# Mall of Africa central skylight

The Mall of Africa project comprises a 131000 m2 development at Waterfall Estate, located between Sandton and Midrand in Gauteng. At the centre of the Mall, there is a 4300 m2 undulating free-form skylight, running 170 m in the north-south direction and spanning up to 51 m in the east-west direction. MDS Architecture generated the initial skylight design to bring light into the Mall and to create a unique feature element. Novum Structures was appointed as the design-build specialist subcontractor for the design and installation of this skylight. Aurecon designed the perimeter concrete support structure, and the main contractor was a joint venture between WBHO and Group 5.

The 3D surface and grid development of the skylight was a multi-stepped iterative process which aimed to balance the overall architectural intent, the spanning capacity of the cladding, drainage, cost and other structural considerations. To create a single-layer steel structure, the overall skylight was designed as three independent thrusting skylights, separated by two building expansion joints. The structural design was carried out using the direct design method considering both local and global imperfections and considering lateral movements in the perimeter concrete upstand beams. Due to the large spans at the central region of the skylight, tree columns were added to ensure that the same overall rectangular tube sizes could be used throughout the skylight.

A combination of 1352 unique rectangular steel beams with custom end castings and 577 machined nodes were used to create the free-form structural grid. To increase the accuracy and speed of installation, the beams were sitebolted to the disk-shaped nodes using the Novum FF-system. The cladding Aerial view of the Mall of Africa in Midrand, Gauteng; note the skylight in the middle of the roof Mall of Africa all of Africa central skylight entral skylight 32 July 2016 Civil Engineering consists of 1 352 unique aluminium extrusions which support 846 ETFE pillows. In order to efficiently manage the fabrication, transportation and installation of these components, each part was marked with a unique number and the orientation was stipulated in the installation drawings. The structure and cladding were fabricated by a combination of various in-house Novum entities and local suppliers. Due to site constraints, materials were stored off-site and delivered to site as required to meet the installation sequence.

The steelwork for the skylight was installed using a combination of a selferecting crane standing on the level three slab, and an eight-ton mobile crane on the level five slab. The structure was assembled by lifting pre-bolted three-arm spider sections, consisting of three beams and one node, and bolting these to the partly installed skylight. A series of shoring towers were erected at specific locations to provide temporary support while the structure was being installed. Once a full arch section had been installed and fully torqued, the shoring towers were removed.

The cladding consists of a series of ethylene tetra-fluoro-ethylene (ETFE) air-filled pillows. Each pillow is supported by aluminum extrusions, and the system is inflated by three air machines mounted on the roof. Each air machine is equipped with two blowers, a dehumidifier and a series of sensors which continually monitor the overall pressure in the pillows and adjust this pressure as required. Based on glare and shading studies, the pillows were made of a combination of either two partly opaque ETFE layers or one clear printed ETFE upper layer and a fully clear lower layer. The extrusions and ETFE cladding were installed using nets which were tied to the steel structure and removed once a portion was fully installed and water-tested.

The design and installation of the central free-form and ETFE skylight at the Mall of Africa development offered unique challenges on both the design and installation fronts. To meet these challenges a number of custom-engineering and sitebased solutions needed were developed and implemented. The material used for this project was accurately fabricated and installed to stringent tolerance requirements. The success of this project (which was completed on budget and within the allowable timeframe) can be accredited to excellent teamwork, the thorough upfront iterative design process between Novum and the other professional teams, as well as the expertise and dedication of the site installation teams.

CHINA’S HIGH-SPEED DEDICATED PASSENGER RAILWAY

“Just five or six years ago China opened its first true high-speed modern dedicated passenger railway, and since then a network of such lines totalling about 9000 route-km has been put into operation, with maximum permitted speeds ranging from 250 km/h to 350 km/h. About 800 streamlined highspeed train sets are now in service. Many more lines are under construction to meet China’s target of having a 20 000 route-km high-speed dedicated passenger network in place by 2020,” Evans explains.

China’s high-speed dedicated passenger railway network, with its sleek modern bullet trains and large architecturally dramatic stations in the major cities, has greatly impressed the world, attracting many politicians, railway officials and others eager to assess whether something similar could not provide solutions to particular transport challenges in their own countries.

Evans says that, although there are many factors that support high-speed passenger railways in China – high population, many large cities, rapidly growing affluence and a large pent-up travel demand – there are many in China who question the viability of some of the new high-speed passenger lines. “Internationally highspeed passenger railways have also generally been controversial.”

So, apart from a dedicated high-speed passenger railway, what other modern railway options should South Africa be looking at in China?

# FUTURE OF ENERGY

The energy debate is no longer only dominated by fuel choice. Energy consumption will increase as we grow as a global population. The question is how will we respond and manage this. There is a great need for solutions that can meet climate change and carbon emissions standards, but still reliably keep the lights on for citizens and business.

Rising energy costs and a focus on environmental performance have triggered the need for innovations to manage energy efficiently through technologies such as smart grids. These can offer more control and visibility, resulting in cleaner, reliable and smarter energy. Governments of developing countries are focusing on growing their infrastructure as quickly as possible in response to greater demand and an increased population.

South Africa is currently facing a critical energy shortage, but there is strong government commitment to nuclear power expansion to fill capacity gaps. The goal is to deliver 9.6 GW of nuclear power within 20 years. Decisions regarding nuclear power stations will also be taken in the short to medium term to provide for the long lead times coupled with economic growth requirements.

There is also a drive to include renewable energy into the generation mix, with more than 64 projects being launched in the last decade, and more to come. The dominant technologies are wind and solar. In Mozambique recent gas finds could launch this country to a global top-five gas player, and this could have a major impact on South Africa. The potential exploration of shale gas is also expected to be a game changer for the South African energy landscape.