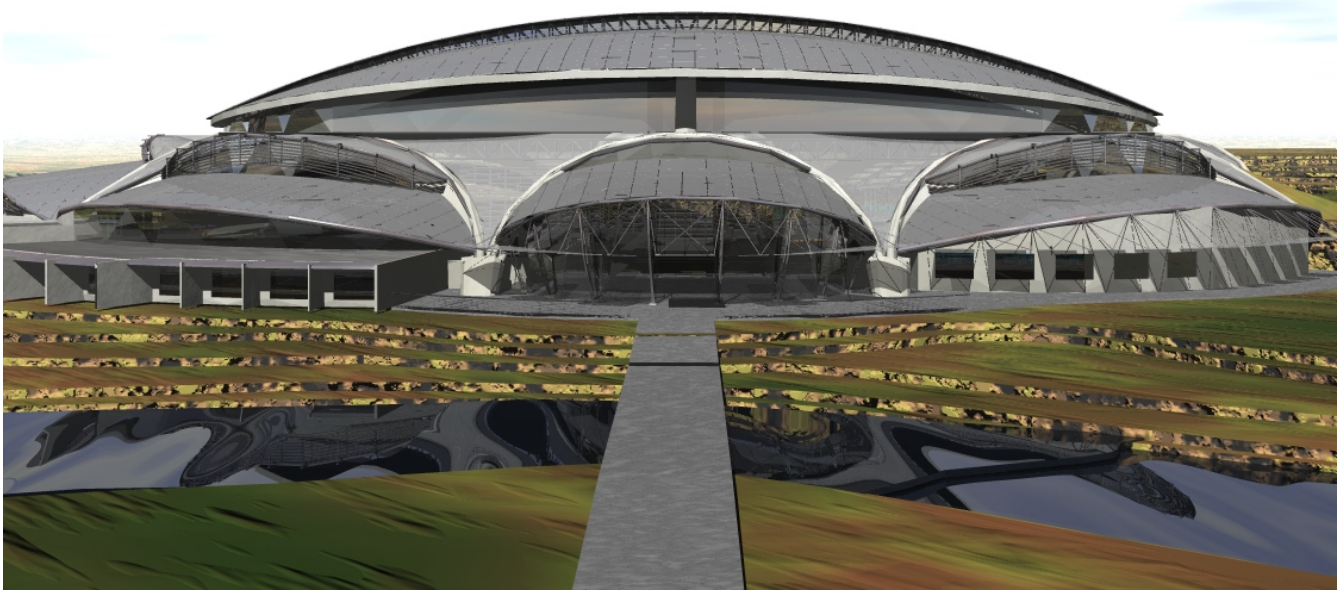
3.7 To conclude

The HPC achieves the hi-performance look with its hi-performance structure that is moulded into the site. The indoor, outdoor feeling is created successfully with the large openings and transparent membranes that connects the building with the outside. The building functions as a whole with integrated facilities and function, looking out on one another with the Hennops River as tranquil backdrop. The HPC provides a holistic and integrated approach in the



Northwestern view of HPC Fig.146

Developing sports hub that embraces a fusion between advanced technology and performance backed by science. This landmark of sport science provides an objective and unbiased sport science product that will serve high performance athletes, the professional sports market, corporate markets and the public.



Nothern view of HPC Fig.147