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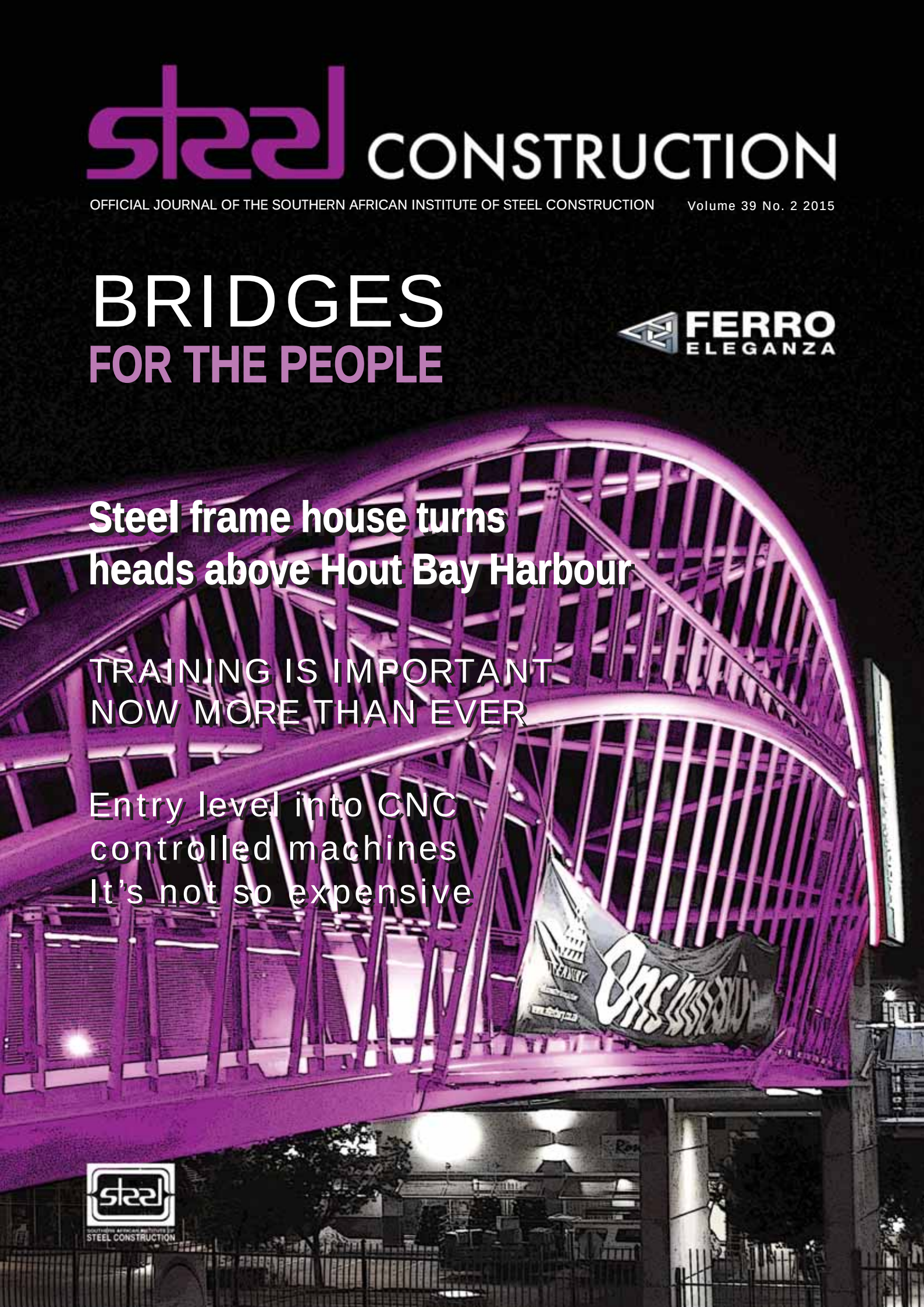
OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION Volume 39 No. 2 2015

BRIDGES
FOR THE PEOPLE

Steel frame house turns heads above Hout Bay Harbour

TRAINING IS IMPORTANT NOW MORE THAN EVER

Entry level into CNC controlled machines It's not so expensive



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John (51) has the key elements of project delivery - structural data from each phase -embedded into the Tekla model, to schedule and monitor project performance from design to supply and installation. Combining all available 3D and management data into the Tekla model allows his team members to stay in the building information loop.

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Front Cover:
The new Daventry Road Bridge
Photographer: Chris Narbonese

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Volume 39 No. 2 2015

OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

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in this issue...

Join us on and YouTube

editor's note

"In this issue Steel Construction looked back in time and chose a few of our favourite pedestrian bridges – in steel of course. That made me think – pedestrian bridges over main roads, highways and rivers are the most elegant billboards in today's 'plaster everything with advertising' mentality.

They are sleek reminders that you can do anything with steel.

"Architects, eat your heart out!"

"Engineers, find innovative solutions to help people cross the divide!"

"Commuters, rest your weary eyes on human-made beauty!"

The one message, I think, that does not stay in our 'target markets' minds long enough is: "This bridge was erected on a Sunday afternoon; over an Easter weekend; on a public holiday – you did not have to fume in a bottleneck of traffic for weeks, months...years!"

The next morning going to work it was just there. Aesthetically it would not make sense to pitch a real 'ugly' billboard next to the bridge to bring this message home.

This was the intent of the feature to showcase those bridges that have become part of our everyday landscape. To highlight the beauty of their architectural design, engineering genius, fabrication perfection and erection programme that was painless to the public.

So why don't we build all bridges in steel? If a road bridge requires widening due to increased usage, surely a steel solution would be much quicker than the usual mass of scaffolding decorating the roads for a laughable length of time?

We have to ask: how do we change human behaviour? An in this case: a long tradition of a large group of people thinking and doing things in a certain way which they believe is the best way.

In other words, we want several oil tankers to turn and go the other way – slowly and one at a time. But it is possible...

The hard **questions** we **MUST ASK** ourselves

By Paolo Trinchero, Chief Executive Officer, SAISC

Boy what a challenge this year is turning out to be!

Given power shortages, slow growth in key export markets, sharply lower commodity prices and generally subdued domestic demand we, as Industry and Institute, have our work cut out for us.

One of the advantages of being at the SAISC and not in the trenches is to look back and forward to conditions in the Industry. When reading about steel Industry challenges going as far back as the 50s, search engines are of course useful tools. Many of the problems we are experiencing are not unique to South Africa and our steel Industry. A great many books have been written on the American, UK and European steel industries. So suddenly this looks like something we have seen before and fortunately there we have experienced people who have experienced the up-and-down nature of the steel cycle and who know what has to be done.

One of the SAISC strategic reports written in the 80s had some sound advice on what to do when experiencing bad times and I quote – "wait for good times". I can't believe that this is the correct approach in today's environment but we have to accept that when outside events dominate we can and should deal with issues under our sphere of influence or control and try not to get bogged down with those we can't.

So the answer is that there is no silver bullet. When our GDP is projected to be 2% or below we need to do what is necessary to stay alive and prepare if we can for when conditions improve.

Within all these challenges there must be some opportunities.

"So the answer is that there is **NO silver bullet.** When our GDP is projected to be 2% or below we need to do what is **NECESSARY to stay ALIVE** and prepare if we can for when conditions improve.

Within all these challenges there **MUST BE** some **opportunities.**"

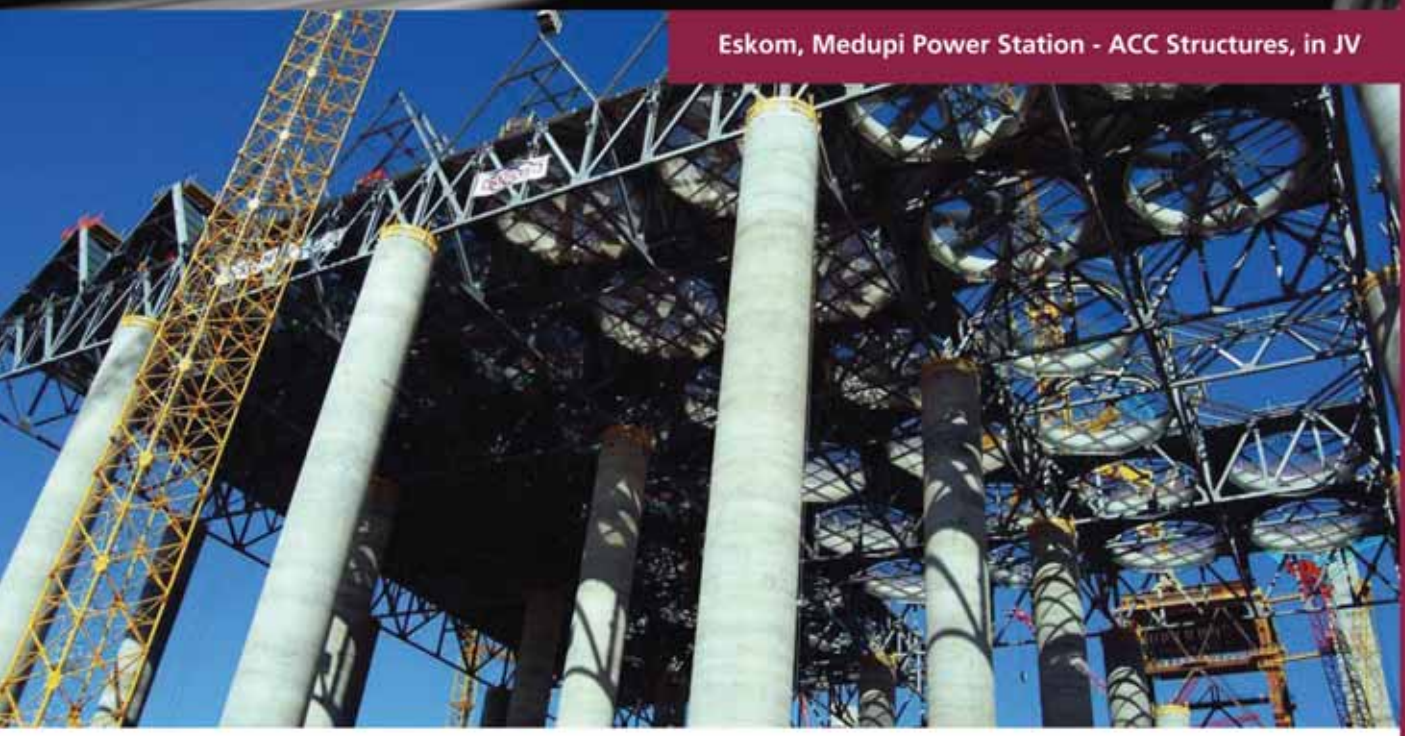
- The SAISC is a firm believer in innovation. Innovation of products and service offerings are needed to keep steel the material of choice in construction. Industry players need to identify new products to diversify into products especially with high export potential.
- Do we need to hit the reset button? Spencer has written an article based on visits to European fabricators.
- We are a globalised Industry and we have Africa rising on our doorstep.
- We can improve and enforce standards as they are more important than ever before. It may be easy for our BRICS partners to export, but it will not be easy to comply with all the necessary standards required.
- We can develop new markets with our unique set of skills.
- The steel Industry can proactively play a major role in solving many of the problems South Africa currently faces particularly with respect to infrastructure and energy.
- From a strategic point of view are we:
- Selling into the right geography (This changes very rapidly within the global context)?
- Altering our cost structures to be competitive and profitable?
- Improving our skills? Do we have the right workforce skills?
- Constantly looking for new markets?
- Differentiating ourselves from our competition – not always in your traditional Industry?
- Standardising our products and services, to save time and money?
- Lowering logistics costs?

The SAISC and sub-associations are working very hard to make a difference to the Industry so please support us with your involvement in our activities and initiatives, and join the Institute.

NEWS FLASH: FABRICATED STRUCTURAL STEEL – IS SOON TO BE A DESIGNATED PRODUCT

CADCON

STEEL CONSTRUCTION AND ENGINEERING



Eskom, Medupi Power Station - ACC Structures, in JV

Established in 1987, Cadcon, as a vibrant and reputable entity, has grown into a leading steel construction, designing and engineering organization involved in major projects in and around Southern Africa and internationally. Cadcon operates from their 15 400 m² workshop and office facilities in Centurion, Pretoria, housing state of the art machinery and latest technology CNC plate, beam, angle, cutting, drill and saw facilities serviced by 20 overhead cranes. Cadcon has also implemented the FabTrol System providing drawing management, material nesting, purchasing, inventory control, production and CNC management, shipping and more.

Eskom, Medupi Ducting Supports, Lephalale

Planning and completion of various significant and complex national and international projects on time, for commercial, industrial, mining and plant sectors, serves as testimony putting Cadcon as a leader at the cutting edge, in a rapidly growing and competitive environment. Cadcon has valuable experience in exports of steel products internationally and strong innovative contributions to the whole of Southern Africa.

Overall Winner SAISC Steel Awards 2011
Sandton City - Protea Court Rooflight, in JV

Furthermore, Cadcon's unique packages include the design and supply of buildings through Mictec, Cadcon's in-house engineering design department. Additional services include crane, truck and trailer hire.

Cadcon operates their full production process from the delivery of raw material, fabrication, abrasive blasting, corrosion protection, erection and finishing to the proud delivery of the final product through their team of graduates and dedicated artisans. Cadcon's methodologies and processes results in their ability to provide their clients with turnkey solutions at optimum efficiency; **STRIVING FOR EXCELLENCE AND PEACE OF MIND IN STEEL CONSTRUCTION**, this being the cornerstone of Cadcon's success and competency.

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Steel Services and Allied Industries

By Viv van Zyl, SAISC Membership Consultant

Steel Services and Allied Industries (SS & AI) is renowned for their steel solutions and bring many an architect's and engineer's vision to life. They work hand in hand with their customers and their group of companies and are able to deliver exactly what their customers require. They offer creative and technical expertise with detailed engineering to deliver appealing and practical solutions and have an unsurpassed reputation for quality, excellent service and reliability.

TOP RIGHT: Their workshop is equipped with state-of-the-art equipment.

Steel Services and Allied Industries has a number of prestigious projects under their belt:

TOP LEFT: New 'A-frame'headgear for Gold Fields South Deep Twin Shafts vent shaft, 2011 (winner of the Steel Awards 2011 Mining and Industrial Category Award)

ABOVE RIGHT: Material Handling conveyors for Goldfields Southdeep Twin Shafts, 2014

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www.steelservices.co.za

In 1985 an employee left the security of working for a company and decided,"I am going to do my own thing". As a qualified boilermaker he ventured into the field of ventilation services and Rand Ducting was subsequently established. The company was very successful and after a couple of years was sold off to Murray & Roberts. But this entrepreneur did not stop there as within a short period of time he again started his own company named Steel Services. Who is this entrepreneur? No other than Ron Bartlett the CEO of Steel Services and Allied Industries.

From the early days when Ron started this new company they have developed into one of the real stalwarts in the mining and construction industry. Also referred to as SS & AI they offer a wide range of services, products and facilities by diverse companies in the group. They are united by key strengths and common values. The main operation is in Carletonville with further sites in the Northwest, Mpumalanga and Limpopo provinces.

The group consists of Steel Services, Steel Trading, Crane Corporation, Ventilation Support Systems, John Richards Engineering and Avron Properties. Their two workshops are situated on almost 50 000m² of land in Carletonville and Rustenburg which include 11 000m² of covered area where they can fabricate complex jobs. They boast modern equipment as well as use the most

advanced computer software to facilitate and deliver high quality projects on time.

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Subsidiaries

Steel Trading was founded by Lawrence (Group MD) in 2008. This company specialises in medium and light engineering and has developed an excellent reputation in the manufacturing, construction and mining industries. They provide a great variety of services and products which include detailing, fabrication, welding, cleaning, procurement, sandblasting, painting, galvanizing, pre-assembly, delivery and erection of various steel products and structures.

Steel Trading's services and products include:

- Headgears
- Plant steel and plate work
- Shaft steel – buntons, guides, cages, penthouse, etc.
- Suspended shaft and tower steel
- Winder house and compressor house buildings
- Silo steel and silo conveyors surface
- Underground transfer conveyors
- Ore passes and tips
- Dip conveyors
- Strike conveyors
- Conveyor belt systems complete with mechanicals
- Workshops / buildings
- Underground tip steelwork
- Ore pass support steel and ore pass
- Control chutes
- General steel fabrication, construction
- Floor grating
- Expanded metals
- Flatex products
- Hand railing systems and stair treads

Commissioning of steelwork includes:

- Building of underground distribution sub stations
- Machining of bushes, wheels and shafts
- Repairing of lifting equipment
- Civil construction for all associated steel work installed
- Installation of main vent fans

A little more about their other subsidiaries:

Ventilation Support Systems is committed to the design, development and production of high performance ventilation products. They are able to create ventilation bends in a fraction of the time it would normally take. Their products are manufactured to the highest standards, ensuring maximum efficiency of airflow and ease of installation. While custom sizes are manufactured according to customer requirements, they can manufacture diameters ranging from 280mm up to and including 1 220mm, with pipe lengths ranging from 1 to 6 metres. Their systems ensure ease of installation and recovery, and are designed to be leak free. Other products manufactured by them range from general fabrication to material handling solutions.

Crane Corporation was established in 2008 by Lawrence Bartlett and specialises in mobile crane hire, specialised transport and rigging and associated services such as CAD–rigging studies. They have an extensive fleet of well-maintained equipment and whether you need one or several cranes, conducting a 5 or 1 000 ton lift, simple or complicated, Crane Corporation can provide the perfect solution.

The SS & AI Group is committed to Employment Equity and to DTI's Broad Based Black Economic Empowerment with a 26% black ownership. They believe in genuine economic transformation and the future success of South Africa and its people. The company invests in the skills development of their staff. All staff are trained, qualified and certified in their various disciplines. On-going staff training is essential and they encourage their people to be flexible and dynamic and grow their potential.

The visionary board of directors headed up by Ron Bartlett (Group CEO) and Lawrence Bartlett (Group Managing Director) understand the value and significance of adapting which encourage the development of innovative solutions that are focused on fulfilling the needs of their customers.

The company's board inspires all their staff and says "Let's not adapt to survive, let's adapt to THRIVE!"

SAISC Steel Awards 2015

THE 34th EVENT AND THE 5th STEEL AWARDS PHOTO COMPETITION

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Industry NEWS IN BRIEF

Changes at the SAISC KZN Regional Committee

Paul Simpson, now at Avellini Bros has been appointed as the new chairman of the SAISC KZN Regional Committee and Elke Hefer of DUT as secretary. The SAISC wishes them the best in their positions on the committee and have no doubt that they will succeed in providing the KZN steel construction industry with a forum to network, raise issues, attend training courses and events, and receive advice from peers wherever possible.

They are supported by the other committee members who remain:
Gordon McNeil – Impact Engineering, Sunthosh Balchund – BNC Projects, Stuart Elliot – Sivest, Mark Ferreira – Churchyard and Umpleby and stalwart Don McLean.

If you are a steel fabrication outfit, engineering practice, steel merchant or any other company involved in construction or steel construction situated in KwaZulu-Natal and would like to join the SAISC KZN branch, please contact Tiana Ferreira at tiana@saisc.co.za. By joining you will receive all the benefits of being a member of the SAISC and the active KZN Regional Committee.

Yellow Book – new edition now in stock

The new edition of the Southern African Structural Steelwork Detailing Manual, otherwise known as the Yellow Book, is now in stock. This manual is part of the SAISC's programme of providing practical, up-to-date information on various aspects of steel construction for the assistance of educators, designers, draughtsmen, fabricators and all others who have an interest in structural steelwork.

The Yellow Book or any other publication by the SAISC and SABS codes pertaining to steel construction and LSFB can be ordered online at www.saisc.co.za – go to Publications – Bookshop or contact Debbie Allcock at debbie@saisc.co.za.

Price
Members of SAISC / ISF / SASFA / SAMCRA / POLASA – R375.00
Normal price – R525.00
Students – R255.00

Young Welder of the Year 2015

Jaco van Deventer has won the Young Welder of the Year 2015 competition and will go on to represent South Africa at the WorldSkills competition to be held in Sao Paulo, Brazil, from 11 – 16 August 2015.

"Jaco is only 20, but the quality of his work is beyond his years. We are hoping for a competitive showing by him in Sao Paolo," says SAIW's Etienne Nell, the Young Welder of the Year convenor. Jaco, who is apprenticed at Steinmüller – a multi-service provider to the power generation and petrochemical industries – faced tough competition this year, and only beat overall runner-up Romario Arendse from West Coast College by 1.25 points.

Nell says that participation in the Young Welder of the Year competition is growing. "The competition has generated a great deal of interest from all over the country. With 20 finalists, we had a record number of nominees this year and as this has become the foremost skills test for young welders in South Africa, we expect participation to continue growing."

Jim Guild, SAIW retiring executive director says that the competition is an industry initiative and would not survive without its sponsors."We are grateful for our sponsors who understand the growing importance of this competition in terms of encouraging welding as an exciting and sustainable career for the youth."

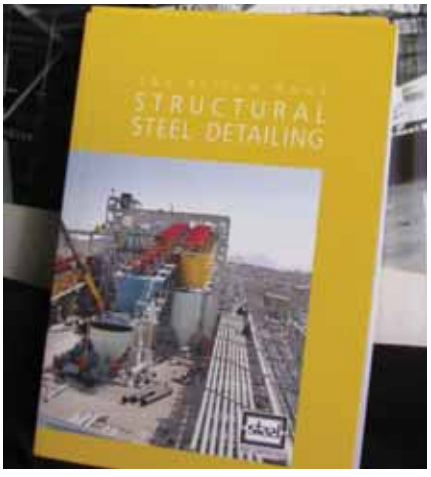
The 2015 competition was sponsored by: Abicor Binzel, Afrox, AFSA, Air Products South Africa, ArcelorMittal, Columbus Stainless, ESAB, Hulamin, Laser Cut Varios, Macsteel VRN, Sangari, Sassda, Thuthuka Welding Products and Welding Alloys South Africa.

Meanwhile the SAIW branch in Cape Town is moving ahead strongly, offering a wide range of welding courses. These include:Welding Inspector, Senior Welding Inspector, Appreciation of Welding for Engineers, Foundation Week and Competent Persons – Steam Generators and Pressure Vessels, AWS D1.1 Codes Training and more.

Easy-Rail modular guardrail system from Andrew Mentis is crash-tested

Easy-Rail, a crash-tested guardrail system representing the latest European safety and quality standards, is being manufactured in South Africa by Andrew Mentis, under license from Volkmann & Rossbach of Germany. Andrew Mentis has teamed up with Road Furnishing Services (RFS) to ensure that the guardrail system is installed according to specification.

This quality modular guardrail system has received attention from the South African National Roads Agency (SANRAL) and the South African Road Federation (SARF).
"The Easy-Rail guardrail system is tested to EN 1317-2. It is a modular system that allows for the most cost efficient solution for



RIGHT: The new edition of the Southern African Structural Steelwork Detailing Manual, otherwise known as the Yellow Book.

FAR RIGHT: Morris Maroga, SAIW President and Jaco van Deventer, Young Welder of the Year 2015.

ABOVE: Andrew Mentis has teamed up with Road Furnishing Services (RFS) to ensure that the Easy-Rail guardrail system is installed according to specification.

various applications," Elaine van Rooyen, Marketing Manager, Andrew Mentis, says.

It provides maximum safety at minimal weight as well as being simple and fast to install. All Easy-Rail modules connect to each other without any transitional construction required, so that the containment level and working width can be adjusted accordingly for a specific application. The guardrail beam is attached to the posts by a single screw in order to minimise the installation effort.

In addition to Easy-Rail, Andrew Mentis also manufactures and distributes its own Mentrail guardrail available in either galvanised or uncoated lengths. Mentrail guardrails are manufactured in 2.6mm thick steel to standard 3.81m lengths, according to SANS 1350-1982 specifications. The guardrails are easy to install without further tension or stretching, and do not require any special tools.

Deloitte Construction Report: African Mega Projects surge 46% to US$326 billion in 2014

Heavy investment in transport, energy and power Investment in African mega projects accounted for the surge of 46% last year.

To qualify for inclusion in the Deloitte African Construction Trends report, projects must be valued at more than US$50 million and had to have broken ground by at least 1 June 2014.

"Africa's rapidly growing middle class continues to drive demand for sustainable social infrastructure," said Mr Andre Pottas, Regional Director at Deloitte.

Of the projects included in the report, no less than 143 were led by the public sector with a further 88 being private sector initiatives and 26 (10%) classified as public private partnerships (PPPs). Energy & Power accounted for 37%, followed by transport (34%), mining (9%), real estate (6%), water (5%), oil & gas (4%), mixed use facilities (2%) and health care (1%).

Southern Africa led the Africa construction projects and accounted for $144.89 billion in projects or 44.5% of the total value of mega projects. West Africa overtook East Africa with 23% of the total projects on the continent. Central Africa experienced a massive 117% surge while North Africa saw the value of construction projects jump almost 36%. East Africa experienced a moderate 10% decline, which nevertheless totalled a respectable $60.67 billion.

"Africa continues to be a magnet for Foreign Direct Investment (FDI) and intra-African capital inflows," said Mr Pottas. "With a 76% completion rate of projects collected from our previous report, expectations remain high for infrastructure to provide the developing continent with much needed market expansion."

Sustainability Week CSIR

SUSTAINABILITY WEEK
GET READY TO PUT IDEAS IN MOTION

Thought leaders, policy makers, practitioners and producers within the country and beyond will share their knowledge at Sustainability Week, hosted by alive2green from 23 to 28 June 2015 at the CSIR International Convention Centre in Pretoria.

The programme boasts an impressive 14 seminars which offer excellent opportunities for various stakeholders to share their ideas.

A foretaste of some of the seminars

African capital cities sustainability forum: This forum will explore various opportunities to address the sustainability imperative arising from the current and numerous challenges African cities face. African cities can reach high levels of quality urban life when supported by appropriate policies, design ingenuity, innovation, technical proficiency, robust implementation mechanisms and adequate infrastructural investments.

Green Building Conference: Green Buildings is rapidly becoming the norm for new large building projects. New design strategies, building materials and approaches are contributing to an ever more innovative and rapidly changing environment. This year's ninth annual Green Building Conference will share the latest thinking, perspectives, case studies and projects as they unfold.

Transport and mobility seminar: The transport sector needs constant maintenance, upgrading, and rolling out of new roads, which ultimately affects communities and the biosphere in profound ways. A key strategy to reduce these impacts is to invest in rail infrastructure and to create the economic conditions to entice appropriate freight to move from truck to rail. Projects to connect African countries can pave the way for much greater Africa-to-Africa trade, bolstering African industries and creating employment.

Sustainability in mining seminar: Mining is South Africa's most important sector, employing hundreds of thousands of workers. Mining IQ mentions that the mining industry contributes an average of 20% to South Africa's GDP and boasts a total annual income exceeding R330 billion. Mining and all extractive industries have a heavy impact on communities and the environment, but not all mines are planned, run, and decommissioned in the same manner.

Green manufacturing and supply chain seminar: Companies will compare experiences and best practice in finding ways to localise manufacturing along the supply chain, seek out energy, water and waste efficiencies, protect communities and the environment, and compete locally and internationally.

Sustainable infrastructure seminar: A sustainable society and economy must rely on infrastructure that supports it. Reducing the environmental impact of the built environment can ultimately only be advanced through infrastructure.

Other seminars include Green business, Water resource, Vision zero waste, Sustainable energy and Food security. For more information on Sustainability Week, visit www.sustainabilityweek.co.za.

dealing with NOT KNOWING WHAT YOU DON'T KNOW IN STEEL CONSTRUCTION

By Amanuel Gebremeskel, Development Engineer, SAISC

U.S. Secretary for Defence, Donald Rumsfeld, famously said it in 2002: "There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know."

The things that we don't know we don't know cause the greatest havoc in society in general and, of course, the steel construction industry is no exception. This is not a new concept and was brought powerfully to the public's attention by Nassim Taleb in his iconic 2007 book, The Black Swan, wherein the core message is that the" unknown unknowns" are responsible for the greatest societal change. Think only of 9/11.

One of the problems with engineers today is that while they are generally great at designing according to what they know and what they know they don't know, they give up on doing anything about the "unknown unknowns". This is a mistake of monumental proportions. There are ways to approach this with the minimum requirement being the study of redundancies in order to achieve ultimate resilience and robustness. The SAISC Steel Academy's training courses include such instruction.

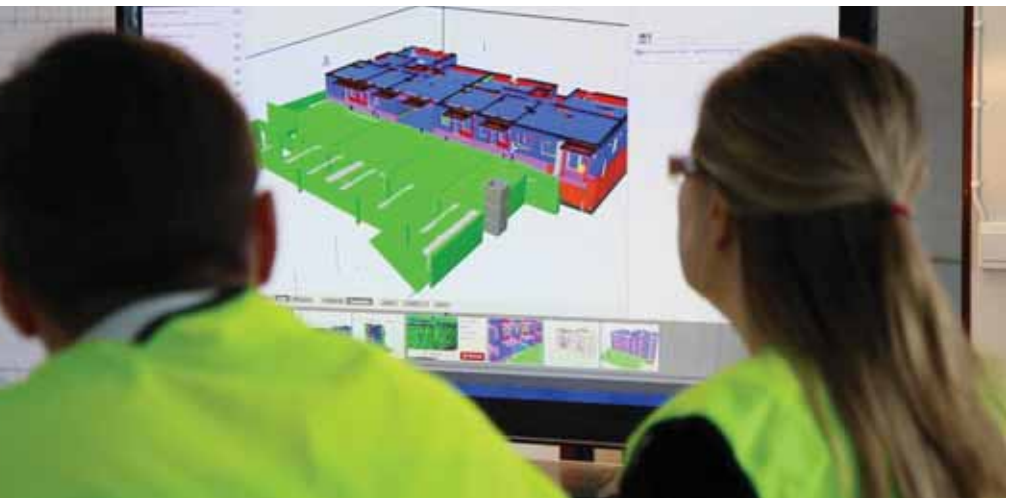
But the problem doesn't end there. Many of the large project houses, including the parastatals, are not doing enough training and even though they may be aware that organisations like the SAISC have a wide range of training programmes that could help prevent a myriad future problems in steel construction, they, for a variety of short-sighted reasons like cost, or the spurious belief that the main contractor is solely responsible for the risk, hardly do any training at all. This is creating a dire situation in South Africa.

The structural element of big projects is always on the 'critical path' and companies should be putting more effort and resources into this aspect of the project than other aspects. This, simply put, translates into investing in more training for the people who are managing the critical processes. Mainly for this reason the SAISC has recently launched the Steel Academy, an umbrella body for all its training initiatives.

Training is critical to the long term success and financial performance of any company and is vital to the continued sustainability and competitiveness of not only the steel

> Cutting back on training in times like these is false economy. Sending engineers for training now will have a direct impact, translating into increased productivity in the workplace and, in the case of more complex systems, will bring about greater reliability significantly reducing overall costs for the steel construction industry in particular and the country as a whole.

RIGHT: New Generation 2014 – The SAISC sponsors several top student from various universities annually to visit steel construction related sites and attend Steel Awards the same evening.



ABOVE: Most of the Steel Academy courses are also aimed at young and practising detailers.

construction industry in South Africa but to all industries. The SAISC is passionate about reversing the dearth of skilled engineers in the industry through the Steel Academy.

This initiative provides short- and long-term courses, structured around the fact that the attendees also have jobs to fulfil. Its interactive training uses a hands-on approach, with personal mentoring, examples, calculations and discussions. On some courses the attendees are required to do work related to their own companies.

Among the host of SAISC programmes relevant to the steel industry are courses covering all aspects of steel design, business development and marketing, financial management, legal and contractual matters, economics of steel design, connection design, steel bridges, materials handling and more.

Through direct academic input, the SAISC also assures the academic quality of the civil engineering faculties at South Africa's top five universities; Pretoria, Wits, Stellenbosch, Cape Town and KwaZulu-Natal. The architectural faculties of some of these institutions also receive input from SAISC. At present the SAISC is also mentoring five interns from the Vaal University of Technology.

Cutting back on training in times like these is false economy. Sending engineers for training now will have a direct impact, translating into increased productivity in the workplace and, in the case of more complex systems, will bring about greater reliability significantly reducing overall costs for the steel construction industry in particular and the country as a whole.

For more information on the courses offered by the SAISC Steel Academy, call 011 726 6111 or visit www.saisc.co.za.

Bridges for the people

steel creates beautiful pedestrian bridges. They last forever and add snaps of visual pleasure to pedestrians and motorists driving in frustrating traffic and under monotonous concrete overpasses. In this issue we showcase a few previous award winning bridges plus a brand new bridge. Unfortunately we could not cover all the pedestrian bridges featured in the past. The roll-out of amazing bridges continues - watch this year's steel Awards!

Daventry Road Bridge, Lynwood, Pretoria

2015

The bridge was assembled with cranes in the parking area of Glenfair shopping centre. Once assembled, completely painted and Bondeck sheeting installed for the concrete walkway, the bridge had to be lifted and erected over the busy road. The erection was arranged on a Sunday with road closures to lift the entire bridge with a 440t crane over the road and set it in place. Traffic was hardly affected.

PROJECT TEAM

Client:
Atterbury Property Holdings

Architect:
Studio3 Architects

Structural Engineer:
DG Consulting Engineers

Quantity Surveyor:
SSQS

Project Manager:
Pro Arnan (Pty) Ltd

Main Contractor:
Archstone Construction (Pty) Ltd

Steelwork Contractor:
Ferro Eleganza (Pty) Ltd

Detailing Company:
Ferro Draughting (Pty) Ltd

Photographer:
Chris Narbonese

(Links: www.leadingarchitecture.co.za, www.atterbury.co.za, www.ferroe.co.za)

The new Daventry Road Bridge forms a landmark pedestrian bridge between Lynnwood Bridge Retail and Office Park and Glenfair Boulevard in Pretoria. This eye-catching bridge spans Daventry Road and links the two properties. Lynnwood Bridge is a new shopping, leisure and business centre, while the Glenfair Boulevard shopping centre has served the community for the past 40 years.

The brief to the architect included to visually match the bridge with the eye-catching design of Lynnwood Bridge, incorporating the ability to house billboards on either side, as well as a pylon with space for illuminated sign boxes on the bridge. In addition, they were challenged with designing the stairs to be as comfortable as possible for pedestrians as the bridge is almost two storeys high.

The architect envisioned the bridge to be more than just a structure that houses a billboard, but creating a bold shape to be experienced in its own right, both from a distance and when walking over the bridge.

Fabricating the bridge to do justice to the architect's vision and to engineering design specifications was another story. The appointed steelwork contractor, Ferro Eleganza, succeeded in this challenge as they received praises from the architect as well as the client for a job well done.

The bridge is a tubular steel structure where the main top cords consist of large rolled 273 circular hollow sections (CHS) and the main bottom cords of 340 x 200 rectangular hollow sections (RHS), the rest of the structure is made up of smaller tubular sections. To add to the aesthetic appeal of the bridge very few visible bolted connections were allowed on the main tubular sections. Only the bracing between the top cords was bolted.

As with any structure the accuracy of the detailed drawings is key to the success of the project. The drawings were done using Tekla software. This allowed the fabricators to do accurate planning and surveying on site, while also enabling them to plan other details like transporting and lifting the structure.

The bridge was assembled in the factory to ensure correct fit-up as no mistakes could be afforded on site.

Then getting the bridge to site posed quite a challenge as the structure had to be transported in two halves – 36m long and 7m wide. This was done by transporting it on a truck and steerable dolly. Imagine this with congested city roads and frustrated motorists!

The bridge was assembled with mobile cranes in the parking area of Glenfair shopping centre. Once assembled, completely painted and Bondeck sheeting installed for the concrete walkway, the bridge had to be lifted and erected over the busy road. The erection was arranged on a Sunday with road closures to lift the entire bridge with a 440t crane over the road and set it in place. Traffic was hardly affected.

The fabricator also faced the looming strike and had to work very hard to get the bridge out of the factory before July 2014. It paid off and there were no delays in the programme.

Two ‘historic’ bridges, Johannesburg

1970

By Spencer Erling, Education Director, SAISC

But the real steel message was that the bridge was put up on Good Friday morning during the Easter weekend. Traffic disruption was minimal, even the taking down and re-hanging of the trolley bus wires happened the same morning.

Johannesburg does have some quite old and elegant steel bridges that were built in the 1970s and are still doing their job. Here is a short description of two such bridges.

The first was the bridge over Houghton Drive joining the east and west sides of that magnificent park known as The Wilds. On the west side to make up the elevation difference with the east side is an elegant curved ramp. The bridge is a few hundred metres north of the cable stayed bridge (Desmond and Leah Tutu Bridge – *see page 16*) linking the St John’s and Rodean schools.

The second bridge was one in which I had a personal involvement. It is over Jan Smuts Avenue at the closed end of Wellington Road in Parktown.

Many years ago, Wellington Road had direct access onto Jan Smuts Avenue. This direct access was lost when the M1 Freeway was built and Jan Smuts Ave. was widened. But in the early 1970s Wellington road sloped quite steeply down towards Jan Smuts. One early afternoon soon after the final bell for the day rang at Parktown Boys High, just up Wellington Road, a scholar very eager to catch the first bus (trolley in those days) ran down the hill, could not stop in time and was killed when he collided with a car.

The City of Johannesburg decided to put up a bridge. It was a trapezoidal box design made from 12mm plate and the deck was filled with concrete to make the walkway surface.

But the real steel message was that the bridge was put up on Good Friday morning during the Easter weekend. Traffic disruption was minimal, even the taking down and re-hanging of the trolley bus wires happened the same morning. By 13:00 the road was re-opened to traffic, with the hand railing/ balustrading completed soon thereafter.

Just think of the disruption to traffic over the N1 highway when the new bridge gets built over it south of the Allandale off-ramp – it is sure to go on for months.

Come on guys, build bridges in steel!

Moretele Gardens Pedestrian Bridge, Hammanskraal

Winner of the Steel Awards Bridge Category

2003

This unique bridge evolved from a conventional concrete bridge with a mesh clad canopy to the elegant shape in which it was finally built – a chorded spiral. However, the premium paid for this most unusual shape, which could only have been constructed in steel was relatively small.

PROJECT TEAM

Client:
City of Tshwane Metropolitan Council

Structural Engineer:
Dekker & Gelderblom, RTBA Design Services

Project Manager:
LTE Consulting

Main Contractor:
Stefanutti & Bressan

Steelwork Contractor:
Boksan Projects cc

When the Moretele spiral bridge was completed, the team received a comment that a more suitable location could have been selected for such a unique bridge. But it is perhaps appropriate that such a bold statement of design and fabrication should serve the poor community of Hammanskraal, where technology and imagination can serve to enhance community projects. The bridge is also a well known landmark for motorists travelling on the N1 to and from the northern provinces such as Limpopo.

This unique bridge evolved from a conventional concrete bridge with a mesh clad canopy to the elegant shape in which it was finally built – a chorded spiral. However, the premium paid for this most unusual shape, which could only have been constructed in steel was relatively small. The geometric shape of the spiral symbolises linear movement along the axis. Here the linear movement is that of pedestrians walking or cycling through the bridge.

The structural system can best be described as a hybrid between a framing using semi -circular shear elements, and a truss using chords to resist axial compressive and tensile forces. A side elevation of the bridge provides some indication of how the system functions. Shear forces are transferred through the curved elements using bending, axial force and torsion.

Circular hollow sections are perfectly suited for this application. In this type of structure the actual load-deformation characteristics of the welded joints connecting the spiral segments to the four stringers can significantly affect the overall stiffness of the frame.

The actual fabrication process was relatively simple. Four spiral segments were cut from circular sections rolled to a full revolution of 4m diameter. Half-shells were fabricated by welding the side segments of the spiral elements to two of the stringers and then the top and bottom portions of the spiral were added to complete the shape. The fast and easy erection of the superstructure provided testimony to the outstanding tolerances achieved in the fabrication.

The project involved the community through interactive communication and participation as well as creating employment opportunities and skills development.

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Desmond and Leah Tutu Bridge

2004

Original article by Coral Fraser

The initial design concept aimed to create a lightweight structure that would hover in a state-of-tension forming an elegant bridge with a spine linking the two institutions. Various concepts were investigated and an asymmetric cable-stayed steel structure, consisting of one pylon and a tubular truss structure with a span of 42.5m was finally selected.

PROJECT TEAM

Client:
St Johns & Rodean Schools

Structural Engineer:
UWP Engineering

Main Contractor:
Cosira International (Pty) Ltd

Steelwork Contractor:
Cosira International (Pty) Ltd

The Desmond and Leah Tutu Bridge, spanning Houghton Drive, was built to link the campuses of St John's College and Roedean School. Houghton Drive is one of the main arterials in the area and carries heavy traffic volumes. The site is located within "The Wilds", a declared natural heritage site and physical site constraints and the aesthetics of the structure were seen as a major factor, and defined the design.

The initial design concept aimed to create a lightweight structure that would hover in a state-of-tension forming an elegant bridge with a spine linking the two institutions.

Various concepts were investigated and an asymmetric cable-stayed steel structure, consisting of one pylon and a tubular truss structure with a span of 42.5m was finally selected.

The use of the cable-stayed design facilitated the light construction of the bridge and minimised the depth of the girders.

The bridge comprises a triangular radiused girder with top booms and single bottom boom made up of circular hollow sections.

Cables were introduced as intermediate supports to increase the stiffness of the structure. While circular tubular sections increased its durability through reduced surface area and simple connections.

The pylon is located on the St John's (east side) side of the structure as this natural rock face was considered the most stable location for positioning the cable footings.

The pylon structure comprising two 22m high fabricated tapered box columns of a splayed construction is situated on the east side of the bridge and holds the four front suspension cables which are connected to the bridge itself. Not only is this splayed form aesthetically pleasing, but it facilitates pedestrian movement across the bridge walkway.

The balustrade support uprights are tapered box sections made from plate and these uprights taper from 2m to 3.54m high on the St John's College side.

The entire bridge structure was hoisted into position using a 275t mobile crane. Erection of the bridge was done over the Easter weekend as traffic had to be diverted to facilitate the erection programme.

Plettenberg Bay Pedestrian Bridge

Winner of the Steel Awards Bridge Category

2007

As you approach the site of the bridge from the west along the N2, the panoramic view of Plettenberg Bay and the Tsitikamma Mountains rises into sight. The intent was to retain this scenic backdrop by using a light transparent structure and an arch bridge was the answer.

The brief from the client, SANRAL, was to create a safe, functional structure with a location and geometry that follows the preferred routes of pedestrians crossing the N2. Plettenberg Bay is also a popular holiday destination so the client required a structure that added both aesthetic and functional value to the area.

As you approach the site of the bridge from the west along the N2, the panoramic view of Plettenberg Bay and the Tsitikamma Mountains rises into sight. The intent was to retain this scenic backdrop by using a light transparent structure and an arch bridge was the answer.

The design incorporated an inclined arch with a slender steel torsion box deck. The bridge spans from the high points on each embankment and is not square to the road. This alignment reduces the ramp lengths and encourages pedestrian to use the structure. A key component of the design was that pedestrians could access the structure without using the stairs.

The bridge is constructed from steel plate and tubes. Although not immediately apparent, the structural system is relatively simple and was a first in South Africa. The main structural elements are the arch, tension hangers and the torsion beam. The arch is set at an angle of 10 degrees to the vertical. The vertical load from the deck is transferred to the arch via the tension hangers. Although this load is out of plane, the arch is prevented from buckling by the tension hangers that are restrained by the horizontal stiffness of the deck. The deck is a trapezoidal box constructed from steel plate. Sizing of the box was done by reviewing the torsional rigidity required to ensure the serviceability conditions.

A key challenge was the structure's 'buildability'. Careful consideration of the fabrication process and erection sequence was taken during the design stage. The fabricator was provided with detailed dimensions of each steel plate. They then independently modelled the assembly of the plates in a three dimensional CAD package and the results were cross checked against the numerically calculated design values.

The bridge was fabricated and painted in Cape Town, split into four parts and then transported 550km to Plettenberg Bay. After being reconstructed in the central island of the N2 the full length of the bridge was lifted into place and welded onto the circular steel supports. Dimensional accuracy with this approach was absolutely essential.

The bridge was lifted into place in one day on Sunday, 10 December 2006.

The construction of the bridge has provided a safe crossing for the many pedestrians walking to and from Plettenberg Bay each morning and evening.

PROJECT TEAM

Developer/Owner:
SANRAL

Architect:
Ahmed Janahi

Structural Engineer and Project Managers:
Vela VKE (Part of the SMEC group)

Main Contractor:
Civils 2000

Steelwork Contractor:
D&D Fabrication

7th Avenue Bridge, Johannesburg

Winner of the Steel Awards Bridge Category

2010

The team created a bridge that SANRAL and Johannesburg are surely proud to be associated with not only from its great looks, but also as it is used by a great number of pedestrians, including scholars that cross the busy highway to meet their school busses on the other side.

PROJECT TEAM

Developer / Owner:
SANRAL

Architect:
SANRAL

Structural Engineer:
SANRAL

Project Manager:
Ian Weir

Main Contractor:
WBHO

Steelwork Contractor:
Omni Struct Nkosi (Pty) Ltd

In their brief to the professional team, the client, South African National Roads Authority Limited (SANRAL) clearly requested that the opportunity be used to create a special bridge that would be seen as a 'gateway' to Johannesburg. The response of the team certainly did justice to the request resulting in a bridge that SANRAL and Johannesburg are surely proud to be associated with not only from its great looks but also as it is used by a great number of pedestrians, including scholars that cross the busy highway to meet their school busses on the other side.

It is designed as a cable stayed bridge but breaks from tradition in that the bridge does not have a counterweight rear span. In the case of this bridge the traditional short concrete counterweight span is replaced with an outwards leaning concrete tower column which transfers the forces in the cable stays both axially and by bending moment into the footing.

The walkway and cable stay ends are tied to a toblerone circular hollow section truss creating a clear arched span over the freeway.

The absence of a counterweight span gave the team an opportunity to do something very elegant. But you still have to create a load path for all those forces at the top ends of the cable. The concrete tower leans back from the road, creating an axial path down the concrete that redirects all those sloping cable forces through the concrete structure down to the ground.

Dealing with the ends of the cables is one of the intricate issues in designing, detailing and building such a bridge. Each slope is different and each angle of intersection between the cable and the concrete tower is different. As in all structures immaculate attention to detail is the name of the game!

The use of a concrete walkway surface (composite deck) makes sure that concrete loads are all compressive in their nature to suit the strengths of the concrete. The steel carries the tensile forces where it is strong as well as some of the compressive forces.

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- Nelson Mandela Square refurbishment - Liberty Properties
- Warehouse extension (250t) - ABI Devland
- Frankenwald Warehouse Extension (200t) - Capital Property Fund
- Mall of Africa Central Skylight, Bifurcated Columns (215t) - Novum Holdings
- Modderfontein Private Hospital (120t) - Group Five
- South African Breweries, Conveyors, Buildings, Stairs (120t) - SAB Alrode
- Stryker and Hilti Warehouses (120t) - Stryker and Hilti
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Buitengragt Bridge, Cape Town

Winner of the Steel Awards Bridge Category

2011

Building a bridge next to the city's two busiest hotels also meant that all construction activities had to be continually monitored to reduce dust and noise pollution. The use of a prefabricated structural steel structure greatly assisted in minimising the construction impact.

PROJECT TEAM

Developer/Owner:
City of Cape Town

Architect:
GAPP Architects and Urban designers

Structural Engineer and Project Manager:
Vela VKE (Part of the SMEC group)

Main Contractor:
Vusela Construction (Pty) Ltd

Steelwork Contractor:
ADM Engineering (Pty) Ltd

Welding Sub-contractor:
SA Five Engineering

The Buitengragt Bridge was one of the many projects that were brought about by the World Cup 2010. Historically pedestrians had to cross the five-lane road through an almost continuous flow of traffic. To accommodate the increase in pedestrians during the World Cup, a bridge was required. Today the bridge is a positive legacy that has greatly improved the pedestrian linkages in the city.

The structure's position presented a number of challenges to the design team. Partly founded on top of a buried parking garage and partly on land reclaimed from the sea, the foundation design required some innovative ideas. Integrating the bridge into a narrow corridor between two of the city's main hotels also influenced the design outcome. In particular the need to limit the noise impact became an unavoidable constraint.

A structural steel asymmetric box girder was not an obvious choice of structural form. It did, however, offer a number of specific benefits. The use of structural steel significantly reduced the dead weight of the bridge, which had to be 4 metres wide. This was important considering the founding conditions. Because it was necessary for pedestrians to access the structure along its length, a closed box section with an up-stand beam on one side was developed. The lift shafts (provided for disabled access) and additional access staircases were then able to connect directly onto the open side of the bridge deck.

The main challenge in fabricating a closed torsion box is the assembly and welding sequence and ensuring that all the required welds can be accessed. The presence of internal longitudinal webs introduced the need for access windows at the diaphragms.

The completed steel box sections were fabricated in 6 metre long sections then painted and transported to site. The on-site welding was a technical challenge as it included overhead welding. Specialist welding sub-contractors were employed to provide the necessary expertise. The commitment and skill of the on-site team was the critical factor that made the project a success.

Building a bridge next to the city's two busiest hotels also meant that all construction activities had to be continually monitored to reduce dust and noise pollution.The use of a prefabricated structural steel structure greatly assisted in minimising the construction impact.

The bridge was constructed on budget and completed in time before the start of the World Cup 2010.

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Hangar Street Bridge, Bloemfontein

Winner of the Steel Awards Bridge Category

2012

The bridge provides a safe passage for pedestrians trying to cross the busy (and dangerous) Hanger Street. But apart from that it provides aesthetic upliftment to the downtown area and forms part of the rejuvenation of the Bloemfontein inner city area.

PROJECT TEAM

Developer/Owner:
Mangaung Metro Municipality – Bloemfontein

Architect:
Incline Architects

Structural Engineer:
Vela VKE (Part of the SMEC group)

Quantity Surveyor:
Rubiquant cc;
Limco QS Arbitration & Project Management cc

Project Manager:
Incline/Vela VKE (Part of the SMEC group) Joint Venture

Main Contractor:
RSI Intermodal Construction (Pty) Ltd

Steelwork Contractor/s:
Omni Struct Nkosi (Pty) Ltd

Detailers/Detailing Company:
Draftline

This tapering-steel-box–girder-spine bridge, situated in the Bloemfontein CBD, is an important link for the pedestrians between the Central Park Bus station and the newly constructed Mangaung Intermodal Public Transport Facility, which accommodates all of the city's taxis. It also provides a safe passage for pedestrians trying to cross the busy (and dangerous) Hanger Street which serves as one of the arterial roads into Bloemfontein from the south. But apart from that it provides aesthetic upliftment to the downtown area and forms part of the rejuvenation of the Bloemfontein inner city area.

The bridge links up with the first floor level of the existing bus station from where the deck slopes upwards and turns approximately 33° towards the new taxi rank facility. This complex geometry in the deck had to be designed to accommodate the significant level difference between the adjacent buildings' first floor levels. The main span of the bridge is 20m and is one of three spans supported by a 650 x 700mm (to 800mm) tapering steel box girder with a 2.9m wide composite concrete deck slab.

Pedestrian bridges are often open, slender structures but the prerequisite for this bridge was to provide cover to pedestrians commuting between the transport facilities while still ensuring a transparent and safe enclosure. Custom-made 450 x 150mm rectangular hollow ribs were designed for aesthetic purposes as well as to provide the framework for the roof and glazing panels.

The 150mm concrete deck is supported by the steel box girder, via shear studs, as well as permanent shuttering. The concrete deck insures a more solid walking surface thereby adding to pedestrian comfort.

The 450 x 150 x 6mm rectangular frames are not standard sections and had to be custom made. This entailed that the section had to be welded up from two rolled halves. The 6mm wall thickness had to be carefully assessed to ensure that the flat plates of the two halves could be rolled to form the 90° corners in accordance with minimum radius specifications. The 450mm depth of the frames were a geometric requirement to accommodate the roofing and flashing between the frames where the bridge slopes.

The bridge's steel box girder spine, with its steel fins and the bottom part of the frames, was welded together in the steelwork contractor's workshop in Johannesburg and the three major spans were delivered to site individually with the rest of the sections. These main components were then lifted into position and the remainder of the structure welded on site.

Isando Pedestrian Bridge

Commendation in the Bridge Category of Steel Awards

2014

The new Isando Pedestrian Bridge is still fresh in our minds, but it definitely deserves a mention in Steel Construction's pedestrian bridge feature.

PROJECT TEAM

Developer/Owner:
SANRAL

Architect:
GAPP Architects and Urban Designers

Structural Engineer:
SMEC South Africa

Project Manager:
SMEC South Africa

Main Contractor:
Raubex

Steelwork Contractor/s:
Vital Steel

Cable Stressing:
Amsteele Systems

With a total length of 446 metres, the bridge and its approaches connect the Isando Rail Station with the OR Tambo International Airport (Johannesburg). The structure is well used by some 9 000 commuters crossing each day.

The central 126.4m long section of the bridge has a four-span configuration with spans of 25.4, 14.8, 22.2 and 64 metres. The superstructure consists of a continuous composite steel box girder with a 5.4m wide concrete deck slab. The main span is supported by two vertical planes of fanned cables that are anchored into the back spans. A main feature of the bridge is its two un-braced cigar shaped steel pylons - one leans forwards at 11 degrees and the other backwards.

The versatility of structural steel made the final form of the structure possible. For the inclined pylons, the use of steel enabled off-site fabrication and the relatively simple erection of sections. It also allowed the creation of a sculpted tapering section with internal cable anchorages that retained the sleek look of the pylons. The use of a torsionally stiff structural steel box girder proved an economical way of supporting the walkway. It also allowed for the asymmetrical cable arrangement on either side of the deck.

The shaping of the towers was carefully considered as they are a visually dominant feature of the footbridge. The most satisfying aspect of the project is to witness the daily use of the bridge by thousands of people and the improved space that commuters now have.

Bridges for rural communities

Apart from the landmark pedestrian bridges across national and main city roads, there are bridges that are mostly only visible to the rural communities that live near them. But these bridges often change the quality of their lives.

KZN Department of Transport Pedestrian Bridge Project

Commendation in the Bridge Category of Steel Awards

2010

The client was so impressed with this structure that they made the recommendation that this design be adopted as a standard in future years.

Children in rural environments often need to cross rivers to go to school and if there isn't a bridge that would carry them safely to the other side, they often face the possibility of drowning or not being able to go to school when the river is in flood.

For this reason the KZN Department of Transport launched a project to build suspension bridges across these rivers – with steel of course.

PROJECT TEAM

Developer/ Owner:
KZN Department of Transport

Structural Engineer:
GDB Engineers cc

Project Manager:
Lead Consultants VNA Consulting / Nathoo Mbenyane Engineers

Main Contractor:
Erbacon (Pty)/JV Partner Mahambayedwa

Steelwork Contractor:
Steelcon (Pty) Ltd

District consultants were given a brief to provide 1.2m wide pedestrian bridges at a height of 1m above the 50 year flood level. Various designs were proposed and this modular suspension design was built over the following rivers in areas that were remote and difficult to access: The Bisi, Hlembitwe Mtwalume, Nondweni, Umzimkhulu (Qulashe) and Umzimkhulu rivers.

The structure is a hybrid suspension bridge of 90m span ideal for use on the majority of sites which cross inaccessible valleys with difficult founding conditions and limited access for transport vehicles.The client was so impressed with this structure that they made the recommendation that this design be adopted as a standard in future years.

The design uses suspension cables sized to carry all dead and imposed loads. In addition a light steel bracing truss, capable of carrying a portion of the imposed and dynamic loading back to the supports, was introduced. The suspension cable doubled as a compression member of the bracing truss when carrying imposed loading.

This approach to the design was used to create a very stable structure with very little perceptible movement even under unfavourable loading conditions.

Components were designed for modular off-site fabrication. Hot dip galvanizing was specified for all structures to improve long term life of the bridges.

Tugela River Pedestrian Bridge (KwaJolwayo)

Winner of the Steel Awards Bridge Category

2014

Every effort was made to keep the material content as low as possible whilst providing sufficient strength and stability to meet the client requirements for a safe pedestrian river crossing.

This is a 134 metre, structural steel suspension bridge over the 8 metre deep Tugela River at KwaJolwayo, upstream of Tugela Ferry in the Msinga area of rural, rural KwaZulu-Natal.

The bridge was built to provide safe passage over the river for people residing in tribal areas on the north and south bank to enable them to access employment opportunities and schools on the opposite side of the river.

The design requirement focused on the fact that the higher the mass of a structure the more materials are required to build it with a correspondingly higher cost to the environment, in material quantities and ultimately in rands and cents.

Every effort was made to keep the material content as low as possible whilst providing sufficient strength and stability

to meet the client requirements for a safe pedestrian river crossing.

Structural steel was chosen as the best material to meet the above requirements and the inaccessible deep gorge provided the ideal situation for the engineer to test his mettle.

The final design came to four cables supporting steel Y frames which in turn support a 1.2 metre-wide steel deck.

PROJECT TEAM

Developer/Owner:
KZN Department of Transport

Structural Engineer:
GDB Engineers cc

Project Manager:
Nankhoo Engineers

Main Contractor:
TBA Construction cc

Steelwork Contractor/s:
Steelcon

Rigging:
Fergus Upfold

The suspension portion of the bridge structure consists of two equal spans of 60 metres.The 14 metre approach span on the north bank consists of steel beams.

A scale timber and wireframe model was constructed during the design process to prove the design concept and determine construction methodology.

An exposed rock shelf in the river channel allowed construction (above water level) of a central pier on a base dowelled to bed rock. Grouted rock anchors was constructed at each end of the structure while the steep ground on each bank required blasting to construct building platforms and landing points for the walkway and approach pathways.The reinforced concrete piers, rock anchors and abutments were constructed first.

All other components were designed for modular off-site fabrication and were sufficiently lightweight to be erected by hand or hand operated equipment without the need for heavy lifting equipment at this remote site. All steel

components were hot dip galvanized prior to delivery.

The presence of the structure has resulted in a life changing, safe crossing option for communities on both sides of the river enabling them to access commercial and educational opportunities that were previously inaccessible particularly during the summer months.

Lessons from Spencer's Voortman visit – Part II

ENTRY LEVEL into CNC CONTROLLED MACHINES

It's not so *expensive*

By Spencer Erling, Education Director, SAISC

Voortman recently invited and paid for Spencer's travel costs to visit their factory in Holland as well as a Dutch fabricator and a German fabricator. This is the second of a series of three articles to share my findings with our members. The SAISC's grateful thanks go out to the Voortman team and their SA representative First Cut for making this eye opening trip possible. In this article we look at entry level equipment on offer from Voortman. Look out for our next article in Steel Construction No. 3 for 2015 where we will be writing up about the more sophisticated equipment from the Voortman range.

It does sound a bit crazy to say and think that I was going to Holland to find out about the Voortman range of equipment and this would happen in only about one and a half days on site for the whole range. Just how could it be possible?

Even more so when I think back to 1979 when I first went to Germany to purchase Peddinghaus equipment. We planned on a four-day visit to see just their two models of drill line NC machines but this required visits to factories all around the western side of West Germany even venturing into Holland to Ulft and in passing see some of the punching equipment that Peddinghaus was synonymous with in those days.

So how could it be possible to see Voortmans' vast range of equipment in such a short time? The answer is actually quite simple. Voortman has a strong marketing set-up geared to doing just this. At the heart of the programme is their Experience Centre in which all of their equipment is set up to show and explain their capabilities under one roof. One of the treats for me at their centre is this delightful staircase *(see opposite page)*.

Add to this, they have their own structural steel fabrication shop on site which is a great proving ground for their equipment as well as their production and assembly lines for machines on order. This department is the epitome of European discipline and organisation. Their parts stock control is very sophisticated, computer controlled and items are all automatically withdrawn from their bins and placed into holding bins by order number.

And then finally within an hour and a bit from the centre, there are two very competent fabricators, one sporting a brand new works with an extensive range of Voortman equipment the other having equipment that has been in use for some time now.

ABOVE LEFT: This amazing staircase is in the Voortman Experience Centre.

ABOVE RIGHT: Image of saw short piece clamps (without a piece of steel).

OPPOSITE PAGE: V600 – having only one horizontal drill head it is necessary to turn the beam to enable drilling, slotting and marking to the flanges and the web.

What more could one ask for to get to know their range of equipment quickly, efficiently and without fuss? Well done on that score to the Voortman team. It is a few years since I visited the Kaltenbach bi-annual factory based exhibition or the North American Steel Constructtion Conference where many manufacturers show off their equipment, the modern facilities and whole Voortman approach is startlingly refreshing and clearly a winner.

Entry level equipment

Voortman's approach to software

It is interesting to note that Voortman has developed a software system under the name of VACAM which is used to control the whole range of their machines and handling systems. Apart from the basic common sense that this approach makes, adding new machines or handling equipment to existing facilities becomes, relatively speaking, an easy exercise. Voortman has a team of 15 programmers who are experts at doing just that.

I guess for the small to small-medium fabricator the thought of increasing productivity by purchasing CNC equipment is a daunting concept (especially for those of you who have not done any 'what if' assessments of the equipment).

In the article published in Steel Construction No. 6 2014, *Chasing profitability for the small to medium steel fabricator*, Danny Steyn writes about just how important it is if you want to survive in these tight financial times (and even better – prosper), you must take the plunge and get on the ladder to the future by starting with some CNC equipment. And before going much further let's throw some numbers at you. Consider the following proposal:

Consider a fabricating company is doing say 100 tons per month for 11 months a year. Sadly, due to competition laws, I really do not know what an hour costs in a workshop these days but I am sure that very few of you get away with less than R450.00 per hour.

If you were to save just five hours per ton this works out at a pot of money close to R2.5 million. So in two or three years there is a good chance you will be able to pay off between one and two entry level models. If you do everything manually i.e. sawing, cutting, marking, drilling and the like, saving five hours per ton with a couple of machines is very realistic and probably quite conservative. Just consider how much overheads you can save by your 3D TEKLA package speaking directly to your NC machines.

Can you afford not to be going the route?

Of course the definition of an hour is important here. In my estimating course I teach that the hour that you should be working on is the hours actually recorded to a job, so excluding labourers, grinders, despatch and the like whose costs would be added to the recorded hours. In addition each hour attracts a portion of the company overheads.

If you do not know about these things maybe you should consider doing the SAISC estimating course.

Which machines are available at entry level from Voortman?

You will be pleasantly surprised just what can be found for realistic prices. Somehow everyone automatically seems to start by thinking about a beam drill line. Even before looking at the models available, learn from the experience of those who have already gone the route. On more than one occasion I have been told "had I known what I know now, I would have started with a plate processing machine before a beam drilling machine - of all my NC machines it is the plate processing that works two shifts to keep up with the demand". Think about it!

Beam drilling

Right at the bottom in its simplest form is the **V600**. Having only one horizontal drill head it is necessary to turn the beam to enable drilling, slotting and marking to the flanges and the web. To ensure accuracy of holing on each of the three faces, each

time the beam is turned by the machine zero is identified for the new face of the steel to be drilled using laser. The drill head moves along the length of the steel.

As with all their drilling equipment, high speed carbide drilling is available (which is dramatically faster than high speed drill bits), as well as the automatic tool changer with five stations (including tapping up to 30mm diameter, centre point marking and counter sinking) capable of up to 40mm diameter holes.

Next step up is the **V613/1000** (the 1000 indicating nominal maximum width of beam.The actual width maximum is 1050).

Here the big difference when compared with the V600 is that the single drilling head rotates to suit the flanges and the web i.e. two horizontal and one vertical position and the steel passes through the machine compared with the V600 where the machine travels along the length of steel.

In addition to the drilling capabilities mentioned for the V600 it has 2 x 5 station tool changers. Optional extras include layout marking (i.e. where attachments need to be assembled) and numbering marking for part identification, feeder truck or roller feed measuring systems.

We will look at the full beam drilling capability of the V630 machines in the next article.

Beam sawing machines

Unless your business is based on cut-to-size ordering from service centres, one should not think in terms of standalone drilling machines but rather linking them into a sawing machine station.

Thinking along the lines as above, if buying cut-to-size is costing you between 5 and 10% of the basic steel price it does not take rocket science to calculate that to pay off a saw does not need too many tons per month, but do not forget to ask about the cost of replacing the band saw blades which can be quite often for heavily working saws.

The Voortman range of band saws all have the **VB** description followed by the nominal maximum width capability (VB750, 1050, 1250)

All are mounted on rotating turn tables for any angle of cut, have hydraulic blade tensioners and guides either side of the beam to be cut by width; to keep the cut square and have the options of length stop, roller feed or truck length measuring systems.

One of the items that was a first for me was their "short piece removal" clamping system (useful for short beams or scrap removal). It is also possible to program the machine to return longer length off-cuts back to the stock yard. This works very well for lightly loaded saws as it is quite time consuming.

The great thing is that when you buy from Voortman they will work through your planning requirements and in the case of a saw/ beam drill combo it is possible to have just one operator for the two machines. Layout and movement are designed to minimise handling.

ABOVE: V320 – Length of plate options come in 6.100, 9.100 and 12.100 and width options in 2000 and 3000 (nominal widths).

BELOW LEFT: The simplest of concepts in how to catch the punching slugs.

BELOW CENTRE AND RIGHT: Image of a typical hydraulic cropping head part of punch and shearing equipment and typical hydraulic numbering system on punch and shearing machines.

Plate processing machines

Voortman offers cutting alone, drilling alone, drilling and cutting combined machines in their range.

The machine that caught my eye for entry level is the **V320**. Length of plate options come in 6.100, 9.100 and 12.100 and width options in 2000 and 3000 (nominal widths).

The beam has one cutting and drilling support gantry with cutting being on the front face and drilling being on the back face of the gantry.

Cutting options include plasma and oxy fuel. High speed carbide drilling and other drilling capabilities, tool changing etc. are as for their beam drilling. Marking both for assembly and identification purposes can be done either using plasma (a different gas permits the melting of the surface for marking when compared to cutting with plasma) or milling.

The simplicity of the design of their automatic discharge table and conveyor as well as their scrap slugs clearly shows one of the reasons why Voortman equipment is so successful. KISS Keep It Simple Stupid.

Quite often plate processing machines can be kept busy on one large plate for quite some time, allowing the operator to attend to other equipment. The screen will show how long the machine will be busy with this particular plate and it is also possible to build in an electronic communication warning system sending messages to the operator if something has or is going wrong whilst he is not at the screen. The wonders of modern wireless communication!

Voortman does offer standalone plate cutting machines and plate drilling machines depending on your production and through-put requirements.

Angle and flat bar punching and cutting machines

For the smaller steelwork fabricators who specialise in typical relatively light angle iron roof truss construction, they should be considering the basic model **V505M** which is a punching and shearing machine with a hydraulic numbering unit. The machine has 2 x 2 unit punching heads, one for each of the legs of the angles. The units come with automatic in-feed systems and roller feed measuring systems.

You have surely noticed that when you look at the details of the various models described above there does not seem to be a one off machine 'does it all' solution available from Voortman.

That is not true with the advent of combining plasma and robotics. Watch out for next article in this series which not only explores the possibilities that robotics, when combined with plasma, open up to the industry but also looks at the more sophisticated models in the Voortman range. It is guaranteed to make for exciting reading.

For more details of the Voortman range visit their website www.voortman.net or contact Steve Van Wyk at First Cut at +27 11 614 1112.

CALENDAR OF *Events*

MAY	
14 - 15 May	Basic Moment Connection Design
14 - 15 May	Steel Fest
21 - 22 May	Steel Fest
13 May	Detailers Association Launch
14 May	SASFA Industry Meeting
21 - 22 May	Typical Portal Frame Design to SANS 10162
JUNE	
11 June	Exhibition and Breakfast Talk
JULY	
6 - 11 July	SASFA Builders Course
15 July	SAISC Council Meeting
AUGUST	
27 August	Sophia Gray Congress
SEPTEMBER	
3 September	Steel Awards
7 - 11 September	Post-graduate Steel Course
14 - 19 September	SASFA Builders Course
OCTOBER	
15 October	Breakfast Talk and Steel Day
22 - 23 October	SASFA Code & Engr Course, Johannesburg
26 - 27 October	SASFA Code & Engr Course, Durban
29 - 30 October	SASFA Code & Engr Course, Cape Town
NOVEMBER	
9 November	POLASA AGM and Industry Meeting
12 November	SAISC AGM
DECEMBER	
3 December	SASFA Committees Luncheon

We would like to highlight the following important event – diarise it now before you miss out on booking in time.

STEEL AWARDS 2015

• Awards dinner in Johannesburg / Durban / Cape Town: 3 September

For information contact: marle@saisc.co.za

ENQUIRIES:

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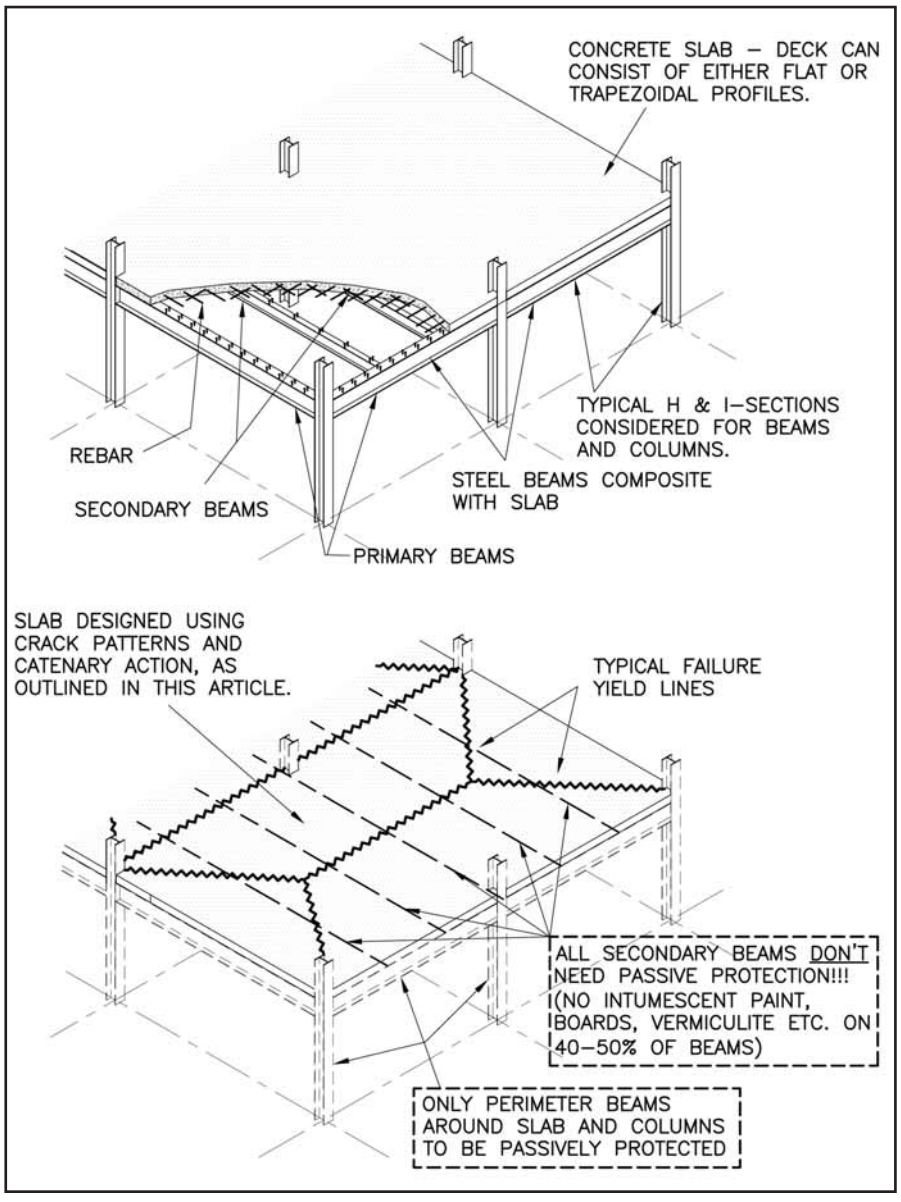
SASFA: john.barnard@saol.com POLASA: kobus@saisc.co.za
SAMCRA: dennis@saisc.co.za

SAVING MONEY ON PASSIVE FIRE PROTECTION -

DESIGNING COMPOSITE FLOORS IN FIRE: THE SLAB PANEL METHOD

By Caroli Geldenhuys & *Richard Walls (Pr. Eng.), Stellenbosch University, Dept. of Civil Engingineering, Fire Engineering Research Group.

Passive protection such as intumescent paints, vermiculite boards and spray-on products can be very expensive. Thus, rational structural fire design methods, as presented here, can lead to significant savings. This article presents a brief introduction to a design method, the Slab Panel Method (SPM), which allows engineers to design composite floors for fire.



Believe it or not, when you set fire to a composite steel and concrete floor it just doesn't want to fall over. It heats up to hundreds of degrees Celsius, beams buckle, floors sag, concrete can crack – but floors don't collapse because they become giant hanging catenaries. Using results from full-scale tests this behaviour can now be modelled and designed for, potentially leading to significant savings in the cost of passive fire protection on steelwork – with as much as 40-50% of floor beams not needing protection *(see Figure 1)*. Passive protection such as intumescent paints, vermiculite boards and spray-on products can be very expensive. Thus, rational structural fire design methods, as presented here, can lead to significant savings. This article presents a brief introduction to a design method, the Slab Panel Method (SPM), which allows engineers to design composite floors for fire.

Overview of the Method

The Slab Panel Method is a structural fire design method used for composite steel and concrete floors in severe fires. Certain steelwork can reach above 850°C in the design, but the system still remains structurally sound. The method was developed by Prof Charles Clifton in New Zealand.

See the report R4-131:2006 for complete details regarding calculations. His work was originally based on the results of the famous full-scale fire tests done at Cardington by the BRE (Building Research Establishment), and the tensile membrane work by Prof Colin Bailey. Since then the SPM has been developed based on numerous other research projects as well. *Figure 2* shows the eight storey composite steel and lightweight concrete building used at Cardington, where various parts of the building were progressively exposed to severe fires and the overall structural behaviour studied.

The SPM procedure incorporates the reserve strength from a floor system under deformation in a fully developed fire. It is an ultimate limit state design procedure in some ways similar to building design for response to earthquakes, in that certain degrees of structural damage are permitted provided that collapse is prevented, but damage may occur in very severe fires.

How the SPM Works

The SPM design model is based on using yielding-moment action and tensile membrane enhancement. The procedure is applied to large regions of a floor, known as slab panels, and incorporates the inelastic response of slabs (i.e. floors bend and sag permanently). At ambient temperatures the way loads are transmitted through a composite steel building involves:

The slab -> secondary beams -> primary beams -> columns.

When severe fire conditions occur and the interior secondary beams are unprotected, they lose most of their strength and the load path above cannot be maintained. The beams form plastic hinges and the load-carrying mechanism changes to a two-way spanning system, as illustrated by *Figure 3*. Here the load carrying path becomes:

The slab panel -> primary supporting beams - > columns.

From this it can be seen that the secondary beams no longer play a major role, and simply form part of the sagging slab panel system. Hence, they do not need to be passively protected. However, it is essential that primary beams are protected as these carry the sagging slab panels.

The SPM theory is based on membrane action which is caused by in-plane forces within the slab. This allows the composite floor slab to bridge over the unprotected beams. This basically means that the rebar in the concrete slab, and the remaining secondary beams' capacity, allow floors to hang from where support can be found, even when steelwork has failed. *Figure 4* shows displacements of the beams that occurred during the fire tests at Cardington. It can be seen that no structural collapse occurred, even though significant deformation has occurred. It is interesting to note that the structure shown in *Figure 4* had no passive protection whatsoever, experienced temperatures of over 1000°C, should have failed according to any standard design codes and yet did not collapse.

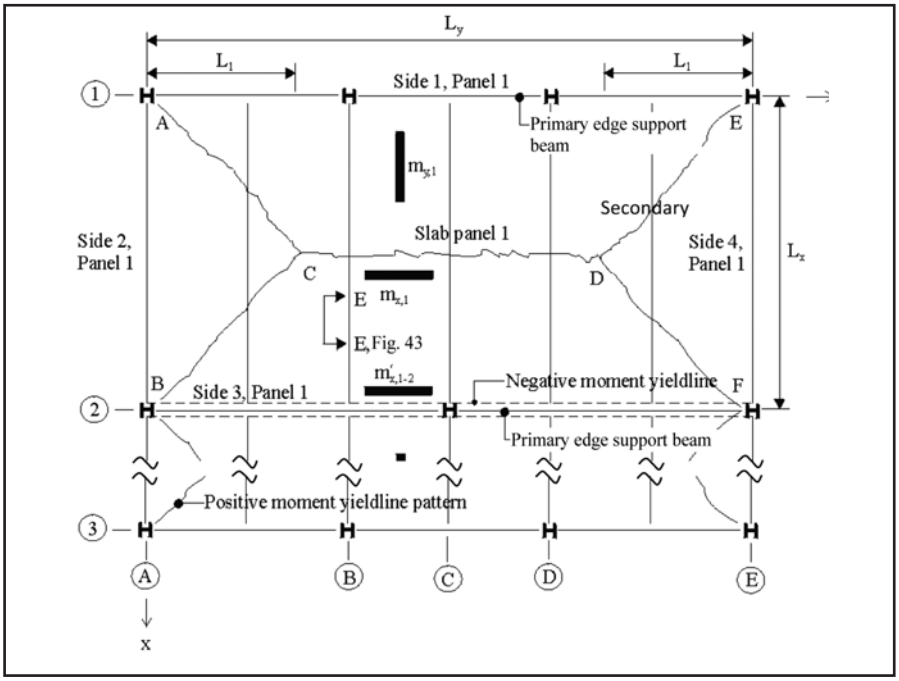
Under ultimate load conditions at ambient temperature, yield-line behaviour develops first and then tensile membrane enhancement, which occurs as the plastic hinges form. But under severe fire

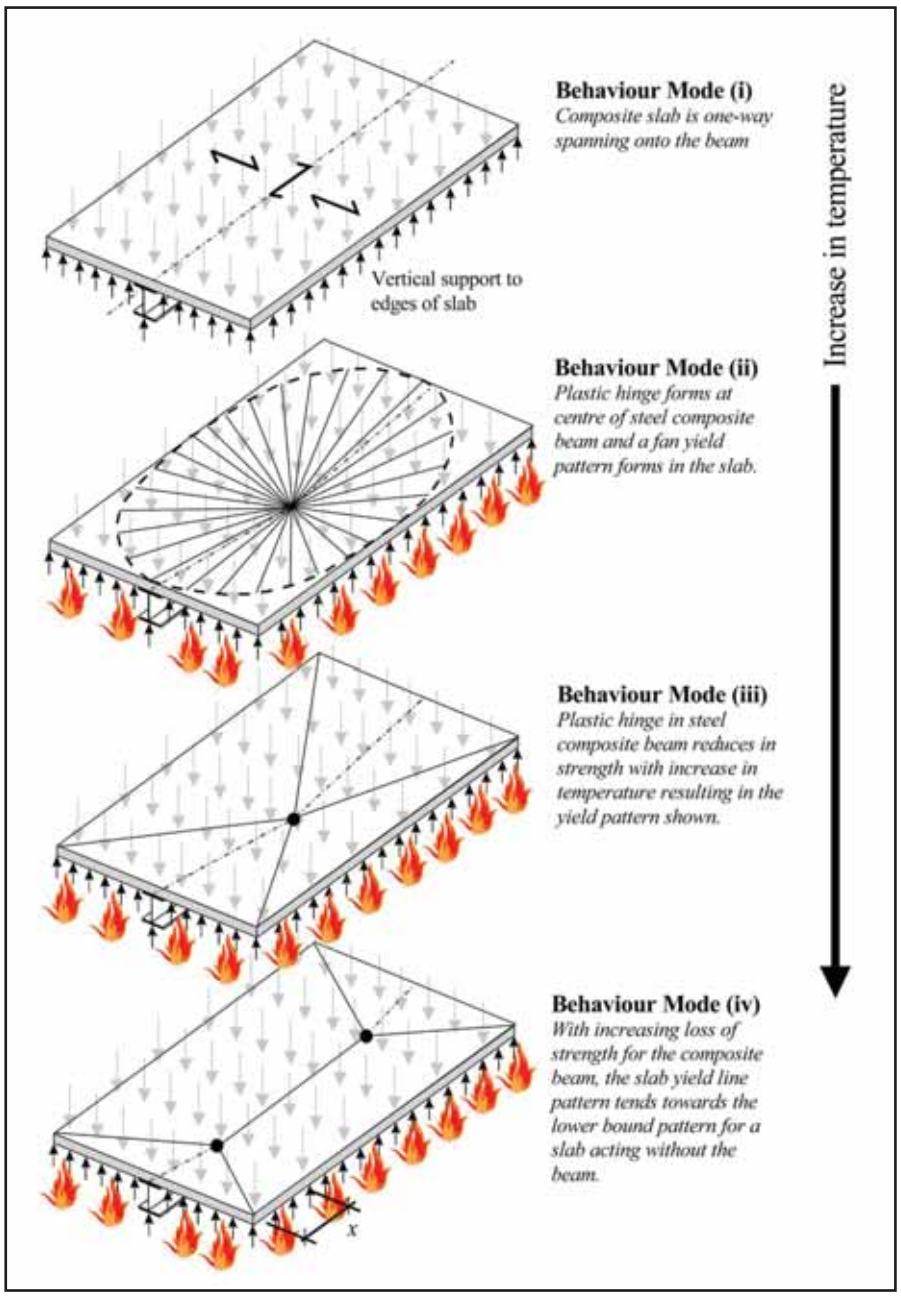
OPPOSITE PAGE LEFT: Figure 1 – Using methods such as the SPM only primary beams and columns need passive protection.

OPPOSITE PAGE RIGHT: Figure 2 – The 8-storey composite steel and lightweight concrete building at Cardington. Various sections of the building were progressively exposed to severe fires to study building behaviour (www.hera.org.nz).

BELOW TOP: Figure 3 – Deflected and cracked floor plan for application of the slab panel fire engineering design procedure to a concrete slab on profiled steel deck supported on primary and secondary beams (Clifton & Abu, 2014).

BELOW BOTTOM: Figure 4 – Deformed composite slabs after severe fires at the Cardington tests. The floors show catenary-type behaviour, hanging from the supports around them (Clifton & Abu, 2014).





ABOVE: Figure 5 – Development of catenary action and plastic hinges in a composite slab (Bailey, 2004).

conditions, tensile membrane enhancement occurs first – i.e. the floor capacity increases as it becomes a hanging catenary. In the event of a fully developed fire, the SPM performs as follows:

1. The slab and the unprotected secondary beams may undergo considerable permanent deformation.
2. The primary support beams and columns undergo much less permanent deformation compared to that within the panel.
3. The load-carrying capacity and the integrity of the floor system are preserved.
4. Both local and global collapse are prevented.
5. The development of the failure patterns in a slab panel is shown in *Figure 5*. The design equations are based on the final lay-out shown in Behaviour Mode (iv), as also seen in *Figure 3*.

After a severe fire secondary beams may potentially need to be repaired or replaced. However, very severe fires cause such significant damage, that everything in the building would probably have been destroyed. Recently a structure designed according to the SPM experienced a fire, and the structure survived with almost negligible damage. It is understood that the cost of the damage to the contents far exceeded the cost of the damage to the structure.

Software for the SPM

The Heavy Engineering Research Association of New Zealand has developed software to do the numerous calculations required to carry out SPM designs. This can now be purchased from Steel Construction NZ. Alternatively, similar free software that could also be used for this purpose is MACS+ from ArcelorMittal, or TSLAB from the SCI in the UK. Stellenbosch University is currently using the SPM software for research purposes.

Note: before using any of the above software make sure that you read and understand the design theory and methodologies. Rebar and certain detailing requirements are essential for the use of these methods, and the SPM guidelines provide good information regarding this.

The SPM and fire design in South Africa

SANS 10400 – Part T states that rational fire design in South Africa may be used provided that it achieves the same level of safety as implied by the document. These rational designs must be in accordance with BS 7974, which further states that competent persons must demonstrate that due diligence has been applied during the design process and the approving authorities can assess that due diligence has been applied. This basically means that under the auspices of rational design methods such as the SPM could be applied safely and according to SA code requirements (but it is important to discuss this with your local fire chief and fire engineers).

A recent project at Stellenbosch University (Geldenhuys, 2014) sought to calibrate the SPM to suit local South African conditions. It was shown that the SPM can be used as is, with only minor adjustments where New Zealand's fire loading code is included. For more information on structural fire engineering principles and design you can contact the *corresponding author at Stellenbosch University's fire engineering research group.

South Africa will soon have additional fire design principles and methods available in the updated SANS 10162-1 structural steel code. The recommendations presented in the Canadian CSA S16 code will be adopted, making fire design available to local engineers in the near future. More details to follow soon...

Corresponding author: rwalls@sun.ac.za, 021-808-9584

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Steel-frame house turns heads above Hout Bay harbour

Nestled between indigenous vegetation, with a spectacular view of Chapman's Peak and Hout Bay harbour, a new development, constructed by Silverline Group, altered the Houtbay skyline forever.

This 340m² triple-storey house took only four months to complete and has drawn attention from tourists and locals alike.

The owner has substituted conventional brick and mortar for his eco-friendly light steel frame (LSF) house – a growing trend in South Africa. Construction of the house produced very little waste and has an 80 percent smaller carbon footprint than conventional building practice. This project started at the end of February and was completed by the end of June 2014.

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The low mass of the structure and walling allowed the engineers to design a shallow concrete raft foundation with outer beams 450mm deep and 250mm wide and a 70mm thick slab cast in recycled PVC Modulo Blocks. Compared to the heavy reinforcing and thick concrete for conventional building techniques this LSF house saved costs on materials and labour associated with the foundation and floor slab construction.

Once the foundations were completed, the ground floor walls were erected using LSF panels, fabricated from high strength galvanized steel sheet. The engineer specified the use of chemical anchors to bolt the structure to the concrete foundation. A LSF joist floor was erected on top of the walls and covered with fibre cement boards as the new floor.

The remainder of the walls were constructed with light steel frame wall panels fixed together with corrosion protected screws, ensuring a rust-free building in spite of its close proximity to the harbour. 9mm fibre cement board external cladding gave an overall external wall thickness of 133mm, with an R-value of 2.8 and a 1 hour fire rating. The R-value is a measure of the thermal insulation of the wall panels – the higher the R-value the more effective the insulation of the building.

Comparing the R-value of the light steel frame structure to a standard un-insulated double brick wall with R-value of 0.26, shows the superiority of the composite wall system that LSF offers. The LSF structure's external walls consist of 9mm fibre cement board, fixed to the light steel frame through a thermal break layer and a Tyvek vapour permeable membrane, glasswool cavity batt insulation installed in the wall cavities followed by a 15mm fire resistant high impact gypsum board on the inside.

Internal walls consist of light steel frame panels clad with high impact 15mm fire stop gypsum boards (with a more than 30 minutes fire rating), and glasswool cavity batt insulation in the cavities, to enhance acoustic insulation.

The insulating layers reduce the building's energy requirements for heating and cooling, with tests on the building's total energy demands indicating that it has

As a regular brick-and-mortar kind of guy, I was initially quite reluctant to build with anything else. But five months into the construction of my newest project and busy with the final finishing, Bay Harbour House, Hout Bay, I am a convert. Light steel frame houses are the future – especially in this country.

achieved a 17% to 20% improvement in energy efficiency, compared with those of conventional designs and due to the energy efficient design the buildings heat up faster in winter and cool down faster in summer.

With the light frame steel panels protruding from the roof, the house creates the feel of a warehouse inside – which was precisely the owner's aim. The house is situated below the road and the architect designed a LSF access bridge connecting the house with the street above.

The house is complete with a four-car garage and two balconies overlooking the bay. All internal doors were cladded with metal plating in keeping with the industrial theme. Double LSF wall structures were used for load bearing walls which made it possible to eliminate heavy steel or concrete columns, resulting in a huge cost saving for the owner.

The net effect is a high end product that will last a lifetime.

Excerpt from Feel the Steel

By the owner, Dieter Losskarn, freelance journalist

As a regular brick-and-mortar kind of guy, I was initially quite reluctant to build with anything else. But five months into the construction of my newest project and busy with the final finishing, Bay Harbour House in Harbour Heights, Hout Bay, I am a convert. Light steel frame houses are the future – especially in this country. Everybody talks about green and saving energy and this house does it so well. Even on really cold days, when a brick structure would be chilly as a morgue, the LSF house retains the daylight sun and is – even without any additional heat source – surprisingly warm inside. With a fire place burning, even my double-story, open-plan house will be pleasant and cosy inside.

It was also built in less than half the time of a normal brick structure. I loved the fact that the electrician and the plumber followed with their services through the wall cavities, instead of messily breaking and chasing through brick walls afterwards.

And you can bring all your own ideas into the project. The entire light steel frame for the construction is custom-made locally, according to your individual design and plan. Look at my new place. I wanted to create a warehouse-style residential home with lots of open spaces and a long industrial looking bridge into the first floor entrance. I could not have achieved this design with brick and mortar.

And even, if I sell this house in the future and the new owners would want to change things, it is easy to add an additional floor to a LSF house. Once you feel the steel, you never go back.

ABOVE: The house is situated below the road and the architect designed a LSF access bridge connecting the house with the street above.

BELOW: With the light frame steel panels protruding from the roof, the house creates the feel of a warehouse inside – which was precisely the owner's aim.

CLADDING VS. THE WEATHER

By Dennis White, Director SAMCRA

SAMCRA
SOUTHERN AFRICAN METAL CLADDING AND ROOFING ASSOCIATION

www.samcra.co.za

Leaking pierce-fixed roofs following hailstorms

Over this summer SAMCRA received a number of requests for assistance from property owners whose mainly pierce-fixed roofs have leaked following hailstorms where fine hail has accumulated on the roof up to a depth of 40/50mm. On the Highveld this type of storm is not uncommon over a period of ten years or so. The root cause of the leaks is that the hail reduces the water carrying capacity of the cladding thereby causing a buildup of water at the interface between the melting hail and cladding which results in the development of a capillary siphon at the side-laps between adjacent sheets. The flatter the roof the more prevalent the leaks – a roof inclined at 10° has a drainage capacity 36% greater than one inclined at 5°.

The solution is to insert a butyl based sealer strip, preferably one with a reinforcing string, on the weather side of the fasteners along the entire length of the lap joint. In order to ensure the development of a continuous weatherproof seal we recommend that stitching screws be installed, at no more than 600mm centres, between the fasteners anchoring the cladding to the supporting structure.

An area often overlooked is the top section of a curved roof which is effectively flat – the larger the radius the greater the extent of the 'flat' section. It is strongly recommended, as an absolute minimum, that a sealer strip be fitted in the side-laps from the crest to the point where the slope of the cladding is equal to the minimum slope for the respective profiles.

Weatherproofing of in-plane rooflights

SAMCRA also received enquiries pertaining to the weatherproofing of in-plane rooflights and in particular those comprising polycarbonate material.

In-plane rooflights are those where the translucent material is made to the same profile as the roof cladding material and effectively replace a section of the cladding at the point where a rooflight is required as opposed to out-of-plane rooflights where the translucent component is fixed to a supporting frame, etc. which projects above the plane of the roof. In-plane rooflights are by far the preferred form of rooflight used in South Africa.

The most common in-plane rooflight configurations are:

- Chequer board
- Ridge to eaves
- Mid slope (a hybrid of chequerboard) and
- Ridge to eaves with portions of metal cladding at the ridge and eaves.

Whilst the chequerboard configuration is considered to provide the most even

The solution is to insert a butyl based sealer strip, preferably one with a reinforcing string, on the weather side of the fasteners along the entire length of the lap joint.

distribution of light it is the most difficult to weatherproof. A ridge to eaves configuration eliminates the problem of upslope metal to translucent lap joints but exposes the translucent cladding to the high wind loading at the eaves and to a lesser extent at the ridge. As translucent cladding is in the main non-trafficable the ridge to eaves configuration will inhibit access across a roof. Of the three configurations the mid slope is the most practical.

The two main factors that make it so difficult to weatherproof in-plane rooflights are differential thermal expansion and thickness of the translucent materials.

GRP (Glass Reinforced Plastic) and polycarbonate cladding have longitudinal coefficients of expansion of 2.5 and 5.6 six times respectively of that of steel. Surface temperature on a roof is considerably higher than ambient temperature. Surface temperatures of 60°C are common during the summer months. Heated through 60°C a 3.6m long metal sheet will expand 2.6mm whereas a GRP sheet will expand 6.5mm and a polycarbonate sheet 14.6mm.

Assuming an operational range from 0° to 60°C and the cladding is installed at a temperature of 15°C the steel will expand/contract 1.9/0.6mm, the GRP 4.9/1.6mm and polycarbonate 10.9/3.6mm. The differential movement at the ends will be +1.5 –0.5mm for GRP and +4.5 –1.5mm for polycarbonate. GRP cladding will require a hole 3mm larger in diameter than the fastener and polycarbonate a 10mm slot. If the differential is not provided for, the translucent cladding will buckle between fasteners or may even crack. It is important to remember that the weatherproof seal on the underside of the metal washer of the primary fastener also has to accommodate this differential movement as does the sealer strip inserted in the end laps. With sealants transfers movement is directly related to thickness. A bead of sealant squashed to 2/3mm simply won't cope. **Based on this data we recommend that the lengths of GRP and polycarbonate profiled cladding be limited to 8.0m and 3.6m respectively.**

Profiled translucent cladding is designed to fit over metal cladding, not under it. This is the reason it is almost impossible to weatherproof a metal over translucent end lap. A more practical solution is to fix the translucent cladding over the metal cladding on all four sides and then back flash the upslope lap to the ridge.

ABOVE: In-plane rooflights are those where the translucent material is made to the same profile as the roof cladding material and effectively replace a section of the cladding.

BELOW LEFT: Inadequate provision for thermal expansion.

BELOW RIGHT: An example of an out-of-plane rooflight – the translucent component is fixed to a supporting frame, etc. which projects above the plane of the roof.

The two main factors that make it so difficult to weatherproof in-plane rooflights are differential thermal expansion and thickness of the translucent materials.

SAISC SCHOOL OF DRAUGHTING Snippets

By Jenny Claassens, Office Manager, SAISC School of Draughting

SAISC SCHOOL OF DRAUGHTING

ABOVE LEFT: Steel Academy mentors, Roy MacKenzie and Steve Mackie with course participant.

ABOVE CENTRE: Steel Academy mentors WITH course participants in action.

ABOVE RIGHT (From the front to the back):
On the left: Louis De Kok, Norman White, Tevin Willams, Vian Van Zyl, and Gerhard Channing.
On the right: Chris Blomstrand, Lechané Van Zyl (Facilitator), Wayne Robberts, Dagan Barnard and Jaco Van Der Westhuizen. Not present when photo was taken Marcel Dreyer, Eric Petzer-Moore.

BELOW LEFT AND RIGHT: Kusile site visit.

Steel Academy Courses

Hands-on SAISC Steel Academy Courses for young Engineers and Draughtsman were presented in the Genrec Boardroom at the School of Draughting. Focus areas included:

- Basic Strengths and Theory of Structures relative to Steelwork on 26 and 27 February 2015. Industrial building layouts, basic loading and load paths and joint configurations on 5th and 6th March 2015.

See calendar of events for more courses on page 29.

Farewell to our Group 7 students that finished their studies on 28 February 2015 – Congratulations to everyone and good luck!

Kusile site visit

On 11th February 2015 the SAISC School of Draughting visited the Kusile power station site. They saw and experienced heavy engineering type steelwork and connections first hand. The students were most impressed and enjoyed every minute of the visit.

Our grateful thanks to Mitsubishi Hitachi Power systems and Murray & Roberts for the warm welcome and informative visit.

Please phone or e-mail Jenny Claassens for any enquiry or information on the SAISC School of Draughting on 011 876 2300 or jenny@saisc.co.za.

2014 FIFA WORLD CUP BRAZIL STADIUM
ITAIPAVA ARENA FONTE NOVA
REALISATION: **2012 - 2014**
COATING SYSTEM DESCRIPTION:
HEMPADUR ZINC 17360
HEMPADUR FAST DRY 15560
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Photo: ME/ Portal da Copa/ Março de 2013

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SOCIAL SNIPPETS

By Marlé Lötter, Events Manager, SAISC

SASFA Exco 10 February 2015

Members of the SASFA Exco at the first meeting for 2015 held in the SAISC Boardroom.

Stewart Murray of MiTek and Annamarie Roberston of LaFarge attended the SASFA Exco meeting.

SAISC Council Meeting

29 January 2015

RIGHT: The Steel Institute started 2015 with a meeting of the SAISC Council on 29 January 2015.

Henk Langhoven, Economist of SEIFSA, was the guest speaker at the event.

Dorman Long / Dorbyl Get-Together 26 February 2015

RIGHT: A substantial number of the stalwarts of Dorman Long/Dorbyl/DSE got together for a leisurely reunion on 26 February 2015 at Harvard Café, Rand Airport. This annual get-together is convened by SAISC director, Kobus de Beer, who is also a former MD of DSE Structural Engineers.

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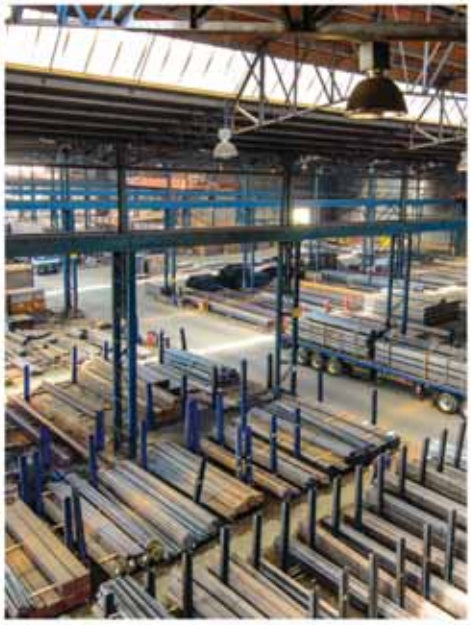

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