2013 On Site Review Report

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by Jean-Charles Tall

Mapungubwe Interpretation Centre

Limpopo, South Africa

Architect
Peter Rich Architects

Client
South African National Parks

Design
2006 - 2007

Completed
2009

Mapungubwe Interpretation Centre
Limpopo, South Africa

I. Introduction

The Limpopo Valley may be one of the most remote and isolated places in South Africa. The huge Mapungubwe National Park is located at the confluence of the Limpopo and Shashe Rivers. Thispark is a property of the South African National Parks authority (SANParks) who commissioned the Interpretation Centre which celebrates the ancient civilisation of Mapungubwe, linked to the Great Zimbabwe. The rocky landscape is a result of geological events that reshaped the area. At that time the course of the Limpopo River was also changed; from going towards the Atlantic Ocean it now headed towards the Indian Ocean.

The vegetation is that of a dry area with mopane and baobab trees, and could easily be likened to a "hilly" savannah. Understanding the landscape is essential to the Mapungubwe Interpretation Centre as the whole design and architecture of this building is focused on its integration into the natural landscape of the park.

The Interpretation Centre is located past a pond, on the side of a mesa that sisters the main mesa of the Heritage Site, the ceremonial centre of the Mapungubwe civilisation, one kilometre away, close to the entrance to the park.

Peter Rich, head of Peter Rich Architects, has taught architectural theory and design for three decades at the University of the Witwatersrand's Department of Architecture in Johannesburg. He partnered with Michael Ramage and John Ochsendorf for the Mapungubwe Heritage Centre.

II. Contextual Information

A. Brief historical background

The Limpopo Valley is located in the north of South Africa at the confluence of South Africa, Zimbabwe and Botswana. The Mapungubwe civilisation is a kingdom dated between 1075 and the 14th century. We have very little information about this kingdom since there is no written documentation about it and the oral traditions of the region do not mention it.

The site was discovered in 1933; it was declared a World Heritage Site in 2003, as a Cultural Landscape. The landscape is characteristic of a savannah with mopane trees, huge baobabs and thorny trees forming the vegetal cover that is intricately tied to the rocky sandstone formations all around.

The Mapungubwe civilisation produced historical artefacts that show the brilliance of this civilisation and its commercial links to Egypt and Asia. The famous Golden Rhino was discovered on the historical ceremonial mesa of Mapungubwe National Park.

B. Local architectural character, including prevalent forms and materials

It is very difficult and tricky to relate Mapungubwe to any existing form of architecture nearby. There are no inhabitants close to this area; this huge reserve is totally free of any human presence. After flourishing for centuries, the area has been long abandoned.

However, different ethnic groups of the region claim traditional ownership of the land. This became a serious issue for the project which the architects had to confront by ensuring that their building did not refer to any one particular group, as this would have raised controversy.

C. Climatic conditions

It is located at 29°23'E and 22°19'S; the site is in a semi-arid climate.

Maximum temperatures average between 25°C (June) and 32°C (January). Peaks occur in summer (45°C). Minimum temperatures average between 9°C (June) and 21°C (January).

Annual rainfall is around 400 millimetres and there are approximately 10 rainy days a year. At the time of the visit, there had been flooding after heavy rainfalls, occurring after a two-year period of draught.

D. Immediate surroundings of the site

The project site is empty of human presence. The nearest inhabitants are those from game farms, several kilometres away.

E Topography

Mapungubwe sits between 300 to 780 metres above sea level. The site is very rocky and hilly, the result of important seismic movements that even changed the direction of the flow of the Limpopo River from towards the Atlantic Ocean to the Indian Ocean. The sandstone rocks are everywhere in the environment and form the specific nature of the area, together with the baobab and mopane trees.

III. Programme

A. History of the inception of the project

The pre-existence of traditional African states and kingdoms has always been a very controversial issue in South Africa during the time of Apartheid. However, when this regime ended, the South African government decided to emphasise the legacy of those kingdoms. Research that had been halted – or simply not taught – resumed, and the government decided to revive these studies. When the area was granted World Heritage status in 2003, this boosted the policy to develop Mapungubwe and the Interpretation Centre followed as a result.

Construction took place between October 2007 and June 2009, while the official opening was celebrated in December 2009.

B. How were the architects and specialists chosen?

SANParks launched a national design competition in 2005. Peter Rich won this architecture competition and was commissioned in December 2005. The design started in March 2006 and was completed by August 2007. Peter Rich partnered with Michael Ramage of the University of Cambridge (UK) and John Ochsendorf of the Massachusetts Institute of Technology in Boston (USA) to develop the conceptual vault design.

C. General programme objectives

The objective was to provide the National Park with an Interpretation Centre that could give the visitor a very clear understanding of the importance of Mapungubwe in this region.

D. Functional requirements

The general programme was very precise, and the architect also had to devote much attention to the social and political environment. The Interpretation Centre is composed of a museum, including an introduction hall where the general history of Mapungubwe is told with information on the context, different rooms hosting exhibits of the artefacts found in Mapungubwe, the history and social organisation of the kingdom and a sacred place dedicated to remains found in the area.

Facilities were developed for the visitor (coffee bar, restaurant, shop, etc.).

Offices for SANParks are included within the complex. The building, of course, had to take into account the climate of the region and the arid conditions.

An outdoor amphitheatre and facilities for researchers are included in the programme.

Different tribal claims on the land also made it difficult to relate to one particular group in the region. The architect had to be very careful to avoid any potential controversy in his proposals.

IV. Description

A. Building data

The ground floor is 1,130 square metres, while the total area is 2,750 square metres.

The Centre sits on the side of a mesa. It is formed of a series of vaulted forms linked by outside areas in a combination of “ins and outs”. Access to the Centre is via a small bridge, which also gives the first indication about the ideas behind the massing of this project: to keep the ground untouched in respect for the sacred nature of the site.

The project itself is a series of vaulted forms of different sizes and structures built in light earth bricks and covered with sandstone. All the vaults are just laid on the hillside with complete respect for the natural environment. No big earth-moving works or embankment projects were carried out. The different parts of the programme were just laid on the hillside as though it might have resulted from a natural geological event.

B. Evolution of design concepts

1. Response to physical constraints

The design started with an equilateral triangle that defines a route climbing through the buildings to the top of the hill. The vault system was made of several layers of thin earth tiles assembled with mortar gypsum. Stones were used as a covering layer of that structure.

The global conductivity of this layer is very low and very efficient in terms of controlling heat transfer towards the interior. But more important is the general thermal slowness resulting from such a massive structure. This creates a phase shift in temperature that allows self-regulation. Basically, the heat accumulated in the walls during the day will be transmitted at night and the low outside temperature during the night will result in cooler temperatures inside the building during the day.

2. Response to user requirements

Spatial organisation is very simple. The SANParks administration offices are located at the beginning of the scheme. Then a first bridge leads the visitor to the Interpretation Centre itself. A series of outdoor spaces is the first impression he gets, while these spaces connect different vaults to create a combination of patios.

The entrance to the interpretation rooms is unique because of the indoor/outdoor feeling created by the second bridge towards the first hall. The different rooms are then organised as a series, letting the visitor circulate smoothly from one area to another and experience different degrees of the sacred environments while moving further into the Centre.

3. Purely formal aspects

The formal aspects constitute an important feature of the project. At no point does the Interpretation Centre look like a “building” in this context. It is basically designed like “another stone hill” within a context of stone hills. The building is integrated in such a way that, at first sight, it is not very easy to spot when arriving from Johannesburg.

The lighting on the vaults also provides a very unique experience of the project.

There is no prevalent facade for this project. Each point of view around the building gives the impression of integration into the site while offering a distinct experience of the architecture.

No traditional decorative motifs were used, due to the necessity of avoiding any local tribal reference and the choice of completely integrating the building into the natural environment.

However, it is important to mention the two huge decorative openings. The one on the west side of the building bears recycled copper bars that glow a dramatic golden colour at sundown. The one on the southern side of the main exhibition hall is decorated like a stained-glass window with simple techniques.

4. Landscaping

There has been no special landscaping. The natural environment *is* the landscape. Therefore, the architect decided to respect it and to integrate the building into the dramatic existing landscape of stones and hills.

C. Structure, materials, technology

1. Structural systems

The structural system of the vaults is impressive. This is a revival of a 700-year-old vaulting system of the Mediterranean area. These vaults are footed on thick sandstone walls stressed in compression. The largest vault spans 14.5 metres with a thickness of 30 centimetres. The vaults are made of thin, non-fired stabilised-earth tiles. They form a double curved structure that was constructed with minimum formwork.

Barrel vaults are used as formwork for the horizontal slabs.

The whole design was based on static graphics, allowing a continuous review of the shapes of the vaults while resolving the structural problems.

The stress in compression is very low. The parabolic forms allow this stress to be transferred vertically to the walls. Horizontal thrust is, of course, much higher and is resolved on the largest vaults with steel tension ties embedded into buttresses.

Computer calculations have been very helpful in finalising the structural system of vaults.

2. Materials

Structural members

- concrete structure and slabs;
- sandstone walls;
- stabilised-earth bricks;
- diverse recycled materials (metal poles, etc.)

Infill materials

- brick walls, with aluminium window;
- recycled plastic sheets;
- glazing

Renderings and finishes

- earth tiles;
- cement plastering;
- recycled copper bars;
- recycled plastic sheets

3. Construction technology

The vaults system used in the building is brand new to the South African context. Consequently it was necessary to train unemployed women of the villages next to the site in how to produce earth bricks Then, finally, unemployed men were trained to construct the vaults.

Training was conducted by the members of Peter Rich's team themselves.

There is an extensive use of bamboo and recycled materials for other parts of the building. The recessed vaults are used as a permanent formwork for the concrete slabs.

Walls are built in dry stone using the traditional techniques of the Ndebele people of South Africa.

4. Building services, site utilities

Electricity is provided on site as well as water. The sewerage system is an individual one, specifically designed for the project.

It is notable that, in addition to the thermal characteristic of the building developed through the architecture and the nature of materials (thermal slowness), the architect designed a specific evaporative cooling system for the project. This system uses a specific feature of thermal exchanges in construction that is called maximal evaporative capacity of the air. The system is used in the SANParks office whereas the curators of the main exhibition halls decided that additional air conditioning was needed there for the sake of the artefacts.

D. Origin of

1. Technology

Developed on site (testing, training and operation).

2. Materials

Local

3. Labour force

Local

4. Professionals

Architects:	South Africa
Contractors:	South Africa
Consultants:	USA/Great Britain/New Zealand/Switzerland/South Africa/others

V. Construction Schedule and Costs

A. History of project design and implementation

Competition:	December 2005
Design:	March 2006–August 2007
Construction:	October 2007–June 2009
Opening:	December 2009

B. Total costs and main sources of financing

USD 1,875,000.

C. Qualitative analysis of costs

USD 681/m^2 funded by SANParks.

D. Maintenance costs

Not known.

From the analysis of the construction we can foresee very low costs of operation and maintenance in the context of Mapungubwe climate.

VI. Technical Assessment

A. Functional assessment

The different spaces of the building are very well arranged and provide quick access and understanding of the spatial organisation. The hierarchy in light treatment increases the dramatic side of the procession towards the sacred. The other functions of the site are nicely disseminated and the use of interspaces as functional spaces delivers a great architectural ensemble.

B. Climatic performance

All provisions for lighting, climatic performance, heat control, acoustics and other systems are achieved through natural control. Natural lighting is ensured through windows and oculi that give to each space a particular type of lighting in relation to its function.

Heat control is essential in this area and it is performed here with great efficiency. The shape of the vaults, designed from paraboloids, creates a good balance of sound and the sandstone walls and brick vaults associated to the volumes created ensure a delicate reverberation time that towel suits the solemnity of the exhibition spaces.

C. Response to treatment of water and rainfall

A system of waste-water treatment has been installed. The annual rainfall (10 days a year) is not significant enough to justify the installation of retention systems.

D. Environmental response

This project is all about adapting to its context. It readapts the general responses of nature to the constraints of a particular human project.

The vaults perfectly fit into the general hilly and undulating landscape and their covering materials have been extracted from the site. The interior space designed by this project is like a series of caverns that react to the climatic constraints exactly the way a real cavern would. The structural constraints of a cavern are reproduced in a way to serve the architecture of the Centre. The answers of nature to its constraints is generally very efficient in terms of economy (the quantity of energy developed vs. the goal to reach). The Interpretation Centre goes in that direction.

E. Choice of materials, level of technology

The main materials were extracted from the site, manufactured on site or recycled from waste. 85% of materials are local. The result is a very empowering technology that was easy for the local unemployed people to acquire. In fact, unemployed women (manufacturing bricks) and men (structural works) benefitted from the training to acquire skills and actually use them to build the project.

The technology is both simple and sophisticated: simple because this is basically an application of static principles and the renewal of an ancient technique; and sophisticated, because the technique allows a degree of freedom in the design of the Centre that could only be achieved with concrete structures (30% more expensive and with the disadvantages of using concrete in such a climate).

F. Response to, and planning for, emergency situations

The recent flood occurring in the region after two years of drought hit the building and caused no noticeable leaks. We are not aware of other emergency situations. We foresee that the structures will

perform well in the case of fire. It has also suffered several seasons of wind and this did not cause any damage to the structure.

G. Ageing and maintenance problems

Ageing should not be a problem provided the building is properly maintained, which seems to be the case up to now. Buildings of this type have lasted for centuries without any major damage.

H. Design features

The design of this building is a lesson in architecture. The integration of the masses to the site environment, the structural response to the construction constraints, the articulation of inner and outer spaces are all of very high quality. There are no neighbouring buildings.

I. Impact of the project on the site

The project raised a lot of interest in this area. This can be measured by the number of different websites of safari organisers who "sell" the Mapungubwe Interpretation Centre as a "must see", exactly the way they sell the site itself. We were told by some professionals met on the site (game farmers, restaurant owners, guides, etc.) that since completion of the building they have noticed a growing interest in Mapungubwe.

J. Durability and long-time viability of the project

The building is designed and will remain as an icon for the Mapungubwe Heritage Site. I anticipate an increasing interest in the park as the Interpretation Centre becomes better known to the professionals and the public.

K. Interior design and furnishing

Interior design for the exhibition is of great quality and facilitates the presentation of collections of artefacts. The last room of the centre (sacred remains room) is designed in a dramatic way that helps heighten the tension of the visiting experience.

VII. Users

A. Description of those who use or benefit from the project

Sixty unemployed low-skill people hired on the site worked through the government-funded poverty reduction programme received training in how to manufacture bricks.

A hundred people were trained for the construction works, while the site works continuously used an average of 10 to 40 people at the same time during the eight months of construction. They were able to find a job on the site from this training. After completion of the project, six small-size companies

were created by the workers. The architect Peter Rich has just been commissioned for the entrance gate of the relatively nearby Kruger National Park and he is going to use these now-skilled workers for the project since they are already active in the region.

B. Response to project by clients, users, community, etc.

1. What do architectural professionals and the cultural "intelligentsia" think about the project?

The project is highly regarded by architects, not only in South Africa but in the African region and all over the world. It has gained several prizes since its completion, amongst which:

- World Building of the Year, World Architectural Festival, Barcelona, October 2009
- World Building, Culture Category winner, World Architecture Festival, Barcelona, October 2009
- David Alsop Sustainability Award
- British Structural Awards, 2009
- The Institute of Structural Engineers
- South Africa Absolut Visi Designer of the Year, 2009
- Wienerberger Brick Award, 2012

2. What is the popular reaction to the project?

Many articles in South African and American newspapers emphasise the quality of the work of Peter Rich on the Mapungubwe Interpretation Centre.

3. What do neighbours and those in the immediate vicinity think about the project?

The people we talked to in the Limpopo Valley were mainly game-farm owners, officers of the park, some tourists. They all praised the quality of the design and construction.

VIII. Persons Involved

Architect:	Peter Rich
Designers and structural engineers, tile vaults:	Michael Ramage and John Ochsendorf
Architect:	Timothy Hall
Structural engineer, overall project:	Henry Fagan
Vault construction training and supervision:	James Bellamy
Contractor and quantity surveyor:	Usna Bouer and DHR

IX. Bibliography

List of publications

Amongst others:

- "Mapungubwe Interpretation Centre/Peter Rich Architects", *ArchDaily*, 21 Apr 2010.
- "Mapungubwe Interpretation Centre by Peter Rich Architects, Mapungubwe National Park, South Africa", *The Architectural Review*, 1 February 2010.
- "Mapungubwe Interpretation Centre", *Designboom*, 2 May 2013 and 5 November 2009.

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Mapungubwe
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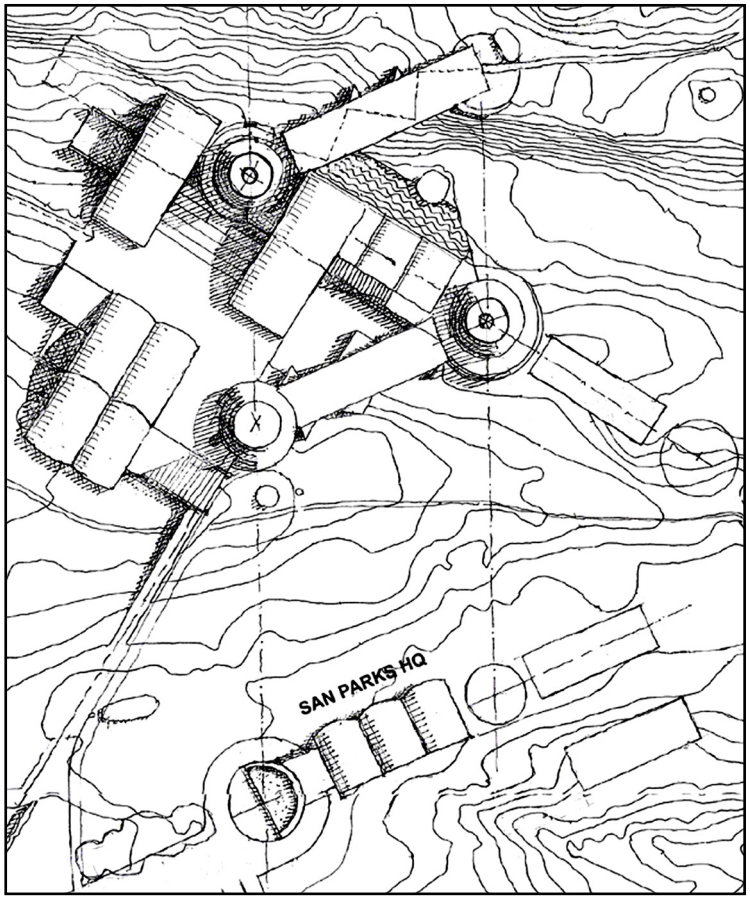
SAN PARKS HQ

The Mapungubwe civilization is a kingdom dated between 1075 and the 14th century. The site was discovered in 1933. It was declared a World Heritage Site in 2003, as a Cultural Landscape.

The landscape is characteristic of a savannah with Mopane trees, huge baobabs and thorny trees forming the vegetal cover that intricates with the rocky sandstone formations all around.

The Interpretation Centre is composed of a Museum including an introduction hall, different rooms and a sacred place dedicated to remains found in the area.

The project itself is a series of vaulted forms of different sizes and structure built in light earth bricks and covered with sandstone.

The centre is formed of a series of vaulted forms linked by outside areas in a combination of “ins and outs”.

Access to the Centre is a small bridge that gives the first indication about the massing of the project.

An outdoor amphitheatre and facilities for researchers are included in the program.

The largest vault spans 14,5m with a thickness of 300mm. These vaults are made of thin non-fired stabilized earth bricks. They form a double curved structure that were constructed with minimum formwork.

the general history of Mapungubwe is told with information on the context, artefacts found in Mapungubwe, history and social organization of the kingdom.

All provisions for lighting, climatic performance, heat control, acoustics and other systems are achieved through natural control.