steel CONSTRUCTION

Volume 35 No. 6 2011

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CONGRATULATIONS TO ALL THE STEEL AWARDS WINNERS

OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

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EDITOR'S NOTE

"It is better for the press to get something wrong, than not say anything at all" Nelson Mandela

There is a perception I think among 'ordinary' people that freedom of speech (media) is restricted or just plain banned in only a few countries like Zimbabwe, maybe Libya (under the rule of Gaddafi) or say China. But if you look at the 2010 World Map of Press Freedom (www.freedomhouse.org) only a few places in the world (green areas) are seen as countries with complete press freedom. They include North America, Europe, Australia, some countries in South America, one or two in Africa and Japan.

South Africa is grouped with the partly free crowd (yellow), which include some other southern African countries, mostly South America, India, some Middle Eastern countries and Indonesia. The rest are sadly not free at all.

With the passing of the Protection of Information Bill in Parliament on 'Black Tuesday' 22 November 2011, South Africa has edged closer to the purple 'not free' areas on this map. This seems to be just the beginning of the restriction of the media in South Africa according to the broader plans of government.

You might agree with the protesting press that "yes, this is quite concerning for democracy" but that business will continue as usual. However, this does not end with that slippery concept they call democracy. For example: A direct effect on the industry could be that corruption within the tender process of contracts, including big construction projects, could be protected from the scrutiny of the media. Indirectly this could slowly corrode the international community's confidence in the country and impact on foreign investment in mining projects often seen as the bread-and-butter of the steel industry.

But luckily history (even in the recent history of South Africa) often shows that the people of a country can and do decide in the end what is good for them, regardless of their country's political system.

2012 is going to be an interesting year.

steel CONSTRUCTION

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The Steel Construction journal supports the freedom of media and speech implicitly enshrined in our Constitution (Article 16).

OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

Front Cover: All the Steel Awards 2011 winners
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SAISC COMMENT

By Dr Hennie de Clercq,
Executive Director, SAISC

Even on the level of the steel construction industry we are reliant on the rest of the world. We import machines, technology, knowledge and ideas. There is a huge and growing body of knowledge and experience about steel construction swirling around in the world and we benefit from it on a daily basis.

THE GLOBAL VILLAGE

Every day's news just seems to hammer the message home: we are citizens of the world. What happens in places very far from here, places that most of us have never been to or have any special interest in, affects us. Sometimes in ways as intimate as what happens to the little bit of money we have set aside for our old age. And if we have to generalise about what comes to us from all over the world we have to say: mostly bad news. Even what we hear about the prosperity of some countries brings with it a sting as it reminds us of the aggressive way in which they move into markets, posing a challenge to our own industries.

But on the whole we get vastly more good things than bad things out of the world. Think for a moment what would happen if South Africa were to sever all contact with the rest of the world. Well, that's impossible to think, goodness knows how hard we tried to be self sufficient in the past what with sanction busting etc. and hopelessly failed, because it's implausible and just getting an understanding of what citizenship of the world means is a subject so huge that one cannot get your head around it.

Even on the level of the steel construction industry we are reliant on the rest of the world. We import machines, technology, knowledge and ideas. The SAISC maintains relationships with a large number of organisations and we have a 'negative balance of trade' with them: we receive much more from the relationships than we feel we contribute. There is a huge and growing body of knowledge and experience about steel construction swirling around in the world and we benefit from it on a daily basis. In fact, sometimes we feel that we are an inadequate vehicle for finding available knowledge, sifting it, 'South Africanising' it, and making it available to our industry and professions.

Some international projects are featured in this issue of Steel Construction. We hope you enjoy these, and that you will find them stimulating. Needless to say, the supply of such projects is so vast that I cannot even say on what basis we decided which projects to include, except that what we could lay our hands on clearly played a role.

Since we mentioned our place in the world and certain issues we battle with, I may as well touch on a broader subject we are grappling with at the moment, which is simply what the Institute should concentrate on in the coming year. Our interface with other countries and industries is certainly one aspect we are thinking about and for which we need to devise a strategy. But we appreciate that our members also have to deal with day-to-day issues of a local nature. The Institute is committed to deal with every aspect of steel construction, and the somewhat broader issue of the use of steel in construction, with the exception of labour relations and the training of people up to artisan level (and even here we ventured into the field of the training of structural steel assemblers).

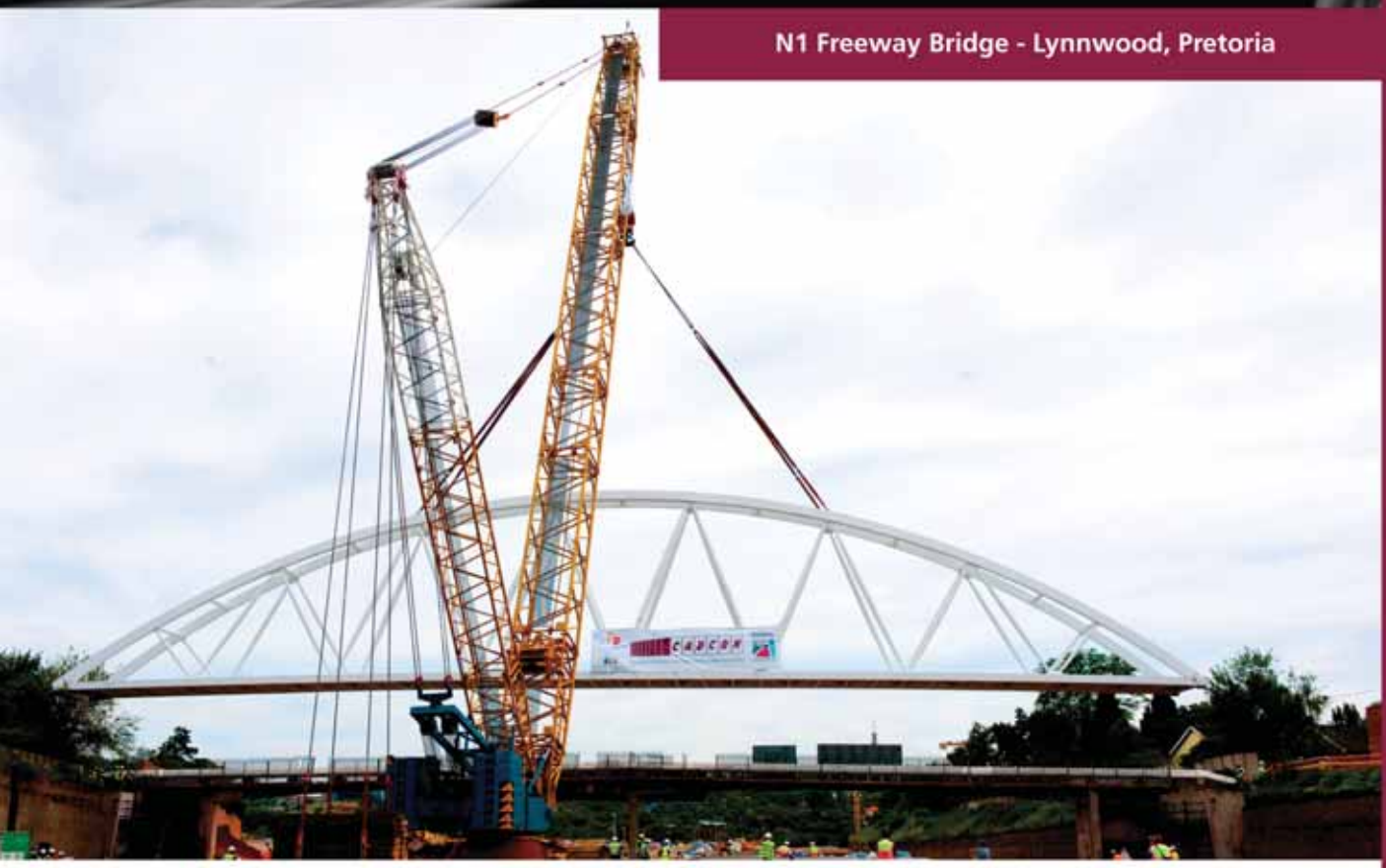
So this is a good time for you as a reader and thus a person with an interest in steel construction to let us know about the issues that concern you or hold you back. What are the opportunities you see? How should we change our method of operation to be more effective? It would be good to know what people think regarding the sort of environment that would be conducive to growth and development in the industry (not that the Institute has control over much of the things that constitute the environment we operate in, but there are things that we can influence, at least if the industry stands together and if we collaborate with other organisations).

I would like to encourage you to let me know what you think (even if it is just "throwing the pebble in the pond"). Feel free to send me an email at hennie@saisc.co.za – I will make sure your views are taken into account in the think tank session we are planning for the latter part of January 2012.

On behalf of all of us here at the Institute: thank you for your support during the past year, and may 2012 be a wonderful year for you!

CADCON

STEEL CONSTRUCTION AND ENGINEERING



N1 Freeway Bridge - Lynnwood, Pretoria

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.

Medupi ACC JV for ESKOM, Ellisras

Mbombela FIFA Stadium JV, Nelspruit

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.

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PROFESSOR PETER DUNAISKI (1950 – 2011)

By Dr Hennie de Clercq, SAISC and
Prof Johan Retief, Stellenbosch University

The Southern African Institute of Steel Construction pays the highest tribute to Peter and to the work he did during his lifetime. We will miss him sorely. But his legacy will be with us for years to come, especially in the form of individual engineers in practice or academia who serve the profession and its related industries with integrity, enthusiasm and capability, following the example set by Peter Dunaiski.

It is a matter of great sadness to us that since the beginning of 2011 we had to bury both Prof Peter Dunaiski and Prof Alan Kemp, both Honorary members of the Institute, highly respected and dear friends. Peter and Alan differed in personality, in the way they presented themselves to the world, and in many other ways, but they also had much in common. They were highly principled men, loyal to people and causes, significant contributors to the knowledge base for steel structures, and enthusiastic about engineering things. It did not take much to get either of them into a deep and even heated discussion of some structural concept.

Peter Dunaiski unexpectedly passed away on 14 September 2011 at the age of 61, after starting to make good progress with treatment for cancer. He was Professor in Structural Engineering at the Department of Civil Engineering and Vice Dean of the Faculty of Engineering at the University of Stellenbosch. Peter was a fellow of SAICE and a registered professional engineer. Recognition of his professional contribution was made when he was elected as a Fellow of the South African Academy of Engineering. He was one of the very few Honorary Members of the Southern African Institute of Steel Construction.

Peter Ernst Dunaiski was born in Windhoek on 8 March 1950. When he finished school in Windhoek, he went to Stellenbosch University where he successively obtained the Engineering degrees HonsBEng (Civil); MEng (Structural) (cum laude) and PhD (Structural). He spent three years in private practice in Pretoria and Windhoek, and joined his alma mater again in 1978. He went through the ranks until his appointment as Professor in the Iscor Chair of Steel Construction in 1991. He served as Head of the Division of Structural Engineering and Informatics, Director of the SU Institute of Structural Engineering (SU-ISE), Chairman of the Department of Civil Engineering and lately as Vice Dean of the Faculty of Engineering.

Amongst Peter's many outstanding achievements, and the most important from the point of view of the steel construction industry, was the establishment of the Centre for the Development of Steel Structures (CDSS) under the SU-ISE. The CDSS is dedicated to research as a medium of training structural engineers in having a thorough understanding of structural steel. This initiative made a substantial contribution to the scientific base and expertise of the industry. These activities were rooted extensively in his experience in specialist structural steel design, which he built upon by continued involvement in the industry. CDSS produced a whole generation of Structural Engineers at Masters-level and a significant number of Doctorate Engineers. These 'deliverables' of the programme are subsequently playing prominent roles both in industry as well as academics.

Another achievement of Peter's was the establishment and implementation of the field of Civil Engineering Informatics at the Department. Through his leading role, Informatics was established as a fundamental mathematically based sub-discipline of Civil Engineering, derived from the approach of Bauinformatik developed in Germany. The field was introduced at undergraduate level, continued as a field of specialisation at graduate level, with research done up to PhD level. Peter's leadership and management of the academic process, research supervision and international networking were vital to the success of the programme.

As Chairperson of the SABS TC 59-I Basis of Structural Design and Actions Peter played a leading role in the development of structural design standards, amongst other related activities. However, he was not only 'chief', but also 'cook-and-bottle-washer' in performing the duties of championing four of the eight parts of SANS 10160:2010, developed by the SAICE Working Group on the Revision of the Loading Code. Related activities included substantial interactions with the development of relevant Eurocode standards by participating and supporting liaising activities with Eurocode. A significant outcome of this process is that the new Loading Code provides the basis for the systematic introduction of Eurocode standards and Eurocode-based standards to South Africa.

He leaves behind his wife, Irmel, of 33 years as well as their three daughters – Elke (32), Anke (30) and Wibke (27)

The Southern African Institute of Steel Construction pays the highest tribute to Peter and to the work he did during his lifetime. We will miss him sorely. But his legacy will be with us for years to come, especially in the form of individual engineers in practice or academia who serve the profession and its related industries with integrity, enthusiasm and capability, following the example set by Peter Dunaiski.

Mario Stolz, CEO, Midvaal Structures.

Midvaal Structures' organised workshop as seen from the outside.

MIDVAAL STRUCTURES

By Viv van Zyl,
SAISC Membership Consultant

At the core of their business stands their capability to supply their client with all the aspects of a construction project from the design, using first class software design tools, to managing the erection of the steel and cladding components of any structure concerned.

When driving towards Vereeniging on the R59 highway one notices the striking premises of Midvaal Structures on the left, a couple of kilometres from the Meyerton turn off. The clever signage directs visitors (and potential clients) from the highway right to their door where the neat garden and well organised buildings form a good first impression. Their focus on quality and solid foundation confirm that this 'external' image is definitely not just window dressing.

Their mission is to become one of the top five steel companies in the country and they are currently implementing their strategy to make this happen.

Mario Stolz, the company CEO, acquired Midvaal Structures in June 2003. The company was established five years before and fabricated steel structures for the light industrial market. Mario together with his brother Rudi and the Midvaal team expanded the business to offer a turnkey solution for larger projects including; medium to large factories, warehouses, shopping centres and other commercial buildings. Midvaal Structures also pride themselves with first-rate quality procedures and workmanship and is ISO 9001 approved. They are also members of the SAISC.

The company has first class equipment such as the Ajan 3000 high definition plasma table.

Midvaal Structures

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Plasma Table

Madupi Power Station

Python X

Madupi Power Station

- Offers an in-house detailing and architectural studio to assist customers from the early design stages right up to the final construction of their steel construction project.
- Works with a variety of roofing solutions, from small portal frame-type structures, through to 60-metre-span lattice girder designs.
- Mainly serves the commercial and industrial markets, with smaller contracts in the domestic market.
- Exports its solutions to various African countries – including Angola, Mozambique, Malawi, the Democratic Republic of Congo, and Swaziland.

Midvaal Structures specialise in the cost effective building of steel structures for churches, factories, warehouses, hangars, shopping centres and offices.

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Mario and his brother Rudi (left) expanded the business after taking it over in 2003.

Midvaal Structures operates from a large workshop (5 970m²) situated between Henley-on-Klip and Meyerton. They have recently ordered an additional crane which will vastly increase their lifting capacity in their workshop. Increasing the size of their premises will probably be the next step for the Stolz brothers. The company employs about 100 staff members that include workshop and office workers.

At the core of their business stands their capability to supply their client with all the aspects of a construction project from the design, using first class software design tools, to managing the erection of the steel and cladding components of any structure concerned. The company works with a variety of roofing solutions, ranging from portal frame structures to 60-meter-span lattice girder roofs.

To compliment this turnkey solution they also take on repairs, alterations and additions to existing buildings, special installations in steel, concrete floors and foundations, mezzanine floors, steel decking as well as rigging and cladding. All this is offered with a strong emphasis on cost effectiveness of design without compromising on quality or the aesthetic appeal of the project.

To be able to achieve their long term goal of becoming one of the large steel construction companies in South Africa, Midvaal already owns the only Python X (7-axis robotic plasma cutting machine) in the country. They recently purchased an Ajan 3000 high definition plasma table, with a HP260 generator and jet filter. This machine enables them to do their own in-house cutting of various plate products including base and connection plates. They have purchased a second machine which will be delivered soon. This machine will increase their cutting capacity by 100%.

They also acquired a small steel merchant company, Midvaal Steel, in 2008 as part of their expansion plans.

The long list of Midvaal's completed projects include small factories, hangers, warehouses and shopping centres and most recently the completion of a sector at the Medupi Power Station near Ellisras. Mario also mentioned that they have been successful in acquiring a contract for a 23 000m² warehouse from Alstom for the Kusile power station in eMalalheni (Witbank).

Some of their projects:

- A project for Medupi – 11 515m²
- A project for Kusile – 23 000m²
- Cornie van Greuning, Pretoria – 6 000m²
- Fouche Motors, Vanderbijlpark – 5 570m²
- A 2 400m² project in Ballito
- New Way Building, Alberton – 7 000m²

About the people...

Mario and Rudi grew up amongst welding rods, grinders, etc, since their father was in the steel construction business and together have 'steel' experience of more than 30 years. Mario and Rudi talk with humble pride about what they have accomplished so far in the past eight years and then with enthusiasm and passion about the future of their company.

Both brothers believe that their work takes a lot out of them and both take time to 're-generate' their energy. Rudi works out at the gym and the Mario enjoys the freedom and exhilaration of the open road and a powerful motorcycle.

They also spend as much time as they can with their families. Mario is married to Tania and they have three beautiful daughters namely Leandi (8), Marcel (6) and Karla who has just turned one.

Rudi is married to Sylvia and they have two children namely Mario who is three and the very young Monique, 6 months old.

One of their projects – Fouche Motors, Vanderbijlpark.

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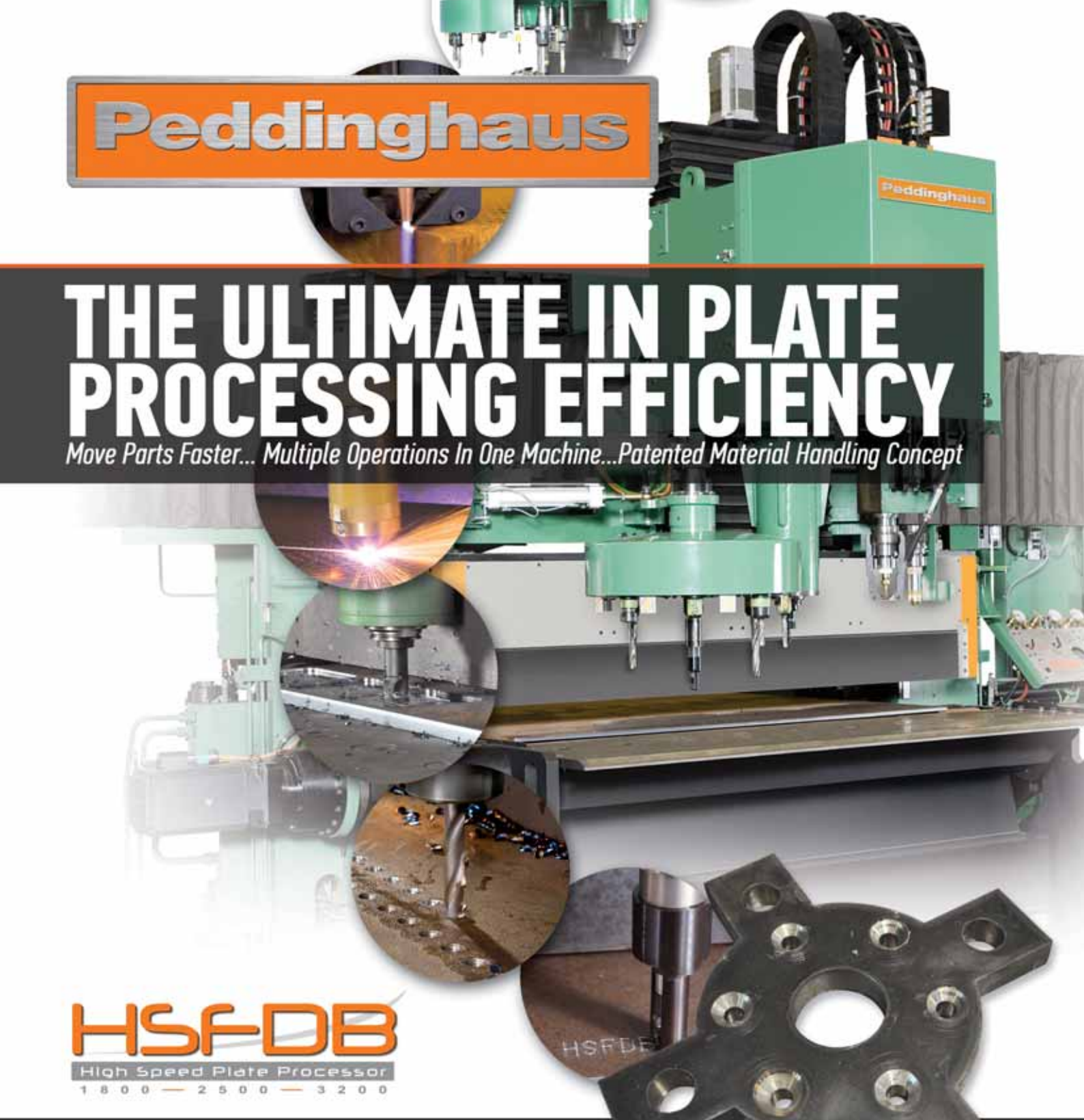

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INDUSTRY NEWS IN BRIEF

NEW MANAGING DIRECTOR OF PROJECTS TO TAKE COSIRA GROUP (Steel Awards Partner Sponsor) INTO ACCELERATED GROWTH PHASE

In a strategy to create a sustainable business model centred on calculated growth, Silva Group Holdings recently restructured its assets into four key areas namely Cosira Group; Silva Plant and Logistics; Silva Corrosion Solutions and Silva Property Investments.

The appointment of Jean-Raoul Charoux as Managing Director of Projects this year reinforced the company's intention. With over 35 years' intensive experience in the construction industry, 20 of which were at a senior managerial and leadership level, Charoux is ideally qualified to take Cosira into the next phase of its development.

While still drawing on its entrepreneurial prowess, growth of the business forms an important step in the corporate evolution of Cosira. "The plan is for the company to double in both physical size and projected turnover in the next three to five years," says Charoux. "This incorporates the immediate development of a three-year business plan which will unite the separate entities within the Group through a common mission, vision and organisational purpose. Primarily this involves driving a performance-based pioneering, empowered and innovative spirit and culture throughout the organisation and fostering an attitude of accountability."

Whilst the goal is to utilise the capacities and capabilities of the company's in-house team and

Jean Charoux, Managing Director of Projects – Cosira Group.

equipment, Cosira is not averse to outsourcing elements that would benefit clients. "This also reduces issues with logistics and risk as all outsourced work is governed by performance guarantees and strict contractual criteria," says Charoux.

Although Cosira has a recognised base of steel fabrication projects throughout southern Africa, Charoux admits that for the company to truly become a force to be reckoned with, it needs to implement a definitive strategy outlining operational parameters.

"This could well include identifying efficiencies and the outsourcing of work to third parties. At the same time, while we will endeavour at all times to utilise local skills and resources, in the interests of effective project execution, it will sometimes prove necessary to import skills from South Africa into pan African operations.

"One of our underlying differentiators is that we continue to find new and innovative ways of facing the challenges posed by working in both South Africa and in cross-border countries. At the core of our business ethos is the insistence that our entire team places quality of workmanship, coupled with customer service, on their top priority list." Charoux concludes.

BYSTRONIC RANGE OF LASER CUTTING MACHINES AND CONSUMABLES ADD FURTHER BENEFITS TO FIRST CUT (Steel Awards Partner Sponsor) CUSTOMER OFFERINGS

Adding another string to First Cut's bow is the recent decision to distribute the Bystronic range of cutting machines and consumables locally. Swiss company Bystronic is a global supplier of high-quality solutions for the economical processing of sheet metal and other sheet materials. Customers profit from application-oriented systems and services for laser and waterjet cutting and bending.

"Bystronic high quality cutting machines have a defined footprint in South Africa and their reliability,

productivity and cost-effectiveness are attributes well known in the industry. All these factors made our association with Bystronic an attractive one," says Andrew Poole, Managing Director of First Cut.

"In turn, we can leverage the extensive knowledge and experience we have gained with our existing customer base to offer Bystronic customers all the benefits associated with our own track record in supplying consumables and capital equipment to a discerning market for over five decades," he adds.

Poole says that apart from its reputation in the South African market, the Bystronic offerings were particularly appealing to First Cut because of their acknowledgement as a leading competence centre for the manufacture of waterjet cutting systems. "Abrasive waterjet cutting, that is ultra-high-pressure cutting using a water-sand mixture, has the advantage that the cut material is not influenced by thermal or processing forces. Further benefits of this process are the almost boundless range of materials that can be processed and the saving of incidental costs thanks to the high quality of the cut," Poole explains.

Andrew Poole, Managing Director – First Cut.

Gordon Gilmer, CEO – Robor.

"In addition, the range of laser cutting equipment manufactured by Bystronic, such as flying optics, laser source, the unique Direct Helical Motor System (DHM), CNC control and Bysoft application software substantially improve the production process. In all instances, less energy is required to provide a high-tech, professional finish. This is an important factor in an economy crippled by increasing energy costs and a growing emphasis on reducing the carbon footprint," says Poole.

ROBOR CLAIMS DELOITTE BEST COMPANY TO WORK FOR TITLE ONCE AGAIN

For the third year running, steel tube and pipe manufacturer, Robor has been named a winner in the Deloitte Best Company to Work for Survey in the manufacturing industry category.

Manufacturing companies in South Africa have had a particular difficult year and the metal industries strike had a negative impact on productivity and staff morale. Despite these challenges, Robor decided to participate in the survey for the fifth year.

"To be a competitive, sustainable global company, we recognise that our employees need to be highly productive, talented and are expected to often deliver more than what we are able to compensate them for" said Gordon Gilmer, CEO of the Robor Group. "As such every employee owns a share of Robor through our Employee Share Trust as well as participation in the 'Gainshare Scheme" continued Gilmer.

These employment issues are not unique to Robor but are felt throughout South Africa. Multi-skilled employees who assist companies to reduce their manpower dependence – especially during industrial action – are the way forward. "With these challenges in mind, Robor's employees are urged to constantly infuse new ideas and provide 'out-of-the-box' solutions to meet our customers' requirements" says Sundrie Naidoo, Group HR Executive at Robor.

Leadership development, education and mentoring are at the core of Robor's holistic approach to transformation. Part of this approach is the 'Young Graduates Forum' currently in its fourth year. This forum encourages young graduates many from previously disadvantaged backgrounds to grow into senior management. This forum facilitated by Robor's CEO Gordon Gilmer, exposes employees to the group's strategic plans and insights.

HATCH AFRICA ACQUIRES LOCAL ENGINEERING FIRM

The recent acquisition of Eon Engineering by Hatch will help increase Hatch's local capabilities in addressing one of South Africa's major strategic needs – power transmission infrastructure, transmission and distribution.

INDUSTRY NEWS

The Hatch acquisition of Eon Engineering, which was finalised at the beginning of July 2011, enables the immediate start up of a Hatch Transmission and Distribution (T&D) business unit in South Africa.

Eon Engineering will augment Hatch's local capabilities in order to help address South Africa's major needs of power transmission, providing its extensive experience in power system engineering solutions for the entire life cycle of electricity plants and networks, explains Hatch's global transmission and distribution MD Richard Carryer.

Eon Engineering was established in 1998 as a joint venture between leading black economic empowerment company KE Consulting, and Eskom Enterprises, a wholly owned subsidiary of South African power utility, Eskom. The company's engineering solutions, now available to Hatch's clients, range from feasibility and system planning studies, conceptual design, detailed engineering design for generation, transmission, distribution systems, project and construction management of new networks and the refurbishment of existing networks.

The acquisition allows Hatch, through its new T&D unit, to now offer various specific power system infrastructure and refurbishment design consulting services to its clients, in areas that include power line designs, cable installations, substation designs up to 765 kV, project and programme management, commissioning of complete power systems and full engineering procurement construction management (EPCM) services.

"Major energy supply projects, such as new thermal energy generating capacity, major mining clients expansions and renewable generation projects all require interconnection to the grid, or expansion of the grid capabilities, and Hatch is now in a position to provide these engineering, procurement and construction management services," he explains.

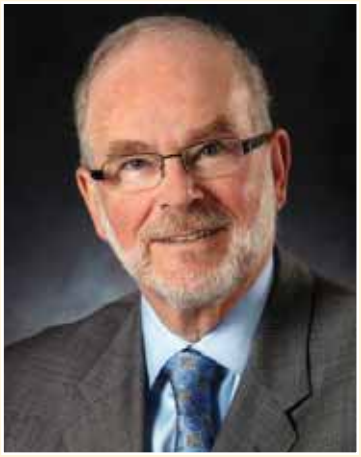
COURSES FOR BUILT-ENVIRONMENT PROFESSIONALS (BEPs)

A common factor amongst BEPs is a lack of financial literacy. *(This observation does not necessarily apply to contractors!)*

A 2-day hands-on financial course, worth 2 CPD credits, is presented by Wolf Weidemann PrEng, a retired consulting engineer, under the auspices of the South African Institution of Civil Engineering. Although the first part is applicable to any business, this is followed by a section specifically valuable for consulting engineers. *(And Yes: Contractors who attended also found it to be of benefit.)*

The Development of Financial Literacy, apart from learning the jargon, deals with matters such as:

- The goal of a business; How to set up a business,
- Sources of money and their rewards,
- Uses of money, recording transactions, calculating profit,
- Return on investment,
- The balance sheet,
- A simple business model,
- Time sheets, debtors, control of debtors,
- Allocation of salaries to COS and FC,



Hatch's global transmission and distribution MD Richard Carryer.

- The income statement,
- Costing models, multiplier approach,
- Discounting,
- FIDIC project averages,
- The DuPont chart system of control etc.

The main concepts are supported and reinforced by exercises to achieve 'conscious competence' of the course participants. Upon completion, the Work Book serves as a valuable summary and reference source.

Wolf also presents another CPD course for consulting engineers and their clients: Handling projects in a consulting engineers practice. Here the sometimes misunderstood functions and procedures of a consulting practice are unravelled. The interaction with clients could definitely be of interest for contractors!

For details of these courses contact Dawn Hermanus at 011-805 5947 or dhermanus@saice.org.za

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EXCELLING through EXCELLENCE

CSIR RESEARCH CONFIRMS THE SUPERIOR ENERGY EFFICIENCY OF LIGHT STEEL FRAME BUILDING

By John Barnard, SASFA director

(As shown in the findings) the LSFB house will require less than half the electricity to heat and cool to thermal comfort levels than the Brick Base case, and still notably less than the other two insulated masonry alternatives.

John.barnard@saol.com; www.sasfa.co.za

A recent research project by the Built Environment Division of the CSIR confirmed that a light steel frame (LSF) dwelling, built to SANS 517, will result in significant savings of electricity used for heating and cooling of the building, compared with a conventionally built heavy masonry building.

In order to obtain an objective prediction of the thermal performance of a light steel frame dwelling compared with a masonry building in the different South African climate zones, SASFA approached the CSIR to carry out the analyses.

A typical 120m^2 single storey house was used for the comparison. The LSF and the masonry houses were specified to be geometrically identical, with identical orientation. The LSF house complies in all respects to SANS 517 Light Steel Frame Building. A typical masonry house with double leaf external clay brick walls, without any insulation in the walls and ceilings, was used as the base case. The effects of adding (i) 40mm insulation in the ceilings, and (ii) similar ceiling insulation as used for LSF buildings (140mm) and 50mm insulation in external walls, were also evaluated.

The Built Environment Division of the CSIR decided to use the Ecotect TM V 5.6 software to carry out the computer analyses. In order to eliminate the effect of user input data which could influence the outcome, it was decided to use a passive analysis, i.e. without making assumptions regarding the occupancy and usage patterns of the house. The heating effect of lights and appliances was also not taken into account.

The analyses were firstly aimed at determining the number of hours of uncomfortably high or low temperatures in each of the buildings. The buildings were considered to be naturally ventilated and the thermal comfort temperature range for naturally ventilated buildings in Pretoria is 17.8°C – 28.3°C. The adaptive model was used in calculating the levels of thermal comfort in the two houses.

The electricity needed for heating and cooling for each of the buildings to thermal comfort levels (ranging from 20°C to 24°C, as recommended by SANS 204) was also determined.

The major differences between the two types of building are the thermal insulation and the thermal mass. The walls in a LSF building have better thermal insulation, but lower thermal mass than masonry buildings. The higher thermal mass in the walls of brick buildings reduces the diurnal internal temperature swings towards the average temperature, which could be too high or too low for comfort. It should be noted that the concrete floor in both building types contribute to the thermal mass of the building.

FINDINGS

Results indicate that the LSF house will be warmer than a base case masonry building in winter, as well as in summer. If the hours of discomfort due to too high and too low temperatures are added together, the LSF house performs better than the masonry alternative in all locations but Durban.

As example, the indoor temperature of the LSFB was within the thermal comfort range for 74% of the time in Pretoria's climate, compared with 71% for the masonry base case – a relatively small advantage.

However, the analyses indicate that electricity required to heat the base case brick building to comfort levels will on average be double that required for the LSF building, ranging from 89% more in Pretoria, to 112% more in Bloemfontein.

THERMAL PERFORMANCE COMPARISON: LSF vs MASONRY DWELLING						
	Discomfort hours (hrs)			Annual heating & cooling energy (GJ)		
	too hot	too cool	total	heating	cooling	total
	Base case LSF					
Pretoria	414	1824	2237	36.6	6.9	43.5
Durban	562	455	1017	12.8	9.7	22.5
Bloem	299	3229	3528	74.9	4.3	79.2
Cape Town	45	2878	2923	60.7	1.8	62.4
Average	**330**	**2096**	**2426**	**46.3**	**5.6**	**51.9**
	Base case brick					
Pretoria	116	2411	2527	69.3	30.6	99.9
Durban	127	749	876	25.1	37.9	63.0
Bloem	80	3820	3900	158.6	22.3	181.0
Cape Town	0	3818	3818	117.4	5.5	122.9
Average	81	2700	2780	92.6	24.1	116.7

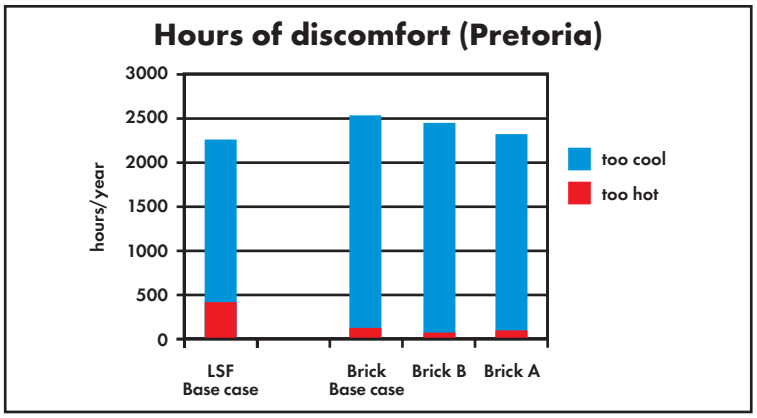
If cooling to comfortable temperatures is required, it will take on average three times more electricity to cool the masonry building down to thermal comfort levels compared with a LSFB.

This enormous increase in the amount of electricity required to heat or cool the internal spaces of a masonry building can be ascribed to the thermal mass of the walls – apart from having to heat the air inside the building, the walls of the masonry building absorb some of the heat, resulting in additional energy consumption and a delay in the change of the internal temperature. The inverse happens when cooling, when the heavy masonry walls have to be cooled down together with the air inside the building.

When the brick building is insulated, the performance improves. *Graph 1* compares the hours of thermal discomfort in a LSFB with that in three alternative masonry buildings:

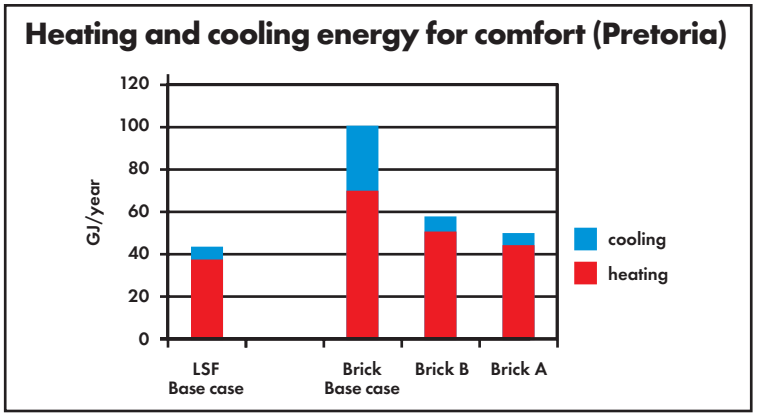
- Brick base case: no ceiling or wall insulation
- Brick B: 40mm thick glasswool insulation in ceilings
- Brick A: 140mm thick glasswool insulation in ceilings, and 50mm polystyrene insulation in the cavity of all external walls.

While the LSFB will result in more hours of discomfort without heating and cooling in Pretoria's summer climate than the masonry alternatives, occupants will have less discomfort in winter, and less discomfort in total.



Graph 1.

As is shown in *Graph 2*, the LSFB will require less than half the electricity to heat and cool to thermal comfort levels than the Brick Base case, and still notably less than the other two insulated masonry alternatives.



Graph 2.

Savings in electricity for heating only:

LSF compared with Brick Base Case:	32.7 GJ/yr (89%)
Brick B:	13.5 GJ/yr (37%)
Brick A:	7.7 GJ/yr (21%)

CONCLUSION

The CSIR's comparative thermal analyses indicate that LSFB offers improved energy efficiency compared with conventional masonry buildings – this means significant savings (between 20% and 90%) of electricity required for heating of residential buildings in Pretoria, as example.

These findings are generally supported by testimonials received from occupants of LSF houses. In a recent survey carried out by SASFA, 57% of respondents reported that their LSF house was cooler in summer, while 71% said it was warmer in winter.

The CSIR research also indicated specific areas where further gains in energy efficiency can be captured for LSFB, and these will be investigated and implemented in the LSF building methodology.

Reference: 'A predictive comparative thermal performance analysis for light steel frame and masonry residential buildings', T Kumirai and Dr D Conradie, CSIR.

SASFA NEWS

ABSA SUPPORTS NEW BUILDING TECHNOLOGIES

One of the key drivers in Absa's aim to contribute towards solutions for the housing demands of the nation is through the identification and financing of innovative and affordable housing solutions.

Over the past few years, Absa has, in association with its partners, conducted two highly successful Housing Innovation Competitions in both the affordable and subsidy housing markets. The objective of these competitions was to stimulate imaginative and viable alternative building designs which challenged traditional masonry construction and offered a variety of affordable, high quality housing solutions which were then rolled out by tender through provincial and local government developments.

These competitions, held in Gauteng and the Western Cape, were endorsed by the Minister of Human Settlements due to the affordable, innovative and energy efficient alternative solutions they could provide. The competitions are also attracting a growing interest from local and international developers wishing to showcase new and innovative building systems. This has resulted in a third competition anticipated to take place early next year in one of the provinces (to be announced shortly).

The competition will have a rural theme and setting, focusing mainly on:

- Affordable and subsidy housing
- Green housing technology
- Energy efficiency
- Planning and an eco-site design
- A rural character where housing compliments the beauty of the natural environment without compromising sustainability, safety and comfort for its inhabitants.

To date, Absa has a number of approved alternative building technologies which it considers financing. The criteria broadly include:

- The cost of the technology and its affordability to customers
- The durability, architectural design and quality of housing products
- Cost effectiveness and value for money
- The speed of construction
- Energy efficiency
- The verification of energy products for finance
- The acceptability of the innovative building system to targeted customers
- Absa's internal mortgage lending policies, terms and conditions

Absa has since the outset accepted light steel frame building (LSFB) in principle, and has granted finance to LSF housing projects subject to the above. SASFA remains in close contact with Absa, and provides information on the LSFB industry and products when required.

REPORT: LSFB TRAINING FOR BUILDING CONTRACTORS, CAPE TOWN, OCTOBER/NOVEMBER 2011

SASFA's six-day training course for building contractors was presented at Saint-Gobain's facility in Epping, Cape Town, from 31 October to 5 November 2011. This was the 7th time we offered the course.

Attendees of the LSFB Training for Building Contractors Course in Cape Town.

We received 10 registrations for the course, four from Gauteng, two from Eastern Cape, one from the Free State, and only three from the Western Cape.

The four-day section on steel frame manufacturing and erection was presented by John Barnard (SASFA) and Richard Bailey (consultant, previously from MiTek). Kevin Gargan (Academy manager Saint-Gobain, Cape Town) and Johnny van der Merwe (estimator/draughtsman Everite Technical Services) presented the one and a half day section on cladding, lining and insulation. As in the past, we had Hilti illustrate the use of their laser levels, as well as their range of anchor bolts, and Speedfit Africa illustrated the installation of plumbing in LSFB using their product range. Students each received a set of course notes, a copy of SANS517, and product literature from both Everite and Saint-Gobain.

Saint-Gobain had cast a 6m x 4m slab inside one of their training buildings, on which the light steel frame, supplied by Razorbill, was erected by the students as part of the practical component of the course.

Cladding, lining and insulation materials were supplied by Saint-Gobain and Everite for fixing to the steel frame, under the guidance of Kevin, Riaan (also from Saint-Gobain) and Johnny. Joints were completed on the internal lining, and even the repair of a hole bashed through the lining was illustrated.

The students had to write two tests, to assess the level of their knowledge. The average combined score for the two tests came to a very good 78%. All the students achieved in excess of the required minimum of 60%, and hence all qualify for the SASFA certificate for successful completion of the course.

SASFA aims for 15 to 20 enrolments per course, and would have preferred a slightly larger group. However, judging by the students' response, presentation of the course was certainly worthwhile.

WINGS OF STEEL

UNDERGROUND UTILITIES IMPOSED SITE CONSTRAINTS THAT LED TO ARUP'S STRIKING SOLUTION

By Ignacio Barandiaran, principal and project director Arup, San Francisco

This article was previously published in the February 2011 issue of the American Institute of Steel Construction's magazine, Modern Steel Construction.

The survey requested that respondents rank the designs in order of preference from 1 to 4. More than a thousand people responded. Through the preference survey the community ruled out the plain concrete alternative. The cable-stayed bridge was too costly. Considered to provide an appropriate balance among cost, function, and aesthetics, the arch edged out the somewhat less expensive steel truss.

PHOTO: GLENN FLEMING

The four steel arch sections are suspended with two cranes and ready to be bolted together. The blue bracing shown between them was removed when all bolting was completed.

The desire for an iconic bridge, combined with constraints imposed by a spider-web of underground utilities, led the designers of a new $6.8 million pedestrian and bicycle bridge to design an arched rib structure with curving members that meet at a common point to minimise substructure requirements. Adding to the complexity, the deck curves in plan, causing the arches to incline at slightly different angles. The new Robert I. Schroder bridge provides safe passage over busy Treat Boulevard in Contra Costa County to be an integral part of the Iron Horse recreational trail. The trail, formerly a railroad corridor, also serves as a right of way for several underground utilities and includes an easement for a future transit line. These constraints made foundation placement complex and were the main determinants for the design of the bridge structure.

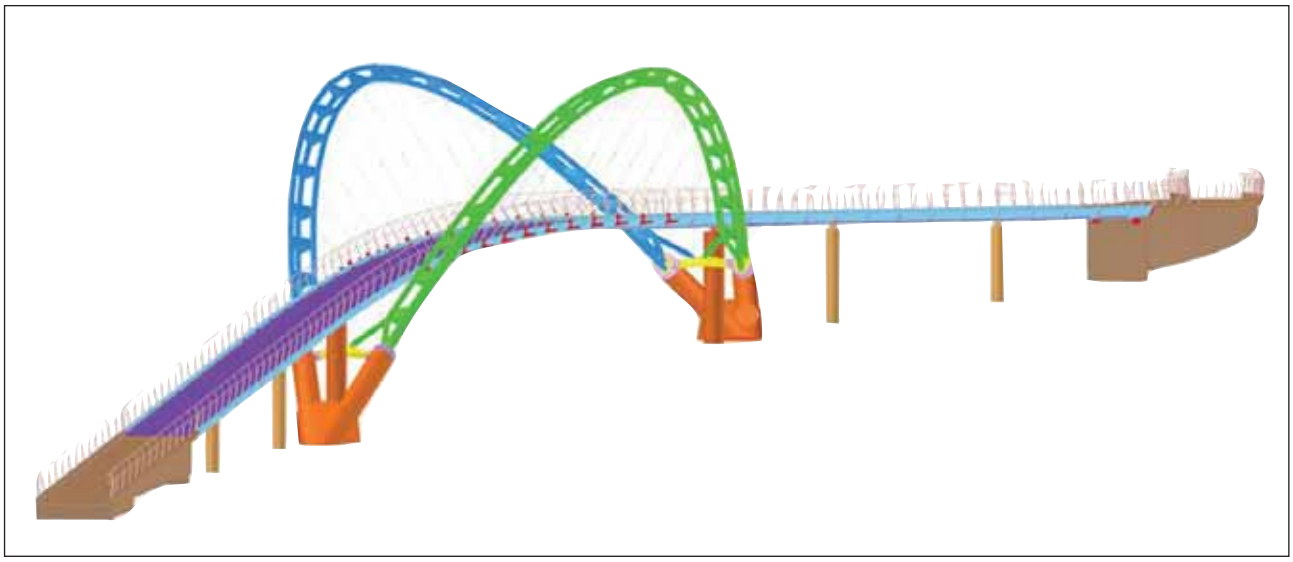
BRIDGE SITE

The bridge is sited within the Transit Village built around the BART Pleasant Hill/Contra Costa Centre station in Contra Costa County. This station is one of the

PHOTO: IGNACIO BARANDIARAN, ARUP

Precast concrete inclined columns ready to receive the steel arches, which are bolted to the steel connections at the top of the inclined columns.

IMAGE: ARUP



The arches meet at a common base point, resulting in a narrow foundation and thus avoiding existing underground utilities. The deck curves in plan, causing the arches to incline away from the deck at slightly different angles.

busiest in the BART system for commuters. The surrounding development consists of high-density residential condos and apartments, extensive commercial and retail space, and high-rise garages for parking. The Transit Village and the bridge have both been developed by the Contra Costa County Redevelopment Agency, led by its director Jim Kennedy. The Contra Costa County Public Works Department was charged with managing the process for the final design, to get the project built, and to maintain it after its completion.

Parallel to the BART system is a railroad right of way called the Iron Horse Trail that by the late 1980s was no longer being used by its original owner, the Southern Pacific Railroad. Spearheaded by Robert Schroder, then mayor of nearby Walnut Creek and later a county supervisor, the county started purchasing this right of way in the 1980s. Currently the trail connects residential and commercial areas, business parks, schools, public transportation, open space and parks, regional trails, and community facilities. It runs north and south for some 30 miles (±48km) in the San Francisco Bay Area.

The agency saw an opportunity to upgrade the trail in the area near the BART station by adding a signature pedestrian bridge for foot and cycling traffic. The new bridge takes the trail over the heavily travelled, eight-lane Treat Boulevard.

GAINING PUBLIC CONSENSUS

The agency selected Arup as the prime consultant for the bridge. Being conscious of the appropriate use of public funds, the agency called for a thorough community outreach programme to achieve consensus on the need, exact location, and form of the bridge structure. The extensive outreach programme required multiple meetings and design charettes with people and organisations that provided a representative sampling of the community.

Although a relatively small project, the bridge involved a significant amount of decision complexity given the prominence of the location and how the project could affect the neighbouring stakeholders. The public meetings made a concerted effort to explain the physical constraints, cost issues, design trade-offs, and construction aspects.

The outreach process culminated in four buildable bridge designs for the main span's superstructure: steel cable-stayed, steel arch, steel truss, and concrete girder. Designs for the approaches were similar and the alignment was the same for all four.

Arup provided a detailed report on the design issues and the estimated cost of construction for each main span design. What followed in 2003 was a web-based preference survey of all those who participated in the outreach meetings and for the community at large. The survey requested that respondents rank the designs in order of preference from 1 to 4. More than a thousand people responded.

PHOTO: JAKE WAYNE, ARUP

The main span of the arch, with a length of 240 ft (73m), crosses Treat Boulevard with a curving deck and independent arches inclined away from the deck.

Through the preference survey the community ruled out the plain concrete alternative. The cable-stayed bridge was too costly. Considered to provide an appropriate balance among cost, function, and aesthetics, the arch edged out the somewhat less expensive steel truss.

PHOTO: JOE REYES, HANNA GROUP

Each arch rib is built up from three 10-in. (0.25m)-diameter steel pipes bent to the appropriate radius and welded together with steel box stiffeners spaced at approximately 14 ft (±4.2m)along the length of the ribs.

DEALING WITH SITE CONSTRAINTS

Among the many constraints that are typical in the design of infrastructure projects in the public right of way, one most affected the design for this project: the existing underground utilities along the Iron Horse Trail. Each of the several utility owners had specific easement rights, concerns with maintenance and access, and plans for new facilities in the future. Underground utilities include a 60-in. (1.5m) diameter sanitary sewer, an 84-in. (2.1m) storm sewer, a jet fuel line, underground power cables, a gas line, potable water mains and fiber-optic cables. A 115 kV transmission cable looms overhead. The underground utility constraints ruled out shallow spread footings that would limit their access and expansion. This required the alignment to weave its way around the utilities such that foundations of minimal width could be placed to avoid them.

In the case of the winning arch design, the solution used a pair of inclined arches coming down to a single narrow, deep foundation at each end of the main span. Vertical arches would have required two foundations and a pile cap on each end, which would have more than doubled the width and would have conflicted with utilities. For example, at the south end the arch foundation is wedged between the sanitary and storm sewer pipes. Each of the foundations consists of two, 90-ft. (±27m) deep, 6-ft (1.83m) diameter piles along the bridge alignment that are tied together by a narrow pile cap.

The Iron Horse Trail includes a linear park on the north side of Treat Boulevard adjacent to the bridge. A bridge straight across the roadway would have hidden the park as viewed from the adjacent street to the west of the park. The community outreach programmes indicated that people wanted to avoid the park being hidden behind a bridge structure. As a result, the bridge curves in plan toward the east in an 'S' shape as it approaches the north side. In this way the bridge preserves a grove of heritage oak trees, becomes an attractive backdrop for the park, and does not provide concealment for unwanted night time activities.

DESIGNING THE ARCH CONFIGURATION

The utility constraints and lateral curve of the deck were the main drivers of the design of the bridge arches. The single deep foundation at each end meant that the arches had to incline outward and away from each other. The lateral curvature of the deck meant that the arches had to incline outward at different angles. The arch on the east side is more vertical than that on the west side.

One of the most important structural design aspects of the bridge is the lateral bracing of the

arches which was placed just below the deck. This allows the full length of the arch ribs above the deck, over three-quarters of their length, having no cross-bracing connecting the two arches together. Bracing the asymmetrical outwardly inclining arches above the deck would have been awkward because of the increasing distance across from arch to arch as they incline outward. As it is, pedestrians and cyclists traversing the bridge have an open, roofless feeling. From afar the bridge resembles the wings of a butterfly.

The steel arch ribs are supported on inclined 42-in.-diameter (±1m) concrete columns that follow the arch line of thrust. The length of the steel ribs from one column to the other is 240 ft (73m). A curved, steel box beam brace, across the tops of the inclined concrete columns, provides a stiff point to brace the steel arches below the deck. The two arches come down and bolt to the top of the columns and to the middle of the box beam.

Each arch rib consists of three 10-in.-diameter (0.25m) steel pipes in a triangular cross section. Steel box stiffeners connect the three pipes together at roughly 13-ft (±4m) intervals so that the three pipes for each rib form a composite structural section. This choice over a more conventional single, large-diameter steel pipe had two advantages: first, smaller diameter pipes

PHOTO: JAKE WAYNE, ARUP

The curved alignment of the deck was designed to make the bridge the backdrop to the new park.

are more readily available than larger ones, and, second, the built-up arch rib has an open, more airy look that offers interesting light and shadow effects.

Connection plates welded to the underside of the stiffener boxes serve to attach a pair of cables at each of the 24 locations where the deck hangs from the arches. The cables in each pair cross each other and form a vertically elongated 'X' shape as they stretch from the arches down to each side of the deck. California regulations require that pedestrian bridges have a 'projectile fence' as they cross over streets and highways. This requirement posed a special challenge to the design team: how to provide for this safety feature and avoiding a 'caged' feeling for the bridge users. Taking advantage of the leaning arches with an open top, the design of the projectile fence was integrated

PHOTO: GLENN FLEMING

Two arch sections are lifted to their final positions with temporary bracing. The arches were erected on the first night of three weekend night closures.

PHOTO: GLENN FLEMING

Arches being lowered onto the inclined concrete column supports, prior to being bolted down.

with the geometry of the arches. The fence, which is made from a woven stainless steel mesh, is complemented with a pair of low and high hand rails along the full length of the deck. This design makes the 10-ft (3m) width of the deck feel more spacious.

An important requirement for the bridge was to have adequate lighting on the deck and in the surrounding park for user safety, as well as appropriate decorative lighting. The design team developed a system of strip LED lights that is concealed in a cove integral with the deck structure, and supplemented by ground mounted fixtures to illuminate the sidewalks and the bridge superstructure.

ERECTING THE BRIDGE

In the spring of 2009 the Contra Costa County Public Works Department received eight bids for the construction of the project and awarded the contract to Robert A. Bothman of San Jose, California. The winning bid of approximately $6.8 million was almost 20% below the engineer's estimate, which along with the number of bids reflected the competitive market conditions at that time.

Arup required the erection subcontractor, Adams & Smith, to develop a dimensionally accurate 3D CAD model for bridge fabrication and a detailed erection procedure. The complex geometry of the bridge ruled out reliance on conventional 2D shop drawings. Adams & Smith's chief engineer, Jeff Darby, developed the erection procedure and retained a construction engineer, OPAC, to perform a detailed structural engineering analysis of each stage of erection. The 3D CAD model was developed by Axis Steel Detailing and was required to be cross-checked with the construction engineer's own analytical model.

Adams & Smith subcontracted fabrication to Mountain States Steel, which fabricated each arch rib in two 120-ft (±37m) segments for shipping to the site. Each of the four rib sections weighed approximately 20 tons. Mountain States fabricated the deck in 11 sections of various lengths weighing from 10 to 18 tons each. The design team selected splice locations in the arches and deck to maximise the sections for shop fabrication and to ensure that they could be shipped by truck. The design was such that no field welding was required.

Erection of the bridge took place over three nights in June 2010. The arch ribs arrived on site in four pieces, and were bolted together and to the inclined column supports during erection the first night using two cranes. On the following weekend night closures erection crews used one crane to hang the deck sections from the cables and bolt them together. Additional night closures allowed for final cable tension adjustments and installation of the projectile fence.

The extensive planning work that was done initially by the design team and then by the construction team paid off. Working as a team with the owner to anticipate and resolve issues as they arose, the site work proceeded quickly and on time and on budget ready for its inauguration on October 2, 2010.

The new bridge makes the Iron Horse Trail safer at a busy thoroughfare and provides an attractive structure for the community. The urban redevelopment project at the Contra Costa Centre Transit Village now has an iconic piece of infrastructure that is both a place marker and gateway. As reporter John King of the San Francisco Chronicle newspaper put it in his article reviewing the bridge, "The Robert I. Schroder Overcrossing shows what an icon can be. This larger cultural role is what civic infrastructure can achieve when built with ambition and the long-term view."

project team

Owner:

Contra Costa County, California

Prime consultant:

ARUP, San Francisco

Steel Detainer

Axis Steel Detailing, Inca., Ores, Utah

Steel Fabricator

Mountain States Steel, London, Utah

Steel Erector

Adams and Smith, London, Utah

General Contractor

Robert A. Bothman, San Jose, California

A WORLD FIRST FOR MULTI-STOREY STEEL-FRAMED BUILDING

This article was previously published in Steel Construction New Zealand's SteelFocus: Industry Showcase and Sourcebook 2011.

"At the end of the earthquake, the preload in the springs bring the frames back to rest in their pre-earthquake position. As far as I am aware, this is a world first for a multi-storey steel-framed building."

Dr Charles Clifton

The Tower has the dormitory rooms and links to the third building with a bridge at the common amenity level, which contains the dining area.

When the Victoria University of Wellington, New Zealand decided that additional student accommodation and facilities were needed, the available site was steep and exposed, at the southern end of Kelburn Campus. The brief given to the architects (Architectus) envisaged 348 dormitory rooms, 298 studio rooms and three two-bed apartments. The architects' Auckland partner Michael Thomson describes the design concept: "Three separate accommodation buildings are linked by an amenities level. The Terrace is a low-rise development of four levels, linked to the second building, the Tower, by an entry courtyard and administration wing. A bridge at the common amenity level, which contains the dining area, links to the third building, the Edge, which runs on a north/south axis along the steep contours at the edge of the site. The project was to be known as the Te Puni Village."

Hawkins Construction was engaged to construct the Architectus design. VUW as the client made a significant request right at the outset, stipulating that Aurecon (then known as the consulting engineers Connell Wagner) was to incorporate in the design the latest advances in 'damage avoidance', as applicable to structural steel-framed buildings under severe earthquake attack. Aurecon's Sean Gledhill explains: "In the philosophy of 'damage avoidance' design, the bracing structure is designed to withstand a major earthquake with minimal and readily repairable damage. This typically involves incorporating mechanisms in the structure that can control loads and sustain large deformations. VUW's objective was to ensure that, after a large earthquake, the student accommodation buildings could be utilised as an administration facility while other university buildings were under repair. In short, the university would be functional."

To compliment the architecture, Aurecon engineers developed a seismic resisting scheme that included perimeter longitudinal moment resisting frames with transverse concentrically braced frames, or CBFs. To develop a damage avoidance solution, they pursued the idea of using a tension fuse at the junction of the CBF frames and its foundations. Adapting research done previously at the University of Auckland, they coupled the CBFs with stepping bases controlled through pre-stressed Ringfeder springs. The system works by allowing the building to lift off the ground and rock, using railing buffer

project team

Owner/ Developer:

Victoria University of Wellington

Architect:

Architectus

Structural Engineer:

Aurecon (then known as the consulting engineers Connell Wagner)

Steelwork Contractor:

MJH Engineering Ltd

Slide hinge joint designer:

Dr Charles Clifton, Assistant Professor of Civil Engineering, University of Auckland

A typical sliding hinge joint connected to a concentrically braced frame.

technology to control the movement. The system also incorporates sliding hinge joints between the columns and the foundation, as well as in the steel beams.

The sliding hinge joint was developed by Dr Charles Clifton, Assistant Professor of Civil Engineering at the University of Auckland. Incorporating bolt sacrifice, the joints between the beams and the columns are allowed to slide, dissipating seismic energy. Dr Clifton comments: "At the end of the earthquake, the preload in the springs bring the frames back to rest in their pre-earthquake position. As far as I am aware, this is a world first for a multi-storey steel-framed building."

MJH Engineering Ltd was the steel constructor on this project. Managing director Malcolm Hammond says the damage avoidance solution was simple to fabricate and easy to install. "The sliding hinge joints presented the challenge of establishing a suitable bolt tightening sequence, but we met this with a detailed construction methodology to ensure the tolerances were achieved. An excellent speed of construction was maintained. This enabled the main contractor Hawkins Construction and MJH Engineering to maximise shared carnage for the erection of the steelwork and the placement of precast flooring."

The prestigious international award recognising Aurecon's innovation in the Te Puni Village project was made by the British Institution of Structural Engineers in 2009.

BEAM DISTORTION

A STUDY INTO THE EFFECTS OF RESIDUAL STRESSES AND THE HOT DIP GALVANIZING PROCESS – A UNIQUE METHOD OF PREVENTING UNWANTED DISTORTION

By Steve Hornsey of VSR (Africa)

This paper looks at the causes of the distortion and the usage of a system known as Vibratory Stress Relieving (VSR) as a means of either preventing or greatly minimising this distortion. The VSR system is already being used in many parts of the world with a high success rate on components prior to them being galvanized, and thereby minimising the distortion, or as in many cases, completely eliminating the distortion.

Hot dip galvanizing is a highly cost effective method of protecting structural steel fabrications against corrosion. Its usage can be traced back almost one hundred years. A disadvantage of the galvanizing process however, is that the large temperature gradients that are generated in fabrications, coupled with the (uncontrolled) release of internal stresses during the galvanizing process, can cause distortion during the hot dipping and cooling of the galvanizing operation. It is not unusual for these distortions to exceed the allowable out of straightness tolerances for structural components. This paper looks at the causes of the distortion and the usage of a system known as Vibratory Stress Relieving (VSR) as a means of either preventing or greatly minimising this distortion. The VSR system is already being used in many parts of the world with a high success rate on components prior to them being galvanized, and thereby minimising the distortion, or as in many cases, completely eliminating the distortion. The Vibratory Stress Relieving Service has been in commercial use here in South Africa since the mid-eighties and the service is now available in all major centres of South Africa, Botswana, Zambia and Namibia.

Distortion of a component during/following hot dip galvanizing is a problem that is encountered by galvanizers worldwide. Although unacceptable distortion only occurs in a very small percentage of the tens of thousands of components that are galvanized daily, it is this very small percentage that creates problems for the galvanizer and the fabricator thus leading to designers and fabricators seeking other less efficient means of corrosion protection. Fabrications often contain a myriad of locked in stresses resulting from the original rolling process, cold working if applicable, hole punching, and through the joining (welding) processes involved. Poor conceptual design and detailing of components, coupled with a lack of knowledge as to the galvanizing process on the part of the fabricator can also contribute to the high stresses locked into the component.

Research shows that temperatures as used in the hot dip process (450-460°C) will bring the steel into the temperature range where the yield strength of most steels will be reduced by about 35%. This reduction is only temporary, as the yield strength will revert back to its normal strength upon the cooling of the material.

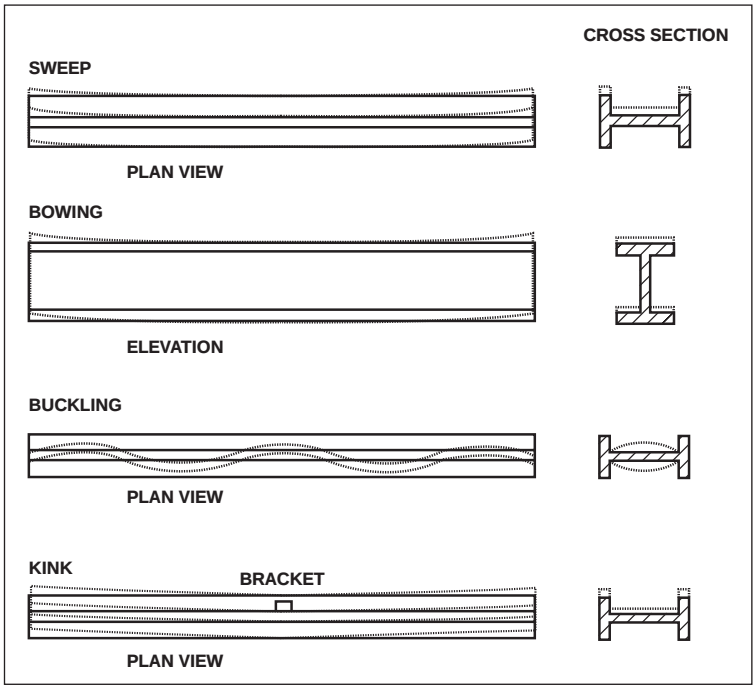
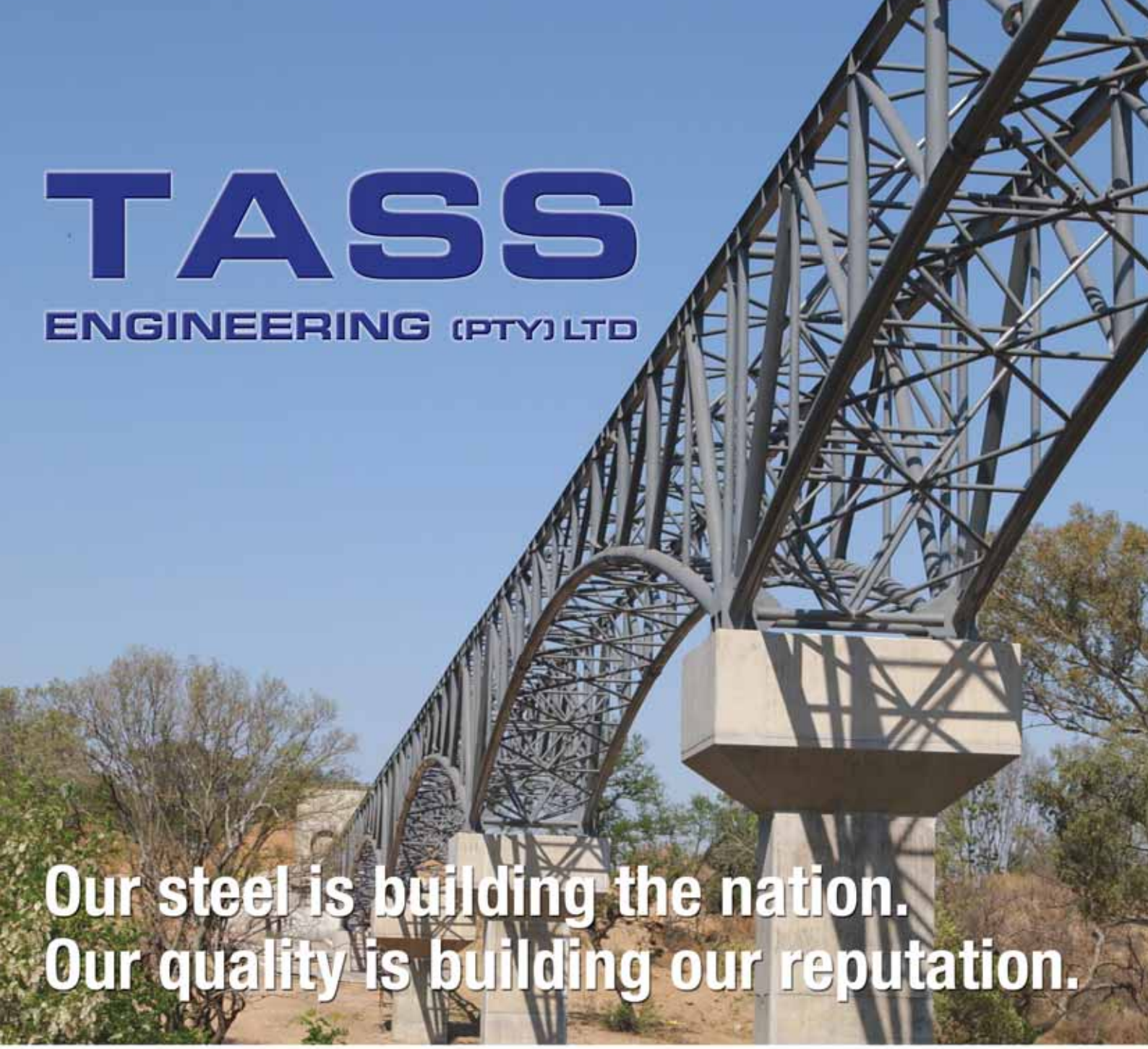


Figure 1: Typical distortion in beams.



TASS Engineering has been actively involved in structural and architectural steel fabrication and erection for more than four decades.

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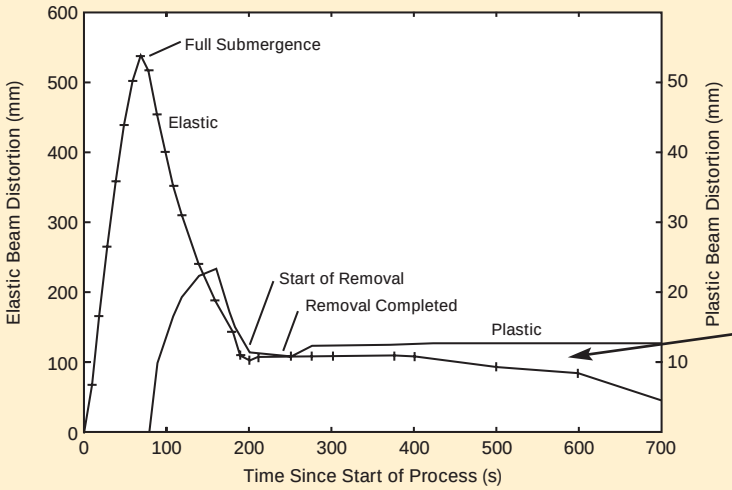

During the removal process, the top flange cools slightly more rapidly, thereby increasing the stress over the rest of the beam. With the lower portion of the web and the bottom flange being hotter, it yields even more resulting in a small increase in the plastic (permanent) distortion.

Figure 2: Time estimates of distortion during dipping and removal.

This reduction combined with an uncontrolled release of stresses when immersed into the galvanizing bath will often bring about the unwanted distortion. These stresses to the combined effect can result in 'plastic' strains. In the case of plate girders the result is web buckling distortion. The magnitude of the distortion is often a complex function of component geometry and dipping practice. Following removal from the zinc bath, the component may either be allowed to cool on the shop floor or it may be chromate dipped in a cooler temperature than the molten zinc having a quenching effect. As with heating, the changes in temperature during cooling can generate unwanted thermal stresses. Structural beams form a significant percentage of the wide product range that is suitable for hot dip galvanizing. Large fabricated plate girder beams are costly items, and owing to their size and strength, they may not be easily straightened after distortion has occurred.

A structural beam following galvanizing should always be allowed to cool whilst resting upon a flat surface as any beam at 450ºC with the corresponding reduction in yield strength while resting upon supports will experience additional forces due to the effects of gravity which will produce bending moments and associated bending stresses in the beam.

These stresses will reduce naturally over time (the ageing or weathering process). The reduction can be also accelerated by bumping during the loading operations and whilst in transit on the back of a bouncing truck/trailer which can compound the distortion, causing unexpected problems on arrival at the work site.

A particularly severe problem of beam distortion following galvanizing was noted by our associate company VSR (UK). The galvanizers were Hereford Galvanizing who at the time was contracted for the galvanizing of a large quantity of fabricated beams for Forth Engineering Ltd, contractors to the Ministry of Defence. The beams ranged in length from 8m to 12m and all having additional braces welded to the webs, some of the beams would distort up to 22 mm following the galvanizing. Initially the UK Welding Institute was called upon to assist and they suggested various welding solutions, none of which solved the problem.

Figure 3: Beam VSR treated prior to galvanizing.

Beam dimensions		**Steel properties @ 30ºC**
Height	±1050mm	Modulus of elasticity 200GNm^{-2}
Width	390mm	Coefficient of expansion 1.2x10^{-5}K^{-1}
Length	6-12m	Thermal Conductivity 45Wm^{-1} K^{-1}
Web Thickness	16mm	Yield Point 277Nm m^{2}
Flange Thickness	30mm	

Galvanizing conditions	
Bath temperature	±455°C
Dipping angle	30° to horizontal with webs vertical
Dipping velocity average	500mm/min
Removal velocity average	1m/min

Figure 4: Beam and galvanizing details.

Example of fabricated structural beams undergoing VSR treatment to effect a reduction in the distortion *(courtesy Tass Engineering)*.

The Welding Institute then recommended that they try applying the VSR process to the girders at the fabricator's workshop prior to delivery to the galvanizers.

An on site study into the galvanizing process was carried out by observing deflection for a plate girder being dipped in the vertical direction, bottom flange first into the zinc. It was established that initially the beam would bend within the elastic range, reaching its peak deflection at total submergence which would correspond to the maximum temperature differential between the upper and lower flanges. Plastic (permanent) deformation commences following this as the beam heats up and the yield point of the steel decreases. Further temperature increases result in continuing plastic deformation with the first, the lower and the hottest flange yielding resulting in a permanent bending of the beam, with the top flange yielding to provide stress relief and a reduction of the beam distortion. This is clearly detailed in Figure 2 amazingly this distortion occurred within $3^1/_2$ minutes of total submergence in the bath of molten zinc!

A photograph of one of the beams undergoing a VSR treatment is detailed in Figure 3. Figure 4 shows beam and galvanizing details.

Initially the first beam received a frequency scan which was recorded upon a graphic print-out for further reference purposes. The beams were basically identical and as their natural frequencies are in part determined by size, shape and mass, it was assumed that the other beams would be very similar in their modal response.

The trial beams were then VSR treated at their first bending mode in each plane for 8 minutes, a total of just 24 minutes treatment per beam. Following the galvanizing process the beams maintained a tolerance of within 7mm, well within the specified tolerance of 10 mm rendering them all fit for service with no further rework after galvanizing. The procedure was then adopted to include VSR on all beams prior to galvanizing.

Tass Engineering (Pty) Ltd, a well-known and respected Johannesburg based company specialising in structural steel had been contracted to fabricate a large quantity of beams for Eskom's Medupi Ash and Coal Project. The average size of these beams were 1m in height by 10m in length with a flange width of around 450mm. The welding process was completed using submerged arc welding, (a process which can minimise welding stresses owing to the lower cooling rate of the welding).

Following the hot dip galvanizing process areas of buckling distortion were measured along the webs of the beams, the specified tolerance of which was 7mm. Following galvanizing the worst amount of the distortion measured was 11mm and as such the entire batch of beams was rejected by the on-site inspector. (See item 3 of Figure 1 for a drawing of the distortion).

After trying, without too much success, various methods of mechanical straightening of these beams, the VSR Witbank office was approached with a view to vibratory stress relieving the remaining batch of beams with the required end result being that of limiting web distortion to within tolerance if not completely eliminating the distortion.

Treatment of these beams averaged around 25 minutes each with the first resonant frequency being around 34Hz. Following the VSR treatment the worst of the distortion had been greatly reduced, in some instances by as much as 8mm with the remainder of the buckling all being brought back to within the required tolerance.

Prior to VSR treatment the expert staff at Tass Engineering had attempted to press out some of the distortion but owing to the high residual stresses

within the structure this proved to be impossible. Although VSR had brought the beams back into tolerance, a mechanical press was used to remove some of the remaining high spots and owing to the material relaxation brought about by the successful stress relief process the beams were now easy to process.

The fabricated beams were treated with the intent of removing the buckling distortion that was caused by the varying temperature gradients induced during the Hot Dip Galvanizing Process and the results obtained were as required. Technically though this is not the ideal scenario for the treatment of beams of this type and size. Through the additional handling of the beams and combined with the attachment of the VSR equipment (using heavy duty clamps) to the component there is always the risk of damaging small areas of the expensive galvanized coating which of course is undesirable to the end user. This can lead to improper repairs to the coating which then shortens the lifespan of the corrosion protection.

A far more satisfactory result would have been achieved by the inclusion of the VSR process at the final stage of the beams production or just prior to the galvanizing process being carried out. When the high (and often uneven) stresses in the components are released by the raised temperatures during the galvanizing process, unwanted distortion usually occurs. A beam treated in this manner if the galvanizing procedure and subsequent storage of the beam whilst cooling is correct would exhibit little or no distortion along its axis.

It is unknown what percentage of the hundreds of components that are treated daily in South Africa using on-site VSR services, requires the services of hot dip galvanizers as no survey has ever been carried out.

What is now known is that where stress relief or component stability is required VSR can match that of thermal stress relief. A fact which is proven by the thousands of different users of the service on the hundreds of different components ranging from fan impellors, machine and pump base plates, through to heavy fabrications. A detailed listing of users is available if required.

Components which are currently being treated in the UK prior to hot dip galvanizing include the long complex fabrications which are used as jigs in the manufacture of complex aircraft wings by Airbus Industries of Broughton North Wales.

Following the VSR treatment the worst of the distortion had been greatly reduced.

Vibratory Stress Relieving can now be found in all major centres of South Africa. The process is quick, and it is clean with no scaling or discolouration to the component, and more importantly there is no unwanted change to the materials properties or loss of material yield strength. The system is also fully portable, running off a 220v single phase supply, with no atmospheric pollution as is in comparison to a thermal stress relieving oven.

One must always remember that VSR is not a replacement for thermal stress relieving, it is merely an acceptable alternative, and there still remain some applications that will require the use of a furnace. Where a metallurgical change is not required VSR is fast becoming the preferred method of stress relieving owing to time and cost savings.

Treatment capacity ranges from less than 1kg to in excess of 150 000kg, the process can be carried out either at the fabricator's own premises or at the galvanizing plant.

Further information if required is available from the VSR website http://www.vsr-africa.com

Fabricated structural beams undergoing VSR treatment.

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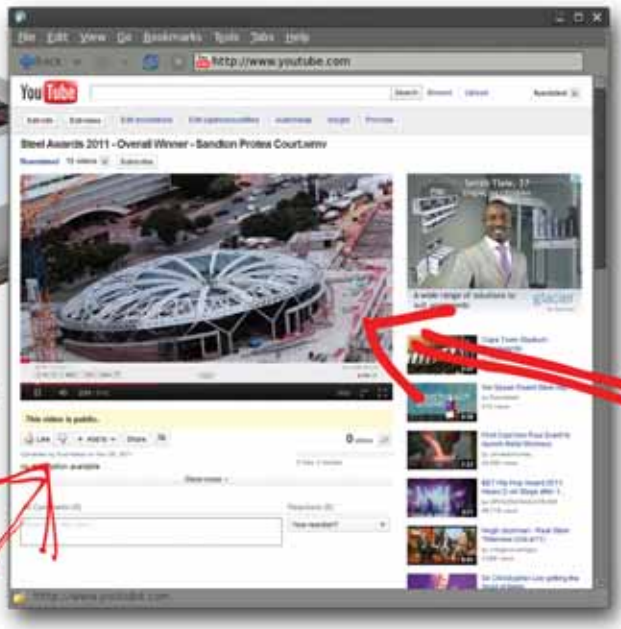

Check out the Steel Awards 2011 Winners video clips!

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SOCIAL SNIPPETS

By Marlé Lötter,
Events Manager, SAISC

STEEL AWARDS 2011 MAIN SPONSOR AVENG GROUP: MANY REASONS TO 'LIKE THIS'!

Following the huge build-up towards the 2010 World Cup, which reflected in the number and type of entries considered with Steel Awards 2009 and 2010, as well as in the attendance of the awards dinners, SAISC organisers expected a decrease of activity on all levels with the 30th event this year.

While we did not see a single stadium entry this time, we were pleasantly surprised with the quality and scope of the 68 project entries considered for Steel Awards 2011; the measure of interest and support from event sponsors; and the positive attendance at the respective awards dinner venues on 15 September 2011. In Gauteng the event at Emperors Palace was attended by around 830 guests, Suncoast Casino in Durban hosted about 220 persons and 105 guests attended the event at the One & Only Hotel in Cape Town.

The SAISC proudly recognises all the event sponsors who invested in this marketing platform – thank you for loyal support that made another brilliant celebration of structural steel possible *(see them all on page 38)*.

Congratulations to the deserving award winning projects:

Overall Winner: Protea Court Rooflight, Sandton

ASTPM Tubular Category: Saxon Hotel skywalk bridge, Sandton

Stewarts & Lloyds Light Steel Frame Category: 2011 All Africa Games – Athletes' Village, Maputo

Mining & Industrial Category: A-frame headgear for Gold Fields South Deep, Carltonville

Bridge Category: Buitengragt Bridge, Cape Town

Architectural Category: Moses Mabhida Station, Durban

(More details and pictures of these projects were covered in Steel Construction, Vol. 35 No. 5 2011, the edition handed out at the Steel Awards dinner.)

Tim Tasioulas of Tass Engineering received the 'Overall' prize as main steelwork contractor of the Protea Court Rooflight.

Members of the project team for the Protea Court Rooflight received certificates for their involvement in the Steel Awards 2011 Overall Winning project.

Ryan Hogarth, Gauteng MC presenting the Steel Awards edition of the Steel Construction Journal.

(The Other) Michael Jackson, MC in Cape Town.

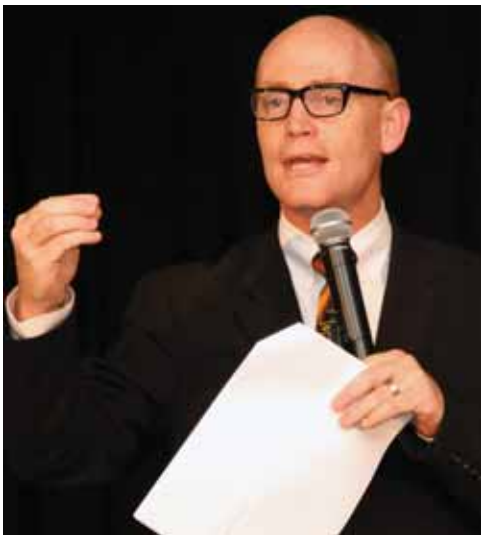
Nik Rabinowitz sharing his perspective on typical South African issues at Steel Awards 2011, Cape Town.

WHAT A JOKE!

In a planning session with the main event sponsor, the AVENG Group, it was mutually agreed that the industry could do with a bit of a laugh in 2011. To 'lighten things up' the event theme focused on 'social media'. As a result several elements associated with Facebook, Twitter, YouTube, etc. were built into event communication, the visual production and the event décor. Of specific note is the fact that the SAISC launched its own Facebook page in the build-up to Steel Awards 2011. ('like us', if you have not done so yet!)

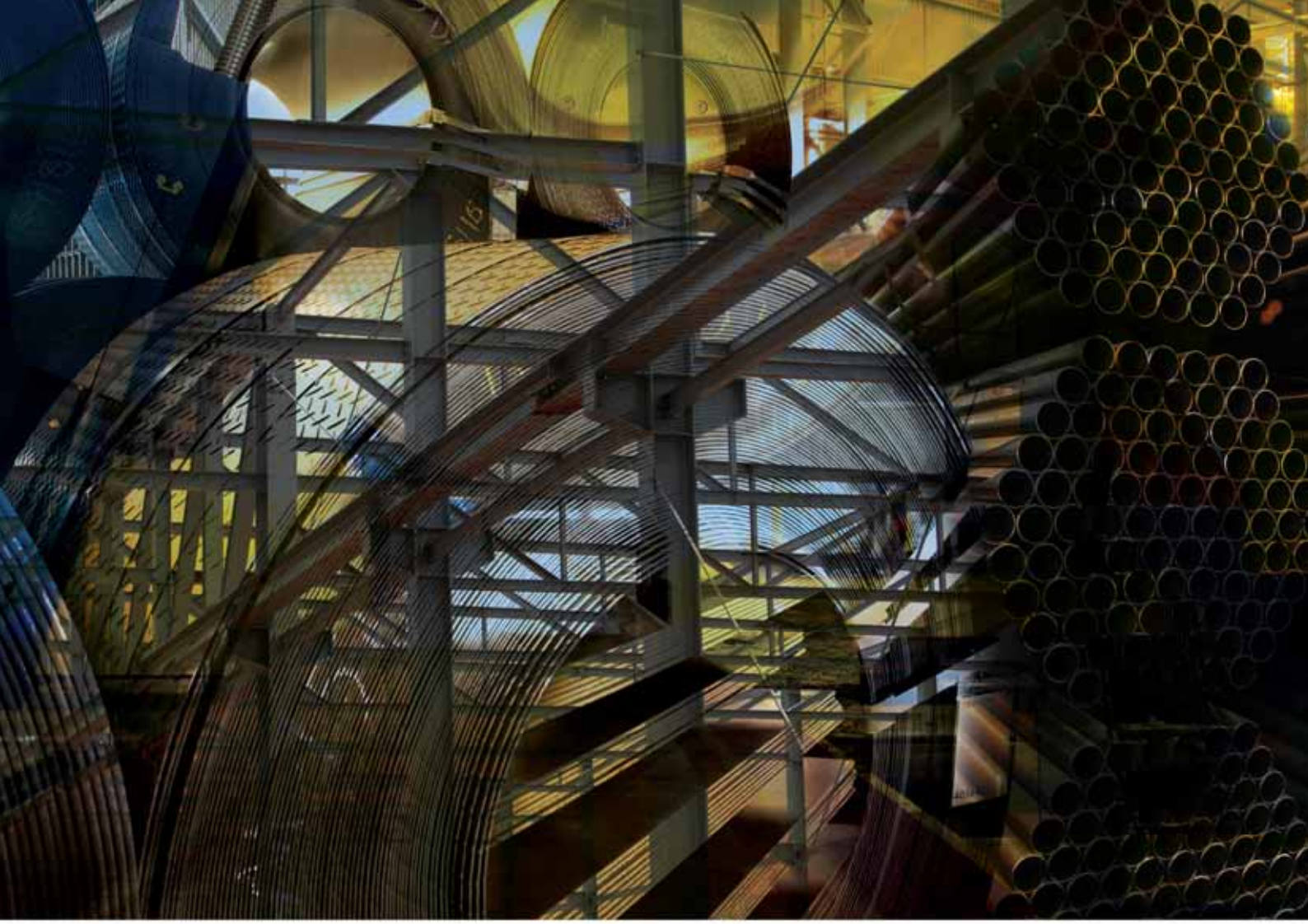
Entertainment at all three venues was provided by seasoned comedians. The highly skilled ventriloquist, Conrad Koch, had guests at Emperors Palace (Gauteng) in stitches, especially when he turned two industry stalwarts, Vossie Vorster of EVRAZ Highveld Steel and Freddie Herselman of the DTI into a 'boy band' with attitude! Cape Town guests were laughing at Nik Rabinowitz, the well-known voice of 'The week that wasn't' on Radio 702 and Cape Talk Radio, who spared nothing and no one with his 'social comment' in a variety of local dialects. At the Suncoast Casino in Durban guests were entertained by the multiple personas of Aaron McIlroy, who also acted as the able master of ceremonies. In Cape Town the smooth proceeding of the event was in the efficient hands (the other) Michael Jackson and in Gauteng social media expert, Ryan Hogarth, was the MC.

While the visual presentation still contained substantial technical information concerning the shortlisted and winning projects things were kept decidedly light with short YouTube clips and captivating dance sequences by the judges – some of these even bordering on a Chippendale act! In addition Tim Tasioulas of Tass Engineering was duly awarded the 'Overall' prize as steelwork contractor for the overall winning project.



Aaron McIlroy did MC work and had guests roaring in Durban.

Ventriloquist/comedian Conrad Koch (centre) turned men of steel, Vossie Vorster (EVRAZ Highveld Steel, left) and Freddie Herselman (DTI) into a mean 'boy band'.



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Centre pieces created by Canaan Wire, commissioned by table décor sponsor, CadexSA.

Leon Krige receiving a ceremonial card and a cash prize of R10 000 from Dave Dawkshas and 'the Bank of Macsteel' for his winning picture of the Alice Lane complex. Macsteel was the Steel Awards 2011 photo competition sponsor.

COMMUNITY SUPPORT – MORE TO SMILE ABOUT

Continuing on the initiative started in 2010, guests to the Steel Awards dinner once again had the voluntary option of donating any amount to a chosen community project in return for a chance to win the centrepiece on their table in a lucky draw towards the end of the evening.

The intricate wire sculpture centre pieces were individually crafted by the Canaan Wire community workers and comprised men of construction in different poses. The pieces were commissioned by John Swallow of CadexSA, table décor sponsor of Steel Awards 2011.

At the venue in Cape Town the amount of R5 355 was raised among just over 100 guests and at Emperors Palace, with around 830 guests, an amount of R61 336 was collected. The money raised in Cape Town will be donated to the Western Cape regional office of CHOC, the organisation supporting children of all races with cancer and life threatening blood disorders. Half of the Gauteng funds will be donated to ABBA House for abandoned babies. This cause meets our broad selection criteria for a beneficiary: focused on people (as opposed to nature/science), non-denominational with a history of good funds management.

This specific beneficiary was also chosen to honour the memory of Louise Warden (owner of the events company Ping Pong Communications) who has rendered an exceptional event management service to the SAISC over many years and in preparation for Steel Awards 2011. She had also dedicated a full day of her busy week to work as a volunteer at ABBA House until she died so unexpectedly in a plane accident near Tzaneen on 14 August 2011. The other half of the Gauteng funds will be donated to SA Cares for life, the national umbrella organisation of which ABBA House forms a part.

The SAISC sincerely thanks every guest who contributed. If you were lucky enough to win a centrepiece, we trust you will have a warm feeling every time you look at it.

PICTURE PERFECT

The photo competition for the best picture supporting project entries for Steel Awards 2011 was a novel idea resulting in an excellent selection of pictures. Angela Shaw's picture of Moyo on the Pier was awarded best winning picture in the KwaZulu-Natal region, while the picture of the Philippi Soccer Stadium taken by Adam Letch took the regional honours in Cape Town. A spectacular night time picture of the Alice Lane building in Sandton, taken by Leon Krige, was crowned as the overall winning picture. The photo competition and the cash prizes to the winners were sponsored by Macsteel.

NEW GENERATION PROGRAMME

Since 2008 the SAISC has hosted the New Generation Programme as an incentive for top performing students and lecturers in structural engineering. The programme is funded by 10% of the contributions of the respective event sponsors and R25 of the attendance fee for every guest.

This made possible the complimentary attendance of the Steel Awards 2011 dinner by three participants in Cape Town, one in Durban and 19 in Gauteng. 14 of the participants in Gauteng could also be treated to a full day programme that started with an overview of the special structure that had to be built to accommodate a flight simulator and then had exhilarating experience inside the actual simulator under the expert guidance of Glen Warden, Flight Captain and Manager of Commercial Operations & External Training for Comair.

Top performers in structural engineering attending Steel Awards 2011 in Gauteng, Durban and Cape Town as part of the New Generation incentive programme.

The group then visited the Vanderbijlpark workshop of DSE Fabrication, division of AVENG Grinaker-LTA, arranged by Gary Jones with guidance by Albert Hafkamp. The day programme was concluded at Sandton City where Rob Mylroie of Tass Engineering provided technical insight into the Protea rooflight structure and the broader refurbishment plans for the Sandton City precinct.

SAISC membership consultant, Viv van Zyl, and SAISC development engineer, Amanuel Gebermeskel, acted as hosts throughout the programme to make sure that we retain all the top performing participants for the future.

The positive and in some instances quite expressive feedback received from participants indicate that the programme was successful, met its goals of providing special insight into the structural steel industry and creating an excellent networking opportunity with fellow top performers and key persons in the industry, and should be continued in the future in spite of the financial implications and rather challenging logistics. These are some of the things participants had to say afterwards:

"...I cannot wait to become part of a team who would hopefully one day receive a Steel Award..." Wandie Kramer, US, after attending the dinner in Cape Town

"...the programme... is fantastic for networking and advertising (structural) steel" Mhairi Riddet, WITS

"...eye opening... at undergraduate level I was not really exposed to the benefits of constructing in steel..." Jarryd Buratovich, UCT

"If young engineers are exposed to (structural steel) technology, they will introduce it into future projects." Gina Skinner, UP

The SAISC congratulates and thanks all the mentors and top performers who participated in New Generation 2011 and hope to hear the following names in the future of this industry:

Full day participation in Gauteng: UCT: Jarryd Buratovich, Michael Chikwava; US: Etienne van der Klashorst (mentor), Emma Nel, Alet Appelo, Hendrik Stephan; WITS: Mhairi Riddet, Effort Mokoena, Ryan Bradley; UJ: Mpho Shikwambana; UP: Dario da Silva, Gina Skinner

Awards Dinner - Gauteng: WITS: Prof Alex Elvin, Riccardo Opeka, Gillian Jarvis; UJ: Dr Morgan Dundu, Henry Miller, Phathamandla Sithole; UP: Prof Ben van Rensburg; Cape Town: UCT: Prof Pilate Moyo; US: Algurnon van Rooyen; Wandie Kramer (SAISC Bursar); Durban: DUT: Jermaine Pillay

MAKING MEMORIES – PICTURE CD AND AWARDS DVD AVAILABLE

A large selection of event pictures can be found on *www.saisc.co.za - Events / Recent Events*, then open the page for Steel Awards 2011 and follow the prompt to the picture selection. You can also contact us for a free copy of the Steel Awards visual production on DVD and the picture selection for the venue of your choice on CD/DVD:

Pamella Mnyanda, pamella@saisc.co.za or Marlé Lötter, marle@saisc.co.za or Tel: 011 726 6111.

CALENDAR OF EVENTS

SAISC OFFICES CLOSED
23 December 2011 (from 12:00) – 2 January 2012 (opens on Tuesday 3 January 2012)

STEEL AWARDS 2012 – DEADLINE FOR ENTRIES
30 April 2012

SAISC GOLF DAY
9 May 2012
Houghton Golf Club, Johannesburg

10th INTERNATIONAL CONFERENCE ON ADVANCES IN STEEL CONCRETE COMPOSITE AND HYBRID STRUCTURES (ASCCS 2012)
2 – 4 July 2012
Singapore

STEEL AWARDS 2012
13 September 2012
Venues TBA

14th INTERNATIONAL SYMPOSIUM ON TUBULAR STRUCTURES
12 – 14 September 2012
London, United Kingdom
www.imperial.ac.uk/ists14

SMMH 2012 - STRUCTURES FOR MINING AND RELATED MATERIALS HANDLING INTERNATIONAL CONFERENCE
15 – 18 October 2012
Vanderbijlpark

FOR MORE INFORMATION ON EVENTS VISIT OUR WEBSITE – www.saisc.co.za

EVENT SUPPORT FOR STEEL AWARDS 2011

The SAISC is very aware of the importance of contracting highly skilled and motivated support persons to ensure the success of this high level event across multiple venues. We proudly acknowledge and recommend the services of the following event associates:

Event management support, including seating arrangements:

Nadine Piek of Ping Pong Communications, with special assistance by Hendré Piek and Glen Warden – Contact: 083 264 4496 / nadine@ping-pong.co.za

Regional event support:

Gauteng:	Miems van Zyl of Omni Arts & Crafts, Tel: 016 349 6839 & Carina Young of Media Chef, Tel: 012 346 5252
Western Cape:	Alfreda Coetzee of Attitude Events assisting Western Cape members of SAISC – 084 549 8447 / alfreda@attitude-events.co.za / www.attitude-events.co.za
KwaZulu-Natal:	Lisa Smith with the SAISC KwaZulu-Natal Committee, chaired by Ricardo Avellini – lisa.m@chillibyte.com

Masters of ceremony and comedians:

Gauteng:	Ryan Hogarth – Contact: Paul at Unique Speakers Bureau, 083 268 6057 / www.uniquespeakersbereau.com / ryan@hogarth.co.za
	Conrad Koch – Contact: conradkoch@mweb.co.za / www.conradkoch.co.za
Western Cape:	(The Other) Michael Jackson – Contact: Paul at Unique Speakers Bureau, 083 268 6057 / www.uniquespeakersbereau.com / michael@theothermichaeljackson.com
	Nik Rabinowitz – Contact: Emma Ress, ERM Stars, emma@ermstars.com / www.nikrabinowitz.co.za
KwaZulu-Natal:	Aaron McIlroy – Contact: Debbie Sumner Entertainment, Debbie@dsentertainment.co.za / www.aaronmcilroy.co.za

Visual Production (all venues) and event production management (Gauteng):

Sian Clark and Wendy Conzalves of Sian Clark Communications – Contact: 083 604 0379 (Sian) / sianclark@vodamail.co.za

Steel Construction journal – Steel Awards 2011 special edition:

Editor:	Reneé Pretorius – ...with pepper communications
Lay-out:	Sandra Addinall – CBT Design
Printing:	Camera Press
Advertising:	Viv van Zyl

(See contact details on page 1 of this issue)

Graphic design (theme, invitations, banners, programmes, loop presentation etc.)

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Framing of awards certificates:

Viv van Zyl of Omni Arts & Crafts – Tel: 016 349 6839 / viv@lantic.net

Technical/AV support and stage sets:

Gauteng & Western Cape:	Dave Mostert & Lenke Elferinck (WCape) of Multi-Media Staging Contact: 011 315 3585 / www.multi-media.co.za
KwaZulu-Natal:	Arranged by the venue, Suncoast Casino Contact: Valerie Pillay, 031 328 3358 / valeriep@tsogosun.com

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Alan Browde of Brooke Browde Communications
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Western Cape:	Adele Goldberg of Picmemories Contact: 083 242 4809 / picmemories@mweb.co.za
KwaZulu-Natal:	Photography by Colleen Contact: 084 408 6677 / colleen@photographybycolleen.co.za

Gauteng stage set created by Dave Mostert of Multi-media.

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