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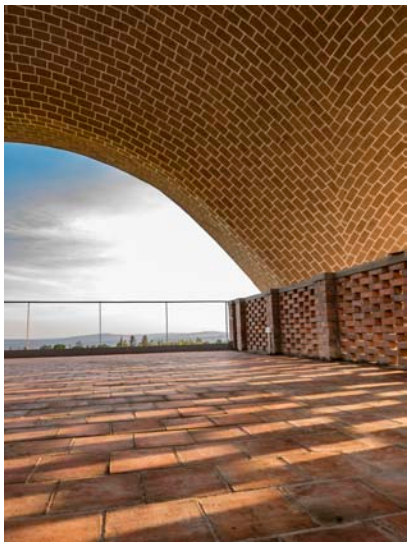

Rwanda Cricket Stadium

Gahanga, Kigali, Rwanda

The project is part of work undertaken by Light Earth Designs for the Rwanda Cricket Stadium Foundation over a 5-year period on how Rwanda can transition from an agriculture-based economy to development using local home grown labour intensive construction techniques, thereby avoiding imports, lowering carbon, and building skills and economies.

The primary enclosure of the cricket stadium, the vaults, adapts ancient Mediterranean tile-vaulting (using compressed soil-cement tiles) to a moderate seismic context by using geogrid reinforcing in the layers and bearing the springing points of the doubly curved vaults on the ground. The vaults follow the natural resolution of forces toward the ground, closely mimicking the parabolic geometry of a bouncing ball and evoking the cherished hilly topography of Rwanda. The masonry vaults are completely in compression allowing the use of a simply layered thin shell composite of low strength tiles.

The tiles are produced on site from local soil by low skilled and skilled locals - hydraulically pressed with a small addition of cement and do not require firing. They are laid in layers onto a temporary timber skeleton - again using a combination of low and higher skilled local labour and span up to 16m. Geogrid is added to give some seismic protection, developed by research in architecture and engineering at Cambridge University. The shells are waterproofed then topped with local broken granite (found everywhere across the country), blending into the natural palate while the granite adds weight and stability.

Simple, efficient and thin concrete tables are inserted into the vaults, providing space for the more enclosed functions the service areas, the changing rooms, an office and a restaurant. These tables are topped with natural Rwandan agro-waste-fired tiles made of commonly found wetland clay. The open mezzanines - a bar and a clubhouse - enjoy wonderful raised clear panoramic views over the Oval and wetland valley beyond.

Bricks are used to define edges and spaces - often laid in perforate bond - allowing the breeze and light to filter through. These bricks are sourced from enterprises set up by Swiss NGO SKAT Consulting, and are also low carbon agro-waste-fired bricks using high efficiency kilns, further reducing energy and carbon. Waste stone from Rwandan granite floor and worktops are used for flooring. The plywood

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rectangles used to press the tiles are reused as countertops while timber and plywood from the vault guidework is made into joinery and doors, ensuring that a maximum of waste material goes into primary production. Local slate is configured to allow rain water to permeate and infiltrate the soil. Retaining walls are either local granite boulders or are hollow to encourage planting

The building grows out of the cut soil banking that was formed as the pitch was levelled - thus becoming part of the landscape. The banking creates a wonderful natural amphitheatre with great views to the pitch and wetland valley beyond. Whilst the language of the building speaks about progression and dynamism through extreme structural efficiency, the materials speak of the natural, the hand made and the human. It a building made by Rwandans using Rwandan materials.

The design builds on vault design and research by Michael Ramage at The University of Cambridge Centre for Natural Material Innovation alongside Ana Gatóo and Wesam Al Asali, and extends work of Ramage with John Ochsendorf (MIT) and Matt DeJong (Cambridge).

Peter Rich Architects with Michael Ramage and John Ochsendorf pioneered soil tiled vaulting at The Mapungubwe Interpretation Centre (SA). Light Earth Designs (Tim Hall, Ramage, and Rich) continued with The Earth Pavilion (UK), FR2 offices for Joseph Ritchie (Chicago, USA) and have undertaken research in geogrid application in seismic zones conducted at the University of Cambridge.

The vault construction proposes a mix of low skilled and skilled worker teams. The teams are trained by an expert mason, in this case James Bellamy (a mason from New Zealand). The tiles are laid with the inner layer resting on a temporary guidework (made of timber and scaffold) that allows the form to take shape. The inner layer of tiles are laid upwards from the perimeter and stay in place through the use of a quick setting gypsum mortar. As the first layer continues, successive layers of tiles are laid in a thin lime and cement mortar inlaid with geogrid. The number of layers is determined by the vault span, in this case we have up to 6 layers with a large span of 16m. The tiles are topped with a screed and waterproofed with a torched sheet membrane. On top of this a network of geogrid is laid - with a composite granite stone and lime/cement/sand mortar mix.

The imperfections are celebrated - they are human and beautiful - and when combined with the layering of natural textures the building becomes imbues and celebrates this wonderful place.

Client

Rwanda Cricket Stadium Foundation

Light Earth Designs team

Tim Hall - Partner and lead
Michael Ramage - Partner and vaulting lead
Ana Gatóo - Project lead architectural engineer; on site lead
Ben Veyrac - Project architect at tender and architect
Wesam Al Asali - formwork design

Anton Larsen - architect
Marco Groenstege - architectural technician
Oliver Hudson - engineering support
Killian Doherty - project inception architect

Contractor

Roko Construction, Kigali
James Bellamy, Vault Specialist