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ON THE COVER

In celebration of 20 years of *Construction World's* annual Best Projects Awards, this month's cover article explores the evolution of cement, aggregates and concrete over the past two decades – and the contribution made by AfriSam over this period.

As the official sponsor of the 'AfriSam Innovation Award for Sustainable Construction,' AfriSam is committed to advancement and best practice in the sector, according to sales and marketing executive Richard Tomes.

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Some of Crown Publications' staff who assist with Best Projects (from left): Wilhelm du Plessis (Editor – Construction World***), Karen Grant (Publisher – Crown Publications), Erna Oosthuizen (Advertising Manager –*** Construction World***), Karen Smith (Web Manager – Crown Publications) and Shaun Smith (Digital Administrator – Crown Publications).***

COMMENT

Early in November Construction World *hosted the 20th edition of its Best Projects Awards. This issue features the winners and entries and as such reflects the diversity and depth of the South African construction industry. It is a highlight for the brand as it celebrates excellence – despite the current economic state.*

This depth and diversity is reflected in many of the comments we received from attendees. Sheldon Temlett, Contract Manager for Quantibuild, who won the Civil Engineering category, said "It is nights like these that remind us that our industry is still robust."

Maxine Nel, Head of Corporate Communications at AfriSam (who has been the main sponsor of Best Projects for 20 years) said, "Congratulations on a great awards ceremony and for promoting the best our industry has to offer."

Best Projects has become an integral part of *Construction World's* brand. Over the last 20 years it has developed from a fledgling award to being a relevant, anticipated and eagerly awaited event on the calendar. I would like to thank the entrants, judges, sponsors and those at Crown Publications who help with the execution of the awards project.

Looking ahead to 2022

While this issue is testament to the expertise, experience and depth of the South African construction industry over the past year, many and complex challenges for the industry exist.

The economic slowdown caused by the COVID-19 pandemic compounded the already existing depressed industry as it led to further delays, suspension and cancellation of various projects – locally and internationally.

However, according to Aon's 2021 Global Risk Management Survey, "The top 10 risks facing the construction industry" the impact of the pandemic is diverging. Commercial construction activities that thrived during the pandemic (distribution, healthcare, etc.) have stayed buoyant and the study says that they have even accelerated. At the same time construction activity for industries such as hospitality and retail is yet to return to pre-pandemic levels. These sectors are still directly impacted by the pandemic.

Over and above these challenges, the report states that there is a serious risk of material shortages that may be caused by the fact that the pandemic has caused limitations on movement. At the same time the pace of recovery is uncertain and this has led to investors holding back.

According to Tshepo Mofubetsoana, Aon South Africa's Senior Broker in its Construction, Engineering and Renewable Energy Division, industry in South Africa is entering a 'K-shaped' recovery to the pandemic. Such a recovery is when different parts of the economy recover at different rates, times, or magnitudes after a recession.

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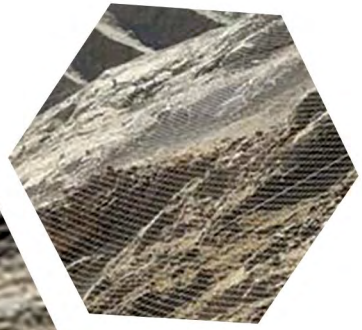

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20 YEARS OF EVOLUTION IN CEMENT, AGGREGATE, CONCRETE

In celebration of 20 years of Construction World's *annual Best Projects Awards, this cover article explores the evolution of cement, aggregates and concrete over the past two decades – and the contribution made by AfriSam over this period.*

As the official sponsor of the AfriSam Innovation Award for Sustainable Construction, AfriSam is committed to advancement and best practice in the sector, according to sales and Marketing Executive Richard Tomes.

"It is commendable that *Construction World* has regularly hosted the Best Projects Award, and we regard the event as an important date on the industry's calendar," says Tomes. "This kind of recognition of excellence is vital to spur the construction sector onto greater heights, especially with the range of challenges it faces today."

He notes that the cement sector has had its fair share of ups and downs over this time. South Africa's re-entry into the global economy after its first democratic elections in 1994 saw the disbandment of the government-sanctioned cement cartel, in accordance with World Trade Organisation principles of fair competition. The years that followed saw the two largest global cement players moving into the local market, with AfriSam (then Alpha) becoming part of Holcim and Blue Circle being acquired by Lafarge.

Boom times

"The new government's Reconstruction and Development Programme spurred a number of housing programmes, which created added demand for cement and concrete products," he says. "The real boom for the sector, however, came in 2004 when South Africa won the bid to host the FIFA Soccer World Cup in 2010."

This led to a spike in infrastructure investment, from the building of the Gautrain and upgrading of soccer stadiums and airports, to the roll-out of new road networks and associated structures. Local cement production capacity at that stage stood at about 7 million tonnes, he says, but demand grew rapidly and peaked at 15 million tonnes in 2007.

"Local producers ran out of capacity and – with good margins at the time – opted to import cement to supplement requirements," he says.

"It was essential that the country meet the demands and deadlines for this prestigious global event, which promised so much in terms of visitors, tourism and our international reputation."

Market set-backs

The demand growth also stimulated more local cement capacity with new facilities and kilns, as well as the entry of two new players who each built their own production facilities in the country. Sadly, the good times were not to last; 2008 saw a global financial crisis which caused economies to slow drastically, and the start of considerable political uncertainty at home.

By the time South Africa's two new cement producers brought their plants on-stream in 2015 and 2016, trading conditions had worsened, and a price war had ensued – reducing margins for all players. Tomes notes that margins in the cement sector have dropped by two-thirds since 2010.

"With a steady decline in government spending on infrastructure since 2015, the demand for cement has continued to suffer," he says. "This has led to a situation where the industry's supply capacity is around 20 Mt, while the demand is only about 13 Mt."

Sustainability

Despite the challenging market conditions in recent years, AfriSam has remained at the forefront of technical advances to reduce carbon emissions and the overall environmental impact of cement production. These have been driven by the imperatives of both commercial efficiency and environmental sustainability, according to AfriSam Executive Cementitious Hannes Meyer.

"Over the past 20 years, we have reduced the volume of carbon dioxide produced per tonne of cement by about 30%," says Meyer. "Our drive to cut greenhouse gas emissions began as early as 2001, focused initially on finding ways to use less clinker in our cement as clinker production is energy intensive."

The energy consumed in making an ordinary Portland Cement can be up to 25% more than the extended or composite cements that the company has developed, with the inclusion of fly ash or ground granulated blast-furnace slag. With leading experts in the organisation, AfriSam has been a leader in composite cement technology, creating benchmarks for others to follow, he says.

"We have even gone another step further in terms of

AfriSam has evolved its operations in many ways to be good neighbours.

Opposite (from left): Over the past 20 years, AfriSam has reduced the volume of carbon dioxide per tonne of cement by about 30%; AfriSam's technological advances have included the use of specialised grinding aids, adding these to the milling process; AfriSam has about 20 000 different concrete mixes on its database; and The 2010 Soccer World Cup led to a spike in infrastructure development.

mechanically or chemically activating our additives," he notes. "This allows us to achieve much higher reactivity from our extenders, so that we can extend further still. For the past couple of years, AfriSam has also been working on changing the mineralogy of clinker to make it more reactive."

Grinding aids

The company's technological advances have included the use of specialised grinding aids, adding these in the milling process. Using surface tension, having as its ultimate task the prevention of cement particle re-agglomeration during and after the milling process, these additives help to make material more flowable and easier to break down. These are specific to the different extenders used in the manufacturing process.

"We also enhance the strength of our cements with additives like these, helping with cement hydration and strength development," he says. "These strength enhancers or admixtures can improve early strength by 10-15%. The result is less clinker per cubic metre of concrete and so less energy is required and less carbon dioxide is emitted."

Conserving power

Thermal energy has traditionally been a major cost in cement making, and AfriSam has over the past two decades explored alternative fuels extensively. The burning of used tyres in an environmentally controlled manner, for instance, has been implemented to some extent, while it is hoped that greater government facilitation could increase these levels. Carbon sludge is also being burnt, replacing up to 10% of coal-based energy.

"We have invested in a multi-channel, high-efficiency burner at one of our cement plants and plan to install another, which can accommodate five or six different fuels at a time," says Meyer. "This not just allows alternative fuels to be used, but also reduces nitrous oxide emissions."

He highlights the technological developments in dosing and metering systems in cement plants which have become more accurate and more controllable. These in turn achieve better energy efficiency, by not exceeding the energy requirements necessary for chemical reactions.

"The life of the burning zone refractories in our kilns have also been improved, allowing kilns to run continuously for longer," he says. "By running our kilns more reliably through our AfriSam Way maintenance approach, we have doubled the life of kiln refractories – giving us more uptime."

Changing face of quarrying

The past two decades have also seen considerable change in the readymix and aggregate sectors, where AfriSam has long been among the leaders in the local market. Construction Materials Executive Avi Bhoora notes that a significant shift was when mineral rights became vested in the state, and quarries fell under the same regulations as large mines.

"Urban growth in South African also meant that our quarries – located in what were quite rural areas – now felt the encroachment of industrial and residential areas," says Bhoora. "In line with our philosophy of respecting people and planet, we have evolved our operations in many ways – to be good neighbours." This has affected many aspects of work, from drilling and blasting to loading and hauling, and even working hours. Innovations have had to address key areas of concern to the social and natural environment, including dust control, noise abatement and vibration control. The proximity to living areas is exemplified by the position of it Jukskei quarry, for instance; once a remote site between Johannesburg and Pretoria, the quarry now has the Mall of Africa, light industry and residential suburbs on its doorstep.

Being classified as mining operations, quarries have also been required to develop and apply Social and Labour Plans. AfriSam has aligned its policies and practices accordingly, and often goes beyond compliance to ensure that it maintains a resilient social-licence-to-operate among stakeholders.

Greener readymix

AfriSam's readymix operation, the other pillar of its vertically integrated structure, has seen considerable evolution in the last 20 years, he says – not least as a result of the environmental sustainability imperative.

"In the same way that we have evolved our cement for lower carbon emissions, so our readymix products have also followed this path – using less clinker and cement," he says. "One of the impacts of this is less water in the mix to lubricate the particles, so our aggregates have to be smoother and have better workability."

To manage the void content in the mix, a more continuous grading of aggregate is necessary. Developing and applying technology to achieve all these outcomes has therefore been vital to drive AfriSam's objectives of performance, efficiencies and sustainability.

Spoilt for choice

Bhoora notes the diversity in concrete strengths and mixes that has been developed over two decades. When he joined the sector some 30 years ago, 20 to 25 MPa was regarded as adequate for most building and construction applications.

"Today, it is common for us to receive requests for strengths of 60 to 80 MPa, and we recently were asked to supply concrete specified to 110 MPa for basement pillars," he says. "Combining our expert skill sets with the latest technologies, AfriSam has about 20 000 different concrete mixes on our database."

In the short time since the millennium, the world of cement, aggregate and concrete has covered considerable ground – with AfriSam often leading the charge to a greener future. ■

CELEBRATING 20 YEARS OF EXCELLENCE

Construction World's *Best Projects Awards was held for the 20th year on 3 November. The black tie event, hosted at Victoria Yards in Johannesburg, was attended by 150 people.*

Best Projects is the only award in South Africa that celebrates excellence across the entire built environment and recognises civil engineers, building contractors, specialist contractors and suppliers, architects and consulting engineers. In addition, the 'Innovation award for sustainable construction' sponsored by AfriSam is given to excellence in construction sustainability. AfriSam has also been the main sponsor of the event since Best Projects' inception. They were joined by Den Braven (bronze sponsor), Sika (associate sponsor) and Cement and Concrete South Africa (sponsor).

Best Projects are independently judged by stalwarts of the built environment: Trueman Goba, Nico Maas and Uwe Putlitz. Despite challenging times in the construction industry, 2021 had a healthy 56 entries with more projects than any year before receiving recognition – testament to the fact that excellence triumphs, even in tough times. In the 'Civil Engineering Contractors' category, the winner of the award is the impressive 'Relocation of the 30 Mℓ Khutsong Reservoir' (Quantibuild) while a Highly Commended award was given to 'New Ashton Arch' (AECOM).

The 'Building Contractors' category attracted 15 entries. The winner in this category was 'Hensoldt Optronics' (WBHO), a Highly Commended award was given to 'Castle Gate Lifestyle Centre' (WBHO), while both 'Jubilee Hospital' (Concor Construction) and the 'MSC new passenger terminal' (Stefanutti Stocks Coastal) received Special Mention awards.

Sika South Africa was the Winner in the Specialist Contractors or Supplier category for 'New Ashton Arch'. A Highly Commended award was given to 'Thornwood embankment rehabilitation' (Keller Geotechnics), while the company also received a Special Mention award for 'Northfield Business Park Ground Improvement'.

Competition was fierce in the Consulting Engineer category and this resulted in six awards being made. Hatch Africa triumphed with its project 'Moving Kenmare wet plant B to Pilivili'. Three Highly Commended awards were given: 'New Ashton Arch' (AECOM), 'Design and Construction of the 25 Mℓ reinforced concrete Emoyeni Reservoir' (Knight Piésold Consulting) and 'Construction of Neckartal Dam and Phase 1 Bulk water supply' (Knight Piésold Consulting). Special Mention Awards were given to 'Oceans' (Sutherland) and '16 on Bree' (Zutari).

'Jewel City: a mixed-use urban renewal project' (GASS Architecture Studios) was the winner in the 'Architects' category, while '52 Katherine Street'(Paragon Architects) and 'Kasteelpark Office Refurbishment' (Boogertman + Partners Architects) both received Highly Commended awards. The latter also received a Special Mention Award for both 'Greenbay and Greenlee' while Vivid Architects received a Special Mention for 'Bridgewater'.

The judges commented that completion was tough in the AfriSam Innovation Award for Sustainable Construction. The eventual winner was 'Vopak Terminal Lesedi – Administration building' (Zutari). Highly Commended Awards were given to '16 on Bree' (Zutari) and 'Radisson RED – Oxford Parks' (Concor Construction). Special Mention Awards went to both 'Witzenberg Zero Waste to landfill pilot project' (JG Afrika) and 'Project Mariachi' (WBHO). ■

THE JUDGES

TRUEMAN GOBA

- Registered professional engineer since 1983
- Established Goba Maohloli & Associates, which later merged with Keeve Steyn to form what became Goba, now part of Hatch Africa.
- President of the SA Academy of Engineering
- Honorary Doctorates in Engineering awarded by Stellenbosch University, KwaZulu-Natal and McMaster in Canada

NICO MAAS

- Masters degree in Civil Engineering
- Chairman of Gauteng Piliing
- Chairman of Federate Employers Mutual
- Former cidb board member
- Past President of MBA North and MBSA

UWE PUTLITZ

- Professional Architect, Construction Project Manager and fellow of the RICS
- Appointed as CEO of Joint Building Contracts Committee in 2011
- Part-time lecturer and external examiner since 2009 and currently a visiting lecturer at the School for Construction Economics and Management at the University of the Witwatersrand
- Member of SACPCMP's panel that reviews and interviews prospective construction managers
- and construction project managers for registration.

LUCKY DRAW WINNERS

Concor sponsored a luxurious hamper
Concor is a diversified infrastructure construction company with core competencies in infrastructure development, building, property development and opencast mining.
Seen above is Martin Muller (right), Contract Manager at Concor handing over the hamper to Gordon Jackson (Hatch).

Makita sponsored a DHP482RFE 18V Cordless Impact Driver Drill Kit
The kit includes the Cordless DHP482Z Impact driver drill, two 3.0Ah 18V LXT Lithium-Ion Batteries and the DC18RC Fast Charger all in a handy carry case.
Erna Oosthuizen, Construction World's *Advertising Manager, handed over the prize to Jacques Pansegrouw (GASS Architecture Studios).*

NGAGE sponsored a Google nest mini smart speaker
If you are looking for an industrial marketing and communications expert, look no further – NGAGE is known as the go-to Agency for Industry. NGAGE offers Public Relations, Technical Writing, Advertising, Design, Video Production and Social Media Services.
Renay Tandy, Communications Director at NGAGE handed over the prize to Willem Botha (Zutari).

Icon sponsored a Nespresso machine
Icon Group is a trusted provider of bulk earthworks, demolitions and civil engineering construction services that are needed to get a commercial, industrial or mining site into an ideal state of build readiness.
Bernadette McIvor, Marketing and HR Administrator of the Icon Group handed over the machine to Michelle Fick from CHRYSO.

BEST PROJECTS AWARDS SPONSORS

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Den Braven Sealants – Do it right the first time
Bronze Sponsor and also the sponsor of the Architects Category

BUILDING TRUST – Sika
Associate Sponsor

Cement & Concrete SA
Sponsor
Cement and Concrete Society South Africa

CIVIL ENGINEERING CONTRACTORS: Winner – Relocation of the 30 Mℓ Khutsong Reservoir
(From left) Michael Benhura (Morad Consulting); Neil van der Wat (Quantibuild); Khosi Radebe (Morad Consulting); Nadine du Toit (Quantibuild); Willem Manders (Quantibuild); Tim Dubber (Res Spec) and Sheldon Temlett (Quantibuild).

BUILDING CONTRACTORS: Hensoldt Optronics – Leandro Feiteira (left) and Kenton Rhodes (WBHO).

BUILDING CONTRACTORS: Highly Commended – Castle Gate Lifestyle Centre
(From left) James van Jaarsveld; Ivan Viljoen; Werner Lourens; Jackie Chipa; Leandro Feiteira; Kenton Rhodes and Jako Badenhorst (WBHO).

BUILDING CONTRACTORS: Special Mention – Jubilee Hospital
(From left) Gideon Grobler (That Interesting Company); Nasreen Motara (Motara Consulting Quantity Surveyors); Hope Selolo (Concor); Rui Santos (Concor); Sakela Sifuba (Concor) and Deon Van Onselen (Osmonde Lange Architects).

'New Ashton Arch' won three awards: it was the winner in the Specialist Contractors or Suppliers category and was Highly Commended in both the Civil Engineering and Consulting Engineers categories. Back (from left): Jacqui Gooch (WCG); Merwyn Fischer (All-Weld); Shaun Saxby (Sika); Louise Buys (AECOM); Paul Adams (Sika) and Marike Meier (Aecom). Front: Melanie Kemp-Hofmeyr (WCG) and Philip Ronne (AECOM).

BUILDING CONTRACTORS: Special Mention - MSC new passenger terminal Sergio Cunha (Stefanutti Stocks Coastal) and Ross Volk (MSC) (right) .

SPECIALIST CONTRACTORS OR SUPPLIERS: Keller Geotechnics received both a Highly Commended ('Thornwood embankment rehabilitation') and a Special Mention ('Northfield Business Park Ground Improvement'). From left Jaco Pienaar; Devendra Lalbasanth; Lafras Uys; Brian McDonald; Nicol Chang; Dulce Simoes and Brett Markides (Keller Geotechnics).

CONSULTING ENGINEERS: Winner - Moving Kenmare Concentrator plant B to Pilivili From left: Conrad Blake (Hatch); Leon van Heerden (Hatch) ; Nico Cipriano (Hatch); Garry Wrightson (Kenmare); Gordon Jackson (Hatch); Pierre Olivier (Hatch); Willem Groenewald (Hatch) and Gary Short (Kenmare).

CONSULTING ENGINEERS: Knight Piésold won two Highly Commended awards for 'Construction of Neckartal Dam Phase 1 Bulk water supply' and for 'Design and Construction of the 25 Mℓ reinforced concrete Emoyeni Reservoir'. From left: Vishal Haripersad; Edwin Lillie; David Stables; Sharlenee Moodley and Leon Furstenberg (Knight Piésold).

CONSULTING ENGINEERS: '16 on Bree' received a Special Mention Award in the Consulting Engineers category, but also a Highly Commended Award in the AfriSam Innovation Award for Sustainable Construction category. From left: Joe Ndala; Jaco de Villiers; Nick Bester; Eduard Vorster and Emmanuel Makhele (Zutari).

CONSULTING ENGINEERS: Special Mention: Oceans – Ian van Rooyen (left) and Jermaine Pillay (Sutherland).

ARCHITECTS: Winner (left) – Jewel City: a mixed-use urban renewal project . (From left) Jacques Pansegrouw; Marco Teixeira, Georg Van Gass and Wandile Mntambo (Gass Architecture Studios).
RIGHT: Boogertman + Partners Architects won two awards. It received a Special Mention for both 'Greenlee' and 'Greenbay' and a Highly Commended award for 'Kasteelpark Office Refurbishment'. From left: Salome Richter; Alexander Evdemon; Stefan du Plessis; Marius Badenhorst; Ruan Jansen van Rensburg; Christa de Waal; Hatim Hassan and Leanie van Brummen. Front: Trishal Ramjee and Natasha Swartz.

ARCHITECTS: Highly Commended – 52 Katherine Street
(From left) Rangano Mutezo; Warren Wesson; Arthur Davies; Michael Botha and Huzaifah Kathrada (Paragon Architects).

AFRISAM INNOVATION AWARD FOR SUSTAINABLE CONSTRUCTION: Winner – Vopak Terminal Lesedi: Administration building
(From left) Willem Botha (Zutari); Joe Ndala (Zutari); Jana Jooste (Zutari); Ivan Sibisi (Vopak); Sebastian Hoyland (Zutari) and Eduard Vorster (Zutari).

AFRISAM INNOVATION AWARD FOR SUSTAINABLE CONSTRUCTION: Highly Commended – Radisson RED: Oxford Parks
(From left) Rui Santos; Martin Muller; Blaine van Rensburg and Sakela Sifuba (Concor).

AFRISAM INNOVATION AWARD FOR SUSTAINABLE CONSTRUCTION: Special Mention – Project Mariachi (From left) Franco Trosello; James Mthembu; Llodi Langa; Theodorus le Roux, Sibusiso Mwandla and Jako Badenhorst (WBHO).
RIGHT: Special Mention: Witzenberg Zero Waste to landfill pilot project (From left) Litha Peter; Boipelo Madonsela; Zuleika Silinda and Kabelo Matabane from JG Afrika.


Menu
Sliced Fillet Medallion served Medium Rare on a Buttered Crostini with Chimichurri, Cauliflower Butternut Puree and Red Wine Reduction
/
Wild Mushroom and Truffle Risotto with Mascarpone, Crispy Onions and Shaved Parmesan
Dessert
Pavlova with Custard, Torrone and Summer Berries
/
Baked Chocolate Mousse with Chocolate Crumble, Orange Gel, Salted Dulce de Leche and Berries


Warren Wesson
Paragon Architects
Shaun Sandy
Sky Lit
Vishal Haripersad
Knight Piesold
Sharlenee Moodley
Knight Piesold
Trueman Goba
Judge
Sergio Cunha
Stefanutti Stocks
Coastal
Trishal Ramjee
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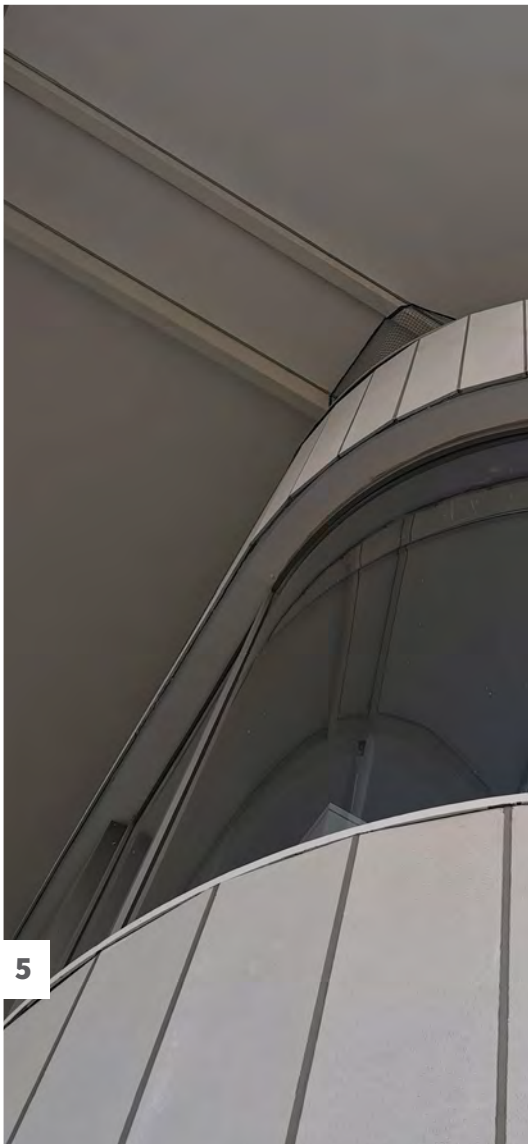

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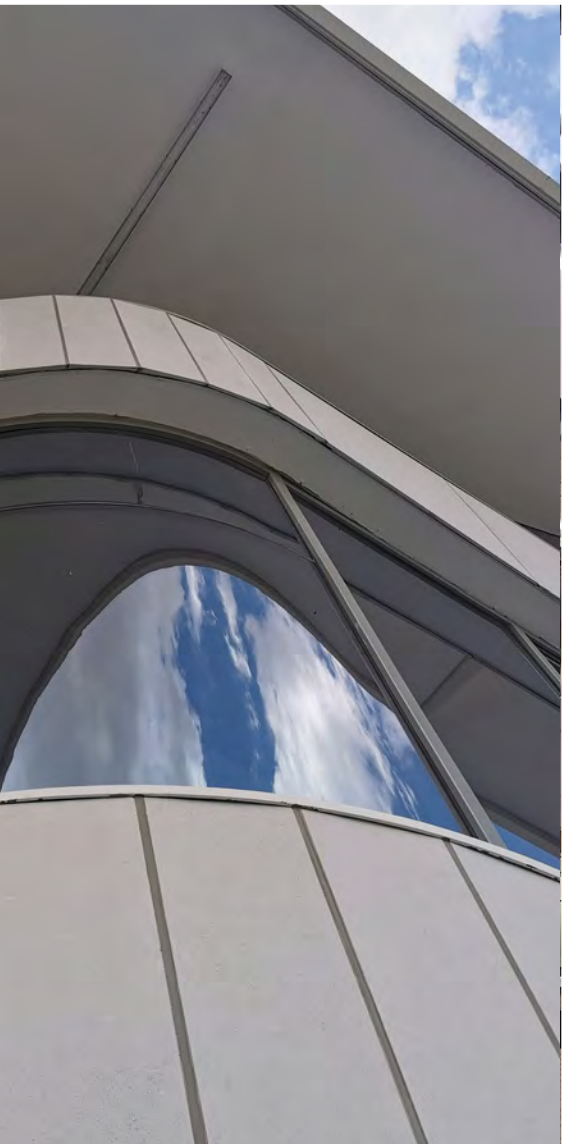
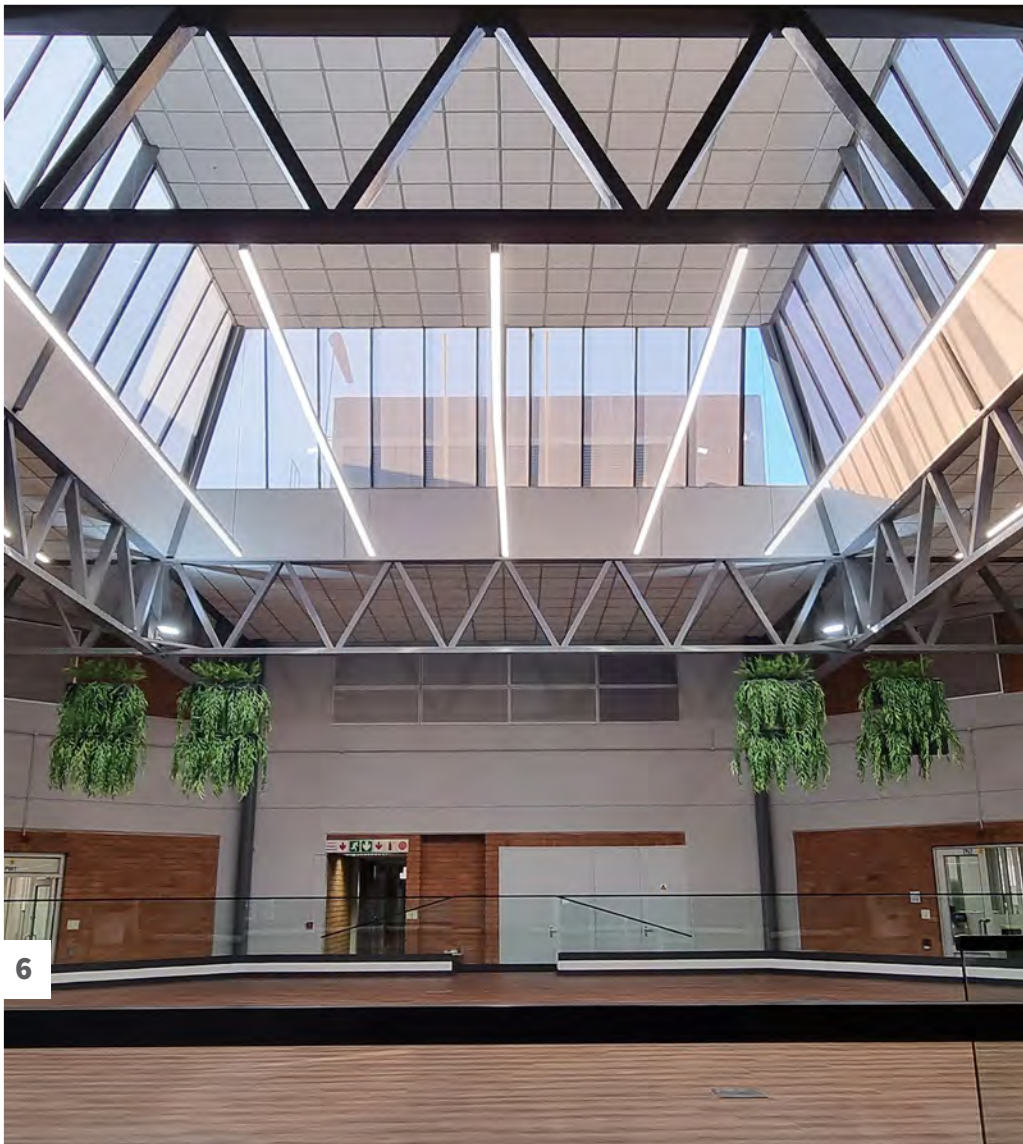
3

Captions for this spread

1. Relocation of the 30 Mℓ Khutsong Reservoir
2. New Ashton Arch
3. Moving Kenmare Concentrator Plant B to Pilivili
4. Jewel City
5. Vopak Terminal Lesedi – Administration building
6. Hensoldt Optonics





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RELOCATION OF 30 Mℓ KHUTSONG RESERVOIR

The community of Khutsong is located on the West Rand of South Africa near the mining town of Carletonville. Given the dolomitic geology, sinkhole formation is a common occurrence in Khutsong. When sinkholes form, the local municipality are often required to repair, rebuild or relocate infrastructure to ensure its residents are safe and that service delivery continues. The relocation of the 30 Mℓ Khutsong reservoir is one such project undertaken by the Merafong City Local Municipality.

The existing reservoir servicing Khutsong Extension 3 is currently unable to retain water due to formation of a large sinkhole under the reservoir floor. The relocation project involves constructing a new thirty mega-litre reservoir and supporting infrastructure several hundred meters away from the existing, unused reservoir.

The supporting infrastructure includes connecting pipelines for both the supply to and distribution from the reservoir, a pump station and general facilities for accessing, maintaining and securing the infrastructure.

Following the termination of the previous Contractor in July 2020, Morad Consulting were appointed on a turn-key basis to complete the works from no-fines levels upward. Quantibuild was appointed on a design and build basis to execute a proposed alternative in December 2020. The construction physically commenced in February 2021.

As a result of the dolomitic geology, one of the major design requirements for the reservoir floor was the capacity to span a sink hole five metres in diameter whilst fully loaded to overflow height. This requirement led to the first round, prestressed reservoir raft floor in Africa being designed and constructed at the Khutsong 30 Mℓ reservoir. The basic philosophy behind the prestressing option for the floor involves applying pre-compression to the raft floor to provide additional resistance to crack inducing tensile stresses. The timing of the stressing, profile of the cables and the concrete mix design were the three critical factors to ensuring the performance of the 450 mm thick raft floor slab.

PROJECT INFORMATION

- **Company entering:** Quantibuild
- **Project start date:** 1 February 2021
- **Project end date:** 30 March 2021
- **Client:** Merafong City Local Municipality
- **Main Contractor:** Quantibuild
- **Principal Agent:** Morad Consulting
- **Project Manager:** Morad Consulting
- **Consulting Engineer:** Res-Spec
- **Subcontractor:** Amsteele Systems

The Khutsong reservoir is located on hazardous ground underlain by dolomitic rock with long-term risk of sinkhole formation. Risk mitigation measures included ground improvement, in the form of a 3-4 m thick engineered soil raft, and the specialist design of a concrete raft foundation/floor slab. The raft needed to be capable of spanning a 5 m diameter sinkhole, located anywhere under the 59,25 m diameter floor, under 12 m water load (12 ton/m^2).

Quantibuild Construction partnered with Res-Spec to offer a superior and cost-efficient PT Slab-on-grade raft solution, which ensured continued water-tightness and long-term serviceability under emergency sinkhole formation state. The solution, which was cheaper than a conventionally

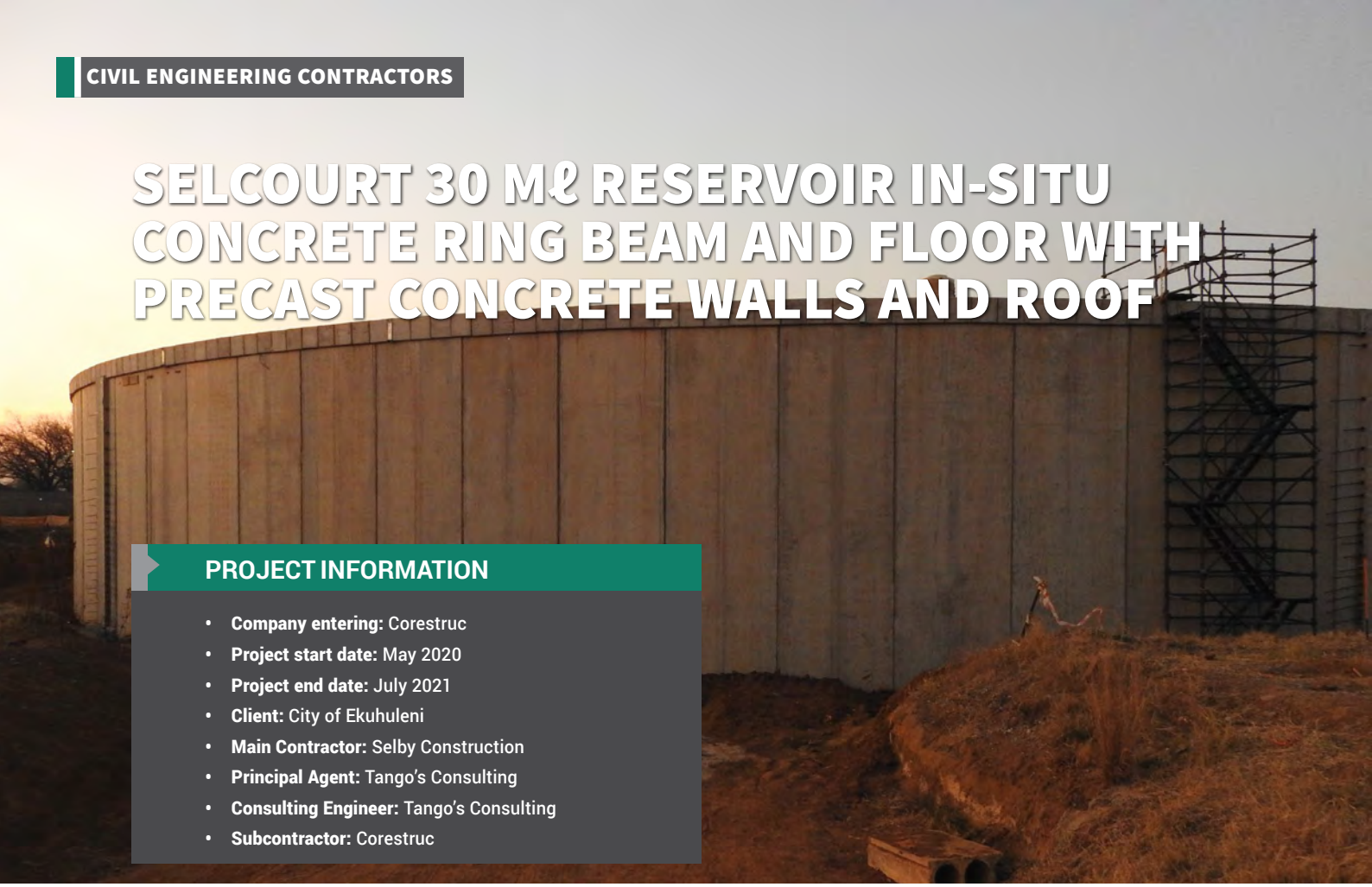
reinforced raft slab, further ensured a single-pour jointness slab construction and zero cracking under normal load conditions (not sinkhole state).

Noted savings were achieved through optimal utilisation of both prestressed and non-prestressed reinforcement in a partial-prestress crack-width design with consideration of optimal location of tendons in the section thickness.

Further savings were achieved through optimal tendon arrangement, viewed in plan. The innovative arrangement enables all PT anchorages to be aligned perpendicular to the circular edge and distributes compressive stresses economically and uniformly in both circumferential and radial directions.

As a company that specialiasing in water-retaining structures, Quantibuild is tremendously proud to have successfully pioneered the first prestressed round reservoir raft floor in Africa along with our partners Res Spec and Morad Consulting and progressive Employer, Merafong City Local Municipality. In terms of both technicality, economy and long-term sustainability, the application of prestressed raft floors in round reservoirs should become standard practice for the dolomitic regions throughout South Africa. The solution has provided substantial saving to the Employer and will one day soon provide substantial improvement to the quality of life of the Khutsong community. ■

SELCOURT 30 Mℓ RESERVOIR IN-SITU CONCRETE RING BEAM AND FLOOR WITH PRECAST CONCRETE WALLS AND ROOF



PROJECT INFORMATION

- **Company entering:** Corestruc
- **Project start date:** May 2020
- **Project end date:** July 2021
- **Client:** City of Ekuhuleni
- **Main Contractor:** Selby Construction
- **Principal Agent:** Tango's Consulting
- **Consulting Engineer:** Tango's Consulting
- **Subcontractor:** Corestruc

A newly built 30 Mℓ reservoir in Selcourt has introduced a more efficient manner of constructing these technically complex water-retaining structures to Ekurhuleni Metropolitan Municipality. The municipality has embarked on a large water-augmentation programme to ensure water security in its jurisdiction and was, therefore, willing to test new technology that would enable it to deliver this vital service-delivery infrastructure quickly. The technology also enables the construction of final structure that is of a very high quality and provided notable savings in construction costs for the client.

The reservoir was built by Selby Construction and the construction programme supervised by Tango's Consulting. As the design engineer, Tango's Consulting also reviewed the technology to ensure that it was structurally sound and adapted it to this project. This was undertaken together with the designer and developer of the technology, Corestruc.

The technology was introduced to the professional team by Selby Construction which had worked with Corestruc on previous projects and was, therefore, aware of the quality of its precast-concrete systems and workmanship on site.

Constructing reservoirs have traditionally been a very complex undertaking. Using conventional cast-in-place methods, the reservoir wall is constructed first. The task at hand entails significant steel-fixing and the onerous process of installing the side shutters.

Once the wall and insitu columns have reached their final height, work commences on the roof of the structure. This entails installing many tons of scaffolding inside the reservoir to support the forms for the frame of the roof structure.

Corestruc commenced manufacturing the roof and wall of the reservoir at one of its factories during the bulk earthworks and site terracing stages. The assembly of the inner-portion of the concrete roof was completed while the principal contractor constructed the ring foundation for the precast-concrete panels that make up the wall of the structure.

The roof structure comprises precast-concrete columns that are placed and grouted onto insitu stubs or bases that are constructed by the principal contractor while the precast-concrete system is being manufactured. These concrete columns support precast-concrete beams and hollowcore slabs. The hollowcore slabs are stitched together to create a single monolithic slab and a precast-concrete coping installed around the circumference of the reservoir as part of the final phase of the construction programme. Corestruc achieved tolerances of 20 mm on this aspect of the construction programme – and this was while working at heights.

Construction then commenced on the wall with the placement of the first panel onto the ring-beam. It was supported temporarily and then with the other precast concrete elements to mitigate the need for extensive propping and, in so doing, freeing up space on the construction site.

Unbonded cables were installed through the sleeves that were strategically positioned and cast into each precast-concrete panel at the factory. They are also installed between the joints between each precast-concrete element. These unbonded cables are tensioned via the four buttress panels, which are equally spaced around the circumference of the reservoir.

The joints between the panels were then sealed with rubber gaskets before a low viscosity grout was pumped around the circumference of the reservoir in a controlled manner. Cooled to ensure its flowability while it was being pumped, the grout is self-healing and reaches compressive strengths of up to 100 MPa in a short period. Before the grout reached this compressive strength, the cables were stressed to their specified yield.

The wall was then pinned by casting a 200 mm to 250 mm high reinforced kicker on the wall footing on both sides of the panel. While work proceeded with the construction of the reservoir, the principal contractor completed the ancillary works, including the inlet and outlet chambers, as well as all the interconnecting pipes. ■

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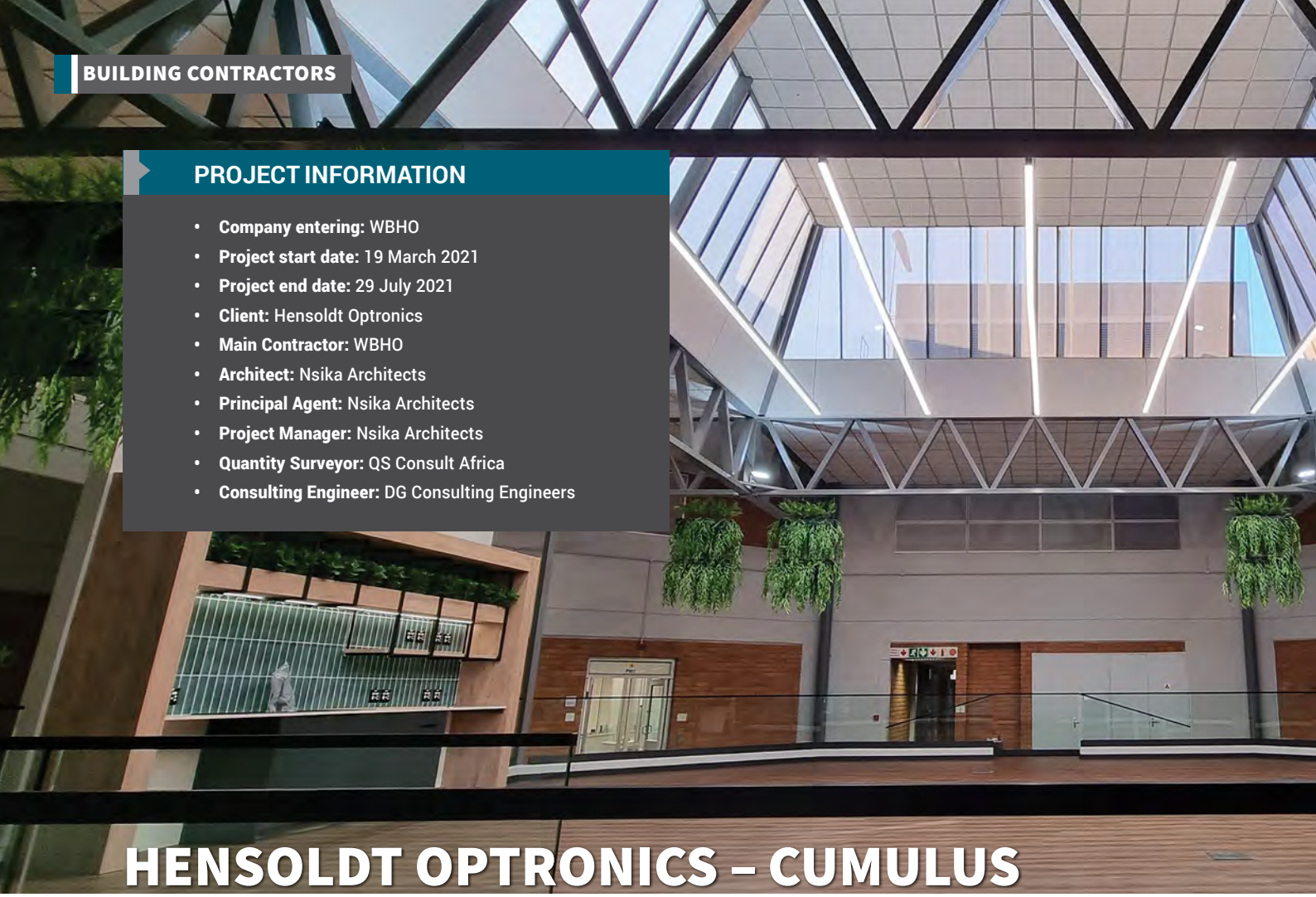


PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 19 March 2021
- **Project end date:** 29 July 2021
- **Client:** Hensoldt Optronics
- **Main Contractor:** WBHO
- **Architect:** Nsika Architects
- **Principal Agent:** Nsika Architects
- **Project Manager:** Nsika Architects
- **Quantity Surveyor:** QS Consult Africa
- **Consulting Engineer:** DG Consulting Engineers

HENSOLDT OPTRONICS – CUMULUS BUILDING UPGRADE

Hensoldt Optronics is an innovative, German-owned company which specialises in the development and manufacturing of UAVs, gimbals, sub-marine periscopes, long range ordinance guidance systems, cyber security and surveillance equipment. The equipment is supplied to military, policing and private sectors worldwide. Hensoldt is currently tenants at three buildings inside Denel's Centurion Office Park, which is a National Key-Point facility.

The Cumulus Building, constructed in line with Nuclear Building Codes in the 1980s, is an ideal facility to produce the wide variety of Hensoldt's products. WBHO were tasked with upgrading the existing Cumulus building to ISO 5, 6 and 8 quality production areas, fully upgrading the toilet cores, introducing an Agora Café as well as upgrading the existing office spaces. All access, demolition, service installation, wet works and finishes to the 7 900 m² footprint were rolled out while the tenants were still fully operational.

The site condition requirements were extremely specific, which made the project execution very unique. WBHO was literally operating as a building site inside a clean room quality environment. Each morning started at 6:30 with screening contractors outside of the main facility entrance gate. Planning, access, logistics, safety requirements and protection of existing works were discussed prior to work starting at 7:00. The contractor would begin by laying down carpet protection on top of the existing ESD Vinyl Flooring, protecting walls with cardboard and covering sensitive equipment with plastic sheets.

The project was split into eight sections which included: ablution blocks, office quadrants, an external covered walkway, production laboratories, a laser laboratory, storage facilities, change-rooms, blacked-out rooms and new staff canteen. Each scenario had to be treated differently based on the direct implication to client production requirements.

Ablution blocks were demolished from the inside out with the doors and grilles sealed until the dust-producing works were complete. Work inside open areas were scheduled for weekends and after hours with daily tenant cleaning teams processing the sensitive areas before the client production proceeded. Laboratories and office areas were boarded and sealed in drywall segments. These segments needed to be fully complete before starting a new area.

Based on the project's extreme sensitivity to dust, noise and vibration, the use of vacuumed power tools was implemented where possible. New floor and wall chasing as well as grinding was kept to a minimum. Any gaps at the working perimeter were sealed with masking tape and were only opened at lunch times and at the end of shifts. The HVAC system was manipulated to create positive pressure in the areas where the client was busy with production.

With the building being over 30 years old and having several previous upgrades, no as-built information or drawings were available to do service installation from. Reusing and tying in to existing services proved to be an incredible challenge. Very few electrical circuits were labelled, services ran in the floors, walls and ceiling voids with little respect to current building best practices. Manufacturing the kind of products that Hensoldt is responsible

for requires a complex array of services which had to be re-routed, blanked off, extended and installed from first fix.

The area in which the project is situated is considered to be a brown-field site and as such, the environmental sensitivity of the surrounding land is considered low. While there were no formal environmental requirements for this project, WBHO's internal Environmental Management System was implemented for the duration of the project. Through the implementation of this, there were a few potential risks identified prior to construction.

Sections had to be handed over to a high quality standard in order to minimise the amount of rework once Hensoldt had taken occupation of an area. Any additional scope or snag related works were actioned after hours. The project recorded a total of 299 snags with nine remaining at PC. This translates to one snag every 9 m². Every interim PC date was achieved during the project, with some dates being achieved early. The project as a whole was also handed over on time. ■

CASTLE GATE LIFESTYLE CENTRE

The Castle Gate Lifestyle Centre commenced construction in September 2019 and would undoubtedly be a project filled with both challenges and ultimately successes that the team celebrated in its entirety at the Centre's grand opening on 26 November 2020.

The contemporary Industrial and farm style retail Centre covers an area of approximately 19 700 m² GLA.

The parking area consists of 1 174 parking bays over an area of approximately 29 500 m² and facilitates a market from time to time that ties in to the central open food court between the contemporary industrial, farm style restaurant blocks.

The construction of the retail centre took 14 months in total (Including a three month lockdown) and consumed approximately 8 500 m³ of concrete as well as roughly 400 tons of reinforcing.

The retail centre is comprised of six blocks, four of which have anchor store's located within the blocks. The individual blocks are connected with external walkways and a central open air park area surrounded by concrete and steel trees that support the external walkway canopies. All façades were constructed with a locally sourced and manufactured face brick. Wall panels constructed include standard stretcher bonds to curved, ventilated Flemish bonds.

The central tower is cladded in a ventilated Flemish bond face brick and represents an old industrial style brick factory chimney with exposed steel beams that tie it together. The internal structure of the tower is made up of four concrete columns rising to a height of 18 m with two internal slabs to house air-conditioning plant for the tenants below.

The top of the tower holds a structural steel box cladded in aluminum and glass. The entire tower is illuminated in the evenings. Over 125 m of 3 m high off shutter concrete retaining walls were constructed on the northern perimeter of the site. This also included eight 12 m off shutter Class 1 concrete signage pylons with LED lights. These columns were cast in a single lift and the team made use of high frequency internal and external vibrators to ensure a high level of quality in terms of the concrete finish.

The catchment area of the roof structures totaling 26 850 m² feeds the concrete gutter slabs that in turn act as a catchment and channel for storm water off the main roof structures and feed a 100 000 ℓ capacity stormwater harvesting and water filtration plant that supplies potable filtered water to the retail centre.

The location and geology of the terrain added a challenge with regards to the design and installation of wet services

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 19 August 2019
- **Project end date:** 26 November 2020
- **Client:** Atterbury Properties
- **Main Contractor:** WBHO
- **Architects:** Boogertman + Partners Architects
- **Project Manager:** Boogertman + Partners Architects
- **Quantity Surveyors:** Norval Wentzel Steinberg
- **Consulting Engineer:** DG Consulting Engineers

below the ground. Due to the presence of dolomite in the area, sewer, stormwater and water mains reticulation needed to be installed within a dual containment system. The total square metres of asphalt imported equated to 35 810 m^2 and over 4 400 m^3 of G1 for the asphalt.

Developing in the area identified for the retail centre 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.

Quality Assurance of the retail centre was of the utmost importance and essential to the WBHO team. It constructed the building to the best quality, as the company knew that if it did not, it could have a negative impact on the life span and life cycle of the building. Of specific interest were the high specification floors within the Builders Warehouse and Woolworths. These concrete casts were monitored off site during and post cast by CCTV surveillance to ensure every truck was accounted for and night shift teams completed their works effectively.

If the level of quality required by the client was not achieved, this would negatively impact the building in respect to construction safety, services, costs, maintenance and functional requirements at a later stage. This project had major constraints in terms of budget and the completion of the retail centre within the client's budget, signalled a success on multiple fronts from the entire team. ■

JUBILEE HOSPITAL

One of the fastest hospitals built to date in South Africa is the 300 bed COVID-19 facility at the Jubilee Hospital site north of Pretoria in Hammanskraal. This turnkey project set a benchmark in what can be done and one from which others will learn.

The fast track process began with an urgent Request for Proposal (RFP) from the Gauteng Department of Infrastructure Development (GDID) on 6 May 2020, requiring proposals to be submitted by 15 May 2020. This gave contractors just 11 calendar days in which to plan their respective solutions.

Leveraging its in-house capabilities and expertise – combined with close collaboration with consultants – Concor proposed an innovative solution using alternative building technology which would meet the demanding project timeline.

Just five months after work began on 27 November 2020, Concor handed the facility over to the Gauteng Department of Health.

The facility comprises 10 modular units containing 300 beds with related facilities for COVID-19 patients. Five modules are designed as 25 bed intensive care units (ICU) and include a two-bed isolation ward. The other five modules are 35 bed high care units (HCU). The ICU and HCU modules each have two separate wings with a central nurse's station, sluice and ablutions with central utility areas for offices, storage and waiting areas.

Selecting alternative building technology enabled Concor to speed up construction without compromising the standards demanded by a world class medical facility, and to meet the extremely fast track nature of the project.

The Light Steel Frame (LSF) construction methodology delivered a 50% time saving compared to traditional building methods, and was implemented using less labour and associated costs than brick and mortar construction. The low mass walls eliminated the need for heavy masonry foundations, allowing further savings.

This also reduced transportation costs with pre-manufactured LSF sections transported to site for assembly. A specialist on-site team made up the frames, facilitating closer control over sequencing and pace of the construction operation. Panels were installed between steel sections and bolted into place.

The intrinsic dimensional accuracy of the system allowed frames and trusses to be erected rapidly, significantly reducing human error and need to rework. The fast-paced erection created the opportunity to install services much earlier than would have been feasible had conventional brick and mortar construction been employed. Services such as electrics, gas and plumbing are located in the internal drywall system, facilitating a clean interior wall with improved infection control.

Super flat floors were selected for the facility enabling the rapid application of vinyl, speeding up the finishing process. This meant highly accurate transverse and longitudinal tolerances had to be achieved when pouring the readymix using specialised plant and equipment.

Concor demonstrated its commitment to socio-economic development, employing more than 230 local unskilled and skilled individuals from Hammanskraal in accordance with the government's Expanded Public Works Programme (EPWP). The company facilitated additional training for this local labour force, and these individuals received certification trades such as electrical works, plumbing and painting.

A modular approach was used in Concor's construction plan, with units completed and put into operation while others were still being constructed. This allowed clusters to be completed from mid-October 2020, with only commissioning needing to be conducted. The design brief, applied by Osmond Lange Architects & Planners,

PROJECT INFORMATION

- **Company entering:** Concor Construction
- **Project start date:** 29 June 2020
- **Project end date:** 27 November 2020
- **Client:** Gauteng Department of Infrastructure Development
- **Main Contractor:** Concor Construction
- **Architect:** Osmond Lange Architects
- **Principal Agent:** That Interesting Company
- **Quantity Surveyor:** Motara Consulting Quantity Surveyor and Farrow Laing Quantity Surveyors
- **Consulting Engineer:** Dihlase Consulting Engineers

incorporated a combination of field hospital standards and the usual Infrastructure Unit Support Systems (IUSS) requirements. This included a requirement to accommodate possible future expansion as well as future use beyond the COVID-19 pandemic.

The HVAC systems were a modular design, so all mechanical services could be in place and commissioned independently, allowing each cluster to be fully functional on its own. Using self-contained package type units, these could be zoned and sized to provide full conditioned fresh air to contaminated areas within the clusters. The manufacture and assembly of the HVAC systems was easy to accommodate and install on site, minimising effort and risk of delay.

The project management approach adopted a disciplined agile approach since the more conventional waterfall approach would not have met the stringent and highly compressed timeline. Daily sessions with key stakeholder representatives were used to collectively identify and mitigate risks while managing and monitoring integration and delivery.

Constant consultations and feedback mechanisms were in place with the client throughout the project duration.

This enabled consistent expectation management translating into client satisfaction. ■

MSC NEW PASSENGER TERMINAL

This project will be be the new Passenger Cruise Terminal (point of entry) for all cruise vessels that will berth at Durban Harbour. This project was two years in the design phase and went through many changes in the overall appearance before arriving at the current and final design we see today.

The design of the building is unique and now serves as a landmark building in the area. Such a unique design obviously came with a multitude of design challenges that needed to be overcome by the design team and the main contractor.

Using state-of-the-art 3D modelling technology the design idea was bought to life. On this project the contractor made use of BIM360 to manage, issue drawings and information. BIM360 was also used to record and manage quality control on site. Stefanutti Stocks also made use of 3D scanning technology to generate a 3D model of the as built structure prior to the structural steel being installed.

Probably the most unique and eye-catching feature of the building is the geometrically shaped roof design and subsequent multi coloured cladding. The cladding system was a proprietary system that was designed, supplied and installed by sub-contractor, MRC. The system is made up of roof sheeting that is fixed to a structural steel frame.

Another unique design feature of the building is the internal ceilings which were constructed from imported birch ply. These boards were cut into custom sized triangles and installed onto the ceiling grid which followed the shape of the roof structure.

This project, although not green star rated, does have some innovative energy saving features.

Throughout the contract duration, Stefanutti Stocks as the main contractor, sourced locally produced materials where possible. There was a waste managment system on site whereby all waste was seperated into different recepticals (steel, plastic, paper and general waste) and sent away to the necessary recycling depots.

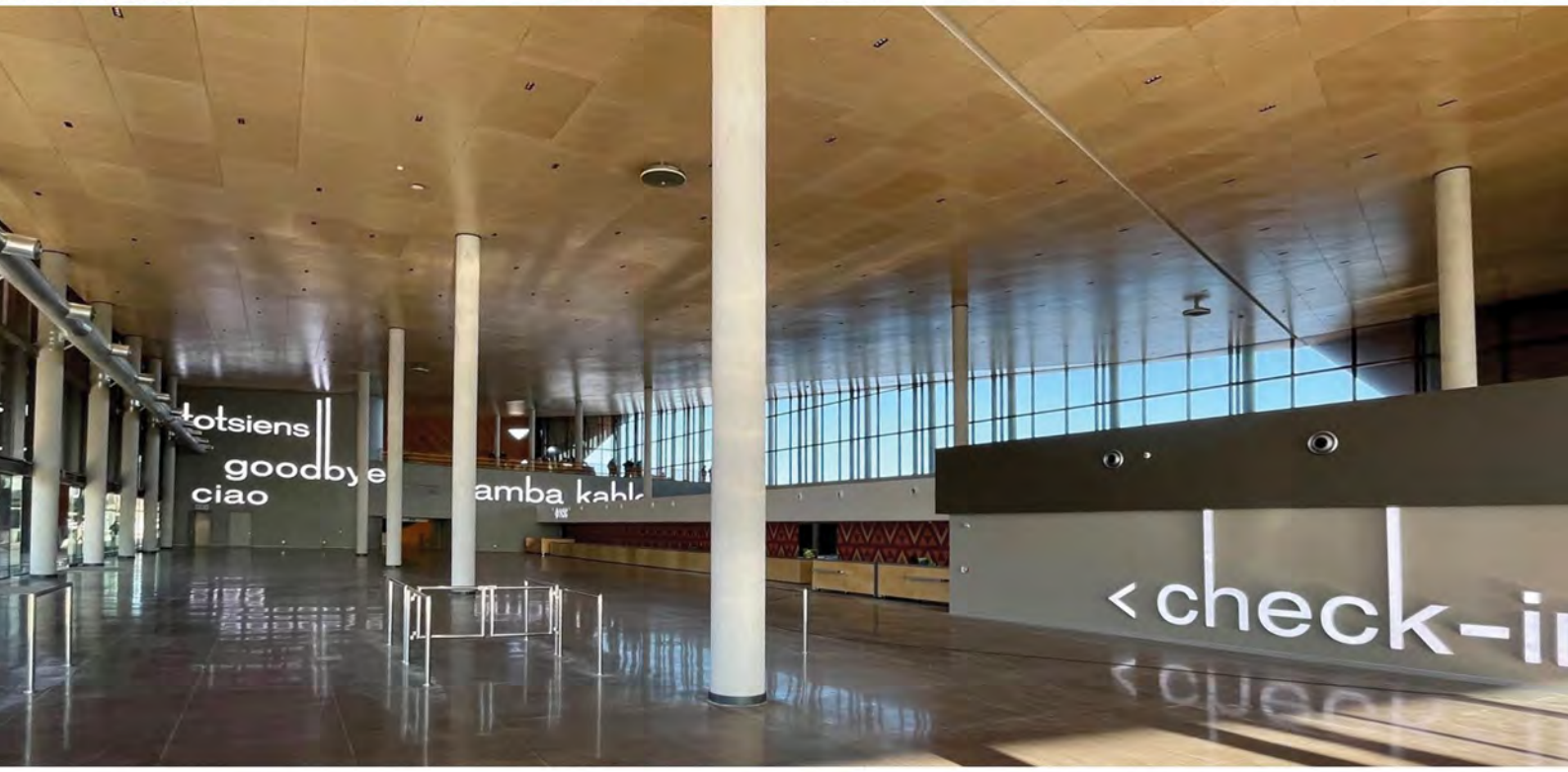
An interesting fact about this building is that it was a privately funded government institution. It is built on state owned property which serves as a point of entry. The private client invested heavily in a project that will ultimately become a state owned asset, but they felt in order to service their growing business (cruise liner tours) this was a necessary expense.

An unknown fact about this project and will mostly go unnoticed is the quay side. Due to the size of the cruise ships that will be docking alongside the terminal the keyside of 24 bollards needed to be upgraded. This was a last minute issue which was bought up at the eleventh hour.

Fortunately, with Stefanutti Stocks being a multi-disciplinary service provider it was able to provide a working solution and managed to upgrade the quayside concurrently with the construction of the terminal. ■

PROJECT INFORMATION

- **Company entering:** Stefanutti Stocks
- **Project start date:** 11 November 2019
- **Project end date:** 7 September 2021
- **Client:** KwaZulu Cruise Terminal
- **Main Contractor:** Stefanutti Stocks Coastal
- **Architect:** Elphick Proome Architects
- **Principal Agent:** Turner and Townsend
- **Project Manager:** Turner and Townsend
- **Consulting Engineer:** Arup



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100 WIERDA RD EAST

On 7 November 2019 WBHO established site in the suburb of Athol in Sandton and started construction of 100 Wierda Rd East. The building consists of a dining area, meeting rooms, gym, spa and 69 three-bedroom serviced apartments spread over five floors.

The structure is supported on load bearing brickwork from ground floor up which posted its own challenges during the structural phase. Due to this WBHO had to lay 16 000 bricks a day to make programme. This was a major challenge as the company had very little laydown area and also only had one tower crane to support the structure. This resulted in a minimum of 75 lifts a day to supply bricks, mortar, rebar, scaffold and staging for WBHO to stay on program. Another governing factor was that WBHO was only allowed to work from 6:00 till 18:00 daily as it is a residential area, thus preloading during night shift was not an option. It therefore had to work a full Saturday every week to make the production rates on the tight program.

The company's structure team did an excellent job with giving good access for the finishing team to follow on, placing tremendous pressure on the architect and consultants to issue finishing drawings on time as per the Info Schedule.

As this is the biggest development that the developer has done it came with a lot of challenges and redesigns pushing the envelope of what was possible in the time allowed for in the finishing program. WBHO also had no electrical nor mechanical engineers on the project, instead it had design and supply subcontractors who were appointed for the respective works. This made coordination a challenging task but the company had a good team to make it work at the end of the day. ■

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 7 November 2019
- **Project end date:** 15 April 2021
- **Client:** 100 Wierda Rd East
- **Main Contractor:** WBHO
- **Architects:** Miguel Cardoso & Associates
- **Principal Agent:** Davidoff Project & Development Managers
- **Quantity Surveyor:** Tricolt
- **Consulting Engineer:** DSGN Consulting

FORD FRAMELINE PROJECT SILVERTON

Ford Frameline project in Silverton Pretoria is being constructed as part of the Tshwane Automotive Hub in Pretoria for the Government. This forms part of the Tshwane Automotive Special Economic Zone (TASEZ) which is being built through a joint partnership with Ford and the Department of Trade and Industry. This as a move to consolidating office and warehouse space for Ford and will house most of the business units operating in this area supplying all the parts for the construction of there Vehicles. This facility will accommodate approximately 6 700 Ford employees. Frameline project consists of a Frameline Warehouse 53 000 m², an eCoating and Wax facility of 20 000 m², office space of 5 000 m², with a staff facility, canteen areas and basement parking.

Ford Frameline factory and ancillary works in the Tasez (Tshwane Economic Zone) is underway – to construct a factory and operation that gives the opportunity and possibility to manufacture and export Ford Automotive vehicles from the heart of South Africa. This, Ford Frameline, is one of the integral parts of the entire New Ford Facility.

The approximately 78 000 m² internal surface beds on the project required a high-quality concrete floor finish to minimise the total maintenance budget of the facility and as short as possible construction schedule. The bulk of normal floors maintenance costs are caused by the joint's failure in the form of deteriorated joint edges, damage by and to equipment such as forklifts etc. so it was decided to implement metallic floor hardener to help curb this cost.

The panel sizes were only limited by the day casting capacity. The compressive pre – stress system allowed it to have a stronger material and stiffer section along with improved drying shrinkage control. This allowed the floor to be built without traditional reinforcing thus ensuring a shorter construction period. External concrete hardstands are made up of approximately 24 000 m² of 210 mm thick concrete and paving to the area.

The roof steel structure designed by Zutari Es, for the Main Warehouse was economical at around 37 kg/m² total including columns and facades. This by using 150 deep cold formed lipped channels spanning 5 m, designed continuous over two spans at 2,2 m c/c. Internal columns on a 25 m x 25 m grid with all being full height steel columns internally. Perimeter columns are made up of reinforced concrete to 4 m above Finished Floor Level, with steel columns going to roof level. Girders at 25 m c/c, supporting trusses spanning 25 m at 5m c/c. Bottom chords of trusses and girders were horizontal and not sloping with top chord to simplify fixing of services to the steel.

The project was handed over to WBHO with the first platform ready from the bulk earthworks in February 2021 with completion expected 1 February 2022.

A project such as this always has a large value of imported component consisting of, amongst others Busbars, tiles, electrical equipment, dock levellers, sectional doors, HVAC equipment, lifts, goods hoists, generators, and floor coverings. The impact of the COVID-19 pandemic on the manufacturing of imported materials in Europe and the Far East, delays on shipping and customs delays at South African ports has been closely managed to ensure delays are minimised or mitigated to prevent any delays on the project. ■

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 28 January 2021
- **Project end date:** 1 February 2022
- **Client:** Tasez
- **Main Contractor:** WBHO
- **Architect:** dgit Architects
- **Principal Agent:** CSM
- **Project Manager:** CSM
- **Quantity Surveyor:** RPE
- **Consulting Engineer:** Zutari

BOSJES PANTRY AND SHOP

Situated in the Breedekloof Valley west of Worcester, the Bosjes Estate now includes two new structures completed by GVK-Siya Zama, the pantry (Die Spens) and deli (Die Winkel). The project boasts ecologically minded landscape design enfolding these two new structures consisting of impressive sculptural trellises that are woven back into the landscape.

Construction consisted of two conical shaped spheres, a smaller structure for offices and a boutique (shop) overlooking two symmetrical lines of lemon trees and a circular children's water play area with a fully functional Archimedes screw and a larger, lower structure that accommodates a restaurant, kitchen and ablution facilities. Both structures are submerged below ground and their entrances are hidden from visitors as they approach the gardens.

Visitors enter via a timber bridge over a stream that cascades down the full length of the site; its flow broken by robust crisp lined concrete weir walls. A path framed by locally cut stone buttress walls and trees, grasses and flowers leads down through the site and uncovers the two structures. The two buildings are fully 'enfolded' within an integrated network of landscape structures and planting that weave in the concept of working ecology into the cultural landscape.

Designed by London-based lead design architect Coetzee Steyn of Steyn Studio (who also designed the Bosjes chapel on the estate) and realised by project architect Tiaan Meyer of Meyer & Associates, the two built elements are similar in style. Their aesthetic and form were inspired by the San matjieshuis (mat house) and the first dwellings of the Dutch settlers, the kaphuis (truss house). The matjieshuis was a portable, curved, slat-framed structure covered with woven mats – used by San herders as they migrated seasonally – while the kaphuis consisted of a series of A-frame trusses covered with thatch. Like these traditional structures that blended seamlessly into the landscape, so too do the new Bosjes buildings.

(Source: *Visi Magazine*)

Both dome structures are wrapped by a lattice structure that envelops the movement zone and mirrors the roof of the domed soffits. To allow the trellis pattern to appear continuously weaved between the interior and exterior, the glazing imitates its pattern, resulting in a zig-zag arrangement to achieve alignment of the two elements.

The deli shop structure is manufactured from steel tubing while the restaurant structure consists of a layered lattice comprising four timber members. The modelling of the structural components' curvatures and connection loading points were critical. Hours of surveying and setting out to project and mark the points on the inside of the dome were required. Despite the changes in elevation and curvature, the shapes formed by the lattice structure had to remain visually symmetrical and consistent in dimension. Steel elements were rolled, and timber elements steamed and bent off site and then transported to site for installation – a moment of truth test.

Not only did the structurally glazed façade have to withstand all imposed loads and keep the water out, it also had to enable continuity of the lattice structure through to the inside of the dome – all while transferring load to the fixing points on the domed soffit. The entire façade was templated to the highest degree of accuracy possible, and the performance glazing then manufactured to suit off site.

To achieve a Class I curved concrete finish, within specified dimensional accuracy for architectural concrete elements, innovative materials and methods were employed to construct the curved water feature and play pit zones. Custom made shutters were formed using high density Styrofoam to achieve the accuracy of the radius and smooth finish in one pour.

The curved walkway and terraced dam walls were constructed and clad from natural cut stone sourced from the estate and prepared on site. This contributed to local vernacular and champions sustainability. ■

PROJECT INFORMATION

- **Company entering:** GVK-Siya Zama Building Contractors (Cape)
- **Project start date:** September 2018
- **Project end date:** May 202
- **Client:** Farmprops 53
- **Main Contractor:** GVK-Siya Zama
- **Architect:** Steyn Studio
- **Principal Agent:** Meyer & Associates Architects
- **Project Manager:** Meyer & Associates Architects
- **Quantity Surveyor:** 2ii Consulting
- **Consulting Engineer:** Grobler & Associates


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OLD CAPE QUARTER

De Waterkant, situated on the slopes of Signal Hill and overlooking Table Bay, has a history that dates to the 1 700s and today is one of Cape Town's most fashionable districts.

The project consisted of three levels of basement parking, ground floor retail, first floor offices and the addition of four floors of residential units on the existing heritage structure. The strengthening of the existing structure with three additional lift shafts and staircase shafts were constructed to carry and support the new structure. In addition the tender specification included specific instruction on various elements to achieve green star rating.

GVK-Siya Zama took site in May 2019 and the first priority was to hoard the building on Dixon and Waterkant Streets. Due to the location and historic nature of the structure, a geotechnical evaluation commissioned at the outset provided insights to conditions on site. The team knew that the site was underlaid by stiff residual soil that graded through soft to hard rock and that the expected water table varied from 18 m to 21 m.

Strengthening of the basement foundations and columns became extremely difficult because of the confined space. As the excavation and exploratory works proceeded, it became clear that the design had to be adapted due to conditions underground. Provision at the outset allowed for 4 000 dowels and in the end, 11 000 dowels were used during this process.

Back-propping throughout the existing structure was immense with certain strategic foundations requiring piling, new foundational bases, and column replacement within and under a structural steel supporting framework. Strengthening of columns and beams included the use of specialised concrete mortars, reinforcing and structural steel wrapped columns.

In order to accommodate the delayed access to various retail areas GVK-Siya Zama adopted an out of sequence construction approach whereby the lift core was built ground up and top down to minimise delays to the programme.

The construction team proposed to create a crash deck on level 0 to allow them to work on the shaft in two halves. Once the demolished shaft reached level 0 at ground floor level, they proceeded to cast the new shaft on steel beams, back-propped all the way down to basement level. This allowed the team to halve the expected delay and work on the shaft in two halves.

Lockdown in 2020 brought about a particular set of challenges to progress on the project. The level 2 slab, for which decking was already in place, had to be dismantled as it posed a safety risk with winter approaching, along with the uncertainty about how long the decking would need to stand before the actual cast date.

Easing of lockdown restrictions and the return to site around June 2020 required specific safety protocols in place to enable the safe return of subcontractors to site and the ramping up to full production.

The original structures on the lower level blend well into the historic look of the Bo-Kaap neighbourhood and make a bold statement with colourfully painted facades. The new section comprising luxury apartments over four floors has a modern appeal with a play on contrasting colours between light and dark shades. External balconies are clad with Siberian larch which provides a light timber finish with a Scandinavian feel.

At the time of going to press GVK-Siya Zama had achieved practical completion of this challenging project of bringing a classy lady back to life. This milestone stands alongside the team attaining 1 000 000 LTIF hours, a proud achievement indeed. ■

PROJECT INFORMATION

- **Company entering:** GVK-Siya Zama Building Contractors
- **Project start date:** May 2019
- **Project end date:** September 2021
- **Client:** The Cape Quarter Property Company
- **Main Contractor:** GVK-Siya Zama Building Contractors
- **Architect:** dhk Architects
- **Principal Agent:** Igual Project Managers
- **Quantity Surveyor:** Smith and Co Quantity Surveyors
- **Consulting Engineer:** Sutherland Engineers

IRENE LINK BUILDING B

Irene Link Building B in Irene Centurion was constructed as the second building in the Irene Link Precinct for Abland. The office block consists of 6 000 m² of underground basement parking space and 8 000 m² of office space. There are two basement parking levels; four office floors (two of which fit outs were completed in); the roof houses two entertainment areas and plant rooms.

The façades are made up of off-shutter concrete portals; flush glazing; strip windows in between versus coated brickworks and a handing lightweight wall. Externals consisted of paved parking areas and landscaping surrounding the building.

The off shutter portals on the northern façade of the building are the main feature and the face of Irene Link Building B. These were constructed as four monolithic concrete walls. Each concrete wall standing at 8,2 m high had to be poured in one single pour, no joints were to be tolerated as to ensure the quality of the off shutter wall was to the highest standard. Once the walls were cast the remainder of the structure was tied in with numerous coupler bars and pull out bars. In total the walls consumed 140 m³ of concrete and 29 tons of reinforcing.

Irene Link Building B achieved a 4-Star Office V1.1 Design Rating.

Sustainable building features which have contributed to the rating of the building include but are not limited to the following:

- By implementing a comprehensive Waste Management Plan from project inception to project completion, more than 70% of all demolition and construction waste was diverted from landfill through reuse/recycling;
- There was in excess of 30% replacement of Portland Cement by industrial waste products for all concrete used in the project which allowed for the reduction in mining of natural resources and Green House Gas emissions associated with cement production;
- At least 20% of all construction materials that were selected for the project were sourced and manufactured within a 400 km radius from the site, reducing the impact of long distance transportation emissions on the environment;
- Exposure of building occupants to air pollution was minimised by using and installing low VOC paints, adhesives and sealants and flooring systems (carpets and vinyl);
- All insulation, refrigerants and gasses installed in the building have an Ozone Depletion Potential (ODP) of zero, thereby ensuring no further long-term damage to the ozone layer.

Considering the site started in March 2020, so construction took place through all of the five stages of COVID-19 restrictions. This placed t extra strain on an already difficult challenge of maintaining the health and safety requirements on site. The site had no lost time injuries through the project, achieving over 420 000 LTI free hours. ■

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 2 March 2020
- **Project end date:** 19 March 2021
- **Client:** Abland
- **Main Contractor:** WBHO
- **Architect:** Nsika Architects
- **Project Manager:** Abland
- **Quantity Surveyor:** Quanticost
- **Consulting Engineer:** DG Consulting

JORISSEN STREET STUDENT ACCOMMODATION

WBHO was awarded the project in January 2019, this after the closing of Liviero. It had completed the earthworks, the basement and half of the first-floor structure. WBHO had the challenge of establishing on a site with little room to work with, with only one crane, and a wayleave of one lane for all deliveries and concrete works.

Neighbouring buildings right against the perimeter wall meant that site establishment and planning became the critical first task to handle.

The Jorissen Street student accommodation project is situated in the heart of Johannesburg CBD in Braamfontein, across from Wits University and Art Museum, and was constructed as a brand new 17 storey building. This forms part of South Point's student accommodation growth, allowing students to stay more central to universities.

With a structure that consists of a single shaft and three shear walls in the centre of the building's footprint, a hydraulic UNI-ULMA climbing system was used to allow the building's shaft to climb ahead of the rest of the structure.

The engineering between all parties at the beginning of a high-rise structure and the correct positioning of a crane are imperative to the success of the structure and this will lead to the successful completion of a contract.

The first concrete was poured on 19 February 2019 and the last slab of the 17th floor was poured on 11 October 2019. The 17-storey high rise building's structure was completed in little less than eight months.

The interior of the building consists mainly of the trending lightweight Hebel block. This was a new innovation used to save on weight, therefore allowing a lighter slab design for the entire building. These blocks were used more than 30 years ago which were hollow to allowed for a saving in weight. The Hebel block is a full block made from lightweight concrete which incorporates polystyrene. An estimated 28 000 m^2 of Hebel blocks was laid in this project.

A Roan Satin face brick façade incorporating tiling, euro spray and powder coated steel windows saw this building blend into the new look of the Braamfontein precinct. ■

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 9 January 2019
- **Project end date:** 12 December 2020
- **Client:** South Point
- **Main Contractor:** WBHO
- **Architect:** LTY Architects
- **Principal Agent:** LYT Architects
- **Project Manager:** LYT Architects
- **Quantity Surveyor:** Etics
- **Consulting Engineer:** ADA Engineers

PRETORIA HEAD & NECK HOSPITAL

The new R450-million Pretoria Head and Neck Hospital is an 11 000 m² special surgical facility developed by JSE-listed Growthpoint and Cintocare. It broke ground on 12 September 2018.

Located adjacent to Menlyn Maine Central Square, the new hospital will enjoy street frontage. The exterior of the building has been designed to be in sync with its particular inner purpose. Its glass façade will be complemented by design features that evocate spinal vertebra found in the neck, serves to shade the building. The hospital will have a direct access-link to the retail and restaurants of Menlyn Maine Central Square.

The hospital would be the first of its kind in Africa and become the first the green-certified hospital in South Africa. The development's green edge is bolstered by the fact that it will be located in the burgeoning green precinct of Menlyn Maine in Pretoria.

Working closely together, Growthpoint and Cintocare are creating a clinical centre of excellence that focuses exclusively on the head and neck, spinal and vascular surgery with highly-specialised medical professionals and state-of-the-art technology. The highly specialised medical professionals will include neurosurgeons, maxillofacial surgeons, reconstructive surgeons, radiologists, pathologists, audiologists as well as speech and swallowing therapists.

The development partnership is delivering the full suite of services for the hospital – from inception to completion. The building comprises seven floors in the following configuration: The hospital plantrooms on the roof level, which sit directly above the theatre blocks themselves. On this level are also the Doctors & nurses rest areas, plus a visitor's deck area.

This 100-bed hospital also has a built-in capacity to expand to 160 beds. The hospital has 335 secure and structured parking bays.

The building was completed in August 2020. ■

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 18 September 2018
- **Project end date:** 25 November 2020
- **Client:** Growthpoint Properties
- **Main Contractor:** WBHO
- **Architect:** A3 Architects
- **Principal Agent:** A3 Architects
- **Project Manager:** GladAfrica
- **Quantity Surveyor:** TMS Quantity Surveyors
- **Consulting Engineer:** Sotiralis

THE RIDGE – V&A WATERFRONT

PROJECT INFORMATION

- **Company entering:** GVK-Siya Zama Building Contractors
- **Project start date:** 16 April 2019
- **Project end date:** 3 November 2020
- **Client:** V&A Waterfront Holdings
- **Main Contractor:** GVK-Siya Zama Building Contractors
- **Architect:** StudioMas
- **Principal Agent:** Mace Management Services
- **Quantity Surveyors:** Smith & Co Quantity Surveyors
- **Consulting Engineer:** Arup

The Ridge is situated opposite Merchant House, the University of Cape Town's Graduate School of Business, and the well-known One & Only Hotel, in Cape Town's V&A precinct. It consists of four stories, all finished to high end specifications, as well as a 3-level basement parking facility, which in total, covers some 8 500 m^2.

Cape Town's newest 6-star Green Star Design awarded commercial building, the Ridge in the V&A Waterfront, has opened and the Cape Town office of its tenant, Deloitte South Africa, is trading from inside its unique spaces.

The Ridge deploys some of the most advanced sustainable building technology available globally, as well as original blue-sky thinking. It was born from the V&A Waterfront's vision to set new standards for the future of commercial office buildings.

The Ridge features a number of 'firsts' for the green building/sustainability industry in South Africa. These included energy-efficient and passive climate control measures, the use of renewables, sustainable water handling and usage, the lowering of the carbon footprint of the building and a focus on the use of natural lighting.

Green star compliance across a large spectrum of design and as-built information enabled the client to increase the tender spec from level 4 to level 6 resulting in a 6 star GBCSA grading achieved. GVK-Siya Zama was responsible for these as-build credits to contribute to the final score and grading. An estimated 12 000 'eco-bricks', which consisted of plastic waste-filled PET bottles, were compacted to the Engineer's specification and used as void forming materials for non-load bearing concrete elements.

Further environmentally friendly elements included rainwater harvesting and greywater treatment facilities located in the basement of the building. Harvested water is treated to near potable standards and used to irrigate the gardens and to flush the toilets.

PV panels optimally placed on the roof of the building harvests solar photovoltaic power. The overall building plans made provision for a 750 kVA power requirement and the PV power to be grid-tied, but with no feed back into the grid. The building is expected to generate around 25% of its own energy requirements.

Heating and cooling of the building are provided through a combination of mechanical air conditioning equipment, passive cooling technologies and natural ventilation. This plant is distributed on the roof slab as well as in plant rooms on the four floors of the building.

The building is designed to minimise its energy consumption through integrated design principles, layering of the mechanical systems within the façade and the structural solutions of the building. The façades were designed to enable a naturally ventilated building for most months of the year utilising manual and automated openings in the perimeter façade and through the opening of high level vents in the street atrium space. These complex systems are monitored and managed by an integrated BMS system.

The building also contains a Thermal Activated Building System (TABS) installation. The concrete slabs of the office floors (1st, 2nd, 3rd and roof slabs) have a network of embedded pipes cast into the slabs. This system delivers a cooling capacity and temperature differential between the indoor conditions and the TABS. This is an alternative method to deliver the cooling to the spaces as a radiator and more efficient to move cooling water than cooling air in the spaces.

All rainwater from balconies and roofs are directed to a rainwater tank in the basement. Overflow from this tank is diverted at ground level to discharge directly into the municipal stormwater network at the nearest manhole outside the site boundary, below Dock Road. ■

WOODLANDS OFFICE PARK: OLD DELOITTE CAMPUS – ALTRON REFURBISHMENT

Growthpoint properties has invested to modernise and refurbish the previous Deloitte campus, housed in the Woodlands Office Park. This is the new home for the technology group Altron. The project comprises a refurbishment of eight existing buildings, which amounts to approximately 27 000 m^2 of rentable office space. The project included the construction of a new covered walkway activity spine, a new two storey parkade, additional carports to existing parking areas and the refurbishment of the building and courtyard façades.

The activity spine, constructed of lightweight steel structures with a mixture of open and enclosed walkways presented some interesting challenges, both in design and construction.

In order to work without affecting the natural surroundings, many carefully planned and executed handworks were required to complete the construction. Some of the structures were modified on site in order to accommodate and include the trees into the structures. With the eight buildings situated on the boarder of what is essentially a game park, environmental controls of the site needed to be strictly maintained.

Noise and dust were kept to a minimum and suppressed. As the rainwater of the office park catchment fills the attenuation and retention dams in the game park, all stormwater inlets were covered with mesh filters and bales of hay were placed against the lower lying sections of the site boundary fence to ensure that no construction materials could escape the confines of the site.

For the demolition of the existing fixtures and fittings, a salvage contractor was employed and as a result very little landfill waste was generated. Electrical and sanitary fixtures and fittings were carefully removed. The florescent tube globes from the old office light fittings were all carefully removed from site and disposed of in a registered hazardous waste facility.

Weekly formal programme updates of all areas allowed the project team to identify slip issues early, forecast upcoming requirements and ensure risks were adequately managed.

Shop drawings were formally submitted until approved to ensure the design and service co-ordination could be done proactively in the design office and not retroactively on site.

The well organised, motivated and enthusiastic contractor management team handed the project over on-time, to a happy client. ■

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 1 June 2020
- **Project end date:** 4 February 2021
- **Client:** Growthpoint
- **Main Contractor:** WBHO
- **Architect:** ARC
- **Principal Agent:** Morta PM
- **Quantity Surveyor:** Farrow Laing
- **Consulting Engineer:** EDS Africa

NEW ASHTON ARCH

The newly completed Ashton Arch in the Western Cape is South Africa's first concrete tied-arch bridge constructed using a transverse launching method. The bridge replaced an existing multi-arch bridge, which no longer fulfilled its functional requirements such as service life, width and hydraulic capacity. The new tied-arch bridge comprises a cable-supported concrete deck which spans 110 metres between supports with arching ribs rising 22 metres above the asphalt road surface.

AECOM were the appointed structural engineers, while the build was contracted to H&I Construction. State-of-the-art bridge analysis software packages were used for the construction stage analysis, in-service analysis, and design, a joint effort by AECOM's SA and UK Long-span complex bridge teams.

The management team of H&I Construction worked in close relationship with AECOM to develop meticulously detailed method statements, well in advance of each activity, to ensure compliance and agreement before construction commenced.

The New Ashton Arch forms part of a broader construction project conducted under the auspices of Western Cape Provincial Government's Department of Transport and Public Works. This involved the reconstruction of parts of Trunk Road 31 Sections 2 and 3, between Ashton and Montagu in the Western Cape which includes the historic Cogmanskloof pass.

The greater Ashton-Montagu region, and Cogmanskloof Pass in particular, has experienced substantial flood damage on several occasions over the years. This resulted in multiple road closures and significant operational disruptions, with adverse impacts on the local economy. The largest of these recent floods occurred in March 2003, with severe block and overtopping at the new Ashton Arch location as shown below.

A key consideration of the bridge was to minimise flow restriction and improve the available free board within the restrictions of adjacent properties and road alignment levels. Through an economic analysis, the technical options for the river crossing and construction strategy were evaluated with due consideration of the impact of construction strategy on road user costs.

The selected final design of the bridge consists of a single span (110 m) concrete tied arch solution with a deck suspended by stay cables which accommodates four traffic lanes and two pedestrian walkways. This

PROJECT INFORMATION

- **Company entering:** Sika South Africa for AECOM
- **Main Contractor:** Haw & Inglis Civil Engineering
- **Client:** Western Cape Government, Department Transport & Public Works, Roads Branch
- **Temporary Works Designer:** Mafeiss Engineering
- **Launch System Designer:** Nyeleti Consulting
- **Concrete Supplier:** Afrimat
- **Specialist Product Supplier:** Sika South Africa
- **Consulting Engineer:** AECOM
- **Scaffolding:** Formscaff
- **Subcontractor:** Amsteel
- **Subcontractor:** Allweld Marine & Industrial

largely eliminated the possibility of debris build up and provided the shallowest deck depth option (key considerations). Construction adjacent to existing bridge and transverse launching after completion minimized traffic disruption during construction.

Design considerations related to the concrete tied-arch

The New Ashton Arch has a single tied-arch structural configuration, with a span of 110 metres between support bearings. The typical cross-section of the arch bridge deck provides for four 3,4 m traffic lanes and two 2,4 m sidewalks.

- The overall height of the bridge is 23 m.
- The twin parallel arch ribs are connected via five 15,5 m wishbone beams that provide lateral stability to the arch ribs, post-tensioned tie-beams complete the arch structural form.
- Post-tensioned tie-beams complete the arch structural form.
- Post-tensioned longitudinal and transverse beams support the integral deck road slab and transfers load to the tie-beam.
- Twenty-four fully locked coil strand-type hangers connect the arch rib and tie-beam by cast steel fork sockets, to welded metal anchor plates fixed with strength stress bars.

Structural modelling for design and construction

State-of-the-art bridge analysis software packages were used by AECOM's complex bridge specialists for

the design, construction stage and in-service analysis. This allowed an accurate simulation of the time-dependent material behavior with the possibility of force adjustments during construction.

The updated models were calibrated for determination of the following:

- Stay cable length determination, which require long procurement lead times applicable to international suppliers.
- Hanger force distribution optimisation.
- Pre-camber requirements and influence of temporary works displacements.
- Movement capacities of temporary, permanent bearings and expansion joints.
- Geometry control by structural deformation validation.

Through a specified laboratory testing programme, the desirable concrete mix properties were selected; favouring structural and thermal performance properties, as well durable and sustainability parameters while also providing technical inputs to a construction stage finite element model. Construction methodology of large volume concrete elements was planned with due care and management of thermal performance aspects.

Structural behaviour monitoring, assessment and verification

An extensive monitoring plan was prepared for construction and included system identification by full-scale dynamic testing as well as structural behaviour verification by deformation measurements, requiring continuous modelling and monitoring during all construction stages.

Deformation measurement was particularly critical during the hanger tensioning phase, where the deformation of the arch ribs was measured and compared to theoretical deformation predicted by the calibrated FEM models. Load cell, extension and vibration readings were correlated to ensure that the intended cable force values were achieved within allowable tolerances.

Temporary works, post-tensioning, and anchor plates

The temporary sacrificial concrete support columns to the deck formwork system required additional structural strengthening to ensure compatibility with the temporary force distribution during all construction stages. For this SikaWrap®-300 C, a high-quality unidirectional woven carbon fibre wrapping system was specified.

The SikaWrap®-300 C confined the head of the temporary concrete support columns, in combination with Sikadur®-330, a structural impregnating epoxy resin adhesive. SikaWrap®-300 was chosen for its high load capacity, easy application and quick installation, saving time and money on the project. The Sika® CarboDur® FRP Design software, a state-of-the-art external structural strengthening design program was an added benefit, making the designing process feasible.

The installation of tendons and stay cable tensioning was a technically complex operation successfully performed by Amsteel during various stages of construction.

All-Weld Marine & Industrial, who successfully manufactured the compound steel anchor plates in a record time.

Founding level variations of the west abutment

During the excavation operations for the western abutment foundation, after installation of the lateral support it was found that the founding material dipped away sharply towards the rear of the abutment, especially on the side of the bridge in its temporary position. The founding material strength was considerably lower than the strength at the temporary abutment position. This founding material strength variability implied certain settlement implication in terms of the design bearing pressure. A comprehensive

re-assessment of the implications of the unexpected founding conditions was required. Through a multiple option quotation, up to five design scenarios were tested in the market to assess the cost and programme aspects. This led to a large diameter (>1 000 mm) piling solution with approximate 10m length was adopted for the west abutment, with embedment within the competent Enon formation.

Transverse launching

Using a transverse launching method of a completed concrete tied-arch road bridge is a first in South Africa where more than 8 000 tons of concrete and steel was moved over 24 m in less than 12 hours after several years of meticulous planning, design and construction.

To install the sliding and permanent bearings the 8 000 ton deck had to be vertically lifted and lowered by H&I Construction. This was done in phases by installing the bearings at one abutment before repeating the process at the next. 12 No 500 t hydraulic jacks were used for lifting and lowering the deck per abutment.

The launching of the bridge from its constructed position to its final position required a perfectly levelled surface. This was achieved by using Sikadur®-42 ZA, high strength epoxy grout with its high compressive strength and high abrasion resistance. Tests with other products were performed prior to application, Sikadur®-42 ZA met all the stringent requirements set out by the Project Engineers. Sikadur®-42 ZA not only met the levelling requirements but could also be applied in a thin layer in a wide area without having any shrinkage or cracking. The entire incremental launch went flawlessly to plan – with Sikadur®-42 ZA being an important part of the success.

The ultra-high strength cementitious grout, SikaGrout®-295 ZA, typically utilised in the under-steel baseplate grouting of wind turbines on our local and international wind farms, was used in several vital applications. This included the grouting behind the anchor plates and jacking frames that created the permanent plinths for the permanent bearings. SikaGrout®-295 ZA was chosen for its ultra-high strength, 90-minute pot life and high flow properties that allowed it to be self-compacting and for easy application whether pumped or poured into place. The rapid strength gain of this product was critical to the progress of the project.

Health and Safety

The large number of inherent safety risks associated with the works included, but were not limited to, deep excavations, heavy crane lifts, working at height, working overflowing water and close proximity of fully operational regional route. To successfully complete the project, these risks were required to be effectively managed and mitigated.

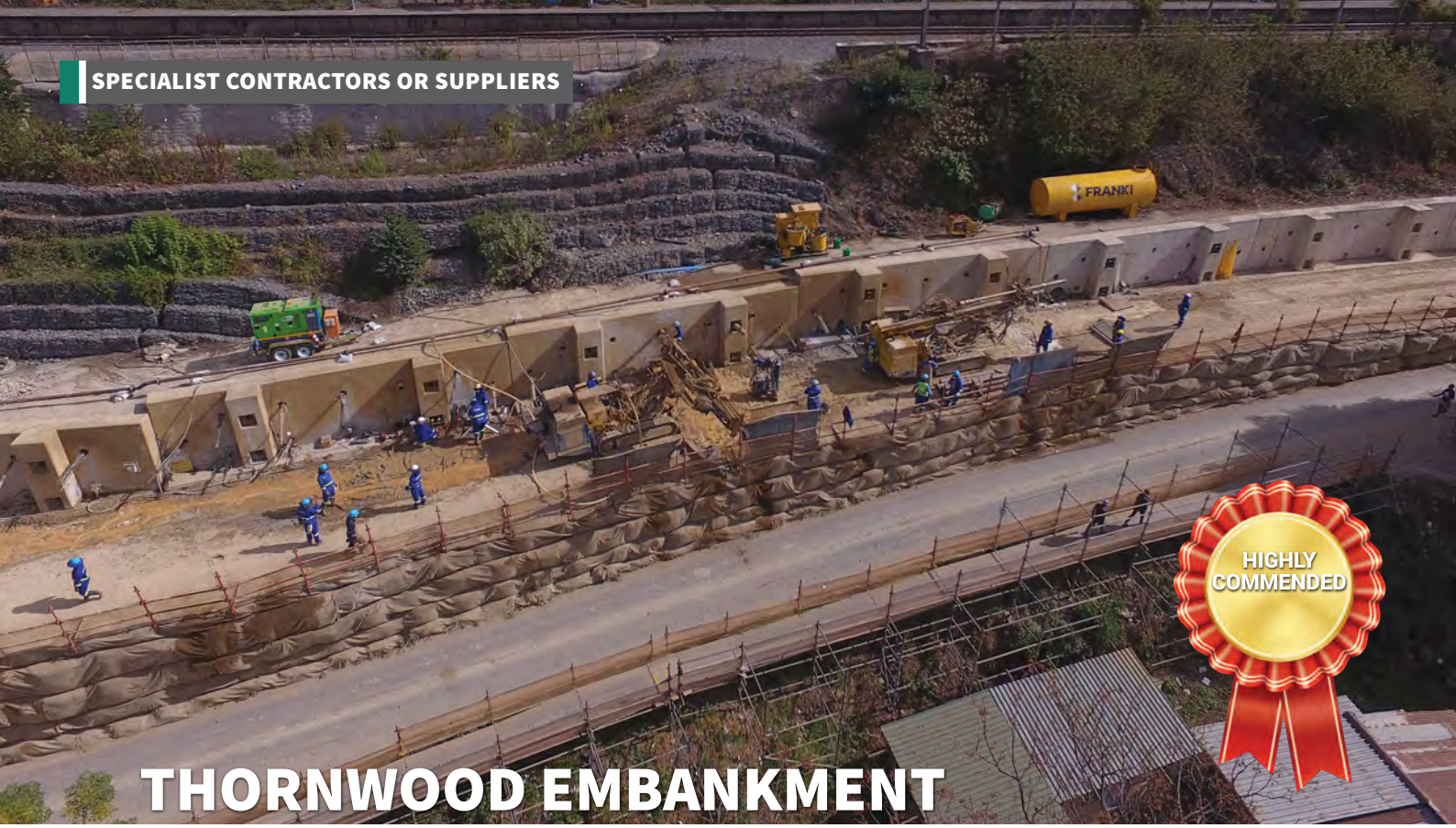
During 2020, the COVID-19 pandemic led to the declaration of the national state of disaster by the South African government. All staff were screened daily according to the agreed site guidelines at the site camp.

The works were audited monthly by Eppen-Burger & Associates for legal compliance with the provisions of the Occupational Health and Safety regulations. The contractor maintained full legal compliance throughout the project and averaged more than 92% on the monthly audit compliance scorecard for the duration of the contract.

Environmental Controls

During the construction of the substructure and temporary works various aspects were taken into consideration regarding the water management and discharge of water in the river as required by the General Authorisation from DWS terms of the construction activities and the ECO freshwater specialist which related to water abstraction limits as well as requirements for related to the quality of water discharged into the water course.

The planning extended to sustainability considerations by recycling the old fabric of the original bridge into the permanent foundation fill of the new bridge. Structural form and bridge aesthetics received meticulous attention during the conceptual design with due consideration of the historical significance of existing multiple-span arch bridge which also inspired the structural form. ■



THORNWOOD EMBANKMENT REHABILITATION

The embankment at Thornwood Station, located west of Durban, has been progressively moving over the past several years. The excessive movement, first reported in the latter part of 2012, prompted concerns of imminent failure. In 2013 rock-filled gabion baskets were placed in critical areas in an attempt to stabilise the slope.

Subsequent movement and settlement of the embankment occurred, and in 2014 a comprehensive slope stability analysis was carried out. The analysis consisted of a detailed geotechnical investigation which concluded that the embankment slope was marginally stable with a high potential to fail at any time in the future. The investigation identified a series of factors contributing to the slope instability and proposed remedial action. The proposed solution included the construction of a reinforced concrete bearing wall and post-tensioned ground anchors installed into the underlying bedrock.

Keller offered a design, supply and installation solution comprising 132 no. permanent ground anchors of up to 40 m in length.

The drilling rigs used on the contract were two Casagrande C6 machines. A Symmetrix 193 casing drilling system was utilised for drilling of the cased portion over the free length portion of the anchor holes. The casings were advanced until competent rock was encountered, which was up to 40 m deep.

The fixed length portion of the anchor was then drilled past the casing into the competent rock utilising a conventional 6” DTH hammer and a 165 mm drill bit. Due to the high comprehensive strengths on the competent rock (up to 250 MPa) and highly fractured in some places, special modified drilling bits were used.

To assist with the flushing during drilling through the fractured rock, a mixture of drilling foam was injected into the air supply. The drilling foam also acts as a cooling medium for the drill bits during hard drilling. Transnet sent out a design and supply tender for permanent lateral support comprising 44 no. cable anchors permanently fixed into a 132-m-long by 3-m high bearing. The infrastructure and reinforced concrete bearing walls were constructed by others.

However, prior to Keller’s involvement, the installation of the anchors was not successful, and tenders were then sent out again for the installation of these technically challenging anchors.

Keller recognised the technical difficulties and the challenging conditions that the installation and stressing of the anchors posed. The challenges were mainly due to tight tolerances between the anchor and the casing (requirement for permanent anchors), limited working and laydown area, the weight of the anchors and the size and weight of the jack required to stress the anchors.

After several technical meetings and discussions, the Keller team formulated a feasible and constructible solution. Keller’s proposed solution was to replace each of the 44 no. 24 strand anchors with 3 no. 8 strand anchors (132 no. anchors in total) with an equivalent combined total capacity.

PROJECT INFORMATION

- **Company entering:** Keller Geotechnics
- **Project start date:** February 2020
- **Project end date:** 2 March 2021
- **Client:** Transnet SOC ITD
- **Main Contractor:** Transnet (RME)
- **Principal Agent:** Transnet Freight Rail (RME)
- **Consulting Engineers:** Transnet Group Capital (TGC)
- **Quantity Surveyor:** Transnet (RME)

Controls during construction ensured environmental pollution not to occur. A comprehensive waste management plan was prepared before construction and focused on the waste that was anticipated to be generated during the project. This included grout, waste water generated from the 40 plus crew. The plan was updated to deal with unexpected situations like COVID-19 impacts and the drilling foam that needed to be controlled as a sudden increase in the drilling operations will blast the foam out of the hole and cause the foamy bubbles to descend on the pedestrians. Which was well received by the pedestrians and to their delight on the hot summer days.

There were several challenges the Keller team had to contend with. Firstly it was the inconsistent ground conditions before the competent rock, which made drilling conditions extremely challenging. Drilling through a previously constructed gabion wall of up to 3 m thick, followed by overburden with a mixture of clay, sand and boulders (up to 3 m diameter).

Secondly, a two-way road nearby had to be reduced to a single-lane road to accommodate the formation of Keller's drill rig working platform. Despite these efforts, the working area was still confined. Traffic control was put in place to ensure minimal disturbance to the community road.

The COVID-19 pandemic brought a complete halt to many construction projects in the country, including the Thornwood embankment project, towards the latter part of March 2020. The project resumed mid-May 2020 under strict regulations stipulated by the government. There was a shortage of critical supplies during this period as most industries had been working with reduced resources.■

NORTHFIELDS BUSINESS PARK GROUND IMPROVEMENT

The project is located in Northfields Business and Logistics Park, Durban North, on which numerous 'mega' warehouse structures are planned. The site comprises large cut to fill earthworks platforms which pose significant challenges for the foundation design, particularly in areas where fills in excess of 25 m are present.

Instead of conventional piled foundations, Keller's foundation solution utilises stone columns to improve the ground to allow simple shallow foundations to be used. For the various platforms, over 3 500 no. 800 mm diameter stone columns with depths between 5 and 15 m were installed.

Stone columns proved to be a cost effective, environmentally friendly solution for the development.

Stone columns were installed using the Keller Vibrocat. Gravel is fed through a pipe to the bottom of the column and compacted by the Keller depth vibrator. The technique allows gravel to be compacted efficiently without large consumptions of water.

Stone columns with diameter up to 1 m and depths up to 18 m can be installed using this technique.

After completion, the site is clean with no obstructions (protruding rebar, concrete pile) for the subsequent contractor. In addition, the site is immediately available for the main contractor to commence subsequent civil works.

Keller invited consulting engineers to have first-hand experience of the vibro stone column installation process. Since the solution is relatively new in South Africa, it is important that these solution and skills are transferred to local engineers for future application.

Stone columns were used to improve the existing ground to allow shallow foundations to be used to support the warehouse structure. The ground is designed as a mass with improved shear strength and stiffness properties.

As the solution is aimed to improve the ground as a mass, it allows designers/contractors the flexibility to adjust position, size of footings easily if required.

The use of stone columns significantly reduces carbon emissions for the project. Compared to conventional piled foundations, stone columns use no cement, a primary contributor to carbon emission in the construction industry. The result is emission of around 750 t CO_2 for the project, a reduction of around 80-90% compared to traditional piled foundations.

Besides the program, cost and environmental benefits, stone columns also provide significant health and safety advantages. The installation of stone columns does not require people working close to rigs, dramatically reducing the probability of accidents.

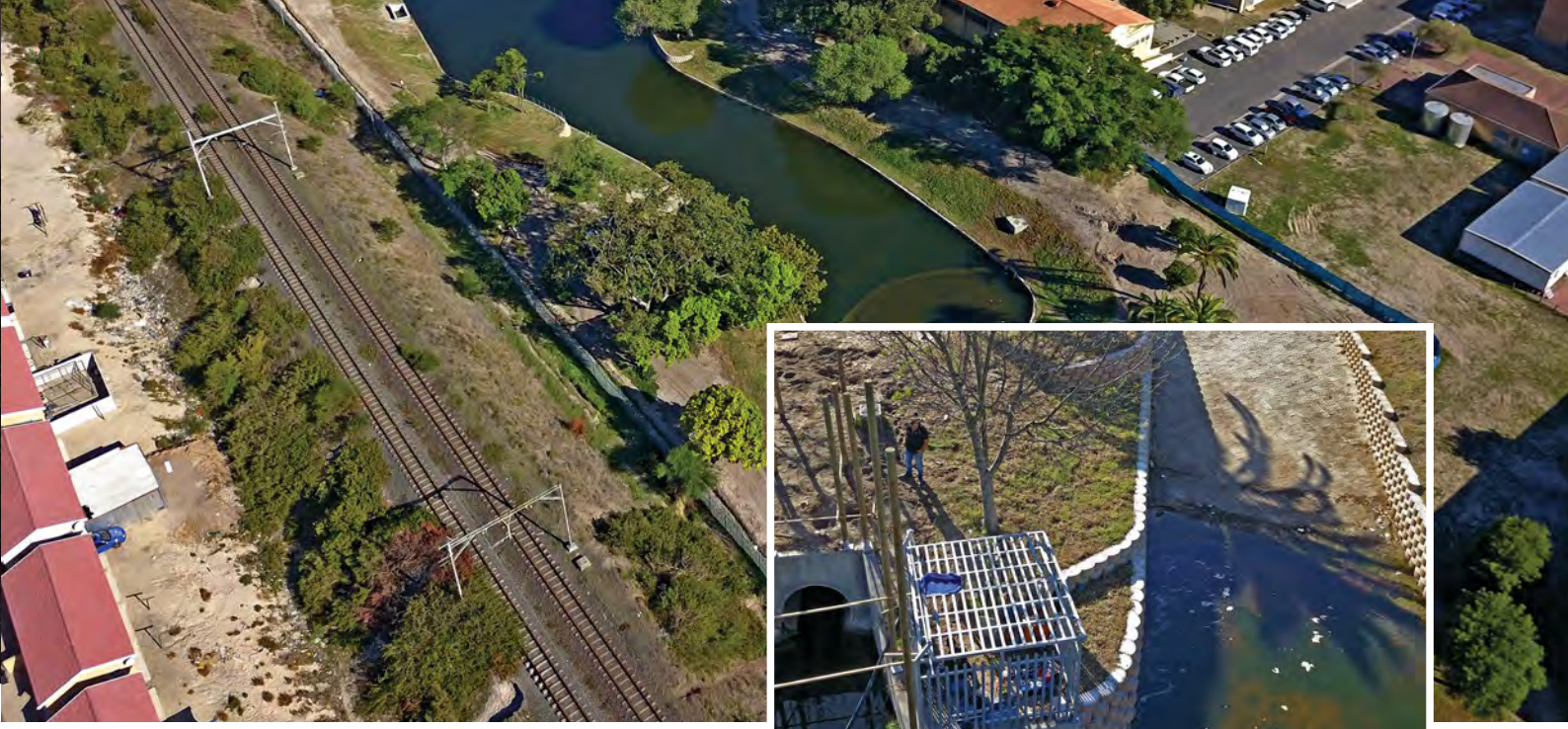
The stone columns were completed over a period of around six months, around one third of the time required to install pile foundations, and around 40% of the cost. All work was carried out in accordance with Keller's ISO 9001:2015 accreditation.

Apart from the benefits on H&S risk, stone columns (and ground improvement in general) are solutions with low design and construction risk. Stone columns improve the properties of the soil mass and hence small deviations from design requirements would have little impact on the performance of the ground improvement.

The project was originally designed on piled foundations, and subsequently revised to ground improvement with stone columns. The outcome is a cost effective, environmentally friendly foundation solution completed in a significantly shorter program. ■

PROJECT INFORMATION

- **Company entering:** Keller Geotechnics SA
- **Project start date:** 24 November 2020
- **Project end date:** 27 September 2021
- **Client:** JT Ross Properties
- **Main Contractor:** Keller & WBHO
- **Architect:** Ries Shaw Architects
- **Principal Agent:** JT Ross
- **Project Manager:** Vigar & Associates



CPUT RETENTION POND

During the drought in 2017, the Cape Peninsula University of Technology (CPUT) Bellville Campus announced that all their existing green spaces were being irrigated with recycled water that is collected and pumped into an on-site lake. In August 2020 – to comply with City of Cape Town's by-laws and regulations for storm-water management - this lake was extended and upgraded to increase the capacity of the existing retention pond as well as refurbish the existing outlet and inlet structures.

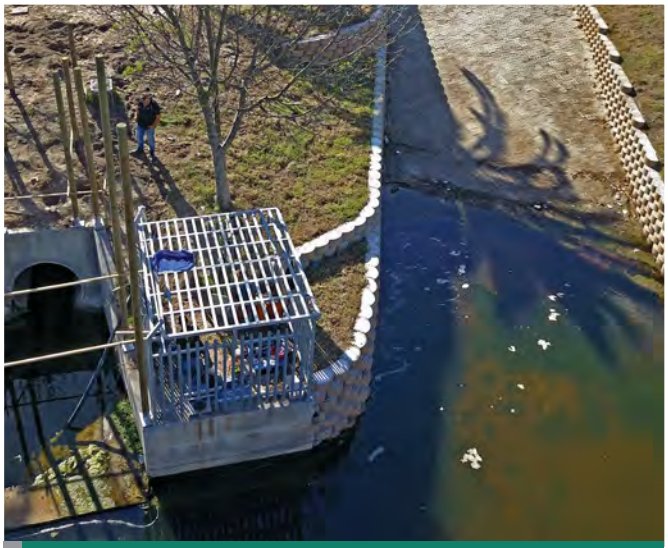
The capacity of this pond is now greater than ever and has been improved in terms of aesthetics and functionality, so that the campus can deal with flooding and drought alike. Says Douglas Curran, CPUT's Chief Horticulturist: "It's been nearly 30 years since the treated effluent water is used to irrigate the sport fields and their drainage system collects the water and sends it to the campus' lake which pumps it back to the dam. The irrigation system ends up using the same water five times."

A retention pond (or wet pond) is a man-made reservoir – built in lower land areas that tend to accumulate excess water - that is designed to catch storm-water from higher elevation areas, to give that water a place to go, where it can be concentrated and contained.

This prevents erosion and foundational issues in the immediate surroundings, as well as reduce the risk of flooding. Retention ponds also aid in the removal of pollutants, such a fertilisers, oils, petroleum, and animal droppings from the stormwater runoff: the algae, bacteria, and other biological organisms in the water consume the pollutants, eventually purifying the water to a large extent.

Westcoast Retaining Systems, Terraforce Recommended Contractor, was contracted by Ruwacon, a leading construction company in Southern Africa (51% black ownership and a 9GBPE rating from cidb), to install the Terraforce L12 interlocking retaining blocks along the edges of the pond.

Says Hannes Mostert, Westcoast Retaining Systems:



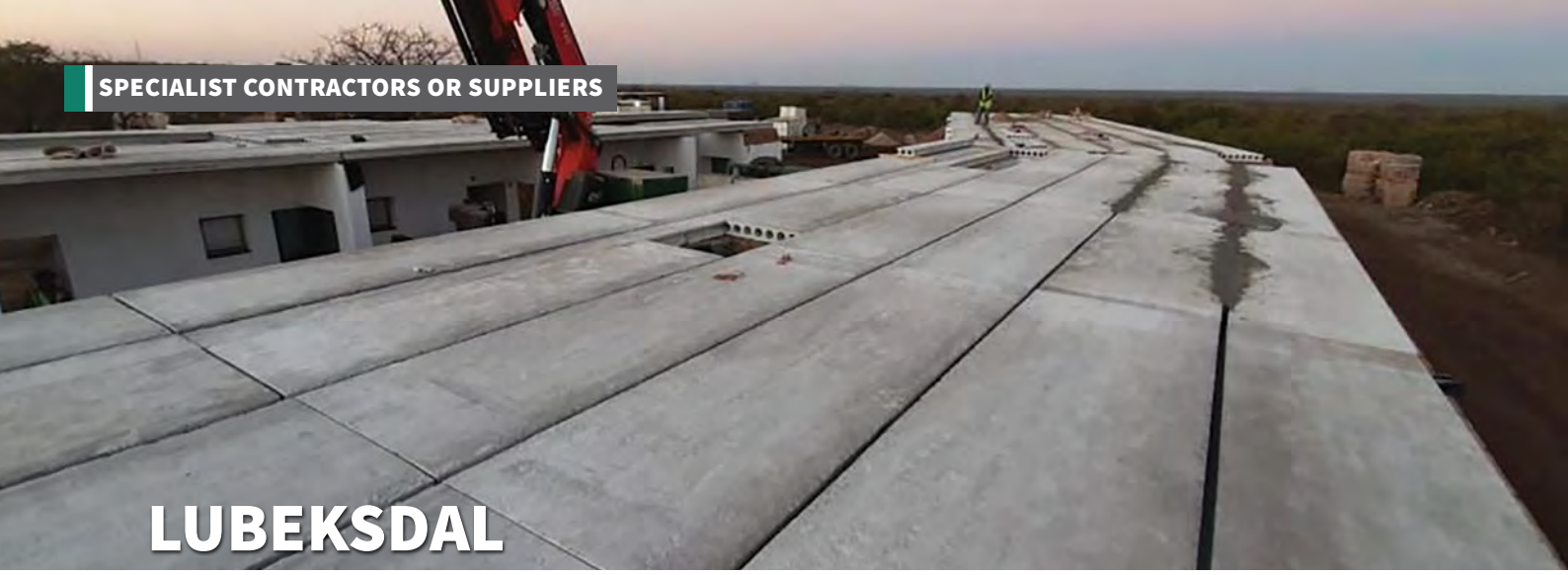
PROJECT INFORMATION

- **Company entering:** Terraforce
- **Project start date:** August 2020
- **Project end date:** February 2021
- **Client:** Cape Peninsula University of Technology
- **Main Contractor:** Ruwacon
- **Subcontractor:** Westcoast Retaining Systems
- **Consultants:** KFD Wilkinson Consulting Engineers
- **Terraforce Block Supplier:** Klapmuts Concrete

"The existing pond was losing a lot of water, and that is why CPUT decided to build a 420 m long retaining wall around its circumference. The blocks were installed on a 750 x 300 mm, 25 Mpa concrete foundation, with drainpipes running behind the entire length of the wall. All blocks were concrete filled for extra stability. In some places the wall had to be built higher to accommodate some big trees growing along the pond boundary, to protect their roots from too much water ingress."

Albert Botha, Contracts Manager, Ruwacon, says that it was difficult with rain, sludge, and ground water seepage to get the pond to the new design levels for installation: "The sludge within the pond and with the reducing of levels during construction made it difficult to install the concrete foundation upon which the Terraforce blocks were installed. We had to install a concrete stone pioneer layer before the concrete could be cast. The cast could also only be for short lengths. A pump had to be run a lot of the time during installation to keep the water at bay".

Once these challenges were overcome, the verges of the pond were grassed, and a family of ducks introduced to the area. Visually the pond now showcases a lush, green, and peaceful setting that students and animals can enjoy alike. On a functional level, leakage is curbed, and more water will be available for future water shortages. ■



LUBEKSDAL

A new development that will provide accommodation for a large international contracting team that has been appointed to work on an industrial project in Limpopo is progressing ahead of schedule. This is only two months after the building contractor, Projects 2000, broke ground on this R32-million building project.

The impressive progress made in such a short timeframe bears testament to the vast skills and experience of the entire professional team, which also includes Cosmoplan Architects & Industrial Designers; Fanoy Consulting, the consulting engineer; MVM Africa Electrical Engineers and Quanto 2000, the quantity surveyor.

The company's suspended slab solution played a critical part in helping the contractor to significantly accelerate the works programme.

A total 1 170 m^2 of hollowcore slabs were installed by Coreslab in only four days. This enabled the contractor to commence fitting out the rooms below and with the brick work above almost immediately after they were installed.

The hollowcore slabs are manufactured to the highest quality and cut-to-size at Coreslab's factory. They are then transported to site where they are positioned onto the load-bearing walls and grouted into place according to the building plan.

The contractor would have never achieved this impressive production rate if it had used conventional cast-in-place methods to construct the floor slabs. This is considering that it takes up to 28 days for concrete to cure before the shutters can be stripped so that work can commence above and below the slab.

The use of hollowcore slabs also did away with the need to install tons of support and scaffolding in preparation of the concrete pours for traditional in-situ slab construction. Extensive propping underneath the slab also restricts trades from working below on a conventional building project.

The use of hollowcore slabs also provided a safer solution by doing away with the need to work at heights on scaffolding. The precast concrete elements are manufactured at ground level in the factory and installed on site by a small team of skilled and experienced workers. This includes a foreman, surveyor, rigger and crane operator.

Coreslab undertook its first site visit on 2 June 2021 when Projects 2000 was still at foundation level for the three structures. By 27 June 2021, Coreslab had surveyed the three blocks, completed all its inspections and manufactured the precast-concrete elements. The first slab was placed on 2 July 2021 at 13:16 and the entire installation was completed on 3 July 2021 at 9:01.

PROJECT INFORMATION

- **Company entering:** Coreslab
- **Project start date:** 21 May 2021
- **Project end date:** 30 November 2021
- **Client:** Lubeksdal Farming
- **Main Contractor:** Projects 2000
- **Architect:** Cosmoplan
- **Project Managers:** Projects 2000
- **Quantity Surveyor:** Quanto 2000

Projects 2000 has been constructing concrete floor slabs in this manner for many years and, in most instances, has relied upon Coreslab to provide the company with the service.

The company was appointed as the principal contractor for this development based its more than 20-year-long legacy delivering quality real-estate development assets in the larger Limpopo province. They include malls, as well as commercial and industrial space.

The two two-storey sleeper blocks together house 80 rooms, while the lodge includes administrative space, a kitchen, lounge and bar, in addition to a swimming pool.

The project also provided ample opportunity for Projects 2000 to innovate.

Among the challenges was completing a R32-million development in the four-month contractual period while also working in an extremely outlying area of the province. The construction site is located on a game farm within vicinity of the industrial project.

To mitigate delays, site surveying started many weeks prior to the contractor breaking ground to commence working on the project.

The design incorporates many cost-effective green elements to reduce the building's energy use. Heat pumps were specified as they only use a quarter of the electricity required by a geyser, while also being a more affordable alternative to solar water heaters. The bedrooms and entertainment areas have been positioned to receive direct sunlight and take advantage of cooling breezes throughout the day. Aerolite in the ceilings also lowers the natural exchange of heat that occurs in the building. ■

ANNADALE SOCIAL HOUSING DEVELOPMENT

Coreslab successfully completed the installation of 15 000 m² of hollowcore slabs for a large low-cost housing project that is being constructed in Polokwane. This 17 000 m² development consists of 11 triple storey apartment blocks which, together, will provide an additional 500 30 m² and 40 m² rooms in Polokwane. The development is being driven by the Polokwane Housing Association, a division of the Polokwane Municipality and managed by multidisciplinary consultant, Chiefton Consulting & Services.

Coreslab's component of the project was an impressive feat that entailed manufacturing and installing more than 3 000 hollowcore slabs, each mainly 5 500 mm in length and 150 mm in width. This is in addition to the 92 precast-concrete steps that were also manufactured with a special reveal and installed by Coreslab on behalf of the principal contractor, Motheo Construction, as part of the project.

Hollowcore slabs are manufactured in a controlled factory environment and then installed on site by a specialist sub-contractor. This approach eliminates the risk of potential errors to keep projects on schedule.

Once the hollowcore slabs have been grouted in place, work can also commence above and below the suspended slab almost immediately to help further accelerate a construction project.

Cost savings were also realised by eliminating the need for raw materials and extensive propping associated with rib-and-block systems. An accurate installation the first time round meant that there was also no wastage due to having to redo mistakes. Coreslab worked according to a very strict production schedule and careful planning was critical to the success of this project. The professional team also had to make up for lost time due to unforeseen circumstances that delayed the start of the project.

An optimal installation rate on this project was about 350 m² a day to complete a floor. To avoid delays, there was also constant interaction between the factory, the heart of the operation, and the installation team, which can easily place up to 400 m² a day by installing one slab every five minutes in a single shift. The hollowcore slabs were dispatched to site on a just-in-time basis and then lifted directly from Coreslab's truck trailers using a mobile crane. This also freed up available space to provide a clean and clear worksite.

Coreslab's team, including a site manager, rigger and crane operator, moved from one block to the next according to a predetermined schedule that was adjusted by the principal contractor on a weekly basis.

Due to excellent team dynamics, few challenges were encountered on this project. After the hollowcore slabs were installed on the first three blocks, an optimal production process had been established and progress continued unhindered. While also less labour intensive than rib-and-block systems, many jobs were created on other aspects of this sizeable project. By February 2020 when Coreslab completed the installation, there were already 200 people employed on the construction site.

They included the five bricklaying teams, each comprising 12 skilled bricklayers and 18 general workers per subcontractor.

The teams were also being closely managed by the principal contractor to ensure that they maintain high quality standards throughout and each achieve their production target of laying a total of 6 000 bricks a day to keep the project running according to schedule. ■

PROJECT INFORMATION

- **Company entering:** CoreSlab
- **Project start date:** 1 February 2019
- **Project end date:** 30 September 2021
- **Client:** Polokwane Housing Association
- **Main Contractor:** Motheo Construction
- **Principal Agent:** Chiefton Facilities Management
- **Consulting Engineer:** Chiefton Facilities Management

SALAMANCA HOSPITAL, SPAIN

When in mid-2020, Terraforce received the final images of a newly completed Terraforce block wall at the Salamanca Hospital, Salamanca, Spain, installed by subcontractor Obre Tecnicas Y Medioambiente, it wase immediately struck by the technical excellence on display. Having followed the installation process step by step, this outstanding outcome is not surprising.

The four Terraforce L16 rock face finish walls – installed by Obre Tecnicas Y Medioambiente, an environmental engineering company, specialised in the construction of reinforced soil structures – cover 2 300 m² surface area, with a maximum height of 7,86 m.

Says Miguel Seller, Civil Engineer at Obre Tecnicas Y Medioambiente: "The main wall supports a new access road to the hospital, and in some sections special consideration had to be given to the placement of geogrids due to the presence of a large drainage pipe (2,5 m in diameter) near the visible face of the wall. Another unique challenge was that we had to adapt the slope of the wall to meet another vertical wall. It was very complex from a topographical point of view. Another technical aspect to highlight is that part of the wall is located in a floodplain area of the river Tormes, so in those cases a permeable soil was used as the reinforced soil, with better geotechnical characteristics."

Seller adds: "We used Huesker (Fortrac) geogrids with nominal tensions between 35 and 80 kN. The natural foundation ground was a slate soil, with 28° of internal friction, 10 kN0/m² of cohesion and 19,95 kN/m³ of specific weight. In the reinforced soil, we use a soil with 30° internal friction and a density of 20,00 kN/m³, of course without cohesion.

The new road, Paseo de la Transición Española, adds a length of almost 600 metres to the existing road system and provides direct access to the hospital emergency zone. It also includes another central roundabout that allows access to the new hospital complex and future parking. Landscaping and a bicycle path are still to be completed.

Without a doubt the final result is pleasing to the eye, and the additional coping blocks, the fencing along the top, as well as the large rock strip lining the foot add an eye-catching visual dimension to the wall. ■

PROJECT INFORMATION

- **Company entering:** Terraforce
- **Project start date:** January 2020
- **Project end date:** July 2020
- **Client:** Salamanca City Council, Spain
- **Project Manager:** Excelentísimo Ayuntamiento de Salamanca
- **Main Contractor:** Ferrovial Construcción
- **Sub Contractor:** Obre Tecnicas Y Medioambiente
- **Terraforce Licensed Manufacturer, Spain:** Prensagra Prefabricados

VILLA BIJOUX

Purchasing property on a steep slope often leaves the owner faced with finding a safe, but also attractive way to create enough level building space for their dream home. In this case, two plots needed levelling to allow optimal space for two new luxury villas and generous gardens to be built on the slopes of Paarl Mountain, South Africa.

The Terraforce retaining wall system was proposed by Energy Master Builders, offering the most cost-effective and aesthetically pleasing solution, and Decorton Retaining Systems, Terraforce Recommended Contractor, were contracted to install the retaining walls on both properties.

Says SP van Blerk, Decorton: "The installation was straightforward, on a concrete foundation with the specified drainage system and geofabric reinforcement for added stability. To green up the walls, trees and shrubs were planted along the terraces and bottom boundaries of the walls, while some sections were planted with fast growing creepers that will eventually cover most of the blocks. The result? A softer, greener solution to a problem that would have otherwise warranted solid concrete walls that cannot not be planted easily and cost a fortune." ■

PROJECT INFORMATION

- **Company entering:** Terraforce
- **Project start date:** October 2018
- **Project end date:** December 2019
- **Client:** Johan Visser
- **Main Contractor:** Energy Master Builders
- **Architect:** e-design studio
- **Principal Agent:** Energy Masterbuilders
- **Consulting Engineer:** A19
- **Subcontractor:** Decorton Retaining Systems

MOVING KENMARE WET CONCENTRATOR PLANT B TO PILIVILI

The Moma Titanium Minerals mine in Northern Mozambique is owned and operated by Kenmare Resources. It is one of the largest titanium minerals deposit in the world. Mining is principally undertaken using dredges that float in artificial mining ponds.

The dredges mine the mineral rich dunes from the ponds and pump the mineral sands to the floating Wet Concentrator Plant (WCP). With the objective of increasing ilmenite production at the mine from 1 million to 1,2 million tonnes per year on a sustainable basis from 2021, the last of three development projects was undertaken in 2020: the Wet Concentrator Plant B (WCP B) was moved 23 kilometres from its previous site at Namalope to a new high grade ore zone called Pilivili.

In addition to moving the WCP and dredge the infrastructure for the new operation at Pilivili (water and HMC product pipelines, 110 kV overhead powerline, a Statcom, sub stations and site electrical reticulation, a product stacker and reclaim system and a positive displacement pumping system) had to be designed, procured, and constructed.

Mining at Namalope was completed in late August 2020. The relocation of the WCP and its associated dredge was undertaken by Mammoet, a global specialist heavy lifting and transport contractor, using platform vehicles called self-propelled modular transporters (SPMTs). The dredge and WCP were moved in two stages.

Once they had been placed on concrete plinths in a relocation pond and the pond had been dewatered, the first stage involved the movement of the dredge to Pilivili. On completion of this relocation, the SPMTs returned to Namalope to transport the WCP along the same route.

The relocation of the dredge took place between 14 and 16 September 2020. The WCP, only able to travel at one kilometre an hour followed on 21 September. On 25 September, a major milestone was achieved with the WCP arriving safely at the staging pond in Pilivili.

This project had a unique scope due to the nature of the material upon which the WCP and dredge had to be transported.

The project included the civil infrastructure required for the moves; roads, earthworks, relocation pond, staging and float-off ponds, river crossing mining starter pond and a terrace for the infrastructure at Pilivili.

Construction innovation technology

The 1 700 tonne dredge and the 7 000 tonne concentrator were transported along a new purpose-built road using platform vehicles called self-propelled modular transporters.

Haul Road and Float-over Channel

The completed road travel way needed to be 42 metres wide, to accommodate the 60 m-wide WCP with some clearance on either side. The excavated land contained untreated, collapsible sands without any cohesion, placing enormous pressure on available resources. Several material tests were undertaken to determine the best possible option for road layer works.

Impact compaction of the insitu material, was implemented in the form of impact rolling with a vibratory polygon roller, to depths of 2,5 m, to assist in the densification of the insitu material and increase the stiffness. The subbase layer comprised of 2 x 150 mm thick layers of cohesionless, compacted red sand. The wearing course was a blend of granular material and red sand from local borrow pits and was compacted to a 200 mm thick layer.

In addition, a float-over channel (600-metres long by 70-metres wide and 2-metres deep) across the Mualadi River was constructed, for the dredge and plant to float

over to the Starter Pond, from where the dredge would commence mining operations in the new ore body.

The construction of this float-over channel involved the removal of a 65 000 m^3 mixture of clay and peat. Four ponds were constructed for relocation, staging, float-off and starting. Two river crossings were also traversed along the relocation route, which included up to 2 m Ø corrugated stormwater pipes.

Relocation pond

The relocation pond covered an area of 11 ha with 6m high containment berms constructed from local cohesionless compacted sand. In anticipation of the pond eventually being flooded to accommodate the floating WC plant and dredge onto the 1,5 m high concrete plinths, and shortly thereafter to be drained entirely, special attention had to be given to the pond floor underneath the plinths and 23 mm thick mass concrete slab.

Cognisance also had to be taken of the potential of rising groundwater while considering the pond floor design. After drawing the high groundwater down via a series of subsoil drains within the pond, a 150 mm thick layer of sand filled geocells were placed on 600 mm thick compacted insitu material. This was followed by a layer of 180 mm thick granular material and stabilized with 6% cement and compacted, followed by a 170 mm thick layer of the same stabilised material, and compacted.

Design innovation

The completed road has a weight-bearing capacity of 8,4 t/m². The move process took only a few days, but Kenmare scheduled up to eight weeks of downtime, owing to the time needed to drain the relocation pond, prepare the assets for the transporters, and re-establish them once they arrived at Pilivili.

The rare opportunity to access the WCP B and the dredge in dry conditions was used to undertake some maintenance work, as they will not be required to move again during their economic life.

The road now serves as the main access road between the Pilivili ore zone and the main operational area an Namalope, where the mineral separation plant, camp, and Kenmare's other mining operations are located. It will also be used by the Moma mine's host communities.

Environmental impact consideration

During the construction of the road, careful water management was critical to the environmental sustainability and integrity of all these systems, involving over 500 000 m³ of water. During the design phase, several options were considered and some of these options had environmental impacts which made the design considerations even more challenging.

Some options which made the design task more challenging were that mass cement stabilisation in the road layer works was not allowed, due to the close proximity of human settlement and the active rural community as well as the long-term impact on flora and fauna. The use of seawater for construction also posed a problem in the effect that it could have on surrounding flora and fauna.

Other environmental considerations were the silting of the Mualadi River crossing during the construction of the float-over channel and coffer dams were implemented to minimise this.

Motivational facts about the project

This record-breaking move was completed safely while overcoming many challenges as a result of COVID-19.in a harsh and difficult remotely located site.

Despite the impact of COVID-19 the move was completed only three weeks after the planned date. ■

PROJECT INFORMATION

- **Company entering:** Hatch Africa
- **Project start date:** July 2019
- **Project end date:** December 2021
- **Client:** Kenmare Resources (Moma Titanium Minerals Mine)
- **Main Contractor:** TPH Mozambique LDA
- **Project Manager:** Kenmare Projects Director
- **Quantity Surveyor:** Professional Cost Consultants
- **Consulting Engineer:** Hatch Africa
- **Subcontractor:** Mammoet Southern Africa
- **Subcontractor:** Binvic

PROJECT INFORMATION

- **Company entering:** Knight Piésold Consulting
- **Project start date:** September 2013
- **Project end date:** February 2020
- **Client:** Ministry of Water, Agriculture & Forestry (Namibia)
- **Main Contractor:** Salini Impregilo
- **Principal Agent:** Knight Piésold Consulting
- **Project Manager:** Knight Piésold Consulting
- **Quantity Surveyor:** Knight Piésold Consulting
- **Consulting Engineer:** Knight Piésold Consulting

CONSTRUCTION OF NECKARTAL DAM AND PHASE I BULK WATER SUPPLY

The Neckartal Dam and Phase 1 Bulk Water Supply is the symbol of hope for a Namibia that wishes to move forward from a series of drought hardships faced over the past few years. The project was designed by Knight Piésold Consulting, which also supervised construction, for the Namibian Ministry Of Agriculture, Water And Land Reform. The Dam was designed to irrigate 5 000 ha of land, with Phase 1 Bulk Water Supply for 1 960 ha and Phase 2 for the remainder, sometime in the future.

The project is one of the largest projects in recent years undertaken by the Namibian government and needed more than one million cubic metres of concrete to complete the construction process. The project contributed to the creation of more than 5 500 jobs.

The Neckartal Dam and Phase 1 Bulk Water Supply (further referred to as the Project), inaugurated on 13 March 2020 by the Vice President of the country, His Excellency Dr Nangolo Mbumba, is the symbol of hope for a Namibia that wishes to move forward from a series of drought hardships faced over the past few years. By implementing this environmentally sustainable project, success has been made to secure water supply and assistance in providing for the country's food independence.

The project is part of vital new infrastructure planning that will provide water to the //Karas Region in the southern arid region of Namibia. It will provide irrigation for about 1 960 hectares of land, promoting agriculture and employment in the sub-economic area of the country. The project may be extended in future with a second phase, which will increase the irrigatable land to approximately 5 000 hectares.

The Dam, the largest in Namibia, was designed by Knight Piésold Consulting and constructed by Salini-Impregilo S.p.A. The Project is located 40 kilometres west of the small town, Keetmanshoop. The project is the first phase of the Neckartal Irrigation Scheme (NIS) which, through irrigation, will improve the region's agricultural development, especially for cultivating products such as lucerne, grapes and dates.

The Fish River's water volume, impounded by the Dam, through deliberate releases, will flow downstream for 13 kilometres to reach an Abstraction Weir. From there, quantities of water will then be pumped from the adjacent Pump Station (capable of pumping at 2,1 cubic metres per second) to a Holding Dam in an approximately 9 km-long steel Pipeline of 1,1 metre

diameter, from where it will be routed to the irrigation areas for agricultural use as needed.

The Dam was built using the Roller Compacted Concrete (RCC) construction technique and is 78,5 metres high with a crest length of 518 metres. The dam has a storage volume of 857 million cubic metres extending over a 39 km^2 surface area at its full supply level. To construct the project, over 1,1 million manhours were utilised. In the period from 2018 to 2020, there where zero workdays lost due to no injuries, which was a record-breaking feat in terms of Health and Safety for the contractor.

In Keetmanshoop and in the surrounding areas the Project created a total of 5 500 jobs; 3 000 workers were hired directly and 2 500 indirectly with 65% of these workers coming from the //Karas Region.

Two physical models of the dam wall structure were studied during the design stage of the dam. These models were constructed to scales of 1:60 and 1:120, with the latter model including the upstream topography. The initial aim was to investigate the hydraulic behaviour of the stepped RCC spillway and to determine the efficiency of the energy dissipation structures situated downstream. The study revealed that for the recommended design discharge (RDD) flood event, a sub-atmospheric pressure region occurred downstream of the spillway crest and was further accentuated for larger flows. These results were in contradiction with known literature which predicts hydrostatic pressure to be present during the RDD (USACE, 1992). The physical models showed that the effect of three-dimensional flow, curvature of the dam wall and the asymmetric approach channel could not be neglected when designing the Ogee crested spillway. The results were subsequently integrated for the development of significant improvements to the spillway layout, as well as the energy dissipation structures.

Flow in the Fish River is seasonal with the wet season from December to May, in good years. As the contract was awarded later than envisaged, the contractor had to re-program his work compared to that originally tendered. Coffer dams had to be constructed at unplanned times to take account of the shifted river flow. Unfortunately, this increased the time for completion and the overall cost.

Nevertheless, throughout all the unplanned disruptions, stringent quality control was maintained, both by the Engineer and the Contractor. Concrete batch records, cube test results, pre-concrete inspections and hydro mechanical installation inspections and the like, were well documented, easily obtainable and constantly archived for easy reference.

The dam was built in a deep valley; implying that the dam's surface area is relatively small for the volume of water held, making it ideally positioned to reduce the effect of evaporation in the dry climate experienced in Namibia. The Neckartal Dam reservoir will have a surface area of approximately 42 km^2, a perimeter of 295 km and full supply volume of 853 Mm^3.

Once commissioned, the dam will contribute significantly to the sustainable economic development of the //Karas Region. The dam will yield water for irrigating farms for crop cultivation covering up to 1 960 ha during Phase 1 which may be extended up to 5 000 ha in the future, employing several hundred people in the process. Two turbines at the main dam will generate hydropower for the irrigation scheme, as demand requires.

The total volume of concrete required to complete the construction of the Neckartal Dam was just over 1 000 000 m^3. Interestingly, only 65 kg of cement was used per cubic metre of concrete. This low volume of cement is one of the characteristics of using roller compacted concrete (RCC) that makes it such an economically sound choice for the construction of a dam wall of this magnitude. At peak production, construction had taken place 24 hours a day, seven days a week.

On completion, this massive multi-billion Namibian Dollar dam structure, situated in the Fish River, will be the largest dam in Namibia, with nearly three times the volume of Hardap Dam (currently the biggest reservoir in the country).■

DESIGN AND CONSTRUCTION OF THE 25 Mℓ REINFORCED CONCRETE EMOYENI RESERVOIR

The design and construction of the Emoyeni Reservoir was unique in that several aspects in both areas deviated from previous designs as well as construction techniques.

On the design side, historical methods were to have a structure with several movement joints to allow for the movement and shrinkage of the concrete while still maintaining water tightness of the structure. The client (eThekwini Municipality) had used this concept design for most of the existing reservoirs in and around the Durban area. The problem with these designs is that they relied on the construction of the joints and specifically the water bars to be undertaken correctly. Any errors or movement of the water bars during the concrete pours results in the water tightness being compromised.

For this design, Knight Piésold decided on a different approach, doing away with the movement joints in the structure. As this was a very large concrete structure (100m x 35m x 8m), the removal of movement joints required careful modelling. Furthermore, the previously utilised tapered wall width was changed to uniform walls. The modelling of the structure showed that the uniform walls performed better as a propped cantilever with smaller crack width as well as making the reinforcing designs at the corners simpler and easier to construct.

These design changes resulted in a structure that was commissioned with zero leaks and a high quality of concrete. On the construction side, the structure had several challenges. The large structure was constructed in the heart of a high-income residential suburb with very little working space and with issues such as noise pollution, dust pollution and traffic congestion to take cognisance of.

One of the unique construction techniques utilised on the walls was to pour the 8 m high walls in a single lift. This was done to reduce the number of construction joints as well as to reduce the Construction duration. Normal concrete pours are not done higher than about 4 m as there is a risk of aggregate separation during the pour as well as the difficulty in achieving adequate vibration at the base of the pour.

It should be noted that the reservoir site is in a densely populated residential area. Following a stakeholder meeting with the residents in the area wherein the proposed designs were tabled, the residents adjacent to the site disapproved with the size and proximity of the structure to the site boundary. The reticulation system was modelled using Bentley WaterCAD software and the future demands introduced to the system. Following a 48-hour simulation it was determined that the reservoir size could be reduced to 25 Mℓ excluding the old 5Mℓ reservoir.

To keep the system, live, the reservoir would be constructed in 2 chambers such that the old reservoir could continue to operate while chamber 1 was being constructed. Only once chamber 1 was complete and commissioned could the old reservoir be demolished and chamber 2 constructed.

The construction of Emoyeni Reservoir had many challenges. The reservoir site is in the middle of a high-income residential area and as such an extensive stakeholder engagement process was undertaken leading up to the construction commencement.

On the construction side the main challenges faced by the contractor was the limited working space, keeping the system in operation throughout construction and finishing within the time duration.

The limited working space and live existing system meant that the two chambers were constructed separately.

Another challenge that the contract faced was the COVID-19 epidemic. The site had to be closed for the duration of lockdown which delayed the construction by three months. Once the works started again, strict safety protocols had to be initiated to continue working safely. These also caused delays to the overall duration. ■

PROJECT INFORMATION

- **Company entering:** Knight Piésold Consulting
- **Project start date:** July 2019
- **Project end date:** February 2021
- **Client:** eThekwini Municipality – Department of Water and Sanitation
- **Main Contractor:** Afrostructures
- **Principal Agent:** Knight Piésold Consulting
- **Project Manager:** Knight Piésold Consulting
- **Consulting Engineer:** Knight Piésold Consulting

OCEAN

The latest Building Information Modelling software (BIM), was used by the professional team to design and coordinate the complex buildings. Revit, Navis Works, and Tekla were some of the three-dimensional design software packages that were used by the project team to design and coordinate the buildings.

Snag R App, was used to assist with real-time snagging and sharing of information between the consulting and contracting teams. The App provides a platform where photos and reports can be uploaded to a mobile phone or tablet, with specific reference to a drawing and location of the photo. The App greatly assisted the project team to keep track of quality control items over the large construction areas and keeping up with the fast-paced construction program.

The Oceans development has contributed to job creation within the community and it is estimated that 15 000 indirect and 2 500 permanent job opportunities will be created by the development during the construction phase and after completion.

The latest 3D design software was used to model and design the large and complex structures. One of the cost and space saving items that were adopted at an early stage was to increase the concrete compressive strength of the columns in the three high-rise towers. The increased concrete strength resulted in a reduction in the reinforcing steel in the columns, reduction of column sizes, and offered cost and spacing savings to our client. As an example, an increase of 20 MPa in the compressive strength of the columns reduced the size of the columns by approximately 20%, and this resulted in cost savings and more usable space in the hotel and apartment rooms.

Another innovative engineering solution that was developed for the project was the complex transfer structures that were required to support the irregular form of the residential towers. The oval shape of the residential towers required a bespoke column and shear wall arrangement that did not align with the parking and retail structure below the towers and various transfer options were considered. A series of 2,5 m deep concrete transfer slabs and beams were designed to change the structural grid of columns and shear walls at the sixth story of each of the two towers. The complexity of the structure and the overall size proved a great challenge to the project team.

The project adhered to strict health and safety protocols to ensure the safe use of the site and surrounding public areas. Regular audits were done to ensure that the highest safety standards were achieved.

The Oceans project is one of the largest mixed-use developments in South Africa and proved to be a great challenge to the project team. The fast-paced construction with multiple contracting teams working simultaneously required fast and accurate information from the consulting team. Careful planning in the lead-up to construction, the latest 3D software, and a highly skilled team working around the clock to produce the information accurately and on time. ■

PROJECT INFORMATION

- **Company entering:** Sutherland Engineers
- **Project start date:** 2017
- **Project end date:** 2022
- **Client:** Oceans Umhlanga and PIC
- **Main Contractor:** WBHO
- **Architect:** EPA Architecture
- **Principal Agent:** PMSA
- **Project Manager:** PMSA/Betts Townsend
- **Quantity Surveyor:** Crane Group Consulting
- **Consulting Engineer:** Sutherland Engineers

ACSA WESTERN PRECINCT OFFICES

WSP in Africa was appointed for design and construction monitoring on the new Airports Company South Africa (ACSA) Western Precinct Offices development.

The ACSA Western Precinct Offices (AWPO) is a new turn-key commercial development situated adjacent to OR Tambo International Airport. AWPO forms part of ACSA's strategy to expand the airport's offering and to drive new sources of growth for the entire region.

Construction started in May 2019 with practical completion achieved in June 2021. The building comprises a 5 storey parkade for use by both the public and AWPO tenants. The parkade also forms the base of a landscaped podium level, upon which three sculptural building forms are located. These building forms provide white-box office space for ACSA, the South African Civil Aviation Authority (CAA) and a future tenant.

The objective of the buildings forming separate multi-tenant spaces is to turn the precinct into the neighbourhood's new landmark while maintaining visual harmony with the surrounding environment. Additionally, the building is targeting a 4 Star Green SA As-Built rating from the Green Building Council of South Africa (GBCSA).

Some of the challenges posed during this project included that the site is located on a previously shaded carport parking area positioned between main entrance roads to the airport, and the construction planning needed to factor in continuous traffic to and from the airport. The site also presented challenging ground conditions with a high-water table that required the use of dump-rock and continuous flight auger piles for the foundation construction. Whilst the bulk earthworks was in progress a sewer main line was discovered, the relocation of this existing 'live' sewer line servicing the airport precinct required careful planning to ensure uninterrupted service to the airport. Additionally, access, health and safety aspects related to construction near a fully operated airport had to be taken into consideration from an engineering perspective.

WSP's Structural team managed all design, civil and structural engineering components of the project.

Throughout the conceptual and detailed design phases the team made use of Revit Modelling/ Draughting as the primary software to ensure detailed consistency was maintained. Additionally, a Building Information Modelling (BIM) platform was used for the design and analysis of all civil and structural engineering components, preparation of construction documentation and quantity take-offs.

The team also worked closely with the client to ensure successful project construction execution. All project deliverables have been in line with client's expectations and in accordance with coordinated architect and building service consultants' drawings and specifications.

Some of the innovative design features of this project are in relation to the link bridge between Building A+B. The architect had requested a clear distance of 16,8 mx 16,8 m in the entrance atrium below with no vertical support structure. ■

PROJECT INFORMATION

- **Company entering:** WSP in Africa
- **Project start date:** May 2019
- **Project end date:** June 2021
- **Client:** Airports Company South Africa
- **Main Contractor:** Tiber
- **Architects:** Paragon Achitects
- **Principal Agent:** MMQSMACE
- **Project Manager:** MMQSMACE
- **Quantity Surveyor:** MMQSMACE

UCT AVENUE ROAD STUDENT RESIDENCE

The University of Cape Town's (UCT) R222-million Avenue Road Residence in the Mowbray precinct provides 500 additional student beds, an invaluable addition to the university's student accommodation provision. It also set a local benchmark as the first student residence in South Africa to achieve a 4-Star Green Star Custom Design rating from the Green Building Council of South Africa (GBCSA), for its water and energy savings and full suite of disability features.

WSP's team in Africa was engaged by ERIS and worked closely with the full professional team to ensure successful project construction execution and that the targeted sustainability aspects were achieved.

Construction started in July 2019 with practical completion achieved in October 2020. The building comprises three and four storeys and consists of an entrance lobby, security (with desk, toilet, kitchenette), consultation offices, communal lounge, general toilets, 500 student beds (mix of 144 single rooms and 173 double rooms – and made up per floor to include student bathrooms, student meeting/ lounge rooms, student lounges, student tea kitchens, student (box) storage), two warden's flats (2 bedroom units), warden's offices, laundry, staff change and mess facilities, storage, cleaner's stores, maintenance workshop, building service, refuse room.

The Residence building is organised around three landscaped courtyards, allowing natural light into the inter-perimeter of the building strips. At the head and tail of each strip there is a tea kitchen and set of bathrooms and showers catering for the student dorms.

There are multiple communal lounges to encourage social interaction and group learning. This building forms a backdrop to the existing Avenue and Cadboll House buildings along Avenue Road and forms an edge along Matopo Road. The Dining Hall is a column-free, multi-functional, 536-seater main dining area, supported by a foyer, toilets, a preparation kitchen and serving spaces. It is near the new residence building and adjacent to the existing University House residence, which it also caters for.

The site of the Student Residence and Dining Hall is bounded by Rhodes Drive (M3), Rhodes Avenue, Avenue Road and Matopo Road within the larger Mowbray precinct, which consists of a number of buildings, most of which are heritage-protected.

Some buildings and parts of others were demolished to make way for the new structures, and the placement of the new structures was carefully thought through in order to enhance and control vehicular and pedestrian movement.

Every area of the design and construction of the residence focuses on sustainable concerns such as energy, carbon emissions, embodied energy, water, healthy spaces for people, ecology, transport and construction management. ■

PROJECT INFORMATION

- **Company entering:** WSP in Africa
- **Project start date:** July 2019
- **Project end date:** August 2021
- **Main Contractor:** CSV Construction
- **Architect:** Jakupa Architects & Urban Designers
- **Principal Agent:** Focus Project Managers
- **Project Manager:** Focus Project Managers
- **Quantity Surveyor:** Matla QS
- **Consulting Engineers:** WSP in Africa

JEWEL CITY

This massive urban redevelopment project on the outskirts of the Maboneng Precinct in Joburg's eastern CBD breathes new life into the previously walled-off former centre of the diamond and precious metals trade industry in Johannesburg, South Africa. The complex consists of six city blocks of industrial buildings, some dating back to the 1930s. The entire area was closed off to the public in the mid-90s and has remained an isolated and forgotten node for decades.

Jewel City includes the reinvention of this pre-existing industrial complex as an open, vibrant mixed-use precinct that introduces a more sustainable dimension (socially and economically) and new diversity to early inner-city rejuvenation projects.

The architectural brief involved repurposing the existing industrial buildings, which included the conversion of Block 1, The Diamond, into apartments, Block 2, The Ruby, into a commercial building and Block 4, The Amber, has been converted into a retail block. Block 5, The Sapphire, has been upgraded and remains the main commercial building in the precinct. Block 3, a commercial building, received minor refurbishments and will form part of a second phase along with the redevelopment of The Amber. Block 6, The Onyx, previously an empty city block used as a parking lot, now houses a 13-storey residential building that stands as the Flagship building of the Jewel City precinct. The Onyx features a large public square and urban park that is flanked with trees and retail space as well as a safe children's play area that spills out on to the square, animated by fountains and public art.

The existing buildings were not substantially altered externally, although their façades were refurbished and adorned with local artwork throughout the precinct. The construction innovation for the refurb buildings took its inspiration from the local context of the area and surrounds. The new residential building has also drawn inspiration for the local context which has been translated in to a simple concrete frame with infill brickwork and a Shed-like façade that comments on the industrial sheds in the surrounding areas. The aim for this approach was for the precinct to blend in to the context architecturally though its materiality and stand out through its spatial experience. The new residential units include a wide range of apartment types, from micro-studios to family-size two-bedroom flats, encouraging not just economic diversity, but also social diversity. Jewel City comprises of apartments, commercial spaces, various retail spaces, offices, a school, a medical facility and a five a side soccer club among other.

Other interventions are woven into the architectural fabric, which introduces a layer of heritage through artworks, signage, and interpretive panels. The involvement of local artists and artisans has been a priority, symbolically introducing the idea of the city's new era of prosperity being anchored in its people rather than reliance on mineral wealth, while substantiating that theory with an economic injection into the local art economy.

GASS Architecture Studios has placed major emphasis on the precinct's public realm. While they have made pragmatic provision for vehicle access at key points around the peripheries of the precinct, the precinct is largely pedestrianised along its central axis. The precinct includes a largely pedestrianised Fox Street as its main axis through the precinct. Along this axis, a series of tree forests and gardens with seating and play areas further enhances the public experience. Toward the east of the precinct, a large public square is merged with Fox street that includes a large lawn, flanked with seating areas and trees as well as an interactive fountain for children to play in. The theory behind public space at Jewel City is that public space that is safe and friendly where children can play, is a safe space for all.

The quality of the public space and the broader architectural character of the precinct is designed not only to catalyse and support a greater diversity of people within the precinct, but also to invite and encourage further investment into the CBD.

The peripheral areas and sidewalks along the busy Commissioner and Main Streets have also been repaired and upgraded, and additional lighting has been introduced to create a cleaner, safer space around the precinct. The precinct has a CCTV monitoring system that is integrated with each building and that relays back to the main precinct security control room in Block 1 (The Diamond). The precinct also has 24 hr

PROJECT INFORMATION

- **Company entering:** GASS Architecture Studios
- **Project start date:** November 2018
- **Project end date:** September 2020
- **Client:** Divercity, Atterbury, Ithemba
- **Building contractor:** Nomad Group (Blocks 1 & 3); WBHO & Motheo JV (Blocks 2, 4, 5 & 6); Pentacon Civils (Fox Street)
- **Architects:** GASS Architecture Studios
- **Quantity Surveyor:** Matla Quantity Surveyors
- **Landscape installation:** Bidvest Top Turf

roaming guards. Each building has a security control room that caters for each individual building.

Edge accreditation/simulation was done with theoretical results for building's energy use, material use, and water use based on the post construction criteria of the building with favourable results. All wet services systems are designed in accordance with Part XA of the National Building Regulations, SANS 10400, which legislates the design and installation of sustainable, energy efficient systems. Hot water is generated via air-to-water heat pumps, which uses up to 66% less electrical energy than conventional electric resistance heating.

Potable water pump systems were designed by taking cognisance of the efficiency of the pump motors and considering variable speed drive technology which reduces the pump duties and electrical usage in times of low demand. Low flow sanitary fittings were also part of the design to ensure a more sustainable development.

The abovementioned design principles have been implemented for both the residential developments with similar concepts for the commercial buildings. Locally sourced materials were used as far as possible along with the use of local labour for various trades sourced through community involvement processes and a CLO. This process also assisted with the risk management through a successful inclusion of local communities within the project. Jewel City has been envisioned as a fully functional mixed-use development. The intention and concepts behind the development revolved around creating a precinct where families can truly live. through introducing commercial/retail tenants that can support family living (tenants such as pharmacies, supermarkets, a school, a clinic etc).

Jewel City is thus not just a destination point in the CBD of Johannesburg but offers a socially and economically diverse environment that fosters social sustainability.

The tenants at Jewel City take pride in the area they live/work in. Jewel City offers safe spaces for people to enjoy the beauty of inner city living whilst providing the necessary amenities for public spaces.

One of the great successes of Jewel City lies within the way the precinct has been designed holistically with separate elements that each play their significant part in the urban setting of Johannesburg.

Sustained by a belief in the transformative potential of urban design and architecture to catalyse economic and social energy, dignity and prosperity, Divercity and GASS Architecture Studios has re-envisioned this all-but-defunct industrial complex into a series of thoughtful interventions that breathe new life into Johannesburg's CBD, while remining respectful of its heritage.

The Jewel City redevelopment broke ground in November 2018 and was completed in September 2020. ■

KASTEELPARK – OFFICE REFURBISHMENT

Kasteelpark Office Park is located on the corner of Nossob Street and Jochemus Street, in Erasmuskloof, Pretoria. The office park consists of five almost identical buildings of approximately 5 000 m² each: Buren, Nassau, Oranje, Leerdam and Katzenellenbogen. These buildings were constructed during the early 1990s and designed by the architectural company, Vennootskap Marais & Du Plessis in an attractive modernist style, with face-brick cladding throughout. A particularly attractive feature is the use of 'piloti' or freestanding columns at ground level, raising the office space above the parking and creating virtually unobstructed views of the lush vegetation and abundance of trees on the campus.

PIC approached Boogertman + Partners to design the comprehensive refurbishment of Kasteelpark following on from the successful refurbishment of Castle Walk shopping centre close to this property. The existing buildings were outdated and in desperate need of a facelift to increase the client's asset value and attract

prospective tenants. A continuous architectural language was to be applied to the building façades with the entrance to each building being easily distinguishable. The buildings and amenities also had to be made compliant with the National Building Regulations. As a result lighting, HVAC, Wet Services and Fire Installations needed to be replaced.

Oranje, Leerdam and Katzenellenbogen fall into Phase 1 of the refurbishment process currently underway. Architecturally, Oranje received a new exterior face and interior renovation of the circulation core, lobbies, receptions, atrium, ablutions and pause areas while the other two buildings, home to Military

Health Services, received an exterior refurbishment and only MEP compliance items dealt with internally, with the tenant in situ during construction.

Used for the first time in South Africa in any volume, an Italian perforated vinyl stretched fabric is extensively used to manage solar control, bird infestation and dramatically alter the external appearance of the buildings.

The façade renovations remain true to the original form of the building while a mask was applied to completely alter the appearance. The best features of the buildings, namely the effect of the offices floating over the parking area, are enhanced further by cement bagging and then painting all the face-brick elements in a dark grey colour. This has the additional benefit of dramatically altering the appearance of all the buildings and adding some texture to what is otherwise a very slick design. There are three different façade types applied according to the elevation and required sun control treatment.

Façade Type 1 – Flush curtain walling is applied only to Oranje's South Eastern Elevation and wrap around the adjacent corners. The mullion and transom spacing reflects the optimisation of the standard glass sheet sizes to reduce wastage.

Façade Type 2 – Stretched perforated PVC mesh veil by Serge Ferrari, framed by powder-coated aluminium extrusions, spans between the slender brick clad columns on Oranje's North and South Western Façades. The mesh veil also curves artfully around the building's corner. The colour selected is dark grey on the inner face and a light metallic grey on the outer face. When standing inside the building and looking out, the mesh is barely visible and gives the illusion of no visual barriers present.

Façade Type 3 – Louvred screens provide solar control on Oranje's North-Western elevation and envelope the circulation core to define the entrance. Finding a curved louvre blade proved much more difficult than one would think but we eventually found a company that was able to manufacture a curved louvre blade to suit the tight radius of the building corners. ■

PROJECT INFORMATION

- **Company entering:** Boogertman + Partners Architects
- **Project start date:** 5 October 2015
- **Project end date:** August 2021
- **Main Contractor:** P-Wise Projects
- **Client:** Government Employees Pension Fund C/O Public Investment Corporation
- **Quantity Surveyor:** Aecom
- **Project Manager:** SECO
- **Consulting Engineer:** Asakheni
- **Electrical Engineer:** Mott Macdonald
- **Mechanical Engineer:** Spoormaker & Partners
- **Architect & Interiors:** Boogertman + Partners Architects

52 KATHERINE

Alchemy Properties is the co-owner of neighbouring building the Sasol Head Office. The site, on the corner of Albertyn Road and Katherine Street, was initially a taxi rank on the corner of Sasol, but Alchemy Properties had the vision to convert the existing taxi rank on behalf of the municipality to a new premium-grade office building independent of Sasol.

By transforming the taxi rank on the corner of Katherine Street and Albertyn Road into a P-grade office development, Alchemy Properties would complete the Sasol precinct with a strong, street-facing corporate identity that was previously unmanaged and rundown.

Alchemy Properties was able to secure an international law firm as a tenant for the development proposal, which would bring investment and future revenue to the municipality that previously was unavailable. The design brief was to maximise the permissible floor area ratio, coverage and height as far as possible on a narrow, long site. The building was to be designed with its own corporate identity when viewed against the Sasol development, which proved to be a key design challenge on the project. Standing at a total of four storeys above ground, the building consists of 3,5 basement parking levels. The design process explored how best to create a new office building in close proximity to Sasol's three-storey black basement façade, which would both complement Sasol's basement façade in scale, and also have its own brand identity when viewed against Sasol, while considering the strict fire requirements due to the

PROJECT INFORMATION

- **Company entering:** Paragon Architects
- **Project start date:** October 2019
- **Project end date:** April 2021
- **Client:** Alchemy Properties
- **Main Contractor:** Trencon
- **Architect:** Paragon Architects
- **Principal agent:** Alchemy Properties
- **Project Manager:** Orion
- **Quantity Surveyor:** RLB Pentad Quantity Surveyors
- **Consulting Engineer:** Sotiralis Consulting Enginee

proximity of the two buildings. Paragon Architects was fortune enough to have worked on both 52 Katherine Street and Sasol's head office. This allowed us to use

the 3D BIM technology from the latter to coordinate and test various shapes and plans for the former against the existing Sasol basement wall.

In the test fix exercise, the building was pulled away from the Sasol basement to allow light into the south and east office areas. The addition of full-height black windows and undulating balconies were strategically planned when considering the fire-break regulations in relation to Sasol. This resulted in the unique shape and rhythm you see now. The undulating geometry created between the levels of the build also allowed for private courtyards in unexpected areas. These courtyards included water features, recessed seating and soft surrounding landscaping, which adds a cool, quiet and shaded atmosphere outside of a busy, loud and hot urban environment.

Sasol's wall is clad in a natural black slate tile. Therefore, we opted for a contrasting white smooth granite tile finish that would offset Sasol's basement façade. The white marble walls and strong undulating geometric design of 52 Katherine Street contrasts strongly against the dark grey, organically-shaped slate-tiled Sasol head office, which give it its own identity and presence outside of the Sasol precinct.

The façade consists of strong horizontal and vertical elements made up of full-vision, dark, low-emissivity windows and solid white cladded ceramic tiled walls. The façade solid to vision ratio was articulated to allow light and views to filter into every office module. The undulating nature of the design creates balconies towards the north and east façade, providing spectacular views over Sandton.

The building design maximises the coverage of the entire site. Its proximity to the Sasol head office presented design challenges relating to fire design and compliance. The whole of the south and west building façade faces onto the Sasol basement façade, where special fireproof Pyron glass had to be introduced for office planning along that façade so as to receive natural light.

While 52 Katherine Street may look like a simple building, it is in fact very complicated in its interface detailing regarding the use of glass, aluminium, steel, brickwork and ceramic tiling. Rather than using the traditional specialised cladding and unitised systems for the facade, Paragon Architects opted for a more traditional masonry façade construction made up from positively fixed tiles and steel channels to reduce construction costs. The scale of the building was perfectly suitable for this type of construction, although managing such large-format tiles on scaffolding did prove a challenge.

Environmental Impact Consideration

The building is not Green Star rated. However, as good practice, some key strategies were accommodated:

Indoor environmental quality: The unique window arrangement is purposefully planned in a ratio that allows natural daylight into every office module arrangement. The windows have a low-emissivity coating to improve solar control and thermal insulation, without sacrificing too much natural light. More than 60% of the offices have a direct line of sight to the outdoor environment. Low-VOC materials were specified in the interior components of the building.

Transport: The parking bays do not exceed local planning requirements. The project is located centrally to the Sandton hub, which promotes the use of public transport, especially with it being in walking distance of the Gautrain.

52 Katherine Street was a unique project for. It showed the architect that no matter how small or difficult a site may seem, even a narrow taxi rank on a seemingly unusable, tight site can be made into an income-generating asset.

The project has established a relationship between the developer and the local municipality, due to their

shared vision for an invested future, which resulted in a small building with a large presence among its larger, more intimidating skyscraping neighbours.

The collaboration between the project team necessitated by COVID-19, using new technologies such as Zoom and BIM, showed that even during an unprecedented pandemic, there are new ways to work together to achieve a high-quality end product on time and within budget.

COVID-19 was unforgiving, and the architect know everyone who worked on this project will not just see 52 Katherine Street as a building, but as a reminder of what South Africans can achieve in the darkest of times. ■

BRIDGEWATER

Vivid Architects designed Bridgewater as an entire city block, and it is very exciting to see the conceptual thinking behind the Bridgewater development coming to reality. The building acts as a wonderful interface and transition between the urban neighbourhood of Century City Square and the extraordinary natural environment of the newly re-imagined mixed use Ratanga Precinct, new park and rehabilitated waterbody. The development connects Bridgeways with the new Ratanga Park via a timber clad footbridge, and creates a defined public wharf edge to the redesigned waterway system that emulates the memory of old Amsterdam canal-side row houses and walkways. Bridgewater was designed to allow seamless connectivity and pedestrian access in, around and through the development.

The 'city block' development was intentionally designed as a number of individual buildings with their own unique language and personality all linked and unified around an internal central public square or court. This court acts as a wonderful filter for pedestrian movement linking the many buildings of the overall Bridgeways precinct to the newly designed Ratanga Park and waterfront. The mixed use nature of this development will ensure all day activity and life beyond the 9-5 working day. The use of tactile and warm materials was intentional to create a place for people to feel comfortable to work, live, and play.

There are three predominant buildings or typologies that make up the Bridgewater development, including 80 hotel beds, 122 apartments, three separate Office buildings with over 350 parking bays. They each play their own very important unique role in design, use, scale and materiality to address their particular position on the site. For the residential component of apartments and hotel accommodation, Vivid Architects took clues from the timeless and recognisable design ethos of the Amsterdam canal edge row house architecture to front onto the wharf that defines the water facing elevation of the development. It interpreted this in a stripped down and contemporary manner with elegant thin façade verticality further accentuated by combining natural and painted face brick to ensure colour variation and elevational interest.

As one approaches Sable circle, the architects wanted a building that literally swept you around it with its sleek flowing flush glazed façade that would speak of high end office space with a great corporate identity and views back to Table Mountain. To offset this, Vivid Architects created a third building typology of Wharf style warehouse buildings that accommodates small office studios that front onto Conference Lane and form the focal corner entrance to the hotel porte cochere drop off.

The Bridgewater construction process was a unique experience, as any current building contract, due to the interruption of the Covid pandemic hard lockdown in march 2020. The construction status was up to 2nd floor slab in some areas, when the site was abandoned for three months. As such there was an agreed extension of time negotiated between client and contractor to the mutual 'benefit' of both parties. Through this experience, with its many challenges, the quality of the outcome was not forfeited and the end result is a project to be proud of for client, contractor, and consultants.

The entire Bridgewater construction site was built simultaneously with the new Ratanga Park, sharing a site and a main contractor, and as such the environmental impact of the build was mitigated by the rigorous and detailed re-working of the Ratanga canal system which was drained for the duration of the project. The canal system was fully rehabilitated with all major and sensitive vegetation protected or sensitively moved. This process is ongoing and will benefit the greater Cape Town as a major public facility once completed.

Bridgewater and Ratanga Park offer sensitively and managed designed public spaces and facilities, offering truly urban and natural environments side by side in a unique setting that will contribute massively to both Century City and Cape Town as a whole. ■

PROJECT INFORMATION

- **Company entering:** Vivid Architects
- **Project start date:** November 2019
- **Project end date:** September 2021
- **Client:** Rabie Property Group
- **Main Contractor:** WBHO
- **Architect:** Vivid Architects
- **Principal Agent:** Vivid Architects
- **Quantity Surveyor:** B&L QS
- **Consulting Engineer:** Zutari

GREENBAY AND GREENLEE

Balwin Properties has long been recognised as a leader in the residential green building space, and now its Green collection developments are taking the green building to new heights. All targeting EDGE advanced apartments and GBCSA 6 Star Green Star New Build and Net Zero Carbon ratings for their lifestyle centres are known as Green Barns, the Green collection developments aim to be the leading developments in the affordable market. The 3rd Greenbarn will be completed in 2022 at Greenbay in Gordons Bay, which was recently crowned the 2021 African Property Awards Winner for Best sustainable residential development in South Africa.

The residential blocks consisting of a mix of 1,2, and 3 bedrooms are carefully designed to minimise its carbon footprint and optimise the human scale of each block.

Boogertman + Partners director, Andre Wright says that embedded within the concept of the Green Barns being active centres of participation and connection, is the design driver to make the elements of sustainable design visible as demonstrable landmarks of green principles. "By exposing every green intervention and making it part of the aesthetic, as opposed to submerging it in the fabric of the building and surrounding landscape, its value and importance are shared within the community. The concept forefronts green design as a living principle that will influence greater awareness and ultimately change behaviour."

Balwin as the contractor, client, quantity surveyor and procurement manager, they have the luxury of procuring products aligned with their ultra-green vision for these structures. Building materials are carefully selected to ensure a high content, with Balwin committing to using steel with over 90% recycled content and more than 1% of their contract value is made up of materials with recycled content. During construction, project-specific environmental and waste management plans have been developed to minimise the environmental impact and contribution of waste to landfills through the construction process.

Of course, sustainability hinges as much on how a building operates as the design and materials used in its construction and, to this end, sophisticated systems are in place to ensure maximum efficiency across the board. The energy efficiency of the building is achieved by applying various Greenstar measures as well as the extensive solar array installed on site. An energy model of the building was generated in the design stage which showed that the overall building design showed an overall improvement of 100% over a SANS 10400 notional building. These measures have resulted in the base building operating at net-zero carbon emissions. ■

PROJECT INFORMATION

Professional team: Greenbay

- **Company entering:** Boogertman + Partners Architects
- **Start date:** January 2020
- **Project end date:** January 2023
- **Client:** Balwin Properties
- **Main Contractor:** Balwin Properties
- **Architect:** Boogertman + Partners
- **Project Manager:** Balwin Properties
- **Consulting Engineer:** KCE Engineers

Professional team – Greenbay

- **Company entering:** Boogertman + Partners Architects
- **Project start date:** January 2019
- **Project end date:** January 2023
- **Client:** Balwin Propertiese
- **Main Contractor:** Balwin Properties
- **Architect:** Boogertman + Partners
- **Project Manager:** Balwin Properties
- **Consulting Engineer:** K&T Engineers

DEPARTMENT OF RURAL DEVELOPMENT AND LAND REFORM

Arising from a history of a non-democratic society, South Africa's Constitution has been hailed as one of the most progressive in the world, a culmination of far reaching and inclusive negotiations. Human rights and freedoms are central to this document and are stipulated as those of equality, freedom of expression and association, political and property rights, housing, healthcare, education, access to information, and access to courts.

The fundamental goals which have guided the design process are:

- Producing an environmentally responsible design
- Producing a design based on principals of nature and honest materials
- Providing a democratic environment for public participation and interaction
- Providing a building that is easily accessible and welcoming to the public and responsive to the heritage of the site
- Producing a concept that is representative of the Department's culture and values
- Creating a pleasurable and productive work environment for staff
- Providing a quality building which also encompasses Value for Money for the Department of Rural Development and Land Reform.
- Create an iconic symbol of and for the city, within the limits of affordability as prescribed in the RFP documents.

The building footprint is strongly influenced by the urban fabric and spatial organisation of its context.

The situation of the overall structure is shaped by passive energy saving/sustainable principles; the extent of glazed façade is oriented along a north/south axis while the structure's east/west 'bookends' are kept as solid elements. As such the arrangement of the lengths of floorplates are in an east-westerly direction. This optimal orientation, together with a useable floor depth of 17,5 m across all blocks, permits the most effective light penetration into the offices and minimises low angle direct sunlight from the east and west.

The building's location clearly defines the streetscape and boundary of the site. This massing also distinguishes the facilities from the surrounding urban/residential fabric. A dramatic open space is created between the old (heritage buildings) on the western edge of the site opposite the new offices to the east. A layering of time will be experienced with old and new closely integrated in its uses.

A controlled and secure dedicated road access for employees/staff of the department has been planned to the north of the site off Justice Mohamed Street/Rhodes Avenue. The lower podium level will also provide access into the facilities for service vehicles, making deliveries to the archives as well as providing the Minister and other VIP's alternate emergency exit route. The ingress and egress points to this parkade are off Justice Mohamed Street and Rhodes Avenue.

The VIP and public access is planned off Lilian Ngoyi Street at the intersection to Willow Road.
A dedicated VIP parking garage is directly under its associated building block on the upper podium level and is secured. Public parking is also accessed at this intersection and is positioned within the upper podium level. A vertical circulation core within this secure public parking area will move visitors up to the top of the podium where a security screening point will monitor and vet the public accessing the precinct.

The proposed new building has been planned to be deliberately different in its architectural approach and design language to the existing heritage structures. It has been set back from these historic buildings to not impose on their presence or scale. A bermed landscaped lawn area is created between the existing and new structures which creates a neutral space for these two opposing structures to be marvelled at.

The berming of the landscape on the western and northern edges of the structure allows for a direct transition from the public and private realms to the field.

This open area is envisaged as a people friendly space to be utilised and experienced by all. The planning of this space has been strongly influenced by the injustices of the past; by attempting to abstractly reverse the hierarchy and social order of open space and create a public realm that is accessible and open to all.

The building aims to utilise as much natural light as possible. The main goal is to reduce the building's dependency on electrical light. ■

PROJECT INFORMATION

- **Company entering:** Boogertman + Partners Architects
- **Project start date:** March 2021
- **Project end date:** December 2022
- **Client:** Tshala bese uyavuna
- **Main Contractor:** WBHO and Mhlaba Properties
- **Architect:** Boogertman + Partners
- **Project Managers:** WBHO and Mhlaba Properties
- **Quantity Surveyor:** AECOM
- **Consulting Engineer:** Pure Consulting

JOHANNESBURG INTERNATIONAL TRANSPORT INTERCHANGE (JITI)

A proposal to construct an international long distance and cross border transport and shopping hub has been on the agenda of the City of Johannesburg for over 15 years – as the city became a more important trading destination after the birth of democracy.

However, migrants and their families have had a need to travel safely and accessibly for as long as Johannesburg has existed as a formal town. The establishment of this building aims to restore dignity to those passengers who traditionally have been forgotten and neglected by providing them with a world class facility.

The need to improve the quality of life of commuters, streamline the flow of traffic and strengthen the commuting connections with the rail service all indicated that there was an urgent requirement to develop a new integrated transport facility with good access to Park Station. The underdeveloped Kazerne Taxi facility provided an opportunity for such a facility.

In the context of the strategic importance of this site, in proximity to Park Station and the proposed project to deck the railway line and connect Braamfontein with the inner city, there was an opportunity to increase the scale of this development.

Research and analysis in the draft Johannesburg inner city traffic and transport study had estimated that there were about 190 000 taxi trips (provided by about 5 800 taxis) and 30 000 bus trips in the morning peak in 2010 in the inner city. Even with moderate growth projections and the shift to bus commuting through the Rea Vaya service, the architect expects these numbers to be at about 185 000 taxi trips and 45 000 bus trips in the inner-city morning peak by 2030. The Johannesburg International Transport Interchange (JITI) aims to address these major shortages.

Prior to developing the concept scheme the design team invested a significant amount of time to research the local dynamics and inner workings of the site's immediate setting. It was of paramount importance to ensure that the scheme would seamlessly integrate into the urban context and work in unison with the complex surrounds. Once the context was fully understood the various components could be aptly positioned.

At its core, the main purpose of the project was to provide a world-class facility for long distance travellers. This was a segment of society that traditionally was neglected and never catered for. A series of informal, unsafe, and severely inadequate bus ranks are dotted throughout the city. These informal ranks act as the 'front doors' into the city for those seeking greener pastures.

One of the most significant designs challenges was to safely harmonise the movement of taxis, buses, and pedestrians all under one roof.

In order to assist with this process a series of high tech vehicular and pedestrian traffic models were developed. This allowed us to simulate flows and address bottlenecks upfront. Entrances and exits needed to be carefully considered and by adding a dedicated public transport route around the full perimeter of the site uninterrupted traffic flows were ensured.

One of the key successes of the project was due to the way the design team embraced the informality of the context and celebrated it within the building. They did not simply impose first world models of transportation buildings but instead provided us with a truly contextual building that responds to its complex backdrop.

The size and variety of the retail units effectively provides for economic progression. Shops range in size from small 5 m units right up to anchor store sizes. This allows our smaller retail tenants to grow and progress to larger shop sizes as their needs expands.

This iconic transport hub serves as a gateway into Joburg's inner city. The use of bold colours expressed in the red polycarbonate cladding creates a beacon of light in the landscape of the city. Our insistence on using robust and low maintenance materials was adhered throughout. ■

PROJECT INFORMATION

- **Company entering:** Urban Soup Architects
- **Start date:** 2016
- **End date:** 2021
- **Client:** Johannesburg Development Agency
- **Main Contractor:** Enza Construction
- **Architect:** Urban Soup Architects
- **Principal agent:** Badat Developments
- **Project Manager:** Badat Developments
- **Quantity Surveyor:** KDM Quantity Surveyors
- **Consulting Engineer:** Hlanganani Consulting Engineers

FAIRBRIDGE MALL

Fairbridge is situated on the corner of Old Paarl Road and Brackenfell Boulevard in Brackenfell South, Cape Town. The mall was redeveloped from a poorly performing retail only space to a mixed use offering, with Checkers Hyper as the anchor tenant on the ground floor and commercial office space for Checkers Hyper on levels 1 and 2.

Our goal was to create a beautifully simple yet dynamic building form. The concept is of a white glass box sitting on top of a black glass box. The white glass box accommodates the office component while the black glass box contains the retail component. It is a slick minimalistic design that makes a dynamic statement in its context. Its design impact is the simplicity of form and concept.

Design considerations

- Clear well-planned retail layout on the ground floor.
- Active front façades.
- Convenient access and parking.
- Incorporating a courtyard in the design assists with natural lighting to the office floor plates.
- Both concrete and metal sheet roofs have insulation underneath. This assists with thermal gain and loss which reduces AC consumption.
- The colour and thermal performance of the curtain wall glazing has been optimized, further assisting with reduced AC consumption.
- Skylights above the shopping mall provides natural light, therefore reducing lighting requirement to the mall.
- Passive design solutions such as the cantilever of the 2nd floor office over the 1st floor office, providing shade to the north and west elevations on the 1st floor.
- Fritted white glass is incorporated on the 1st floor office façade as a means of glare and heat load reduction.

Fairbridge Mall offers 25 shops which are located on a single retail level, with Checkers Hyper as the anchor tenant. National brands represented include Clicks, Capitec, Checkers Liquor, Miladys, PEP Home and PnP Clothing. The site offers 1 056 outside parking bays with easy access to the retail level via three entrances.

The redevelopment of this poorly performing mall resulted in a compact, convenience-orientated retail offering that services not only the local area but the many Checkers staff who are accommodated in the new building and in the adjacent Checkers head office campus.

Checkers Hyper Brackenfell has become one of the group's flagship branches. The state-of-the-art shop promises a world-class shopping experience with a strong emphasis on fresh food and convenience. The store offers a unique shopping experience with a coffee bar, wine store, sushi bar, pizza oven, imported rodizio grill, food truck, and in-store Kauai. The high-end bakery features well known brands like Schoon and Houwhoek Pies. A one-stop-shop, this flagship store also has a dedicated wellness section, party shop, and improved pet department. ■

PROJECT INFORMATION

- **Company entering:** Vivid Architects
- **Project start date:** June 2019
- **Project end date:** 12 August 2021
- **Client:** Shoprite Holdings
- **Main Contractor:** Isipani Construction
- **Architects:** Vivid Architects
- **Principal Agent:** Vivid Architects
- **Quantity Surveyors:** Senekal Allen & Partners
- **Consulting Engineer:** KLS Consulting

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MALL OF THEMBISA

Mall of Thembisa is an iconic new shopping mall designed by MDS Architecture for rural retail development specialist McCormick Property Development (MPD). The new 44 781m² GLA mall is situated on the busy Olifantsfontein Road in the North Western quadrant of the growing township of Thembisa.

The development includes a standalone Cashbuild and KFC, a taxi rank for 56 taxis as well as a community-based market garden initiative on site. Earthworks commenced mid-2019 and Mall of Thembisa opened to the public on 20 November 2020.

The presence of pockets of dolomite on the site created engineering and construction challenges which required the addition of specialist consultants to the project team. The significant slope of the site and the requirement to strategically deal with the stormwater run-off away from the building due to dolomitic conditions, created further design challenges for the team. The design solution was the cutting into the slope of the site to create a centrally located double-storey rectangular building, with the public entering the lower ground level along the east façade and upper ground level along the west façade. The centre is surrounded by on-grade parking with a fall away from the building, with numerous external entrance roofs and walkway canopies ensuring that the water is kept away from the structure.

The design response to the slope of the site and building's shape and central location with the entrances along the two sides, essentially gave the building two prominent front façades. This required strategic and innovative design thinking in terms of the placement of services and delivery areas, which are extensive components of any retail development, especially one of this size. In response, a services passage ensures easy access to multiple service areas, while design elements along the façade enhance the aesthetic and mask potentially unattractive aspects of service areas.

The main features of the Mall's external architecture are the distinctive entrance canopies which comprise columns in the shape of stylised tree trunks and branches and leaf shaped roofs, and various walkway canopies along the building's perimeter, ensuring that the building is externally orientated as much as possible. The innovative design moves away from the idea of the shopping mall as a 'shed' where the design

PROJECT INFORMATION

- **Company entering:** MDS Architecture
- **Project start date:** June 2019
- **Project end date:** November 202
- **Client:** McCormick Property Development and KJA Group Holdings
- **Architect:** MDS Architecture
- **Contractor:** Mike Buyskes Construction
- **Structural Engineer:** SCIP Engineering Group
- **Civil Engineer:** SCIP Engineering Group
- **Quantity Surveyor:** Quanticost Quantity Surveyors
- **Electrical Engineer:** KKA Consulting Electrical Engineers
- **Mechanical Engineer:** Pretocon Consulting Engineers
- **Wet Services Engineer:** CKR Consulting Engineers
- **Fire Consultant:** Fire Safety Designs Fire Consultants

is internally orientated and little attention is given to the building's façades. The external walkways connect the various entrances with some of the shops also having exposure and entrances along the building's façade. The largest leaf-shaped roof covers the external food court area and main entrance, offers al fresco dining options and opens out to the external children's play area.

The anchor restaurant, Imbizo, is located on the most prominent north east corner of the building, and can be entered internally from the mall as well as from the external parking area. The restaurant takes full advantage of the magnificent views of the township beyond with numerous large windows and internal and external seating areas located in the circular aluminium-clad, triple volume form which also forms a focal point of the building from the main road.

Given the anticipated footfall numbers at the Mall, the brief was to maximise natural light and a feeling of space within the Mall of Thembisa. The provision and large extent of the clerestory windows created structural challenges, as well as a challenge of providing smoke extraction for the mall areas. The design solution was the utilization of actuated windows in lieu of more traditionally used louvered openings.

Window actuators were installed on a number of clerestory windows, allowing these to open in case of fire. This ensured that the number of louvres required was reduce, and the number of windows and provision of natural light thereby maximised. The actuated windows can be further utilised to provide natural ventilation to the internal space as required.

The numerous pop-up roofs flooding the interiors with natural lighting through clerestory windows are a prominent architectural feature. There are also extensive openings in the upper ground floor slab, with glass balustrades creating double volume spaces which further bathe the building with natural lighting all the way down to the ground level.

Further innovative technology which was pioneered on the project was installation of light sensors which adjust the levels of internal artificial lighting according to external lighting conditions and the amount of natural light coming thorough the clerestory windows. ■

VOPAK TERMINAL LESEDI – ADMIN BUILDING

Vopak South Africa Developments, a joint venture between Royal Vopak and Reatile Resources (referred to here as 'VSAD') is undertaking the development of a bulk storage facility known as the Vopak Terminal Lesedi, in Heidelberg, Gauteng Province.

Central to manifesting VSAD's requirement to achieve a high-quality indoor environment for the facility's Admin building that focuses on the well-being of the building's occupants is a sophisticated and complex advanced Heating, Ventilation & Air Conditioning (HVAC) system. This consists of a mixed-mode ventilation system that optimises the use of natural ventilation when the outside air conditions are desirable, and switches to mechanical air conditioning when the outside conditions are not favourable.

The Admin building design incorporates an extensive range of environmentally sustainable initiatives, and achieved a 5-Star Green Star South Africa Office v1.1 Design rating from the Green Building Council of South Africa (GBCSA).

Vopak South Africa Developments (VSAD), a joint venture between Royal Vopak and Reatile Resources is undertaking the development of a bulk storage facility known as the Vopak Terminal Lesedi (VTL), in Heidelberg, Gauteng Province.

The purpose of the project was to design and implement a VTL Admin building incorporating an extensive range of well-integrated environmentally sustainable initiatives in line with the Green Star South Africa Office v1.1 certification tool from the Green Building Council of South Africa (GBCSA).

These were to achieve outstanding indoor environmental quality, energy efficiency and water-saving, in order to reduce the building's carbon footprint and the related global warming effect.

In order to accomplish VSAD's requirement to achieve a high-quality indoor environment that focuses on the well-being of the building's occupants, the building features passive design combined with an advanced Heating, Ventilation & Air Conditioning (HVAC) system. This consists of a mixed-mode ventilation system that optimises the use of natural ventilation when the outside air conditions are desirable, and switches to mechanical air conditioning when the outside conditions are not favourable.

The project has achieved a 5-Star Green Star South Africa rating and preparation for application for an As-built rating is under consideration.

Construction exemplifies passive design

The VTL Admin building project was targeting a net zero energy performance; hence the starting point was passive design. Various options related to the building envelope and façade treatment were considered and modelled in order to optimise the choice and the performance of the active systems.

Reflecting this, the building includes large roof overhangs sufficient to cast shadows on the building's north, east and western façades, whereas the atrium was designed on the southern side to encourage large amounts of natural light. while maintaining lower cooling loads.

The high-performance glass façade included thermal breaks, which reduces the building's external heat gain, allowing for a lower cooling capacity air conditioning system to be installed. The façade can also be 100% disassembled for reuse in the future.

The northern façade faces the large tarred road where fuel trucks drive. The main access road on the northern side of the building was given a grey surface finish reflective paint to prevent the urban heat island effect increasing the external heat gain into the building.

These initiatives contributed to an energy performance simulation that indicated a 173% reduction in energy consumption compared with a notional SANS 204 compliant building. This was achieved in spite of the fact that the extensive glass façade allows 91,5% of occupants to have external views.

DESIGN INNOVATION

The VTL Admin building design employs technologies that are not commonly found in the local commercial building market:

- The primary ventilation operation mode is natural ventilation (NV) by means of hopper windows
- Automatic switching to a variable refrigerant flow, heat recovery system when external conditions become unfavourable
- All fresh air fans systems operate as variable air volume systems with CO_2 monitoring in each room
- Sophisticated building management system turns off any energy-wasting lights and air conditioning units
- A photovoltaic installation on the roof enables 'Net Zero energy' operation.
- Extensive water management features even an on-site blackwater treatment plant

The building's heating, ventilation and air conditioning system is an innovative mixed mode or 'hybrid' ventilation design. This system optimises the use of natural ventilation when the outside air conditions are desirable, and switches to mechanical air conditioning when the outside conditions are not favourable.

The natural ventilation portion of this system uses motorised chain actuators that are connected to the façade and internal hopper windows.

Automated NV system

The natural ventilation (NV) system analyses the external wind speeds and temperatures, and has a rain sensor which all link back to the NV control panel. Should there be excessive wind speeds, extreme hot or cold external temperatures, or rain, the NV system

will command all the hopper windows to close. This weather station also records instantaneous wind direction, and will plot data over a 12-month period to allow further refinement of the NV control logic. The intention is to reconfigure the control system to open windows on the side of the building opposing the wind direction. This will allow the building to function in NV mode for longer periods.

The NV system is also linked to internal space temperature sensors that allow the windows to modulate based on the room temperatures. For security and other reasons (e.g. to avoid insect ingress), the NV system is locked out at 18:00, which then activates the mechanical system.

Advanced VRF air conditioning plant

The air conditioning system consists of a Variable Refrigerant Flow (VRF) plant installed with heat recovery modules to recover heat during intermediate seasons. Each space has its own evaporator unit linked to an individual port of the heat recovery module. This allows for separate heating and cooling simultaneously throughout all the required spaces within the building. While VRF systems are commonly used, this system is linked to a central control system networked to the building management system (BMS). The building management system analyses the room occupancy status from the DALI lighting system. If the space has been unoccupied for an extended period, then the BMS will turn that specific indoor unit and light off, to save energy.

Reducing the building's carbon footprint

A range of interventions were implemented to reduce the carbon footprint of the VTL Admin building and the related global warming effect, including:

- The air conditioning system contains R410 – a refrigerant gas with a Zero Ozone Depletion Potential (ODP)
- The LED energy efficient lights lower energy demand and consumption
- The rooftop Photovoltaic cells provide on-site clean energy generation
- The occupancy sensors switch off the lighting and individual AC units to reduce energy consumption
- During NV mode in the respective rooms, the AC will be off, which reduces energy consumption
- There is a 30% reduction in Portland cement content of the concrete mixes used
- The façade has the ability to be 100% disassembled. This means that it can easily be removed for future reuse. The components are able to be reused without having to be recycled.
- 16% of the building materials were sourced within 50 km of the site and a further 20% within 400 km of the site. This resulted in less carbon emissions from the logistics to get materials to the site.

Promoting transport sustainability

- 54 parking bays have been provided for the VTLL Admin building. (This is less than is required by the local planning authorities to encourage building users to make use of alternative modes of transport).
- Preferential parking for fuel efficient (FE) vehicles and motorbike parking
- Two electric vehicle charging bays have been provided on site
- Bicycle cycling facilities (cycling lanes, parking facilities, showers, and lockers) are available to staff and visitors. ■

PROJECT INFORMATION

- **Company entering:** Zutari
- **Project start date:** February 2019
- **Project end date:** December 2020
- **Main contractor:** Enza Construction
- **Architects:** Fokkema & Partners Architects (Netherlands), Messaris Wapenaar Cole Architects (South Africa)
- **Principal Agent:** Vopak South Africa
- **Project Manager:** Vopak South Africa
- **Quantity Surveyors:** Zutari
- **Civil Engineer:** Zutari

16 ON BREE STREET

In response to a strong demand for quality residential apartments in Cape Town, FWJK Developments conceived the development of an iconic high-rise in the foreshore area.

A key requirement for the City of Cape Town's development approval was to retain a 12-metre-high existing heritage façade on the site. Preserving this fragile historic feature, which had been built using rock, clay and limestone, at ground level of the proposed tall building required innovative structural solutions to fit within the project budget and timeframe.

Appointed the structural and civil engineer on the project, Zutari (previously Aurecon South Africa) was responsible for designing the tall building. Innovative structural solutions were also required to create sufficient parking within the building's constrained footprint, and to break away from traditional high-rise design in order to mitigate lateral drift under wind load.

At 120 m and 36 storeys high, 16 on Bree is the tallest residential and second-tallest mixed-use development in Cape Town over the last 20 years. It offers unrivalled views of the city's natural beauty, while still being in walking distance to the V&A Waterfront commercial hub and the CBD.

Keeping within the project budget and timeframe was a tribute to the successful collaboration between the structural engineers, the developers and the rest of the project team.

Due to the relatively small size of the site, the architectural scheme for 16 on Bree did not allow sufficient space for a core that was able to resist the lateral loads that the structure had to accommodate. Consequently, the lateral design of the building called for out-of-the box thinking to ensure that the geometric architectural requirements, as well as the structural requirements, could be satisfied simultaneously.

The solution adopted was a lateral system consisting of a substantially smaller reinforced concrete core situated in the middle of the building (in plan), with outrigger walls at two distinct locations that were connected to two perimeter columns. This meant that when the structure was loaded laterally the core would want to overturn; however, the perimeter columns would be engaged to the core through the outrigger walls. They would aid in resisting the overturning moment due to the lever arm between them and the core centroid.

The elegance of the solution was that the outrigger walls did not need to be placed in the parking levels hampering the vehicle flow. Rather, the outrigger walls were located in the residential levels and aligned with apartment walls to avoid losing any saleable residential area.

The size and complexity of the building, as well as the unconventional lateral system and large number of load cases and combinations that had to be considered, meant the structure required a more substantial analysis than is typically carried out for standard buildings. To cater for all of the complexities, a three-dimensional finite element model of the full building was produced. The modelling was also used to optimise the number and position of the outriggers to mitigate the effects of stabilisation and vibration from the central lift and stair core.

The finite element model included all combinations of gravity and vertical loads that were required to be considered. Furthermore, envelopes of the load combinations were included, which made it possible to very easily and quickly determine the required design forces for any element in the model for all load combinations. The foundations and columns were designed using the finite element model as it provided a more accurate contributing area, and therefore provided a better estimate of the axial loads.

The ingenious solution for protecting and preserving the historic façade was to construct a steel bracing

system with large counterweights on the street side stabilising the fragile façade wall. This allowed uninterrupted construction of the building, while the wall was kept safely in place. Once the parking levels behind the wall were built, the wall was tied into the concrete floors using movement-compensating connections, allowing the steel bracing to be removed. An essential requirement for development approval, retaining the heritage façade creates an eye-level experience that blends in seamlessly with the surrounding area.

To be able to accommodate the required number of parking spaces within the building's footprint, a compressed central lift and stair core was designed: an alternative to the decentralised lift and stair core on traditional tall buildings. However, the compressed central lift and stair core meant the lateral structural stability in the shorter direction of the building was compromised.

Initial thinking on reducing potential lateral drift under wind load was to use outrigger walls, which stiffen the core by connecting it to enlarged perimeter columns on the upper levels of the building – resulting in a 'push-pull' effect between the core and the enlarged columns, and considerably enhancing the lever arm of the force-resisting mechanism.

The height of the structure of 120 m above ground level, together with the relatively small site created significant geometric restraints, made the design of the building more complicated than conventional buildings in terms of gravity and lateral design perspectives.

For the design of the columns, a sophisticated approach was required to enable strength considerations to be optimised within the constraints of the project budget. For instance, the heavily loaded columns towards the bottom of the building required high strength concrete (60 MPa), while the slabs only needed to be a standard concrete strength (30 MPa) and it was uneconomical to use a high-strength concrete. However, typical construction methodology employed in casting slabs onto columns results in portions of the column concrete having a lower strength. This lower strength area had to be accounted for to ensure that the force in the column could be transmitted through it.

To further complicate this, the building comprised three unique occupancy types, namely retail (two levels), parking (nine levels) and residential (25 levels). The column locations for the three occupancies differed from one another, which resulted in either large, heavily loaded transfer beams or column transitions with significant eccentricities that had to be designed for. For some instances, three-dimensional, non-linear finite element brick models in which both the concrete and reinforcement were modelled to check concrete strains. This also required the use of international design codes and specialist technical literature.

As there was little margin in the budget to ensure that the building was financially viable, most elements had to be individually designed and optimised to a utilisation ratio of around 90%. This required the utmost understanding in order to do so. In addition, a BIM model was used to estimate costs for each element and provide projected estimates to ensure that the structural cost of the building was within budget. ■

PROJECT INFORMATION

- **Company entering:** Zutari
- **Project start date:** March 2018
- **Project end date:** April 2021
- **Client:** FWJK Developments
- **Main Contractor:** Concor Construction
- **Architect:** FWJK Developments
- **Principal Agent:** FWJK Developments
- **Project Manager:** Orion Project Managers
- **Quantity Surveyor:** FWJK Quantity Surveyors
- **Consulting Engineer:** Zutari
- **Structural Engineer:** Zutari
- **Civil Engineer:** Zutari

RADISSON RED OXFORD PARKS

The Radisson RED hotel in Rosebank, Johannesburg – the second in the group's RED brand in Africa – embraces key themes of art, fashion and music, reflecting this fashionable suburb's character of design freedom and exploration. Concor, through its professional approach, meticulous planning and resourcing capability, converted the Radisson RED vision into reality between October 2019 and April 2021, despite delays caused by the country's COVID-19 lockdown.

Situated in the vibrant Oxford Parks mixed-use precinct in Rosebank, the contemporary 222 room hotel was designed to meet a minimum 5 Star Green Star Custom Hotel rating.

The building basements were completed as part of the first two phases of the Oxford Parks Precinct, enabling Concor to immediately begin construction of the superstructure from ground floor up. At the peak of construction activities, this fast track project had over 500 people including more than 45 different subcontractors on site.

The base build spec was provided by dhk Architects, while the interior design spec was by Source IBA. Concor took the project through to furniture, fitting and equipment (FF&E) stage including beds, chairs, television sets and the physical backbone for Wi-Fi connectivity.

Accommodating 222 rooms on a limited footprint translated into an architecturally sophisticated yet compact design which incorporates functionality on an optimised footprint. Ensuring the comfort and safety of guests, most of the internal partitions are constructed using dry-walling materials with high acoustic and fire-rated properties. The specifications for these partitions are highly technical, eliminating noise transfer from room to room. Comprising seven levels on top of a ground floor, as well as a roof level for plant and services, the building is a concrete structure based on conventional and post-tensioned slabs with grids to suit the room sizes.

Concor's work was guided by two sets of design specifications, one for back-of-house and another for front-of-house. The base build spec was provided by dhk Architects, while the interior design spec was by Source IBA.

To accommodate the compact design, majority of the plant infrastructure is located on the roof (the eighth level). This includes water tanks and all heating, ventilation and cooling (HVAC) systems. The utility area has been cordoned off using artificial foliage screens making it aesthetically pleasing.

Enhancing the modern appearance and functionality of the east and western ends of the building are double glazed glass curtain walls with offset vertical aluminium cladding. The north- and south-facing sides have an attractive, yet practical face brick patterned façade with punch-out square windows.

The building is monitored using both a Building Management System (BMS) and a Guest Room Management System (GRMS) system. This follows the trend in smart building development where automation is used enabling greater functionality and an enhanced user experience.

Radisson RED is committed to sustainable design and the hotel contains numerous elements underpinning its 5 Star Green Star Custom Hotel rating. This rating recognises that the building demonstrates 'South African excellence', and is a step above the Best Practice level.

Using both a Building Management System (BMS) and a Guest Room Management System (GRMS) facilitates significant energy savings as those utilities when not in

PROJECT INFORMATION

- **Company entering:** Concor Construction
- **Project start date:** 30 September 2019
- **Project end date:** 12 April 2021
- **Client:** Intaprop
- **Main Contractor:** Concor Construction
- **Architect:** dhk Architects
- **Principal Agent:** Duncan Clark Project Management
- **Project Manager:** Duncan Clark Project Management
- **Quantity Surveyor:** Gro2 Consulting
- **Consulting Engineer:** Pure Consulting

use are switched off automatically. This includes the HVAC installation and lighting.

All glass used in the Radisson RED is solar performance glass which lowers internal ambient temperatures significantly reducing HVAC energy consumption.

Cognisant of the need to reduce the carbon footprint of the structure, Concor worked closely with its cement and readymix supplier to ensure the concrete would have a low carbon footprint. Using building materials sourced from close proximity to the project site also minimised the carbon footprint.

With the ultimate objective achieving a 5 Star Green Star Custom Hotel Rating, it was critical that all construction activities were aligned with this aim. Key individuals in the Concor team obtained Green Star certification underpinning the knowledge base required to accomplish this goal. ■

PROJECT MARIACHI

AbInBev regards itself as one of the world's leading beverage producers, paving itself to become the greatest brewers of all time. Being the flagship brewer in Africa for AbInBev, Rosslyn brewery takes no despair in achieving this goal through the expansion project, namely Mariachi.

Risk management can be encompassed as the components of project initiation, completion and far importantly, risk exposure. This includes – but not limited to – delays, project management oversight, communication, scheduling etc. Project Mariachi is unique in the sense that it implements risk management in all facets of the project – this well and truly upheld by the logs of activities, meeting minutes and field reports that need to be carried out daily. This is essential in the when accessing detailed reports by the client or contractor when needed.

Lack of integration creates data silos that block the flow of information – a statement far from truth as far as Mariachi is concerned as the risk exposure is assessed thoroughly by signing highly detailed scheduled work permits on a daily basis, monitoring the risks by having weekly safety walks and site incident reports with the client and contractor engineers. Lastly, planning for risks by forecasting critical tasks to be undertaken throughout the entirety of the project areas through careful collaborative virtual meetings between the main contractor, client-appointed subcontractors (not associated with main contractor) and the South African Breweries company.

In addition, risk management is implemented through the appointment of a trustworthy and professional contractor such as WBHO who has a proven track record for the delivery of highly complicated and duration-conscious projects along with its longevity in the construction industry.

The most important risk management tool between the main contractor and client is the type of contract the two parties are willing to engage in.

The state-of-the-art Krones machinery is the life of the Packline 9 warehouse through which the Corona beer flows. The newly-built 7 781 m^2 Packline 9 warehouse is a fierce addition to the mega-plant boasting an optimal functioning capacity of 100 000 beers per hour making it the largest producer of beer in Africa.

Unique to Mariachi is the micro-fiber concrete used in the construction of the railway road. This reinforced concrete is used to check shrinkage and ultimately prevent cracking. Consequently, it is used to stop water bleeding into the concrete by reducing its permeability. An additional use of this concrete is to create a railway road that is resistant to abrasion and shattering.

Stainless steel pipes are also popular and exclusive to the project expansion works as they are exclusively used in the plants pipe works. Although the process being meticulously executed, there are no margins for error, they add a new aspect to corrosion resistance of pipes, making them more durable against the acid and effluent that flows through them.

Project Mariachi's EIC mainly focuses on programs that may impact the planning and execution of activities and its neighbouring environment. Factors include environmental compliance, pollution inhibition and conservation. These factors require integration between the EIC, health and safety and risk mitigation measures to ensure that strict precautions are adhered to when any activity is in progress since the surrounding environment involves live works.

The project's environmental compliance is in line with Act No. 59 of 2008: Waste Act – this Act provides a framework on managing all the waste generated during construction activities. This includes the implementation of disposal procedures and refuse control systems to control wastes amounts on site. The site promotes waste separation and places strict controls against burying and burning of any waste material – a certified off-site refuse area is established where all waste materials are stored, recycled and re-used by local communities for different purposes.

Dust pollution remains one of the most problematic issues on site – high dust content can affect the respiratory system and reduce visibility. This may not be ideal for a live environment.

The site has been identified to have groundwater, activities such as excavations tend to disrupt aquifers that contain groundwater. This exposes groundwater to large amounts of contaminants (such as fuels, nitrates, biological and radio-active materials). ■

PROJECT INFORMATION

- **Company entering:** WBHO
- **Project start date:** 17 February 2021
- **Project end date:** 31 April 2021
- **Client:** Anheuser-Busch InBev
- **Main Contractor:** WBHO
- **Principal Agent:** RHDHV
- **Project Manager:** ABInBev
- **Quantity Surveyors:** Turner & Townsend
- **Consulting Engineer:** ARUP
- **Steel Construction:** Cadcon

WITZENBERG ZERO WASTE TO LANDFILL PILOT PROJECT

JG Afrika and Circular-Vision were approached by the Wellington Association Against the Incinerator (WAAI) to assist in undertaking a Zero Waste to Landfill Strategy Pilot Project (Project) in Witzenberg Municipality (WM).

The landfill site in the WM are in a critical state due to high operating costs and limited landfill capacity, therefore, the overarching aim of the Project was to reduce the amount of materials disposed of at landfill.

Households in Tulbagh were selected by the WM Waste Manager to participate in the Project which entailed the household source separation of waste into the four categories of food waste, garden waste, recyclables and landfill waste. The Project ran from 2 October to 4 December 2019.

The aim of the Project was to test the source separation and collection methods for future replication within the WM.

The Project was undertaken in response to the landfill sites in the WM being in a critical state due to high operating costs and limited landfill capacity.

The Project Manager and project team engaged with the WM officials (including the Waste Manager and Municipal Engineers) on the challenges experienced in the Municipality, and possible solutions.

Once WAAI obtained additional funding, and part of conceptualising the Project, included meetings with the WM to obtain their input and consent into the methodology and programme. The WM selected the town for the pilot and allocated resources in terms of staff and vehicles.

The challenge was to develop a Zero Waste to Landfill model for WM due to the constraints on the current waste management facilities.

The solution

Phase 1

The intention of Phase 1 was to understand the character of the waste in the area to inform the development of a Zero Waste to Landfill model and divert as much waste as possible from landfill.

Phase 1 comprised the Waste Characterisation and Brand Audit for the following towns: Ceres, Tulbagh, Wolseley (including Op die Berg),Nduli, Prince Alfred Hamlet and Bella Vista.

This was conducted over two weeks (25 March – 5 April 2019) and included training of the local WAs to enable their assistance on the project.

Phase 1 concluded that opportunities that should be further assessed in the short to medium-term would be

separating the organics and recyclables in the waste stream at source and identify a method to collect these from households. Recyclable materials (paper, glass, plastic and metals) are cleaner if organics have been removed and removing organics from landfills reduces greenhouse gas emissions.

Phase 2 commenced with a follow-up waste characterisation and brand audit on 2 and 3 October 2019. All the black bags from the selected pilot area were included and the characterisation was undertaken by the local WAs after a refresher capacity building session.

Thereafter, participating households were requested to separate their waste according to the following:

- Clear Bag for recyclables
- Compostable bags for food waste
- In accordance with the existing system in WM:
- Green Bag for garden clippings
- Black bag for waste to be landfilled

All households in the identified pilot area were encouraged to participate on an 'opt-out' basis. Leaflets were placed in post boxes and residents were invited to a community meeting. At the community meeting, households were requested to register for acceptance of the starter pack of a caddy, recycling and compostable bags and thereby commit to participating in the Project for the duration.

Weekly weighing and collection of the separated waste as part of the Project commenced on 16 October 2019 and concluded on 4 December 2019.
The WAs were divided into four teams, each with a section of the pilot area for which they were responsible for weighing and recording the bags of waste on the kerb for collection.

Once weighed, the bags were collected with compostable and garden waste taken to a compost facility, the recyclables to an existing recycler operating from the landfill site. Black bags were disposed of at landfill.

Replacement clear and compostable bags were provided to participating households weekly.

The WAs continued to interact with the community and encourage participation or assist with problems that were experienced.

Environmental Sustainability

The Project was guided by the principles of the waste hierarchy (WH) as well as a Circular Economy (CE) approach.

The WH is an approach included in the National Environmental: Waste Act to address waste management in South Africa.

The WH places importance on managing waste by first reducing the generation of waste and leaving the last available option as disposal to landfill.

ACE approach refers to using products and services in closed cycles. The system is based on three principles: Designing waste and pollution out of the system; keeping products and materials in use at their highest value; and regenerating natural systems .
A CE approach is aimed at facilitating long-term resilience, economic opportunities, and providing

environmental and social benefits. The Project aimed to illustrate how a closed-loop system can be enabled within the WM, through ensuring that as much of the waste generated is recycled and re-used.

- The brand audit assisted the WM to identify opportunities for closed-loop take-back systems with local businesses.
- A closed-loop system prevents material leakage by keeping products and infrastructure in use for longer. Separation-at-source system aid in ensuring materials are available for reuse and recycling, reducing disposal and extending landfill lifespans.
- Diverting waste to recycling and composting helps to support existing composting and recycling operations and create new businesses within the WM waste sector.

Project learnings

The following project learnings are related to participation and separation of waste:

- Initially participation levels were low as residents were not showing interest in the pilot. Participation increased as the pilot progressed.
- Several residents were already composting food waste at home. Home composting should be encouraged by municipalities as the preferred solution to diverting organic waste from landfill.

The following project learnings are from composting organic waste at the compost facility:

- Some dog faeces and food waste were disposed of in plastic bags, instead of paper bags/newspaper or compostable bags and included with the organic waste component. This presented contamination challenges to the composting process.
- Majority of organic waste received at the compost facility was garden waste, meaning the composting process was not as quick as if there was a higher percentage of food waste with a higher moisture and carbon content. This would be expected to increase over time as the programme grows.

Overall, continuous education and awareness is critical in ensuring that separation-at-source is undertaken correctly to effect the desired behaviour change.

Feedback from the Compost Facility concluded that source-separation of organic waste is vital to ensure that viable compost is produced.

This Project proved that composting provides a viable solution to landfilling organic waste and the second phase is an opportunity to increase diversion of waste from landfill for composting and recycling; however, increasing residents' participation is important.

Note: The WM ensured the availability of WAs and a dedicated vehicle once a week for the separate waste collection and this is therefore not included in the contractual costs.

Composting was undertaken during the pilot by a local composter. The payment for the composting services did not fall within the scope of the JG Afrika fees.

Civil and financial contribution

The following significant civil contributions to the Tulbagh community were realised from the project:

- Education and awareness resulted in improved understanding of waste management and its impact on the environment and on municipal finances.

Estimated cost savings from implementing the Zero Waste Model are:

- Estimated 85% diversion of waste from landfill, adding 15 years to the Tulbagh Landfill and an annual landfill operational cost saving of R4 017 780.00 per annum (pa).
- Waste transport cost saving of R2 671 500 pa.

Opportunity for local enterprise development

The estimated jobs that could be created from implementing the Zero Waste Model at WM over a two-to-five-year period are:

- 20 WA jobs to provide Integrated Waste Management services.
- 50 jobs for waste pickers who will be integrated into the Zero Waste Management system.
- 100 community vegetable gardens and compost facility managers and operators.
- 150 recycling jobs.
- 1 500 jobs from compostable product manufacturing, waste collection, education and awareness, construction of waste related infrastructure. ■

PROJECT INFORMATION

- **Company entering:** JG Afrika
- **Project start date:** March 2019
- **Project end date:** December 2019
- **Client:** Wellington Association Against the Incinerator (WAAI)
- **Partner:** Witzenberg Local Municipality
- **Community:** Tulbagh
- **Consutants:** JG Afrika (Pty) Ltd and Circular Vision

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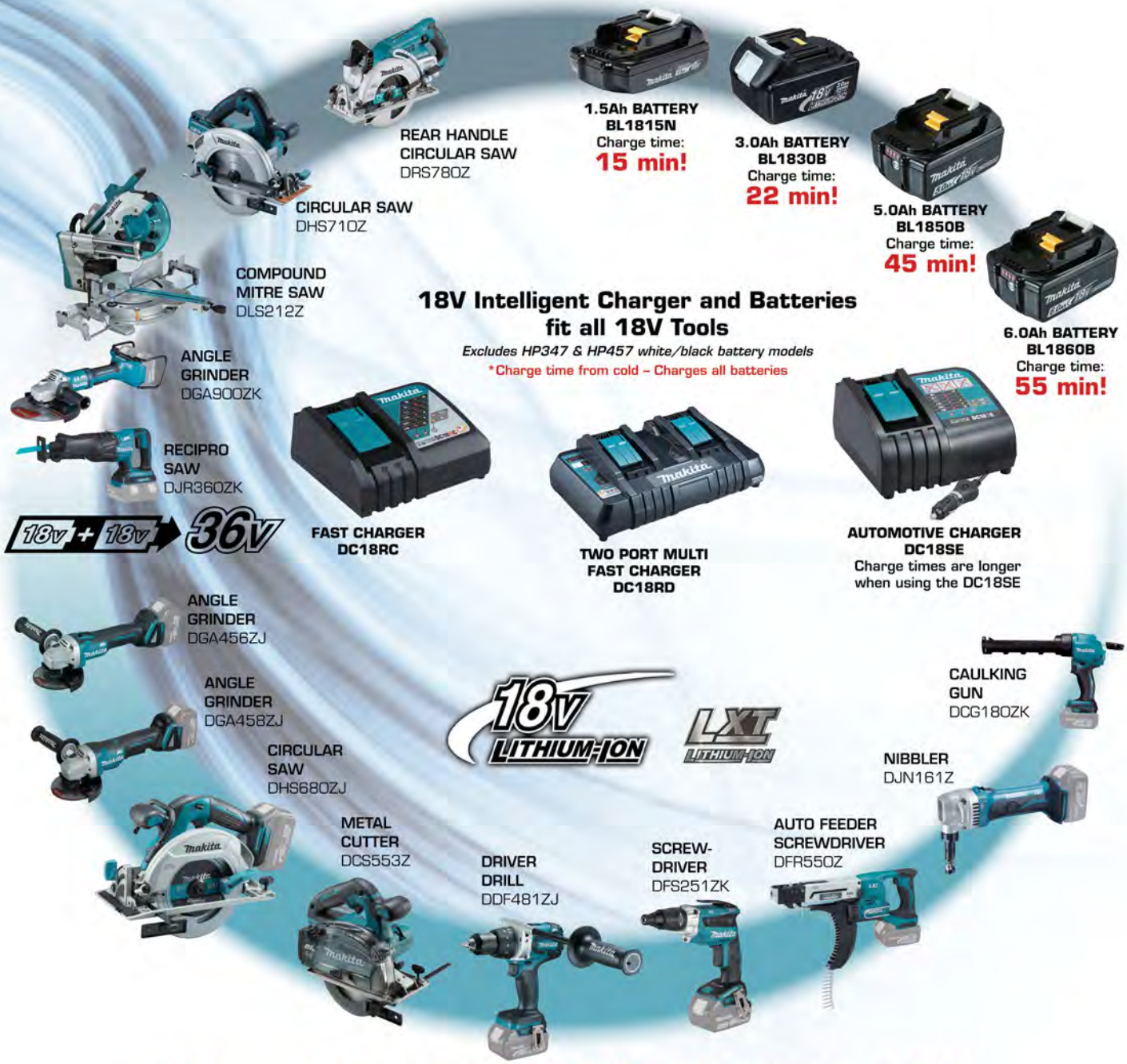

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