



Preliminary

The exploration into methods and means of the most important technical aspects of the project will serve as the crux for this section. It must be noted that this project is not of a neutral nature and certain key elements are highlighted while others have just been thought about and presented in totality.

The theme of this dissertation revolves around the experience and culture represented by motorsport, and as such, the technical inquiry follows on this theme.

Think of it this way: a racing car gets finely tuned and set up for a specific race, hours go into the preparation only for someone else taking part in the race to swipe you from the side on the second lap. Into the pits the next time round and thirty seconds later you are back in the race having only lost two positions. Bolt on, bolt off. It is about the connection, being able to change elements quickly and precisely.

Cars are made in sheds, industrial places with hard flooring and a lot of steel. Products that can take the punishment of a manufacturing facility.



The evolution of the private motor vehicle over the past few decades has seen the safety of the occupants become a major role player and, as such, has influenced car sales dramatically: the more safety features, the safer the car and the higher the sales. Likewise for the building industry, except that it is not the safety features that determine the popularity of a building (that should be taken for granted with the various codes enforced on designers nowadays by the regulating authorities), but the sustainability of the building.

Until very recently, motor vehicles have been the furthest thing from being sustainable, but this is slowly changing with the introduction of hybrid vehicles. Although not completely set apart from the traditional car, the blend of the old with new technologies is a dramatic step in the right direction.

This technical inquiry will represent exactly that which was mentioned above, a balance of old ways with new technologies. These are technologies that are a step in the right direction towards sustainability, keeping in mind the industrial theme of the project.

MATERIALS

Choosing the correct materials for a structure of this nature took inspiration from the traditional industrial warehouse or shed. Steel frames with infill of bricks and mortar, corrugated roof sheeting and cladding and monitor lighting glass forms a large portion of the barrier between inside and outside and comes as a result of trying to obtain as much natural light as possible throughout the entire facility.



figure 5.02_design perfection, aston martin



figure 5.03_ steel frame construction



figure 5.04_ cocobrik horizon satin FBS



figure 5.05_ high technology glass

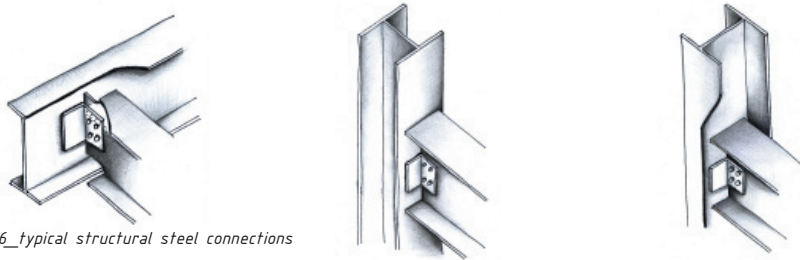


figure 5.06_ typical structural steel connections

steel

For decades steel has been used extensively in the industrial sector, for the simple fact that erection time of the structure is drastically reduced. Most elements are pre-manufactured in the workshop and then transported to site and bonded together, either by bolting, welding or riveting.

Steel is the primary structural material throughout the facility, consisting of a number of 305 x 305 x 158 H - columns that run the required vertical length, fixed at the base by a 20mm plate to a concrete footing in the traditional manner. 305 x 165 x 41 I-beams connect to the H-columns by means of an end plate with bearing bolts on a flush connection and a 10mm thick angle welded to the flange of the H-column for bolting to the flange of the I-column on the recessed connection.

brick

Before steel became such a commercial material in the industrial sector, bricks were commonly used in the construction of warehouses and manufacturing facilities. Red brick specifically is reminiscent of these times and can be used effectively in the design as a reminder of the historic car garages and industrial evolution.

The brick infill takes place primarily in the construction of the museum sheds and the servant spaces between the sheds. Typical two-layer (single skin) stretcher bond wall construction (flush mortar joint) with wall-ties every sixth-course, due to the height of the walls on the eastern façade and where the wall connection to the steel H-column takes place, connection will be by pre-welded 2mm steel plate sheeting on H-column, bent down between brick courses, every twelfth course.

glass

Although the climate in South Africa is very favourable, the solar radiation can cause extreme heat gain within the building. Glass technologies have revolutionized the building industry with the variety of "energy efficient" glass façade systems available today.

figure 5.07_ brick wall to H-column connection

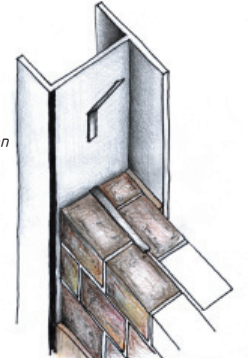
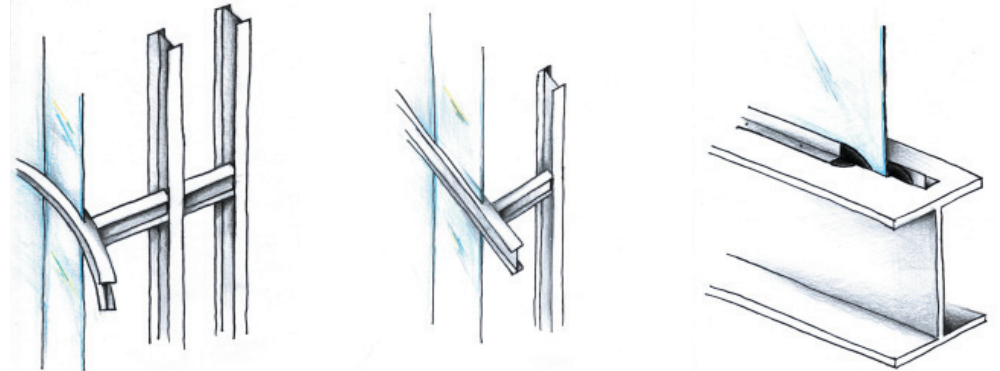


figure 5.08_ typical glass fixing detail



The use of a high technology glass throughout the facility was based on two important criteria: heat gain, specifically on the eastern and western facades of the admin block and entry rotunda and the parallel between high technology of motor sport today with the high technology of the material.

8mm SmartGlass Armourlam SolarVue Neutral toughened laminated safety glass was chosen due to its excellent solar control capabilities.

End fixing of the glass panels will be by the use of 3mm aluminium angles, inside and out, with neoprene sealing strips and self-tapping stainless steel screws and glass on glass sealing will be provided with a 5mm structural silicone seal.



figure 5.09_aluminium cladding

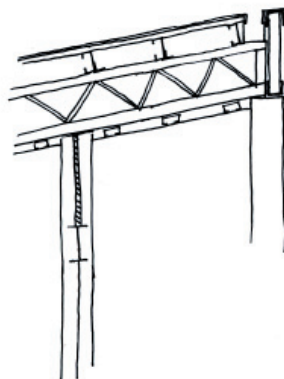


figure 5.11_rotunda roof edge detail

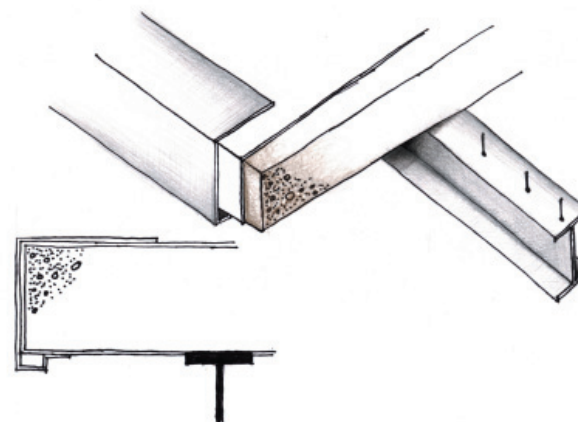


figure 5.12_admin roof edge detail

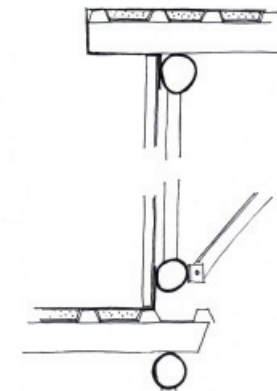


figure 5.13_museum shed monitor roof edge detail



figure 5.10_aluminium cladding detail

aluminium

Although aluminium has a high-energy consumption during the production process, the possibility for recycling of the material has developed over the past number of years. It is relatively maintenance free and requires little or no preparation. It is easily workable and is aesthetically pleasing, especially in a context of a high tech environment.

Composite 3mm aluminium cladding panels, Hula-Bond in this case, are used selectively throughout the facility, internally and externally and portray the slick high-tech image associated with motor racing. The fixing system is standard for cladding panels of this type: vertical channels bolted to the wall skin, providing support for aluminium round bar running horizontally. The panels are bent and notched accordingly and “hung” onto the bars. Vertical seals are made with structural silicone while top and bottom ends are fixed with cover seals.

Aluminium flat sheeting; 0,7 – 1,6mm thickness, provides the ideal solution for an awkward roof shape that cannot otherwise be solved by concrete. See roof element for fixing detail.

ELEMENTS

Certain elements make up the “highlights” of the facility, the most important ones will be explained in more detail, enforcing why they work the way they do and what components make up that specific element.

roof structure

The roof structure can be broken down into three different types covering the three different volumes. The roof over the rotunda (will bare a resemblance to the roof over the museum sheds and raked grand stand seating), the roof over the admin block and the museum shed roofs.

rotunda roof

The column set up for the rotunda is based on the fixing for the glass, the 20 sun screening and for support for the ramp. The columns provide for adequate support for the roof structure. Due to the transparency and lightness of the rotunda, it was decided that a lightweight steel roof be used.

The system comprises a round fabricated steel truss resting on top of the outside I-column ring with its apex at the crossroad junction. Connected to this truss is a series of smaller trusses, crossing each other mid-point with support by the inner ring of concrete columns. Lipped mild steel channels run horizontally from the apex as purlins for corrugated mild steel roof sheeting, IBR profile. A purpose made box gutter runs the length inside the outer circular truss with down pipes at strategic points.

The valleys of the IBR are filled with expanded polystyrene as insulation and the entire roof is covered in 1mm aluminium sheeting, starting from the lowest point with 300mm overlap and neoprene seal, fixed to IBR with blind rivets and sealing washer. Ends are folded over into box gutter.

admin roof

As a design decision, a concrete roof is chosen for the admin block. Cast in-situ concrete on top of I-beam structure at 3 degrees with ribar welded to top of beam. Sealing of the concrete by means of a torch-on bitumus layer, over the ends and 200mm back on the underside. Flashing is provided for on end details by 1mm aluminium sheeting, bent over ends and back under with a drip. This is fixed by pressure shooting galvanized steel nails into the concrete roof.

museum sheds

The roof over the museum sheds and ground stand seating follow the same principle as the rotunda roof. IBR galvanized roof sheeting with expanded polystyrene infill and 1mm aluminium sheeting covering. Support by 102ø x 2.8mm round hollow section purlins at 1200 centres on top of steel trusses at 6m centres. Extra purlin support by strut braces from bottom truss chord to side of purlin, every second row. Added insulation between purlins and IBR by fire rated industrial sisalation.



figure 5.14_typical roof composition detail

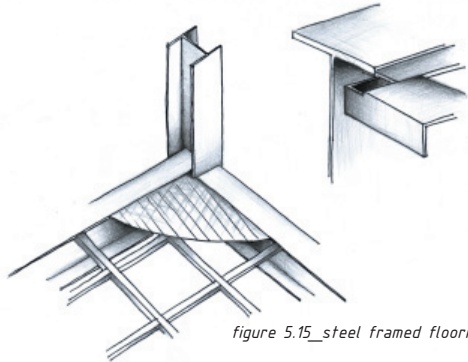


figure 5.15_steel framed flooring system

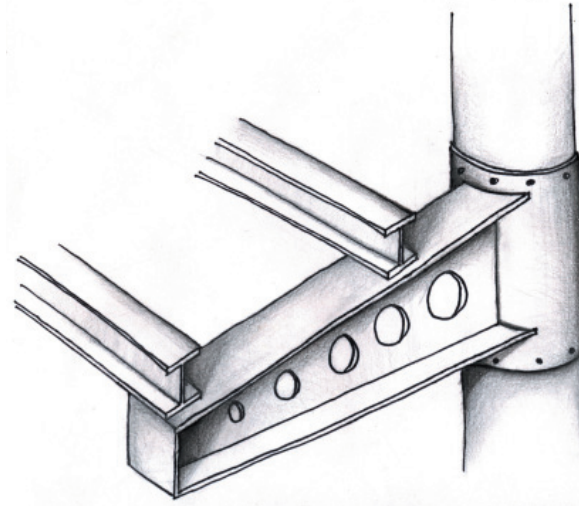


figure 5.16_ramp support detail

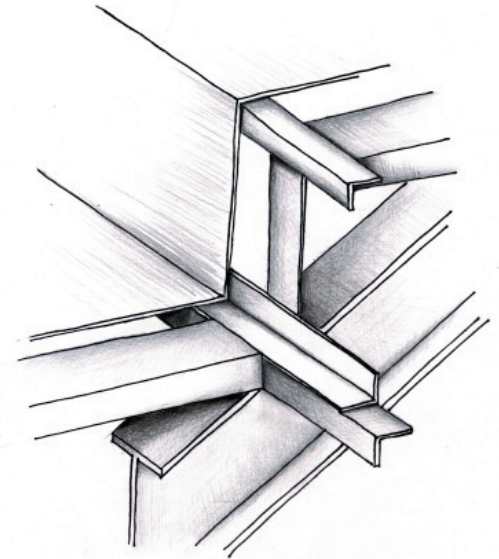


figure 5.17_steel framed seating

This method of roof covering was chosen due to the outward expansion of the trusses from the centre point out. The aluminium sheeting provides for complete weather proofing and also creating a flush finish on the roof reminiscent of a Formula One racing car.

flooring

Movement patterns can be suggested with changes in floor covering material. The variety in flooring material changes with the floor levels and changes in horizontal spaces and places.

Pedestra vinyl floor tiles are used throughout the facility on ground floor. Changes in pattern and colour will differentiate movement zones. They have a concealed fixing system, are water repellent, non-slip, impact and stain resistant and are easy to clean, ideal for industrial flooring.

“Vastrap” floor plate pays with the industrial theme and is used on all floors above ground where prominent circulation follows and for stair treads, fixed to steel channels by rivets that are countersunk.

Office and private box flooring comprised a mix of steel channel supports between beams and 6mm flat steel covered in Pedestra vinyl floor tiles for sound absorption.

ramp

Free flowing movement is the concept behind the ramp. It allows for unobstructed pedestrian movement within the rotunda and creates exceptional view points out towards the track. It also doubles as exhibition space regarding the evolution of Kyalami Grand Prix Circuit.

The ramp structure itself is constructed out of steel beams and bracing covered in 6mm “vastrap” floor plate. It is supported from one side by large cantilever I-beam sections connected to 500Ø concrete columns clad in 1mm aluminium sheeting.

grand stand seating

The ability to include public seating areas as part of the complex was a crucial benefit to the viability of the project. The inclusive seating manifests in two parts: the public seating area above ground on the retail curve and the private boxes, above ground, on the western facades of the museum sheds.

A prefabricated concrete seating element was out of the question due to the entire structure being steel, so a purpose designed steel frame system that is clad in 6mm “vastrap” floor plate was used. Tread and riser follow stadium viewing ideals of 800 tread and 400 riser. The boxes are separated from each other by a dry walling system that is plastered and painted with a collapsible shop-front glass door system to secure the boxes when not in use.

interior partitioning

All partitioning on the inside of the admin block is provided by a dry walling system that is plastered and painted. This allows for a re-use system to take effect should the building’s function no longer be required.

external seating

As with the necessity to provide for viewing areas and seating as an included element of the structure, it is also necessary to provide for seating on the outside of the building as part of the landscape.

The seating flows in levels as the natural ground line rises and terminates subtly into the landscape. Construction is by red corrobriek retaining walls with neutral pavers up to the dedicated walkways. Sight lines are kept with the traditional tread of 800 and riser of 400.



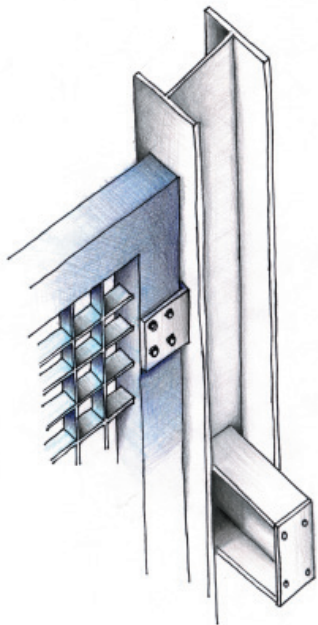


figure 5.18_'mentis' grid sun shading

figure 5.19_'mentis' grid sun shading example



figure 5.20_horizontal aluminium louvres on eastern facade

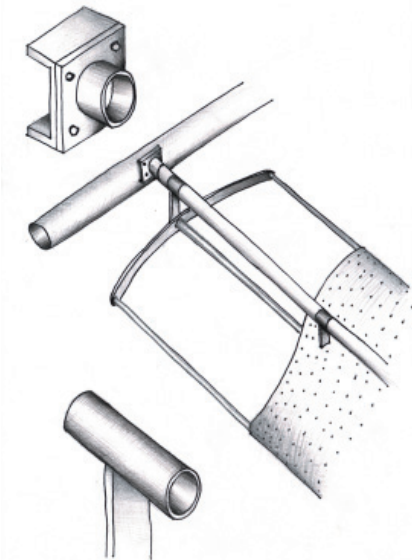


figure 5.21_punched aluminium west facade sun shading

SOLAR ATTENUATION

The effects of direct solar gain can be damaging in many ways to the interior spaces of buildings. Permanent destruction of materials housed inside in direct sunlight can take place and spaces can become increasingly uncomfortable to be in if the air temperature is not controlled properly. Problems arise with keeping the sun out and allowing as much natural light in as possible.

The only effective solution is to create a balance between high technology glasses (as mentioned previously) and sun-screening.

mentis grid

70 x 50 x 2mm aluminium expanded "mentis" grid is used as an effective sun-screening device on all northern facades of the museum sheds. They allow ample natural light penetration and prohibit the direct gain of sun. The same profile mentis is used for solar protection around the rotunda and as a secondary skin on the admin block.

The "mentis" panels are welded to a 100x70x3 rectangular frame and then bolted at strategic points to the I-columns.

aluminium louvres

Horizontal aluminium louvres are used solely at the main entrance to highlight that point. Horizontal louvres were chosen as a design decision and do not run parallel to the glass façade entrance, but appear to be falling over forward so as to accommodate for the east and west orientation.

overhangs

Large overhangs are used on the western façade of the museum sheds, both on ground and seating level. The main views are to the west and it is not possible to disrupt them. Punched aluminium sheeting, profiled on a curve, is used as sun screening on the western façade. It is fixed to a frame by rivets and bolted to the top chord of the truss for the seating area and the I-beam for the lower museum.



figure 5.22_example of monitor lighting

monitor lighting

The museum sheds are spaces for display of racing cars and all aspects of motor sport in South Africa. The industrial theme is carried through and provides for natural lighting by the use of monitors. They are clad in profiled fibreglass sheeting fixed to the open side of the steel truss by self-topping stainless steel screws and sealing washers. The northern side consists of white opaque sheeting and the southern side by transparent sheets.



figure 5.23_roof monitors for natural lighting and ventilation

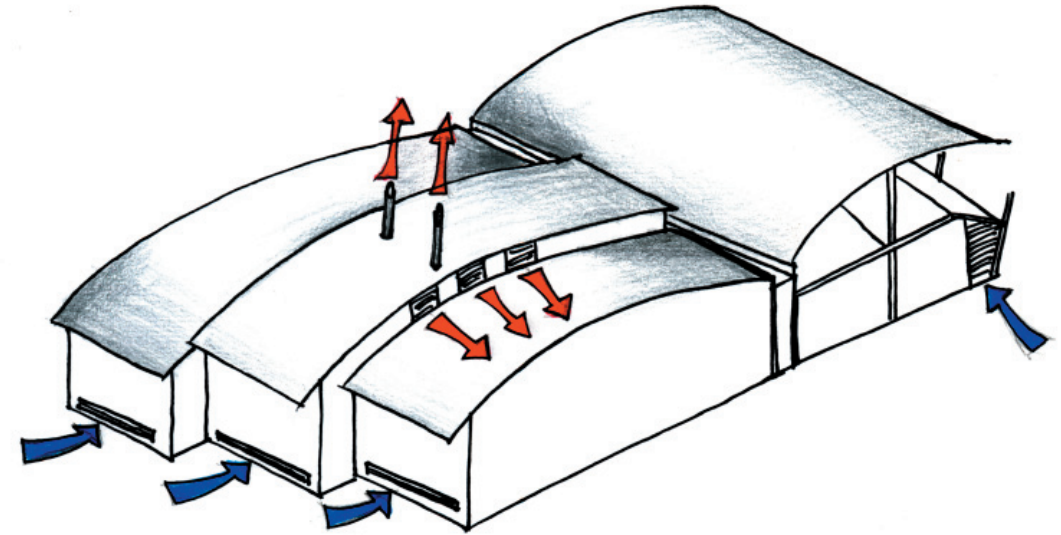


figure 5.24_ventilation flow diagram through museum shed

VENTILATION

The use of air conditioning to cool interior environments is constantly being questioned by those in the sustainability field. Passive technologies are being used all over the world with great success. A combination of features that include passive methods and energy consuming ones is ideal in this situation. The cost of supplying air-conditioning throughout the volumes of the museum spaces is not feasible, as the occupation of the spaces is not constant, therefore, a naturally ventilated system will be put into place in these areas.

A strip of adjustable aluminium louvres runs at floor level on the eastern facades of the museum sheds, with large fixed ventilation louvres on the north and south facades on the eastern corners of each shed. This allows for adequate fresh air flow into the spaces. Warm air extraction will take place by aluminium louvres positioned in the monitors at every fourth fibreglass profiled sheet.

Non-adjustable aluminium louvres are also positioned at the roof cross-over points in the transition spaces.

air-conditioning

For a productive work environment and spaces where computers make up a large percentage, air conditioning is a requirement. The admin block and rotunda will therefore be air-conditioned by a plant on the roof of the building.

This allows for maximum fresh air intake from the height of the building and for the safe expulsion of warm air into the atmosphere.-

All internal ducting will be exposed and will be fixed to the underside of the floor/ceiling beams. All electrical cabling will run likewise and lie in the galvanised steel cable trays.

