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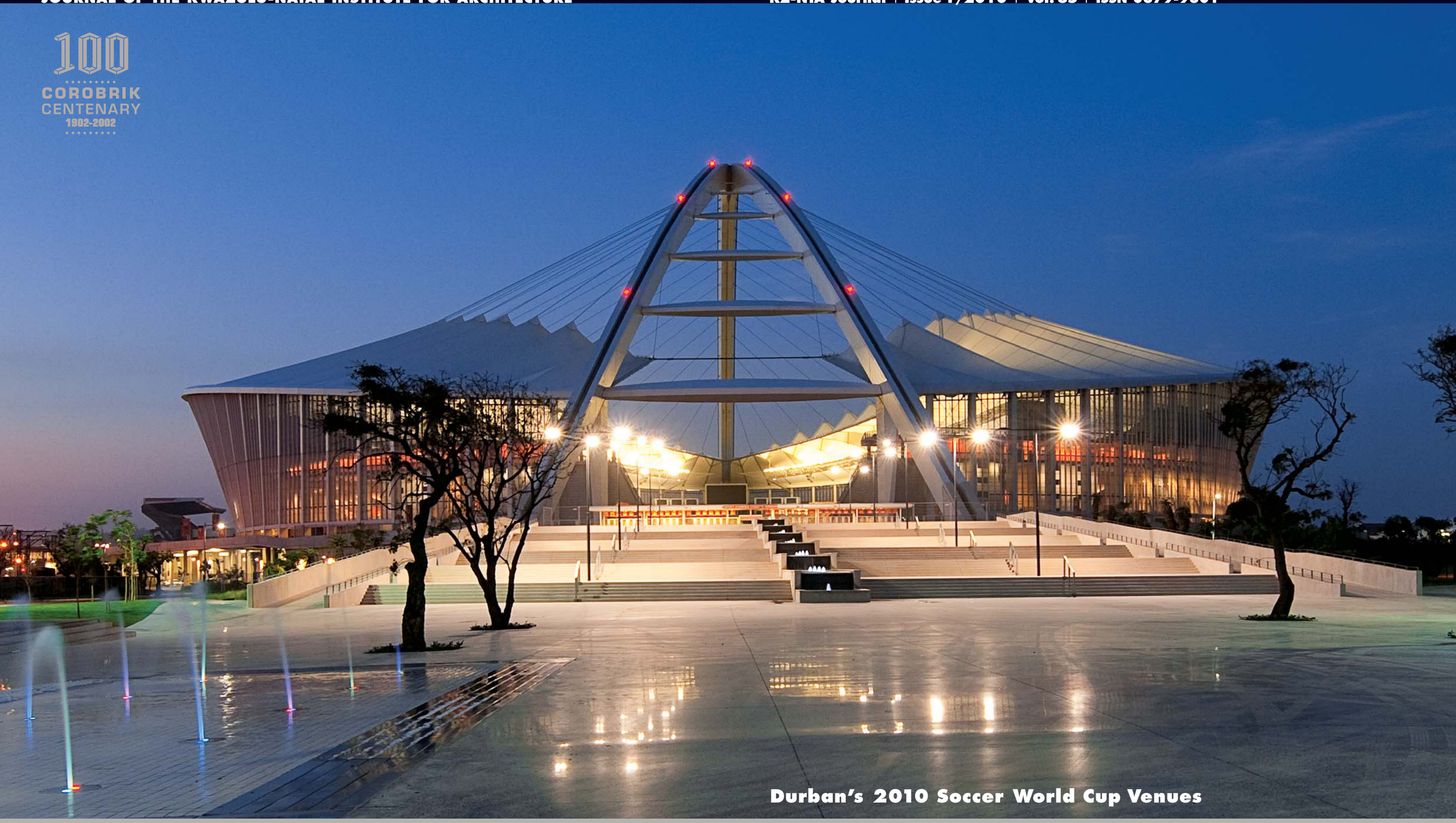

# Durban's 2010 Soccer World Cup Venues



KZ-NIA

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## NEWS

### UKZN School of Architecture

At a ceremony held on Tuesday, 11th May, KZ-NIA President, Miles Pennington presented the following Institute prizes for academic achievements to the top students of the years of 2008 and 2009 respectively:

**Bachelor of Architectural Studies**

Year 1 *Barrie Biermann Prize*: **Vincent Richter**, **Devin Audibert**

Year 2 *Gordon Small Prize*: **Helen Reeves**, **Ian Rall**

Year 3 *Calvert McDonald Prize*: **Ian Tarboton**, **Michael Brunner**

**Master of Architecture**

Year 1 (4th) *Clement Fridjhon Prize:* **Ryan Harborth**, **Stephanie Zangerle**

Year 2 (5th) *Sonny Tomkin Prize:* **Lauren Haiden**

### In Memoriam

*KZ-NIA Journal has learned with regret of the deaths of the following members and colleagues:*

**Andrew Swiatek** (1952 – May 2009)

**Uwe Potter** (1949 – December 2009)

**Peter Jones** (1961 – December 2009)

**RW (Bill) Straw** (1937 – March 2010)

**Martin Knoetze** (1924 – 2010), concurrent ISAA secretary/ executive officer and SACA registrar 1972–97, and founder registrar of the SA Council for the Architectural Profession until retirement in 2005. His contribution was acknowledged nationally in 1991 when he was given honorary membership of ISAA, and internationally when, in 2004, he was rewarded with honorary Fellowship of RIBA.


Francois van der Westhuizen

### *Corobrik* Regional Student of the Year 2009

**Lauren Haiden won the 2009 *Corobrik* KwaZulu-Natal region Student of the Year award for her Design Dissertation "The Design of a Centre of the Performing Arts: Catalyst for the Rejuvenation of Durban's Embankment."**


Sean Williams, Zoom Photography

### 2009 *Corobrik* Student of the Year

**At a function held at Johannesburg on Wednesday, 10th March, Guy Ailion of the University of the Witwatersrand was announced architectural Student of the Year. In his thesis entitled "Every – Where is Here", Ailion "explored a spatial re-interpretation and an adaptation of the traditional information platform within a developing world context and concluded with the design of an open-information-campus model". In the photograph above, Ailion is being presented the prestigious award by *Corobrik* Chairman Peter du Trevou.**

### A celebration of architecture

**The KZ-NIA year opened with a presentation of the 2009 Sophia Gray exhibition and lecture "More Ways of being an Architect" by Walter Peters at KZNSA Gallery, Durban, 19–24 January, sponsored by *Corobrik*.**

Craig Hudson

### Mapungubwe National Park Interpretive Centre

At the 2nd World Architecture Festival held in Barcelona, 4–6 November 2009, the Mapungubwe National Park Interpretive Centre by Johannesburg colleague Peter Rich was announced World Building of the Year. *(See Letter below)*

### Letters to the Editor

Dear Walter,
Always such a pleasure when KZ-NIA Journal arrives.

Congratulations to all the winners of the Awards for Architecture.

The wonderful thing about South African architects is that they know the difference between "timeless" and "old fashioned" ... their unashamed use of natural materials (preferably found on site), their modesty and good manners is such a welcome contrast to most architecture here in England ... if it's not outrageous it's no good!

And the buildings sit so well in the landscape. Peter Rich's Mapungubwe is another classical example of the African Architectural Renaissance that is taking place.

It must be wonderfully exciting for you to be in the middle of it.
All the best
*Issy Benjamin*, London

Dear Wally
One hundred not out!
Wonderful ... keep batting.
Congratulations!

Looking at the mini-covers I found the one that accompanied the Student Congress in 1987 ... I remember I broke the so called academic boycott to attend!

On my return to England some erstwhile friends, then high-ups in the ANC-in-Exile cornered me in London to have a go at me ... I was unrepentant as I felt my credentials were impeccable ... I HAD left the country in a bit of a hurry after a warning.

The aftermath was that Oliver Thambo released a Press statement a week later that said in effect ... "Certain academics *should be encouraged* to visit South Africa. The slogan is no longer 'Liberation before Education' but rather 'Education before Liberation! *Stop burning down the schools!*' "

It was for me a great Congress ... and an even better aftermath ...and finding that cover amongst all those others unlocked a huge bank of memories.

I went back to my papers and found a study of Seaview houses by I think Bryan Lee ... exquisite sketches ...I could almost smell and *smaak* the mangos and the litchis.

Well done Wally... you brought me a touch of home!
Best regards
*Issy Benjamin*, London

## *Durban's 2010 Soccer World Cup Venues*

# Editorial

When in May 2004 South Africa was awarded the privilege of hosting the 2010 Fédération Internationale de Football Association (FIFA) World Cup, Durban as a host city had to carefully consider its sporting venues. On the advice of professional consultants, ABSA rugby stadium at King's Park could not be extended economically and the design of the soccer stadium opposite was found to be incapable of expansion. Thus followed the invited design competition for the new Moses Mabhiba stadium and the winning submission was published in *KZ-NIA Journal 3/2006*. Amazingly, the new stadium was completed within 32 months at the end of 2009.

The brief had spelled out that the new stadium was to be iconic and in the context of Durban, the term was understood "to represent more than an object or building…but as a place, a spirit, a memory". However, during the design process it became evident that the emphasis would need to be placed on a much broader precinct than the existing site offered. This called for the creation of an urban design framework from which several projects were identified and proposed, and in this issue those are being featured.

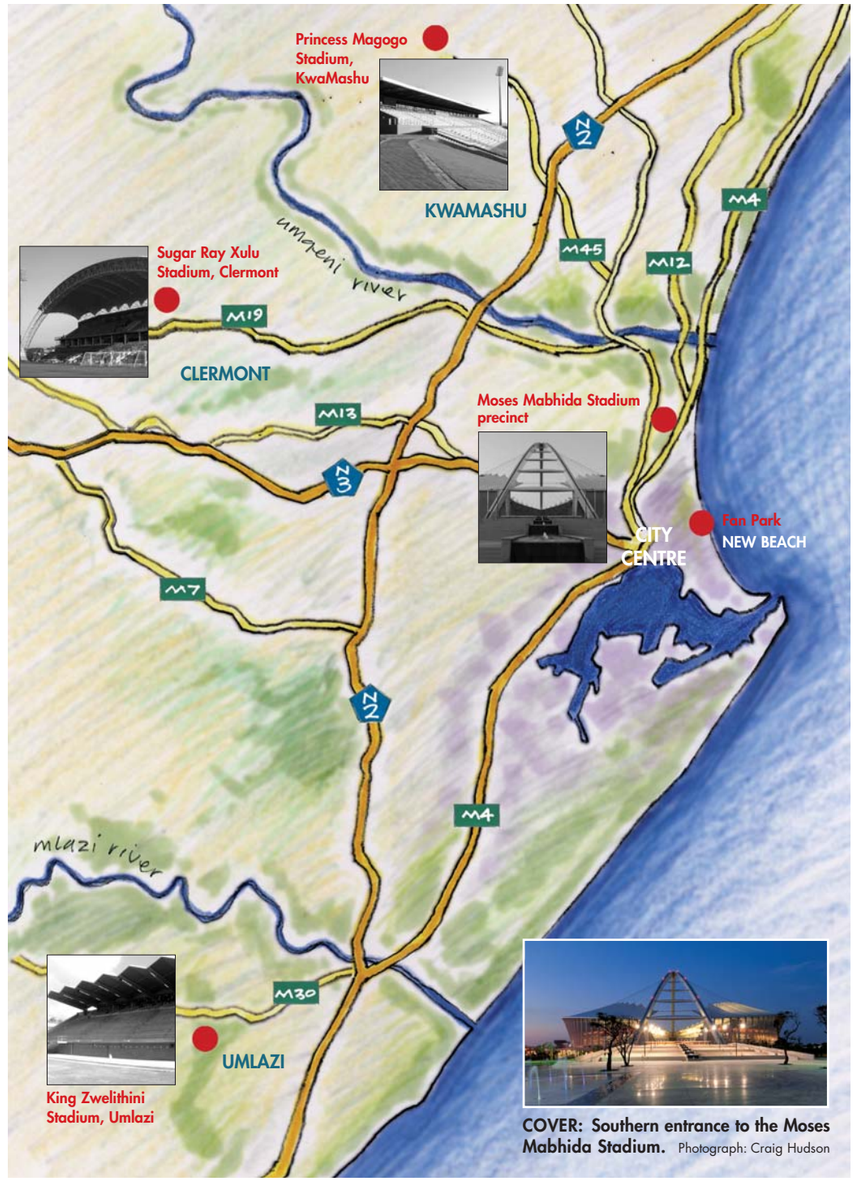
However, hosting the Cup involves more than the provision of an arena. The competing teams require training venues, and for Durban three were developed. Durban has many stadiums but none complied with the specifications set by FIFA for a training venue.

Responsible planning warrants a careful look and re-think of existing resources. Besides upgrading selected stadiums, here was an opportunity to take soccer to the people, promote it as a sport and, generated by the Cup, leave a lasting impression as a legacy. What is more, beyond multi-functionality, a major contemporary purpose of any stadium is that it serves as a catalyst for urban regeneration and benefits its location and community long after any event.

In this case, the city fathers looked to the possibility of upgrading former township stadiums and the decision fell on Umlazi, Clermont and KwaMashu. However, the focus would not be on upgrading the stadiums in isolation, but rather on developing sports hubs within these communities, and the designs had to provide examples of sustainable building development and landscapes. In this issue *KZ-NIA Journal* features Durban's World Cup stadiums well beyond their function as spectator facilities but as venues for creating a sense of community.

From the kick-off concert on Thursday, 10th June at Soweto's Orlando stadium to the finale exactly a month later on Sunday, July 11th, South Africa will host football's most prestigious tournament, as the first African nation to do so, and for which 32 national teams have qualified. Besides the Moses Mabhiba Stadium where six matches and a semi-final will be held, and the training venues, Durban will have a 'Fan Park' catering for some 25 000 supporters with screens and live entertainment at New Beach. But, the iconic value of the Moses Mabhida stadium on Durban's skyline, and the legacy for soccer and sports in general will surely live on for generations to come.

*Walter Peters, Editor*




**COVER: Southern entrance to the Moses Mabhida Stadium.** Photograph: Craig Hudson

## *Durban's 2010 Soccer World Cup Venues*

# Moses Mabhida Commuter Rail Station
# Architects: *ARUP Interchange Design*

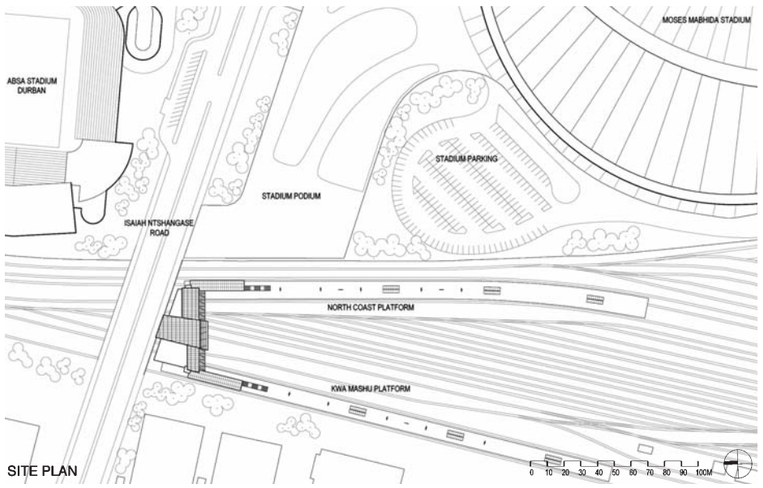
Railside.

*The winning submission in the competition for the Moses Mabhida Stadium proposed the inclusion of a dedicated new commuter station (see KZ-NIA Journal 3/2006) and identified the bridge on Isaiah Ntshangase (formerly Walter Gilbert) Road as its location. Consequently, the new station consists of a parallel bridge over the existing railway lines at a point where the tracks no longer run parallel but split to define the marshalling yards and visually terminate on the city centre in the distance.*

What shape should a station take, especially one seen from all sides and in the shadow of the iconic Stadium and what could inform the detail design decisions? How does one provide dignity to public transport? These were some of the questions confronting the architects as they were designing the Moses Mabhida Station.

Entrance on Isaiah Ntshangase Road.

While a station would be utilitarian in nature and built of concrete and robust materials, here was an opportunity to create a gateway and make the experience of departure and arrival at the stadium precinct memorable.




SITE PLAN

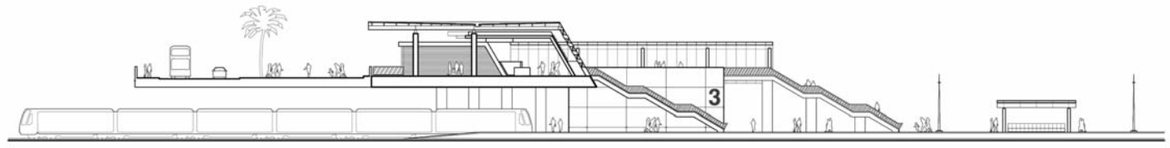
The station's configuration is based on a two-level arrangement consisting of an entrance, concourse and distribution arms with stairs and lifts to the lower platform which acknowledge the diverging geometry of the railway lines. The station building is distanced from the road and is connected to the precinct by means of a pedestrian bridge, spanning from the kerbside. In its form and choice of materials it contrasts, rather than competes, with the stadium.

The plan for the station grew out of a careful analysis of its different functions and the geometry of the infrastructure. There are two components each in the form of a trapezium and conceived architecturally as pods. The smaller accommodates security and supervisory facilities, while the larger is focussed on commuters with ticket offices, public ablutions and administrative spaces. The open end of the smaller pod faces the road and is enclosed with a screen of horizontal timber slats as *brise soleil*, the other has a front of solid concrete and is canted with its more permeable façade facing the concourse.

Access is gained astride the two components and the space widens to the turnstiles before merging with the concourse set at an angle to the path of entry. This space captures the distant view, yet is glazed and louvred as it is unfavourably orientated.

To deflect the weather, the cross-section through the concourse is battered and this






SECTION A-A

geometry is echoed in the concrete sections of the two pods. In keeping with its function, the axis of the entrance sequence warrants a higher ceiling. This is expressed as a slab of *Corten* steel hovering over and breaking forward from the two pods to provide a gateway on the landside. On the railside the higher roof overlaps the lighter secondary roofs of the concourse. These are supported on exposed steel I-beams, the alignments of which reflect the directions of the lines of the tracks to appear woven on plan.

The tracks also determine the design of the strip lighting on the ceiling and the different coloured inserts in the floor which articulate the polished concrete, the principal material of the stadium podium.

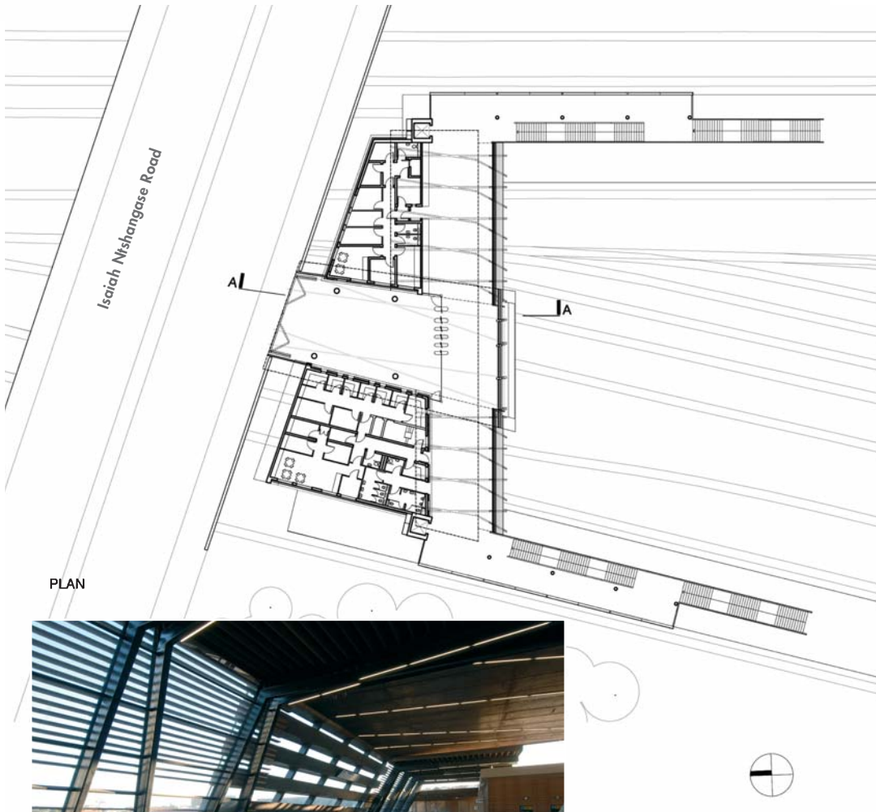
The choice of materials and the detail design of the station draws inspiration from characteristics of Durban: the port with its cranes, gangways, concrete wharfs, containers and the matte industrial environment; and the cultural artefacts of the community e.g. basket and wire weaving.

With the sides and the roof exposed to the view, the surfaces were carefully considered as aspects for design and in their layered composition and detailing influenced the final form of the building. *Corten* steel cladding underscores the association with the harbour. The distribution arms with stairs to the platform levels are protected by sheer concrete walls and roofed with folded canopies also of *Corten* cladding, bolt-fixed to a steel sub-frame. In addition, the galvanised steel handrails have balusters of *Corten* angle iron.

Moses Mabhida Station has connected with the locale in fresh ways and in the process provided an inspired gateway to and from the stadium.

*Walter Peters, Editor*

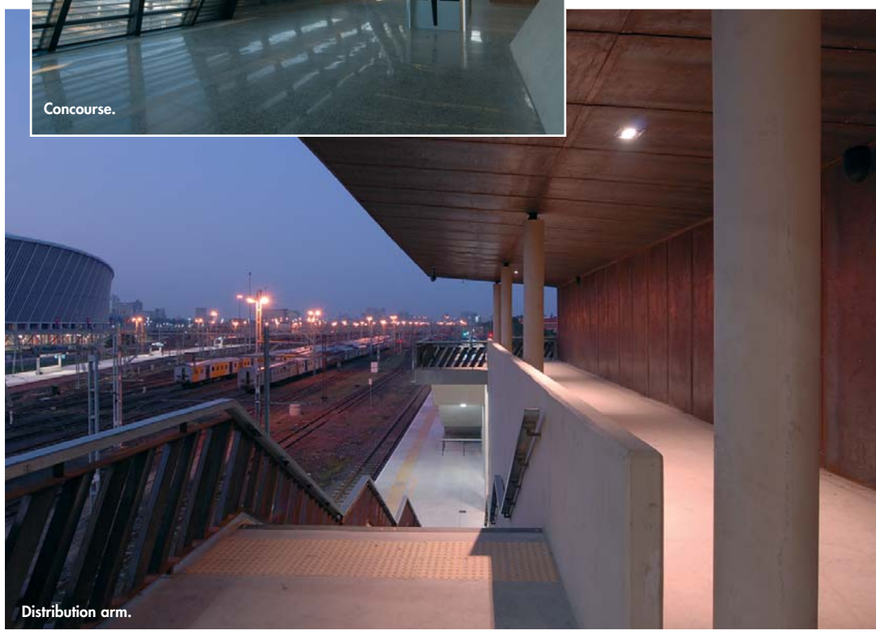
*Architects:* ARUP Interchange Design
*Project Director:* Leszek Dobrovolsky
*Lead Project Architect:* Caroline Sohie
*Architectural Team:* Elaine Lamb, Ray Harli
*Project Managers:* ARCUS GIBB
*Structural Engineers:* ILISO Consulting
*Mechanical & Electrical Engineers:* ARCUS GIBB
*Quantity Surveyor:* LDM
*Contractor:* Grinaker: LTA
*Photographer:* Craig Hudson




PLAN



Concourse.



Distribution arm.

*Durban's 2010 Soccer World Cup Venues*

# Moses Mabhida Stadium precinct
# Lead Urban Designers: *IYER Urban Design Studio*

The urban design of the stadium precinct represents a landmark achievement in the integration of design between 'building' and 'space'. This often tenuous relationship, particularly within large scale projects, was overcome through the incorporation of urban design as a core competency within the overall team structure of Ibola Lethu Consortium. A key success factor to the design approach and achievement was the understanding, willingness and support of urban design by the client body.

The site for the design competition (2006) was based on the confines of the former King's Park soccer stadium and the brief emphasised that the new stadium was to be 'iconic'. Yet beyond object or building, the term iconic was to be understood as "place, spirit, memory".

During the competition process it became evident that if a broader agenda was to be adopted, then the emphasis would need to be placed on the design of a much enlarged precinct. This prompted the preparation of an urban design framework out of which four precinct projects were identified:

1. the entrances and immediate surrounds of the stadium;
2. Peoples' Park, a multi-functional public park located on a sliver of land south of the Stadium between Masabalala Yengwa (NMR) Avenue (M12) and the marshalling yards, of which a portion could become available, and terminated on Sandile Thusi (Argyle) Road.
3. realignment and upgrading of Isaiah Ntshangase (Walter Gilbert) Road and the creation of Imbizo Place, a public open space occupying the north-eastern quadrant of the stadium precinct; and
4. pedestrian link to the beach (by eThekwini City Architects' Department);

## Overriding Urban Design Concepts and Ideas

In exploring the notion of looking beyond the building itself, the design team developed the following key concepts which grounded the urban design framework.

**Embedded in the city.** A primary starting point is ensuring that the stadium forms a meaningful part of the city fabric, its network of connections, visual references and morphology. This would suggest that the stadium is placed within a framework that considers broader city spatial structuring in which the stadium is seen as a generator for future development. Understanding the potential scale of the building as a reference point which, together with other landmarks and references to the existing built and natural features (the Indian Ocean, Bluff, key movement arterials), would contribute to tying the building back and embedding it within the city.

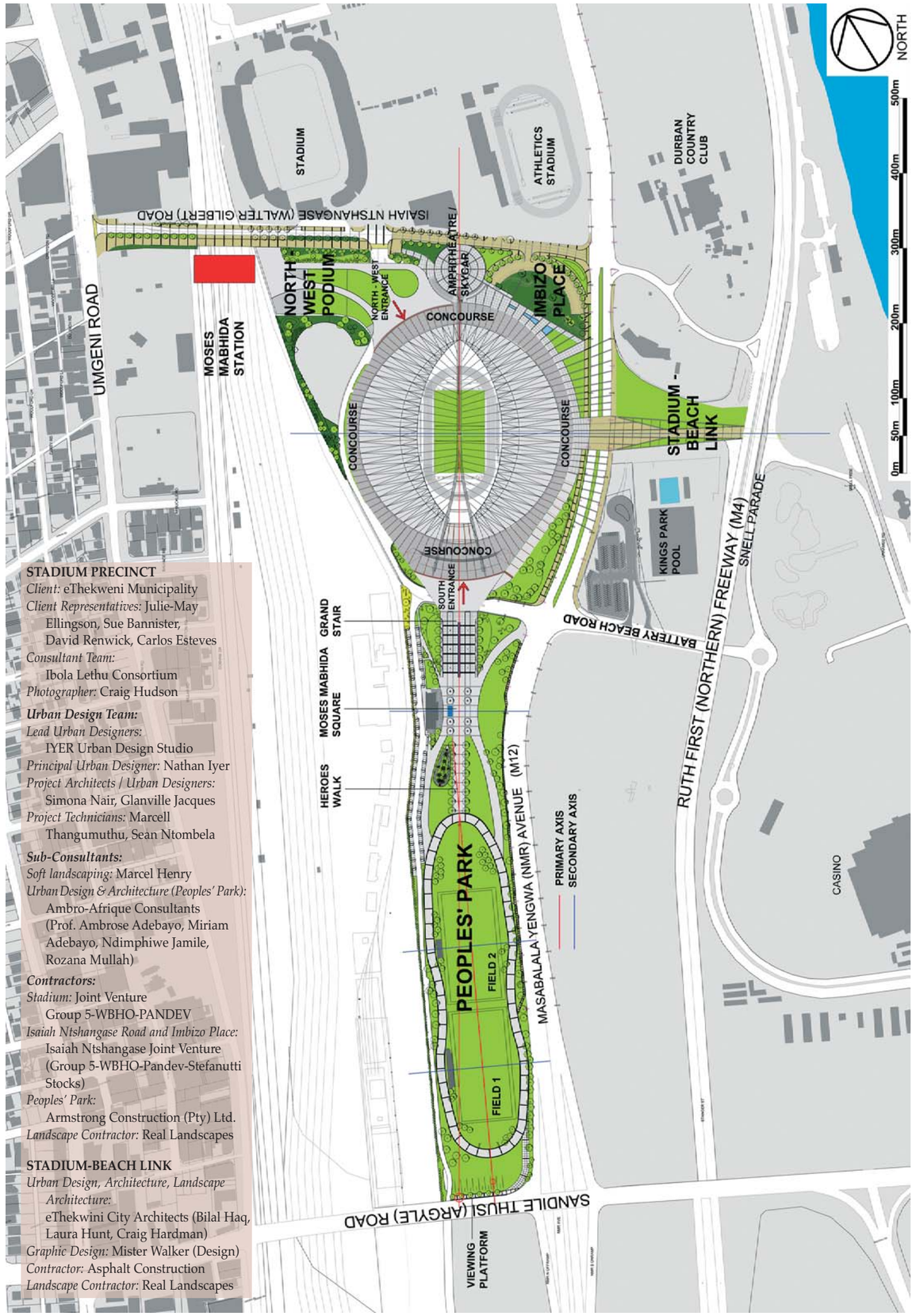
**Precinct Contextual Influences.** The design of the stadium at the level of the precinct would acknowledge that each interface and approach is unique and requires an appropriate response. The northern approach makes contact with other sport infrastructure, the western interfaces with important public transport infrastructure whilst the eastern is with the Ocean, the Golden Mile (beach front) and key city vehicular arterials. The southern is the most direct 'city' interface. Each of these approaches requires a particular response.

**Maintaining a Sense of Publicness.** In considering the need to ensure that the stadium forms a meaningful part of the city suggests that the design must incorporate the making and support the delivery of a vibrant public space system. Whilst fulfilling the requirements of 2010 and beyond, in terms of managed and secure access to the internal space (stadium and arena), the development of a supportive public domain made with a sense of generosity and scale would ensure the democratisation of the investment, and the external environment should be accessible to all and be made as captivating as the building.

**Encouraging Mixed Use.** Ensuring sustainability and promoting ongoing activity requires that consideration be given to encouraging mixed use. This applies to the design of the stadium and to the precinct. At a precinct urban design level, it is important that opportunities for a range of activities are catered for. These should include sport and recreation as well as other related activities that contribute to a vibrant public realm. Within the broader precinct, therefore, consideration needs to be given to making the precinct over time a place to 'live, work and play'.

**Investigating Scale.** Whilst often impressive, where stadiums are conceived as single-purpose objects in space, the challenge of reconciling their scale with that of the city and its inhabitants becomes daunting, particularly when located within the city fabric. Possibilities for 'humanising' the building and integrating it into the city fabric and landscape become important drivers for design.

**Forming Part of a Journey.** The potential for the building to reflect the 'journey' made by the country, its people and their collective consciousness and belonging to the continent of Africa are powerful elements for context and design generation. This journey, however, should be underpinned by a sense of celebration and whilst being necessarily retrospective in 'documenting' where one is rooted, in the main this journey and the expression of the building in particular, must speak of the now, in contemporary Africa, and the power with which one is heading forward. This journey is, therefore, best spoken through the combination of precinct and building.




**STADIUM PRECINCT**
*Client:* eThekweni Municipality
*Client Representatives:* Julie-May Ellingson, Sue Bannister, David Renwick, Carlos Esteves
*Consultant Team:* Ibola Lethu Consortium
*Photographer:* Craig Hudson

***Urban Design Team:***
*Lead Urban Designers:* IYER Urban Design Studio
*Principal Urban Designer:* Nathan Iyer
*Project Architects / Urban Designers:* Simona Nair, Glanville Jacques
*Project Technicians:* Marcell Thangumuthu, Sean Ntombela

***Sub-Consultants:***
*Soft landscaping:* Marcel Henry
*Urban Design & Architecture (Peoples' Park):* Ambro-Afrique Consultants (Prof. Ambrose Adebayo, Miriam Adebayo, Ndimphiwe Jamile, Rozana Mullah)

***Contractors:***
*Stadium:* Joint Venture Group 5-WBHO-PANDEV
*Isaiah Ntshangase Road and Imbizo Place:* Isaiah Ntshangase Joint Venture (Group 5-WBHO-Pandev-Stefanutti Stocks)
*Peoples' Park:* Armstrong Construction (Pty) Ltd.
*Landscape Contractor:* Real Landscapes

**STADIUM-BEACH LINK**
*Urban Design, Architecture, Landscape Architecture:* eThekwini City Architects (Bilal Haq, Laura Hunt, Craig Hardman)
*Graphic Design:* Mister Walker (Design)
*Contractor:* Asphalt Construction
*Landscape Contractor:* Real Landscapes

# 1. STADIUM PRECINCT ENTRANCES

A critical aspect in the design of the approaches is the anticipated volume of people and cars arriving. The analysis by the traffic engineers, Iliso Consulting Engineers, advised of the following order: from the western approach via Isaiah Ntshangase (Walter Gilbert) Road 23 000 people per hour, from the eastern link to the Beach 16 000, the southern 15 000 and the northern 6 000.

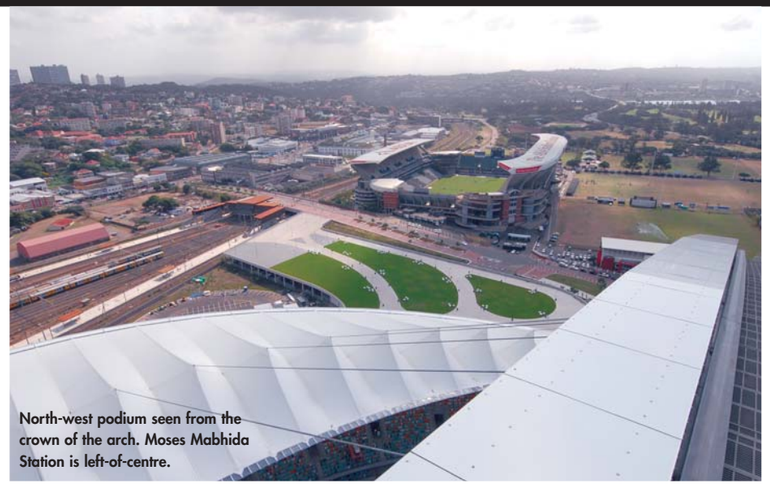
As it is on the visual alignment with the city centre, the **south entrance** is the grand or ceremonial entrance out of which was born the concept of Peoples' Park.

There are three ways to get to the south entrance. The grand approach is from Peoples' Park onto the Grand Staircase with a central cascading water channel. On either side of the staircase are ramps at 1:12 gradient with landings, the second approach. The third is from a 13m wide ramp of the same gradient, also with landings, which follows the curved outline of the stadium up from Masabalala Yengwa (NMR) Avenue (M12).

Once through the gates or turnstiles of the podium, spectators enter the **concourse**, the formally secured portion of the podium surrounding the bowl, a generous open area of width varying from 20m to 33m.

**North-West Entrance** gives access to spectators arriving from Umgeni Road and the new Moses Mabhida commuter Station. It was conceived as a plane centrafugally radiating from the podium and at its extreme reaches Isaiah Ntshangase Road horizontally where the road bridges the railway lines to offer universal accessibility.

The post-tensioned concrete slab of the podium was engineered to include a dropped portion (350mm) for 'roof lawns'. These lawned areas provide soft surfaces within an otherwise hard landscape which the public is encouraged to use, and they are equipped with irrigation outlets and bases for lighting posts. The textured finish implemented on the 8m wide pathways is high-level diamond-polished and extends the finish of the concourse.


North-west podium seen from the crown of the arch. Moses Mabhida Station is left-of-centre.

One of the guiding principles was that the design of a public space should function as planned on an event day, yet encourage enjoyment generally. The North-West Podium is thus to provide a setting for multi-functional public use and also cater for smaller events such as flee-markets, promotions or gatherings on any day. Consequently, street furniture and lighting is arranged to allow for moments of refuge along the path and also for the erection of temporary structures.

The design of the stadium limits the points of access into secure areas. The **entrance for theVIP, media and players** is on Battery Beach Road, beneath a bridge between the stadium and grand staircase, and an alternative point of egress is onto Isaiah Ntshangase Road.

The scale of the stadium and the fact that the site boundary coincides with the kerb of Masabalala Yengwa Avenue posed critical challenges on the **eastern elevation** where various components required resolution into an integrated design. Among these is pedestrian movement along the retail edge, the path of which, recessed from the colonnade in the line of the podium over, abruptly terminates in a wall. This happens at the junction with the pedestrian crossing over the Avenue and where the apron of the colonnade merges with the ramp which commences its upward path to the southern entrance to the concourse. With the motorway status of the Avenue, this confluence called for careful design of detail.

While the pedestrian crossing of Masabalala Yengwa (NMR) Avenue was implemented by the city, the driving idea had been formulated by the urban designers, which was to stitch the stadium precinct into the city, a principle symbolised in the radials emanating from the column positions on the plan of the stadium and project across the Avenue. However, before reaching the Avenue, these radials cross the lawned area between apron and Avenue as onyx-dyed, high-level diamond polished concrete strips to define islands with seats. On crossing the motorway these radials become bands of pavers recessed into the asphalt surface which, beyond their symbolic significance, serve to alert oncoming drivers of this highly active pedestrian area, the crossing of which is concomitantly wide at 45m. Conversely, to imprint the dangers on the conscience of pedestrians, a generous distribution of bollards lines the pavement and the island of the motorway, and the polished concrete finish of the apron reaches to the kerb of the pedestrian crossing to provide a visual threshold to the stadium precinct and safety.


Interface.


Pedestrian crossing, Masabalala Yengwa Avenue.



# 2. PEOPLES' PARK

While the competition brief called for the inclusion of two multi-purpose playing fields, the report submitted with the winning competition entry proposed Peoples' Park, "a place for recreation" which "could also contain practice fields for sport". In addition, the report recommended a Heroes Walk within the Park, an avenue commemorating icons of sport and culture onwards from 1994, the advent of South African democracy. These proposals remained relevant and guided the development of the design. The design of the Park was generated by the following:

**Structuring Axes**

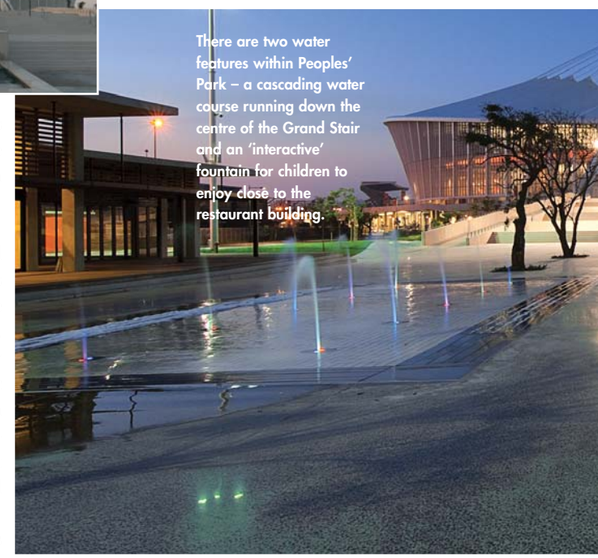
The main north-south axis of the stadium provides the visual axis through the Park and culminates at a viewing platform on Sandile Thusi (Argyle ) Road. Due to the shape of the site, a secondary axis organizes the layout of the fields and running track. Where the two axes cross a vertical focal point is proposed.

**Change of Levels – the Grand Stair**

There is a 5.4m level difference between the Park and the podium of the stadium, and the challenge was to integrate a 'grand stair' with wheelchair access. The width of the stair was generated by the number of people entering and exiting the stadium on a match day (estimated maximum of 15 000), a width generally too wide. That led to the proposal of a central water course, cascading to mask the traffic noise of Masabalala Yengwa Avenue. There are five landings to the staircase, each large enough to cater for activities such as art displays or markets etc, and these are linked to the wheelchair ramps on both outer sides.

**Place of Gathering – Moses Mabhida Square**

The various paths to and from the stadium culminate in a new public space known as the "Moses Mabhida Square". This space is defined on the western edge by a new restaurant building and interactive water feature and on the eastern edge by a low curved seating wall known as the "Workers' Wall" which memorialises the individuals who were involved in the construction of the stadium and the precinct.

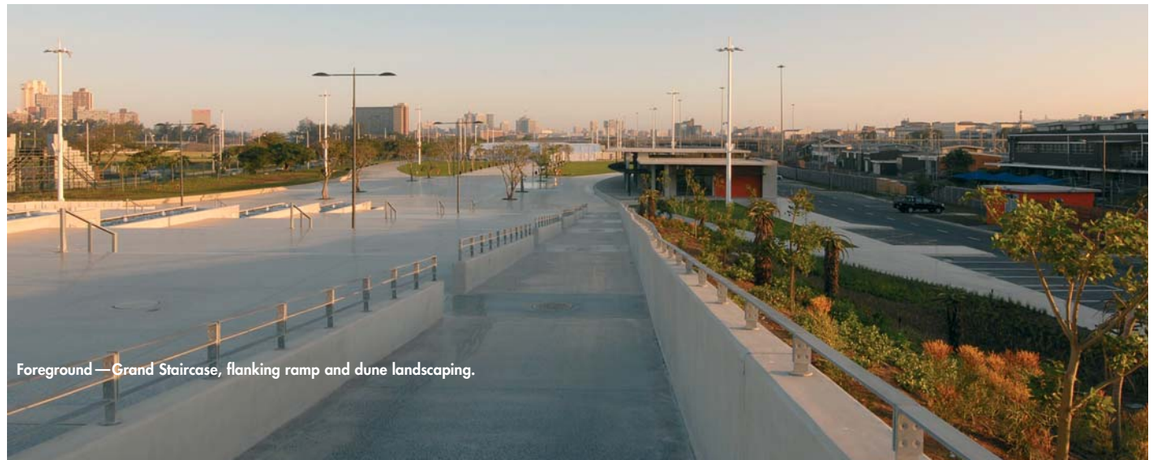

There are two water features within Peoples' Park – a cascading water course running down the centre of the Grand Stair and an 'interactive' fountain for children to enjoy close to the restaurant building.

**Heroes Walk**

Heroes Walk is a processional avenue linking Moses Mabhida Square to the playing fields on the south. The avenue is defined by trees, lighting and public seating and articulated with sporting achievements engraved on granite bands set flush with the general polished concrete surface.

**Running track and Sports fields**

Field 1 can be used for PSL matches, if required, with adjacent change rooms. This field can be secured and also cater for eg musical concerts with the stage positioned on the southern edge. Field 2 is a more general playing field with public toilets. During the Cup, the combined fields serve as the FIFA hospitality area. The 12m wide running track, 1km in length, surrounds the fields and this is available to the general public for jogging and cycling on non-match days.



Foreground — Grand Staircase, flanking ramp and dune landscaping.

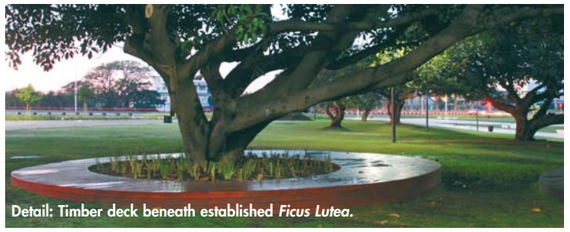
## 3. IMBIZO PLACE:

### The realignment and upgrading of Isaiah Ntshangase Road and the establishment of Imbizo Place

The motivation for the realignment of Isaiah Ntshangase (Walter Gilbert) Road was twofold. The first was to redefine the former use of the road from a fast-paced, four-lane road with standard city sidewalks to a pedestrian-prioritised shared space with two-lane road and sidewalks varying from 2.5m to 15m to provide a safe, tree-lined and well lit edge for the expected high volumes of people. The second was to create a forecourt suitable to the scale of the stadium.

The forecourt now known as Imbizo Place is staked out by a colonnade in the line of the podium from which are recessed a series of the retail outlets under the grandstands, the 'amphitheatre' at the foot of the northern leg of the arch where the funicular has found its base, and the realignment of Isaiah Ntshangase Road which saw its crossing with Masabalala Yengwa Avenue moved northward.

To make Imbizo Place accessible, public parking for approximately 105 vehicles has been provided in the form of a crescent, a form which extends the circular geometry of the stadium while conserving a cluster of established *Ficus lutea* trees within the space released by the new road crossing. As these trees are within the *paspalum* lawn, *Balau* timber decks have been built under two for sitting in the dense shade where lawn fails to grow.


Detail: Timber deck beneath established *Ficus Lutea*.

As Imbizo Place enjoys best orientation and accessibility, this is anticipated to be the busiest corner of the stadium precinct. Consequently, a concentric apron extends the 'cool concrete' floor of the colonnade, articulated with onyx-stained radials determined by the columns of the stadium, and three pools with fountains define the hardened area from the lawn which stretches to the parking crescent. On plan, these pools are wedged between the apron and a tangent linking the centre of the 'amphitheatre' with the underpass from the beach, and cut by radials projecting from the perimeter columns of the stadium. As it is assumed that people will gravitate towards these centrepieces, they are raised and provide both an edge for sitting on and a basis for seating arrangements for patrons of restaurants leasing the retail space.


Water features punctuate the space.


Imbizo Place.

**Development of Imbizo Place**

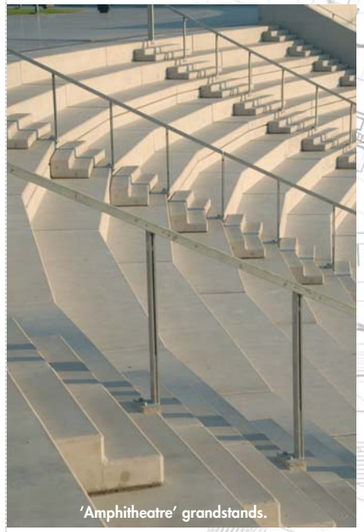
1. 'Amphitheatre'
2. Isaiah Nthsangase Road
3. Masabalala Yengwa Avenue (M12)
4. Water pools
5. Retail outlets
6. Funicular base

**Former area**

7. ABSA Rugby Stadium
8. Walter Gilbert Road
9. Former King's Park Soccer Stadium
10. NMR Avenue (M12)
11. Northern Freeway (M4)
12. Snell Parade


Funicular.

Courtesy of Independent Newspapers


'Amphitheatre' grandstands.




Historical aerial photograph.

eThekwini Municipality

# 4. STADIUM — BEACH LINK

## *eThekwini City Architects' Department*


Courtesy of Independent Newspapers

The stadium competition-winning entry showed a bridged link from the stadium podium over Masabalala Yengwa Avenue to King's Park Pool, opposite, and another over Ruth First Freeway to the beach, see *KZ-NIA Journal* 3/2006. As this proved too costly at R140million, the eThekwini Transport Authority (ETA) looked at the option of widening the existing 5m wide culvert to cater for the peak hour pedestrian flow of 11 000 sports fans.

Because of the limited coverage between the soffit of the tunnel and road surface of the freeway (400mm), the ETA initially thought any tunnel widening infeasible until the eThekwini Roads Department investigated traffic deviations and lane closures as alternatives. The relocation northward of the Isaiah Ntshangase Road on-ramp to the M4, allowed for its removal and a reduction in tunnel length.

By the time the Architecture Department was briefed with the design of the link, Roads Department's engineers had already designed the widened tunnel. The original was 5m wide and 90m long; the new would mirror the existing with an identical box-profile culvert to its north, but shortened in length to 50m.

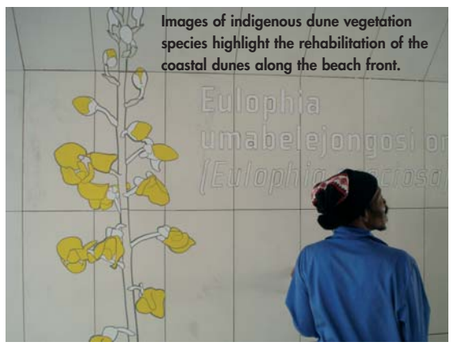
The geometry of the pedestrian crossing and this 'street' is defined by radials projecting from columns on the stadium's east elevation which meet at the underpass. The splay, about halfway along the length of the street visually reduces the 180m length of the path and allows for gathering crowds at the pedestrian crossing. The gradient is 1:60.

In keeping with the landscaping ethos of the beach front, and a relaxed atmosphere of a sport precinct, this extent is staked out by an avenue of coconut palms. On either side, a concrete seating wall stretches from the same end points of the path, with grassed zones between the two. The whole stretch is articulated with bands of cobbles in the clay-brick field to recall paving palette of the stadium and further reduce the path length. Besides defining the extent of the pathway, the seating wall (cost effective reuse of the beach-front seawall profile) offers seating for the weary in the shade of new indigenous *Mimusops caffra* (Red Coastal Milkwood) and *Erythrina caffra* (Coast Coral tree). In the long term, the land to either side of the underpass, east and west, could provide for hotels and additional sports facilities.

Increasing natural lighting into the tunnel was achieved by cutting two large skylight slots in the Freeway and Snell Parade medians, and opening the wing-walls to give the appearance of bridge embankments instead of entrances to a tunnel. The challenge was to get two parallel tunnels feeling like one, which was done by puncturing and cutting away the common wall until the engineer said, "Easy, there's more air holding up the freeway than concrete". It's gratifying to see children cycling in and out of these openings and peeking through the cored holes in this wall.

The internal finishes needed to be robust and light. With uneven floors in the old and new tunnels, a polished screed was laid throughout to unify the two, and new polished porcelain tiles reflect the landscaping at both ends giving the illusion of widening the underpass.

*Laura Hunt*


Images of indigenous dune vegetation species highlight the rehabilitation of the coastal dunes along the beach front.



# 5. ISSUES OF DETAIL DESIGN

Isaiah Ntshangase (Walter Gilbert) Road is a low access road which transforms into a pedestrian street during events. Therefore the lighting needs to be of street pole type, fit for hanging banners. The 7.5m high light poles were manufactured locally and are galvanised and painted a graphite colour.

### STREET LIGHTING

The City Beautification project undertook the new (white) light fittings on white painted poles along Masabalala Yengwa (NMR) Avenue to the Umgeni River and also along Sandile Thusi (Argyle) and Umgeni Roads, and the precinct light fittings and poles were meant to contrast with these, and emphasize them.

### STREET FURNITURE

**Isaiah Ntshangase Road and Imbizo Place.** The first challenge was form. Of course, the streetscape elements could be ellipsoidal, or at least rounded in shape to recall the stadium plan, but the nature of **public seating** in a stadium precinct is different from that of a bench in a park. Effectively this is a case of resting from fatigue, for which a low seating level is required, and best if it provides space for more similarly fatigued members of a group. That purpose suggested a flat plane with neither arm nor backrest, and which for ease of manufacture and for reasons of economy came to resemble the blocks of a (stone) column, of which two types were developed, a square and a double square. This proposal seemed suitable, because the forms extend the oeuvre of pure geometry and thus alongside the oval of the stadium appear neither reticent nor jarring.

The seats measure 800x800x400 and 1600x800x400 respectively, are hollow, and sit on a 50mm slab, recessed from the outer planes to define a plinth. They were manufactured of polymer modified concrete.

The **litter bins**, are also square in plan with recessed plinth but dark in colour to match the light poles. The **bollards** are of two types, fixed and movable, and each extends the language of the seats and bins. The fixed bollards are of solid concrete cubes with the 400mm height conducive for doubling-up as seats, while the removable bollards are of steel, narrower and taller so as to be visible from a car or truck as they are at potential access points onto the precinct.

**People's Park.** As they are sited astride the tree-lined Heroes Walk and in a setting for reflection, the use of park-like **benches** with back rests is appropriate. Due to the angle of support, the seating plane was conceived as a folded plane resting atop a base and the dark colour was chosen to reduce maintenance. The benches are arranged in pairs separated by a bin and placed between the lighting columns under the trees. The benches, bins and lighting columns are all in a dark grey colour to define the edges of the avenue.

*Simona Nair, Nathan Iyer, Glanville Jacques*

North-west podium.

Heroes Walk.

## 6. SOFT LANDSCAPING

The early ecology of the area would have been coastal forest with extensive wetland and grassland areas. The site specifically had wetland and riverine vegetation due to its proximity to the historical course of the Umgeni River and the low lying nature of the land with its high water table. Very little of this natural habitat remains, but the potential exists to re-introduce some of the local species and create a local identity.


Before any development commenced, the trees on site were inspected and identified. The indigenous trees were moved to a holding nursery (with similar climatic conditions) in close proximity to the site, and later replanted. In all, 46 well established trees which included *Erythrina caffra* (Coast Coral Tree), *Ficus lutea* (Giant-leaved Fig), *Phoenix reclinata* (Wild Date Palm) and *Hibiscus tiliaceus* (Lagoon Hibiscus) were replanted.

The approach to urban design and landscaping was driven by practical considerations, resulting in large areas of hard surfaces for the efficient and effective flow of people. The remainder of the open space has been intensively planted with lawns and local indigenous vegetation including trees and ground covers.

Landscape planting followed the guidelines contained in the document *Guiding Principles for the Landscaping of the Durban Inner City and KwaZulu-Natal Coastal Belt* and the *List of useful Indigenous Plants for the Durban Inner City Area* prepared by the eThekwini Parks Department.

The challenge was to use planting that would respond to the micro-climates of the site with due consideration for the proximity to the sea, be cost effective on maintenance and irrigation, and provide food and shelter for indigenous birds, insects and other urban wildlife.

Some of the species planted include existing and new *Ficus lutea*, *Ficus bubu*, *Aloe barberiae* (Tree Aloe), *Strelitzial nicolai* (Natal Wild Banana), *Harpephyllum caffrum* (Wild Plum), *Erythrinal caffra* and *Lysistemon*, *Celtis africana* (While Stinkwood) and various shrubs and grasses such as *Anthericum saundersiae* and *Aristide* as well as vast areas of lawn.

### AREAS OF SPECIAL LANDSCAPING

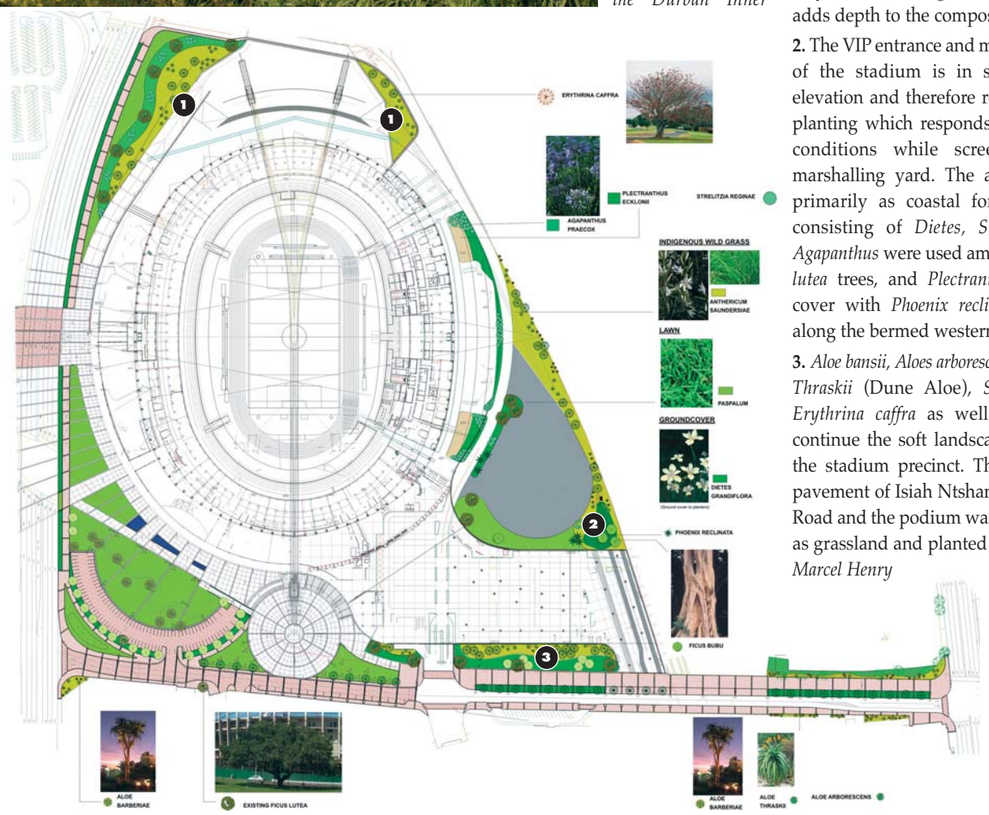
Within the overall landscape plan, three distinct areas of micro-climate were identified and given special landscaping treatment: Coastal Forest, Grasslands and Dune landscapes.

**1.** The triangulated and inclined space bounded by the Masabalala Yengwa (NMR) Avenue, Battery Beach Road and the ramp to the south entrance of the podium is particularly exposed to sun and winds and was thus conceived as a mixed dune and grassland landscape. Species selected effectively respond to the height or topography of the embankment in three tiers creating a play with textures and colours by way of different ground covers, which also adds depth to the composition.

**2.** The VIP entrance and media compound west of the stadium is in shade and lower in elevation and therefore requires a selection of planting which responds specifically to these conditions while screening the adjacent marshalling yard. The area was landscaped primarily as coastal forest. Ground covers consisting of *Dietes, Strelitzia reginae* and *Agapanthus* were used amongst "re-used" *Ficus lutea* trees, and *Plectranthus ecklonii* groundcover with *Phoenix reclinat*a and *Ficus bubu* along the bermed western edges.

**3.** *Aloe bansii, Aloes arborescens* (Kranz Aloe), *Aloe Thraskii* (Dune Aloe), *Strelitzia reginae* and *Erythrina caffra* as well as various grasses continue the soft landscaping thread through the stadium precinct. The edge between the pavement of Isiah Ntshangase (Walter Gilbert) Road and the podium was conceived primarily as grassland and planted accordingly.

*Marcel Henry*




**Landscapes for micro-climates**

**1.** Dune and grassland
**2.** Coastal Forest
**3.** Grassland



*Durban's Training Venues for the 2010 Soccer World Cup*

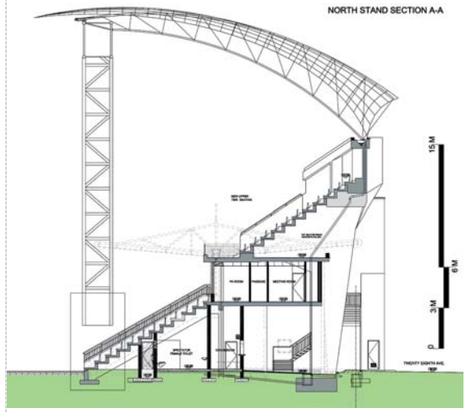
# Sugar Ray Xulu Stadium, Clermont
## Ruben Reddy Architects, Osmond Lange Architects & Planners

**The existing venue had grandstands on both the north and south sides providing seating for a total of 1626 spectators. This project involved enlarging the capacity to 6550 and adding new player, media, VIP and spectator facilities while adhering to both FIFA and PSL (Professional Soccer League) Training Venue requirements and specifications and, most importantly, Stadium Disaster Management regulations.**


### Design Concept

The design was driven by the broader Clermont Town Centre Urban Framework and the development of a sports hub and conditioned by the positions and orientations of the existing stadiums.

To maximise viewing opportunities of the pitch, both existing stadiums were extended on both their ends and each was topped by an additional and slightly steeper tier. Between the two tiers of the north stadium were accommodated the Venue Operating Centre, a board room and spectator suites. New change rooms and ancillary accommodation for players and medical facilities were extended to the existing ones underneath the lower tier.




The seating extensions were achieved with prefabricated concrete elements resting on in-situ trabeated bases. On-site and off-site prefabrication of the major elements and multiple crews working simultaneously, resulted in a swift delivery programme.

**Roof.** Following on from the simple cantilever roof used at the Chatsworth cricket stadium (by Ruben Reddy Architects for the 2003 Cricket World Cup), the associated architects for Clermont examined the new generation of light-weight roof systems. Bearing in mind that in most stadiums the scale and form of the roof is what people see first, this roof was conceived to serve its functional requirement and symbolically to provide a beacon in the otherwise degraded environment.

To meet with its primary objective of shelter, the leading edge of the roof facing the pitch is in the form of a huge arch anchored by north and south abutments which serve as bases for the principal lighting masts. The arch is a segment of a circle with a radius of 99.960m, and spans the straight length of what will be a future six-lane 400m athletics track.

The tensile covering material is a PVC-coated polyester woven fabric supplied by Ferrari sa, chosen for its properties in accommodating the complex double curve of the form. The material is tensioned between the ridges of the lattice girders that anchor the roof to the trailing edge of the upper stand.

*Carl Wright, Ruben Reddy*

*Client Representative:* Gary Kimber
*Project Managers:* TQM
*Urban Design:* Iyer Urban Design Studio
*Structural & Civil Engineers:* Goba, Flexible Structures cc
*Mechanical & Electrical Engineers:* Dihlase
*Quantity Surveyors:* VCA, Felix & Msomi, Malata & Associates
*Contractor incl Landscape:* GLTA

*Durban's Training Venues for the 2010 Soccer World Cup*

# Princess Magogo Stadium, KwaMashu

## *Choromanski Architects cc*

New entrance and layer of accommodation on north-west.

**The brief was twofold, to provide an Urban Development Framework Plan (UDFP) with guidelines for creating a sports hub at KwaMashu town centre within the Inanda, Ntuzuma and KwaMashu (INK) region, and to redevelop the existing Princess Magogo Stadium.**

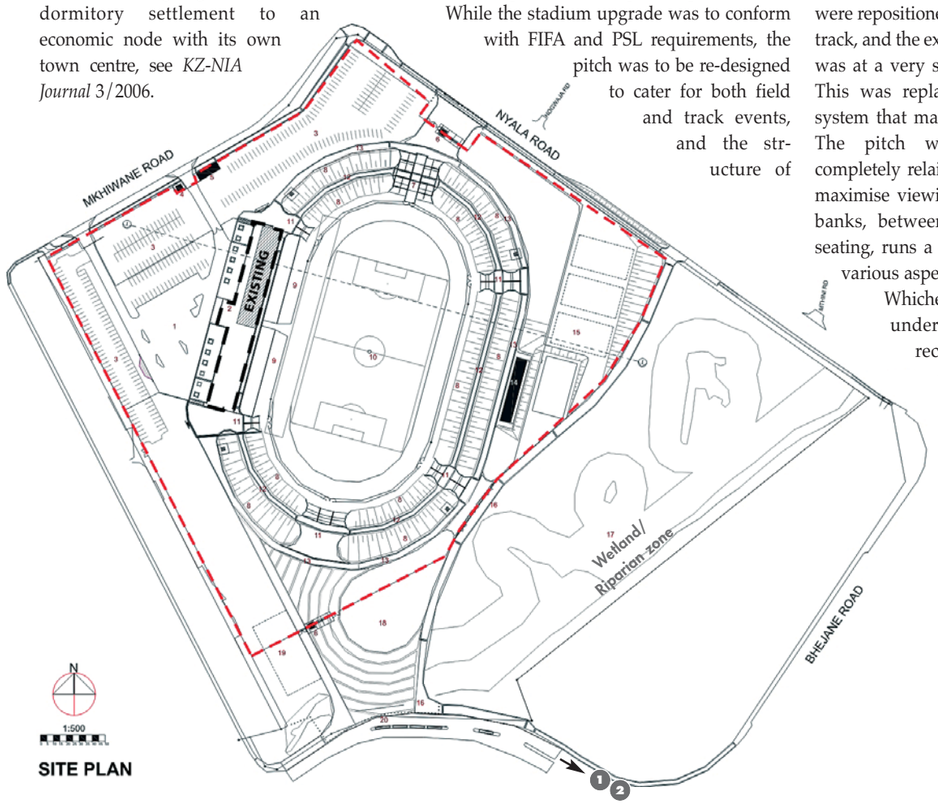
The township of KwaMashu, built 1957–68, has been undergoing a transformation from a dormitory settlement to an economic node with its own town centre, see *KZ-NIA Journal* 3/2006.

The existing pedestrian grid extends from the KwaMashu Railway Station to the new sports precinct and allows for an activation of available spaces for future built form. The new sports precinct, a segment within the developing town centre, will now assist in displacing the public energy from the through-road namely Malandela Road which is typified in townships as the main public space.

While the stadium upgrade was to conform with FIFA and PSL requirements, the pitch was to be re-designed to cater for both field and track events, and the structure of the existing covered grandstand was to be utilised as much as possible.

The original pitch and grandstand were asymmetrical to each other, a consequence of the additions over a period of years, surrounded by existing grass embankments. In order to accommodate the accommodation schedule, the grandstand length had to be increased. The original grass embankments were repositioned to accommodate an athletics track, and the existing lower tier seating, which was at a very shallow rake, was demolished. This was replaced with a steeper pre-cast system that matches the covered grandstand. The pitch was also repositioned and completely relaid as well as being lowered to maximise viewing angles. At the apex of the banks, between the grandstand and open seating, runs a concourse which connects the various aspects of the stadium.

Whichever facilities could be wedged under the grandstand were, but reconcilingceiling heights with the existing structure saw the




SITE PLAN



partial removal of the highest seating rows to accommodate suites and commentary boxes. Nevertheless, the spatial requirements made a new layer of accommodation at the back unavoidable. It seemed logical then to concentrate vertical circulation centrally around a new foyer and, working within the confines of the existing structure, to cover the new layer of accommodation with a mono-pitch roof, symmetrical about the existing one and to create a butterfly roof with box gutter.

While most of the design challenge was functionally and affordably determined, terminating the gable ends of the grandstand provided an aesthetic challenge. In the nature of any space occupying a corner position, views can be enjoyed in two directions, and as this was the case on both upper levels, the side windows were framed. In this way the building is scaled and the ends are related with the side from which the entrances and the new vertical circulation core project.

### Green Goals

At the start of the project the importance of green principles was impressed upon the team and the City's Environmental Department contributed towards the implementation of green considerations.

**Irrigation.** While the pitch will serve as a large collector for rainwater, embedded sensors control the level of irrigation and with the drainage system linked back to a pump, the stadium is able to reclaim between 50 to 60% of the water used. In this way the dissolved nutrients are also recycled.

**Water heaters.** Geysers originally specified were replaced with heat pump water heaters that use a quarter of the energy. A by-product of the heating process is cold air which is usually wasted but here is ducted to the change rooms below.

**Lighting.** Four new high-mast flood lights were installed with the total international lux level of 1 000. However, these are wired to allow for four levels of operation, practice at 200 lux, non-televised at 600 lux and televised at 1000 lux. The lighting system is controlled by computer to ensure even usage of lamps and minimal replacement as opposed to having lamps dedicated for each level.

**Standard Building Practice.** The grandstand is fitted with water-saving and energy efficient fittings. Suites and offices are divided by light-weight partitions, allowing for easy removal and re-use of spaces should this be required in future. 80% of the external façade consists of face brick and off-shutter pre-cast concrete materials that require minimal maintenance and are relatively inert.

*Rodney Choromanski, Dean Ramlal*

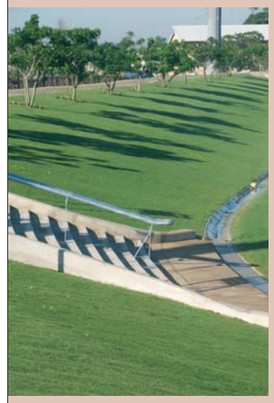
*Client representative:* David Renwick
*Project Managers:* PMSA

### Landscaping and Sustainability

Planting is the most obvious contribution towards creating a sustainable environment in the broader sense. The construction of 2010 soccer stadiums throughout the country provided an ideal opportunity to give form to this principle and ensure an environmental upgrade as well as improve conditions for the local community. Princess Magogo Stadium provided the opportunity to review and intervene on the state of public open space in the townships and in the city in general.

The stadium site is located adjacent to a "wetland area" or (more technically correct) riparian zone. Storm-water control has been improved and the wetland and stream have been rehabilitated and planted with appropriate vegetation. Invasive species, which reduce natural water quality and levels, and which had a negative impact on flora and fauna have since been removed.

Trees and plants endemic to KwaZulu-Natal, were used to landscape the site. Plant types were selected to respond to the micro-climate of the site and the rehabilitation of the wetland zone taking into account the need for cost-effective maintenance and irrigation. Landscape planting has increased bio-diversity and restored ecological value to the area.

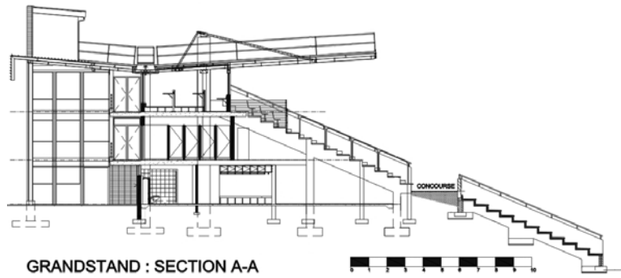


The grassed embankments around the play surface allows for additional spectator viewing as well as proving a protected arena for the pitch and irrigation systems. The irrigation is unique and innovative in that water from the pitch is recycled by means of a sump and water storage tanks built beneath the main staircase. Both water and nutrients are captured for re-use, thereby reducing the wastage of this valuable resource.

A pedestrian link was created between adjacent residential blocks to reinforce a broader link to the railway station and new town centre. Road verges were paved and landscaped to improve the general environment and encourage pedestrian safety. A larger public space was created at the entrance to the stadium to ensure the movement and accommodation of large crowds of people, but more importantly to serve as a catalyst for the New Town Centre of KwaMashu.

With 2010 we hope this new public square will "kick off" the awareness and importance of public open space and contribute to its rebirth in these parts of the city. —*Marcel Henry*

*Urban Design and Architecture:*
Choromanski Architects, Urban Architects
*Structural Engineer:* Linda Ness and Associates
*Civil Engineer:* ZAI
*Mechanical Engineer:*
ADX Projects
*Electrical Engineer:* BFBA
*Quantity Surveyors:*
Mbatha Walters and Simpson, BTKM, e-QS
*Contractor:*
Stefanutti Stocks
*Landscaper contractor:*
Topturf, Real Landscapes
*Photographer:*
Craig Hudson




GRANDSTAND : SECTION A-A


## *Durban's Training Venues for the 2010 Soccer World Cup*

# King Zwelithini Stadium, Umlazi
## *Walker Smith Architects cc*

**Umlazi township on the southern periphery of Durban was established in 1950, and the existing King Zwelithini Stadium probably dates from the 1960s.**

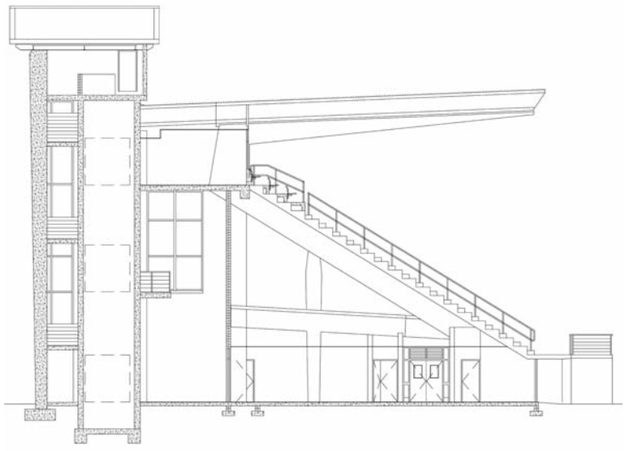
The 'Urban Development Framework Plan' (UDFP), conceptualised prior to the stadium upgrade, aims to provide an integrated design vision for the development of the KwaMnyandu Node in Umlazi, of which the stadium forms an integral part. It defines the precinct as a T-structured formation, stretching from the Mangosuthu University of Technology in the east, up to and including the existing King Zwelithini Stadium on the west, the Communal Swimming Complex on the north and the railway line on the south. This precinct is central to Umlazi, traversed by the M30 Highway and served by KwaMnyandu Commuter Rail Station. It warrants densification as a development node and the UDFP seeks to facilitate the establishment of mixed use activities that include inter-modal transport, commercial, residential, social and sporting amenities. This ultimate vision is to be realised in phases, of which the upgrade of the stadium with its immediate surrounds is the first.

The existing western grandstand remains as the principal building of the arena. The concrete structural frame with its upper level spectator seating was retained. New player and administrative areas are housed on the ground level, with public facilities on both ends. A new floor with lounges, hospitality and media areas, including new dedicated upper level seating tiers, has been erected at the top of the existing grandstand.

The new north and south grandstands are conceived as segmental earth embankments, and the existing eastern grandstand has been refurbished, yielding a total stadium seating capacity of approximately 10 000.

*Rakshni Moodley, Patrick Smith*

*Client Representative:* Fikile Ndlovu
*Principal Agents:* BKS (Pty) Ltd
*Project Managers:* Enhance Strategies (Pty) Ltd
*Principal Architects:* Walker Smith Architects
*Associate Architects:* Theunissen Jankowitz Architects, Ambro-Afrique Consultants
*Principal Urban Designers:* Walker Smith Architects
*Associate Urban Designers:* Ambro-Afrique Consultants
*Structural & Civil Engineers:* BKS (Pty) Ltd, Iliso Consulting Engineers
*Electrical Engineers:* DBA Consulting Engineers
*Quantity Surveyors:* Davis Langdon (Pty) Ltd, Abakali
*Contractors:* Cyclone Construction (Pty) Ltd, Stedone Civils (Pty) Ltd
*Landscape Contractors:* Idube Landscaping, Real Landscapes





## *Training Venues: Greening and/or Sustainable Interventions*

# Pennington & Associates, WSP Energy, WSP Facilities Management

**In July 2008 the Environmental Management Department of the eThekwini Municipality commissioned consultants to identify potential generic design strategies, technological interventions and/or retrofits in the upgrading of the three existing stadiums chosen as Training Venues for the World Cup.** As a point of departure we carefully studied the report 'Review of the greening status of the (Moses Mabhida) Stadium for the 2010 FIFA World Cup South Africa' prepared by Green-by-Design, Paul Carew Consulting and the CSIR, which in turn was based on the 'Work Plan for Greening the 2010 FIFA World Cup Events in Durban'. Whilst the practice stadiums bear some resemblance to the Moses Mabhida venue, they do also differ significantly: they are upgrades to existing arenas and have much smaller capacities, at less than 15 000, where the Moses Mabhida Stadium is a 'greenfields' project with a seating capacity of 70 000. It is also expected that these venues will not be as extensively used as Moses Mabhida.

Site inspections of each venue were carried out. The existing building design, function and layout, plus its surrounds, were recorded. This record included the construction materials used and the service structures implemented.

Interventions were to be consistent with the principles and strategies of the '2010 Greening Program', and focus on minimising environmental impacts and leaving a positive environmental legacy. The purpose was to reduce the carbon footprint, primarily though a reduction in the use of electricity, to minimise the impact on already scarce water resources, and to manage waste and the use of transport, all in a sustainable way. The review of the proposals was to inform the respective professional teams of possible 'greening' interventions that might be achieved within a reasonable budgetary framework so that they could be funded from an external source.

During the five stages of the analysis of the practice stadiums, several issues emerged.

First, the social aspects of sustainability in particular, but also transport and waste management, were largely beyond the scope and budget of the stadium teams, notwithstanding the developed precinct plans.

Second, in a follow up meeting with the Department, it was made clear that the primary objectives were (a) the reduction of electrical energy demand, by maximising electrical efficiencies and the utilization of renewable energy opportunities, and (b) the identification of water saving measures through optimal installations, recycling and harvesting, issues which the funding sources of the project saw as the two most important aspects.

Whilst it was understood that other potential interventions were not to be passed over eg climate neutrality, embodied energy of materials, waste, transport and biodiversity enhancement, it was the aforementioned two elements, energy and water, of the original six strategies that were to be most closely scrutinized.

Once we had completed our analysis of the three proposals, we discovered that many 'greening interventions', particularly those where the difference in cost between 'business-as-usual' and 'green' products/technologies was marginal, had already been incorporated into the projects. This was as a result of Greening Reports undertaken by each team in September 2008. The items listed in those reports we called 'best practice' and did not consider them for further review or possible funding as they had already been budgeted for.

As a result, and having analyzed where these instances had occurred, we set about identifying a set of interventions (a) that had not been included by the professional teams, either through oversight or because of budget constraints, and (b) that met the funding requirements .

Spreadsheets of these aforementioned items were drawn up for each stadium, given that quantities between each differed, and those items that had not been included in the original Greening Reports were analyzed specifically in terms of their "cost-to-'green' benefit" ratios, and were then rated on a scale starting with 1 being the optimum. This was done in order that the Environmental Management Department could readily assess their efficacy and, where appropriate, recommend that funding be made available for their inclusion in the project in question – see example below.

*Miles Pennington*

### Example: King Zwelithini Stadium

| | | | | |
|---|---|---|---|---|
| **PASSIVE DESIGN SAVINGS** | | | 633,909.00 | |
| **INITIATIVE** | **DETAILED DESCRIPTION** | **SAVING per ANNUM (KG's - CO2eq)** | **COST** | **RATING** |
| facebrick | Table 5 : Note 1 | 95 | 633,909.00 | **1** |
| **ELECTRICAL ENERGY SAVINGS** | | | 1,204,950.00 | |
| **INITIATIVE** | **DETAILED DESCRIPTION** | **SAVING per ANNUM (kWHr)** | **COST** | **RATING** |
| motion detection for all internal lighting | Table 5 : Note 3 | 144,000 | 295,000.00 | **3** |
| flood lighting controls | Table 5 : Note 4 | - | - | **-** |
| timers and daylight switches | Table 5 : Note 5 | 23,500 | 35,000.00 | **2** |
| heat pump technology | Table 5 : Note 6 | 175,000 | 119,450.00 | **1** |
| Building Management System | Table 5 : Note 7 | 144,000 | 670,000.00 | **4** |
| **WATER SAVINGS** | | | 1,259,623.67 | |
| **INITIATIVE** | **DETAILED DESCRIPTION** | **SAVING per ANNUM (kLitres)** | **COST** | **RATING** |
| flow restraint valves for WB's | Table 5 : Note 8 | 2,304 | 47,544.00 | **3** |
| tap aerators - shower and WB | Table 5 : Note 9 | 2,048 + 2,880 | 517,111.00 | **4** |
| dual flush cisterns | Table 5 : Note 4 | 345 | 56,993.67 | **5** |
| water-wise indigenous landscaping | Table 5 : Note 11 | 15,360 | 200,000.00 | **2** |
| intelligent pitch irrigation | Table 5 : Note 12 | 9,216 | 70,000.00 | **1** |
| rainwater harvesting | Table 5 : Note 13 | 183 | 367,975.00 | **6** |
| | | | **5,838,146.34** | |