SASFA FEATURE
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COFIMVABA SCIENCE CENTRE

Introduction and background

The Department of Science and Technology (DST), in collaboration with the Department of Basic Education (DBE) and the Eastern Cape Department of Education (ECDE), led an initiative that sought to examine whether the introduction of innovative and tested technologies would improve the quality of learning and teaching in the Cofimvaba Schools District, Eastern Cape, some 60 kilometres east of Queenstown. It is within this initiative that the development of a science centre in Cofimvaba was conceived. Science centres, in addition to their primary role of bridging the gap between science and society, complement formal classroom learning and teaching of Mathematics, Science and Technology (MST).

The Science Centre will advance the goals and objectives of the DST-led campaign to promote public awareness of and engagement in science and contribute to the development of a pipeline for skilled and capable workforce to support an inclusive growth path, particularly scarce high-level research skills in science, engineering and technology (SET) areas.

The centre comprises of the following:

Educational spaces

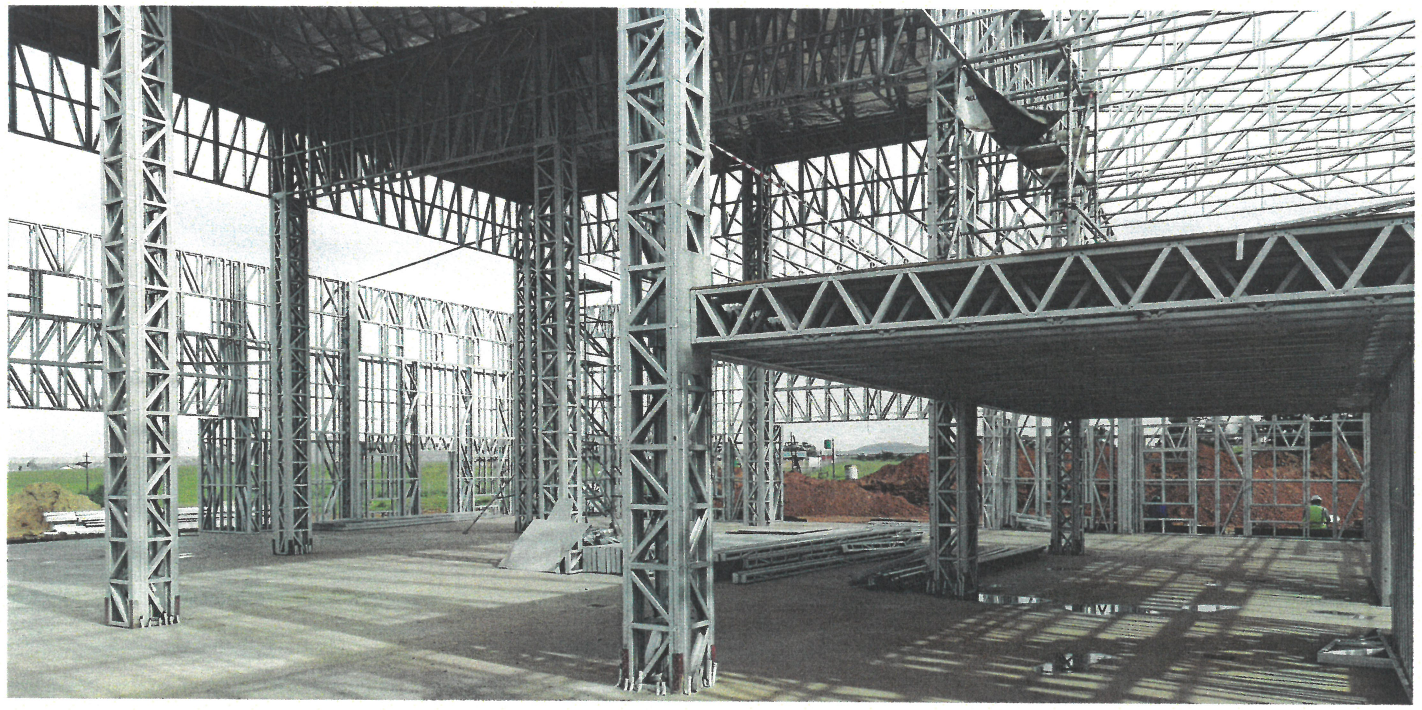
- Four multipurpose classrooms plus storage rooms attached to each classroom
- Two technology innovation pods

Exhibition spaces

- Science engagement interactive exhibits
- MST curriculum-linked hands-on exhibits
- Workshop (for repairs and maintenance of exhibits)

Administration spaces

- A staff administrative area
- Centre Head's office
- Ablution space
- Kitchen & storage



Innovative building technologies

Because the centre aims to promote technology and innovation it was decided to use the opportunity to test and showcase various innovative building technologies in the design of the building. To this end the building fulfils one of the objectives of the IBT Cabinet resolution of August 2013 namely, the construction of demonstration buildings. Two key decisions taken in this regard are the use of innovative building systems, and off-grid services.

Innovative building systems

Two building systems were selected namely light steel frame (LSF) and insulated concrete composite (ICC). A third technology was also selected but unfortunately challenges arose regarding the availability of that system. The LSF system is used for the double storey sections of the building namely the double volume exhibition area and entrance foyer, and the double storey administration area. The ICC system is used for the single storey classrooms, stores, and ablution facilities.

The LSF system was selected for its ability to cope with double volume construction, a factor that rules out many IBTs. Additional considerations were speed of erection; ability to prefabricate offsite and deliver to site for erection purposes only (an important consideration given the remote rural location of the centre); thermal insulation value; a reduction in the use of cement and water; and the reduction of waste.

The experience to date has validated the selection: the LSF erection process has saved time; the delivery of the prefabricated light steel components has been seamless; significant water saving has been effected; and no waste is visible on the site.

We were surprised by the accuracy of construction (each component was installed without any need for adjustment or modification), and the versatility of the system. The LFS system has lent itself to the complete construction of innovation pods in the exhibition area (floor, stairs, walls, and internal ceiling); the construction of two solar chimneys; and the construction of a planetarium, including the domed ceiling.

Off-grid services

The opportunity has also been used to evaluate to what extent public buildings can go off-grid. This research aims to demonstrate that social infrastructure can be provided in areas where no municipal services are available. To this end the building is designed to be:

- Energy independent – five energy sources are employed namely photovoltaic panels; building-scale wind turbines; hydrogen fuel cells; battery; and Eskom power (as a back-up);
- Water independent – the building relies on rainwater harvesting and water recycling for its water supply. To achieve water independence the toilets are connected to a closed-loop bio-based system that recycles its own water, and the greywater is recycled through a constructed wetland;
- Sanitation independent – as stated above, the sewerage treatment occurs on site through a bio-based treatment system that converts the solid wastes to a fertilizer, and recycles the water for reuse in the toilets;
- Solar heating, cooling and ventilation – the building makes use of solar chimneys to heat and cool the building, and to boost cross-ventilation. In this way it is designed to be HVAC-free.

Conclusion

The project is demonstrating the benefits of using IBTs thus far. The facility is due for completion in August 2019. A thorough post-construction evaluation will take place to measure the performance of the system, and its efficacy in-use will be measured through a post occupancy evaluation (POE) after twelve months of use. The lessons learnt will also be included in these reports.

Credits

Implementing agent: CSIR Lead Person: Llewellyn van Wyk

Construction and Project Managers: Royal Haskoning

Architects: Ngonyama & Associates

Consulting Engineers: Element Consulting

Quantity Surveyors: CBI Quantity Surveyors

Main Contractor: Helm Construction

LSF Subcontractcor: Siteform

Comments from Johan Fourie

MD of Siteform, the LSF subcontractor

'We were very fortunate to be involved in the project from the planning stages to avoid major design difficulties once the project gets to the actual building phase, which in turn saves cost as the building was pre designed and quoted accordingly. Therefore the changes were minor and more of cosmetic nature. The major material suppliers were Marley Building Systems, United Fibre Cement Company, and Saint-Gobain.

The challenges we had with the design included the central part of the building, approximately 14m x 14m in plan, which had a 9m high double volume atrium. The surrounding display area has walls of 6.2m high with two mezzanine floors.

The two solar chimneys which will be utilised for heating and cooling of the building (without the use of electricity) stands 11m high.

A further challenge was that this building is built in an area where snow is bound to fall from time to time, therefore all the roofs had to be designed to incorporate a snow load.

I believe that this Science Centre will stretch the boundaries of what Light Steel Framing is capable of in South Africa, and that it is a truly viable alternative building method for bigger commercial structures as well as residential buildings".