OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF

steel CONSTRUCTION

JANUARY / FEBRUARY 2019
VOL. 43 ISSUE 1

STEEL IN ARCHITECTURE: 6 PROJECT PROFILES

A BRAVE NEW AGE – FABRICATION INTO INDUSTRY 4.0

KEY CONSIDERATIONS WHEN DESIGNING A ROOF DRAINAGE SYSTEM

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COVER PHOTO: Silo 3 Exterior
PHOTO SUBMITTED BY: Arup for Steel Awards 2018

FEATURES

THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

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SAISC COMMENT

PAOLO TRINCHERO
CEO, SAISC

REALITY, STRATEGY **AND ACTION**

"THERE IS STILL MUCH WORK TO BE DONE BUT CO-OPERATION AMONGST THE MEMBERSHIP WILL BE A NECESSITY."

Economists predict that this is likely to be a challenging year. Internationally we have trade tensions and potential slowdowns, and locally 2019 is an election year which brings uncertainty. **In times like these it's very important to accept the realities, devise a strategy, identify priorities and act.**

Having experienced a very tough 2018, I think we should all be working very hard to get through this period and engineer opportunities wherever possible. The SAISC and its committed staff will continue to promote the positive image of the South African Steel Industry to all industry players, decision makers and customers. We would like to see the industry coming together on a regular basis to share and solve industry problems in a proactive way.

There are currently three objectives which the Institute and its sector focussed divisions will be engaged in persuing, essentially forming our value proposition for 2019.

1) Market growth for steel

All SAISC divisions (Steel Construction, Tube and Pipe, Metal Cladding and Roofing, Light Steel Framing, Powerlines and more) are focused on initiatives to grow and sustain the market for steel construction and related manufacturing. This includes steel framed multi-storey buildings, steel bridges, light steel framing and various products in the tube and pipe and metal cladding industries.

Education, training, maintenance of technical standards and quality are a key component of these initiatives. **Keep an eye out for full scale fire tests on the SAISC modular building system.**

2) Retaining the South African market share

3) Developing regional markets to increase steel consumption.

Where are the opportunities you may ask? (Many we have yet to discover)

- Significant investments have been promised from various international sources and we may see projects gaining some ground this year.
- We have a world class mining industry that may well start spending if the policy environment improves. Our EPCM's are getting busy which means we may see a turning point from care and maintenance to investment. This helps the construction, manufacturing and mining industries. The SAISC has been collaborating with the Mandela Mining Precinct and we hope to be able to report back on some projects in 2019.
- Our SOE's finances despite being in intensive care could improve in time. All SAISC divisions have worked very hard to encourage localization and continue to encourage unlocking of projects.
- **Our industry is leaner than it has been for a long time and it will benefit from an uptick in the economy.**

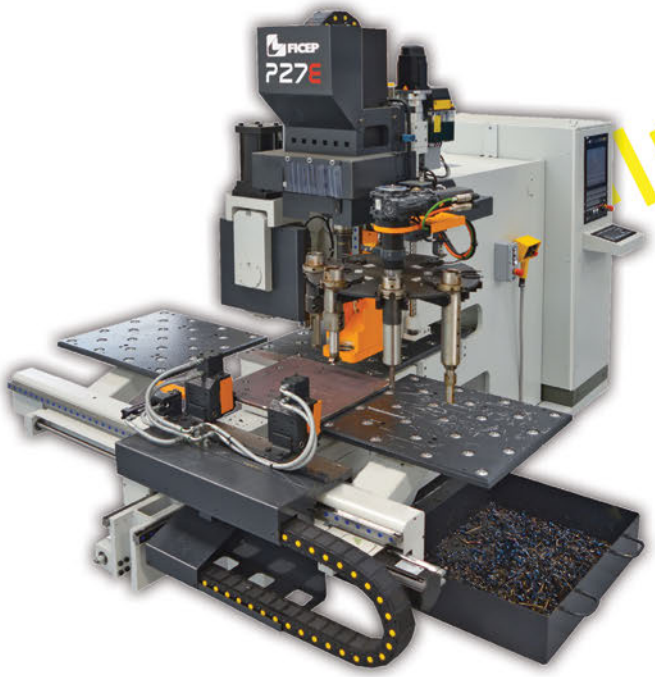
Steel construction has a number of favourable policy support measures with regards to fair trade and many have been rolled out across the various SAISC divisions to widen the net as far as possible. **There is still much work to be done but co-operation amongst the membership will be a necessity.**

We cannot rely on support measures to protect our industry alone as we have seen that domestic growth and **competitiveness are key.**

We would appreciate your comments to ensure we are on the right track and delivering on our mandate.

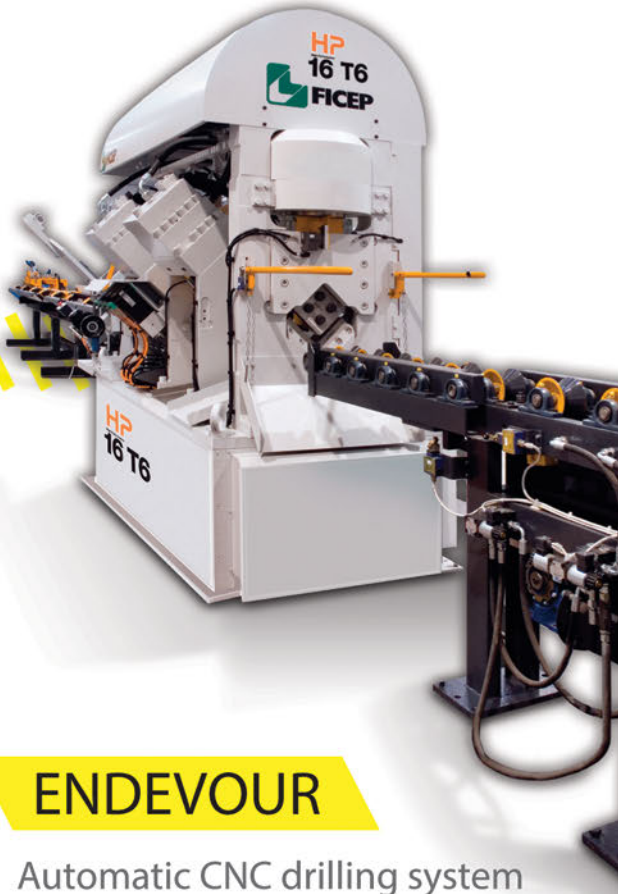
MACHINERY FOR THE HIGH QUALITY PROCESSING OF METAL PROFILES

FICEP



P 27 E

Plate drilling machine specifically designed for the automatic processing of plates up to a thickness of 80mm.



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EDITOR'S NOTE

DENISE SHERMAN
MARKETING MANAGER, SAISC

WELL HELLO THERE **2019...**

IT'S A CHANGE IN THINKING, NOT A CHANGE IN CALENDAR DATE THAT WILL BE THE CATALYST FOR GREAT THINGS!

Whether you believe in resolutions or not, there's no denying that there's a renewed sense of optimism in the air. Its amazing what a bit of December break can do for the tired brain. Does it really make that much of a difference though?

Why are we so often conditioned to endure the last quarter with a "I can't wait for this year to end" mindset? Confession time: I caught myself repeating that very phrase during a conversation at our AGM in November 2018. What I got was a thought-provoking rebuke of sorts. "What will be different on 1 January 2019 from the status quo on 31 December 2018?" *(thanks for that Johann Strauss!)*

Perception is reality, and mindset affects everything. The seemingly endless onslaught of challenges our industry faces is enough to dishearten and immobilise even the strongest of people. However… there is a light at the end of the tunnel, which (hopefully) isn't an oncoming train!

I'd like to think that the light is that there are many people with a passion for steel who want to see the industry succeed, and are determined to play an active and positive role to make it happen. It's a tough task I know, but the right mindset, coupled with active collaboration will drive the industry forward. It's a change in thinking, not a change in calendar date that will be the catalyst for great things!

Marketing matters!

Those of you who have engaged with us at events from mid-2018 onward, or who follow any of our social channels, will know that we've kicked into high gear as far as digital marketing efforts are concerned. There are a myriad of tools and platforms available to spread the *#PositiveStoryOfSteel* – and we'd like to encourage you to get connected and work alongside us. When approached in a smart and structured manner, digital platforms can be used effectively to tell your brand or product story, reinforce a positive image and build relationship with current and potential clients.

Authenticity is the name of the game, and being consistent in the type and frequency of content you post is the key to seeing results. People do business with companies they know, like and trust, and digital platforms can enable you to increase your online presence and develop those relationships in a cost-effective manner. Ensuring that your digital marketing content is well structured and aligned to your business objectives is essential in order to realise the best return on your marketing investment. Whether you handle digital platforms inhouse, or outsource to a specialist agency, having an understanding of each platform and its potential is important. The SAISC will be hosting an interactive ½ day workshop with "Social Media guru" Jacqui Mackway-Wilson on the 14th of March, at our offices in Johannesburg. Join us for an insightful and practical morning that will equip you to tackle social media marketing with confidence.

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FEATURE

AMANUEL GEBREMESKEL
TECHNICAL DIRECTOR, SAISC

UNPREDICTABILITY: **THE NEW 'NORMAL'?**

Unpredictability appears to be the new normal. This may have been the most important lesson of 2018. For instance who would have thought that removing international sanctions from Sudan and Zimbabwe would lead to their economic and political collapse?

As professionals many of us are very much into data collection, analysis and forecasting. Our era may then very well be coming to an end. This unpredictable era suits those who are pragmatic and very responsive to changes in their environment.

If it is not possible to reasonably predict the future then how does one make plans? For instance how would a steel mill decide where to deploy capital if it cannot predict the volume and nature of future demand? Merchants, fabricators and consultants who have relatively lower investment requirements face similar problems.

If Zimbabwe's political crisis deepens the most important role for architects, engineers and fabricators would be to come up with quick deployment resting places for potential refugees. Moreover food, water and sanitation requirements at camps could become extremely urgent. But how is a company executive to know that catering for refugees – rather than diamond mines – would be the next major demand. Even the South African government with all its resources does not seem to have anticipated the situation in Zimbabwe.

The answer may lie in reconfiguring ourselves and the companies in the industry to promote innovation and responsiveness. If an industry or firm adopts an attitude of tracking emerging needs and innovating consistently then it would be able to respond quickly to new and even unusual demands.

This will likely require a major shift in priorities for our industry members and associations. The first challenge will be to recognize that investment in people is significantly more important than in machines or other technology. This goes against the grains of most current management methods.

We are more likely to celebrate the newest imported fabricating machines and artificial intelligence gadgets – themselves products of prior innovation – than we are to support investment in key innovators in our own industry. Many of our industry members do not have experienced engineers within their companies. Our industry associations do not have architects who can plan and design emergency camps and settlements.

The underlying assumption is that our role is to produce standard products, and innovation is for others. Unfortunately the competition is merciless and the environment too dynamic for us to focus on producing the same products and services for very long.

A company in Germany is unlikely to respond to a refugee crisis in Zimbabwe by asking South Africans to solve the problem. They will more likely solve the problem in Germany and sell their products to South Africa from Europe. If so then we either need to invest in innovation in our own backyard to compete, or find ways to partner strategically with such innovative foreign companies so that we can absorb their culture through collaboration.

2019 will likely be less predictable than 2018. An attempt to plan for the year using historic data and standard forecasting methods is highly unlikely to work. A better approach may be to anticipate that we probably face several years of unpredictability and reconfigure ourselves to be able to respond quickly to sudden changes.

Image Source: Arquitectura Viva. (2019). *Emergency dropdown module for natural disasters.* [online] Available at: http://www.arquitecturaviva.com/en/Info/news/details/8019

POPULARITY OF MULTI-STOREY STEEL FRAME BUILDINGS **ON THE RISE**

By Axel Kayoka, Product Sales Specialist, Macsteel Trading

The recently completed Raceworx KTM Building in Little Falls makes use of a steel framed system with non-composite cellular beams to support the floors. Steel was a common feature throughout the structure and this aided in producing faster erection times, thus reducing costs.

Cellular beams are commonly used in steel-framed building applications due to their versatility. They are produced by using a patented profiling process which splits the beam into two tees. The two tees are then welded to form a cellular profile which is approximately 40 – 60% deeper than the parent section. This results in a final section size 2.5 times stronger than its parent section. They provide the ideal solution for long span-column free designs, maximising the flexibility in use and future adaptability of buildings. Faster steel erection times are achieved thus being much quicker/cheaper to build.

Cellular Beams can be incorporated with various types of floor systems and can play a significant role in steel framed buildings. They provide a technically better solution for service integration which can allow for extra floors to be provided in multi-storey building applications and offer further optimisation opportunities such as reducing floor to floor height, which reduces cladding costs.

Various steel profiles were used for the cellular beams for the Raceworx KTM Building project, with the 533 x 210 x 82.2 [759.1 x 210 x 82.2 (533mm @ 800mm) cellular beam] being the heaviest section used. Large services were able to be accommodated through the cellular voids.

Precast hollow core slabs were used as the flooring system, and placed once the steel frame was erected. This created an added benefit of creating a working platform for the construction workers.

A component of steel framed-buildings is the choice of flooring system. There are different options in floor systems, each with its-own benefits, as follows below:

Composite slabs

Composite floor systems consist of concrete reinforced with mesh, casted onto a profiled steel deck with connecting shear studs onto the steel beam. The concrete acts together with the steel to create a stiffer floor. This contributes to decreasing the weight of the structure, thus producing a less expensive structure, as decrease in weight may decrease foundation costs.

Precast slabs

Precast floor systems consist of precast and prestressed solid or hollow-core units used in conjunction with

structural steel frames. They provide faster speed of erection due to fewer beams being needed as opposed to conventional metal decking applications.

Shallow floors

Building requirement may dictate the height of floors either to minimize overall height of a building or maximizing the number of floors for a particular building height. Ultra-Shallow Floor Beams (USFB) offer a solution to this. USFBs are designed to meet the client's required floor depth, and can be as shallow as 160mm. USFBs are formed by welding two asymmetric cellular tees. The deck or slab sits on the wide bottom flange, producing a very shallow overall construction zone. The regularly spaced cells in the web allow for the passage of reinforcement tie bars, and can also be used for service integration if required.

WHY CHOOSE STEEL FOR **A MULTI-STOREY BUILDING?**

The use of steel in multi-storey building construction is based on tangible client-related benefits including the ability to provide column free floor spans, efficient circulation space, integration of building services, and the influence of the site and local access conditions on the construction process. For city projects, speed of construction and minimum storage of materials on-site require a high level of pre-fabrication, which steel-framed systems can provide.

In many large commercial buildings, a two-stage construction process means that the tenant is responsible for the servicing and fit-out, and so the building structure has to be sufficiently flexible to cope with these differing requirements. Many smaller buildings are designed for natural ventilation and with a high proportion of renewable energy technologies built into them. Many solutions are possible using steel construction.

The commercial sector demands buildings that are rapid to construct, of high quality, flexible and adaptable in application, and energy efficient in use.

Speed of construction

All steel construction uses pre-fabricated components that are rapidly installed on site. Short construction periods leads to savings in site preliminaries, earlier return on investment and reduced interest charges. Time related savings can easily amount to 3 to 5% of the overall project value, reducing the client's requirements for working capital and improving cash flow. In many inner city projects, it is important to reduce disruption to nearby buildings and roads. Steel construction dramatically reduces the impact of the construction operation on the locality.

Flexibility and adaptability

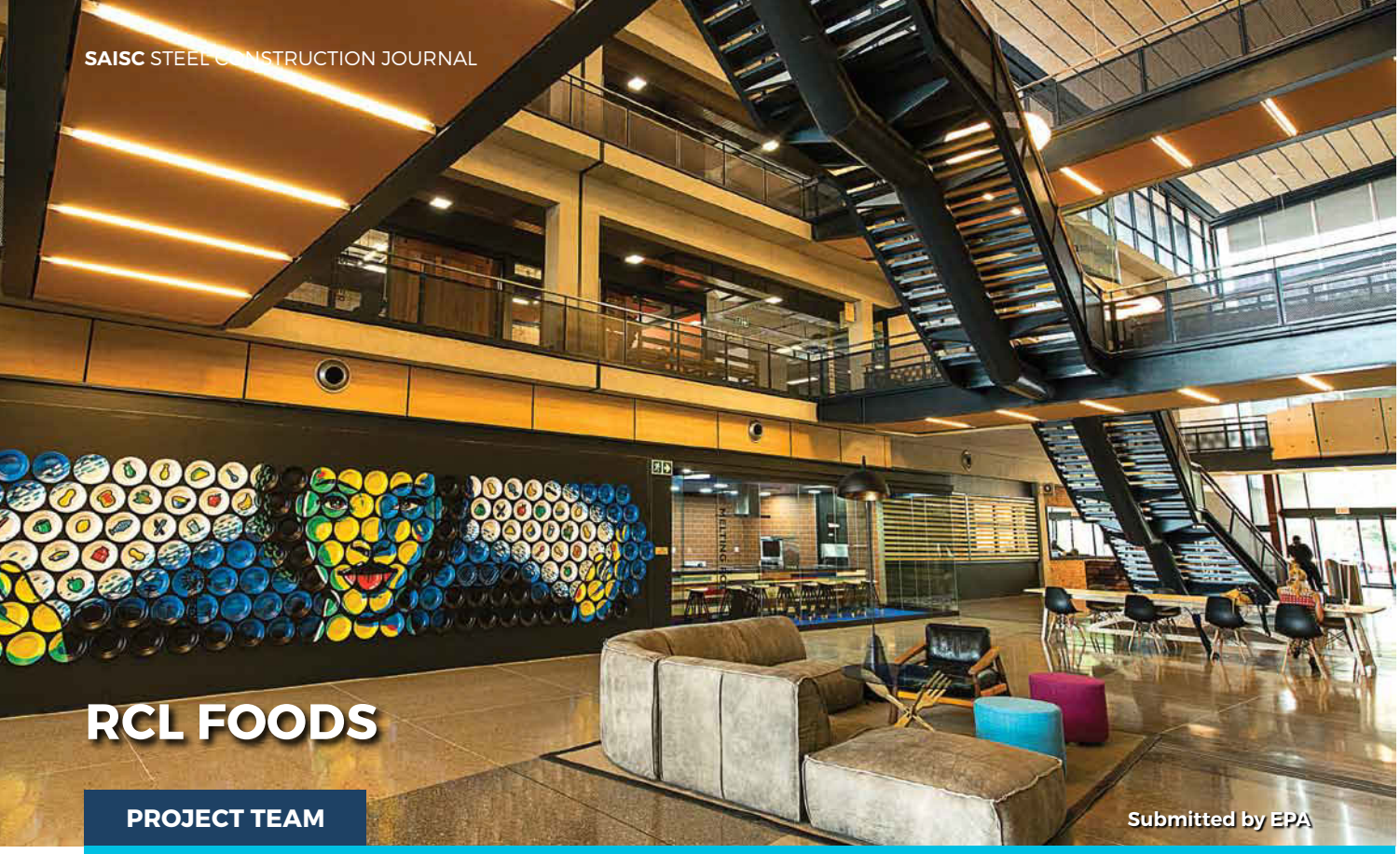
Long spans allow the space to be arranged to suit open plan offices, different layouts of cellular offices and variations in office layout throughout the height of the building. Where integrated beam construction is used, the flat soffit gives complete flexibility of layout allowing all internal walls to be relocated, leading to fully adaptable buildings.

Sustainability

Many of the intrinsic properties of steel usage in construction have significant environmental benefits. For example, the steel structure is 100% recyclable, repeatedly and without any degradation. The speed of construction and reduced disruption of the site gives local environmental benefits and the flexibility and adaptability of steel structures maximise the economic life of the building as it can accommodate radical changes in use.

PROJECT **PROFILES**

STEEL IN ARCHITECTURE



RCL FOODS

PROJECT TEAM

Submitted by EPA

Nominator – EPA I **Client/Developer** – JT Ross I **Architect** – EPA I **Structural Engineer** – BPH Engineers
Quantity Surveyor – MLC Quantity Surveyors I **Main Contractor** – JT Ross I **Steelwork Contractor** – Rebcon Engineering
Steel Erector – Rebcon Engineering I **Cladding Manufacturer** – HB Interiors I **Cladding Supplier** – HB Interiors
Cladding Contractor – HB Interiors

The RCL Food offices (submitted for the SAISC Steel Awards 2018) were required to accommodate 700 people with an emphatic directive to create a bespoke environment exuding the culture of the business at every possible level.

Application and use of steel

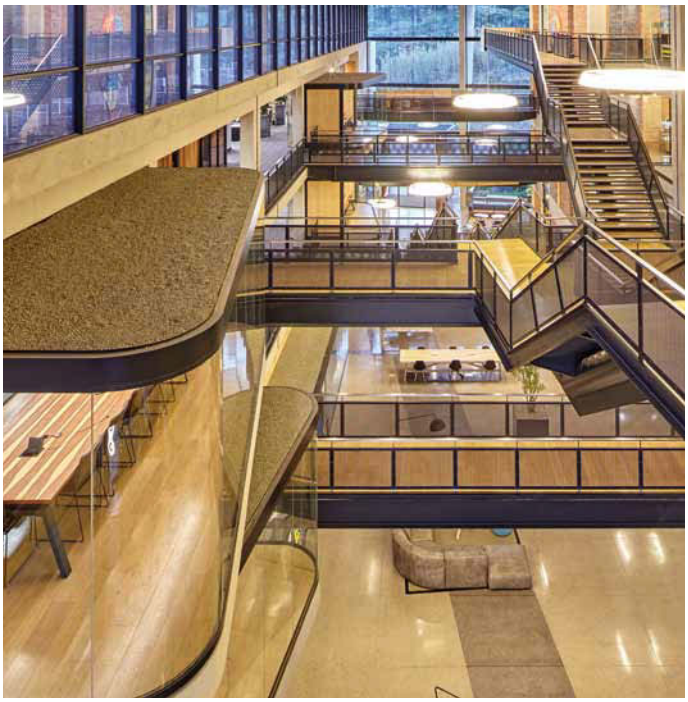
The concept of the building delivers a significant linear atrium connecting all spaces and operations. This space is entirely given over to circulation, spatial connectivity and acts as the heart of the building. The application of steel, envisaged from inception, is expressly utilized in many primary and secondary components in the atrium space and is intended to be on show as the 'theatrical' material.

Connecting elements

The functional and visual focus of the atrium is the cascading staircase which extends from the entrance area to the uppermost floor connecting all levels. This is created from a single 450mm diameter tubular section, which spans up to 13m between bridges which connect the floors on either side of the atrium. This staircase displays cantilevered treads and is carefully crafted to connect to the bridges comprising universal beams and other sections.

Secondary elements

Steel is deployed through the building internally to produce an architecturally dynamic environment. Its sometimes-subtle presence, is almost unperceived and this amplifies



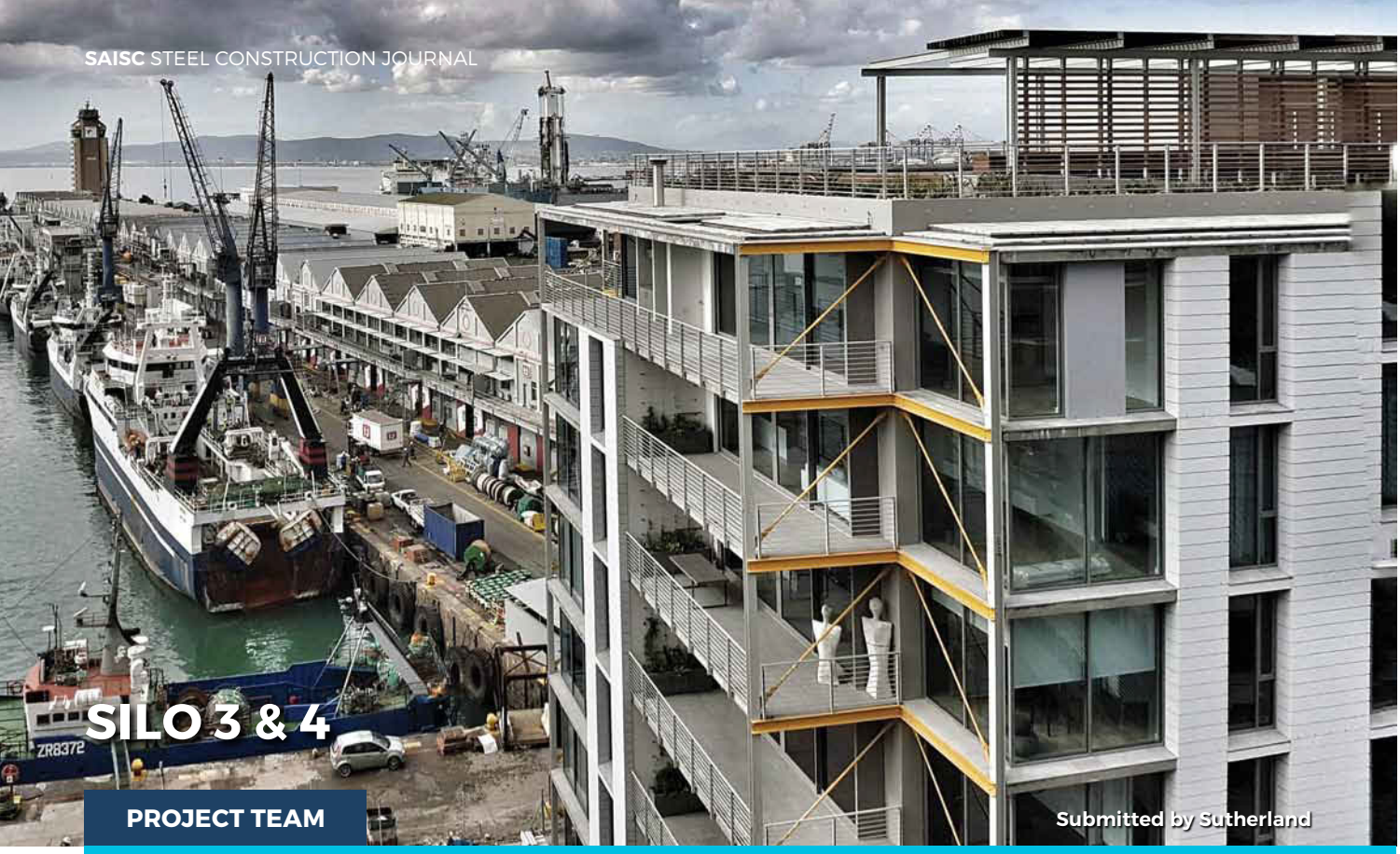
its extraordinary role in this building as both a 'star actor' and 'cameo parts'! The extensive balustrading is a composite of delicate perforated steel plate and both steel and stainless steel sections. This delivers a lightness and transparency which is rarely evidenced in such components. The flush glazed atrium enclosure is neatly supported in slender universal beam sections set unconventionally to accommodate blinds.

Special interior applications

In an office which is unusual in nearly every way, all internal space divisions are unconventional. Curvilinear glazed meeting pods, which precariously cantilever into the atrium, rely on curved steel tubular sections to support internal roofs and glazing, delivering a light and delicate support system. All internal meeting spaces and cellular offices are freestanding steel framed structures where light tubular sections are deployed to support walls, glass and ceilings in many cases.

Tons of structural steel used: 255+

Structural profiles used: Tubular and U.B.



SILO 3 & 4

Submitted by Sutherland

PROJECT TEAM

Nominator – Sutherland Engineers I **Client/Developer** – V&A Waterfront I **Architect** – VDMMA & Makeka Design Lab
Structural Engineer – Sutherland Engineers I **Quantity Surveyor** – MLC I **Project Manager** – MACE
Main Contractor – WBHO I **Steelwork Contractor** – LJ Le Roux Industries I **Steel Erector** – LJ Le Roux Industries
Corrosion Protection (Galvanizing) – Advanced Galvanizing I **Corrosion Protection (Paintwork Contractor)** – MRH Group

No. 3 Silo (submitted as part of an entry for the SAISC Steel Awards 2018) consists of three independent apartment towers containing 79 high end apartments over 11 floors. The three towers are connected by two steel framed lift and stair cores enclosed in expanded aluminium mesh, providing spectacular views of the harbour and V+A precinct.

The character of the building was developed as an interpretation of the inherent "gees, (or 'spirit'), of the precinct as part of a working harbour. In response to the surrounding built environment, the team explored further the themes of 'fit for purpose, working harbour elements', and in its making exploited the possibilities of composite structures – concrete and steel working together – in order to maximise the clear floor to ceiling dimensions of the apartments. Concrete up or downstand beams were entirely avoided in order to maximise the views out all of the Apartments, bearing in mind the overall height restrictions imposed by the planning regulations and consents achieved. Furthermore, in order to construct the expansive floor plates, without resorting to more concrete columns and beams, steel framing 'tied back' to the central shear concrete cores, is used to assist in accommodating the floor plate cantilever. This 'additional steel', has been consciously 'picked out' in colours referencing the cranes and other elements of working machinery in the surrounding dock yards.

The cast-in load bearing steel frames primarily consist of 50mm diameter solid carbon steel bars, adjustable custom reverse thread couplers, welded up 230 x 90 PFC frames, 203 x 203 x 46 H columns and intricate welded end plate connections. Solid bars were chosen for the high tension capacity with minimal lengthening when fully loaded and the custom couplers were chosen to allow for tolerance and future adjustability. The Virgin Active steel roof structure is made up of PFC girders and trusses with solid round bar cross bracing. The exposed round bar cross bracing aesthetic was followed through on the external steel stairs, steel lift shaft structures and the external walkway bridge.

The installation and sequencing of the load bearing steel frames were by far the greatest steel related challenges faced on site. These frames were designed to work compositely with the concrete structure resulting overall in a more slender structure. These frames were installed concurrently with the concrete structure which impacted on sequencing of slab construction, post-tensioning and temporary backpropping. The interface between concrete and steel required works to be highly accurate to achieve the desired aesthetic of exposed steel and raw concrete as well as work compositely as intended. Communication and co-ordination between the architects, structural engineer, main contractor and steel sub-contractor early on in the project was instrumental in achieving this.

The steel components used throughout the building are integral to the building's structural integrity. This is expressed through the bold use of colour, further highlighting the key 'elements' in the structural assembly. Yellow is used on the façade steel elements that support the cantilevering balcony concrete slabs, while red highlights the two circulation cores connecting the three towers.

Cladding materials, including Rheinzink and perforated metal panels were also selected to respond to the harbour industrial shed aesthetic.

V&A GRAIN SILO FACADE

Submitted by Arup

PROJECT TEAM

Nominator – Arup (Pty) Ltd I **Client/Developer** – V&A Waterfront I **Architect** – Heatherwick Studio
Structural Engineer for façade steelwork – Arup (Pty) Ltd I **Quantity Surveyor** – MLC I **Project Manager** – Mace
Main Contractor – WBHO I **Steelwork Contractor and Erector (pillows, zigzag windows)** – Mazor
Steel Contractor and Erector (skylights) – Mazor I **Cladding Manufacturer, Supplier and Contractor** – Mazor

The V&A Grain Silo (submitted for the SAISC Steel Awards 2018) was built in the 1920s to store grain for export out of South Africa. This industrial heritage complex was rejuvenated as the central feature of the world class green Silo District development. Heatherwick Studio was engaged to conceptualise the redevelopment that is now occupied by The Zeitz Museum of Contemporary African Art (MOCAA) and The Silo Hotel.

The most noticeable and significant aspect of the use of steelwork on the project are the 82 pillow windows on the building. These are installed to the rooms and restaurant of The Silo Hotel and on the top floor of the Zeitz MOCAA. The windows on the restaurant level of the hotel are 3.8m wide x 5m high and the windows to the hotel rooms are 3.5m wide and range in height 5m – 3.8m.

For the pillow windows alternatives to steel were explored, such as aluminium. Steel was selected because of:

- The capacity of local industry to carry out this work to the required tolerances
- Robustness of steel welding, which is not subject to reduced strength in the heat affected zone as is the case with aluminium.
- Cost effective for the complex geometry.

The pillow windows were fabricated from flat steel plates 50 x 16 that were welded to one another to form the bulging geometry of the pillow and welded to the 160 x 80 rectangular

hollow section (RHS) forming the perimeter frame. The choice of flat bars / plate was to minimise the appearance of the framing from inside and maximise the views through the window. The frames were positioned at each facet between the glass panels, with the depth of the plate orientated toward the room and roughly perpendicular to the bulging geometry. Aluminium glazing profiles where mechanically fixed to tapped holes on the outer edge of the flat bars / plates. The flat bars act as domed arching structure for wind loads carrying axial loads and bending moments. The perimeter RHS provided additional width for the perimeter weather proofing and structural strength for transferring the framing wind loads to the four steel brackets used for fixing the window to the concrete structure. The perimeter frame also included a temporary hoisting bracket bolted to the frame during hoisting.

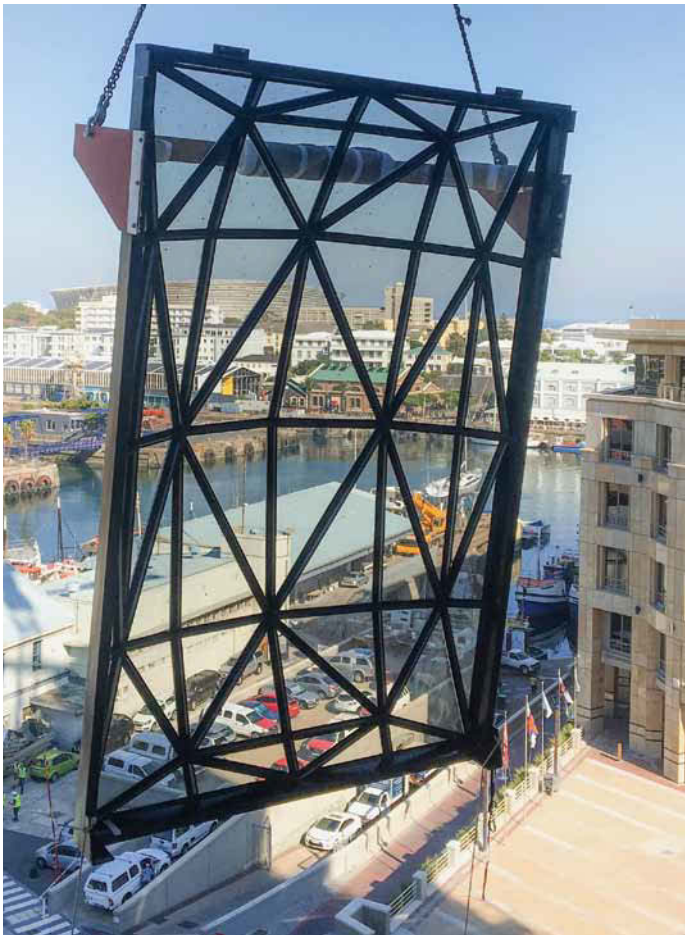
The window includes double glazed triangular panes, structural silicone bonded to the aluminium glazing profile on the outside face of the steel frames. These window panels were installed in the factory and the windows were transported and installed fully glazed and sealed.

Achieving the pillow window geometry was the most significant challenge. The steelwork geometry was defined in detail by Heatherwick Studio and Arup using parametric 3D modelling techniques. This allowed the fabrication aspects, such as orientation of framing and alignment of framing at joints mitre lines to be established in a 3d model developed by Arup, while allowing the geometric parameters, such as the geometry of the bulge, framing positions and window size to be fully defined by Heatherwick Studio.

The parametric model was used to generate a 3D model of each of the five window frames, that included the required member size and orientation that was provided to Mazor, the steelwork fabricator, to produce their steelwork shop drawings.

Building this complex geometry was a challenge that was tackled by Mazor through production of steel jigs to define the geometry of each of the window frames. The steel members were assembled into the jig and tack welded into place, removed from the jig and then the welding completed. Careful planning was required in fabrication of the jig and planning of the welding to ensure that all welds could be accessed and welded after the framing was tack welded together. To achieve the neat appearance at the joints welding splatter at these positions was ground smooth and the joints body filled to achieve a high level of quality at these nodes. Mazor had a specialist team responsible only on dressing and shaping each of these nodes on all the windows.

Transporting and installing was another challenge as the pillows were made and glazed as one assembly in a factory (up to 5 074mm x 5 022mm in size) and transported to site complete. Careful handling was required to ensure that the glass was not damaged in the process. With the window fitting tightly between the concrete beams and columns and inside of the concrete, façade installation was challenging. To reduce the risks it was desirable that the position of the windows during hoisting was similar to installation position of the window and that the hoisting cables did not clash with the concrete structure. To achieve this the design incorporated a temporary lifting bracket, bolted to the perimeter frame, that aligned the centre of gravity of the glazed window with the lifting cables, which also positioned the cables outside the concrete face.



FUTURE AFRICA CAMPUS

Submitted by TMW Fabrication

PROJECT TEAM

Nominator and Steelwork Contractor – TMW Fabrication I **Client** – University of Pretoria
Architect – Earthworld Architects I **Structural Engineer** – WSP I **Main Contractor** – Robenco Construction

The dining hall structure of the Future Africa Campus project (submitted for the SAISC Steel Awards 2018) was envisaged to be a product that can be manufactured off-site and assembled on-site, with efficiency of erection and material use in mind. It was comprised of pre-manufactured elements done with BIM CAD systems so that the elements fit precisely into place at a given sequenced time, with no on-site changes to construction work, making the process from digital to site seamless.

The project was envisaged using timber as an architectural statement from the start as a main structure with steel as a supporting material to complement the timber. The timber was used to form the bold elements of the building and the steelwork to form the fine, sleek detailed part of the structure.

The structural framing is comprised of vertical and horizontal elements, cladded to the main structure. The vertical elements are 16mm custom-profiled laser-cut fins which support horizontal various sized angles which form a trio of horizontal bands in which frameless glazing panels are fixed with aluminium sliding elements. The steel framework creates a sleek look amongst the glazed elements that creates a feel of lightness to the structure.

As the project was based on this on-site assembly process the team found it somewhat challenging to work within the given size parameters. As many components were pre-manufactured they had to make sure that everything was within acceptable tolerances to accommodate the components that followed. To stay true to the assembly process concept, another challenging factor was that the erection of the steelwork was mostly done by manual labour (block and tackle).

The steel was originally designed to be add-on elements to the timber, infill pieces that assist the timber structurally but also add to the aesthetic quality of the building. The roof brackets for instance, used to hold up the roof "waffle" structure, were custom built to every specific connection for the roof rafter beams, precisely built and placed to assist in the assembly process of the structure. Every element made had its place, in a specific timeline to fit into this assembly concept.

VICTOR DAITZ MATHEMATICS CENTRE

PROJECT TEAM

Submitted by StudioJoy+ Architects

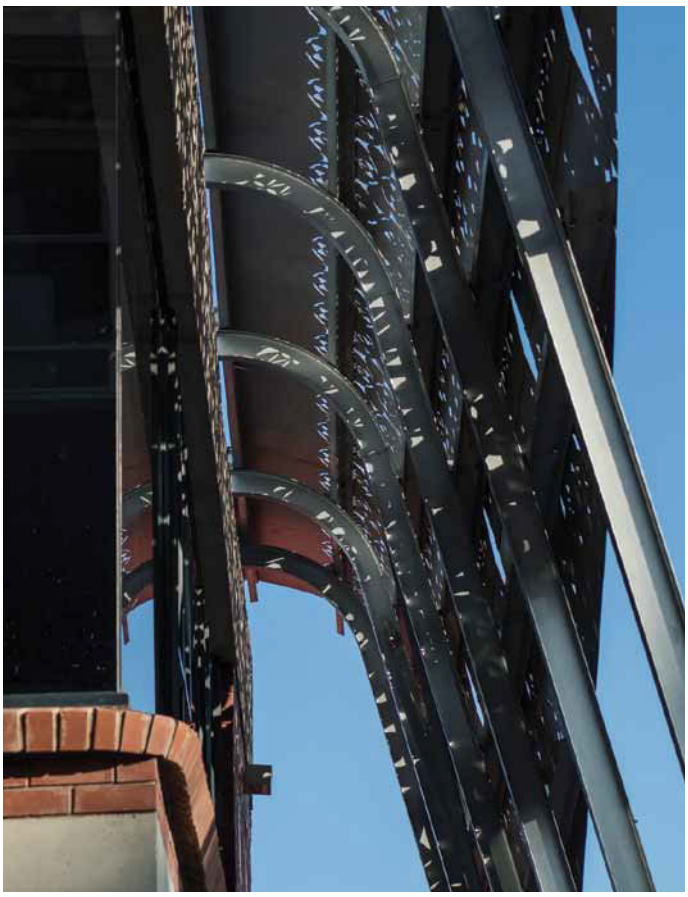
Nominator – StudioJoy+ Architects I **Client/Developer** – Business Manager – King Edward VII School
Architect – StudioJoy+Architects I **Structural Engineer** – eStruct Consulting I **Engineer** – eStruct Consulting
Quantity Surveyor – Stuart Ray Skead Associates I **Main Contractor** – Akhane Construction (Pty) Ltd
Steelwork Contractor – Hybrid Africa I **Steel Erector** – Hybrid Africa I **Cladding Manufacturer** – Metal Graphics
Cladding Supplier – STALCOR I **Cladding Contractor** – Hybrid Africa
Corrosion Protection (Galvanising) – Hybrid Africa I **Corrosion Protection (Paintwork Contractor)** – Hybrid Africa

The King Edward VII Mathematics Centre (submitted for the SAISC Steel Awards 2018) is located at King Edward VII School in Johannesburg. The project is a classroom facility with a hockey pavilion comprising both an upper viewing deck with kitchenette facility and lower area of team ablution/change facilities, as well as a larger ablution facility for scholar use.

The brief to the architect was to propose a scheme as a fund raising platform from Old Boy donors. Two donors, Victor Daitz Trust and Edgar Droste Trust (both deceased Old Boys) stepped up to assist.

The project was to comprise initially 4 x mathematics classrooms and ablution facilities. This later expanded to incorporate a hockey pavilion and ablution facilities. The idea was to maximise the small space adjacent other classroom wings and minimise the number of peripatetic teachers.

From the outset, the project was envisaged as a combination of steel, concrete, brick and aluminium. The sunscreen roof was envisaged as a steel filigree screen with cutout patterns and as one of two elements which could give the project life, the aluminium balustrade being the other. The elements of geometry and mathematics are used here as an inspiration for the creation of their forms.

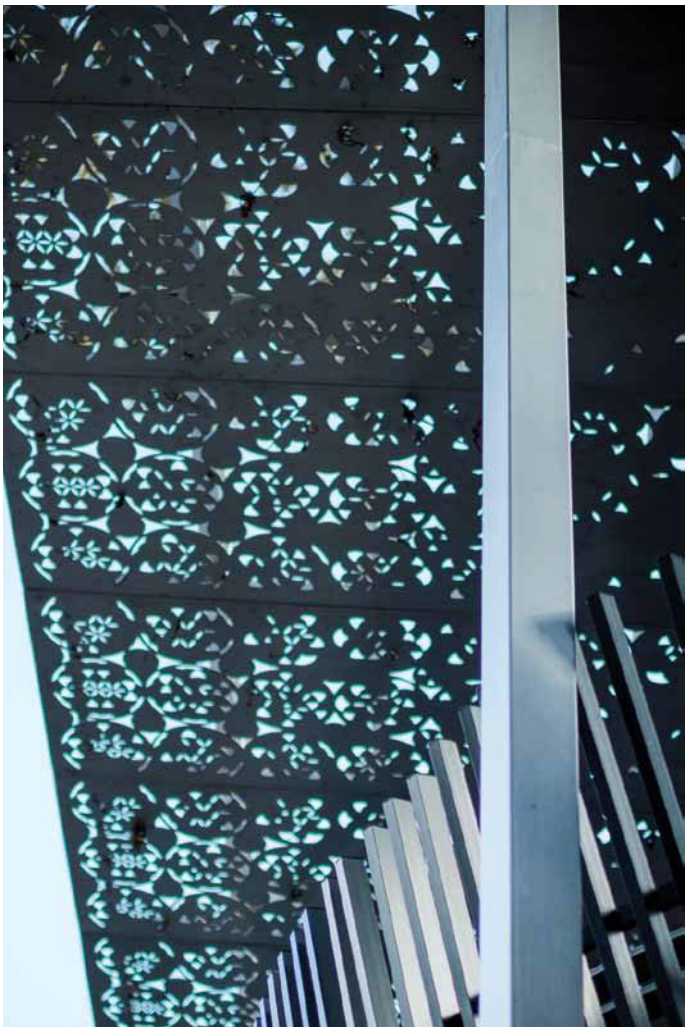


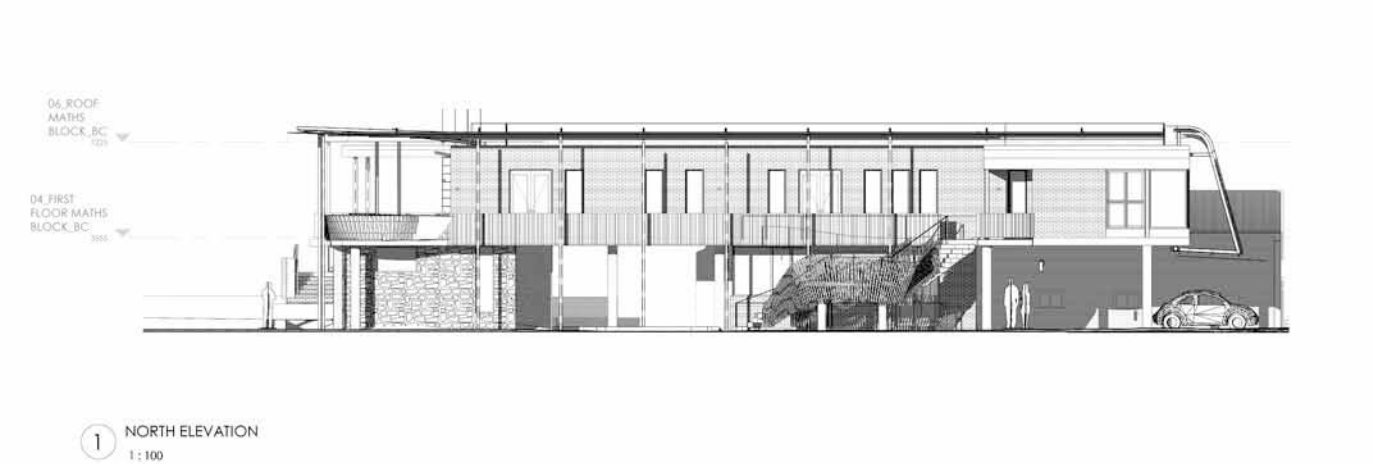
The steel elements of the project vary from Universal Columns to Square Hollow Sections which are used as a giant order to the upper canopy roof to maximize the verticality as an offset to the flat canopy. The rafter and rear screen elements are IPE members and C-channels. The steel sheet canopy is suspended.

From an engineering perspective the challenges to the canopy roof were in the methodology in which the sheeting was suspended from its structure, as an inverted solution. The sheeting is read as a hovering plane that floats above the parapet walling at the building edge. The large over-sailing cantilever sheet at its point hangs off an extended beam and the framed system of beams and rafters. The cantilever similarly covers the passage way, whilst the hockey pavilion sheeting extends the roofline to match. The screen is grounded on double length columns which bypass the building and soar vertically straight to the canopy.

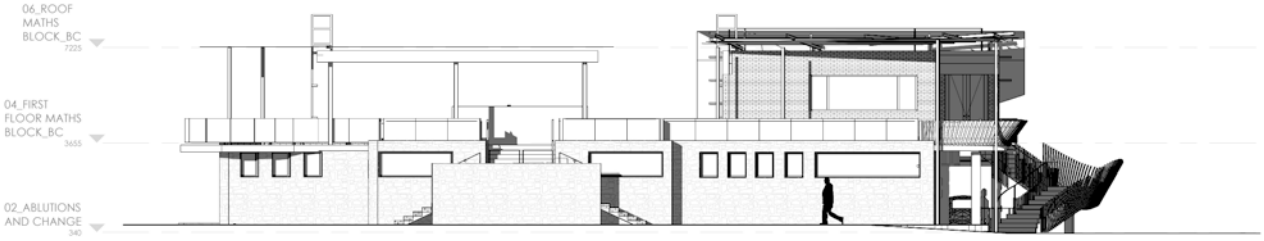
The challenges of fabrication were in the amount of steel sheet that was to be removed in the patterning. Too much cut out created a bend in the sheet, and as such the pattern had to be manually adjusted in order that it read as random, natural and poetic. Most of the panels therefore had individual patterning and as such this required close monitoring on the cutting and installation process.

The resulting aesthetic is a sensitive approach to mathematics and geometry which creates patterns in light and shade which varies constantly throughout the day and night. A visual delight juxtaposed to previous hard insensitive buildings.





1 NORTH ELEVATION
1 : 100



2 EAST ELEVATION
1 : 100

DURBAN GIRLS NEW FACILITY CENTRE

PROJECT TEAM

Submitted by Young + Satharia

Nominator – StudioJoy+ Architects I **Client/Developer** – Business Manager – King Edward VII School
Architect – StudioJoy+Architects I **Structural Engineer** – eStruct Consulting I **Engineer** – eStruct Consulting
Quantity Surveyor – Stuart Ray Skead Associates I **Main Contractor** – Akhane Construction (Pty) Ltd
Steelwork Contractor – Hybrid Africa I **Steel Erector** – Hybrid Africa I **Cladding Manufacturer** – Metal Graphics
Cladding Supplier – STALCOR I **Cladding Contractor** – Hybrid Africa
Corrosion Protection (Galvanising) – Hybrid Africa I **Corrosion Protection (Paintwork Contractor)** – Hybrid Africa

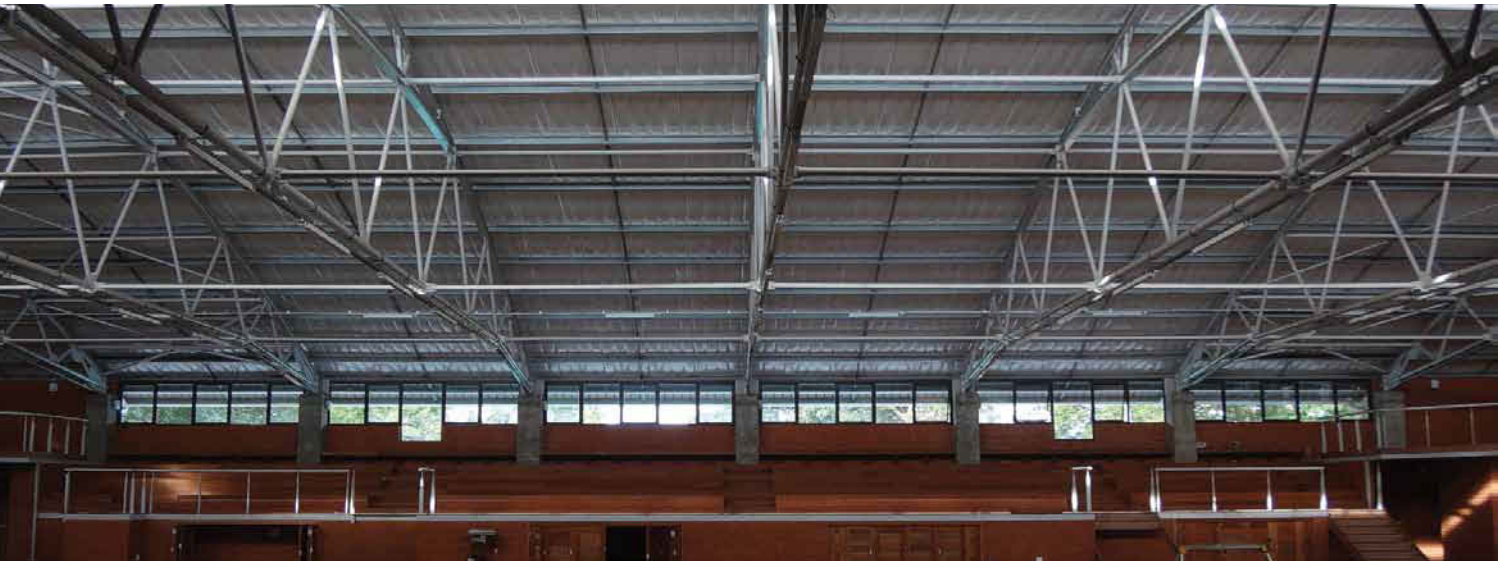
Purpose of the structure

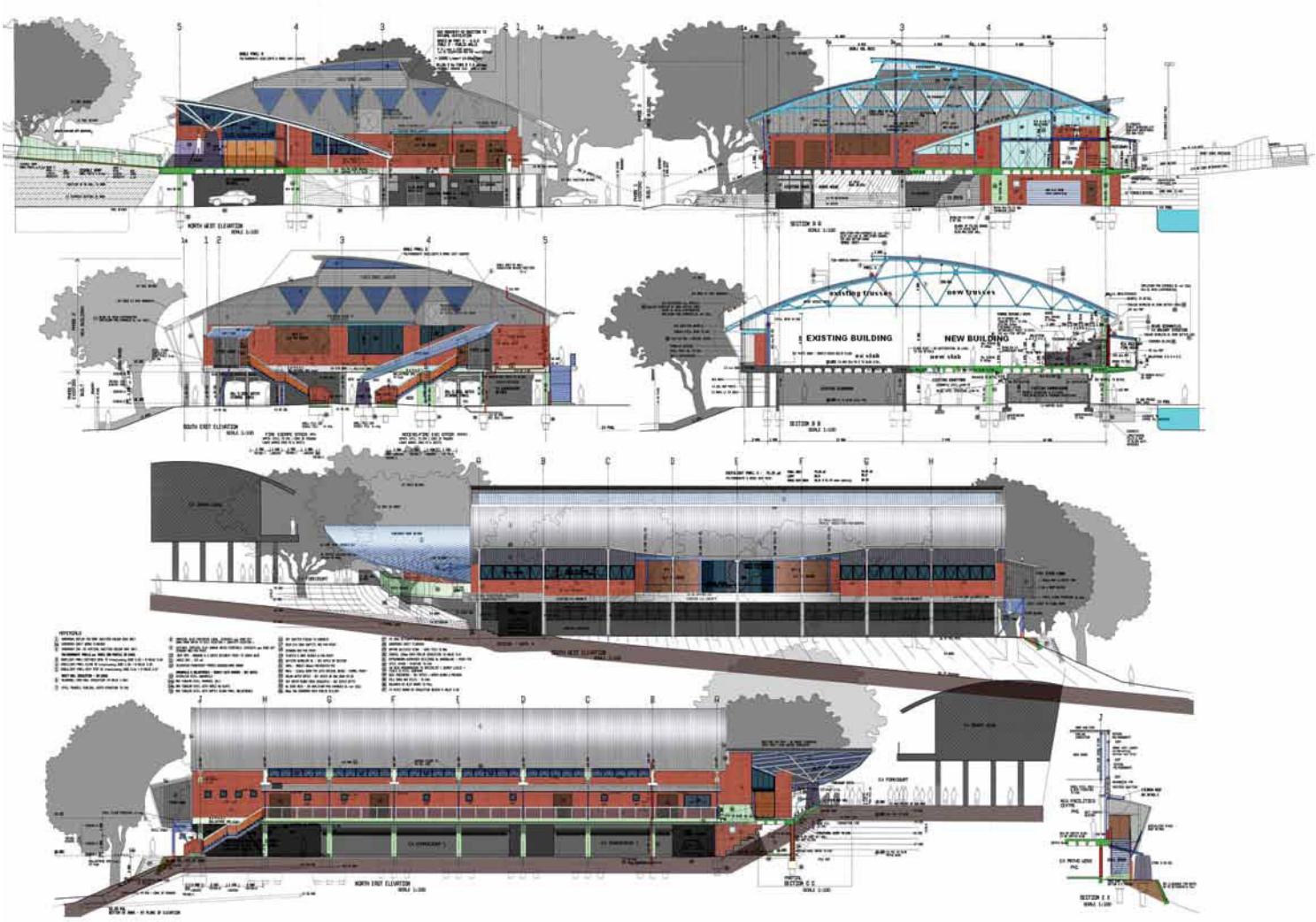
The purpose of the new Durban Girls Facility Centre was to house a large indoor, multi-function space as a major educational facility for a premier girls' high school and to increase their hall accommodation (built in 1938) from 400 to 1 400.

An aesthetic decision was made to express the dynamics of a steel clear span structure, integrated with the translucent sheeting panels of the gable frames and south light. The roof trusses feature tubular sections with profiled gussets framing into H section top rafters. The purlins are standard cold rolled lipped channel sections. The terrace seating, stairs and handrails express steelwork.

Challenges in the fabrication of the project

Approximately a third of the truss was erected as a temporary roof at first floor hall level during an earlier





phase. To complete the project the new roof was site connected to the existing structure and re- erected at the higher new roof level. This presented challenges in the site fabrication and restricted erection access.

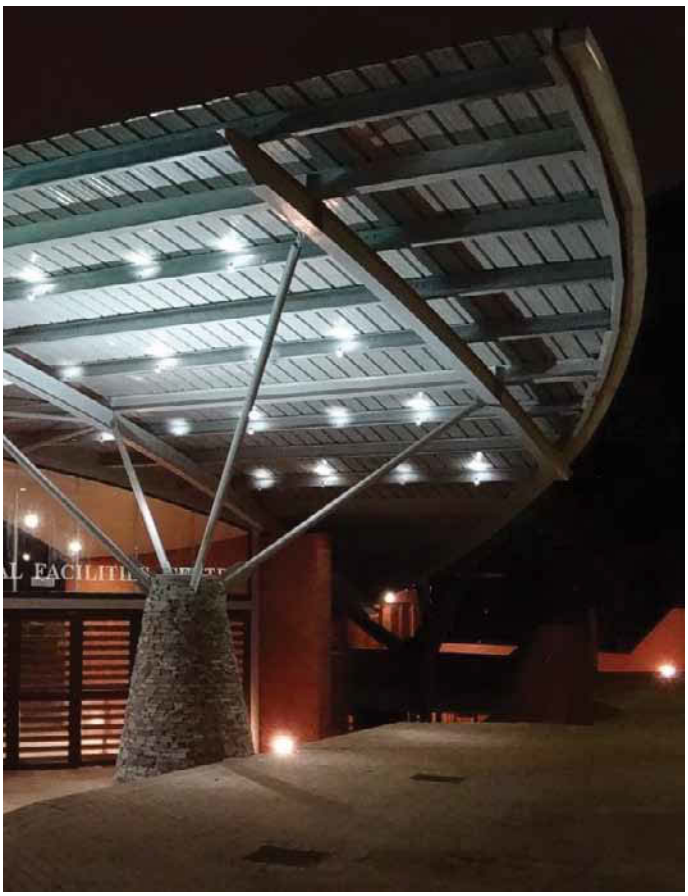
The project team challenges

Due to limited access to the site, being within a wooded suburban area adjacent to a swimming pool, the methodology of construction and erection required a team effort. The Main Contractor further shortened the steel construction critical path by 3 months, necessitating close co-ordination between Architect, Engineer and Steel Fabricator. It is considered that the integrated aesthetic form of the tubular section roof structure, exemplifies the use of steel construction in public facility buildings, in an urban environment.

Innovative aesthetics about the steelwork and cladding

The Porte' and main roof have intersecting curves on the main roof gable. Gable sheeting girts reflect truss V forms with silver heat polycarbonate sidelights which create a chevron lit graphic inside in the day, and externally at night.

To view a short profile video on this structure, including an interview with the structural engineer, visit:
http://bit.ly/DBN-Girls-SCJ



STRUCTURAL STEEL: **PROPERTIES**

(Excerpt from the **Southern African Steel Construction Handbook**, copyright 1987, 2008, 2010, 2016 SAISC)

Do you design or detail structural steelwork? Get your copy of the Southern African Steel Construction Handbook (aka The Red Book) by visiting https://www.saisc.co.za/book-shop/ or calling (011) 726 6111

The contents of this section are based on relevant product data sheets drawn up by the South African steel producers and the relevant specifications. While all possible care has been taken in the preparing of this information, reference should be made to the most recent publications for both further detail and to ensure currency of information.

The term 'structural steel' may be used to define steel used for elements whose primary purpose is to support loads or resist forces which act on a structure. "Structural steel" has also come to mean the products of the steel mill, such as sections, plates and bars, from which structural members such as beams, girders, columns, struts, ties, hangers and girts are fabricated.

Both SANS 10162: Part 1 and SANS 2001 – CS 1 require that steel for structural applications must comply with the requirements of SANS 50025-2, but permit steel complying with other specifications to be used, provided that any such steel meets the requirements of Clause 5.1.4 of SANS 10162: Part 1, which stats that steel must comply with some recognised standard.

The present situation in South Africa is that steel sections are produced to EN10025 – Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels, and specifically to Grade S355JR of this standard.

The proper full designation of steel is: Steel EN 10025-2-S355JR. The exception to the rule is the case of equal angles up to 50 x 50mm that are commonly made in commercial quality steel, and equal angles bigger than 50 x 50mm up to 80 x 80mm that are made in either commercial quality or 355JR steel.

Plates are also available in S355JR, but can also be obtained in commercial quality, in Grade S235JR and S275JR to EN 10025, in Grade 300 W A to SANS 1431, and in other grades.

The mechanical properties of the relevant steels from EN 10025 and SABS 1431 are given in *Table 2.1*

At room temperature all structural steels that are free from notch effects are tough – more so than other common construction materials. Even at low temperatures notch-free members exhibit a greater toughness than is required under normal service conditions. However, when notch effects are present at low temperatures, many steels show a decided drop in toughness and may be prone to brittle fracture. Although notch effects can be minimised, it is hardly possible to avoid them altogether, and in structures that are subject to low temperatures and high tensile stresses (also in the form of residual stress), the use of structural steel with adequate notch toughness may be advisable.

Guidance on the specification of steel to ensure adequate toughness can be obtained from EN 1993-1-10: Eurocode 3 : Design of steel structures – Part 1 – 10: Material toughness

TABLE 2.1: MECHANICAL PROPERTIES FOR STEEL TO SANS 50025-2

Grade	Ultimate tensile strength f_u	Yield stress f_y (minimum) or thickness t (mm)					Charpy V notch impact test	
		$3<t\leq16$	$16<t\leq40$	$40<t\leq63$	$63<t\leq80$	$80<t\leq100$	Test temperature	Minimum average energy absorbed
	Mpa	mm	mm	mm	mm	mm	°C	J
S235JR	360 TO 510	235	225	215	215	215	20	27 (only if specified)
S235J0	360 TO 510	235	225	215	215	215	0	27
S235J2	360 TO 510	235	225	215	215	215	-20	27
S275JR	410 TO 560	275	265	255	245	235	20	27 (only if specified)
S275J0	410 TO 560	275	265	255	245	235	0	27
S275J2	410 TO 560	275	265	255	245	235	-20	27
S355JR	470 TO 630	355	345	335	325	315	20	27 (only if specified)
S355J0	470 TO 630	355	345	335	325	315	0	27
S355J2	470 TO 630	355	345	335	325	315	-20	27

Notes: 1. Consult standards for thicknesses bigger than 100mm.
2. Minimum elongation in tensile test in order of 20% – see standards.
3. Charpy tests on S235JR, S275JR or S355JR only required if specified.

TABLE 2.2: GENERAL GUIDE TO STRUCTURAL STEELS

Specification	Grade (without impact test designations	Nominal yield stress (MPa)	Country/region
EN 10025 ASTM	S235JR A36	235 240	Europe and South Africa USA
BS 4360 EN 10025	43 S275JR	275 275	UK Europe and South Africa
CSA - G 40.20 / G40.21	300W	300	Canada
ASTM ASTM CSA - G 40.20 / G 40.21 EN 10025 BS 4360	A572 Grade 50 A992 350W S355JR 50	345 345 350 355 355	USA USA Canada Europe and South Africa UK
CSA - G 40.20 / G 40.21	400W	400	Canada
Weathering steel:			
ASTM A588	COR-TEN A, B or AF	345	USA and South Africa
High yield strength and abrasion resistant steel:			
Mittal Steel specification for ROQ-tuf	AM700	700	South Africa
Mittal Steel specification for ROQ-last	TH 400 TH500	NA NA	South Africa South Africa
Mittal Steel specification for Supraform	Supraform TM380 - 600	300, 420, 460 500 or 600	South Africa

and through-thickness properties. Note that the steel grades in *Table 2.1* for which the designation ends with J0 or J2 come with a higher degree of proven toughness.

An anomaly in the South African steel construction industry is the existence of commercial quality steel (CQ), sometimes referred to as 'mild steel'. The chemical composition of CQ is controlled, but no mechanical tests are performed on it. The self imposed specifications to which CQ is produced vary somewhat from mill to mill, but it can be assumed that the carbon content will not exceed 0.3%, and the carbon equivalent CE not 0.51%, where

$$CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/5$$

With C, Mn, Cr, Mo, V, Ni and Cu being, respectively, the percentage of carbon, manganese, chromium, molybdenum, vanadium, nickel and copper in the steel. A value of CE less than 0.51% implies that the steel is weldable. Little can be said about the yield stress or tensile strength of commercial quality steel. According to Clause 5.2.2 of SANS 10162: Part 1, the yield stress and tensile strength of 'unidentifiable structural steel' shall be taken as not more than 200 and 365 MPa, respectively.

Table 2.2 contains brief information on South African and international steels that can be used for structural purposes. Steel can be certified as meeting the requirements of several standards simultaneously. Charpy or other tests can be performed if required.

According to SANS 2001 – CS 1, the chemical composition and mechanical properties of all steel incorporated into structures must be stated on a mill test certificate, and according to Clause 4.4.11 of SANS 192103, the steelwork contractor must obtain these certificates for all steel and forward them to the employer.

CONSTRUCTION BOLTING: TEN YEARS ON

Prepared By; R J Pietersma, CBC Fasteners (Pty) Ltd, October 2018.

The use of construction bolt assemblies in terms of the new standard EN14399 has been underway for the best part of nearly ten years now. It has been a steep learning curve to say the least. This article is to share some insights to technical jargon and risks.

Are South African manufacturers geared up?

Up until the new power station builds very few construction bolts were being installed, hence the general lack of awareness and capability. This was on many fronts and not just bolting. Medupi and Kusile changed this and it has clearly been established that design engineers, manufacturers and construction companies had a long way to go to catch up with international developments and best practice standards, including bolting and a range of other requirements.

Experience tells, when choosing the construction bolt route, the first call is a manufacturer capability study with audit of the production processes and quality system. Compliance with ISO 898-1&2 as well as with all the requirements of EN 14399 and most importantly, EN14399-2 needs to be established. Unfortunately in practice bolts and nut assemblies still continue to be a last minute panic purchase.

SANS 10094

SANS 10094, the standard dealing with Construction Bolting has recently been updated and approved. This standard does not recommend grade 10.9 Hot Dip Galvanised (HDG) bolts because of the risks of HE or HisCC. Nevertheless, in practise, there is still a call for this product. The risk can be controlled by the manufacturer avoiding acid contact and further controlling excessive hardness levels at the upper limit of grade 10.9. Further risks associated with undue stressing of grade 10.9 HDG bolts will be avoided if good installation practice is adopted.

EN14399-3 (grade 8.8 and 10.9) vs.EN14399-4 (grade 10.9 only)

Why a universal standard is not adopted is a puzzle. Clearly there were principles that were not negotiable which has led to two possibilities. The historical position has largely been maintained in that the EN14399-4 nut (previously DIN 6915), has a lower height. The intended reason is that the nut threads should fail first (not guaranteed) in the event of over tightening, purposefully avoiding a sudden bolt fracture, with installer safety being compromised. Usual construction practice is that one would like to see the bolt fail in the event of over tightening because one would know it had occurred, whereas with thread failure, this may not present immediately and a future calamity may be lurking when the right conditions prevail. In South Africa, SAISC and SANS 10094 recommends the use of EN14399-3 in grade 8.8 and 10.9. Shear through threads is allowed whereas in EN14399-4 there is a shorter thread and the shear plane is through the shank of the bolt.

Whatever the bolt and nut assembly used, once pre-loaded

1. The nut on the left has been galvanised, designated by ìZî behind grade 10.
2. The nut on the right is not galvanised, apparent similar appearance is from Mos2 lubrication coating.
3. Note product ID, 716 on left nut and 117 on right nut.

1. Nut is galvanized however the galvanized appearance has been offset by the Mos2 coating.
2. Note product ID on Bolt, 7024.

and subsequently removed, they cannot be re-used. The reason is that the threads may have been subject to plastic strains during tightening.

Myth of torque vs. tension

The talk is always about torque, whereas the objective is clamp, a spring condition holding surfaces together. Torque (or the torsional rotation effort) is merely the means getting to the correct clamping force. This whole process would be simple were it not for the introduction of friction. When tightening a bolt and nut assembly, 50% of the effort is as a result of friction between the nut and washer face, 40% is in the thread contact and a mere 10% of the effort is creating the clamping force. This friction can vary. In a rusted bolt and nut (B&N), co efficient of friction it is as much as 0.35, in a un-lubricated hot dipped galvanised B&N is starts at 0.19 and increases up to 0.27 as additional torquing takes place. With molybdenum disulphide lubrication (MoS2), coefficient of friction is between 0.10 from 0.16. So, by way of example, in the case of torquing a M20 bolt at 464 Nm with a coefficient of friction of 0.14, clamping force of 127kN is achieved; when the co efficient is 0.10, less torque of 363Nm will achieve an increased clamp load of 134kN. This leads us to the next important point, the lubrication of nuts.

Pre lubricated nuts with molybdenum disulphide (MOS2)

There may be a misconception since there has been so much talk and use of pre-lubricated nuts that this is a new standard requirement. Whilst we recommend pre lubricated nuts for the reason there is a tested co efficient of friction that can be relied upon, this is by no means a general requirement. EN14399 specifically makes reference to surface finish as processed, meaning lightly oiled, or as agreed between purchasers and manufacturer. Nevertheless, appropriate lubrication is required during installation, particularly with HDG bolts. In the case of no lubrication, galling will take place and in laboratory testing we have established the potential of failure due to torsional tension.

In the case of the turn of nut method of fastening in the B&N assembly with lubrication, up to 25% to 35% additional clamp can be obtained than required by the standard. Without lubrication, the likelihood of thread failure is almost 100%. All the torque value will be absorbed by the galling effect of the soft galvanised layer. If the bolt has not started to fail due to torsional tension, the correct tension will not have been achieved and a loose bolt left in place with future potential failure consequences.

We really do recommend pre lubricated nuts that have been baked to a dry condition. The advantages; it avoids the wrong lubricant choice, the risk of attracting grit on nuts during installation due to sticky lubricant is reduced, the under or over application of lubricant is avoided and; of most importance, certification of the coefficient of friction is supplied, together with recommended torque values. This testing in terms of EN14399-2 also provides confirmation that the B&N assembly complies with the rigorous requirements of the standard.

Another question that has been raised, is it possible of paint over lubricated nut. MoS2 is oilioscopic, which means it cannot tolerate detergents. So cleaning with an industrial de greaser would be the appropriate first step, then priming followed with a final overcoat. Under no circumstances should acid be used clean.

Installation equipment

Many bolters rely on the torque wrenches having been recently calibrated. One of the over looked checks that needs to be undertaken is the wrench verification. This should take place on the day the wrench will be used by testing at least 3 bolts of the diameter to be installed with that wrench on that day. The verification takes place using a static torque meter. The reason for this verification is that calibration can change if, for example, the wrench was dropped. We have observed that many installers do not

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do verify their equipment, nor have the required equipment to undertake the verification. However if one is using the turn of nut method (TON), recommended by SAISC, verification of equipment can be avoided. Provide the markings are correctly made and the tightening process is properly supervised, TON will result in a reliably tensioned assembly.

Conclusion

Experience in the field is that there is a huge amount of poor communication between original design through the manufacturers of Bolt and Nut assemblies and the installer tightening the final bolt. Some of examples include, a request for Nylock nuts for EN 14399 construction bolts, failing this, Clevelock nuts or a rejection of pre lubricated nuts because the black colour gives the impression the nuts have not been hot dip galvanised. Fortunately, many mistakes are covered by the tendency to "over design/deliver"; not only in bolt manufacture but also in structure design. As a result problems get caught in a normal distribution curve of applied margin of safety and no adverse outcome take place. Where outcomes are likely to be negative as in some of the above examples, responsible Bolt and Nut manufacturers make recommendations and institute appropriate training

The greatest adverse effect has been where design engineers have not been involved in the pre-qualification of manufacturers and audit of their quality systems and have not ensured complete certification is in place based on comprehensive testing. Thereafter they have not been on site verifying compliance to their original specification (which is prescribed in regulations of the Occupation Health and Safety Act). Where all this has occurred timeously, we have seen trouble free installation. Where this was deficient, particularly in the early stage of manufacturer prequalification, adverse outcomes have often prevailed. It is emphasised, the problems have not been the fastener manufacturer but the end users poor understanding of their requirements of a design engineer. Unfortunately the B&N manufacturers have often been unfairly blamed in the process.

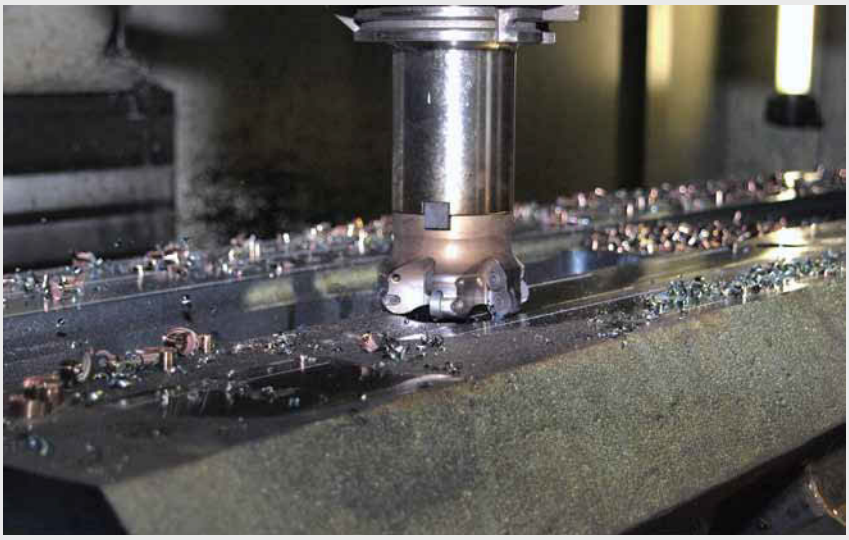
FEATURE

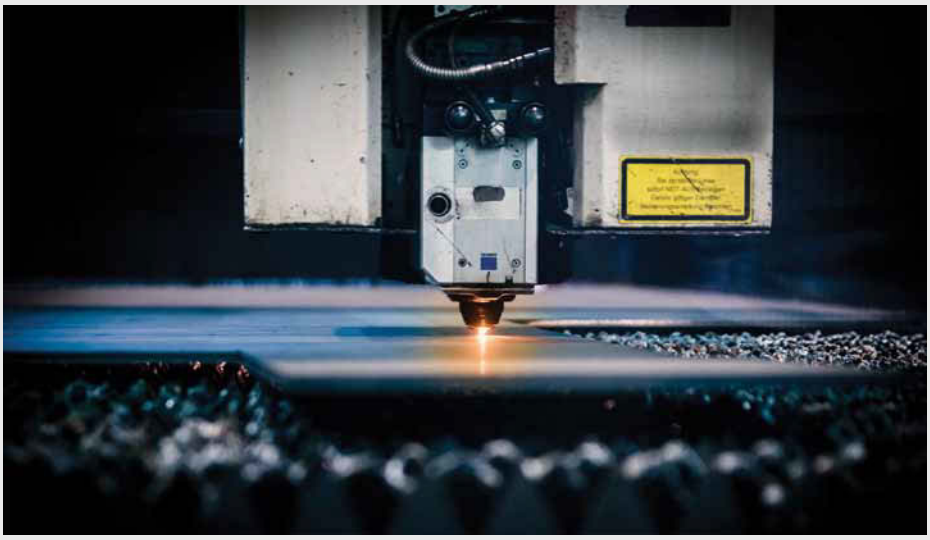
KEVIN HARRIS
MANAGING DIRECTOR, FABSMART

A BRAVE NEW AGE – **STEEL FABRICATION INTO INDUSTRY 4.0**

Kevin Harris is Managing Director of Fabsmart and has a particular interest in technology and organisational effectiveness. He has 25 years of process engineering and high-level management experience in steel fabrication and other manufacturing industries.

In the course of my work, I am fortunate to get an insider's view of many steel fabrication operations in South Africa. What I have seen is that there are as many fabrication strategies as there are fabricators. Each fabricator has their own philosophy on pricing, drawing management, procurement, part processing and assembly production. It has become clear that the old tried and tested fabrication methods are fast becoming outdated. One of the key differences between fabricators is the appetite for technology adoption. On one end of the spectrum, companies opt for a low tech, high labour approach where the methods are manual and labour intensive. On the other end, companies opt to invest large amounts of capital in cutting edge software and hardware where many processes become automated and less labour intensive. There are many factors that dictate which end of the spectrum a fabricator places him or herself. While there are no right or wrong positions, fabricators need to be clear about what they are trying to achieve. One thing that is becoming increasing clear however is that





fabricators on the low-tech side of the spectrum are starting to realise that they are falling behind. Some will unfortunately not have the knowledge or capital to catch up. However, its not all doom and gloom. There are always solutions.

Specialised fabrication software and intelligent CNC machines were the first wave of fabrication technology improvements. In the last 10 years we have seen levels of adoption where almost every fabrication shop is using software and CNC machines to some degree or other. For many, this may be a nesting program and a simple 2D plasma plate profiling machine. For others it could be a sophisticated robotic system capable of programming itself. While for most, 3D modelling software isn't new, downstream software to manage the rest of the process is still relatively unexplored. Depending on the fabricator's strategy, it might be feasible to bypass the NC equipment stage because there is such high adoption in the supply chain, but it will not be possible to avoid implementing good software. I would urge fabricators in this scenario to think carefully about their plans.

The next wave of significant change in this industry is just starting to become visible. IoT or Internet of Things and its Industrial subset IIoT, is being referred to as the 4th Industrial Revolution or Industry 4.0 (after steam, electricity and computers). IIoT and will become a major topic of discussion in the next decade. Adoption in agriculture and security is already significant but in our specific field of steel fabrication, it is a little behind the curve. IoT is essentially a name for internet connected devices that perform a specific task and then send their data to a cloud-based platform. This platform could either simply report that information back to a user via an app or message (SMS or email) or could trigger an automated workflow for that business. Let's use an industrial example: A maintenance manager places an internet connected temperature probe onto a critical motor. The sensor takes readings at predefined time intervals and then transmits this data to a cloud platform. This platform then compares the reading against a pre-set range and when the reading falls outside of that range, the system can either send the maintenance department a message telling them that it is time to service the motor or it could be linked to another system (ERP such as SAP, SYSPRO etc) that automatically generates a works order for a maintenance technician or subcontractor. The data is also reported in real time via an app or desktop dashboard.

Industrial applications are very broad and limited only to the imagination and knowledge of the client. Process variables such as voltage, current, level, pressure, light, level, noise, pH and many others can be used to create highly useful process dashboards and can effectively and efficiently automate significant portions of any process.

The kicker here is that companies with a low technology adoption rate will struggle to take advantage of this new wave of technology because they're not yet tech-enabled. In order to leverage this new field of knowledge, it will be necessary for fabricators to at least have started to build a culture that is open to experimenting with new methods.

Let's be clear though that these technologies are not implemented for their own sake but to solve fabrication problems. Before undertaking any technology development project, it is essential to think critically about what problem you are trying to solve. Buying software and collecting data for the purposes of producing a smart dashboard is useless if it doesn't contribute to the elimination of constraints or risks in the process. By taking the time to properly consider your strategy (i.e. where you want to be in the spectrum described earlier) and identify the obstacles that prevent you from getting there, you might come to realise that there are solutions available that fit your organisation and don't require massive cultural shifts or financial investments. For those that embrace it, IIoT will usher in a host of interesting and useful applications that will facilitate running a sharper, leaner and higher quality fabrication business.

SASFA FEATURE

JOHN BARNARD
DIRECTOR, SASFA

LIGHT STEEL FRAMING FOR FIVE STAR ACCOMODATION IN STELLENBOSCH

Nestled on the banks of the Banhoekrivier, known as the heart of the Stellenbosch Wine country, you will find MolenVliet Oosthuizen Family Vineyards. It is a boutique Wine and Guest Estate with panoramic views of the breath-taking surrounding mountains and vineyards. The boutique 14-hectare Wine Estate produces some of the finest wines, focussing on quality instead of quantity.

It also boasts luxury 5 star accommodation which offers magnificent views of the vineyards, mountains, river and the well-established gardens.

It is easy to see why MolenVliet Oosthuizen Family Vineyards is ranked as one of the top Wedding and Accommodation destinations in the country. Demand started outstripping capacity, and the owners decided to expand the accomodation by adding a second floor. Rancor tendered to do the work as a turnkey project, using light steel framing, to add 7 rooms totalling 600m² to the hotel within the limited permitted construction period.

Charl van Zyl, CEO of Rancor, explains that "the customer's request was to have the best soundproof walls in the industry, as well as superior thermal insulation. Time was also of the essence as the hotel had accepted forward bookings for wedding venues".

A concrete slab was cast supported by the existing masonry walls. To achieve the high acoustic specification, double light steel frame wall panels with Cavitybat in both walls, and 2 layers of 15mm high impact fire

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stop gypsum boards were fixed to the inside of external walls. Tyvec vapour permeable membrane was installed, covering the 12mm thick OSB boards on the outside. A steel mesh was fixed to the OSB sheathing to be projection plastered. A 5 layer Dulux paint system was specified to ensure durability. The brief was to keep the existing look and charm of the old farm and that is exactly what was achieved with the banded plaster finish.

The internal walls were also constructed using double light steel framing with Cavitybat insulation (supplied by Saint-Gobain) in each wall cavity. Two layers of Gypsum 15mm high impact firestop boards were installed on both sides of internal walls to achieve 70 decibels of sound insulation, far superior to the 46 decibels offered by conventional masonry walls.

The trusses were monopitch light steel frame trusses with Diamond Deck roofing – the roof sheets were spray painted to match the colour of the existing buildings on the farm. To ensure good thermal insulation, 135mm thick Aerolite with Sisolation was installed in the roof cavity, and 40mm thick ISO board was used for ceilings, increasing the R-Value of the ceiling insulation to more than 4m².K/W, complementing the superior thermal properties offered by the well-insulated LSF walls.

Rancor delivered the project on time and within budget. They claim it would not have been possible to complete the work in the allotted time, and to the stringent specifications, had it not been for the inherent advantages of light steel frame building.

"...IT WOULD NOT HAVE BEEN POSSIBLE TO COMPLETE THE WORK IN THE ALLOTTED TIME, AND TO THE STRINGENT SPECIFICATIONS, HAD IT NOT BEEN FOR THE INHERENT ADVANTAGES OF LIGHT STEEL FRAME BUILDING."

SAMCRA FEATURE

DENNIS WHITE
DIRECTOR, SAMCRA

SAMCRA
SOUTHERN AFRICAN METAL CLADDING AND ROOFING ASSOCIATION

ROOF DRAINAGE:
KEY CONSIDERATIONS WHEN DESIGNING A DRAINAGE SYSTEM FOR A ROOF

There are a number of factors that have to be considered when designing an effective drainage system for a roof. The most important of which are:

- Rainfall intensity
- Average recurrence interval
- Catchment area
- Influence of wind
- Hail
- Outlets
- Serviceability considerations
- Maintenance

Rainfall intensity

Rainfall in the RSA is basically derived from frontal coastal systems along the coast which produce steady rainfall over a number of hours and short duration high-intensity thunderstorms in the interior which produce heavy rainfall within a period of minutes. However, high intensity thunder storms are known to occur at intervals along the Natal coast plus Port Elizabeth and surrounds. Intensity is measured in millimetres per hour with greatest intensity occurring during a period of five minutes. Generally the country is divided into three rainfall regions i.e. summer 200mm/h, year-round 150mm/h and winter 100mm/h.

Average recurrence interval (ARI) Defines the period, in years, between which the above intensities are likely to be exceeded and the capacity of the drainage system being inadequate. The average ARI for residential buildings is 10 – 15 years and all others between 25 and 50 years depending on the risk of damage to plant, processes and stock. For building of strategic importance such as hospitals a period of 100 years is recommended.

Catchment area

The area of roof to be drained by a section of gutter or downpipe, this will include areas of higher level roofs draining onto a lower level. As rain rarely falls vertically an allowance will need to be made for runoff from adjacent walls.

Influence of wind

Rainfall is normally accompanied by winds of varying intensity which can either impede flow or induce surges in gutters and we recommend the provision of a freeboard allowance equal to 10% of the calculated depth for a gutter with a minimum of 25mm on residential and 40 – 50mm on industrial buildings respectively.

Hail

The accumulation of hail in gutters and downpipes can considerably reduce the effectiveness of a drainage system often resulting in flooding and we recommend the installation of hailguards in areas prone regular hailstorms. *(Please refer to our website, www.samcra.co.za , for details pertaining to the design of hailguards).*

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Outlets

The shape and size of outlets have a major influence on the efficiency of a drainage system. The smoother the transition from horizontal to vertical flow the greater the capacity of flow into the downpipe. The insertion of a conical outlet can improve flow by 10 – 20% and the insertion of a header box or sump buy double that. Side outlets and spigots are less efficient and also impede flow in a gutter and are not recommend for use outside of residential applications. Flanged outlets to be attached to the outside surface of gutters.

Serviceability

A factor often overlooked when designing drainage systems is the speed of discharge from a roof resulting in the water overshooting the gutter which can have disastrous consequences with box gutters. We recommend a minimum width of 600mm for a roof with a slope length of 16 m inclined at not more than 10°. Alternatively it will be necessary to install baffle flashings. On slopes of less than 26° it is of paramount importance that the pans of cladding overhang the gutter by at least 50mm and the pans of the cladding are bent down to form a drip in order to eliminate the risk of runback up the underside of the cladding.

In order to improve drainage and eliminate ponding it is essential that gutters are installed with a fall of not less than 1:500 and that the outlet is at the lowest point.

The installation of grids or cages over outlets is not recommended as they or more readily blocked by debris, even a partial buildup of debris can reduce the capacity of an outlet by 50%. Often rainwater is transferred from a higher to lower roof via a downpipe fitted with a spreader. This practice should be confined to areas of no more than 20m² to avoid flooding the pans of the cladding profile on the lower roof.

Maintenance

Drainage systems i.e. gutters and downpipes need to be inspected and cleaned of all debris and accumulated silt at not more six monthly intervals. Downpipes need to be flushed to ensure there is no blockage within the pipes. All cleaning to be carried out with non-metallic utensils.

CALENDAR 2019

TRAINING:

- **Business Development Workshops:**
  2 x half day interactive workshop sessions on **20 and 27 February 2019**. Presented by Paolo Trinchero at the SAISC's offices in Johannesburg
- **SASFA LSFB Builders Course:**
  25 February – 1 March 2019 (Gauteng), venue to be confirmed
- **Basics of Steel Course:**
  1 Day training course
  5 March 2019 – Johannesburg, venue to be confirmed
  10 April 2019 – KZN, venue to be confirmed
- **Social Media 101 Workshop:**
  Half day interactive workshop sessions on **15 March 2019**. Presented by Jacqui Mackway Wilson at the SAISC's offices in Johannesburg
- **Basic Connection Design:**
  2 Day Course on **18 and 19 March 2019**. Presented by Roy Mackenzie and Steve Mackie at the SAISC's offices in Johannesburg

NETWORKING EVENTS:

- **Industry Feedback and Networking Breakfast:**
  Morning networking session.
  22 February 2019 – Woodmead Johannesburg Country Club
  12 April 2019 – KZN, venue to be confirmed
- **Steel Awards Sponsorship Cocktail Event:**
  Evening session detailing sponsorship opportunities on **7 March 2019** – Johannesburg, venue to be confirmed
- **SAISC Golf Day:**
  June 2019 – venue and date to be confirmed

DEADLINES:

- **Steel Awards 2019:**
  29 March 2019 – Project Nominations

STEASA NEWS

KEITUMETSE MOUMAKOE (K.M)
DIRECTOR, STEASA

OUTWARD TRADE AND INVESTMENT MISSION TO CABO DELGADO & MAPUTO PROVINCES OF MOZAMBIQUE

The Steel Tube Export Association of South Africa (STEASA) took part in a trade and investment mission to Mozambique arranged by the dti and office of the High Commission in Mozambique. The paramount and overarching objectives of the mission were to grant the South African government through the dti the prospect of continued economic collaboration and partnership with Mozambique, increase the formation of commercial partnerships and joint ventures between their businesspeople and for the realisation of higher levels of industrialisation through sustainable trade and investment.

In 2017, 30% of Mozambique's imports came from South Africa which puts it in the first position in terms of the market share in the country. Total trade volume in 2017 stood at R51 billion and the trade balance between the two countries in 2017 was R 26.6 billion in favour of South Africa. Mozambique is a strategic and important partner to South Africa and is amongst the top five of our trade partners in the Southern African Development Community region.

In 2010, Anadarko made its first discovery in the Offshore Area 1 of the deep-water Rovuma Basin, launching one of the most important natural gas discoveries in the last 20 years. Today, the company and its partners have discovered approximately 75 trillion cubic feet (Tcf) of recoverable natural gas resources in Offshore Area 1 and are working to develop one of the world's largest liquefied natural gas (LNG) projects. Most companies in Mozambique both local and international are strategically positioning themselves to partake in the downstream supply chain offerings that will be realized during the construction of the onshore and offshore LNG facilities.

STEASA's objectives on the mission was to engage meaningfully with prospective companies with proven competencies enabling them to bid on subcontracting tenders from the EPCM (McDermot, Chiyoda & Saipem) on the Golfinho- Atum Project. These companies would be in need of tubular related products for which supply could be sourced from SA based steel tube and pipe manufacturers in the upstream, midstream and downstream sectors.

The following was ascertained on the mission regarding the Golfinho- Atum LNG Project:

- Chiyoda, the lead partner in the CCSJV consortium should be awarded the EPCM contract. The other partners are Saipem and McDermott, advised that the majority of the quotations are in and that they anticipate procuring close to $1 billion from South Africa over course of the project's construction period (54 months commencing soon after FID which will be in Q1 next year).
- It is highly likely that the following work packages will go to South African EPC contractors:
- Marine Works (Jetty and Marine Offloading Facility)
- Security Services
- Permanent Fencing
- Tugs & Barges
- Geotech
- Anadarko and Chiyoda advised that due to the sensitivities around local content (in Mozambique) they have to follow a completely transparent procurement process. As such they advised that it is important that would be South African suppliers register on the following website www.mzlng.com as forward work packages will be posted thereon and that the CCJS JV will use this portal extensively.

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PLANTING SEEDS **OF CHANGE**

2017 saw one of the most devastating and deadly shack fires in the country's history in Cape Town at Imizamo Yethu, where about 4 500 structures were completely destroyed and approximately 15 000 residents were affected. This was just one of multiple shack fires that demolished homes and raged across informal settlements around South Africa. These shack fires can be prevented, and playing an active role in prevening future tragedies is the mission of Milton Mzobe, a Community Leader and Pastor living in Cosmo City.

Milton has been deeply affected by the impact of shack fires on communities, so in 2014 he founded the NPO Akunamlilo Fire Fighters, partnering with organisations to supply fire fighting equipment like Fire Extinguishers and Fire Prevention training to nearly 5000 shack owners in informal settlements in Gauteng.

Not only has Milton managed to start, run and maintain a successful NPO that is helping to educate thousands of South Africans on how to prevent fires, along with providing equipment to fight fires before they spread, he is also an inspiring positive role model and example of success to others in those communities.

Milton could not have achieved this without the support, guidance and training of Seeds of Change, one of the growing initiatives of Seeds of Africa which is supported by NJR Steel.

Seeds of Change has been a hugely successful entrepreneurial enterprise development program that gives training, mentoring & seed capital to start-up grassroots businesses, so that they can become sustainable SMEs that offer job opportunities and create economic growth within disadvantaged communities.

Milton's business is just one of 30 that have been empowered and supported by Seeds of Africa. "Not only has my life been changed, but I've been able to help thousands of families become more aware of fire risks and equip themselves against disaster." say MIlton. "The most important lesson I've learnt in life is never give up on your dreams and keep striving to make them a reality. The key to making a success is to partner with organisations that can assist you, like Seeds of Africa. If it wasnt for for NJR Steel supporting my development and my business through Seeds of Africa I would not be where I am today." he concludes.

If you would like to find out more about how to uplift communities and at the same time earn maximum points on your BBBEE scorecard for Enterprise, Supplier Development and Socio-Economic Development please contact Sally on 082 560 3467/sally@seedsofafrica.co.za or visit the Seeds of Africa website www.seedsofafrica.co.za

TELL US YOUR GOOD NEWS!

Let us know what you're celebrating as a company, or what you're proud of that we can share with the industry! **Email denise@saisc.co.za**

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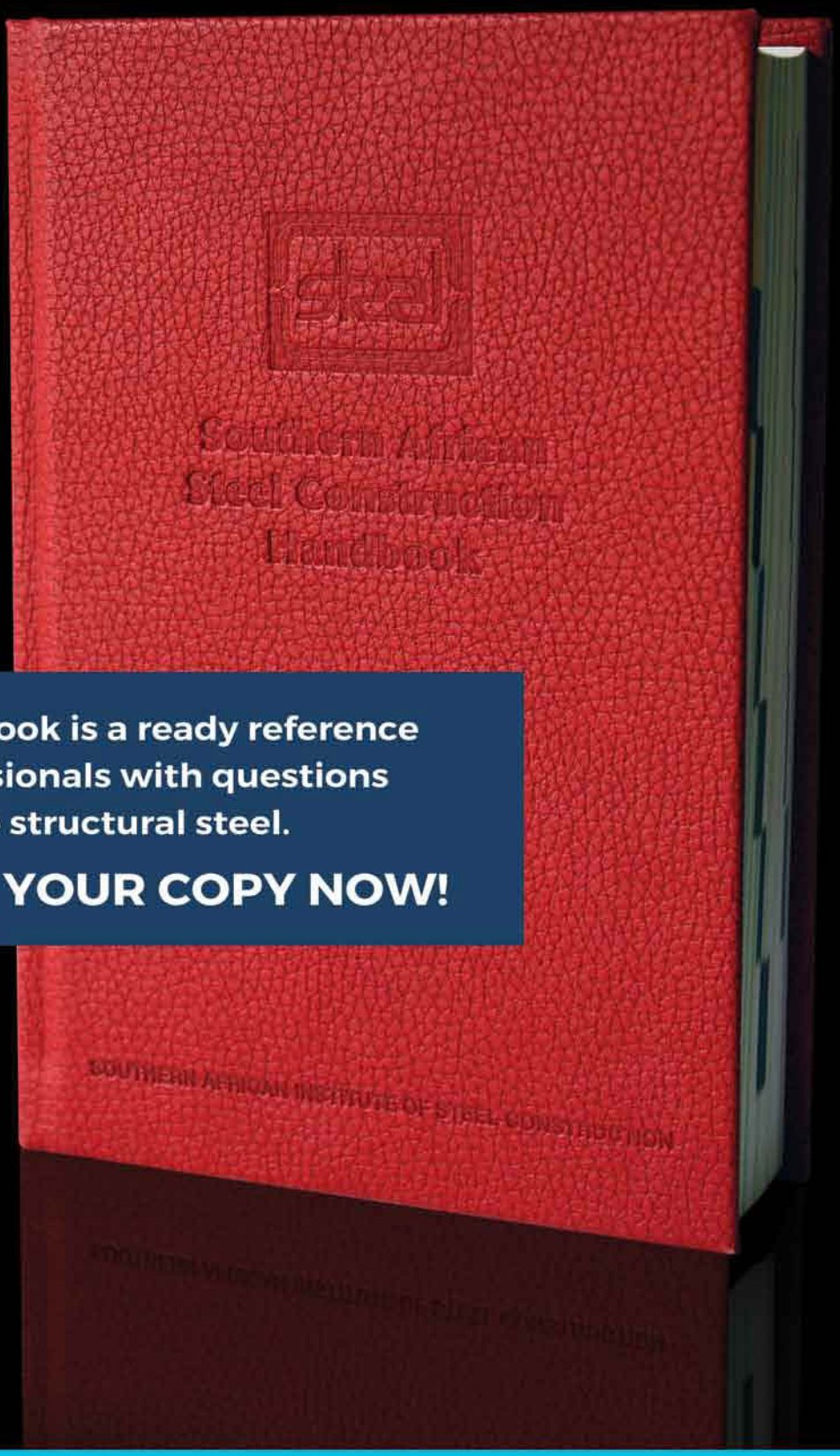

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