COVERING THE WORLD OF CONSTRUCTION

DECEMBER 2024

CROWN PUBLICATIONS

Construction WORLD

2024 BEST PROJECTS SPECIAL ISSUE

WHY LISTENING AND TALKING TO CUSTOMERS MAKE A CONCRETE DIFFERENCE TO SA

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- Filling of washed out material in dams
- Soil stabilisation in dams
- Off-shore, waterfront, waterway structures and foundation applications

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ON THE COVER

Building the company around its customers is what has allowed construction materials leader AfriSam to stand the test of time, with the market – and broader society – benefiting in ways that are often invisible to them. Products like cement, for instance, are often commoditised in the eyes of both large and small customers, to the extent that buyers often consider only the 'price on the bag'. This is why AfriSam has made a concerted effort to add value that customers might not even be aware of.

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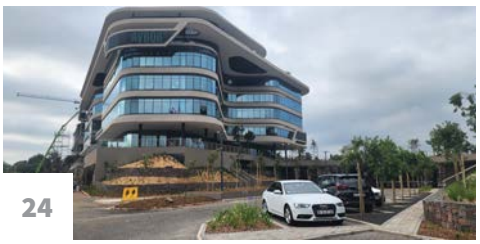

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74

Construction World's December issue is the highlight on the MAGAZINE's ANNUAL PUBLISHING CALENDAR

It features all the winners of Best Projects, a competition that was started in 2002 and which has grown in stature, significance and as one that reflects the status quo *of the construction industry. Reading through the following 88 pages, you will be inspired by the innovation, ingenuity and resilience of the South African construction industry.*

Even though the competition had 84 entries in 2024, which is a record for the awards, mammoth projects are absent. Such projects benefit the industry across the entire supply chain and, for the duration that they are under construction, they play a significant role in the performance of the construction industry – a major contributor to the country's GDP.

Private Public Partnerships (PPPs) have been hailed as a way to change the fortunes of the South African construction industry – an industry that has been flatlining for almost a decade, but kept ticking over by the private sector and sporadic infrastructure projects.

Upcoming PPP amendments have sparked optimism among infrastructure developers. PPP legislation and tenders are notoriously prohibitive in terms of cost, time, effort and their erratic nature.

The construction and infrastructure development sector are now eagerly awaiting amendments to Treasury Regulation 16. These amendments will streamline and support more PPPs (I am writing this before the amendments are made public – which should be before the beginning of December).

The reforms, which were outlined in the Medium-Term Budget Policy Statement (MTBPS) will strengthen planning, appraisal, contracting, financing, monitoring and evaluation. The result will be the faster delivery of infrastructure that supports economic growth, the expansion of access to basic services and boosting job creation.

The amendments will address the challenges that have hampered PPPs such as the bottlenecks in implementation, how PPPs are structured and will hopefully address the interests of both the public and private sectors.

In the draft amendment to Treasury Regulation 16, which was gazetted for public comment in February this year, was the launch of a PPP Advisory Unit to provide expert guidance that will assist in driving projects through the inception, preparation, evaluation, and approval phases.

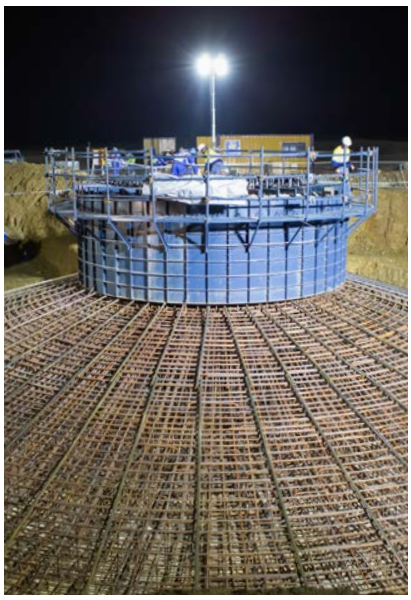
National Treasury proposed establishing two distinct pathways for PPPs – one for high-value projects, and another, simpler pathway for projects below R2-billion. This will create new opportunities for developers to bring creative solutions to the table in terms of ongoing infrastructure challenges such as for water, electricity and roads.

Big and small

This issue highlights the outstanding winners of Best Projects 2024. These range from bigger infrastructure projects to smaller projects that impress with their ingenuity and application of sustainable principles especially. May you be inspired by these projects – and i hope that in 2025 we can welcome more PPPs – big and small.

Wilhelm du Plessis
Editor

Stefanutti Stocks
Inland Region's Bomb Squad
preparing for the 2025 Best Projects season!





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excellence **in execution**

Left: AfriSam has a fully staffed contact centre of trained and experienced people. Right: AfriSam shares its knowledge through training.

Richard Tomes, AfriSam Sales & Marketing Executive.

WHY LISTENING AND TALKING TO CUSTOMERS MAKE A CONCRETE DIFFERENCE TO SA

Building the company around its customers is what has allowed construction materials leader AfriSam to stand the test of time, with the market – and broader society – benefiting in ways that are often invisible to them.

Products like cement, for instance, are often commoditised in the eyes of both large and small customers, to the extent that buyers often consider only the 'price on the bag'. This is why AfriSam has made a concerted effort to add value that customers might not even be aware of, according to Richard Tomes, AfriSam Sales and Marketing Executive.

"AfriSam has leveraged our 90 years in this sector by structuring ourselves around the whole customer experience," says Tomes. "Today, this includes using the latest technology to streamline a customer's journey with us – from enquiries and quotes, through order placement and technical advice, to payments and delivery tracking."

This is facilitated through AfriSam's e-experience platform ClickToGo, allowing customers real-time access to their accounts, where they can manage orders and deliveries with ease. He emphasises, though, that digital tools can never replace the company's personal connection with customers.

"Technology can be efficient and useful, but computers do not understand the complexity of our real-life human working environment," he stresses. "Customers often need a person to talk to, who will understand what needs to be done in any situation."

For this reason, AfriSam has a fully manned contact centre of trained and experienced people – who can be reached quickly. Importantly, says Tomes, these individuals work from a centralised office rather than from home, to ensure high levels of responsiveness and supervision. This attention to detail derives from understanding what different customers want.

"We invest considerable time and energy in finding out what works for our customers, and what doesn't," he explains. "In addition to our daily working engagements with customers, we also conduct a formal, independent Voice of Customer survey twice a year. This helps us keep our finger firmly on the pulse of our markets and their preferences."

AfriSam also keeps a close eye on industry trends, one of which has been the shift towards cement sales from third-party retailers. He points out that cement sales were traditionally split roughly 50:50 between contractors and concrete product manufacturers on the one hand, and retailers on the other. Since 2020, however, this has moved closer to 60 to 70% of sales from retailers, and projections suggest that this trend may continue.

"This change is not academic, having important implications for how we serve our customers responsibly," he says. "An aspect to remember about retail sales is that this suggests a DIY buyer or small builder – and not everyone in these segments is an expert in the selection and use of cement and concrete."

This raises issues of affordability, risk, safety and value for money. While guidance and information can be printed on cement bags, there are high levels of illiteracy in South Africa which need to be considered.

"We take note of these factors when deciding how best to serve these categories of customer," he explains. "Without a certain level of expertise, there can be considerable risk to buying a cement that is not fit for structural elements of construction, for example."

AfriSam's premium All Purpose Cement, widely available in retail outlets, is therefore designed to meet the requirements of many applications – including structural concrete. In this way, AfriSam ensures that even customers who are new to concrete can achieve a long-lasting, safe and cost effective result.

"In South Africa we regularly see the tragic consequences of people eating unsafe food from spaza shops," says Tomes. "There are also cities in Africa where buildings regularly collapse due to use of poor building materials and practices. It shows that informed decision-making is as important in relation to cement as it is with food."

In making these critical everyday choices, it is reassuring for

Left: AfriSam's premium All Purpose Cement is designed to meet the requirements of many applications. Right: AfriSam provides its customers with peace of mind that comes with guaranteed technical excellence.

people to know that reputable companies like AfriSam, with its 90-year heritage, give them the guarantee of quality, safety and long lasting structures, he says.

A further service the company provides to the retail cement segment is by sharing its knowledge through training. It upskills the floor staff at retailers with insights on cement selection and usage, so that customers can be guided in making the most appropriate and responsible selection of products when it comes to construction and renovation of safe and long-lasting houses and structures.

"Our philosophy of quality products and service extends to all our market segments, and has a particular relevance to large civil engineering and building projects often funded from the public purse," says Tomes. "Customers need the peace of mind that comes with guaranteed technical excellence, so that roads, bridges and other structures do not cost taxpayers or investors more in maintenance and repair."

He highlights that AfriSam's long-established reputation for quality has been built on almost a century of continuous research, development, testing and innovation – which are now embodied in the company's trusted brand. This is further reinforced by adherence to global ISO standards and the local requirements of the SA Bureau of Standards and the SA National Accreditation System.

"Adding to the confidence that we can give customers in their journey with us are our offerings across the range of construction materials they need," he says. "This is not just about the convenience of sourcing from a single reliable supplier, but we also bring high-value expertise about how these materials interact with each other for the best results."

Many contractors may have limited in-house knowledge about matching the most suitable aggregate with different cement types, for instance. AfriSam's Centre for Product Excellence is home to some of the brightest minds in this sector, and they provide detailed testing, concrete mix designs and other technical input. Tomes notes that many customers do business with AfriSam because they can rely on this depth of expertise – to answer even the most complex questions related to construction materials in their project.

"It is difficult to put a value on this aspect of our service, but most of the market is well aware of the risks in construction, and our customers often come to us to help mitigate those risks," he says.

An important part of AfriSam's technical contribution to customers is the way it supports industry bodies and educational institutions to raise skill levels and best practice – for the good of the broader economy. Students are sponsored to become part of the next generation of civil engineers and technologists to underpin economic growth.

"This social role is a vital part of our DNA, and expresses our commitment to the local construction sector and the broader economy and country," says Tomes. "A reason that customers do business with us is because they recognise the importance of nation-building through technical expertise and production capacity." He emphasises that, in a country with such high unemployment, the company promotes inclusive development that will build livelihoods and opportunities for the future. With this in mind, it has recently sponsored 40 candidates in the Youth Employment Service (YES) programme, in addition to its established in-house and external development schemes.

AfriSam's e-experience platform, ClickToGo, is a first of its kind in the industry.

"We embrace the challenge of building our local economy, which will result in much-needed job creation," he says. "As a Level 2 BBBEE contributor, we continue to invest in local development that we trust will transform lives and livelihoods."

As a local cement producer, this means shouldering costs and responsibilities that do not apply to importers, he concludes. While cement producers find solutions with government to ensure a level playing field for international trade, AfriSam continues to invest in transformative initiatives that empower communities and reduce impacts on the environment.

"This is all part of our value proposition to customers," says Tomes. "It starts with listening to the needs, but goes much further – to help them achieve their dreams." ■

BEST PROJECTS 2024's WINNERS

The winners of Construction World's Best Projects awards for 2024 were announced at an event held in Johannesburg in November. These awards have, for 23 years, recognised excellence in the built environment in South Africa. The competition attracted 84 entries, the most yet, and the winners represent the whole spectrum in the construction industry – from big to small players.

The awards are independently adjudicated, and judges were impressed by the number of excellent entries in many of the categories. They said this is a sign that, despite tough market conditions, there is great depth, excellence and innovation in the South African construction world.

The judges were **Uwe Putlitz** – a retired professional architect and professional construction project manager; **Hanlie Turner** - a retired business development manager in the cement and concrete environment; **Musa Shangase** – immediate past president of Master Builders South Africa and **Lufuno Ratsiku** – president of the SACPCMP.

AfriSam was the main sponsor (and has been from the start of these awards), CHRYSO Southern Africa the gold, a.b.e.® Saint-Gobain the silver and Baker Baynes the bronze sponsor. They were joined by Sika and the South African Council for Project & Construction Management Professions (SACPCMP) as associate sponsors.

THE WINNERS

CIVIL ENGINEERING CONTRACTORS

Winner
National Route 3, Sections 2 & 3, from Lynnfield Park (km 30,6) to Ashburton
AfriSam

Highly Commended
Kendal Power Station Continuous Ash Disposal Facility Extension Project
Concor Construction

Special Mention
Construction of IRT Phase 2A Infrastructure (W4) Govan Mbeki Road between Landsdowne Road and Heinz Street Cape Town
Govan Mbeki IRT JV (Civils 2000 and Grinaker-LTA)

BUILDING CONTRACTORS

Winner
Irene Building D – Avbob New Head Office
WBHO Construction

Highly Commended
Nuclear Medicine Research Infrastructure (NuMeRi) at Steve Biko Academic Hospital
Washirika 3 Oaks (W3O)

Highly Commended
Parkdene Boulevard
WBHO Construction

Special Mention
SPU Multipurpose Hall
Ruwacon

Special Mention
Middelburg District Hospital
Enza Construction

SPECIALIST CONSTRACTORS OR SUPPLIERS

Winner
Koruson 1 Wind Farm
CHRYSO, WBHO Construction and Concrete Units

Highly Commended
Carinus Bridge (B2918), Velddrif
Sika SA and AECOM SA

Highly Commended
Devin Properties Super Basement: Lateral Support and Piling Works
GeoCiv Group

Highly Commended
General Construction Worlds for the Sasolburg NH3 Tank B and balance of plant project
Stefanutti Stocks

Highly Commended
The One Student Accommodation Basement Lateral Support and Piling Works
GeoCiv Group

Highly Commended
National Route 3, Sections 2 & 3, from Lynnfield Park (km 30,6) to Ashburton
AfriSam

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THE WINNERS

Special Mention
Reinforced Earth retaining walls on the access road to the Polihali Dam Site, Lesotho
Reinforced Earth South Africa
CONSULTING ENGINEERS
Winner
Montrose Interchange Upgrade Project
SMEC South Africa
Highly Commended
Carinus Bridge (B2918), Velddrif
Sika SA and AECOM SA
Special Mention
Munyaka Crystal Lagoon and Lifestyle Centre
Civil Concepts
Special Mention
Shoprite – Wells Estate
WSP Group South Africa
Architects
Winner
Flower Hall Test & Examination Centre
Savage + Dodd Architects and Tri-Star Construction
Highly Commended
Deutsche Internatonale Schule Kapstadt STEM Centre
KMH Architects
Special Mention
The Rubik
dhk Architects
Special Mention
Department of Agriculture, Land Reform and Rural Development
Boogertman + Partners Architects
Special Mention
Cape Station
Boogertman + Partners Architects
THE AFRISAM INNOVATION AWARD FOR SUSTAINABLE CONSTRUCTION
Winner
Kendal Power Station Continuous Ash Disposal Facility Extension Project
Concor Construction
Highly Commended
Flower Hall Test & Examination Centre
Savage + Dodd Architects and Tri-Star Construction
Highly Commended
Coastal Park Materials Recovery Facility (MRF)
JG Afrika
Highly Commended
Construction of the Wela River Bridge No. 3490 on Road P451
Icon Construction
Highly Commended
Green School South Africa – Middle School
GASS Architecture Studios
Highly Commended
National Route 3, Section 2 & 3 from Lynnfield Park to Ashburton
AfriSam
Special Mention
Emondlo Mall
Protean Project Innovations

THE JUDGES

Uwe Putlitz
Retired professional Architect and professional Construction Project Manager.

Hanlie Turner
Retired Business Development Manager in the cement and concrete environment.

Musa Shangase
Immediate Past President of Master Builders South Africa.

Lufuno Ratsiku
President of the SACPCMP.

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BEST PROJECTS 2024 WINNERS

Here are the winners of the 23rd Best Projects awards. There were 31 awards this year – the most yet for Best Projects.

BUILDING CONTRACTORS: Winner - Irene Building D – Avbob New Head Office - WBHO Construction and Highly Commended - Parkdene Boulevard - WBHO Construction. **From left:** Comfort Nkuna, Shaun Malema, Dimpho Mabitje, Matthew Borrageiro, Marcelle Oosthuizen, Awande Khumalo, Jako Badenhorst, Rozaan Jansen van Rensburg, Werner Lourens, and Leandro Feiteira.

BUILDING CONTRACTORS: Highly Commended - Nuclear Medicine Research Infrastructure (NuMeRi) at Steve Biko Academic Hospital - Washirika 3 Oaks (W30). **From left:** Danie Strooh, Tim Scholtz and Hans Bodemer.

BUILDING CONTRACTORS: Special Mention - Middelburg District Hospital - Enza Construction. **From left:** Dave Williams, Faizal Khalia and Tim Rowbottom.

BUILDING CONTRACTORS: Special Mention - SPU Multipurpose Hall - Ruwacon. **From left:** Christo Lewis and Etienne van Deventer.

ARCHITECTS: Winner and Highly Commended (AfriSam Innovation Award for Sustainable Construction). Flower Hall Test & Examination Centre - Savage + Dodd Architects and Tri-Star Construction. **From left:** Colin Savage (Director-Savage + Dodd Architects), Robin Theobald (Project Architect) and Melissa de Billot (Project Architect).

ARCHITECTS: Special Mention - Department of Agriculture, Land Reform and Rural Development . **From left:** Stef du Plessis, Salome Kruger, Marius Badenhorst, Alex Evdemon and Louis Kruger.

ARCHITECTS: Special Mention – Cape Station – Boogertman + Partners Architects. From left: Fanie Nel and Karabo Moumakewe.

ARCHITECTS: Highly Commended – Deutsche Internationale Schule Kapstadt STEM Centre – KMH Architects. From left: Palesa Molopyane, Jordina Mallane, Biljana Krdzalic.

CONSULTING ENGINEERS: Winner – Montrose Interchange Upgrade Project – SMEC South Africa. From left: Tony Leeferink (Function Manager, Structures – SMEC), Jaco Markram (Director – KBK Engineers), Ray Govender (Director of Operations – WBHO) and Tebogo Pooe (Section Manager, Structures – SMEC).

CONSULTING ENGINEERS: Highly Commended – Coastal Park Materials Recovery Facility – JG Afrika. Jefrey Pilusa.

CONSULTING ENGINEERS: Special Mention – Munyaka Crystal Lagoon and Lifestyle Centre – Civil Concepts. From left: Jaco Strydom, Werner Stander and Dane Warden.

CONSULTING ENGINEERS: Special Mention –Shoprite, Wells Estate – WSP Group South Africa. From left: Michelle Dauncey, Nabeel Goolam-Mohamed and Loretta Moodley.

CONSULTING ENGINEERS: Highly Commended - Green School South Africa: Middle School - GASS Architecture Studios. From left: Devon Johnson and Hendri Fourie.

CONSULTING ENGINEERS: Special Mention - Emondlo Mall - Protean Project Innovations. From left: Henk Kies – Protean Project Innovations, Wimpie Kies – Protean Project Innovation and Etienne Viviers – Proud Afrique Trading.

AFRISAM INNOVATION AWARD FOR SUSTAINABLE CONSTRUCTION: Highly Commended - Construction of the Wela River Bridge No. 3490 on Road P451 - Icon Construction. From left: Joshua Mylroie, Prishen Govender and Sibongile Sithole.

SPECIALIST CONTRACTORS OR SUPPLIERS: Highly Commended - General Construction Worlds for the Sasolburg NH3 Tank B and balance of plant project - Stefanutti Stocks. From left: Gino Da Conceicao, Nathan Barber and Ryszard Kacki.

SPECIALIST CONTRACTORS OR SUPPLIERS: Highly Commended and CONSULTING ENGINEERS: Highly Commended - Carinus Bridge (B2918), Velddrif - Sika SA and AECOM SA. From left: Shaun Saxby, Paul Adams, Andrew Ibbotson, Mika Hildyard, Cobus Meyer, Herman Aucamp and Philip Ronne.

SPECIALIST CONTRACTORS OR SUPPLIERS: Two projects received Highly commended awards for GeoCiv Group. Devin Properties Super Basement: Lateral Support and Piling Works AND The One Student Accommodation Basement Lateral Support and Piling Works. From left: Dinesh Naidoo, Frans Visser, Vincent Bornman, Werner Rix, Burger Rust, Greg Whittaker and Jean Breedt.

SPECIALIST CONTRACTORS OR SUPPLIERS: Special Mention - Reinforced Earth retaining walls on the access road to the Polihali Dam Site, Lesotho - Reinforced Earth South Africa. From left: Shobana Singh, Louwtjie Maritz and Darell Vince.

Winner (CIVIL ENGINEERING CONTRACTORS), Highly Commended (SPECIALIST CONTRACTORS OR SUPPLIERS) and Highly Commended (AFRISAM INNOVATION AWARD FOR SUSTAINABLE CONSTRUCTION). National Route 3, Sections 2 & 3, from Lynnfield Park (km 30,6) to Ashburton - AfriSam. From left: Amit Dawneerangen, AfriSam Construction Materials Executive: Sales & Product Technical, Kanyiso Nqabeni - Construction Manager, Rumdel, Eric Diack - CEO, AfriSam, Randal Chetty - AfriSam Regional Sales Manager, Andrew Robinson - Project Site Agent, Glenn Johnson - Construction Materials Executive: Operations AfriSam.

CIVIL ENGINEERING CONTRACTORS: Special Mention - Construction of IRT Phase 2A Infrastructure (W4) Govan Mbeki Road between Landsdowne Road and Heinz Street Cape Town - Govan Mbeki IRT JV (Civils 2000 and Grinaker-LTA). From left: Adie Theron, Hennie Stapelberg and Chris Jansen.

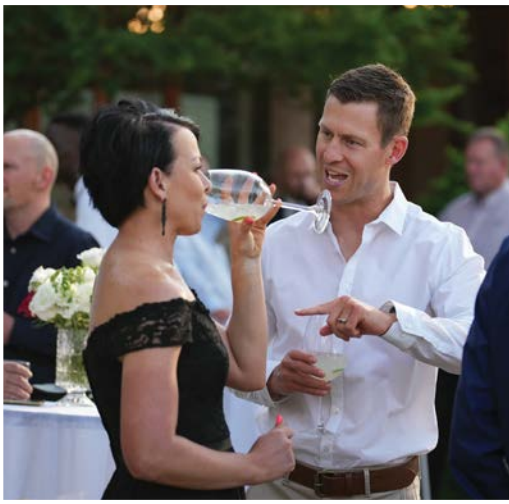
ARCHITECTS: Special Mention - The Rubik - dhk Architects. From left: Pierre Swanepoel, Partner, dhk Architects and Derick Henstra, Founding Partner and Executive Chairman, dhk Architects.

Winner (AFRISAM INNOVATION AWARD FOR SUSTAINABLE CONSTRUCTION) and Highly Commended (CIVIL ENGINEERING CONTRACTORS). Kendal Power Station Continuous Ash Disposal Facility Extension Project - Concor Construction. From left: Donique De Figueiredo, Senior Corporate Affairs Manager at Concor; Pierre Jansen Van Vuuren, Alternate Contracts Director at Concor; Zaheer Mall, Contracts Director at Concor; Phindile Zamaswazi Khanyile, Contracts Manager (NEC appointed PM) Eskom and Coral Fraser-Campbell, Coralynne & Associates.
RIGHT: SPECIALIST CONTRACTORS OR SUPPLIERS: Winner - Koruson 1 Wind Farm - CHRYSO, WBHO Construction and Concrete Units. From left: Alwyn Carstens, Gerald Blackburn, Giben Terblanche, Fred Sonnendecker, Jean Pierre Cairns and Rudi Jordaan.


AfriSam


AfriSam
CROWN


WINNER




SPECIAL MENTION

N3 UPGRADE AT ASHBURTON

An upgrade project on the N3 highway in KwaZulu-Natal has combined two construction innovations to create a pioneering example of how road building in South Africa is likely to evolve. In upgrading the N3 between Ashburton and Lynnfield Park, Rumdel Construction partnered with AfriSam to, firstly, execute continuously reinforced concrete pavement (CRCP) technology while, secondly, using labour-enhanced methods. This is the first project in South Africa to use labour-intensive methods on CRCP work of this scale.

While CRCP is not in itself new to the local construction industry, it is being increasingly employed to ensure the longevity of South Africa's national highways and optimise the infrastructure investment.

There is yet another first that the project has achieved: it is the first CRCP construction in South Africa that has been executed under the new Committee of Transport Officials (COTO) specifications (still in draft format and in the process of being finalised). This added further complications that required a collaborative response from Rumdel and AfriSam.

Project scope

The project entails a complete overhaul and reconstruction of the N3 between the Ashburton and Lynnfield Park interchanges – a distance of 4,6 km. The upgrade from jointed concrete pavement (JCP) to CRCP involved the contractor redoing the bulk earthworks and layer works, and the construction of a cement-stabilised, 300 mm C3 layer using G2 material from AfriSam.

This was followed by an interlayer of recycled concrete from the project, on top of which was constructed the 250 mm thick CRCP. The laying of the CRCP began in December 2022 and stretched through to May 2024 – with only one break of about two months.

Two bridges were also reconstructed as part of the contract. The Lynnfield Park bridge was completely demolished and reconstructed as a widened structure to better accommodate traffic volumes. The bridge over the Mpushini Spruit was also widened, requiring the deck to be demolished and rebuilt, with modifications applied to the abutments.

A permanent median barrier is also constructed using readymix supplied by AfriSam, as well as ancillary works such as v-drains and catch-pits. The project's scope includes the upgrading of 2 km of the R103, which passes underneath the N3 at the Lynnfield Park interchange as well as the interchange itself. Work includes the construction of mechanically stabilised earth walls in high fills, as well as large concrete retaining walls in cut embankments.

Construction innovation technology

Rumdel's N3 upgrade between Ashburton and Lynnfield Park has pioneered the use of manual labour in placing and compacting concrete to construct the robust CRCP layer that will give the road longer life and greater resilience. While mechanical pavers are usually used to expedite the pace of projects, this contract is the first in South Africa to use labour-enhanced methods in such large-scale CRCP construction.

One indication of the level of innovation required from the project team is the fact that the COTO specification makes little allowance for manual labour in concrete work. Indeed, the COTO guidelines limit the application of hand-enhanced concrete work to a minimum – with preference for mechanical pavers to perform the placement of concrete on roads.

High ambient temperatures also demanded special

measures to reduce surface evaporation from the newly laid CRCP, including mist sprayers to keep the temperature down on the concrete surface. Adjustments were also made in the application of curing compound, to reduce evaporation. The compound was applied in two phases: once as concrete was discharged and again after the concrete had hardened sufficiently for the surface to be textured. Batching and mixing concrete under high ambient temperatures involved the use of chilled water to control concrete temperature and mitigate rapid hydration process and loss of workability.

The rainy season from November to April also called for special measures to protect the new concrete. Fit-for-purpose 'tents' were placed over the curing concrete when there were afternoon thunderstorms to protect the surface so the riding specification could be achieved.

Corporate Social Investment

In line with its Contract Participation Goals (CPGs), Rumdel engaged contractors for a defined proportion of the contract value. Local companies were contracted and given the necessary training, supervision, and mentoring to conduct the work to the required quality standards. CPG contractors were used extensively in executing the labour-intensive CRCP aspect of the project, empowered through training workshops that the contractor arranged with industry experts.

Rumdel's project has made a significant social contribution to job creation in the area, adding hundreds of employment opportunities in a region where unemployment and poverty are high.

The contract as a whole has been able to employ about 680 people, of which 120 to 150 were dedicated to the CRCP aspects. Rumdel procured five subcontractors to work on the placement of the CRCP layer, and each subcontractor employed 24 to 30 workers. This represents significantly more labour on the project than would have been required if traditional paving equipment had been used.

THE UPGRADE OF NATIONAL ROUTE N3, BETWEEN SECTIONS 2 AND 3, FROM LYNNFIELD PARK (N3/2-KM30.6) TO ASHBURTON (N3/3-KM0.8)

SERVICE STATEMENT:- Rumdel specialises in delivering complex projects including roads, dams and incrementally launched bridges, and have the capability of executing a wide range of other civil engineering infrastructure projects

RUMDEL

Phone: 043 748 6417 l Email: info@rumdel.co.za l Web: www.rumdel.co.za

As part of the project's contribution to the community, Rumdel's Contract Skills Development Goals (CSDGs) include reconstructing over 5 km of the MR477 road in the area.

Design innovation

Rumdel designed a methodology that completely replaced the use of traditional paving equipment with manual labour. Instead of using the conventional machinery, local workers were trained to hand-place and hand-compact some 50 000 m^3 of readymix supplied from AfriSam's Umlaas Road batching plant near Pietermaritzburg.

Rumdel's execution of the CRCP element of this N3 project was also pioneering in terms of following the latest COTO specification, which adjusted certain aspects of the previous COLTO standard.

Similarly, AfriSam's concrete mix proportioning had to comply with stringent COTO specifications entailing maximum water-cement ratio and minimum cementitious content. Specified compressive and flexural strengths were established, with all tests based on at least six specimens – in accordance with SANS 3001.

Environmental impact consideration

The project was able to reduce its environmental impact through various strategies, promoting a circular economy approach that focuses on the themes of 'reduce, re-use and recycle'. This includes the use of recycled concrete and the conservation of energy and water in the concrete procurement value chain.

In the early stages of construction, the contractor recycled waste concrete from the site in an interlayer beneath the CRCP. This reduced the consumption of natural material while avoiding the carbon emissions associated with trucking in material from off-site.

Given the large volumes of concrete involved in constructing the CRCP, and the energy intensity of cement manufacture, the project's environmental impact was considerably improved by the choice of AfriSam as a concrete supplier. AfriSam has been an industry leader in terms of reducing the carbon footprint of its cement. AfriSam's readymix concrete for the CRCP contains its 42.5R composite cement, which complies with the project specification for a maximum of 20 % of alternative cementitious materials (other than clinker).

In its readymix concrete, AfriSam also ensures water is conserved and carefully managed to ensure no environmental impact. Water used in the rinsing of readymix trucks, for instance, is stored and re-used in the batching process for low low-specification mixes. In terms of concrete recycling, any waste concrete that is returned to the plant can be recycled in the production of sub-base construction material.

Health and safety

In a labour-intensive project that dealt with such high volumes of concrete, a primary concern for the contractor was to manage the health, safety, and workload of each CRCP team. Key factors were the arduous nature of spreading concrete manually, and the high ambient daytime temperatures. Adding to the physicality of the work was the large aggregate size whose weight made it even more difficult to shovel the concrete.

Quantifiable time, cost, and quality

The quality, consistency, and timely delivery of concrete was central to the CRCP construction. Over the course of this work, AfriSam supplied a total volume of 50 250 m^3 of readymix concrete for the CRCP. The special mix included AfriSam HSC 42.5R cement to ensure consistent performance, reliability, and conformance to SANS 50197.

Deliveries were made over a period of 205 days between March 2023 and May 2024, with 200 m^3 to 600 m^3 of concrete poured each day, with the Umlaas Road batching plant capable of producing approximately 42 m^3/hour. Timing was vitally important to balance to volume requirements of the CRCP with the open time of the concrete mix.

To maintain the necessary quality and consistency, AfriSam's aggregates and readymix products are produced and supplied in compliance with its Total Quality Management System, aligned with SANS 9001.

Risk management

The Rumdel CRCP project is the first in South Africa to be conducted under the requirements of the new COTO Specification Standards for Roads and Bridge Works for South African Road Authorities. Among the practical complications this introduced was that the contractor could not core the CRCP layer to re-test the target concrete strength in the event of a concrete test cube failing the strength test. There was also the challenge of aligning the acceptance control as defined by South African National Standard (SANS) 878 (which applied to suppliers) and COTO (which applies to contractors).

To resolve the complexities in a way that would responsibly manage project risk, concrete compressive strength performance was monitored through in-house process quality control.

To align with the COTO requirements, AfriSam enhanced the testing by continuous use of accredited laboratory facilities to verify performance. AfriSam introduced an early warning system to track performance as early as three days, as part of risk management. ■

PROJECT TEAM

- **Readymix Supplier: AfriSam**
- **Main Contractor: Rumdel**
- **Client: SANRAL**
- **Consulting Engineer: NATHOO MBENYANE ENGINEERS**

CONSTRUCTION OF IRT PHASE 2A INFRASTRUCTURE (W4): GOVAN MBEKI ROAD BETWEEN LANDSDOWNE ROAD AND HEINZ ROAD (CAPE TOWN)

The Govan Mbeki Rd (Landsdowne to Heinz) IRT project is a part of the Landsdowne-Wetton Corridor (West) rollout of the larger City of Cape Town's Integrated Rapid Transit (IRT) System implementation.

The scope of work includes widening and upgrading the carriageway. This involves using bitumen-stabilised material (BSM1) and a foamed bitumen base with recycled asphalt (RA) from the existing pavement. The work also includes the removal of existing median islands and the construction of a MyCiti bus lane along 2,25 km of the Govan Mbeki Road (M9) dual carriageway, as well as 700 m of Jan Smuts Drive (M17) on either side of its intersection with Govan Mbeki Road.

Additionally, 800 m of Hanover Park Avenue will be upgraded, and a freestanding elevated traffic circle will be constructed above the existing intersection of Govan Mbeki Road and Jan Smuts Drive.

The free-standing traffic circle, or "sky circle", has a continuous deck and will sit on 33 piers founded on 144 DCIS piles, and 48 oscillator piles, with 53 CFA piles supporting the westbound retaining walls and sewer protection slabs. The deepest piles are down 30 m. The bridge ramps are retained by mechanically stabilised earth walls (MSEW) extending 65 m from the retaining walls to the abutments and strengthened laterally with 4 m and 5 m frictional straps.

The elevated "sky circle" will carry the MyCiti buses running between Mitchells Plain and Khayelitsha and Claremont and Wynberg, taking them off the existing traffic lanes, reducing congestion, and shortening travelling times for the commuters using the MyCiti service.

Below the sky circle, the existing intersection is being upgraded and the capacity of the intersection improved. Separated pedestrian and cycle lanes will be constructed and will provide improved access and safety.

The contract was awarded to the Govan Mbeki IRT JV – a joint venture between Civils 2000 and Grinaker-LTA – in August 2021 and the MOA signed in June 2022. Construction commenced in July 2022, with the completion date set for 15 May 2026.

Construction innovation technology

This project has presented a unique challenge in that the traffic circle and bridge approaches are of a type of free-standing design requiring extensive support works not typical of more conventional designs. Following the piling operations by specialist subcontractor Keller, the temporary works provider, Peri, produced detailed formwork and support work designs, facilitated the installation process on-site, and continues to conduct inspections to ensure the temporary works are correct and safe.

The deck of the elevated circle must be completed without road closures or disruption to the existing traffic running through the Govan Mbeki Road and Jan Smuts Drive

intersection. To overcome this constraint, the intersection below the circle will be converted to a temporary roundabout to allow the tower crane, staging, and materials to be positioned in the centre of the intersection while construction of the deck is undertaken.

The initial concrete pours to the pile caps, diaphragm beams, and bridge deck highlighted the difficulty of ensuring the concrete filled the forms and was compacted properly due to the congested reinforcement. To overcome this the site team developed a concrete mix with two stone sizes and used a type of mini-tremie to ensure the concrete penetrated the rebar and filled the forms from bottom to top.

The design required the bridge approach parapets and deck parapets to be cast in situ. Instead of constructing formwork for each cast, a sliding form system was implemented. This reduced the time required for installing formwork and reduced the consumption of materials on site.

Corporate Social Investment

The City of Cape Town is committed to the upliftment of local enterprises, providing employment and training opportunities, and the participation of women and youth through preferential procurement focused on local suppliers and subcontractors on city infrastructure projects.

To assist that process the Govan Mbeki IRT JV sources materials, subcontractors, and services locally whenever possible. Local external training organisations have provided locally sourced labour with training in steel fixing, concrete finishing, health & safety, first aid, firefighting, scaffold erection & inspection, fall arrest and working at heights, flagman training, banksman training, stacking & storage, and confined spaces training.

Over the past 24 months, more than R16-million has been invested back into the local community.

Design innovation

The elevated traffic circle, referred to as 'the Sky Circle', was designed by SMEC South Africa. It is a unique free-standing traffic circle, demonstrating innovation and excellence in structural design.

The design utilises a variety of piling methods. The elevated roundabout comprises a fully integral, circular post-tensioned box girder. The roundabout deck has spans up to 38,9 m on a radius of 24,5 m.

Consideration of environmental impacts

The City appointed an Environmental Control Officer (ECO) who conducts frequent environmental audits of the site and monitors the impact of the construction activities and compliance with requirements.

Protection of surrounding watercourses and wetland areas has involved the use of filtration devices when discharging water during dewatering operations. Filter socks were installed at catchpits to prevent silt from entering the stormwater network, and the Lotus River Canal, which crosses under Govan Mbeki Road, was protected from pollution by preventing spills or runoff from construction areas entering the canal by using sandbags and temporary bunds.

Health and safety

Live traffic has been the main issue from a safety viewpoint. Access to properties had to be maintained and the site is adjacent to the Heideveld shopping mall, which presented challenges regarding restricting pedestrians from walking across the construction site.

Time, cost, and quality

Problems were encountered with the existing services early on and some technical issues with the piling meant progress lagged behind programme initially. Further delays were experienced due to the very wet winters in 2023 and 2024.

To gain greater control over time a Job Card System was introduced by the project planner, Krivest. The system prioritises critical activities to be completed first and involves micromanaging key tasks, with daily communication and weekly updates to compare planned versus actual progress. This system has ensured that critical tasks are prioritised and completed on schedule.

The original budget for the project was just over R528-million. To maintain control of costs the Govan Mbeki IRT JV site team has a team of quantity surveyors, and a permanent planner and has kept the professional team and client updated with progress and cost information.

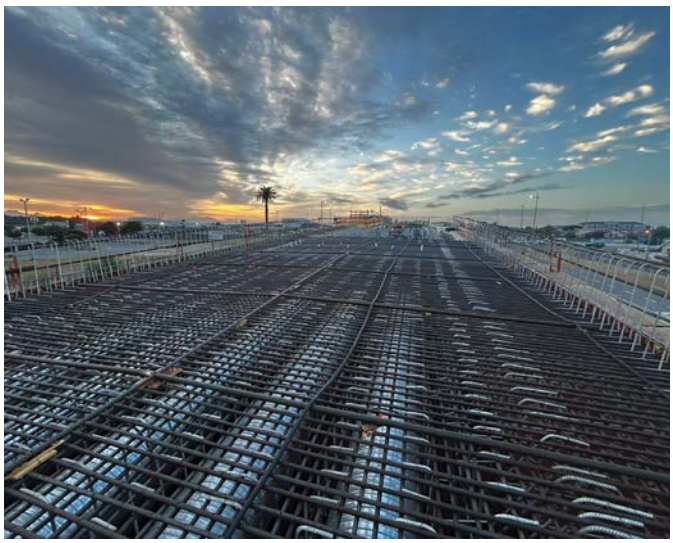
The quality of the concrete in the Cape environment is critical and durable concrete is used in the structure. Quality control of structural elements is evaluated using statistical testing methods and elements not meeting the criteria were subject to correction by application of a nonconformance report and corrective action approach to ensure final quality meets the acceptance criteria.

Risk management

The project risks were assessed by the client and professional team prior to commencement and a shared risk register was developed and reviewed by the client, professional team, and contractor each month. The City's technical team has played a central role in identifying risk and it is continually monitored by all the parties involved. ■

PROJECT TEAM

- **Main Contractor: Govan Mbeki IRT JV**
- **Client: City of Cape Town**
- **Consulting Engineer: SMEC South Africa**



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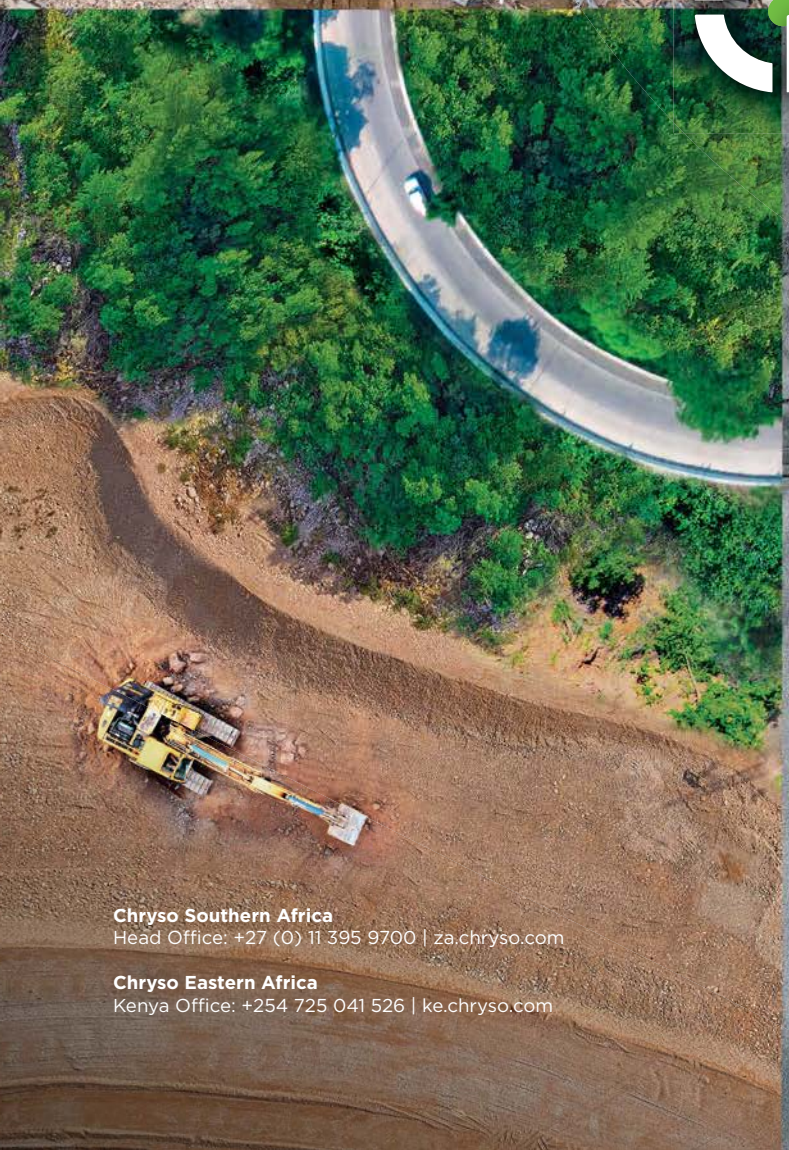

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IRENE BUILDING D – AVBOB

Irene Link Building D is a new build project located in the sought-after Irene Precinct. Irene Link Building D project consisted of the construction of a 10 floor (four basements, five office floors and a roof) commercial office block in Irene, Centurion for Abland Property Developers and the eventual owners Avbob Mutual Society.

The building has 5 200 m^2 across its four basements and 25 100 m^2 of office space across five floors. The building consisted of one lift core housing three lifts, one circulation staircase with two further fire escape staircases. The façade's curvelinear design consisted of both brickwork and glazing. The solid brickwork façades were finishes with a marmoran coating.

The project commenced in October 2022 with a completion of December 2023. Construction of the basement suspended slabs only commenced in April following the challenging ground beam and raft installation in the ground. The structure was topped out in August of 2023 with the full tenant installation consisting of imported Spanish and Italian tiles, partitions, ceilings, carpets joinery and a miriad of lights.

WBHO was proud to hand over the building on 7 December 2023 to the new building owners Avbob Mutual Society.

The façade concept was to create a permeable glass envelope that would sit lightly on the parking structure. This design concept allowed for seamless views between the high-energy of the highway and the adjoining office buildings in the precinct. With a ratio of more than 70/30 between glass and solid façades.

A total of 40 tons of structural steel was erected and cast in to the structure to assist in obtaining the "floating" feeling of the structure. With the aid of a Libherr tower crane with a 45 m jib, 16 000 m^3 of concrete was cast with 1600 tons of reinforcing steel into the various structural elements across the project. This averaged out at just less than 2 000 m^3 of concrete cast per month.

With over 1 300 000 bricks placed within a period of four months on the project, site logistics was a major consideration for the team

Due to the design of the over-spanning 5th floor, the façade temporary works kept the 5th floor slab fully propped until the roof and upstand beams on 6th floor was cast and fully cured.

Corporate Social Investment

WBHO construction as well as a number of subcontractors employed the services of local SMME's and their respective staff from the local community in an effort to ensure the local and surrounding communities benefitted in terms of employment and skills development over the duration of the project.

Through consultation with the specially established local steering committee, a full time Community Liaison Officer was employed to consult with local individuals as well as SMME's on employment opportunities.

Both bricklaying contractors were employed where possible and informal training was conducted with about 200 people.

Design innovation

Due to the dolomitic ground conditions and the prevalence to sink holes in the Irene/Centurion area, the basement underwent rock blasting in order to found on stable


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material. Basement four is approximately 16 m below natural ground level. The building foundations were designed to withstand a sinkhole up to a third of its surface area, which is notable where the ground beams and raft exceed 2,5 m deep in some areas.

The architectural design of the building is predominately orientated in a north-south direction with larger east and west façades. The curvilinear façade design included horizontal louvred shading structures on the fourth and fifth floors. Balconies on the second and fourth floors added to the shading of the glass façade. The ground floor façade is set back from upper levels, creating a shaded main floor façade and adding to the sense of a 'floating' building perched on a solid podium.

This design was achieved by increasing the floor area of each of the slabs as the building rises above Podium level. Most notably, the 5th floor slab cantilever beyond the 4th floor footprint up to 9 m which was supported by 2 m high upstand beams on the roof.

The building makes use of a four-pipe chilled water GEN2 Thermal Energy Storage system and the bleedingEdge building Telemetry System to provide a modern and energy efficient HVAC system.

Interior design and functionality

Floors 1 to 5 Floors are primarily dedicated to operations, designed to support a seamless flow of work. Each floor hosts plaza spaces, strategically placed to function as communal areas where staff can collaborate, dine, or hold informal meetings. These spaces are integral in promoting a sense of community within the building, encouraging interactions across different teams and departments.

Environmental Impact Consideration

Developing in the area identified for the new Commercial Office building required the need for Environmental Authorisation to be obtained. As such, there was a detailed Environmental Management Plan (EMP) drafted for the development and the requirements therein were strictly adhered to mitigate any adverse environmental impacts. Some of the identified impacts were minimised as follows:

Water

The prevention of stormwater pollution was prioritised on this project, and the following mitigation measures were implemented:

Water Management

Due to the dolomitic ground conditions, water usage was closely monitored and control to avoid unnecessary water run-off into the surrounding areas as the area has been identified to have a high prevalence of sink holes.

Air Quality

Dust suppression by means of watering was done throughout the project, especially on exposed soil surfaces and during windy conditions; Service providers transporting loose/fine material were required to make use of tarpaulin to cover their loads.

Noise

Construction only took place during specified hours and neighbours were informed of any noise generating activities which would have a higher impact

Soil

Contamination of soil from accidental spills was prevented by ensuring that the correct storage, handling and refuelling procedures were followed.

Health and safety

Health & Safety being WBHO's highest priority throughout the duration of the project. A number of factors had to be considered due to the number of high risk activities during the construction phase of the project.

To ensure the safety of all staff on the project and to ensure a safe working environment for all, all of course was made up of around 1 200 staff on site at peak, was at the top

of the to do list in terms of priority.

WBHO is proud to have been awarded the following achievement over the duration of the project:

- 2023 MBA Regional award 5 Star Grading (Category F – 100Mil - 250Mil)

Quantifiable time, cost and quality

Quality Assurance of the Irene Building D - Avbob was of the utmost importance and essential to the WBHO team.

Risk management

WBHO ran a risk schedule to ensure all risks were reasonably forecasted and managed on a week to week basis. Risk of missing key dates and deliveries of crucial long lead items were. Changes by Avbob as well as requests from the client to include certain elements were managed and deliverables met every time. A collaborative effort between the design team and the Contractor provided the ingredients to a successful project. ■

PROJECT TEAM

- **Main Contractor: WBHO Construction**
- **Client: Abland Property Developers**
- **Architect: Ntsika Architects**
- **Principal Agent: Abland**
- **Quantity Surveyor: Quanticost**
- **Consulting Engineer: Streng Consult**

PARKDENE BOULEVARD

Parkdene Boulevard commenced construction in November 2023 and has undoubtedly been a project filled with unique challenges and ultimately successes that the team will be celebrating at the centre's grand opening on 24 October 2024.

The project consists of refurbishing the existing shopping centre, whilst also constructing new retail space alongside the existing shops. The existing Checkers Hyper is also in the process of undergoing a refurbishment by another contractor, adding to the complexity in terms of access and logistics.

The existing anchor tenant, Checkers Hyper, covers an area of approximately 9 758 m^2 GLA, while the newly constructed line shops cover an additional area of proximately 22 000 m^2 GLA. A total of 50 retail outlets that will be trading at Parkdene Boulevard.

The parking area consists of 1 426 parking bays over an area of approximately 31 683 m^2, which is surrounded by tiled concrete walkways and four feature canopy entrances.

The construction of the retail centre is tendered for 12 months in total and is set to consume approximately 8 500 m^3 of concrete as well as roughly 250 tons of reinforcing.

Construction innovation technology

The retail centre is comprised of 49 line shops surrounded by external walkways and a central open-air parking area that features landscaped islands and tree linings. All façade plinths were constructed with a locally sourced and manufactured face brick, to match the existing structure's face brick plinth

The existing anchor tenant, Checkers Hyper, remains operational throughout the entirety of the project, creating a challenging environment in terms of health and safety, as well as logistics. Special attention had to be given to programming the phased handover of the parking area reworks, as sufficient parking space needed to be available for the customers shopping at Checkers Hyper.

For the existing structure in which Checkers Hyper and Home Essentials are trading out of, remedial works of the brick façade must be done, to ensure the structural integrity of the cavity wall façade. A total area of approximately 2 800 m^2 is undergoing remedials, utilising approximately 5 600 m^2 Thor Helical Ties. The remedials are being carried out on heights up to 11 m all around the structure with 24x4 articulated cherry pickers over a period of 1 month.

A total of approximately 1 800 000 bricks is projected to be placed over the duration of the project, site logistics is a major consideration for the operational team. Two mobile telescopic handlers and four mobile cranes are being utilised to transport and hoist bricks and mortar throughout the various areas of the centre.

Corporate Social Investment

WBHO construction as well as several subcontractors employed the services of local SMMEs and their respective staff from the local community in an effort to ensure the local and surrounding communities benefitted in terms of employment and skills development over the duration of the project. A full-time Community Liaison Officer was employed to consult with local individuals as well as SMME's on employment opportunities.

Two of the bricklaying contractors (SMME's) were employed through the local steering committee. A total of over 70 locals are currently employed on site.

For Mandela Day, the team at Parkdene Boulevard also assisted the community by using one of the local SMME subcontractors to break out and pour a new screed for the play area for a local school.

Design innovation

The centre boasts a 1664 KW peak supply solar panel array with 648 of 555 W and 2210 of 590 W panels.

One 350 KVA, two 250 KVA, and one 40 KVA generators are also present to provide backup power to the centre and all of its tenants.

The two stormwater attenuation ponds situated on the upper and lower part of the western side of the centre, have a combined storage capacity of approximately 10 000 kl, ensuring that no flooding occurs at the centre.

For the parking area, a total of 34 156 m^2 of asphalt was laid and over 5 123 m^3 of G7 material placed underneath the G1 material. The G7 material was obtained by crushing and reusing the material that was left over from the demolition work that occurred from the existing building.

Environmental impact consideration

Although no Environmental Authorisation had to be obtained for the development of this project, WBHO's standard detailed Environmental Management Plan (EMP) is used and strictly adhered to mitigate any adverse environmental impacts.

Health and safety

With Health and Safety being the highest priority on all WBHO's projects, several factors must be considered due to a number of high-risk activities during the construction phase of the project. This includes items such as:

- Working at heights on the first floor and steel structures for the walkways, including the roof and multiple facades
- High number of moving plants inside of site, such as TLB's, graders, mobile cranes, telescopic handlers etc.
- Managing direct contractors in terms of access and health and safety compliance on site during tenant installations
- WBHO is proud to have been awarded the following achievements over the duration of the project:
- 2024 MBA Regional Award (2nd Place) (Category G – R250M - R450M)
- MBA North 5 Star Grading

Quantifiable time, cost and quality

Quality Assurance Parkdene Boulevard is of the utmost importance and a top priority of the WBHO team on site.

One specific example of such is the use of ready-mix fiber mortar for the plastering on the project, especially the external plaster on the facades. By using fiber in the plastering mortar, a stronger, more crack-resistant plaster finish is obtained, ensuring that the plaster will be durable and of good quality.

The ready-mix mortar also reduces the amount of wastage one would get from mixing manually on site, whilst also ensuring that consistent standard of mortar is used.

Risk management

The WBHO team has a risk management schedule that is re-evaluated and updated monthly.

- Total Man hours worked (up to 6 September 2024) +/- 522 000
- Record man hours without a Lost Time Injury (up to 6 September 2024) +/- 522 000. ■

PROJECT TEAM

- **Main Contractor: WBHO Construction**
- **Client: Abland Property Developers**
- **Principal Agent: Skyscape Architects**
- **Quantity Surveyor: Matla Quantity Surveyor**
- **Consulting Engineer: Streng Consult**

NUCLEAR MEDICINE RESEARCH INFRASTRUCTURE (NuMeRi) AT STEVE BIKO ACADEMIC HOSPITAL

The Nuclear Medicine Research Facility (NuMeRI) at Steve Biko Academic Hospital in Pretoria is a landmark project that has redefined medical research infrastructure in Africa. Spearheaded by Washirika 3 Oaks (W3O), the project was completed in 41 months. It exemplifies the integration of cutting-edge construction technology, innovative design, environmental stewardship, and rigorous risk management.

Construction innovation and technology

The construction of NuMeRI is distinguished by the application of advanced building techniques tailored to meet the unique and complex requirements of a nuclear medicine facility. Unlike conventional nuclear medicine facilities typically built underground, NuMeRI's high-rise nuclear bunkers were constructed on the 5th floor of an existing hospital building.

DLV, the structural engineers responsible for both the original hospital building and the NuMeRI expansion, employed 350 mm x 1,2 m deep transfer beams to distribute the new loads to existing columns, thereby avoiding additional strain on the pre-existing beams or slabs. The new levels added to the structure were meticulously planned:

- Level 4: Dedicated to animal imaging, comprising offices and laboratories for research on laboratory animals, specifically immunocompromised laboratory rats used in various experiments.
- Level 5: The core of the facility, housing research labs and radiopharmacy, including two heavily fortified Cyclotron bunkers.
- Level 6: Designed for patient imaging and wards, ensuring that patient care is seamlessly integrated with advanced imaging technology.
- Levels 7 & 8: Reserved for critical plant operations, including HVAC and electrical systems.

The Cyclotron bunkers on Level 5 were designed with robust structural parameters to ensure safety and functionality. These included internal dimensions of 4 m x 4 m, with floors 1,8 m thick, walls 2,4 m thick, and roofs 2,2 m thick. The concrete mix used for these bunkers was a specialised blend, incorporating 65% fly ash and 35% cement.

Specialised equipment installation and HVAC Systems

NuMeRI is outfitted with state-of-the-art technology, including cyclotrons essential for producing the radioisotopes used in advanced medical imaging and therapeutic procedures. The integration of such heavy and complex machinery within an existing high-rise urban environment presented significant challenges. W3O overcame these through the use of advanced installation techniques, ensuring that the building's structural integrity could support the cyclotrons' weight and operational demands.

Electrical systems and backup power

The electrical infrastructure of NuMeRI was designed with redundancy in mind, ensuring continuous operation even in the event of power outages. Two 1250 kVA 18-cylinder diesel generators were installed in the 7th-floor plant room, providing a reliable backup power source.

Facility layout, space optimisation, and flexibility

The design of the NuMeRI facility was driven by the need for operational efficiency, flexibility, and adaptability to future advancements in nuclear medicine. The facility incorporates modular pre-clinical and clinical imaging modalities, which are crucial for both current medical research and the anticipated needs of the future. The design team, led by Mediplan Designs, faced the unique challenge of optimising space within an existing building. Their solution was to maximise the functionality of each level while ensuring that the facility could easily adapt to future changes in medical research and treatment technologies.

Environmental impact considerations

Sustainability was a central consideration throughout the NuMeRI project. The construction team implemented a range of sustainable practices to minimise the environmental impact of the facility. These included the use of energy-efficient systems, sustainable construction materials, and

innovative waste management strategies aimed at reducing the facility's overall environmental footprint.

Energy efficiency was a particular focus, with the incorporation of advanced HVAC systems, energy-efficient lighting, and other infrastructure elements designed to reduce operational energy consumption. These measures not only contribute to the facility's sustainability but also align with global standards for environmental responsibility, positioning NuMeRI as a leader in environmentally conscious design and construction.

Health and safety

Health and safety were of paramount importance throughout the NuMeRI project. The construction team adhered to rigorous safety standards, implementing comprehensive safety protocols and conducting regular inspections to identify and address potential hazards. This commitment to safety was crucial, given the complex and potentially hazardous nature of the facility's operations.

Radiation safety, in particular, was a critical concern due to the nature of the facility's work. Advanced safety measures were implemented to protect both workers and future users from radiation exposure.

Quantifiable time, cost, and quality

The NuMeRI project was completed on schedule, within a 41-month timeframe from appointment to handover. This achievement reflects the effective project management and coordination among the various stakeholders involved. The project timeline included a 19-month design period and a 22-month construction period, demonstrating the team's ability to meet complex project deadlines while maintaining high standards of quality.

The project was delivered within the allocated budget of approximately R410 million, with effective cost control measures ensuring that expenses were managed efficiently. This ability to deliver the project within budget underscores the team's proficiency in financial planning and resource management, ensuring that the facility meets all its objectives without compromising on quality.

Risk management

Thorough risk assessments were conducted throughout the project to identify potential issues and implement mitigation strategies. The project team identified various risks associated with the construction and operation of the facility, including structural and operational risks, and developed comprehensive plans to address these risks. This proactive approach to risk management was crucial in ensuring the project's success.

Contingency plans were developed and executed to address unforeseen challenges that arose during the project. ■

PROJECT TEAM

- **Main Contractor: Washirika 3 Oaks (W3O)**
- **Client: Nuclear Medicine Research Infrastructure (NuMeRI)**
- **Architect: Mediplan**
- **Project Manager: Critical Path Project Services**
- **Quantity Surveyor: VSB Quantity Surveyors**
- **Consulting Engineer: Spoormaker & Partners**

PROJECT TEAM

- Main Contractor: Enza Construction
- Client: Department of Public Works, Roads and Transport
- Architect: Zimele Architects
- Principal Agent: Motse-LMI Architects
- Quantity Surveyor: AECOM South Africa
- Consulting Engineer: WSP

MIDDELBURG DISTRICT HOSPITAL

The MDH project exemplifies construction innovation through its rapid build model. Traditionally, such infrastructure projects could take 7-10 years to complete; however, the MDH project is set to be completed in just four years.

This efficiency is achieved by adopting a Design and Build approach initiated by Enza Construction, which streamlines the construction process by integrating design and execution phases. Additionally, the facility utilises energy-efficient lighting, solar integration, and advanced HVAC systems to optimise building performance.

Corporate Social Investment

The MDH project reflects a significant commitment to corporate social investment (CSI) by addressing the critical need for upgraded healthcare infrastructure in a growing community. Beyond providing a state-of-the-art medical facility, the project includes various amenities such as a creche, a public cafe, and accommodation for medical students, nurses, and doctors, thereby enhancing local socio-economic conditions. The project also fosters local employment opportunities and could potentially collaborate with local businesses for operating the cafe and training centre.




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Website: www.zimelearchitects.co.za l **Address:** 1 Maxwell Dr, Sunninghill WorkSpace, Unit F18, Waterfall, 2090, Midrand, South Africa

Design innovation

The hospital's design stands out for its innovation, blending functionality with cultural relevance. Drawing inspiration from local Ndebele design, the architecture incorporates subtle ethnic details that promote cultural resonance and a sense of belonging. The building is also user-cantered, designed to be conducive to healing with features like large windows overlooking landscaped courtyards. Color-coded wayfinding within the facility aids in overcoming language barriers, enhancing user experience and accessibility.

Environmental impact consideration

The MDH project integrates several green principles to minimise its environmental impact. The building features energy-efficient lighting, solar integration, and a well-designed thermal envelope to optimise energy use. Solar control measures, including extended roof eaves and sun louvres, are employed to manage heat gain and reduce cooling loads.

Additionally, water-efficient fixtures and fittings are used to conserve resources, and large windows maximise natural lighting, reducing the need for artificial lighting.

Health and safety

Health and safety are paramount in the design and operation of the MDH. The facility adheres to the IUSS Health Facility Guides, ensuring it meets high standards for hospital safety and functionality.

The project incorporates modern safety measures and supports a healing environment through its design. By providing extensive healthcare facilities and support services, the hospital is designed to offer safe, high-quality care to patients.

Quantifiable time, cost, and quality

The MDH project is an exemplar of effective project management in terms of time, cost, and quality. The use of the Design and Build method has reduced construction time significantly from the traditional duration of 7-10 years to just four years. The project's capital investment of R1,3-billion has been managed to ensure the delivery of high-quality infrastructure within budget. The design and build approach have also allowed for better control over project quality and cost efficiency.

Risk management

Risk management is addressed through the Design and Build model, which minimises potential risks associated with traditional project delivery methods. By integrating design and construction phases, the project reduces the likelihood of delays and cost overruns.

Additionally, the inclusion of future expansion provisions mitigates risks related to future demand and growth. The project's adherence to IUSS standards and green principles also contributes to risk management by ensuring compliance with best practices and environmental regulations.

The motivation behind the MDH project is driven by the urgent need to replace the outdated and inadequate existing district hospital. The new facility is designed to serve a growing local population and to function as an academic institution, fostering the education and training of medical students. With comprehensive healthcare facilities, modern design, and future expansion capabilities, the MDH aims to set a new benchmark for IUSS compliant hospitals in South Africa, providing high-quality, accessible healthcare and contributing to the community's overall well-being. ■

MOTSE-LMI Architects specializes in architecture, space planning and project management. The practice has also developed specialist skills in facilities management, and this is fully integrated within our architectural design philosophy and project implementation strategies. We have to date designed and managed construction of more than 260 buildings.

New Middelburg District Hospital (Current)

Baviaanspoort Prison (1998)

Department of Basic Education Head Office (2010)

Eskom Megawatt Park Offices (2004)

Mimosa Mall (2015)

CONTACT DETAILS

CONTACT: 010 009 5483 / 083 4444833 WEBSITE: www.motselmi.com

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SPU MULTIPURPOSE HALL

As the main contractor, Ruwacon is bringing its expertise to an exciting project that is set to transform Sol Plaatje University's (SPU) North Campus in Kimberley, Northern Cape. The construction of a state-of-the-art Multipurpose Hall, designed to accommodate a wide variety of academic, sporting, and community events, is a vital step forward in SPU's ambitious campus expansion. This project underscores SPU's commitment to offering world-class facilities to its students, staff, and the broader community, and it's a testament to Ruwacon's capabilities in managing large-scale, complex builds.

With a contract value of R158,8-million, this is more than just a building project; it's a statement of intent for the future of the university and the region. As the only university in the Northern Cape, SPU is rapidly expanding, and the Multipurpose Hall will play a crucial role in its development. For Ruwacon, the project is an opportunity to demonstrate not only technical prowess but also its ability to innovate, manage risk, and contribute to the community.

Construction innovation

Ruwacon's approach to construction innovation is evident throughout this project, particularly in the challenges posed by its unique design. One of the most striking features is the hall's roof structure - a massive steel roof spanning 42,5 metres over the hall, supported by 17 main trusses, each weighing approximately 3 tons. These trusses were bolted together in three sections on the ground and hoisted into place using mobile cranes, an engineering feat made more complex by the site's space constraints. The team faced the challenge of using a single crane due to the limited space available, requiring precision coordination to hoist the trusses into position.

Similarly, the reinforcing for the columns was pre-fixed on the ground and lifted into place via tower cranes, a technique that saved time and ensured greater safety during the construction phase. The hall's structure includes over 1 600 cubic metres of concrete, and the roof alone, measuring 56 by 50 metres, is covered in Klip-Tite sheeting, known for its durability and weather resistance.

Design innnovation

The architectural design of the Multipurpose Hall is both functional and aesthetically impressive. One of its main features is the "tree column" effect - tapered concrete columns, 5,5 metres in height, supporting steel columns that create a dynamic, angled beam structure. This design not only gives the building a striking, modern look but also highlights the innovative use of materials and structural design.

The hall's entrances are another noteworthy design element. Located on the northern and southern sides of the building, they feature 35-metre stacking shopfront doors, each 3 metres high, which will provide ample light and create an open, welcoming environment. The hall itself is a double-volume structure, with large cantilevers and overhangs supported by approximately 300 tons of reinforcing steel in total, making it a highly durable and resilient building.

Corporate Social Responsibility

Beyond its technical achievements, Ruwacon has made significant contributions to the local economy through its Corporate Social Investment (CSI) efforts. Twenty percent of the project's expenditure has been allocated to local SMMEs (Small, Medium, and Micro Enterprises), ensuring that local subcontractors and suppliers are involved in the project. This commitment to using local resources not only boosts the regional economy but also helps to build local capacity and skills, leaving a lasting impact beyond the completion of the hall itself.

Environmental considerations

In line with modern construction practices, Ruwacon has placed a strong emphasis on sustainability and environmental responsibility throughout the project. Two water reservoirs have been included in the design, serving a dual purpose: they will be used for the building's hydrant and sprinkler systems, while also functioning as walkway ramps that lead to the stage area and an external open space platform. This multifunctional approach ensures that the building not only meets its operational needs but also minimises its environmental footprint by incorporating practical, water-saving features.

Health, safety, and risk management

One of the key challenges faced by the Ruwacon team is the site's limited space. The building is being constructed on an "island" between existing roads, leaving very little room for manoeuvring construction equipment and materials.

This constraint has required the team to be highly creative and organised, managing road closures for the delivery of materials and the casting of concrete.

Health and safety have been top priorities throughout the project, given the complexity of the build and the confined space. The use of tower cranes for moving materials, as well as the careful coordination of deliveries, has helped to mitigate the risks associated with working in such a restricted environment.

Time, cost, and quality

Despite the challenges, Ruwacon is progressing steadily, ensuring the project will be completed to the highest standard. The hall's face brick design, with its distinctive featured brick style, will give the building a timeless, durable quality.

The total contract value of R158,8-million reflects the scale and importance of the project, and Ruwacon's commitment to maintaining high standards of quality throughout.

Looking to the future

Once completed, the SPU Multipurpose Hall will serve as a vital hub for the university and the wider Kimberley community. It will provide a venue for a wide range of activities, from graduations and academic functions to indoor sports and community events. As SPU continues to grow, this hall will play a key role in supporting its mission to provide world-class education and facilities to the people of the Northern Cape.

For Ruwacon, this project is a showcase of its capabilities as a contractor. From its innovative construction techniques to its commitment to social investment and sustainability, Ruwacon has demonstrated why it is one of the leading construction companies in South Africa.

The SPU Multipurpose Hall is more than just a building - it is a symbol of progress, innovation, and community, and Ruwacon is proud to be at the heart of its creation. ■

PROJECT TEAM

- **Main Contractor: Ruwacon**
- **Client: Sol Plaatje University**
- **Architect: Cohen and Garson Architects**
- **Quantity Surveyor: Limco**
- **Consulting Engineer: Zutari**

KORUSON 1 WIND FARM CLUSTER

On the border of the Easter Cape and Northern Cape, just outside Middelburg and Noupoort, lies the Koruson 1 wind farm cluster. It comprises three wind farms in San Kraal, Phezukumoya and Coleskop with a combined installed capacity totalling 420 MW – making it the biggest wind farm in Africa. The scale of the Koruson 1 project is massive, with the three sites spread across 50 km2.

In only four months, an entire precast factory (Middelburg, Eastern Cape) was built specifically for the manufacture of 78 precast concrete windfarm towers (each tower is 124 metres high). In a year, 3 900 precast segments (50 precast segments per tower) were delivered to all three windfarms.

Factory construction

The factory was built on a farm just outside Middelburg to be as close as possible to the wind farms. It was rezoned for temporary industrial use. The precast factory featured two production lanes, each 240 metres long, equipped with five overhead gantry cranes to handle all necessary lifting tasks. Additionally, a 17 000 m^2 storage area was available to store the precast concrete tower sections before they were transported to the respective wind farms. A further 9 000 m^2 area was used for the stores, eating and office areas and a 10 000 m^2 area was used for the batch plants, laboratory, wash bay and aggregate storage.

Design innovation and construction innovation technology

Concrete towers

Production of the 3 900 concrete tower sections began in July 2023. There were 28 concrete moulds (4 metres high) that were manufactured in Brazil and shipped to South Africa via Durban and Port Elizabeth ports.

The 28 moulds varied in size. Their height and width were designed based on the road authority limits. The tower base diameter was 7,8 m and the tower top diameter was 3,9 m. The tower consisted of 50 units and 32 levels, ranging from 3 m to 4 m high sections.

The moulds were filled through a specialised design pump valve situated about 1,2 metres from the base. They were pumped full of concrete from the bottom up, rather than casting from the top of the mould. This was a first in South Africa. It facilitated quicker turnaround times, a better concrete finish, and it pumped out the laitance that typically appears on the surface of the concrete.

Six concrete mixer trucks were used to transport the concrete from the batch plant to two Putzmeister concrete pumps. The average time to fill a mould ranged between 35 to 55 minutes. The pumping speed was carefully monitored to reduce mould pressures and to ensure a sound top finish on the unit.

During the peak production phase of the project, the factory had to produce two towers per week, amounting to 100 precast concrete tower sections. Twenty precast sections were manufactured a day.

A total of over 33 000 m^3 concrete and over 5 000 tons of reinforcing was used for the wind farm.

Concrete mix design

A self-compacting mix design was used, involving the following aspects:

- The required mix design had to have hardened concrete properties of 75 MPa compressive strength.
- The quarzitic sandstone had to be combined with the available cement to reach the required concrete mix.
- Low alkali cement is slower to generate high early age strength, which was necessary for demoulding. Therefore, very low waters cement ratios were necessary to reach 25 MPa strength for 10-hour demoulding.
- Two types of sands were used to minimise the natural variability and to reduce sensitivity of the concrete. Dune sand and quarzitic -3 mm dust were used in different ratios for the optimal flow and cohesiveness.
- The matrix had to be robust enough to hold the 9 mm stone.
- 170 000 litres of CHRYSO®Premia 550 plasticiser was chosen due to its low sensitivity to moisture and offered a bigger tolerance in the acceptance criteria.
- The open time on the concrete mix design had to be at least 60 minutes. This was difficult to achieve in summer and required a few tweaks in the mix design.
- Required de-moulding strength of 25 MPa achieved between 8 to 10 hours of concrete curing.
- It would take anything between 8 and 14 hours to demould the concrete.

Quality control and risk mitigation

There was a primary concrete batch plant and a back up batch plant to ensure consistent concrete production with no unnecessary stoppages. A design validation was done on the concrete mix design, to assess the mix's ability to meet the specified compressive strength, workability, durability, and other performance criteria. This is essential for preventing issues that could compromise the concrete towers' integrity, safety, and longevity.
After the mix design was approved, trials through the batch plant began on the 1st of June 2023 to confirm if the same results could be obtained on site as what was produced in the laboratories.

The fresh and hard concrete properties were also captured daily with an enormous amount of testing. Tests were done to measure air content, fresh concrete density and slump-flow. Other tests like the J-ring, V-funnel, and L-box were conducted at the site's own laboratory. Excessive tests were done on concrete coming out of every readymix truck before it was used.

Three engineers were dedicated to solely monitoring the concrete. All precast units were moved to an inspection bay at the factory for quality control purposes and to ensure each unit falls within the required

specification before they were transported to site.

Each unit had its own file, with information about the concrete and the steel, as well as the signed off quality checks in the inspection bay.

Corporate Social Investment

The low-carbon renewable electricity produced each year by the three wind farms will help to meet the electricity needs of approximately 193 000 South African households. It forms part of Round 5 of the Renewable Energy Independent Power Producer Programme.

In South Africa, precast concrete towers are financially viable to produce on a large scale close to a windfarm. Concrete towers are locally produced and consist of a minimum of 95% local content. Local South African suppliers, subcontractors and skilled labour were used for the manufacture of these concrete towers. The unskilled labour were sources from the town of Middelburg in the Eastern Cape which allowed the community of the area to be involved.

At its peak, the entire project employed approximately 3 800 workers. More than 40% of the project's value is comprises South African goods and services, and 1,25% of revenue generated by the projects over the contractual period was applied to socio-economic development initiatives for nearby local communities.

Environmental impact consideration

A water truck was present on site for the entire duration of the project to assist with dust suppression, for this purpose water was obtained directly from the bore hole as well as recycled water previously used to wash the trucks on site that was captured in wash bay basins.

Waste produced by the site was collected in waste skips and delivered to the local land fill site weekly.

It was important to make sure that water usage did not negatively impact the underwater level. Therefore, there was constant measurement of the water level of the borehole as well as the periodic measurement of other boreholes in the same aquafer and measurement of flow of nearby fountains.

Health and safety

During the peak production phase of the project, a safety manager and three safety officers were appointed to manage the HSE on site.

A total of 1 235 537 hours was worked during the project and at the end of the project 484 164 lost time injury free hours had been accumulated. ■

PROJECT TEAM

- **Specialist Supplier: CHRYSO SA**
- **Client: EDF RENEWABLES**
- **Main Contractor: Middelburg Precast Factory JV: WBHO Construction and ACME Proprietary Limited (comprising Concrete Units and Windtechnic Engineering**

DEVIN PROPERTIES – UMHLANGA RIDGE – SUPER BASEMENT

GeoCiv Group was invited to tender for the construction of a super basement for the new head office of Hollywood Bets within the Umhlanga Ridge precinct. The tender required a geotechnical contractor that could execute the project on a full turnkey basis including all relevant bulk earthworks, civils works, retaining structures and piled foundations accordingly.

The scale of the project was apparent with a total of 90 000 m^3 of cut to spoil, lateral support walls of up to 17 m tall with a final tally of 550 structural foundation piles.

Design innovation

The Umhlanga Ridge area along the coast of KZN and Durban North generally consists of soil conditions called a Berea Red formation. These soils are a made up of a red, clayey sand with a low bearing capacity. When constructing lateral support walls in these conditions, the lateral support walls consist of a combination of soldier piles, post-tensioned anchors and shotcrete arches that create an 'active' system that will limit lateral movement when removing earth support to adjacent and neighbouring buildings and structures, in this prestigious business park.

The lateral support piles were installed for the purpose of preventing bearing capacity failure of the Berea Red soils in the temporary condition, albeit becoming a permanent part of the lateral support wall for a loadbearing purpose on the extremities of the structure. The design of the anchors and anchoring methods allowed us to construct our walls without the requirement of post tensioning, making our system completely 'passive'.

Self-drilling anchors (SDA's) are designed to be installed in soils that would collapse during normal air flushed borehole methods. This is done by using a site batched cement grout as the flushing medium during the drilling works. The drilling rods are manufactured to be sacrificial and after drilling, become the tendon of the soil nail or anchor once design depth is reached.

While introducing the Self-drilling Anchor (SDA), into these soil conditions, the better consolidation of the soils allowed us to significantly reduce the quantity of anchors required for these high walls.

To complete the lateral support system, shotcrete is applied in an arch shape between piles that span the pressures of the soils between each anchor position. A capping beam is cast along the top of the wall that becomes a structural element that will transfer horizontal and vertical loads of the structure in the permanent condition.

Quantifiable time, cost and quality

With the use of Self-drilling anchors (SDAs), and the revolutionary spacing design of these anchors, a large area of support can be completed daily. This method allowed us to commit a single drilling crew for the installation and produce average productions exceeding 250 m of SDA drilling per day. No delays are encountered waiting for curing of pressure grouted anchors that need stressing

Risk management

Design

The position of the Devin Properties basement in proximity to the surrounding office buildings was the main concern during construction of the Lateral Support and Super Basement construction. Excessive lateral movement when constructing a lateral support wall is exponentially increased as the height of the wall increases. Lateral movement of the lateral support system can cause cracking and settlement of the surrounding buildings.

Construction innovation technology

With piled lateral support walls, the system works in a combination of three elements, namely soldier piles, anchors and shotcrete arches to ensure the stability of the wall. GeoCiv's design differs from the norm by

looking at the function of each element separately and implementing each of the three for a more 'Innovative' approach.

These anchors have advantages that are generally overlooked when used due to the high cost of the material. These benefits include speed of installation, the consolidation of soils while grouting and a substantial increase in the friction bond between the tendon and in situ soils. When these benefits are analysed, the high cost of the materials become negligible, and the resultant product becomes an irreplaceable tool in our innovative Lateral Support design.

Corporate Social Investment

With GeoCiv Group being appointed as the Main Contractor for the works, there will always be a requirement for local content expenditure and community participation. With GeoCiv's specialist type of works, it is not always possible to subcontract portions of its scope to the local community that do not have the skills or experience for this type of works.

GeoCiv did however require a large and extensive capping beam to be cast along the brow of the Lateral Support System that was something a less experienced contractor could construct with some guidance and training. The full scope of the capping beam was shared between two local subcontractors, who successfully completed the capping beam within the projects programme.

Health and safety

The scale of this project was truly remarkable, taking six months to complete. Such a technically demanding project brought numerous challenges, particularly in managing sub-contractors and GeoCiv's own workforce

A dedicated team of approximately 60 professionals, skilled, semi-skilled and unskilled workers worked on-site to execute the tasks, with strict adherence to compliance being a top priority. GeoCiv collaborated closely with the client's safety agent, consistently performing well during monthly compliance audits and weekly inspections. Effective planning was crucial as the project involved multiple contractors handling various tasks, from low-risk to extremely high-risk operations, such as earthworks, piling, lateral support, steel fixing and placement of concrete.

Environmental impact consideration

In recent years, the KZN area experienced abnormal rainfall figures which led to major flood damage. Many active construction sites did not cater for the excess stormwater runoff which would transport silty soils from open construction sites into built-up areas and, in many cases causing flood damage and leaving many homes and business structures with irreparable damage and flooding.

Stormwater management was a big concern during construction of the Devin Properties basement. Before excavations commenced, the cleared site posed a similar risk due to the natural slope of the site and many existing office buildings in the La Lucia Ridge Office Estate. We implemented temporary silt barriers and stormwater catch pits to control unwanted silt buildup to areas where we it could be managed. An ongoing effort was made to keep existing stormwater systems free of silt buildup. Existing roads were continuously kept clean and maintained to ensure no blockages could form in the system that may have cause flooding. ■

PROJECT TEAM

- **Main Contractor: GeoCiv Group**
- **Client: Devin Properties KwaZulu-Natal**
- **Consulting Engineer: ARUP**
- **Principal Agent: Investment Property Solutions**
- **Architect: Elphick Proome Architect Architecture**
- **Quantity Surveyor: Schoombie Hartmann KZN**

THE ONE – STELLENBOSCH – BASEMENT STRUCTURE

The "jewel in the Stellenbosch Crown", THE ONE is a unique design for an exclusive student accommodation building in Stellenbosch, Western Cape.

As students and investors alike flock to this unique opportunity for a tertiary education at the prestigious Stellenbosch University.THE ONE, when completed, will be the largest concentration of a student residence within a single building in South Africa, with 508 residential units in the development.

Making a scheme of this scale feasible required the developer to include an underground parking facility up to 7 m in depth with a capacity for 553 parking bays including deep piled foundations to support the heavy concrete reinforced superstructure above.

Design innovation

The difficulty in developing such a large residential cluster building in Stellenbosch including the underground parking structure is magnified by tight access constraints and undesirable founding conditions which required an innovative design for a permanent lateral support system and piled foundations that should negate the shallow water table and strong water seepage encountered on site, through an ancient underground watercourse; and deal with a deep layer of hard cobbles and boulders within a sedimentary transported topsoil layer, that has taken millennia to cut its course underground.

The underlying ground conditions required a composition of highly reinforced percussion drilled and steel driven piles, soil anchors, a permanent shotcrete wall and a capping beam to create a uniform concrete retaining system.

The I-beam sections and capping beam allowed for temporary stability of the cut faces during the initial stages of the installation process. The site is surrounded by existing residential buildings which required protection from localised soil collapse and movement during the formation of the adjacent basement structure.

Shotcrete

Installing a retaining structure with the use of lateral support is completed in a 'top-down' method in increments of 2 m excavated drops. Once an excavation increment is completed, it becomes a race against time to apply a specialist water resistant shotcrete "flash coat" to cut faces due to the inflow of ground water. This required shotcrete accelerators and carefully placed band drains that directed the flow of water through special wick drains installed along the inside of the wall.

Soil Anchors

Soil anchors were completed using self-drilling hollow bars (SDAs). These require a site batched, flowable grout mixture, based on a 0,4 cement-water mix ratio and a specialist admixture which produces extremely powerful water reduction properties (thereby creating high concrete density and high strengths). It extends workability time while still maintaining high early strength and allows for excellent plasticising properties.

Temporary Propping

Two of the elevations became a conundrum regarding the lateral support design, as the neighbouring properties did not permit the installation of soil anchors as required for

the temporary propping of retaining walls. GeoCiv turned to a more conventional system of passive propping for the temporary support required until the basement walls were in place.

Quantifiable time, cost and quality

With the use of Self-drilling anchors, and the revolutionary spacing design of these anchors, a large area of lateral support can be constructed daily. This method allowed GeoCiv to commit a single drilling crew for the installation and produce average productions exceeding 150 m of drilling per day. No delays are encountered waiting for curing of pressure grouted anchors that need stressing before commencing to the next sequence of excavated drops.

Risk management

The most prominent risk during the execution of the basement structure is the risk of collapse of the excavation in the temporary condition. The basement walls were constructed in close proximity to the existing infrastructure and surrounding residential houses, that in some instances were of historical significance.

With the use of the I-beam sections as a temporary measure of stability for the lateral support installation, the risk was greatly reduced to a more localised issue, which is easily treated with shotcrete. To ensure the installation of these piles were done to achieve the minimum design depth, we incorporated a method of predrilling at pile positions.

Construction innovation technology

When dealing with difficult soil conditions, a geotechnical contractor is required to think “out of the box”. When designing a lateral support system, one must consider two scenarios: how will the system act in the temporary condition as well as in the permanent condition depending on the client’s needs.

When drilling a layer of cobbles in a collapsible matrix, percussion techniques would generally be required. The client was limited to a zone of no more than 300 mm wide for the lateral support walls which makes the design of a lateral support pile within this zone problematic. When installing a small diameter pile that is designated to counter bending moments, the axial capacity of the smaller diameter is very limited. Once the first row of Self-drilling Anchors, is installed, the unstable layer of cobble matrix is consolidated during the grouting process. This also limits the potential for water ingress into the excavation and local collapse of the excavation.

PROJECT TEAM

- **Specialist Contractor: GeoCiv**
- **Client information: The One Student Development**
- **Consulting Engineer: Sutherland Engineers**
- **Architects: Boogertman + Partners**
- **Principal Agent: JMHT**
- **Main Contractor: WBHO**

Environmental impact consideration

GEOCIV Group took the opportunity to apply its expertise and capabilities as the leading installers of the largest CFA piles in South Africa

The use of pile diameters of up to 1 metre allows for reduced pile cap sizes and limits the requirement of large pile cap designs to incorporate the spread of loads throughout the foundation structure. The reduction in pile cap sizes also allows for reduced concrete and steel consumption in completing the structure, thus allowing a reduced carbon footprint during construction.

30 Mpa Grout

Producing a high quality and consistent continuous flight auger (CFA) piling grout has its challenges. There are several factors that need to be taken into consideration prior to accepting supply from a ready mixed concrete operation.

- Sufficient flow to allow for pumping over long distances at large volumes.
- Avoiding segregation while pumping under extreme pressures of up to 80 bar.
- Workability retention to allow for accurate placement of reinforcement cages after pumping of the grout.
- Reduced Settlement
- Consistency in delivering multiple loads of grout for a single pile.
- Achievement of design compressive strengths and still allow for the above-mentioned requirements.
- Displacement of subterranean water without loss of performance in the mix.
- Keeping a balance between cement content and plasticity of the mix to ensure no bleeding and spillage of grout that may contaminate the subterranean water table and cause any environmental pollution.

Health and Safety

One of the largest single-phase residential projects of its kind, this contract commenced at the start of a very wet Cape Town winter, enduring relentless rain for the first month and a half. Despite these challenges, the project remained on schedule as the weather improved, allowing the team to recover from the delays caused by heavy rain and flooding. In collaboration with the principal contractor, WBHO, the team ensured that Health, Safety, and Environmental (HSE) standards were maintained throughout every phase, pushing for continuous improvement. Exceptional audit results further highlighted the success of the project. The GEOCIV team worked tirelessly to complete the project safely and on schedule, and we are extremely proud of the team and their dedication and efforts in contributing to such a prestigious residential development. ■

A CONSTRUCTION FIRST FOR SASOL'S LINDE-DESIGNED NH3 STORAGE TANK

The multidisciplinary Sasol NH3 Project for Sasol was completed by Stefanutti Stocks Inland Region in June 2024. The project, located on Sasol Bunsen site in Sasolburg, entailed the construction of a new 8 800 m³ (6 000 ton) double carbon steel wall, low pressure cold storage tank for ammonia.

PROJECT TEAM

- **Main Contractor: Stefanutti Stocks**
- **Client: Sasol**
- **Principal Agent: Stefanutti Stocks**

Design innovation

"The Linde-designed NH3 storage tank that we constructed for SASOL is the first of its kind in the world, and this project has set a new international standards for ammonia and green hydrogen storage," says Nathan Barber, Managing Director of Stefanutti Stocks' Oil & Gas discipline. "It is a fantastic cradle to commissioning project to have in our multidisciplinary construction portfolio, in a particular at a time where our country and continent is actively seeking to implement greener solutions."

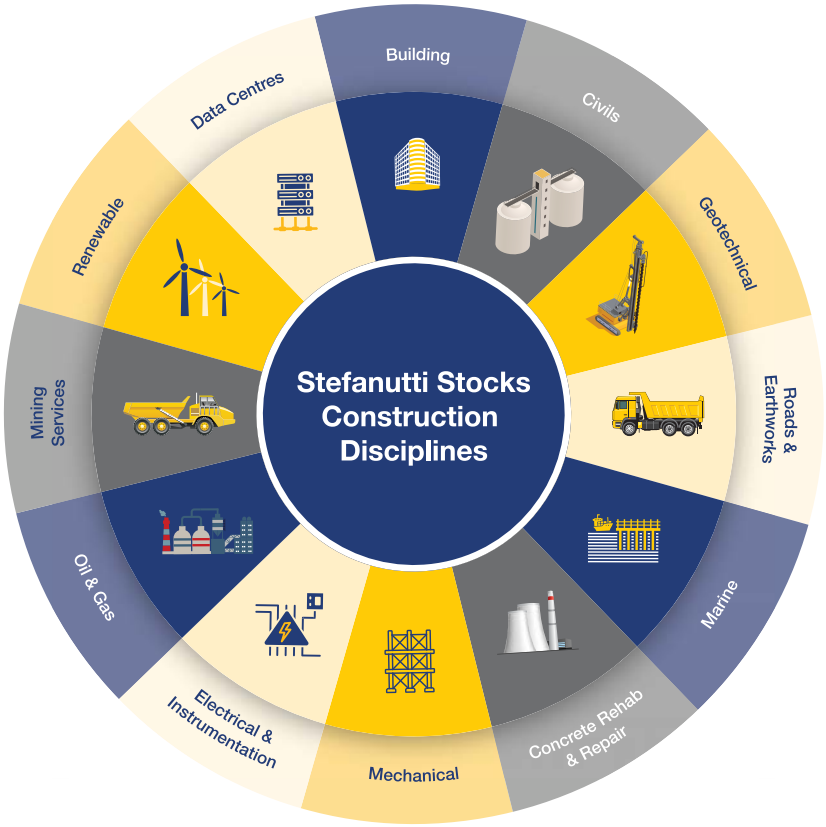
The multidisciplinary Sasol NH3 Project for Sasol was completed by Stefanutti Stocks Inland Region in June 2024. The project, located on Sasol Bunsen site in Sasolburg, entailed the construction of a new 8 800 m³ (6 000 ton) double carbon steel wall, low pressure cold storage tank for ammonia, as well as the balance of plant (BOP) construction scope.

The conventional design of ammonia storage tanks comprise an outer concrete wall, and an inner steel wall. However, over time the gradual failure of the concrete wall results in leakage of ammonia into the atmosphere. The existing NH3 tank at Sasolberg was reaching the end of its usable lifespan, as evidenced by an inspection of the concrete walls, as well as the sharp odour on site.

The BOP scope included geotechnical, piling, earthworks, civil works, tank construction, mechanical, piping (stainless steel, carbon steel, GRP, HDPE), structural steel, insulation, scaffolding, corrosion protection, electrical and instrumentation disciplines as

Stefanutti Stocks Multidisciplinary Construction

across sub-Saharan Africa



Stefanutti Stocks offers a broad scope of niche and traditional construction disciplines to clients across South Africa and Sub-Saharan Africa.

VISION

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excellence **in execution**

well as all the required shut-down activities in order to connect the new storage tank into the existing ammonia facility, and its processes, at Sasol Sasolburg.

Construction innovation technology

Following the completion of the piling and reinforced concrete suspended foundation, and in line with Linde's design requirements, the tank-build sequence began with the construction of the external tank and roof, followed by the inner tank. This erection sequence saw Stefanutti Stocks Inland's Oil & Gas design a special transportation system, that allowed both the outer tank as well as the plates for inner tank shell to horizontally slid into position in a vertical plane on a inhouse designed railing system. The cavity in between these shells serving as a liquid barrier.

"The tank construction method, via a hook and grab jacking system, was a first of a kind for Sasol and South Africa," explains Barber, "and in order to make fast and efficient progress we designed and implemented a railing system that allowed us to work on two fronts at the same time."

Structural Steel

The fabrication of the 269 ton steel structure commenced in January 2023 and the primary structural steel was delivered to site in mid April 2023 ready for installation

Balance of Plant

The civil works for the BoP commenced in February 2023 and comprised earthworks and piling, followed by the construction of a 35-metre diameter suspended foundation, that included an 18-hour long continuous pour of 900m^3.

Piping prefabrication for the BoP commenced in early July 2023 with installation taking place from mid July, including hydro-tests, non-destructive tests (NDTs), the installation of supports, and painting. The piping works was fabricated at the Stefanutti Stocks purpose-built pipe spooling facility in Johannesburg. The insulation installation followed and the piping installation was completed by mid December 2023.

Electrical and instrumentation installation – which included the upgrade of the switchgear and transformers, all associated electrical and instrumentation equipment, and acceptance tests – commenced in the last week of July 2023 and was completed mid January 2024.

In mid January 2024 the tie-in, or shut down work commenced. This, as well as the construction work, was completed on 25 March 2024, and the project was ready for commissioning. Mechanical completion was achieved on 23 May 2024.

The project was ready for overall commissioning. In early June and the site completely de-mobilised, leaving only a brand new tank visible on 12 July 2024.

Health and safety

The project achieved 1 million LTI-free manhours. The key success factors to achieving this safety milestone included planning and leadership.

In the planning phase a dedicated effort was made to gain (and later maintain) a proper understanding of the risks involved in the execution. Safety plans were developed, reviewed and continually improved for both normal and high risks activities. The numerous safety considerations during execution included, amongst others, working at heights, working in confined spaces inside the tank, and complex rigging activities.

The aim, as on all of Stefanutti Stocks' projects, was to cultivate a safety culture of an exceptional standard right from the beginning. Ownership, daily look ahead, interface management, visible leadership on site, as well as regular engagement with site supervision and the workforce promoted safety as the number one priority. An incentive programme, with daily recognition, was implemented and had a positive influence on behaviour.

The collective team effort on this project, right from the start of planning in July 2022 through to June 2024, made it a remarkable success from a safety perspective.

Environmental impact consideration

The environmental impact considerations of the project itself were owned and managed by the client, as the project was undertaken on an existing ammonia storage facility. The long term environmental impact of the construction of this type of double can be farreaching. The design and construction sets new international standards for ammonia and green hydrogen storage,

can be implemented globally, and offer a sustainable alternative to conventional concrete walled storage tanks.

Risk management

Welding processes

The modified SA516 Grade 70 carbon steel tank material utilised meant that the welding processes and the modified consumables were a critical element to the success of the project. Stefanutti Stocks engaged with a number of institutions including the University of Pretoria to develop, via trail and error, a measuring process that ensures the welding heat input is correct, and to prevent weld failures in the modified material. “In order to achieve correct material molecular structure, the welding process had continuously be monitored and controlled. This ensured the desired requirement from the client, and was in line with the intended design as required for the cryogenic surface,” explains Barber. “This also meant that we could not weld temporary connections to the inner tank shell, which is why we imported the hook & grab jacking system from India for this project.”

During the pre-qualification of the welding procedures and the construction of the tank a total of 28 welders were trained in the qualified welding process. A total 15 000 metres of welding took place on the tank, with approximately 15-ton of modified welding consumables used.

Multidisciplinary construction team

The team comprised of experts from all Stefanutti Stocks Inland Disciplines, chosen for their experience, knowledge and skill sets. “During the construction process of this highly technical project many managers were based on site,” says Barber, “and the project enjoyed the full time presence of a welding engineer, quality assurance manager, a full-time site-based tank operations manager, as well as a constant interface with and support from Linde’s engineering team in Germany.”

While the main contractor on the project was Stefanutti Stocks Inland Oil & Gas, the various elements that made up the project were all completed by the Inland Region’s Disciplines. This ensured that site establishment, work culture on site and communication was seamless. Furthermore, with Stefanutti Stocks

taking on the interface risk, this effectively removed that risk from the client. “The full-service, single-point of accountability solution that we offered our client on this multidisciplinary project was instrumental to its success,” says Barber. The geotechnical and piling scope was undertaken by the Stefanutti Stocks Inland Region’s Geotechnical Discipline; the civils portion was undertaken by Stefanutti Stocks Inland Region’s Civil Discipline; and the electrical & instrumentation scope was completed by Stefanutti Stocks Inland Region’s Electrical & Instrumentation Discipline. ■

PROJECT TEAM

- Specialist Contractor: Reinforced Earth South Africa
- Client: Lesotho Highlands Development Authority
- Main Contractor: HSPY Joint Venture (Western Section) & Rumdel (Eastern Section)
- Consulting Engineer: AECOM SA

REINFORCED EARTH® RETAINING WALLS ON THE ACCESS ROAD TO THE POLIHALI DAM SITE

Reinforced Earth South Africa was contracted to provide designs for MSE walls on the Polihali Access Road project.

Construction innovation technology

Reinforced Earth® is a composite material comprising frictional earth, reinforcements and facing elements, which was invented by French architect and engineer Henri Vidal. This invention was one of the most important civil engineering innovations of the twentieth century. Reinforced Earth South Africa (RESA) introduced Reinforced Earth® to South Africa in 1975. Since that time, constant innovation has enabled Reinforced Earth to offer tailored, state of the art solutions for a wide range of structures. TerraTrel® and TerraLink® are two of the innovative technologies first developed in South Africa. TerraTrel® was developed for the first time in 1989 on the road from Tzaneen to Ofcolaco in Limpopo, while TerraLink® was introduced for a retaining wall at the Kei Cuttings in the Eastern Cape in 1999. Now these systems have again been successfully implemented on the Polihali Access Road Project, Lesotho.

TerraTrel® is a Reinforced Earth® metallic, mesh facing that allows for internal settlement of elements during construction, without bulging of the elements between layers of reinforcing strips. A recent innovation, a flexible spacer named SpringTrel®, keeps the initial vertical spacing between the facing elements constant, until squeezed by the weight of the ongoing layers of backfill placed above it during the construction process.

A TerraLink® structure is a hybrid structure combining a Reinforced Earth® structure with a back wall. It is used when there is insufficient space to accommodate reinforcing strips. On this Polihali project, the back face was steeply excavated and reinforced with nails, which enabled the existing road to remain open to traffic. GeoStrap®, a polymeric reinforcing strap, links the TerraTrel facing to the back face. The nails on the back face are extended into the backfill to ensure the overall stability of the structure.

A major advantage of TerraLink® construction is that the design for a standard Reinforced Earth® structure can be adapted on site, by reducing the strap length to meet the actual distance to the prepared back face.

Corporate Social Investment

Rock is packed behind the TerraTrel® facing. This is a labour intensive job and allows for employment of local labour. Due to limited space, the backfill for the TerraLink® structure was also placed by hand.

Design innovation

The combination of the two systems was adopted as the optimal solution because

- TerraTrel® for the headwalls reduced the length of the culverts, and
- TerraLink® structures being the most suitable choice when there was insufficient space behind the facing.

Environmental impact consideration

TerraTrel® construction for permanent works requires rock with diameter greater than 100 mm to be packed behind the facing. This presents a pleasing gabion-type appearance, which blends in well with the arid environment. The contractors constructed the works within the required tolerances and the appearance of the structures is excellent.

Health and safety

Since work takes place from the back of the facing, while personnel stand on top of the compacted backfill layers, and because the advancing facing provides a barrier during construction, there is reduced risk associated with working at height.

Quantifiable time, cost and quality

Time

The TerraTrel® retaining wall structures: The pacing time for construction is the placing and compaction of the earthworks. When the earthworks are complete, so is the structure. This allows a significant saving in time compared to reinforced concrete retaining walls.

A TerraLink® structure links to an excavated or rockface prepared by the contractor, to enable the layers of reinforcing strips/straps to be attached. After the preparation of the back face, the rate of construction is dependent on how quickly the backfill can be placed. In this case the backfill was stone, tipped into the structure from above and levelled without the need for compaction.

Cost

The cost is influenced by the rate of construction, the availability of the backfill and the density of the reinforcing strips/straps which, in turn, is dependent on the height and loading of the structure.

The TerraTrel® structures reduced the length of the culverts and TerraLink® was the only viable solution to widen the road as required, thus making all the structures cost effective.

Quality

Constituent materials for the TerraTrel® and TerraLink® structures:

- Backfill:Dolerite or Basalt that meet the mechanical and electro-chemical specifications.
- Facing: TerraTrel® - manufactured from 12 mm, 10 mm and 8 mm hard drawn wire, welded into a grid with 100 mm x 100 mm apertures. The grid is shaped, and hot dip galvanized to ISO 1461: 2009 specifications.
- Reinforcing strips: 50 mm x 4 mm high adherence, medium tensile steel, hot dip galvanized to ISO 1461: 2009 specifications.

All materials were manufactured in South Africa to strict codes of practice. The construction was according to the specifications.

Risk management

This project presented several challenges due to its remote location and difficult terrain. To overcome these obstacles and ensure all the requirements and specifications were met at each stage of construction, close communication was maintained by RESA with the Engineers and Contractors throughout the process.

The 8 mm, 10 mm and 12 mm TerraTrel® facing bars cannot easily be vandalized. There is no record of any TerraTrel® structure which has been vandalized on any of the hundreds of TerraTrel® projects spread throughout 16 African countries. ■

MONTROSE INTERCHANGE UPGRADE PROJECT

The Montrose Interchange, operated by TRAC, is a key link on the east-west route connecting South Africa, Mozambique, and Botswana. However, the original 1970s design struggled to accommodate rising traffic driven by tourism and trade along the Maputo Development Corridor. To address this, TRAC initiated the Montrose Interchange Upgrade Project. The goal was to provide a cost-effective solution to improve safety and traffic flow between eMalahleni, Mbombela, and beyond.

The project involved realigning 600 metres of the Schoemanskloof road, constructing four new ramps, widening the Crocodile River Bridge from two to five lanes, and building two signature arch bridges over the N4. Additionally, 11 road lighting masts were installed to enhance visibility and safety.

SMEC, the lead designer, played a crucial role in the project from January 2018 (design initiation) to September 2023 (construction conclusion), providing a wide range of professional services across various departments. Throughout the 69-month duration, a total of 23 SMEC staff members were involved in the project. SMEC provided a range of professional services, including inception, preliminary and detailed design development, documentation and procurement, tender adjudication, and additional services such as topographical surveys, environmental and geotechnical support, pavement investigations, land acquisition reports, road safety audits, and traffic studies with modelling.

Construction innovation technology

As the consulting engineering firm, SMEC's involvement in the construction phase was primarily limited to oversight and support rather than direct execution. However, their influence in shaping construction innovation was significant through the design and planning stages, which directly impacted the construction processes.

One of the key innovations during construction was the anchoring of two signature arch bridges into the natural rock formations. SMEC's design facilitated the use of advanced foundation techniques, including controlled blasting and rock excavation to preserve the integrity of the rock mass.

During the widening of the Crocodile River Bridge,

the contractor, guided by SMEC's design, used precise methods such as saw-cutting and cranes for removing existing parapets without disrupting traffic flow or harming the environment.

Corporate Social Investment

The Montrose Interchange Upgrade made a significant impact on local communities through job creation and skills development. Over 350 local labourers were employed, and more than 20 local companies, including Qualifying Small Enterprises (QSEs) and Small, Medium, and Micro Enterprises (SMMEs), were engaged as subcontractors. The project also introduced Labour-Intensive Training (LIT), providing practical experience and accredited training to 44 emerging contractors and 834 local workers. These initiatives fostered economic growth and skill development, leaving a lasting positive impact on the community.

Design innovation

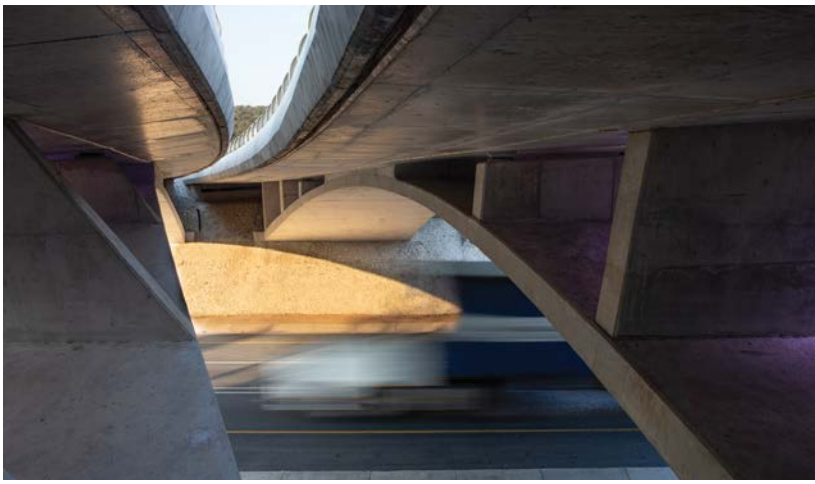
The Montrose Interchange Upgrade is a prime example of design innovation, showcasing how SMEC applied creative engineering solutions to overcome the project's geographical and logistical challenges. The project required reconfiguring the existing at-grade T-junction into a free-flow, grade-separated interchange to address growing traffic volumes and improve safety.

Unique design elements

Located at the confluence of the Crocodile and Elands River valleys, the site's topography presented significant design challenges. SMEC opted for a non-conventional design solution by realigning 600 metres of the N4-6Y road and incorporating two signature arch bridges into the natural landscape. These bridges, inspired by the Maillart Arch Bridges of Switzerland, were designed to appear as if they were emerging from the earth, complementing the surrounding environment.

Future-proofing the design

The design of the interchange considered not only



immediate needs but also future functionality. The project was envisioned as an interim stage, capable of accommodating future upgrades when the N4-6Y is eventually expanded to a dual carriageway. SMEC's innovative design allowed the existing Crocodile River Bridge to be repurposed, avoiding the construction of a costly new bridge, which would have added R350-million to the project budget.

Blending aesthetics and functionality

A standout design innovation was the use of visually slender arch bridges to maintain the natural beauty of the site. The bridges, with a flat span-to-rise ratio of 11,3, were designed to blend seamlessly into the landscape while maintaining structural integrity.

Use of Advanced Technology in Design

SMEC utilised cutting-edge digital tools during the design process, including Bentley's ContextCapture software. This tool enabled the creation of a 3D reality mesh of the project site using drone-acquired photographs. This innovation accelerated the project timeline, saving approximately three months, and reduced survey costs by about 25%.

Environmental impact consideration

The Montrose Interchange Upgrade prioritised environmental stewardship throughout its design and construction. A key achievement was the reduction of CO_2 and NOx emissions by removing the at-grade intersection, allowing for uninterrupted traffic flow. The project also minimised concrete usage by incorporating slender arch bridges, reducing the overall carbon footprint.

SMEC took great care to preserve significant indigenous trees and natural rock outcroppings, while removing invasive species and planting new native trees, enhancing biodiversity. A full Environmental Impact Assessment and Water Use License Application were conducted, ensuring the project met environmental standards, especially regarding the Crocodile River.

Energy-efficient lighting was installed, further lowering carbon emissions. Sustainable construction practices were employed, including the reuse of excavated materials to reduce waste. Additionally, controlled blasting and sensitive rock excavation techniques were used to protect the surrounding environment during construction.

Health and safety

Health and safety were prioritised throughout the construction phase, resulting in zero Lost-Time Injuries for the duration of the project. Rigorous safety protocols were enforced by the construction contractor, WBHO/Motheo JV, ensuring worker and public safety at all times. Specialised construction techniques, including controlled blasting and rock excavation, were

used to ensure the safe execution of complex works, particularly for the signature arch bridges and the widening of the Crocodile River Bridge.

Quantifiable time, cost and quality

The project was delivered ahead of schedule, meeting all key milestones. SMEC began preliminary design work in January 2019, with construction starting in 2020.

The project had an initial budget of R250-million, which SMEC successfully adhered to. Through a series of innovative design changes, the final construction cost amounted to R248,65-million, almost perfectly matching the budget. A significant cost-saving strategy involved shifting the alignment of the N4-6Y to reuse the existing Crocodile River Bridge, rather than constructing a new bridge, which alone would have cost R350-million.

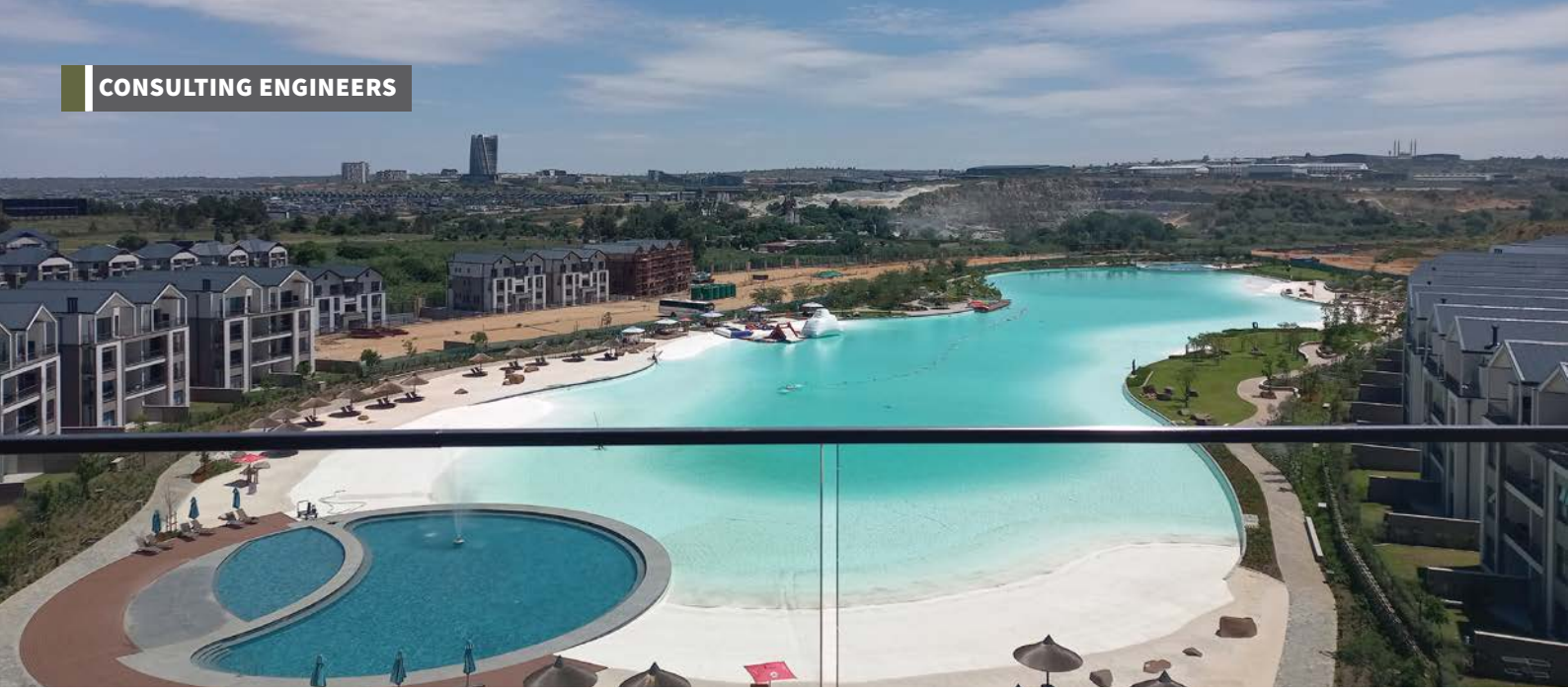
The project achieved outstanding engineering and design quality, adhering to both local and international industry standards.

Risk management

SMEC implemented a comprehensive risk management approach throughout the project. Key risks, such as complex geotechnical conditions, were proactively managed with innovative design adaptations. To manage construction quantities in a remote location, SMEC utilised advanced corridor modelling software, accurately calculating earthworks and pavement quantities, which constituted the bulk of the project's value. ■

PROJECT TEAM

- **Consulting Engineer: SMEC South Africa**
- **Client: Trans African Concessions**
- **Main Contractor: WBHO/Motheo JV**
- **Quantity Surveyor: African Consulting Surveyors**



MUNYAKA CRYSTAL LAGOON® AND LIFESTYLE CENTRE BY BALWIN PROPERTIES

The Munyaka Crystal Lagoon® and Lifestyle Centre project, developed by Balwin Properties in Midrand, Johannesburg, represents a significant achievement in modern construction and engineering.

Combining innovative design with advanced environmental technologies, this project showcases the potential of sustainable development in urban environments. The project comprises a 2,3-hectare Crystal Lagoon®, which contains 35 million litres of water, and a state-of-the-art Lifestyle Centre. The engineering feats and strategic planning involved in this development offer insights into construction innovation, environmental stewardship, and community impact.

Construction innovation technology

The Munyaka Crystal Lagoon® utilises patented technology from Crystal Lagoons® of Chile, setting a new standard in recreational water facilities. Unlike conventional swimming pools, which require constant and high levels of chemical treatment, this technology applies disinfection pulses, reducing chemical usage by up to 100 times. The lagoon's water is maintained through a controlled system of additives applied in specific patterns, monitored electronically by the Crystal Lagoons Control Centre. This reduces environmental impact and operational costs, making the lagoon an economically viable and sustainable alternative to traditional recreational water bodies.

The Lifestyle Centre, a full reinforced concrete structure with a vehicular basement and six floors of residential apartments, was completed in record time. The building's design, executed by LYT Architects, features long spans and thin columns, requiring innovative structural solutions to ensure stability without compromising aesthetics. The construction integrated advanced techniques to manage subsoil conditions and drainage within the granite rock formation, ensuring a dry and stable foundation.

Corporate social investment

The Munyaka Crystal Lagoon® and Lifestyle Centre project reflects Balwin Properties' commitment to corporate social investment by providing a unique recreational and residential environment in Midrand. The project has created significant employment opportunities during both the construction and operational phases.

Design innovation

The design of the Crystal Lagoon® integrates environmental considerations with aesthetic appeal. The lagoon is lined with a Linear Low-Density Polyethylene (LLDPE) liner, and the beaches are constructed with reinforced concrete, coated with specialised Polyurea systems. This design ensures durability and reduces maintenance costs while providing a visually stunning recreational area.

The Lifestyle Centre's unique architectural design, characterised by its arch-shaped structure, creates a visually captivating enclosure for residents. The top floor features luxurious penthouses, adding a premium aspect to the development. The design balances functionality with luxury, offering amenities such as restaurants, gyms, laundromats, and cinemas within the residential complex.

Environmental impact consideration

The Munyaka Crystal Lagoon® stands out for its minimal environmental impact, particularly regarding water usage. The lagoon consumes 33 times less water than an 18-hole golf course and 40% less than a park of the same size. It operates in a closed circuit, with water replenished only to compensate for evaporation. The initial fill and replenishment water are treated using a combination of high-rate clarification and reverse osmosis, ensuring compliance with the high-water quality standards required by Crystal Lagoons®.

Additionally, the project incorporates a sustainable water management system, with stormwater and

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subsoil water intercepted and treated through bioswales and bio ponds before being stored in subsurface reservoirs. This water is then reused for lagoon replenishment, irrigation, and the greywater system of the Lifestyle Centre, reducing the demand for fresh water and minimising the environmental footprint.

The construction of the lagoon required careful consideration of the local ecosystem, particularly the downstream wetlands. Extensive subsoil drainage systems were designed to intercept and redirect natural water flows, ensuring that the wetlands remained recharged and protected from the development's impact. This approach preserved the natural habitat and biodiversity in the surrounding area.

Health and safety

The construction of both the lagoon and Lifestyle Centre involved managing significant health and safety risks. The deep excavations within granite formations required continuous geotechnical oversight to ensure safe working conditions. A specialist blasting plan was implemented to control the impact of blasting near existing structures, safeguarding both workers and the surrounding environment.

The lagoon's water quality is continuously monitored and managed by the Crystal Lagoons Control Centre, ensuring that it meets stringent safety standards for recreational use. This proactive approach to safety extends to the overall operation of the development, where systems are in place to manage risks and ensure the well-being of residents and visitors.

Quantifiable time, cost, and quality

The Munyaka Crystal Lagoon® and Lifestyle Centre were completed within a tight schedule, with the project spilt into phases, earthworks completed within 4 months, the civil construction being completed in 14 months and finally the filling period of 4 months. The lagoon's filling process, which took place over a winter period, required adjustments to the filling plant to accommodate the deteriorated water quality from the Jukskei River. Despite these challenges, the project was completed on time, demonstrating exceptional project management and coordination.

The innovative technologies employed in the lagoon's construction significantly reduced operational costs. The reduced need for chemicals and water, coupled with the efficient use of treated water from the Jukskei River and sewer sources, made the project economically viable. The overall cost of the project was carefully managed, with high-quality materials and advanced construction techniques ensuring durability and reducing long-term maintenance expenses.

The project demanded a high degree of accuracy and quality, particularly given its status as Balwin's flagship development. All exposed metal was specified as Grade 316L stainless steel, ensuring longevity and resistance to corrosion. The lagoon systems underwent rigorous testing by Crystal Lagoons, achieving filling approval on the first attempt - a rare accomplishment internationally.

Risk management

One of the significant risks in the project was the water quality from the Jukskei River, particularly during the winter fill period. The team managed this by implementing a combination of high-rate clarification and reverse osmosis to treat the water to the required standard. The decision to supplement replenishment water with treated sewer water further mitigated risks associated with inconsistent water quality from the river.

The project's location on weathered granite posed several geotechnical challenges, including managing subsoil drainage and ensuring stable foundations. Continuous involvement of geotechnical engineers ensured that deep excavations were safe and that the subsoil drainage systems effectively managed water flow, preventing issues during and after construction.

Integrating the Crystal Lagoons technology with local systems required careful planning and coordination. Language barriers, differences in measurement systems, and the need for 3D integration of mechanical designs posed challenges that were successfully managed through close collaboration between Civil Concepts and the Crystal Lagoons team.

The Munyaka Crystal Lagoon® and Lifestyle Centre is not just a development but a pioneering project that sets new standards in sustainable urban living. The project demonstrates how innovative technology, careful environmental management, and advanced construction techniques can come together to create a world-class recreational and residential environment. The integration of Crystal Lagoons technology into the South African context, the management of complex geotechnical conditions, and the achievement of high standards of quality and safety make this project a standout in the field of consulting engineering. ■

PROJECT INFORMATION

- Consulting Engineer: Civil Concepts
- Client: Balwin Properties
- Main Contractor: Road-Tech Engineering
- Architect: LYT Architecture

STRUCTURAL HOLDING MEASURES AT CARINUS BRIDGE

The Carinus Bridge B2918, an 11-span structure spanning 175 meters across the Berg River, was constructed in 1950 by Murray & Stewart for the Cape Provincial Administration. Located at km 140,55 on Trunk Road 77 (R27) in Velddrif, Western Cape, the bridge is essential for linking the West Coast Peninsula with Velddrif, supporting tourism, mining, and local communities.

The bridge's structural design features simply supported rib-beam decks, with central spans that include an 18-metre drop-in span supported by half-joints. The original design approach has revealed vulnerabilities over time. Routine bridge inspections revealed significant deterioration, particularly in the half-joints of the main span, with distress signs including cracking, spalling, and a worsening 20 mm vertical displacement at Half-Joint 2. AECOM SA, the appointed consulting engineer, conducted a thorough assessment using retrospective design checks and various Non-Destructive Testing (NDT) methods. The assessment revealed severe structural shortcomings, particularly poor detailing of the half-joints, which lacked sufficient redundancy for alternative load paths.

Using Highways England's CS466 guideline for the risk management of concrete half-joint deck structures, AECOM identified an immediate risk, prompting urgent intervention. The Western Cape Government Transport Infrastructure Branch commissioned a project to implement structural holding measures to reinforce the failing half-joints and extend the bridge's service life until a replacement bridge is constructed.

Construction innovation technology

The Carinus Bridge project required detailed on-site verification of reinforcement details and steel grades due to limited as-built information. The Contractor confirmed these details by acquiring reinforcement bar samples for testing at SGS Metlab. The retro-fitment design incorporated a high degree of adaptability to account for potential on-site variations, with Carbon Fibre Reinforced Plates (CFRP) selected for the initial strengthening phase.

Strengthening measures included 448 m of Sika® CarboDur® S626 plates for externally bonded soffit reinforcement in the bridge's main spans and 320 m of Sika® CarboDur® S NSM plates for Near-Surface Mounted (NSM) strengthening of the bridge deck in hogging regions. The externally bonded plates were wrapped with SikaWrap®-300 C carbon fibre fabric and adhered using Sikadur®-330 a 2-component, thixotropic epoxy based impregnating resin and adhesive, preventing debonding and delamination. The carbon fibre fabric ends were structurally anchored into concrete using purpose-made anchorages from SikaWrap® FX-50 C Carbon fibre unidirectional cord bonded into drilled holes using Sikadur 31 epoxy structural adhesive. NSM techniques were used to embed CFRP plates into the concrete deck to avoid potential damage from future asphalt milling. Sikadur®-30 2-part epoxy structural adhesive for bonding reinforcement was applied following pull-off tests, and Sikagard 550W elastic crack bridging protective coating for concrete provided UV protection and a uniform aesthetic finish.

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Corporate Social Investment

The Carinus Bridge B2918 project prioritised both technical excellence and community upliftment, aligning with the Client's Broad-Based Black Economic.

Despite the fast-tracked nature of the project, it provided 3,146 person-days of work to 39 unemployed locals from Velddrif, creating significant economic opportunities. Additionally, 16% of the construction cost, amounting to R2,56-million, was directed towards Targeted Enterprises within the Western Cape, through involvement in the project. In addition, that Contractor spent R26 500 toward formal training courses to improve local labourers' skills in working at heights, traffic safety and traffic pointsman duties.

Design innovation

The consulting engineer, AECOM SA, employed innovative design strategies to address the challenges of the deteriorating bridge. The design incorporated speciality carbon fibre materials, self-compacting concrete, and prestressed materials, ensuring adaptability to on-site conditions.

Following the Contractor's confirmation report, the Design Engineer completed the design check within the contractually allowed 7-day period, enabling the timely ordering of proprietary strengthening materials. The carbon fibre structural strengthening measures were based on the ACI 440.2R-17 guide and the Concrete Society Technical Report No. 55, with analyses supported by the Sika CarboDur software app and Autodesk Structural Bridge Design tools.

A key challenge was ensuring adequate shear transfer across the half-joints while maintaining the bridge's articulation. The design utilised large diameter threaded stress bars, combined with hot-dip galvanised steel sections, to provide shear capacity without causing restraint due to thermal deformations.

Environmental impact consideration

Environmental stewardship was a key focus of the Carinus Bridge B2918 project, given its location within a sensitive Estuarine Functional Zone. The project had to comply with the National Environmental Management Act, 1998 (NEMA).

To ensure adherence, a NEMA applicability checklist was prepared by the Environmental Assessment Practitioner and submitted to the Department of Environmental Affairs and Development Planning. The checklist confirmed that no "Listed Activities" would be triggered under the regulations with the planned construction methods. To minimise environmental impact, the project team used suspended access platforms and rope access techniques, avoiding direct interaction with the estuary and reducing disturbances to the ecosystem.

Health and safety

Health and safety were paramount throughout the Carinus Bridge B2918 project, underscoring the team's commitment to protecting both workers and the public. Due to the project's complexity and high-risk nature, a comprehensive Occupational Health and Safety (OHS) specification was required, incorporating a baseline risk assessment by the Client's appointed Health and Safety Specialist.

Unique health and safety challenges included minimizing undue vibration and loading on the bridge during construction, designing temporary works for the drop-scaffold access platforms, ensuring compliance with the Port Owen Maritime Authority's visibility and access requirements, and handling potentially hazardous proprietary materials with proper PPE and containment protocols. Traffic management was also a critical focus. Regular Health and Safety Audits, conducted every 30 days in accordance with Construction Regulations (CR) 5(1)(o), helped identify and mitigate potential hazards.

Quantifiable time, cost, and quality

Given the urgent need to address the bridge's compromised structural integrity, rapid mobilisation and efficient management were essential. Smart Civils Construction quickly mobilised after the contract award in March 2024, securing necessary approvals and site access promptly. A sequential phase strategy was implemented, where each phase had to be completed before progressing to the next, making meticulous planning crucial to minimize delays.

To adhere to the 4-month construction period, preparation work was carried out in parallel with ongoing activities. Regular updates to the construction program identified critical paths, enabling the team to swiftly address potential delays. Despite challenges such as compliance with the project's Labour Employment specifications and unforeseen site conditions, the project was completed on time and within budget.

Quality assurance was rigorously maintained, with SANAS-accredited Roadlab conducting all laboratory testing to ensure that the work met required standards. The project's successful completion within time, cost, and quality parameters reflects the team's effective management and dedication.

Risk management

Risk management was critical for the Carinus Bridge B2918 project due to the deteriorated state of the half-joints, which posed a significant threat to structural integrity. The strategy focused on mitigating structural, environmental, and operational risks through thorough inspections, testing, and proactive measures.

Structural risks were managed through continuous monitoring of the half-joint's movements and condition, with regular inspections by the design engineer enabling informed decision-making when unexpected site conditions arose.

In particularm the grout injection process required meticulous monitoring and the use of temporary restraints to ensure stability. Despite its complexity and associated risks, this operation was completed successfully. ■

PROJECT INFORMATION

- Specialist Supplier: Sika SA
- Client: Western Cape Government, Department of Infrastructure, Transport Infrastructure Branch
- Main Contractor: Smart Civils Construction
- Project Manager: AECOM SA
- Consulting Engineer: AECOM SA

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DYWIDAG

SHOPRITE – WELLS ESTATE

The project comprises of additions and alterations to the Existing Shoprite Facility in Wells estate Gqeberha, Port Elizabeth. The purpose of the project was to increase the capacity of the existing Fresh store, adding a Dry store and Extensive Returns facility and providing workshop and Washbay facilities for the operating vehicles. The existing Shoprite facility covered 10 000 m², and the substantial extension of 81 000 m² brings the facility up to a total of 90 000 m².

Design innovation

There are multiple different structures positioned on the site, each with their own unique purpose and design requirements. The primary structure is structural steel fixed onto precast concrete frame. The substructure comprises of concrete pad footings with precast concrete columns. The building facades is made up of precast concrete wall panels.

The bulk of the steelwork comprised of trusses and girders to enable large open spaces for client flexibility. The typical internal grid was 32x32 m on the Dry Goods Warehouse which was largest footprint.

The trusses were designed as “Warren trusses” continuous over the girder supports to optimise the design. The top, bottom, and diagonal members of the trusses where angle members and varied with sized depending on the axial force distribution. The primary girders comprised of H and I-sections as top and bottom chords and back-to-back angles for the verticals and diagonals. The trusses and girders were made up of welded frames spliced in transportable sections.

The client was mindful of future expansion, the gable ends of the Dry Goods, Freshmark and Returns facility all have gable ends the enable expansion without disturbing the functioning of the facility itself. This posed a very interesting challenge to the design team. To be able to remove the gable columns in the future, steel columns at this interface were preferable as they would be easy to unbolt and remove. The steel columns however become long and slender, especially at the dry goods warehouse, the longest steel column was 29 m.

With the site being sea facing, wind was a substantial consideration during design and construction. The wind pressures on the buildings were high especially on the roof perimeters, monitors, and canopies. Metsec purlins were concentrated in zones of high wind pressure to ensure adequate fixing for cladding.

Engineers, steel detailers and fabricators worked together to ensure minimal material wastage. Available lengths and section sizes were shared with the designer to incorporate into designs to limit off-cuts.

Steel detailing was done in Tekla Structures. This 3-d software was instrumental in resolving complex connections and interfacing details to the existing facility. A point cloud survey was commissioned at the start of the project, and this information was used to plan the interface connection..

The flooring for the larger spaces where fibre reinforced jointless flooring. This design solution facilitated the large operational loading on the floors but also gave the client flexibility in terms of racking and stacking. The floors had a high quality FM2 finish.

Quantifiable time, cost and quality

The contractor was handed over the various building platforms in stages according to the deliverable needs of the client. The Freshmark facility was handed over first and construction of foundations began in June 2023. The steelwork followed suite and had to be fast-tracked to meet programme dates. Work began on steelwork in April 2023. The handover date was July 2024 but was revised to November 2024 for additional scope added. This would bring total project duration to 18 months.

The option of using precast elements was chosen due to the repetative nature of the columns and walls. this

meant the same casting beds could be used. Precast also allowed us a time saving benefit, precast elements could be cast and stacked while foundations where being constructed.

Environmental impact consideration

There was an Environmental Impact assessment (EIA) done on the site. One of the conditions that needed to be adhered to is excavations on the boundary needed to be reinstated to level of undisturbed ground. This was important when constructing the boundary wall which was also a riot wall. The EIA assessment also noted “No-go” areas set out by the environmental consultant where no excavation was allowed.

Another environmental aspect on the project is the removal of a diesel tank on the site. The task included removable of contaminated soil in the area, as well as rehabilitation of the ground. The assessment of the tank removal had an individual EIA completed by the environmental consultant.

Risk management

Consultants were also appointed for Hazard risk assessment on Ammonia and diesel installation. For Ammonia, toxic release, and analysis and for Diesel, the fire radiation was reviewed. The department of Employment and Labor also conducted major Hazardous installation (MHI) risk assessment.

Emergency response planning also considered in the assessment to comply with SANS 1514:2018. The recommendation was to update process management safety system and notify local emergency services.

Health and safety

The projects main health and safety concern was the installation of the roof sheeting and precast elements in a high wind speed area. The site position being sea facing on Port Elizabeths shoreline. The contractor was required to ensure that the wind speeds were below 25 km/hr when operating the crane onsite to prevent accidents during construction. The Safety agent had to record wind speed measurement daily to clear the crane for operation.

Corporate Social Investment

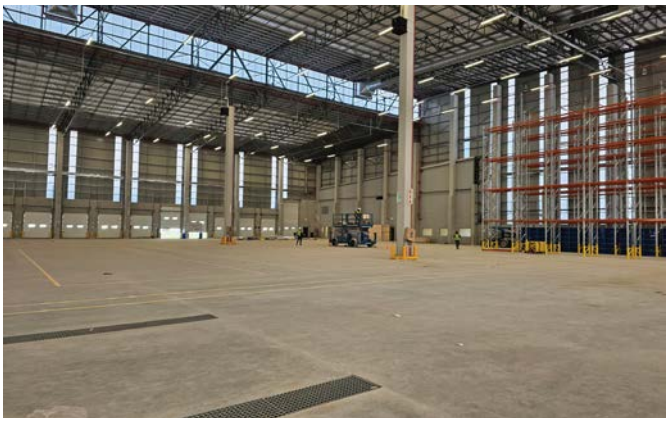
The project attracted a lot of public interest due to its size. The main contract facilitated the use of the local community as well as the local manufacturers.

This benefited the community not only with job creation for the duration of the project but also skills transfer from the experienced personnel at WBHO..

This project was iconic in its size and complexity, it has pushed our design team to design out of the box solutions considering not only the clients current needs but future needs as well. Coordination within the professional team as well as buildability studies with the contractor were essential to meet the very tight delivery timeline. ■

PROJECT INFORMATION

- Consulting Engineer: WSP Group Africa
- Client: Equites
- Main Contractor: WBHO Construction
- Architect: Empowered Spaces
- Principal Agent: Sivest
- Quantity Surveyor: Schoombie Hartmann



REDEVELOPMENT OF WITS FLOWER HALL

The Wits Flower Hall project showcases significant design innovation, led by Savage + Dodd Architects, who skilfully balanced the preservation of the building's historical significance with the introduction of modern functionality. Originally designed as part of the Wits Agricultural Society's infrastructure, Flower Hall's adaptive reuse required an approach that respected its heritage while ensuring it met contemporary needs.

Savage + Dodd Architects introduced two new internal concrete floors, one full floor, and a mezzanine, within the existing volume of the hall, effectively doubling the seating capacity. This structural intervention preserved the external character of the building while enhancing its interior for modern use.

The replacement of the steel glass curtain wall on the south façade with a new glazed curtain wall exemplifies the architects' commitment to preserving the historical fabric while incorporating energy-efficient modern materials.

Construction Innovation Technology

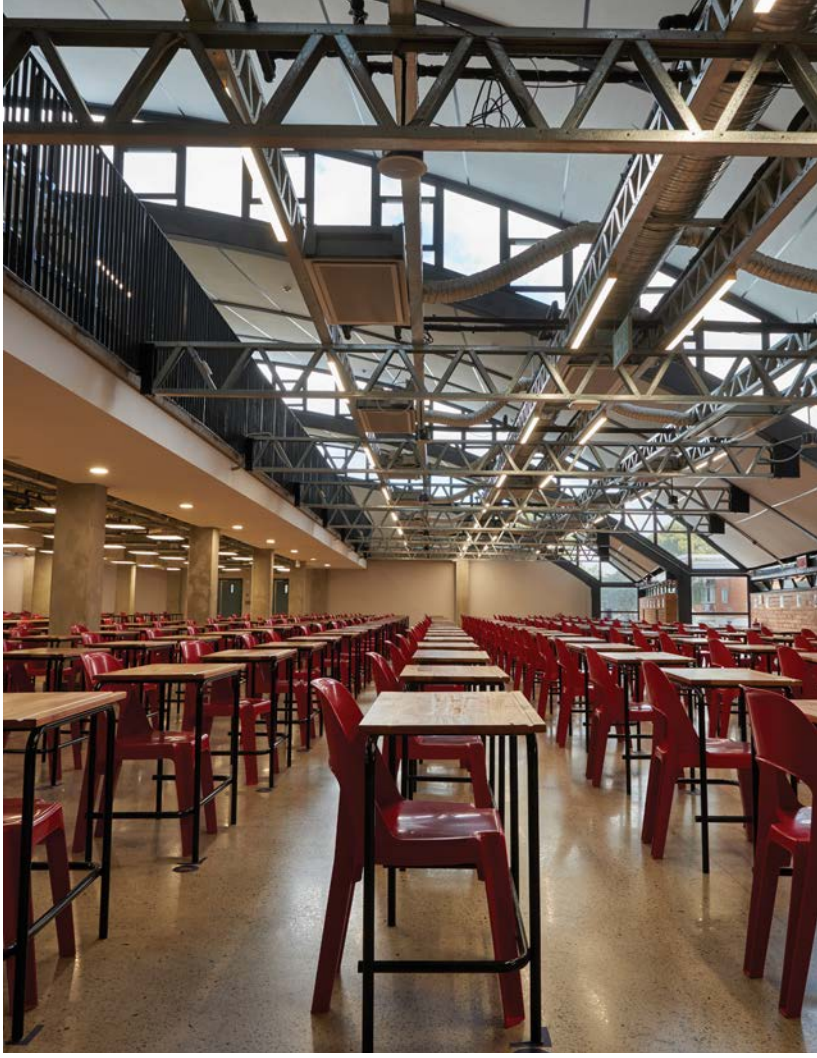
The redevelopment of Flower Hall at the University of the Witwatersrand integrates key technological innovations, particularly within the HVAC system, which reflects the project's emphasis on sustainability and energy efficiency. The introduction of a chilled beam HVAC system is a notable upgrade, enhancing both heating and cooling within the building.

The integration of chilled beams also aligns with the adaptive reuse approach of Flower Hall, ensuring that the building not only meets contemporary environmental standards but also maintains the integrity of its heritage design. The strategic use of modern HVAC technology ensures that the refurbished space is now capable of providing a comfortable environment for students, correcting the previously cold, uncomfortable conditions experienced during exam sessions.

Moreover, this innovation futureproofs the building, making it adaptable for its next phase as a shared Analytical Services Laboratory Complex. The seamless incorporation of the chilled beam system alongside other services such as lighting optimises the space

PROJECT INFORMATION

- **Architect: Savage + Dodd Architects**
- **Client: University of the Witwatersrand**
- **Main Contractor: Tri-Star Construction**
- **Project Manager: BVi Consulting Engineers**
- **Quantity Surveyor: AECOM South Africa**
- **Consulting Engineer: Calibre Consulting**



for long-term functionality without compromising its historical architecture. This approach demonstrates how cutting-edge HVAC technology can enhance both the energy efficiency and the operational flexibility of heritage buildings.

Corporate Social Investment

The Wits Flower Hall project, as part of a larger framework agreement with the University of the Witwatersrand, allowed Tri-Star Construction to extend its commitment to community development through its Corporate Social Investment (CSI) program. In line with this initiative, local contractors were employed for specific trades, ensuring that the surrounding community benefited directly from the project's economic activity.

Additionally, Tri-Star coordinated with all contractors involved to arrange donations of school shoes and blankets, addressing critical needs within the local community. These donations, sourced through collaboration with contractors, highlight the company's broader commitment to making a positive impact beyond the project itself..

Environmental impact consideration

Waste generation: Construction activities generated significant waste, including debris and hazardous materials, which were properly managed and disposed of. Energy consumption: Energy use during both construction and operation influenced the project's carbon footprint.

Noise pollution: Heavy machinery created noise that could disturb nearby communities and wildlife.

Health and safety

Worker safety: With the inherent risks of construction, such as working at heights and operating heavy machinery, the on-site safety department closely managed these hazards to ensure minimal incidents. Daily safety protocols were strictly enforced.

Public safety: To protect the public from potential hazards like traffic disruptions, dust, and falling debris, all work areas were securely barricaded with fencing, and security personnel were stationed at entry points to prevent unauthorised access.

Compliance with safety regulations: Adhering to local and international safety standards, including the Occupational Health and Safety Act, ensured that the project maintained a safe working environment for all.

Occupational health: To safeguard workers from long-term exposure to dust, chemicals, and loud noise, entry and exit medical screenings were conducted for everyone working on-site, ensuring their health was monitored throughout the project.

Quantifiable time, cost, and quality

The Wits Flower Hall project, valued at approximately R56-million (including VAT), was delivered on time and to a high standard of quality. Construction began on 12 May 2021 and was successfully completed on 5 August 2022, meeting all scheduled deadlines.

Tri-Star Construction ensured that the project was handed over on time, maintaining an exceptional record of quality throughout. Any defects that arose

during the post-construction phase were swiftly resolved within the allocated time frame, ensuring that the University of the Witwatersrand received a fully operational and quality-assured facility upon completion. This timely and efficient delivery, combined with strict adherence to budget, highlights the project's success in terms of both cost control and construction excellence.

Risk management

The Wits Flower Hall project posed several unique challenges that required careful risk management due to its unconventional construction methods and the age of the original structure.

Given that the original building was constructed many years ago, the absence of original design drawings added a layer of complexity. This necessitated the opening of various sections of the building to expose the existing services and as-built topology, ensuring that accurate information was available before proceeding with construction.

One of the significant risks uncovered during these investigations was the discovery of underground tunnels beneath the building. These tunnels introduced unforeseen structural support challenges that required immediate attention.

Tri-Star Construction, working closely with the highly capable structural engineers from Calibre Consulting, developed and implemented solutions to reinforce the building's foundation while maintaining the integrity of the original structure.

By proactively identifying and addressing these risks, the project team was able to maintain the project schedule and quality while safeguarding the building's structural stability. This meticulous approach to risk management was key to the overall success of the redevelopment.

Design intent

The Flower Hall at the University of the Witwatersrand was used as an exam venue. Designed by Fleming & Cooke in 1969, it was part of the Showgrounds designed to house flower displays of the Wits Agricultural Society at the annual Rand Easter Show.

It was constructed as an industrial 'shed' with four modules. These correspond to a structural system of four sections of a barrel roof supported on a steel arched member following the plan of the building with splayed walls at these junctions. South-facing roof lights sit between each segment of the roof, continuing down vertically into side windows at each bay.

The building was innovative in relation to its structure and original services that supported its functionality as an exhibition building. A new structure was built within the envelope of the building. Two new floor plates, one full floor, and a mezzanine, were inserted into the building's volume. The building's functional area for seating is effectively doubled.

An infill building – the 'north lobby' connects Flower Hall to the Goldfields building and houses the circulation elements connecting the two buildings.

A 'south' lobby was inserted into the first bay of Flower Hall with staircases leading to the new floors. This area also contains toilet facilities.

The steel glass curtain wall to the south façade was replaced with a new glazed curtain wall.

The spatial adaptation of the building is a simple solution with a complex execution as it required the construction of a 'building' within a building and the insertion of complex new services.

The extensive new floor plates were constructed within the existing envelope of the building without removing any roof elements.

New services were provided to support the use of the building in an energy-efficient way. This includes lighting, HVAC, and a chilled beam system which heats and cools the building. These had to be carefully coordinated as exposed suspended services within the volume of the building with its barrel-shaped roof.

In relation to the concept of adaptive reuse, the life of buildings is extended by changing and adapting them to other contemporary uses.

The significance of the building is maintained by minimising the impact of change on the physical fabric of the building through balancing heritage requirements and the requirements of a contemporary working environment. ■

DSK NEW STEM CENTRE

Over the past 60 years, the German International School of Cape Town has grown its campus, located on the slopes of Signal Hill, with various additions. However, in recent years the school expanded rapidly from 700 learners to its current 950 learners.

Although the existing campus' growth has been well planned over the decades, this rapid learner expansion necessitated the need for more facilities. A new STEM Centre was identified as an urgent teaching requirement. In contrast to the previous additions to the campus, the school chose for the STEM Centre to be a standalone building to allow other areas of the school to be freed up for re-planning and refurbishment.

Site considerations

The site, formerly a level asphalt play space known as the Boltzplatz, is located on the slopes of Signal Hill, nestled amongst indigenous Renosterveld vegetation, and complimented with panoramic views across Cape Town's city bowl.

Design innovation

KMH Architects was selected as the winning architecture firm following the STEM Centre competition. The design process leading up to the competition submission, and the subsequent award was conducted during the height of the Covid 19 pandemic in late 2020.

The resulting design drew inspiration from the natural surroundings of the site, celebrating a dialogue between landscape and building through tectonic architectural forms.

The three science and three biology classrooms are built over two storeys, and each has its own character. The former reads as a monolithic face-brick mass directly referencing the existing mountainside excavation and paying homage to the existing face brick buildings on site.

By strategically shaping and placing the various forms of the new building the design reimagines the original Boltzplatz as three outdoor spaces, each with its own character. These comprise a paved courtyard that is sheltered from the wind, a more secluded green space under the canopy of existing trees that were integrated into the design, and an external multi-purpose amphitheatre shaped out of the ravine directly below the STEM Centre. The roof has also been futureproofed to allow for a trafficable roofscape in the future.

Construction innovation technology

Due to the site's location at the rear of the campus, it was only accessible via a narrow single-carriageway route that crossed various existing play areas. As a result, the contractor's site, staging areas, and daily access required very careful planning.

Enablement and site establishment works entailed an extensive hoarding corridor running roughly 160 m, the full length of the single-carriageway access route through the playgrounds. Temporary access stairs and ramps, bridging up and over the hoarding corridor, were built to allow learners to access play areas without the risk of crossing construction vehicle routes.

A geotechnical assessment identified poor founding conditions and subsidence at the outer edge of the site and piling down into stable founding conditions was required. Piling work and bulk earthworks were conducted during school holidays to minimise interference with the schools' activities. The remainder of the structure is comprised of a concrete frame with suspended ground floor slabs, supported by piles, and coffer slabs to the first floor and roof. Concrete pours with the associated truck deliveries had to be planned to align with weekends and school holidays.

Interior design

The internal aesthetic of the STEM Centre celebrates natural materials and raw finishes with polished concrete floor slabs and exposed concrete coffer slab soffits which provide hard-wearing surfaces, ensuring longevity and low maintenance.

This backdrop is enlivened by an exposed services system reticulated on a suspended cable tray grids which allows the school to easily maintain services and enables future flexibility. The acoustic environment in the classrooms is managed through suspended vertical acoustic baffles which also bring an element of refinement to the spaces.

Internal architectural steelwork is painted in the German Schools trademark navy blue to add an element of playfulness and colour to the interiors. Leaners' desks are on wheels, as are the teachers' desks, fume cupboards, and digital whiteboards allowing for the classrooms to be easily configured as required. ■

PROJECT INFORMATION

- **Architect: KMH Architects**
- **Client: Deutsche Internationale Schule Kapstadt**
- **Main Contractor: Emcon**
- **Principle Agent: Fluid Projects**
- **Quantity Surveyor: B&L Quantity Surveyors**

THE RUBIK

The Rubik is an elegant 27-storey tower located in the heart of the Cape Town CBD, by Abland Property Developers. The building comprises a mix of retail, commercial, and residential accommodation on an 821 m² site which straddles the city's financial and heritage districts. Its striking aesthetic design features a glazed façade on the upper floors with distinctive cubes in angled formation, to break up the volumetric mass of the building.

The parking base features a varied combination of vertical and horizontal elements and planes to ensure a positive relationship with the lower-rise heritage buildings on the southern boundary. The Rubik is a true mixed-use development that densifies the city, offers walkable access to the city's amenities, and is designed to a high standard that adds a significant contemporary insertion to the city centre.

Construction innovation technology

The building is built to use the full footprint of the small, square site. This includes the positioning of the southern façade onto the common boundary with glazing on office residential levels, on the understanding that neighbouring buildings may be built to height in the future, blocking city and mountain views from these floors.

Corporate Social Investment

The Rubik contributes to the social fabric of Cape Town through its design and function. The project supports urban densification by combining retail, commercial, and residential spaces in a single development with walkable access to public transport and city amenities, promoting a sustainable inner-city development model.

The design incorporates retail spaces at ground and first-floor levels, enhancing street-level activity and contributing to the public realm. This activation benefits both the building's occupants and the wider community, creating an engaging streetscape. The inclusion of retail and commercial spaces creates job opportunities and stimulates local economic activity.

Design innovation

The Rubik's design development evolved from an initial 12-storey concept on a smaller site to the final elegant 27-storey design on a consolidated larger site, through collaborative processes between architects, the client, and consultants.

The Rubik features several innovative design elements. The tower's upper portion is divided into three orthogonal twisting reflective glazed cubes stacked on top of each other, creating a distinctive silhouette on the Cape Town skyline. These components are rotated around a central axis, breaking up the mass into smaller articulated masses that reduce the visual impact of the tower structure.

Impact consideration

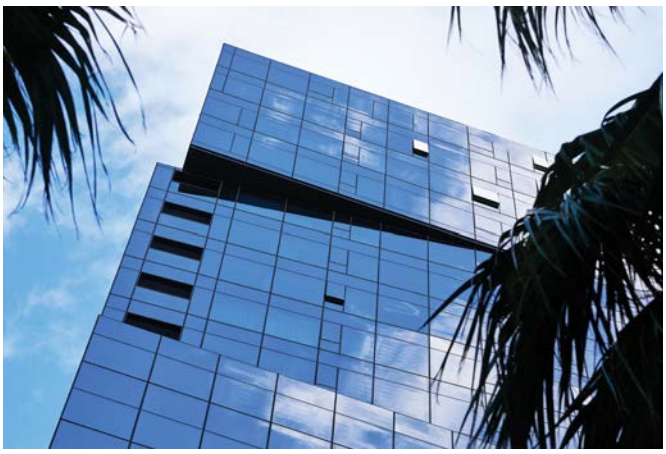
The Rubik incorporates several features to minimise its environmental impact. The building uses high-performance double glazing in office and residential levels, improving thermal insulation and reducing solar gain to lower energy consumption for heating and cooling. Office spaces feature desk-height opaque glazing spandrels that further reduce solar gain and air conditioning requirements. Residential areas include recessed semi-enclosed balconies with limited aperture sizes, promoting natural ventilation. Living areas and bedrooms along the façade have sliding or top-hung windows to enhance natural ventilation.

Quantifiable time, cost, and quality

The site is located in a Heritage Overlay Zone. The design needed to acknowledge the heritage of the surrounding areas and required heritage approval. A key constraint on the site was the existing height restriction of 60 m above base level with a zero-metre street setback up to 38 m, a diagonal setback above that level, and a zero-metre setback on the common boundaries.

Risk management

The Rubik's design incorporates a comprehensive risk management strategy. The design team collaborated with heritage consultants and city planners to ensure compliance with heritage and land use management requirements, mitigating regulatory risks. ■



PROJECT INFORMATION

- **Architect: dhk Architects**
- **Client: Abland Property Developers**
- **Main Contractor: WBHO Construction**
- **Project Manager: Abland Propery Developers**
- **Quantity Surveyor: Du Toit Pienaar Quantity Surveyors**
- **Consulting Engineer: Zutari**

PROJECT INFORMATION

- Architect: Boogertman + Partners
- Client: Department of Agriculture, Land Reform and Rural Development
- Main Contractor: TBUC D&C
- Project Manager: WBHO Construction
- Quantity Surveyor: AECOM SA

DEPARTMENT OF AGRICULTURE, LAND REFORM AND RURAL DEVELOPMENT

Eleven years in the making, the new home of the Department of Agriculture, Land Reform and Rural Development (DALRRD) in South Africa's capital city, Pretoria, adds a glittering landmark to the city's (and the country's) tradition of civic architecture.

Designed less to dazzle than to serve as a powerful symbol of the department's central commitment to "secure a better quality of life for all", the new building's design arises from the foundational principles of its vision and values that reach back to the seminal statement in the Freedom Charter: "South Africa belongs to all those who live in it."

Design innovation

The central design concept was inspired by the land itself, which lies at the very heart of the department's activities: agriculture, forestry, rural development, and land reform. The curved, organic shapes of the building and its low-slung form take their cue from shapes moulded by nature itself. The architecture literally hugs the ground rather than towering vertically over it, almost as a refined or abstracted landform.

The distinctive identity of the building, however, is most emphatically defined by its shimmering façade, which is essentially an artwork in its own right: a complex unitised façade system of individually machined aluminium and glass panels etched with a powerfully symbolic design.

The façade concept aims to create an artwork that visualises the various focuses of the department: agriculture, forestry, rural development, and land reform. Profiles of the most iconic mountain peaks from each of the country's nine provinces are fused together to create an image of a unified landscape that encompasses the whole country. This hand-drawn artwork was transposed into a digital array of pointillist and linear patterns to be laser cut into the aluminium facade panels and glazing systems. The use of a vertical line work pattern on the glazed panels references South Africa's urban landscapes, whereas the pointillist approach on the metallic sections signifies rural South African landscapes. This glass surface slips behind the skirts of the golden façade as it rises and falls, as a symbolic depiction of South Africa's urban and rural landscapes intercepting each other.

Corporate Social Investment

The DALRRD office building is a shining example of how

corporate social investment can be implemented in the design of public buildings. The building reflects the country's rich culture and heritage, celebrates its natural beauty, and supports the local community by integrating social and environmental considerations into the core business of the department.
Employee wellbeing was a key consideration, with the design incorporating features such as social canteen pocket areas on every floor and building, comfortable and ergonomic workspaces that have access to natural light, and a dedicated 'river walk' that meanders through the landscaping along the eastern boundary of the site next to the Apies River.

The landscape design employs planters around the public interface of the building entrance that contain locally grown crops and vegetables. These are harvested and utilised in the on-site main canteen.

An integral part of the design concept is based on traditional South African crafts and artistic techniques such as beading and basketry. These techniques have been transformed into minimalistic design elements, such as the dots extrapolated from beadwork and the lines from weaving patterns.

The glass facades facilitate a powerful connection between the interior of the building and its context, looking out over the landscaped grounds, over the city, and to the mountain ranges beyond.

Environmental impact consideration

The DALRRD office building was awarded a GBCSA 4 STAR Green Star rating for its sustainable design features. The building's complex facade system was designed to minimise internal glare, with specialised vision glazing portions and blinds on all external windows. The office area and floor plan were optimised to ensure that 60 % of the floor area is within 8 m of an external facade, window, or atrium. This provides ample natural light, reducing the need for artificial lighting and cooling. All lights in the building are activated by motion sensors to ensure they only operate when required.

The building's materials were also carefully selected to reduce its environmental impact. Carpets, paints, and all interior adhesives and sealants are low-VOC emitting. Fuel-efficient transport is encouraged with 5 % of all parking spaces labelled for fuel-efficient cars and carpools. Dedicated recycling and waste storage facilities are provided for separation and collection. All external and atrium lighting is designed to keep light pollution to a minimum.

The building consists of five nodes or wings leading off a central spine that bends along a curve in the Apies River, which runs along the edge of the site.

This long, low form creates the wide floorplates that facilitate a light, open, friendly, hospitable, and spatially connected environment in line with the department's values of inclusivity and progressive organisational culture.

Health and safety

For a project this size, health and safety was of utmost importance throughout design and construction.

The contractor maintained a comprehensive safety plan, providing training to workers and conducting regular safety inspections. The project site was divided into separate 'building blocks', each with its own team.

Quantifiable time, cost, and quality/risk management

As part of the PPP project structure, the entire design process was strictly maintained through the design review process facilitated by the transaction advisor. Independent Certifiers were involved in the signing off of works for every discipline, and a comprehensive independent health and safety audit was conducted as part of project completion.

Motivation facts about the project

The new home of the DALRRD is informed at every point in its design by its primary purpose, which is to secure a better quality of life for all.

It is at once mindful of the need to be inclusive, broadly representative, respectful, and welcoming to the needs of all whom the department seeks to serve. It makes a powerful symbolic statement, representing the vision and aspirations of a country and its people through its connection to the land.

Far from prescriptive, however, this building's architecture is designed to allow its occupants to evolve and adapt to the changing times, facilitating its endeavours and enabling the department's mandate well into the future. ■

PROJECT INFORMATION

- **Architect: Boogertman + Partners**
- **Main Contractor: GVK-Siya Zama Construction**
- **Project Manager: SIP Project Managers**
- **Quantity Surveyor: AECOM SA**
- **Consulting Engineer: NAKO Iliso Consulting**

CAPE STATION

The forecourt of Cape Town Station, a landmark in the Cape Town CBD, has been reimagined by Boogertman + Partners for the Eris Property Group as a vibrant new mixed-use space that includes 6 700 m² of modern retail space, accommodation for 3 085 students, and a world-class public square.

The new development was conceptualised to serve students attending the nearby Cape Peninsula University of Technology (CPUT) but is open to students from any institution seeking quality affordable accommodation in the city. It has been designed and built according to Department of Higher Education (DHET) standards as NSFAS-accredited accommodation.

The development shifts Cape Town Station's character from a predominantly transport- and railway-related node to a densified multi-purpose urban neighbourhood, embracing the potential of the site to inject new urban life into this part of the city. It aims to strengthen and restore aspects of the urban design in the area while consolidating the nature of this historical precinct and creating a new urban landmark.

The site is unusual in this part of the city in that it stands alone in the surrounding urban landscape rather than abutting buildings on all three sides. As a result, its design demanded a high degree of sensitivity to its urban context.

Design innovation

The retail space is accommodated on the base level, while the student housing block (topping out at 20 storeys) rises above it, forming two L-shaped blocks that are tied together to form a large courtyard.

The 'massing' of the student block was carved out in response to complex heritage, urban, and contextual drivers, which include the allowable heights related to the scale of the nearby buildings, as well as careful consideration of the key views up and down the surrounding streets and vistas of Table Mountain. Thus, each elevation responds individually to its own specific parameters, while the whole is resolved into a cohesive, flowing, unified design.

Construction innovation technology

Along the main urban artery of Adderley Street, the building echoes the horizontal nature of the station concourse and reflects the scale of the buildings opposite. The northern façade relates to the height of the 60 m Paul Sauer building and views of Table Mountain, while the southern façade steps down to relate to the buildings on Adderley Street.

Aesthetically, the design for Cape Station involves a contemporary reinterpretation of the predominantly modernist face of the built environment in this area of the city, responding to the light material fabric of the surrounding buildings. Its scale is sensitively broken down into smaller portions on the façade, with variations in pattern and colour articulated with seamlines.

Environmental impact consideration

From an urban design perspective, two historical city grids intersect at the station: the historic Dutch city grid, and the modernist layout of the Foreshore. The new building has been designed to moderate this transition. Among its priorities was an imperative to strengthen the street-facing edge along Adderley Street and its response to the surrounding city grid, and to reestablish a green link that runs from Table Mountain through the suburban fabric of the Gardens area and on to the sea, which had become tenuous in the area around the station.

Health and safety

The new precinct was intentionally designed to facilitate pedestrian movement – opening two urban corridors – and to encourage the use of public transport. One corridor enables direct pedestrian access between Strand Street and the railway station (at the same time establishing a grand entrance) while the other extends Riebeek Street into the Galleria.

Corporate Social Investment

The character of the precinct merges the public and civic nature of the station square with the more private and social nature of the student accommodation. The buildings wrap around to create a public square; its four-storey façade in this area imparts a grand civic atmosphere to the retail section.

While the shops and square are open to the public – the shops intend to serve the needs of the students who live in the building, as well as commuters and the broader community living and working in the city. The student accommodation is accessed via a lobby on the first floor, subtly distinguishing public and private realms, and supporting access control and the security of the residential units. Two of the rooftop levels (levels four and 14) feature roof gardens with sports facilities and breakout spaces. Large, loose planters with trees and shrubbery echo the green spaces in the square.

Quantifiable time, cost, and quality

The updated Cape Station precinct introduces a new civic icon and an important transitional architectural intervention into the evolution of the Cape Town CBD – densifying, diversifying, and breathing new life into this part of the city. It sensitively navigates the relationship between heritage and contextual factors, while strengthening, reestablishing, and restoring others, and forging an exciting future for the city centre.

Overview of the project

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The development shifts Cape Town Station's character from a predominantly transport- and railway-related node to a densified multi-purpose urban neighbourhood, embracing the potential of the site to inject new urban life into this part of the city. It aims to strengthen and restore aspects of the urban design in the area while consolidating the nature of this historical precinct and creating a new urban landmark. ■

KENDAL ASH DISPOSAL FACILITY PROJECT

Responsible disposal of coal ash tailings is a critical aspect of environmentally compliant power generation in South Africa. At Eskom's Kendal Power Station near Ogies in Mpumalanga Concor, in a joint venture with Lubocon Civils, successfully completed the strategic expansion of the Ash Disposal Facility (ADF). This important achievement paves the way for Kendal Power Station to continue generating energy for almost another decade while complying with the necessary environmental regulations.

The Kendal ADF project stands out for its vast scale, covering an area of approximately 2,5 km by 3 km. This significant size makes it an exceptional undertaking.

The full scope included the new 65-hectare ADF itself, two HDPE-lined earth dams or basins for clean water, two similar dams for polluted water, silt traps, an extensive 16 km V-drain system with channels for clean and dirty water, access road construction and a major stream diversion.

Engineering work included diverting an existing clean water stream channelled for 3 km around the new ADF area. This substantial waterway is 30 m wide, with a base width of 10m and embankments of 10 m on each side. It is built to robust standards to withstand 1-in-100-year floods.

Among the strict requirements was to avoid any potential contamination of groundwater by the ADF. Stringent measures were implemented to ensure this was achieved, including the installation of HDPE linings.

The project's demanding timeline was driven by environmental licencing deadlines, with 24-hour shifts worked during dry months. Site operations started in June 2020, with work completed in June 2024.

Construction innovation technology

The project included preparing the environmentally compliant infrastructure for the continuous ADF, as well as two lined earth dams and a 3 km stream diversion.

To comply with strict environmental regulations to avoid groundwater contamination, the ADF was lined with an impermeable barrier. This involved constructing two 150 mm thick low permeability clay layers across the base of the facility.

Two HDPE-lined earth dams were constructed close to the ADF, with Dam 1 for polluted water and Dam 2 for clean water. Dam 1 has a capacity for 130 000 m^3 of water while Dam 2 will cater for 257 000 m^3.

Concor's innovative approach to basin construction employed a patented PVC concrete formwork system, boosting efficiency by accelerating the casting panel process. This technique saved time and was labour efficient.

PROJECT INFORMATION

- **Main Contractor: Concor Lubocon ADF JV (A JV between Concor Infrastructure and Lubocon Civils)**
- **Client: Eskom**
- **Consulting Engineer: Zitholele WSP JV**

Construction of these dams required the excavation of about 400 000 m^3 of earth, and all are equipped with a drainage system which necessitated careful preparation of layer courses below the concrete basins.

Solid HDPE and perforated 160 mm diameter pipes were installed as well as separation geofabric around the filter drains. These were checked by specialised cameras to ensure the drainage system remains clear.

HDPE geomembrane of 1,5 mm thickness was used on the dam bases as well as on the inner side slopes, on top of which a geotextile layer was placed for protection.

The stream diversion was a significant aspect of the project, channelling clean water for 3 km around the new ADF area. Built to withstand 1-in-100-year floods, the constructed stream is 30 m wide with a 10 m base width and embankments of 10 m on each side. Constructing the diversion demanded considerable excavation work, but it is the gabion lining of the stream that gives a good indication of the

scale of this endeavour.

Corporate social investment

The Concor-Lubocon JV's approach to CSI aligns with Eskom's own strategies, which are aimed at giving back to local communities. In conjunction with Eskom, for instance, the Kendal ADF JV added modular classrooms, using containers, at a local primary school and also fitted out a kitchen.

Environmental impact consideration

The key environmental aspects of the Kendal ADF were firstly to prevent any potential contamination of groundwater, and secondly to increase the amount of water that can be recycled.

Avoiding contamination required installing a liner by constructing two 150 mm thick low permeability clay layers across the base of the facility, with clay material being sourced from the basin excavation.

By ensuring clean water is always separated from polluted water, the power station can reuse more of this clean on-site water reducing the volumes it draws from other sources such as municipal supply.

The design and construction of the stream diversion aims to hasten the return of a natural ecosystem.

Lining the base of the stream with wetland material from the site allowed rapid revegetation of the stream with reeds and other aquatic life.

The carbon footprint of fill material was reduced by sourcing the rock for gabions from local quarries and crushers.

Design innovation

To comply with stringent environmental regulations, the expanded ADF is lined with an impermeable barrier to prevent any contamination of groundwater.

The ADF design includes a subsoil drainage system, comprising an impermeable liner system with another drainage system installed over this, allowing clean groundwater to run into the clean water dam.

To withstand 1-in-100-year floods, the stream diversion comprises four different cross sections (Types A, B, C, and D) along the 3 km length.

The Type A section of the stream is lined with gabion baskets with a biodegradable blanket to prevent erosion of topsoil and facilitate rapid growth of plants. Type B is the flat portion of the stream, while Type C comprises 17 steps where the stream descends more steeply. Type D, similar to Type A, has wetland material at the bottom and topsoil on the sides.

Health and safety

Driving its Zero Harm strategy, Concor's compact professional project team successfully managed a large total headcount of up to about 600 – achieving a Zero Lost Time Injury (LTI) rate after 2,2 million hours.

Concor implemented its Major Incident Prevention (MIP) programme to concentrate efforts on verifying critical controls by supervisors in the field. MIP analyses pathways where fatalities might occur and where direct intervention can prevent a major incident from occurring.

Ongoing training was conducted at the project to ensure new entrants to the sector understood Concor's company-wide health, safety, and environment (HSE) awareness philosophy: Stop.Think.Act!

Quantifiable time, cost, and quality

The project was under a strict timeline, so the JV partners stepped up the construction programme during the dry winter months – sometimes working 24-hour shifts ensuring a head start before the rains.

Environmental regulations required that construction work be carefully sequenced, as certain activities on the new ADF area could only proceed once the stream diversion was completed.

Underpinning the quality of the project is Concor's 'Build to Last' philosophy with its aim to enhance longevity in all structures and ensure value for money. Each element underwent a specific quality assurance and quality control (QA/QC) procedure.

Quality was also coupled with timesaving

methodologies, such as using K Form shutters instead of conventional steel shutters.

Materials and equipment also required strict quality inspections on and off-site. This included sluice gates, subsoil pumps, HDPE geomembrane, subsoil/leachate pipes, concrete pipes, culverts, fencing materials, Reno mattresses, and gabion baskets, as well as conformance testing of aggregates.

Risk management

There were several potential risks that were carefully managed to ensure the successful delivery of the project. One of the most critical challenges was managing ongoing scope changes. This involved accommodating design modifications while minimising their impact on the construction programme.

Inclement weather also posed a significant threat to the project timeline. To mitigate this, detailed planning was implemented including working 24 hours a day during the dry season to maximise productivity under favourable conditions.

Leak prevention was a paramount concern throughout the project. Rigorous quality control measures were employed to minimise the risk of leaks. Additionally, an electronic leak detection system was used to ensure the integrity of the construction of the ADF, dams, and basins.

The rise in labour unrest within the country was identified as a potential risk. Managing the expectations of the local communities and maintaining transparent communication among all stakeholders were crucial in preventing work stoppages. Ongoing dialogue with stakeholders was essential to address any concerns promptly. ■

COASTAL PARK MATERIALS RECOVERY FACILITY (MRF)

The Coastal Park Materials Recovery Facility (MRF) represents a pioneering initiative by the City of Cape Town: Urban Waste Management Directorate (CCT) to allow for the recovery and separation of recyclable waste stream materials (e.g. plastics, metals, paper, cardboard etc.) from the municipal waste stream.

The creation of this facility is a key milestone for CCT towards the completion of the roll out of the separation at source programme for the City of Cape Town and will become the largest and most productive MRF in South Africa.

The development of this facility was an opportunity for the CCT as well as professional team to "practice what they preach" and design a facility with circular economy and sustainability as guiding principles, by prioritising material re-use, land re-use, waste minimisation and waste reduction while still producing a technically appropriate that is economically, socially attractive.

This project exemplifies excellence and innovation in engineering and construction techniques, addressing complex challenges with creative, economic and sustainable solutions.

Project overview

The Coastal Park MRF is situated on top of a historical solid waste deposit (contaminated, brownfields site, highly unsuitable for development) on the southern portion of the Coastal Park Landfill site in Muizenberg, Cape Town. The project aimed to construct a state-of-the-art facility capable of separating co-mingled recyclables while mitigating environmental impacts associated with landfill operations. The development of the approximately 9 ha area includes the new MRF, an industrial structural steel warehouse structure 60 x 180 m in dimension, and three storey reinforced concrete administration building attached to the end surround by operating roads, and operating apron slabs.

The development site is within 100 m of False Bay shoreline, and situated within the Zeekoevlei Nature reserve, surrounded by endemic and threatened plant and animal species. If those challenges were not enough, the development site was overlain by 500 000 m^3 of historic builders' rubble deposits towering 20 m in the sky and underlain by a 5 m thick historic municipal solid waste (MSW) deposit that was dumped on the site in the late 1980s. There was no space on site to house the builder's rubble deposits if moved, and there was no airspace available to accept the +- 450 000 m^3 of municipal solid waste underlaying the site, never mind the budget. Accounting for a tight timeline, as well as major procurement challenges, the professional team took all challenges in their stride and not only addressed all these challenges, but also produced environmentally sustainable, and economically attractive solutions to the problems that showcase engineering ingenuity.

The development of the site was split over three separate construction contracts, including a Bulk Earthworks and Bulk Services contract (executed under SAICE GCC 2015), a MRF Building and Civils Contract (executed under JBCC PBA 6.2), and MRF Plant Manufacture, Install and Commission Contract (executed under FIDIC Yellow 1999), with the latter two contracts running concurrently and due for completion in the next two months

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The Coastal Park MRF project applies cutting-edge construction innovation through several key technologies.

Dynamic compaction was strategically utilised to stabilise the municipal solid waste (MSW) deposit, allowing construction to proceed efficiently without the need for expensive excavation. This method significantly enhanced the site's structural integrity and minimised settlement risks.

In addition, the project integrated on-site crushing and screening of builder's rubble to create engineered fill material, demonstrating a commitment to sustainability by reusing waste and reducing environmental impact. Another highlight is the advanced gas management system, which includes relief wells and extraction fans to effectively manage landfill gas emissions.

Design innovation

The Coastal Park MRF project showcased remarkable design innovation through its advanced engineering solutions.

A key element was the ground improvement design, which combined dynamic compaction with an engineered fill cap and geogrid to create a stable construction platform over challenging waste materials.

This approach ensured a robust foundation, addressing the complexities of working with municipal solid waste. Additionally, the project employed a material reuse strategy involving rigorous analysis and testing of builder's rubble to produce viable engineered fill.

This innovative application of material science not only optimised the use of waste materials but also demonstrated a commitment to sustainable practices.

These design innovations highlight the project's ingenuity in overcoming site challenges and advancing construction technology.

Corporate Social Investment

The Coastal Park MRF project exemplifies a strong commitment to Corporate Social Investment by integrating community and environmental benefits into its core operations.

The initiative has had a positive impact on local communities through job creation and economic stimulation, providing employment opportunities that contribute to the area's growth and development. The design by JG Afrika has a key focus on the blend between mechanical intervention and physical job creation for recovery of materials, allowing for hundreds of people to be upskilled into the green economy.

The project also emphasises environmental stewardship by adopting sustainable practices such as recycling and efficient waste management. By addressing the pressing issues of waste management and environmental conservation, the Coastal Park MRF not only enhances the city's recycling capabilities but also demonstrates a profound dedication to supporting community well-being and promoting sustainable development.

Environmental impact consideration

The facility employs advanced technologies to manage and mitigate landfill gas emissions, featuring a sophisticated gas management system with relief wells and extraction fans.

This system ensures effective control of gas emissions, thereby protecting air quality and reducing potential environmental harm. Additionally, the project's approach to material reuse, including on-site processing of builder's rubble into engineered fill, significantly reduces waste and conserves natural resources.

Health and safety and risk management

Site safety was a top priority, with rigorous risk assessments identifying potential hazards and implementing proactive measures to address them. Effective risk management strategies were put in place to mitigate health and safety risks throughout both construction and operation phases.

This included advanced safety equipment, regular safety training, and the development of detailed contingency plans. By continuously monitoring risks and adapting safety protocols, the project ensured a secure working environment for all personnel while maintaining operational resilience.

Quantifiable time, cost and quality

The Coastal Park MRF project demonstrated exceptional management of time, cost, and quality through rigorous planning and execution. The project adhered to a well-defined schedule, achieving timely completion across all phases, including planning, design, and procurement. Despite external disruptions such as COVID-19, the construction and commissioning phases were completed on schedule. Efficient project execution was achieved through innovative approaches like on-site processing of builder's rubble, which streamlined operations and reduced both project duration and costs. Additionally, dynamic compaction techniques accelerated ground improvement compared to traditional methods. Cost management was meticulously controlled, with the project delivered within budget thanks to efficient procurement processes and cost-effective strategies. The commitment to quality was evident in the use of high standards for materials and construction techniques, ensuring that the facility met all performance and durability requirements.

The Coastal Park MRF project has been distinguished by its remarkable achievements and ongoing advancements. Recognised at the BEST Project Awards in 2021 for its innovative bulk earthworks and dynamic compaction phases, the project has continued to make significant progress since then. With the facility nearing completion, we are excited to highlight not only the initial groundbreaking accomplishments but also the integration of cutting-edge technologies such as gas-to-electricity conversion.

The Coastal Park MRF exemplifies excellence in engineering, combining innovative design with effective project management to advance waste management infrastructure and promote environmental stewardship. We are proud to present this project as a testament to our commitment to engineering excellence and sustainable development. ■

PROJECT INFORMATION

- **Consulting Engineer: JG Afrika**
- **Client: City of Cape Town: Solid Waste Management**
- **Main Contractor: Power Construction**
- **Architect: Jakupa Architects**
- **Principal Agent: WSP**
- **Quantity Surveyor: Talani QS**

PROJECT INFORMATION

- Architect: GASS Architecture Studios
- Client: First Transaction Capital
- Main Contractor: Energy Master Builders
- Quantity Surveyor: AECOM South Africa

GREEN SCHOOL SOUTH AFRICA – MIDDLE SCHOOL

Middle School, the latest addition to the Green School South Africa (GSSA) Campus, stands as a beacon of innovative educational architecture nestled in Paarl Valley. Defined by its breathtaking mountain surroundings, the campus exemplifies a holistic approach to environmental stewardship and educational excellence. The campus's spatial design draws inspiration from the natural landscape, integrating individual buildings and their interstitial spaces in a way that reflects both macro and micro-level considerations. This design philosophy extends to the buildings themselves, which feature organic forms and eco-friendly materials, fostering environments where children can thrive through exploration and engagement.

Construction innovation technology

The Green School South Africa employs cutting-edge construction innovation technology to realise its vision of a sustainable educational facility. Key technologies incorporated into the project include Building Information Modelling (BIM), prefabrication, and renewable energy systems.

Building Information Modelling (BIM)

BIM technology has been pivotal in the planning and execution of the Green School. By creating detailed 3D digital models of the school, BIM enables accurate visualisation of the building's design, allowing for improved coordination among architects, engineers, and contractors.

Prefabrication

Prefabrication techniques have been employed to streamline the construction process. Prefabricated components, such as modular classrooms and structural elements, were manufactured off-site and assembled on-site.

Renewable energy systems

The integration of renewable energy technologies is a cornerstone of the Green School's design.

Solar panels and wind turbines have been installed to provide a significant portion of the school's energy needs. These systems contribute to the school's goal of achieving net-zero energy consumption, reducing reliance on non-renewable energy sources.

Corporate Social Investment

Corporate Social Investment (CSI) is a fundamental aspect of the Green School South Africa project. The initiative goes beyond merely constructing a building; it aims to make a positive impact on the local community and the broader South African society.

Community engagement

The project actively involves the local community in various phases, from planning to execution. By sourcing materials locally and employing local labour, the Green School supports the local economy and creates job opportunities.

Educational opportunities

As part of its CSI efforts, the Green School South Africa focuses on providing educational opportunities for underprivileged children. Scholarships and community outreach programs are integral to the project, ensuring that high-quality education is accessible to students from diverse backgrounds.

Environmental education

The school itself serves as a living laboratory for environ mental education. Students learn about sustainability practices through hands-on experiences, fostering a sense of environmental stewardship from an early age.

Design innovation

Design innovation is a key feature of the Green School South Africa, reflecting its commitment to sustainability and educational excellence. The school's design incorporates several innovative features that enhance both functionality and environmental performance.

Biophilic design

The school's architecture integrates biophilic design principles, which emphasise the connection between people and nature. Natural light, ventilation, and green spaces are incorporated into the design to create a healthy and inspiring learning environment. Classrooms are designed with large windows to maximise daylight, reducing the need for artificial lighting and enhancing students' well-being.

Sustainable materials

The use of sustainable and recycled materials is another hallmark of the school's design. Materials such as reclaimed wood, recycled steel, and low-impact concrete are chosen for their environmental benefits and durability.

Flexible learning spaces

The design includes flexible learning spaces that can be adapted for various educational activities. Modular and movable partitions allow for dynamic classroom configurations, supporting diverse teaching methods and fostering collaborative learning environments.

Environmental impact consideration

Environmental impact consideration is central to the Green School South Africa project. The school's design and construction processes prioritise minimising negative effects on the environment and promoting sustainability.

Energy efficiency

The school's energy-efficient design includes passive solar heating, high-performance insulation, and energy-efficient windows. These features reduce the building's energy consumption and contribute to its net-zero energy goal.

Water conservation

Water-saving technologies are integrated into the school's design to minimise water usage. Low-flow fixtures, rainwater harvesting systems, and greywater recycling contribute to efficient water management. These measures help reduce the school's overall water footprint and promote sustainable practices.

Waste Management

Effective waste management practices are implemented throughout the construction process. On-site recycling programs and waste reduction strategies minimize the amount of construction debris that ends up in landfills.

Health and safety

Health and safety considerations are paramount in the Green School South Africa project. Ensuring a safe working environment and promoting the well-being of students and staff are key priorities.

Construction safety

During construction, strict safety protocols are adhered to, including regular site inspections, safety training for workers, and the use of personal protective equipment (PPE).

Indoor Air Quality

The school's design emphasises indoor air quality by using low-VOC (volatile organic compound) materials and incorporating natural ventilation systems. These measures help reduce indoor pollutants and create a healthier learning environment for students and staff.

Emergency Preparedness

Comprehensive emergency preparedness plans are developed and communicated to ensure the safety of all occupants. These plans include procedures for evacuation, fire safety, and first aid.

Quantifiable time, cost and quality

Effective management of time, cost, and quality is crucial for the successful completion of the Green School South Africa project. These factors are carefully monitored to ensure that the project meets its goals and objectives.

Time management

The project utilises advanced scheduling tools and techniques to manage construction timelines. Detailed project schedules are developed, and progress is tracked regularly to ensure that milestones are met. The use of prefabrication and modular construction methods also contributes to faster project completion.

Cost management

Budgeting and cost control measures are implemented to manage expenses effectively. Accurate cost estimates are prepared, and financial monitoring is conducted throughout the project.

Quality assurance

Quality assurance processes are integrated into every stage of the project. Regular inspections and testing are conducted to ensure that construction standards and specifications are met. The use of high-quality materials and adherence to best practices contribute to the overall quality of the building.

Risk management

Risk management is a critical component of the Green School South Africa project, involving the identification, assessment, and mitigation of potential risks.

Risk identification

Potential risks are identified through comprehensive risk assessments conducted at various stages of the project. Risks may include financial uncertainties, design changes, and environmental factors. Identifying these risks early allows for proactive planning and mitigation.

Risk mitigation

Strategies are developed to address identified risks, including contingency plans and insurance coverage. Risk mitigation measures are tailored to the specific needs of the project and are regularly reviewed and updated as needed.

Monitoring and review

Ongoing monitoring of risks and regular reviews ensure that mitigation strategies are effective and that new risks are identified and addressed. This proactive approach helps minimise potential disruptions and ensures the successful completion of the project. ■

PROJECT INFORMATION

- Main Contractor: Icon Construction
- Client: KwaZulu-Natal Department of Transport
- Consulting Engineer: Brava Engineers

CONSTRUCTION OF THE WELA RIVER BRIDGE

Approximately 10 years ago, Road P451 between the town of Hlabisa and the Zamokwake and Makhowe districts in Northern KwaZulu-Natal was upgraded and surfaced. This is also the road used by the local population to get to the towns of Hlabisa and Hluhluwe to conduct their business and shopping.

However, due to insufficient funding at that time, the bridge over the Wela River at km 16,34 was not constructed. Residents and other vehicles travelling on Road P451 had to take a diversion and cross an old low level causeway over the Wela River.

The Wela River is susceptible to flooding as there is a large catchment area inland of the bridge site. Unfortunately, over the years, a number of vehicles were washed over the causeway during flooding and a number of people, including children, lost their lives.

Construction

The new bridge consists of a three span reinforced concrete two lane vehicular bridge founded and dowelled into competent bedrock at both abutments and both piers. The bridge deck consists of a continuous cast in situ reinforced concrete deck with void formers. The bridge deck was cast in three stages. There are bearings and expansion joints on both Abutments and the piers are integral with the bridge deck. The bridge has “F” shaped concrete parapets on both sides with Endblocks at each corner for the guardrails to connect onto. There is a raised concrete sidewalk on the upstream side of the bridge for pedestrians.

Icon Construction was aware of the risks of working in a river, having previously constructed a number of river bridges. Risk mitigation was implemented by diverting the river flow away from the work areas, as well as sandbagging to prevent erosion of the berms. Large diameter steel pipes were installed under the staging platform to accommodate the river flow. However, despite the measures put in place, it is not possible to cater for flood type situations. During the construction period, the site experienced flash flooding on four separate occasions. On the first occasion in November 2022, the site experienced no rainfall at all, but the heavy rains in the inland catchment area resulted in a flash flood. The second flash flood occurred during the annual shutdown in December 2022 whilst the site was closed. Icon Construction arranged with a local CPG construction and plant hire company to repair the damaged approach road and re-open it to traffic so that the local population could cross the river. The third flash flood, which was the most serious, occurred in February 2023.

Innovation

The concrete specified for the bridge construction was 30 MPa for the entire substructure, and
40 MPa for the bridge deck and parapets. It was decided for various reasons that site batching was not feasible, and that ready mix concrete would be used. It would also be necessary to pump a lot of the concrete. Afrimat is the only readymix concrete supplier in this area and has a plant in Hluhluwe and in Nongoma.

Local community

There are different wards and tribal authorities situated on each side of the Wela River. The eMpembeni area and the eMdletsheni area are located on either side of the Wela River. Because of this, it was agreed that two Community Liaison Officers would be employed on the contract , with one being selected from each side.

A Project Liaison Committee (PLC) was formed and a Labour Task Team was created from various stakeholders and interested parties from within the district. Their roles were to keep the community informed on matters relating to the contract, and the identifying and selecting of local labour to be employed on the contract and NYS students for training.

A total number of 45 local community members were employed on the contract, as well as a local student technician who was employed to gain in-service training on the contract.

Community participation

The contract Community Participation Goal was set at 27,5% in the contract document.

There were three work packages identified and tender adverts were displayed and distributed extensively within the two Wards, as well as at public buildings in the town of Hlabisa.

Work Package 1 – 4 CE

This work package included the backfilling, earthworks, layerworks, minor concrete work and asphalt surfacing to the finished road and was awarded to Thelbridge Enterprise.

Work Package 2 – 3 CE

This work package included the drainage, stone pitching, structural gabions and concrete kerb and channel and was awarded to Shishiza Trading.

Work Package 3 – 2 CE
This work package included the roadsigns, guardrails, sidewalks, roadmarking and non-structural gabions and was awarded to Inyanla Enterprises.

In addition to the above, Icon Construction also employed a local security company for the site. Where possible, purchasing was done from local stores and vendors and catering for the PLC meetings was done by a local lady. Icon Construction also employed wo. 1 CE local companies for removal of concrete and rubble from the demolition work.

The contractor achieved a CPG spend of 32,3% on the contract, thus exceeding the tendered target.

Training and development

Magnacorp, who are a CETA accredited company, was appointed as the training service provider for the contract.

National Youth Service Programme (NYS) formal training was carried out on the contract. An advert was distributed in the area giving selection criteria and advising youths on how to submit an application. Ten youths were selected after a recruitment process by the PLC and CLO's in both wards.

On completion of their three month period of employment on the contract, local labour was offered the opportunity to undergo training. A total of 10 locals took up this offer and undertook Classroom training in Construction Skills.

Corporate Social Investment

Icon Construction received various requests from within the area for assistance with different facilities and needs within the district.

Because Icon Construction focuses it's CSI spending on education, the request for repairs and maintenance at the Mayakazi Primary School was adopted as the most relevant request received.

Electrical repairs, painting and broken window pane replacement was undertaken in the classrooms. Externally gutters were repaired or replaced and painting was done. The work done by Icon Construction was commended and a letter of appreciation was received from the school Principal.

Successful completion of the contract was achieved by all parties co-operating with each other and working together with a common goal of getting the bridge built for the benefit of the community and the commuters using the road.

Environmental impact consideration

Members of the local community use the water from the Wela River for washing of clothes and draw water which is carried home in containers and buckets for other uses. As a result of this, special attention was paid by Icon Construction to prevent any contamination of the river water. Washing out of concrete delivery vehicles was confined to a specific area and the resulting debris was transported to the landfill site in Hlabisa for disposal.

Construction site ablutions were well controlled and regularly cleaned and serviced to ensure a healthy and clean working environment. General housekeeping and regular removal of refuse and litter was implemented.

Regular Toolbox Talks were held on site regarding Environmental matters and housekeeping, as well the importance thereof.

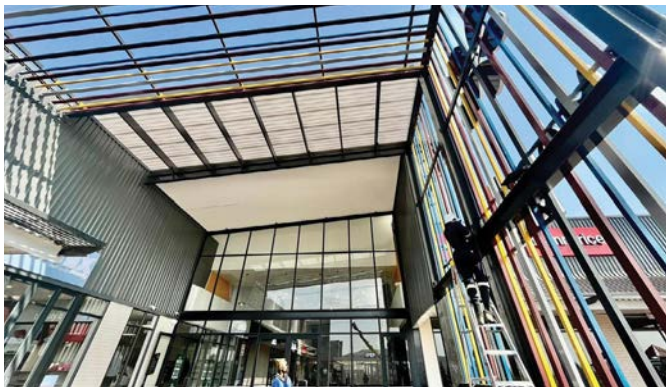
Concrete rubble arising from the demolition of the existing low level causeway was removed from site to landfill by two CPG subcontractors employed from the district.

Stockpile maintenance was carried out by the contractor to remove alien vegetation and to prevent it from growing and spreading.

A Close-Out Environmental Audit was conducted in December 2023 and the site camp rehabilitation and overall site clearance achieved 100% compliance. ■

EMONDLO MALL

Sub header: The Emondlo Mall consisted of a gross building area including covered walkways of 18 690 m². Construction started on 14 September 2022 and the mall opened on 29 June 2023. Shoprite was the main anchor and there are 59 shops.



Construction innovation technology

The construction industry has for a number of years been on a decline and currently is not in a very good place. There are contractors closing their doors on a weekly basis, which makes it very troublesome to pick the main contractor for a project.

In construction cash flow is the lifeblood of the company to get any work done on time, with the correct resources. Some tenders are often submitted with no mark-up or even at a loss in a desperate attempt to secure work.

The hard rock encountered during the bulk earthworks phase was a big challenge that needed some out-of-the-box thinking to work around. Two 30-ton peckers were working 24 hours a day for 3,5 months.

The on-site concrete batching plant faced challenges in sourcing stone for the concrete as this is a very scarce resource in the area. During the peak of the concrete pouring process, stone had to be imported from Ulundi to keep the project on track.

Corporate Social Investment

All projects employed core staff with the balance of the labour sourced from the area around the project. To facilitate this process, it was crucial that a community steering committee was put in place and all local recruitment was managed through the steering committee.

This required a lot of training and supervision to ensure the work was done to the correct standard as the local labour did not have all the skills needed. With the mall being in the Emondlo township, it is a very welcome addition to the area.

One of the big problems the area had was ATMs to withdraw cash. This would be a big draw card to the mall. This service would also save the local community as they no longer have to pay for transport to Vryheid to do their shopping.

Design innovation

Construction was streamlined and the constructability of the mall was promoted by placing concrete columns at the back of the mall. These had brick infill which could be constructed while the steel structure was being manufactured. This allowed the site teams to carry on without the need to wait for the steel structure. Once the steel was up, they could move the focus to the rest of the mall

Environmental impact consideration

The biggest consideration here was to control the rainwater flow as there was little infrastructure in the area. An attenuation dam was built to hold rainwater and slow down the water flow to reduce the impact on the surrounding properties.

Health and safety

Rural shopping centres are always challenging regarding access and public safety. A laydown area for material was identified close to the entrance to the site. A new sewer line and power infrastructure to the site had to be laid down through the surrounding township.

Some local residents took down safety netting. The steering committee addressed the problem and explained that the netting was temporary and put in place for the community's safety.

The project was completed with a total average complement of 273 employees on-site at the peak of the project and a total of 166 909 LTI-free man-hours.

Quantifiable time, cost and quality

The project was completed on time despite the challenges encountered. The quality of the work was of a high standard which reduced snag lists and assisted in the lists being signed off in a very short time. With the project being far away, it was crucial to continuously manage the quality. ■

PROJECT INFORMATION

- **Construction Manager: Protean Project Innovations**
- **Client: Muller Group**
- **Architect: SNA**
- **Quantity Surveyor: GK Projects**
- **Consulting Engineer: Streng Consulting**

REHABILITATION OF THE COASTAL BEACH LINE AT VILANCULOS (MOZAMBIQUE)

The small Island of Vilanculos in Mozambique has faced a series of tidal storms and each storm would leave the coastal line eroded. In order to prevent further damage Santuario was appointed to design a coastal protection solution. Due to the remote location of the Island, Santuario had to design a solution that would not require heavy plant equipment and foreign materials that would need to be transported to the Island.

Finding skilled labour would also be challenging and costly to outsource. Santuario had to ensure that the solution would be able to provide adequate coastal protection in a challenging construction environment.

Fibertex was able to offer Santuario a geosynthetic solution that would help them overcome the challenging construction environment. The preferred Geosynthetic Sand Container was the FiberRock 250VX that allows contractors to fill the bag with a slurry made up of beach sand and sea water.

FiberRock 250VX is manufactured from robust staple fibre geotextile layers sewn together with a UV stable polyester overlocked yarn. The Anti-Vandal layer is made from heavy, coarse highly UV stabilised polypropylene fibres This structure is designed to trap sand particles and promote growth of natural marine vegetation, which enhances its durability characteristics.

FiberRock 250VX is designed with a central chute that allows for in-situ filling. The GSC is filled using a slurry pump that is filled through the central chute with a slurry made up of beach sand and seawater.

The FiberRock 250VX filled dimensions are 2,3 m X 1,8 m X 0,50 m and weighs approximately 4 tons.

Value proposition

Fibertex was able to offer Santuario a product that would solve their design challenges. They needed to carry out a construction project with limited site access for plant equipment and building materials. The in-situ design application of the FiberRock250VX removed the need for plant lifting equipment. The use of the slurry pump that was able to fill the bags with beach sand and seawater eliminated the need for foreign materials that would normally be required, like concrete, steel and bricks. Due to the unique and dynamic installation required for the FiberRock 250VX, Santuario was able to employ a small site team, consisting of local labour.

In spite of the challenges of this unique installation, Fibertex offered Santuario a cost effective, eco-friendly and long-term solution that meets all project requirements. The FiberRock coastal protection system embraces all the mechanical properties of traditional hard structures, yet protects and enhances the natural environment.

Customer success Story

Santuario, with the help of Fibertex, has provided a coastal protection design that meets challenging site conditions. The coastline of the Island is now protected by a natural solution that is aesthetically pleasing and enhances the natural environment. The soft exterior of the geosynthetic sand containers allows for safe public interaction and with time, the sand containers will blend into the background, as natural vegetation grows over the bags.

PROJECT INFORMATION

- **Specialist Supplier: Fibertex SA**
- **Client: Santuario**

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