steel CONSTRUCTION

VOL. 34 No. 2 MARCH 2010 COVER PRICE R15.00

THE GREEN ISSUE:

DSE launches new facilities

On structural steel and sustainability

Hollow section profile design – some important pointers

SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

We Speak Fluent Steel

EDITOR'S NOTE

In this issue we cover the 'green' stuff or rather we endorse the true sustainability of structural steel. The 'green issue' is a tricky one with lots of unchartered areas and opportunities for confusion and miscommunication. Our own executive director, Dr Hennie de Clercq, is very knowledgeable on this issue – read his comment on *page 2* and article on *page 12*).

The two projects featured in this issue illustrate how small changes to the way we do things can make a big impact on the environment. The article on Robor's new facility is not only an example of how workshops can be 'green', but it is also a continuation of our tubular steel story.

The search is on for Steel Awards 2010 entries – see *page 17* for the details. To give you an idea of how much mileage you can get for your entry – both the projects in this issue were entered for Steel Awards 2009 and did not win any award, but made for interesting articles. Enter online - http://www.saisc.co.za/steel_awards_10/ – before 30 April 2010.

The SAISC has launched a new look website. Go to www.saisc.co.za and let us know what you think. We think it has a lot of useful information arranged in a way that is easy to find. We will be featuring a few of the website's pages in the upcoming issues of Steel Construction.

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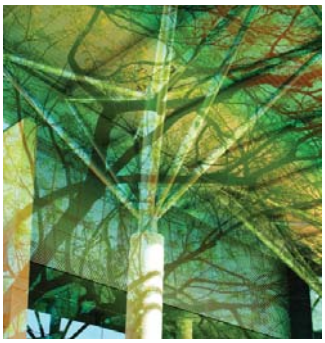
Contents



The Green Issue

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PUBLISHED BY
Southern African Institute of Steel Construction
1st Floor, Block C
43 Empire Road, Parktown West
P O Box 291724, Melville 2109
Tel +27 11 726 6111
Fax +27 11 482 9644
E-mail: info@saisc.co.za
Web site: www.saisc.co.za

EDITOR
Reneé Pretorius
renee@saisc.co.za

ART DIRECTOR
Sandra Addinall
Tel +27 11 868 3408
Fax +27 11 900 1922
E-mail: cbtdesign@adcot.co.za

REPRO & PRINT
Camera Press
Tel +27 11 334 3815

ADVERTISING
Viv van Zyl
Tel +27 16 349 6839
Cell 082 492 8603
Fax 086 647 2788
E-mail: viv@lantic.net

SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION (SAISC)
Executive Director
Dr Hennie de Clercq, PrEng.
hennie@saisc.co.za

Education Director
Spencer Erling, PrEng.
spencer@saisc.co.za

ISF Director
Neels van Niekerk
neels@isf.co.za

SASFA Director
John Barnard
john.barnard@saol.com

CHANGES TO THE MAILING LIST:
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SAISC COMMENT

By Dr Hennie de Clercq,
Executive Director, SAISC

Personally, I am on the side of those who believe global warming is a reality and we have to do something about it. In any case the things that are recommended to fight global warming are generally completely in line with my innate beliefs: my mother taught me to switch off the light when there's nobody in a room, not to waste or destruct, to let what I have go as far as possible.

THE GRAY GREEN ISSUE

If you follow the debate on global warming closely and you aren't confused you are probably one of those who have made up their minds a long time ago and decided that nothing anybody says is going to rock your conviction. For somebody like me who tries to get all the facts and make up my own mind it's a humbling situation – I just experience that in this age where one is bombarded with information it is extremely difficult to evaluate the quality of the information you get, to look through the objectives and biases of those that disseminate information and views, and to come to a conclusion based on sound 'engineering judgment'.

The problem is that there are (at least) two sides to the global warming issue. On the one hand you have the people who say that the world's temperatures are rising and this will have a major impact on humanity, possibly to the point of causing a significant reduction in the world's population (think hunger, war, storms, etc) and the end of civilisation as we know it. If we want to avoid catastrophe the people of the world have to change their ways drastically. More than 90% of the world's scientists who know something about climate, Al Gore and all bunny huggers are in this camp.

On the other hand there are those who say that this is all a scare story, that there is either no proof of global warming or that such warming as there might be is the result of natural phenomena and not of what human beings are doing, and we certainly should not do anything that will cause economic growth to be impaired. A lot of businessmen, George Bush, and a very small percentage of climate scientists fall among the global warming deniers.

There might be uncertainty about the temperature of the earth, but there is no question about the temperature of the debate between the two camps: it's heated! Both sides are blaming the other for twisting the evidence, misleading the public, pursuing hidden agendas, playing with the future of mankind, and being general scumbugs. At the moment I would say that the deniers are making the biggest noise, to the point where they have succeeded in distracting the agenda of world leaders to arrive at a plan for fighting global warming.

Personally, I am on the side of those who believe global warming is a reality and we have to do something about it. In any case the things that are recommended to fight global warming are generally completely in line with my innate beliefs: my mother taught me to switch off the light when there's nobody in a room, not to waste or destruct, to let what I have go as far as possible. Moreover, there is, despite the raging arguments, a strong momentum in the direction of reducing the carbon footprint of everything we do and build. So it makes absolute business sense to position one's company and industry to be in line with this trend.

My recommendations for leaders of companies with regards to this issue are:

- Quantify your company's carbon footprint and take such steps as you can to reduce it.
- Promote steps that will lower the carbon footprint of those you interact with – suppliers, clients, the industry you operate in, etc.
- Think about the business opportunities this whole trend opens up: new products, changes to your product, new projects and clients.
- Tell the story. A company and an industry that is doing innovative things with respect to global warming can surely use this in their marketing and publicity.

Elsewhere in this journal there's an article I wrote on the carbon footprint issue. The primary lesson I would like people to take away from this paper is that we should try to leave a legacy to our kids – something they will find valuable and useful, something that will last.

I believe that with structural steel one can design and build things that will be recognised as legacies for many years after we have left the world, even while allowing us who make these things to make a decent living. Now that's what sustainability is all about!

INDUSTRY NEWS IN BRIEF

B & T STEEL PUTS SAFETY FIRST AND NAILS NOSA AUDIT

B & T Steel's first NOSA audit achieved an outstanding 95.94%, equating to a Five Star NOSA rating.

On the 26th and 27th November 2009, NOSA (the National Occupational Safety Association) conducted a NOSA Integrated Five Star System grading audit at B & T Steel in Delmas. The scope of the audit included all safety, health and environmental activities at the Delmas site. All offsite activities were excluded from the scope of the audit and during the exit meeting NOSA held with B & T Steel, it was clear that B & T had passed their audit with flying colours and that they had clearly outdone themselves.

Lionel Smit, safety manager at B&T Steel is understandably proud of this virtually unheard of achievement first time around: "The NOSA accreditation is compatible with the organisational management systems, standards and legislative requirements of our desired ISO accreditations in quality, environmental and safety and health management. Our next goal is to tackle the ISO9001 Quality Management accreditation, which will focus on ensuring that we meet customer requirements in terms of how we make, sell, deliver and install our products and how much value it adds for our customers." These five stars of excellent quality, environmental, safety, and health management shows B & T's commitment to the best service excellence and delivery a steel construction company could possibly give.

As well as striving to be the best steel construction company in South Africa, it is also very clear that B & T Steel cares for their employees. Moreover, a positive and safe working environment in turn motivates employees to give their best and to always be safety conscious. As part of B & T's commitment to their employees and their commitment to safety, they have installed two LED screens – one in their workshop and one facing the front of the street – on which they display motivational and safety slogans the whole day. This acts as a constant reminder to the B & T employees that safety always comes first.

B&T installed LED screens in their workshops with safety slogans for their employees.

HIGH-LIFT CRANE LEADER

Condra has reported recent deliveries of four high-lift hoists to local customers, one of them an articulated machine with a capacity of 45-tons, another with a very high lift of 112 metres.

Key to this success is the company's K-Series hoist range, which has proved dependable, durable and robust under the conditions of increased mechanical strain associated with the high-lift niche.

The modular design of the K-Series allows rapid modification to specific high-lift application requirements, resulting in delivery times that are usually the shortest available.

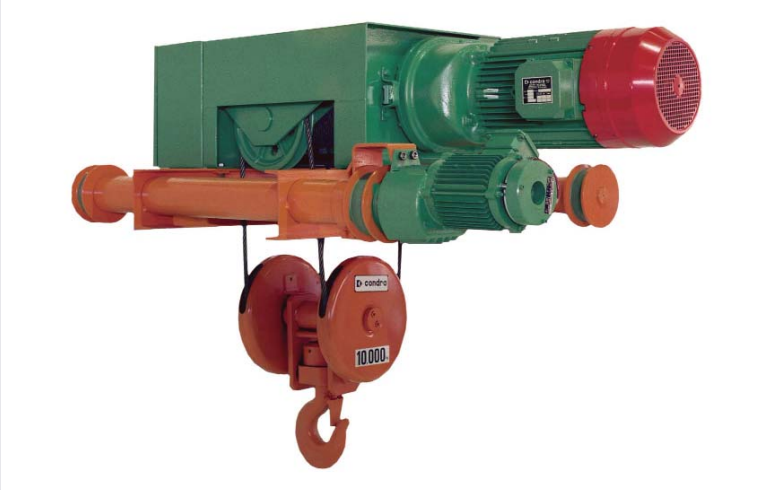
Condra uses silumin rotor cores to enhance K-Series motor-starting torque in the high-lift role, and has developed variable speed control levels on the drives to enable precise load positioning even on lifts of 100 metres and more.

Hoist speeds of between zero and 18 metres per minute, and travel speeds of between zero and 200 metres per minute, are possible.

The company has in the past manufactured mine headgear maintenance cranes with lift heights in excess of 80 metres, more than three times the 25-metres classified by international standards as very high.

ISO 9000 standards are maintained for material and workmanship. Condra is currently finalising its compliance to the ISO 14000 and ISO 18000 standards. Before delivery, all K-Series hoists are rigorously tested for 100 hours, or about 6000 lifts at near full load with double the rated duty. Hoists of 10-tons or smaller are type tested at four times the rated load over a series of ten lifts.

The full Condra range of cranes and rope hoists covers capacities from 250kg to 500 tons. Hoists above 2-tons are manufactured in Gauteng, at the company's custom made premises in Raceway Industrial Park. For lift applications below 2-tons, Condra serves as the sole South African distributor of Hitachi electric chain hoists.



Typical Condra K-Series hoist.

NIGERIAN STUDENTS AT SAIW NOTCH UP FIRSTS

The pioneering 'Train the Welder Trainer' programme that the Southern African Institute of Welding (SAIW) undertook in conjunction with the Nigerian Institute of Welding (NIW) has been a great success. The programme has not only produced Nigeria's first International Welders, but also its first International Welding Practitioners, first International Welding Specialists and – last but not least – Africa's first female International Welding Specialist.

A high-profile Nigerian delegation visited South Africa recently to attend the final graduation ceremony at SAIW, which saw nine Nigerian students receive International Welding Specialist certificates after four months' training in Johannesburg. All of the original intake of 20 students had qualified as International Welders and 14 went on to achieve International Welding Practitioner status.

"The Nigerian students, some of whom had only limited welding skills when they arrived in South Africa, worked incredibly hard to meet the certification standards and progress through the different qualification levels. Spending up to four months so far from home isn't easy and we take our hats off to these students for their staying power and commitment," says SAIW Training Manager Etienne Nell.

Professor Andy Koursaris, SAIW President, said at the graduation ceremony the 'Train the Trainer' project was a wonderful example of regional cooperation. "A skills revolution is needed on the African continent, and this programme has shown us what can be achieved when we work together."

The Nigerian Petroleum Technology Development Fund provided funds for the training programme, which is aimed at building local skills capacity in the Nigerian oil and gas industry, one of the largest in the world. In terms of the agreement with the NIW, the SAIW, an authorised national body of the IIW, is to help Nigeria train and certify welding personnel to international standards.

HOT DIP GALVANIZING ID TAG

KettleTag® PLUS is a metal barcode tag specifically formulated to survive the process of hot dip galvanizing from start to finish.

The tags are attached to fabricated steel parts before galvanizing, via wire fasteners utilising a pre-punched hole

Celebrating excellence: NIW President Simon Edebiri, SAIW President Prof Andy Koursaris; Blessing Diamond – the first woman in Africa to qualify as International Welding Specialist; SAIW Training Manager Etienne Nell; and Jolomi Arenyeka, GM (Finance and Account Division) Nigerian Petroleum Technology Development Fund.

INDUSTRY NEWS

KettleTag® PLUS after galvanizing.

or slot in the tag. InfoSight's KE28xx-series of CO^2 laser printers or LabelLasefi 1000 Tag printers may be used to image barcodes (1D or 2D), standard text, and even galvanizer or customer logos. Bar codes and text remain readable after galvanizing, through to the end-customer's job site.

If a tracking and inventory control system requires an easy and robust method for identification, KettleTag® PLUS is the new industry standard. Real-time printing of custom information, caustic wash and acid-pickling resistance, and zinc dip survivability are just a few of the features of KettleTag® PLUS.

KettleTag® PLUS properties:

- Resists caustic wash and acid pickling;
- Survives molten zinc dip;
- High quality bar codes, 1D & 2D, meet AIM specifications;
- High contract text for easy readability;
- Company logos and bitmap images;
- Free windows-based layout software;
- Metal substrate for durability and rough handling;
- UV-stable and weather resistant;
- Wide temperature range: -22°F to 1400°F (-30°C to 760°C)
- Typical size: 3" x 3" (75mmx75mm), custom sizes available.
- Turnkey print-on-demand system.

SAISC STEEL AWARDS 2010

the 29th event

THE STEEL CONSTRUCTION AWARD FOR EXCELLENCE IN THE UTILISATION OF STRUCTURAL STEEL

SAISC steel awards dinner: 15 september 2010
closing date for nominations: 30 April 2010

CATEGORIES

There are no fixed categories in which to enter projects. Judges decide on categories and winners in the respective categories based on the actual entries received every year. In 2009 the following categories were covered:

● Sports Stadia ● Export ● Tubular Structures ● Technical Excellence ● Architectural Structures ● Light Steel Frame Buildings ● Residential ● Industrial and Mining

Please note that we do our best to give ALL projects entered some publicity – even the so called 'run of the mill' industrial projects.

PLEASE ENTER YOUR PROJECT!

CRITERIA FOR ADJUDICATION

The primary criterion: Does the project illustrate what can be achieved with steel?

Other factors to be considered:

- The importance of steel as a structural component of the project
- Benefits achieved by using steel construction
- Aesthetic appeal
- Innovation in design, fabrication or construction
- Technical prowess required for realising the project
- Engineering expertise
- Environmental awareness
- Tubular content
- Export project
- Satisfaction of client's brief, particularly cost effectiveness
- Special details: cladding, bolted or welded connections, or the like
- Value to society
- Any other unique features

CONDITIONS OF ENTRY

- Substantial completion of the steelwork must have occurred in 2009. Completion of the total project could be later.
- Only structures in which South African steelwork contractors played a significant role will be considered.
- Written and illustrative material forming part of the project entries will become the property of the SAISC.
- The SAISC reserves the right to publicise the nominations and awards as it sees fit.
- The SAISC may visit short-listed structures for adjudication, publicity or filming purposes. The nominator and members of the project undertake to assist in arranging such visits and to furnish the SAISC with additional information about the project on request.
- Certificates will be presented to each company that was a member of the project team associated with the winning structures at the Steel Awards dinner on 15 September 2010.
- A plaque for mounting will be presented to the developer/ owner of the overall winning structure.
- By submission of an entry, the nominator assumes responsibility for the accuracy of all information, and provides the SAISC with assurance that permission for the submission has been obtained from the owners of the project.

MATERIAL TO BE SUBMITTED

To enable the SAISC to give proper publicity to the nominations, the following is requested:

- The fully completed entry form

  Note: It is critical that project information and names of the team members are submitted accurately (also details such as (Pty) Ltd, JV, etc.) – What is submitted will be used in the publicity regarding Awards projects. Errors lead to embarrassment for everyone involved with the project submitted and for the SAISC. Please prevent this by double-checking all details.
- Pictures of the project: A minimum of 5 and a maximum of 10
  - *High-resolution digital photographs on a CD (jpg format, at least 300 dpi);*
  - *Include at least 2 of the whole project (wide angle shots) and at least 3 of relevant detail from a closer view. The balance of pictures may be of any relevant aspect.*
- A description of the project and a motivation for entering the project of at least 500 words.
- Other supporting material (video clips, drawings, etc.) that is really relevant and will give a better understanding of the project may also be included.

PLEASE SUBMIT ENTRIES TO:

SAISC Steel Awards 2010 for attention Reneé Pretorius

Enter Online:
www.saisc.co.za/steel_awards_10/

Office Address:
1st floor, Block C, 43 Empire Road,
Parktown West, Johannesburg, South Africa

Postal Address:
PO Box 291724, Melville, 2109, South Africa

Enquiries:
Reneé Pretorius
Tel: +27 11 726 6111
E-mail: renee@saisc.co.za

Nomination Deadline:
The complete entry must be received on or before Friday, 30 April at 24:00.

Receipt of entries will be confirmed by e-mail within 72 hours. Please enquire if you have not received contact from us in this regard.

we speak fluent steel

CALENDAR OF EVENTS

SAISC COURSE: BASICS OF STEEL
12 April 2010 – Johannesburg
14 April 2010 – Durban
16 April 2010 – Cape Town

HIGHRISE TOWERS AND TALL BUILDINGS 2010: DESIGN AND CONSTRUCTION OF SAFE AND SUSTAINABLE HIGH RISE STRUCTURES
14 – 16 April 2010
Munich, Germany
www.hrs.tum.de

SAISC GOLF DAY
21 April 2010
Killarney Country Club, Lower Houghton

STEEL AWARDS 2010 – DEADLINE FOR ENTRIES
30 April 2010

SAISC COURSE: BEST PRACTISE
6 & 7 May 2010 – Johannesburg
10 & 11 May 2010 – Cape Town
17 & 18 May 2010– Durban

NORTH AMERICAN STEEL CONSTRUCTION CONFERENCE
12 – 15 May 2010
Orlando, Florida
www.aisc.org

1st INTERNATIONAL CONFERENCE ON STRUCTURES AND ARCHITECTURE
21 – 12 July 2010
Guimaraes, Portugal
www.icsa2010.com

SAISC COURSE: LIGHT INDUSTRIAL BUILDINGS
26 & 27 July 2010 – Durban
29 & 30 July 2010 – Cape Town

SAISC COURSE: CORROSION PROTECTION
16 & 17 August 2010 – Durban
19 & 20 August 2010 – Cape Town

STEEL AWARDS 2010 – DINNER
15 September 2010
Conference Centre, Emperors Palace, Jones Road, Kempton Park

STEEL STRUCTURES: CULTURE & SUSTAINABILITY
20 – 22 September 2010
Istanbul, Turkey
www.sscs2010.com

ARCHITECTURE ZA2010
22 – 27 September 2010
Johannesburg
www.saia.org.za

9TH PACIFIC STRUCTURAL STEEL CONFERENCE
October 2010
Beijing
www.pssc2010.com

13th INTERNATIONAL SYMPOSIUM ON TUBULAR STRUCTURES (ISTS)
15 – 17 December 2010
Hong Kong
www.hku.hk/civil/ISTS13/

SAISC, ISF & SASFA AGM
18 November 2010

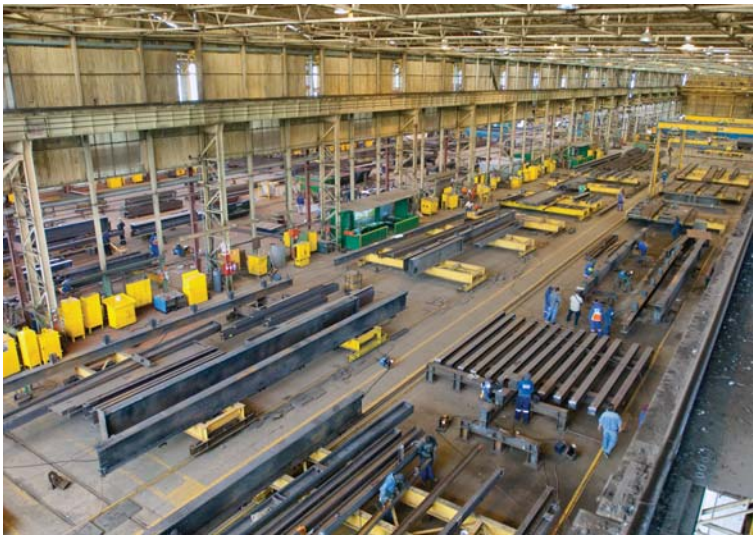
EUROSTEEL 2011
31 August – 3 September 2011
Budapest, Hungary
www.eurosteel2011.com

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

THE AVENG GROUP

DSE LAUNCHES ITS NEW FACILITIES

DSE has gone from strength to strength since celebrating their centenary year in 2003. On 28 January 2010 DSE opened its upgraded and expanded workshop facility at Vanderbijlpark for the industry to experience and enjoy a party they can still not stop talking about (well, until Steel Awards...). And it was a truly 'green' event – to feature befittingly in our 'Green Issue'.



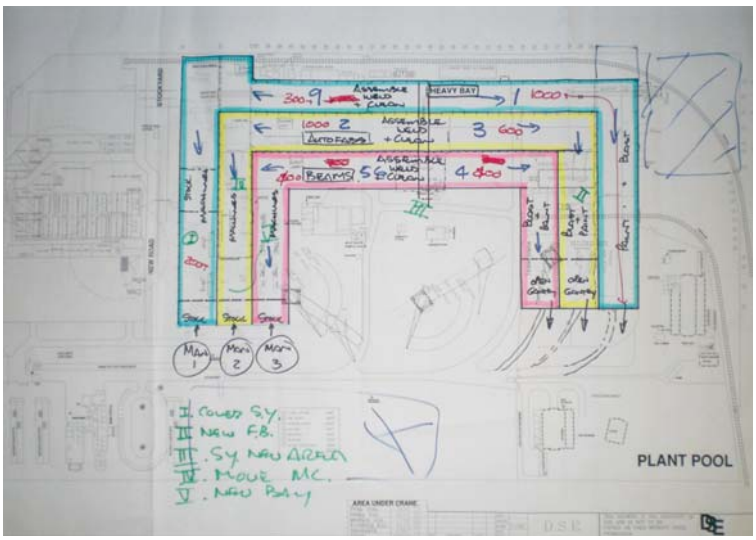
Inside DSE's upgraded workshop.

DSE has gone from strength to strength since celebrating their centenary year in 2003. On 28 January 2010 DSE opened its upgraded and expanded workshop facility at Vanderbijlpark for the industry to experience and enjoy a party they can still not stop talking about (well, until Steel Awards...). And it was a truly 'green' event – to feature befittingly in our 'Green Issue'.

All sectors of the construction industry were represented on the great day. From engineers, project managers, architects, managers, CEO's as well as the media and DSE's own staff and their family members attended the facility tour and the festivities.

This year DSE celebrated a 107 year heritage from 1903 with Dorman Long in South Africa. DSE's Vanderbijlpark workshops were established in 1947 and first started producing structural steelwork for the 'Iscor Works' (now known as ArcelorMittal). With various mergers and acquisitions DSE became part of LTA in 1996 and part of the Grinaker-LTA group in 2000 with a further grouping under Grinaker-LTA M&E in 2002. Since 2006 it is The Aveng Group's structural steel specialist.

Some two and a half years ago DSE embarked on a project to upgrade their existing facility. At the time the facility was an impressive 22 800m² with a maximum output capacity of around 2 000 tons per month.



The big plans started here – a draft of the workshop.

Contact Details:
Kobus Marais
PO Box 68, Germiston, 1400
Tel: +27 (0) 11 871-4111
Fax: +27 (0) 11 871-4141
E-mail: kmarais@grinaker-lta.co.za
Website: www.dse.co.za

An external view of the workshop.

But the beginning of a new DSE came before the decision to increase their capacity...

In order to understand what they needed to change they first had to understand what they wanted to achieve, and hence a new vision:

To be the preferred world class structural steel fabricator focusing on a four (4) week turnaround and the ability to meet market demand.

Using this new vision as a foundation they started to change some of the structure within the company, moved people, created new positions and the branding was updated.

Following on the trend created in The Aveng Group a continuous improvement department was created to ensure that DSE remained competitive.

Learning workshops were held with the artisans, as well as with top management to gather information on what was needed on the shop floor. From these sessions the draft drawing for the shops was compiled and later finalised to what the visitors saw on the day of the launch.

Multiple trips overseas were conducted to acquire new machinery and they also embarked on a huge project to write custom software that will allow them to track individual items through the works with revolutionary technology in the form of BOCAD-PS and hard stamped 2D coding.

Today DSE has a facility that is capable of between 4 000 and 6 000 tons/month dependant on the mix. They have the capacity to lift a

Kobus Marais addresses the audience.

maximum of 200 tons with their cranes in the heavy workshop bay (two 100 ton overhead cranes spanning 36m).

The columns for their workshop bays were previously the support structures that were built for the Moses Mabhida Stadium arch, built in Durban for the 2010 Soccer World Cup. Nothing goes to waste.

Dedicated bays, designed for specific types of work will allow them to estimate and cost according to the bay. They have over 75 000m^2 under cover area and have access to over 220 000m^2 of lay-down area adjacent to the workshop. Part of that is used by Bulldog Projects to do the DSE blasting and painting.

A few years ago DSE also identified draughting resources as a potential problem and together with the South African Institute of Steel Construction embarked on a project where they created what is today known as the DSE/SAISC School of Draughting. Many companies supported this process to make this a success. At the same time as the draughting school, DSE started embarking on a extensive artisan training programme which also included amongst other 20 female welders.

DSE has been involved in building some major iconic structures including almost all power stations in South Africa: Colenso Power station in 1922, Klip P/S, Vaal P/S, Vierfontein P/S, Hex River P/S, Taaibos P/S, Umgeni P/S, Highveld P/S, Komati P/S, Ingagane P/S, Wilge P/S, Camden P/S, Grootvlei P/S, Hendrina P/S, Arnot P/S, Van Eck P/S, Kriel P/S, Matla P/S, Duvha P/S, Tutuka P/S, Lethabo P/S, Kendal P/S, Burj Al Arab in Dubai, Emitares Towers Dubai, Nelson Mandela Bridge, Soccer City in Johannesburg, Greenpoint Stadium in Cape Town, Moses Mabhida Stadium in Durban and many mining and other structures.

They also constructed these works while they were building some of the major infrastructure projects – a major challenge. DSE is currently also involved in the Medupi and Kusile powers stations.

In 2009 they walked away with no less than three Steel Awards: Overall winner for the Moses Mabhida Stadium, Sports Stadia category winner for Soccer City and for no 17 shaft Impala Platinum for winning the Mining and Industrial category.

Kobus Marais, managing director of DSE Structural Engineers and Contractors concluded the formal proceedings by thanking the shareholders (Aveng and Grinaker-LTA) for the financial and moral support in expanding this facility and for 'sticking by' DSE in supporting this new direction and vision. He also thanked the DTI for their financial support through the EIP programme. Investing in the manufacturing and construction industry and creating jobs through these initiatives.

"I also want to thank each and every client that supported us over the past 10 decades, the last 7 years and more specific in the future. What you see here is a start of a major growth in this country, into Africa and for that matter in the world." Marais concluded.

The Green Party..

JEFF PACKER

By Spencer Erling,
Education Director, SAISC

But when it comes to writing about Jeff the real person, we could fill a whole issue of Steel Construction. So, condensing some of his delightful traits into a short order is a tall demand.

It is not often that we have the opportunity to have an authority like Jeff Packer who can and is prepared (and I suspect wants to) come to South Africa and share his knowledge and wisdom in the design and construction of tubular (hollow sections) steel structures.

Jeff has a most impressive CV – here is a summary: He is a Bahen/Tanenbaum Professor of Civil Engineering at the University of Toronto in Canada. He graduated from the University of Adelaide, Australia in 1972, then subsequently received his Master's degree from the University of Manchester (1975) and Ph.D. from the University of Nottingham (1978), in the U.K. Since his initial appointment at the University of Toronto in 1980 he has undertaken research, development and consulting work primarily on tubular steel structures. He has published extensively on this topic, including several co-authored CIDECT design guide books (published in four languages), another in Chinese, two design guides for the Canadian Institute of Steel Construction (CISC), and another for the American Institute of Steel Construction (AISC).

He currently serves on technical committees for the American Welding Society (AWS D1), AISC, the Comité International pour le Développement et l'Étude de la Construction Tubulaire (CIDECT), the Canadian Standards Association (CSA) and the International Institute of Welding (IIW), where he recently also served on the board of directors (from 2004 to 2007). He is a licensed Professional Engineer in Ontario and the U.K., a Fellow of the American Society of Civil Engineers, a Fellow of the Institution of Civil Engineers (U.K.) and has served on the editorial boards of several journals. Having co-founded a University of Toronto start-up company, Cast ConneX®, incorporated in Canada in 2007, he serves as president and a director of this venture.

His recent awards include: Kurobane Lecture Award (ISTS, 2003), American Institute of Steel Construction Special Achievement Award (2005), H.A. Krentz Research Award (CISC, 2005), Houdremont Award (IIW, 2006), a Doctor of Science degree from the University of Nottingham (2006) and the Canadian Society for Civil Engineering "Excellence in Innovation in Civil Engineering Award" (CSCE, 2009).

But when it comes to writing about Jeff the real person, we could fill a whole issue of Steel Construction. So, condensing some of his delightful traits into a short order is a tall demand.

Jeff is an easy going person who mixes easily and comfortably with strangers, especially those who have something in common, which does not have to be only engineering. Jeff loves the outdoors and bemoans the fact that in Toronto Canada, this can be quite restricted in the winter months.

Jeff and his wife Darinka enjoy history and antiquities so they managed to include a few days visit to Cairo on his way down to South Africa. His wife returned to Toronto to carry on motherly duties to their two children (13 and 8).

During his very rushed and busy schedule of three one day courses in Cape Town, Durban and Johannesburg, the working team of Jeff, Franco Mordini, Colin Shaw and Spencer (not all the time) managed to do some 'quality tourist' time. Jeff identified in advance what he wanted to see and visit, from the details below you come to understand more and more about the person.

In Cape Town, this included a tour around part of the Peninsula, a drive past visit to the new Cape Town stadium which was capped with a visit to Robben Island (this was a first for some of the SA team).

The time in Durban was exceptionally short so sightseeing was restricted to a drive by and around visit to Moses Mabhida Stadium – one that really excited Jeff from a technical perspective and overall impression.

The weekend between Durban and Johannesburg was spent in the 'Berg'. Montusi was a delightful venue to spend it in. Being only 20 minutes drive from the Amphitheatre parking area, the team walked for four hours in the Amphitheatre region, but sadly the cloud cover never really opened up sufficiently to really appreciate the grandeur of the Amphitheatre. Oh well Jeff, you will just have to come back for that view!

Jeff is a dedicated father, he shared with us the sobering news that even in first world Canada basic mathematics teaching standards have severely dropped, forcing him to push mental arithmetic and other mathematics 'down his kids throats' to ensure a good grounding for the future.

Jeff has also worked out how to 'use the system' to his family's benefit. When approached to do a one month lecturing visit to Singapore recently the terms of agreement were that his family came with. They were accommodated in a visitors residential facility on campus, where they ate at the student facilities thus keeping costs down, swam in the university pool etc. The nett result was a great summer

holiday for his family, (in the middle of Canada's winter of course!) whilst he 'sang for his supper'.

He has a delightful sense of humour which is not only limited to his lectures.

We look forward to welcoming Jeff and hopefully next time, with his family in South Africa again in the next few years.

NEW FACILITIES AT ROBOR – A GREEN SOLUTION

Storm water is channelled from the roof into a retention dam, which is then recycled as process water back into the manufacturing process. Natural light has been filtered into the building reducing the dependence on factory lighting during the daytime.

Robor has announced a restructuring of its operations in order to expand its service offering and deliver a comprehensive, simplified approach to projects.

Spearheaded by a new R80 million facility and the purchase of state-of-the-art laser cutting and high definition plasma cutting equipment, the initiative sees all value added services grouped under one division with one management structure for improved efficiency.

NEW FACILITIES

Robor's new facility is a fairly light steel construction, which made it feasible to build on previously disturbed land due to underground mining. During the design phase attention was given to the following focus areas: flexibility, green building criteria, energy saving solutions and attention were given to quality standards in steel construction.

The steel construction lends itself to be transformed from a manufacturing facility to a warehouse facility or visa versa. This steel type portal structure ensured maximum versatility and fast erection at a very competitive cost.

In the process of constructing and erecting this facility, a phase approach had to be adopted to allow for an existing warehouse to be dismantled, reconfigured and re-erected.

Need for the factory facility

There were mainly two reasons that facilitated the need for a new factory and lean-to. Firstly, to consolidate the majority of Robor's manufacturing business on a single site to reduce costs through synergies.

Secondly, was a strategy decision taken to create a central 'value add hub' combining current value add businesses, as well as creating a number of new value add businesses.

The Trumpf TruLaser Tube 7000 laser cutting machine is the first of its kind in South Africa

What makes this factory unique?

The factory facility was constructed in two phases. The main reason for a phased approach was to optimise utilisation and also allow for the dismantling of a steel structure that was in the way of the new facility. The old structure was refurbished then re-erected on another Robor site.

Apart from the vast size and fairly light steel construction the factory boosts a number of energy and environmental initiatives.

Natural lighting: The steel structure made it easy to install Polycarbs into both the roof and side sheeting, which negates normal daytime dependence on factory lighting, therefore reducing the electricity usage during the day for factory lighting.

The steel structure and floor have been painted in a light colour which has enhanced the natural light entering into the factory.

Selective switching: Factory lighting has been designed on the basis that lights maybe switched on and off on an individual row bases, allowing for the minimum number of lights to be on as to comply with the statutory requirements.

Robor storm water retention tank.

Generators have been employed to provide uninterrupted power supply, ensuring the value add businesses can continue to trade.

The logistics in and around the factory has been analysed to allow for flexibility within the value add facility.

Storm water from the factory facility roof is contained in a 400 000 litre underground containment tank, which is then recycled back into the factory facility as process water (raw water) providing a self sufficient flow of process water allowing the Value Add production units to continue to operate in times of water disruption.

The structure and good load spread allowed Robor to build on previously mined land.

Roll grooved pipes produced in-house by Robor, with a larger than required diameter, was ring fed throughout the facility. This created additional capacity that supports flexibility.

ROBOR RESTRUCTURING ENHANCES OFFERING

The new facilities allowed Robor to streamline and enhance their offering to their customers.

According to Andrew Winter, managing director, Robor Steel Services, the value added service offering, used with much success in its Pipe Systems business unit for the supply of conveyance systems, is being vertically integrated into the entire Elandsfontein operation. "This move enables Robor to offer customers a more comprehensive service from one supplier, essentially backing our products from start to finish. We are taking advantage of our established systems and logistics to roll out these services, in effect becoming part of our customers' supply chain," says Winter.

The Microstep HD Plasma Cutter is ideal for providing tube for structural applications and features a three dimensional head.

In addition to the conventional services, such as cutting, ring rolling, bending, painting and drilling, Robor is able to take a customer's requirements or drawings and convert them into a solution that is transported to site ready to assemble.

Robor is supplying components for projects, ready to be installed once on site. The benefit for their customers is cost-effectiveness and improved efficiency. As the only supplier, they can ensure better lead times, simplified logistics, less administration and better co-ordination. There are no delays on a project while waiting for other components from other suppliers.

Robor has established solid relationships with sub-contractors that are able to offer complementary equipment and skills should they be required.

The value added service facility is also available for fabricators and distributors to use.

The company's resources, established systems and logistics capabilities allow Robor to supply to a number of projects on a just-in-time (JIT) basis. This reduces a customer's stock holding and assists in making the project more efficient.

2nd phase factory and lean-to.

TRICOM STRUCTURES INSTALL A WIND TURBINE ON A TELECOMMUNICATION TOWER

The site is in a very remote and ecological sensitive area. It was very important to MTN to minimise the environmental impact of the project.

The turbine with the top section of the mounting structure at the start of the lift.

The project was a renewable energy supply for a MTN telecommunications site at Kleinaarpan, approximately 130km North of Upington. The supply and installation of a wind turbine with associated mounting structure was contracted to Tricom Structures.

The site had an existing 80m Tricom tower for telecommunications equipment with the antennas on the top of the tower already installed.

A BWC EXCEL-R turbine was selected for the site. The turbine's weight is approximately 500kg and has a rotor diameter of 7 metres. The site is in a very remote and ecological sensitive area. It was very important to MTN to minimise the environmental impact of the project.

After detailed analysis of the existing Tricom tower it was determined that it is possible to mount the turbine directly onto the telecommunications tower. The main challenges were designing an appropriate interface between the tower and the turbine and constructing a temporary structure that could facilitate the construction of the interface and turbine on the existing tower.

The attachment of the turbine at the top of the tower. The temporary structure also helped the workers by providing a perch from which to work.

Assembly of the turbine

ADVANTAGES OF USING A TELECOMMUNICATIONS TOWER TO MOUNT THE TURBINE

Usually when a wind turbine is installed on a telecommunications site a separate tower for the wind turbine is constructed next to the telecommunications tower. The additional tower requires more land to be used for the site as well as the materials and labour associated with the construction of the foundation and tower for the turbine. Due to cost considerations the turbine tower is usually shorter than the telecommunications tower resulting in shading of the turbine from the wind for certain wind directions.

The power produced by a wind turbine is proportional to the cube of the wind speed. The wind speed increases due to an increase in height and therefore by increasing the height of the turbine the power produced can be increased. For example, a turbine mounted at 85 metres will deliver more than twice the amount of power than the same turbine mounted at a height of 15 metres.

By using the same tower for both the telecom equipment as well as the wind turbine the contractor reduced the land required, the materials and labour used resulting in lower overall cost and environmental impact. Furthermore the turbine's output is increased and a smaller and less expensive turbine could be used to generate the required power.

SITE CONSIDERATIONS

The site location posed a number of challenges. The site is only accessible using 4x4 vehicles and is approximately 1 000km from Johannesburg. In addition no water is available at or close to the site. The construction of an additional foundation and tower would therefore be costly whereas using the existing telecommunications tower results in only a tower-turbine interface that needs to be transported to site.

INTERFACE STRUCTURE

A bolted lattice structure was used for the mounting structure of the turbine. The mounting structure was assembled on the ground in three separate pieces. This simplified the lifting of the structure and the installation on the tower.

The mounting structure for the turbine had to be able to withstand the forces of the weight of the turbine, as well as the wind forces on both the structure and the turbine. It was therefore neces-

Tower with turbine after assembly.

sary that the structure was constructed from steel in order to provide the necessary strength.

The lattice structure was designed in such a way to afford easy access for maintenance inspections on the turbine. This was accomplished by the selection of the width of the structure together with the spacing of the horizontal members. Additionally a small detachable maintenance platform could be attached to the structure in order to provide accessibility to the turbine. The maintenance platform was constructed from angled steel and bolted directly onto the turbine mounting structure.

INSTALLATION

Due to the height of the tower and the fact that antennas were already installed it was crucial that the installation was controlled to the greatest extent possible. A temporary steel structure was erected on top of the existing tower in order to provide a lifting point for the mounting structure and turbine. An angled steel bolted construction was used for the temporary structure and an I-beam with a beam crawl was used to provide an adjustable lifting point.

LIGHTWEIGHT STEEL SOLUTIONS FOR EASTGATE SHOPPING CENTRE

According to Grinaker-LTA contracts director John McLaughlin, weight was a critical consideration for this project due to the fact that they needed to build on top of a parking area, and Vela's solution was an ideal match for the needs of the project.

Vela Steel Building Systems
Tel: 011 397 8742
E-mail: brent@velasbs.co.za
Website: www.velasbs.co.za

project team

Client:
Liberty Life Properties

Principal Agent:
Henry Mokala Projects

Architect:
MDS Architects

Quantity Surveyor:
MLC Quantity Surveyors

Structural Engineer:
AKI Consulting Engineers

Main Contractor:
Grinaker LTA Building Inland

LSFB Contractor:
Vela SBS / Browndeck

10m high entrance wall and canopy constructed with lightweight steel.

Leading lightweight steel solutions company, Vela Steel Building Systems (Vela), has provided a unique walling solution to Grinaker-LTA for the new food-court and restaurant area at the Eastgate shopping centre in Bedfordview.

More than 4 000m^2 of walling with 6m spans between columns and heights of up to 10m were designed and manufactured in Vela's factory in Isando and installed by Browndeck, who are specialist lightweight contractors. "We believe that these dimensions make these walls among the largest ever constructed in lightweight steel in this country," says Brent Harris, managing director of Vela.

COST EFFECTIVE AND EFFICIENT

According to Grinaker-LTA contracts director John McLaughlin, weight was a critical consideration for this project due to the fact that they needed to build on top of a parking area, and Vela's solution was an ideal match for the needs of the project. "We considered alternate solutions and Vela's was the

Primary steel frame being erected prior to fixing of lightweight steel.

Lightweight steel acoustic and feature wall.

most cost-effective, given the special requirements and the fast-track nature of the contract. We are satisfied with the results," says McLaughlin.

Four types of structural walls were erected on the Eastgate project: acoustic walls; screen walls; feature cavity walls and standard walls. All of the wall types included structural lightweight steel frames, various types of board cladding, skim plaster and internal insulation giving them their required characteristics.

Vela contract manager Wayne Cumming says Vela's design and manufacturing process followed a fixed procedure. "All our designs were signed off by an external engineer and our subsequent working drawings then approved by Grinaker's engineers before production at our factory commenced," says Cumming.

"Once the primary structural steel frame was erected by other contractors, its dimensions were accurately measured to ensure the perfect fit for the Vela panels, which were rolled and pre-assembled in the factory and delivered to site on a just-in-time basis."

Cladding of lightweight steel frame wall.

Advantages of the lightweight steel walling system:

- **Speed of erection:** Vela's lightweight steel structures are erected in a short time-frame, which translates into significant cost savings due to a shorter programme and lower P&Gs.
- **Weight reduction:** The lightweight Vela system ensures significant cost savings in foundation design.
- **More usable interior space:** Due to the thinner wall profile, the usable interior space, with the same stand coverage, is larger than if conventional materials were used.
- **Energy saving:** Light steel frame walls provide excellent insulating properties leading to savings in energy. Also, adding to the environmental and sustainable benefit is the fact that the steel is recyclable and there is minimal waste removed from site.
- **Easier installation of services:** Service holes are pre-punched in Vela's wall panels for services to run horizontally or vertically without the need for 'chasing' walls.

MORE COMMERCIAL PROJECTS IN THE NEAR FUTURE

The new food-court and restaurant area at the Eastgate shopping centre was the company's first commercial project for Grinaker-LTA and its success has led to a second project – supplying Grinaker-LTA with 560m^2 of lightweight walling for the new Heineken Brewery in Kliprivier.

Vela has developed a notable reputation for its innovation in lightweight steel manufacture. Vela's wall panels are used in the full gamut of housing from low-cost to upmarket and in commercial situations like Eastgate. The company's lightweight 'U'-Truss roof trusses have also become increasingly popular within the building industry. "Not only are our trusses lighter and thus proportionally less expensive, but they can also be flat-packed and delivered to the site, saving significantly on transport costs. Importantly, the ease of assembly and erection has made them the preferred truss system for erectors," concludes Harris.

John Barnard, SASFA director.

SASFA TRAINING COURSE FOR BUILDERS OF LIGHT STEEL FRAME BUILDINGS

By John Barnard, SASFA director

Registrations for the course came in from far and wide – from Gauteng, Durban, Nelspruit, Despatch, Cape Town, Angola, Nigeria and London! The course was oversubscribed – we could only accept 20 registrations - and we had to ask some applicants to wait for the next course.

In response to many requests from industry for a training course for builders of light steel frame buildings, SASFA offered a course in Gauteng, from 8 to 19 February 2010. The aim was to equip potential builders with knowledge and skills to enable them to erect a simple steel structure, and to be able to plan and supervise the installation of cladding, lining, insulation and services. The course was offered over a period of two weeks – the first week being dedicated to the steel structure, and the second to the cladding, lining and insulation operations. During the course the theoretical aspects were supported by practical work on site.

Great support was received from SASFA members – Mitek offered to host the training course at their premises in Midrand, providing not only the facilities and catering, but also the wall frames and trusses for a 24m^2 building. Everite and Saint-Gobain provided the training required to fully understand the installation of their materials, respectively fibre cement boards for cladding, and gypsum boards and bulk insulation materials for the lining and insulation operations. They also supplied the materials required to clad the structure externally and internally.

ArcelorMittal supplied the high strength galvanized steel for the structure, and Group Five Housing contributed by casting a dimensionally accurate 6m x 4m slab for the structure. Global Innovative Building Systems supplied the OSB board needed for sheathing used in conjunction with fibre cement planks, and Kare supplied most of the specialised fasteners required for the project.

Registrations for the course came in from far and wide – from Gauteng, Durban, Nelspruit, Despatch, Cape Town, Angola, Nigeria and London! The course was oversubscribed – we could only accept 20 registrations – and we had to ask some applicants to wait for the next course.

During the first week, the group was exposed to lectures by John Barnard (SASFA), Mike Crawford (Everite) and Richard Bailey (MiTek) on the LSFB industry in South Africa, the components of the steel frame, background on steelmaking and the properties of galvanized steel. The LSFB manufacturing and building processes were explained, followed by instruction on how to set out the wall frames on a floor slab.

Nobody warned us about having to write tests!

Above left and right: Everybody had a go at the practical part of the course.

Hilti, a supplier of equipment required for the erection of light steel frames such as electric drills, screw guns and laser levels, demonstrated the use of their products on the site, and by the end of the second day, the wall frames of the 6m x 4m training structure had been erected! In this process, the importance of accurately cast foundations and slabs was realised, as spacers had to be installed under the frames to compensate for the expected minor deviations in the levels of the concrete slab. Then it was back to the lecture room to cover the theory around roof structures, which were erected on the 4th day. In conclusion the group had to write an exam to confirm the knowledge gained – they achieved an excellent average mark of 83%!

During the second week attention was given to cladding, lining and insulation. Mike Crawford (Everite) and Peter Harper (Saint Gobain) lectured on the properties of the respective materials – fibre cement, gypsum board and insulation: how it is made, as well as handling, storage and installation. Each section was followed by a practical session on the training site. Due to the limited time, only sections of the walls were clad and lined, not the whole structure. The week was again concluded by a written test.

The students thoroughly enjoyed the course, as was illustrated by their 85% overall rating of the different aspects of the course - venue, content, hand outs, presentation, practical work etc. Certificates of successful completion will be issued, and those candidates not yet members, will be invited to become 'student' members of SASFA for a period of 1 year. We will approach existing members to, as far as possible, assist newcomers to this industry by a process of mentorship on their building projects.

We are planning to repeat the course in Durban and Cape Town later during 2010.

Mike Crawford and Peter Harper.

Richard Bailey answering questions on LSF roof trusses.

Kunle Sonoiki from London, getting to grips with a boerewors roll.

SAISC COURSE OF SILOS AND TANKS

Around the middle of 2009 the Institute presented a course on conveyors and chutes. Many participants to that course indicated high interest in more courses relating to the broader theme of structures for materials handling. As a consequence the Institute presented a three day course on silos and tanks, 8 to 10 February 2010 at Heritage Conference Centre in Rosherville. This time the key presenter was Michael Rotter, a well known expert and author in this specialist field, currently Professor in Civil Engineering at the University of Edinburgh and member of several standards committees, including CEN, ACI, AS, ASME and ECCS.

Judging from the course feedback by attendants, Prof Rotter certainly knows a thing or two about silos and has an engaging way of conveying this knowledge! Wouter Deijs, who was a key presenter with the Conveyors & Chutes course, and SAISC Directors Hennie de Clercq and Spencer Erling also presented complementary lectures during the course. The course was attended by around 86 participants, some from as far afield as Cape Town, Durban and Bloemfontein – among these were a number of industry stalwarts. Judging from the interest in this subject we will need to consider a repetition in a year or two.

355 TUBE LAUNCH

February may be the shortest month, but in 2010 this month was bursting at the seams with training and events in the steel industry.

The Association of Steel Tube and Pipe Manufacturers of SA (ASTPM) and the SAISC jointly hosted a series of double-barrel events across the country to create awareness of the launch of the 355 grade steel hollow section.

International tubular expert, Professor Jeff Packer of the University of Toronto, Canada, delivered a guest presentation on spectacular tubular applications through the ages and around the world to a wider audience over breakfast. This was followed with more technical sessions for the remainder of the day with enough formulae and calculation work to make any structural engineer's heart beat faster (except in Johannesburg due to the seemingly sub-zero room temperature!). The 355 Tube Launch was officially opened in all venues by ASTPM Chairman, Colin Shaw, with complementary presentations by Franco Mordini (ASTPM) and Spencer Erling (SAISC).

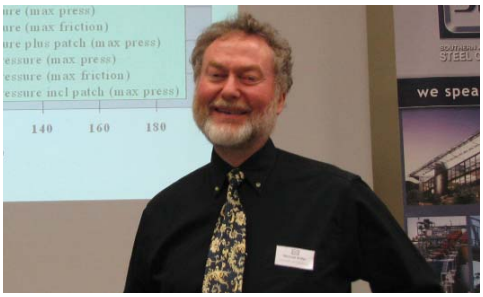
In addition to the presentations, leading role players Macsteel Tube and Pipe, ArcelorMittal SA, Trident Sterling Tube and Robor used the opportunity to exhibit information and models.

The launch was presented in the two-part format in Cape Town, Durban and Johannesburg, reaching a total audience of about 480 persons over breakfast and about 160 for the technical sessions. Companies represented included architects, designers, engineers and even the financial sector.

SOCIAL SNIPPETS

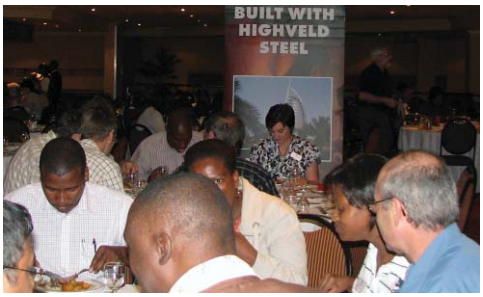
By Marlé Lötter
Events Manager, SAISC

Some of the 'hard-core' members of industry attending the silos and tanks course .



Professor Michael Rotter (Civil Engineering, University of Edinburgh) was the key presenter of the course on silos and tanks.

The 355 Tube Launch was jointly presented by the ASTPM and SAISC.
From left: Guest presenter Prof Jeff Packer (University of Toronto, Canada), Colin Shaw (Chairman, ASTPM), Franco Mordini (ASTPM), Spencer Erling (SAISC).



Highveld Steel courteously sponsored all catering for breaks and lunch for the 355 Tube sessions at the Emperors Palace in Johannesburg.

ON STRUCTURAL STEEL AND SUSTAINABILITY

By Dr Hennie de Clercq, Executive Director, Southern African Institute of Steel Construction

This paper first appeared in the Green Building Handbook, South Africa – The Essential Guide Volume 2

Much has been written and said about sustainability and much more will be said in future. Among this deluge of information I will try to make a contribution by looking specifically at the sustainability of structural steel in South Africa. The question to be answered is: how does steel stand up when measured in terms of the three dimensions of sustainability – social, economic and environmental?

Sustainability is often expressed in negative terms: don't waste, don't exhaust resources, and the ultimate: don't steal from your children!

That's correct, of course, but shouldn't one rather adopt a positive view: make what you have go further, find new resources, and the ultimate: leave a valuable legacy for your children!?

Well, actually one has to do both; there are both do's and don'ts in the battle to achieve the happy situation where this generation has, and future generations will have, the capacity to lead good, meaningful lives.

Much has been written and said about sustainability and much more will be said in future. Among this deluge of information I will try to make a contribution by

Light Steel Frame Building sites have very little building rubble.

looking specifically at the sustainability of structural steel in South Africa. The question to be answered is: how does steel stand up when measured in terms of the three dimensions of sustainability – social, economic and environmental? In the process of dealing with this question I will touch on some of the issues to be resolved when we try to really come to grips with sustainability.

SOCIAL SUSTAINABILITY

The first element of the triple bottom line relates to social sustainability. Does steel, and steel used in construction in particular, make life better for human beings, individually and collectively? And does the industry treat people with respect?

One can start by noting that it is impossible to think of an advanced, industrial civilisation that can enable 6.5 billion people to live on Earth without a material such as steel – abundant, cheap (about as expensive as soft drinks) and with all the mechanical properties required for making a bewildering variety of things. 'If it's not made of steel, it's made using steel.'

A key to structural steel's social sustainability lies in the fact that the elements are fabricated in a workshop, whence they are transported to a construction site and erected quickly. This leads to the following:

- Steel construction provides, in general, better paid, better trained, more stable, safer and more decent jobs than are found in other branches of the construction industry.

In the past 40 years the steel industry reduced the production of CO_2 per ton by 50%.

- Fewer loads of material need to be delivered to site than with most other materials, and this can be done during off-peak hours, which implies less impact on traffic. Also, for structures like bridges over operational roads the impact on traffic can be minimised to a point of disappearance.

Steel construction sites are cleaner, with less noise and dust affecting neighbours.

We can also note that structures with a unique aesthetic quality can be built with steel, making our environment more interesting and attractive. Think, for example, of the roofs of the 2010 World Cup stadia, or such icons as the Eiffel Tower.

An interesting example of steel's value to society comes in the shape of corrugated iron. There can be little doubt about what this material has meant to people in South Africa over the past 150 years, but today we find large numbers of poor people living in informal settlements who regard those sheets that have already done their full service on a house or factory as the material of choice for building the only form of shelter they can afford.

ECONOMIC SUSTAINABILITY

Many types of building and many other forms of structure can be built most economically using steel. Structural steel typically constitutes only a small percentage of the cost of a project but tends nevertheless to be crucial to its success – the presence of the structure enables the rest to happen. That's why the steelwork is typically on the critical path of any project.

Steel enables fast construction, which reduces preliminary and general costs and allows income to start flowing at an earlier date. It also enables buildings with large, column-free areas that are easier to let and to adapt to meet changing requirements. Steel structures can easily be modified. When storeys have to be added or alterations made to an existing building steel is often the obvious material.

ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability refers to a wide range of topics, many of which (such as species diversity) have little bearing on the choice of construction materials for most projects, important as they may be in general. Others, like pollution or the consumption of water in the production of the material, are highly relevant but should be dealt with through regulation and pricing, so that the individual engineer or architect would not have to take them into account in deciding on the materials to be used on a specific project. Exhaustion of resources is highly relevant, but there is no danger of the world running out of the resources for making steel, concrete, bricks, etc for hundreds of years. Energy consumption is clearly crucial, but can be substantially subsumed under the heading of carbon footprint. (In general, the less non-renewable energy you use, the smaller will be your carbon footprint.) This brings us directly to the great fear at the beginning of the 21st century: global warming, as promoted by the carbon dioxide produced by humanity. The carbon footprint of any material, object or process has become the primary measure by which its environmental sustainability is measured.

When steel is produced directly from iron ore using the basic oxygen furnace (BOF) a worldwide average of 2.45 tons of CO_2 is produced for every ton of steel that leaves the steel mill. If steel is produced from scrap using the electric arc furnace (EAF), ie. by recycling steel previously produced, only 0.44t of CO_2 is produced per ton of steel. (In the remainder of this paper this will be expressed as '0.44t/t'.) These figures were obtained after an exhaustive worldwide study by Worldsteel[1], which included South African data.

At 0.44t/t steel's carbon footprint is smaller than almost any construction material one can think of; at 2.45t/t it doesn't look so good. So the message seems clear: use only EAF recycled steel at all costs! That, indeed, is the approach of the Green Buildings Council of South Africa. But such a simplistic approach can lead to unintended consequences, as

Architects design buildings in steel with sun shades to maximise the use of natural light.

happened in Australia where recycled steel was imported for a project, in the desperate pursuit of 'points', from a country that imports BOF-produced steel from Australia. The ships full of steel may well have passed each other mid-ocean!

We need to keep the basic objective in mind, which is to influence people's behaviour in such a way that they will do things that will promote sustainability in the long run. And there's one type of desirable behaviour nobody needs to promote: recycling steel. People already steal manhole covers to recycle them! The equivalent of some 180 Eiffel Towers (1.3 million tons) of steel is recycled each day. Aside from the 2 – 3% of structural steel lost to rust in corrosive environments, every bit is recycled. The behaviour we should encourage among engineers and architects with respect to materials is the following:

- Strive to have a small carbon footprint of the materials for any project, over their entire lifetimes, as small as possible.
- Design for reuse, refurbishment, flexibility, adaptability, etc.

Doing a life cycle assessment for steel, one has to take note of the fact that steel, like most metals, can be recycled many times without any degradation in quality.

The impact on traffic is minimised with the erection of a steel bridge over operational roads.

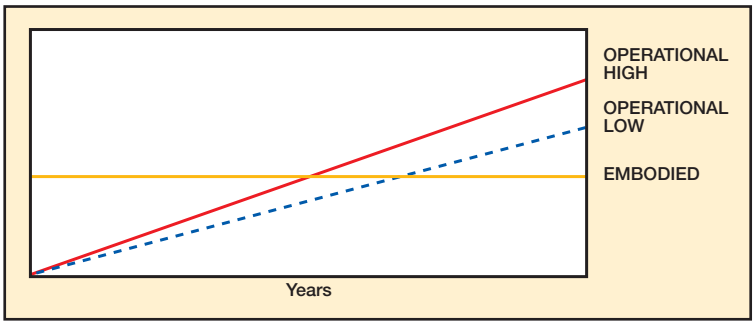


Figure 1: Embodied and operational CO_2.

Most other materials are not really 'recycled'; they are 'downcycled' into inferior products. Worldsteel spent a lot of money on not only collecting high quality data, but also developing a methodology [1] [2] strictly in accordance with the dictates of the ISO 1400 series and having it reviewed and approved by a high-ranking, independent panel of experts. Plugging typical South African figures into the Worldsteel model, one arrives at a carbon footprint over a project life cycle of 0.91t/t for BOF steel and 0.60t/t for EAF steel for profiles or plate, and 1.14t/t for reinforcing, which is produced in South Africa by a combination of EAF and BOF. According to a study by the British Constructional Steelwork Association another 0.3t of CO_2 [3] is produced in the process of fabricating, transporting and erecting a ton of steelwork.

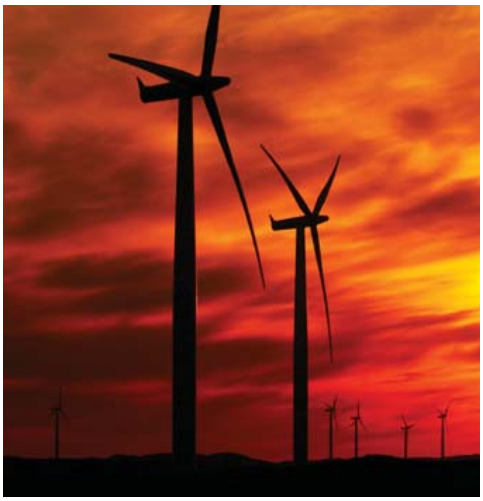
The next step is to look at comparative figures for complete structures made of different materials. Not having reliable figures for concrete, I have to rely on a British study [3] (the figures for steel are pretty similar between South Africa and Britain, and there's little reason to believe that they would differ much for concrete) for a comparison between a steel (composite construction) and a reinforced concrete multi-storey structure. This study found that some 19% more CO_2 is produced with concrete construction than with steel construction. Similar results were obtained in studies in New Zealand [4] and Portugal [5].

So the picture changes entirely when one adopts a less simplistic approach. Steel becomes quite green, and not with envy. 'Recyclable' is clearly at least as important a term as 'recycled'.

The discussion up to here dealt only with embodied CO_2, ie the carbon dioxide produced during the whole process from mining the ore to having the complete structure built, and then getting a 'credit' for recycling the material at the end of the life of the project. It has become an article of faith that the embodied CO_2 constitutes only some 5% of the total produced during the life of a building, the majority being the 'operational' CO_2 deriving from the use of the building. Such a statement is, however, not only simplistic but often wrong. *Figure 1* shows the embodied CO_2 for a building as well as two curves for the operational CO_2, one corresponding to a 'poor' building and the other to a 'good' building.

It is immediately apparent that the life expectancy and the thermal efficiency of a building determine the relative importance of the embodied CO_2. For a well-designed building in South Africa it may well take 20 years [6] before the operational CO_2 exceeds the embodied value. As we move to thermally more efficient buildings, embodied CO_2 becomes even more important.

There may well be arguments about some of the figures and approaches I used, despite my efforts towards being properly founded. I can add a number of other contentious issues to any debate. More important than the specific figures, however, is the need to realise that the issue of environmental sustainability is complex and that the construction industry can only move to a more informed approach to deciding between construction materials or approaches if we have not only reliable information, but a common methodology for interpreting and using the information. South Africa's limited resources oblige us to observe what is being done in other



countries and to select the system that is most appropriate to our needs.

In the mean time, we don't need to sit on our hands. The steel industry and the other materials-producing industries must continue their efforts towards reducing their carbon footprints. In the past 40 years the steel industry reduced the production of CO_2 per ton of steel by some 50%[7]; 10 to 15% since the beginning of the century. The next targets are ultra-low CO_2 steel and very high strength steels. Steel fabricators have significantly reduced their waste (all of which is recycled), but the next challenge is to benefit from the prominent role of computers and software in the industry as well as new fabrication technology to move away from the traditional mass-produced prismatic members to elements that truly optimise the use of material. There is also much scope for designing for the reuse of structures, although we may have progressed further along that line than we are willing to give ourselves credit for, with the currently popular demountable structures.

CONCLUSION

The steel industry worldwide produces more than 2 billion tons of CO_2 per year, enough to cover South Africa in a 2m layer of pure carbon dioxide. It is ironic then that steel is, as discussed above, a relatively 'green' construction material. Moreover, structural steel makes economic sense in many applications. Finally, steel and the steel industry have a hugely beneficial impact on many people's lives.

Similar statements can be made about other construction materials, and there is no arguing that a variety of materials are needed in construction – there is no single material that can meet all the construction industry's needs. But architects and engineers need to make decisions about which materials to use for any project, based, among other considerations, on their sustainability. At present they are hardly able to do so – there are just too many gaps in the available information, too many different approaches, and too much 'green wash'. There is a need for a soundly-based, commonly-accepted approach. The discussion above demonstrates, I trust, that a simplistic approach to environmental sustainability cannot provide all the information on which to base a decision about materials to be used.

Back to steel, however, and to the remarks in the first paragraphs of this paper, I believe that the steel industry is a shining example of a response to the challenge to cut waste to a minimum and to use resources as frugally as one can. But above all this is an industry that does not steal from our children. On the contrary, steel structures have the characteristics that make them usable, and reusable, for many decades into the future, even in this changing world we live in. And even at the end of the life of the project a chunk of scrap steel is a thing of real value. Once you have cooked the iron out of a rock, you have created a real asset for future generations!

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Steel construction provides better trained jobs.

A pedestrian bridge erected on a Sunday afternoon.

RECENTLY LAUNCHED GRADE 355 TUBES – A COMPELLING ENGINEERING SOLUTION FOR MANY APPLICATIONS

By Franco P. Mordini
Chairman of the Technical Committee of the Association of Steel Tune and Pipe Manufacturers of South Africa

Grade 355 tubes, also commonly known as structural hollow sections, were launched in February in Cape Town, Durban and Johannesburg. Previously Grade 300 Tube, launched in June 1997, was available. Engineers can now take advantage of an increased minimum yield stress of 355MPa and an ultimate yield tensile stress of 450MPa for designs.

Grade 355 Tube will enhance the existing benefits of structural hollow sections. Tubes will now be able to compete on a more equal footing with other steel sections as well as competing with other construction materials.

STRUCTURAL BENEFITS

Structural benefits of tubes are apparent when one compares various different profiles required to resist the same compressive loads. In *Table 1* various different profiles are compared in resisting a compressive load of 800kN and an effective length (kL) of 3.0m. In the comparison the circular hollow section is lightest of all, followed by the square hollow section. The circular hollow section is 46% lighter than the 152 x 152 x 37 universal column. In members subject to mainly compression mass savings of up to 55% by mass are possible when compared to other profiles.

In simple terms the material in a tube is ideally positioned far away from the centre of gravity of the profile and hence increases the radius of gyration. This reduces the slenderness ratio thus increasing the load carrying capacity of the cross-section. This material distribution results in a typically higher

second moment of area with a higher section modulus. Another advantage of tubes is that the closed section increases the St. Venant torsion constant (j) hence increasing the torsional resistance of the member. This results in high flexural stiffness in all directions combined with a high torsional stiffness.

Table 2 is a comparison between different profiles where a St. Venant torsion constant of 1.7 x 106mm is required to resist a torsion load

In general, columns and beams made from tubes do not need to be checked for torsional-flexural buckling if they fall within the limits of the slenderness ratio or when the height to breadth of these sections does not exceed 2 to 1.

Another factor often overlooked is that because the tubular structure is lighter and therefore more efficient, a smaller foundation may result, with the potential of reducing costs. This is especially applicable where poor foundation materials are encountered.

These structural efficiencies also give the architect and engineer options of reducing the number of columns in the structure. This effectively provides the developer with more usable space thus optimising the area under cover.

LOW MASS TO STRENGTH RATIO

The lower mass of the structure often provides the engineer with a competitive engineering solution. The lighter, yet stiffer structural members simplify the erection as longer spans can be pre-fabricated, thus increasing the speed of erection and decreasing the cost of erection.

From an environmental aspect less material is used without affecting the functionality of the structure. This is particularly important for long–span girders and trusses, where hot rolled section construction would require lateral stabilising during lifting.

CORROSION DESIGN

The smooth exterior presented by hollow section members together with the absence of gussets, re-entrant corners, inaccessible surfaces (as in double angle members) bolt heads and nuts etc.

RELATIVE MASSES OF STRUTS					
C_f = 800 kN		kL 3.0m			
	Profile	Radius of Gyration min (mm)	Mass Kg/m	Resistance C_f (kN)	Mass ratio
○	CHS 177.8 x 6.0	60.8	25.4	836	1.00
□	SHS 150.0 x 6.0	58.4	27.2	850	1.07
L	200 x 200 x 16 Angle	39.4	48.5	1140	1.91
⊥	152 x 152 x 37 Universal Column	38.7	37.0	860	1.46
⊥	100 x 100 x 10 Star Angles Strut	45.0	35.6	810	1.40
I	150 x 90 x 12 Back-to-back Angles	36.9	43.2	833	1.70

Table 1: Relative masses of struts.

RELATIVE TORSIONAL STRENGTH				
	Profile	J (10^6 mm^4)	Mass	Mass ratio
○	CHS 88.9 x 4.0	1.93	8.38	1.00
□	SHS 75 x 5.0	1.77	11.1	0.76
L	200 x 200 x 24 Angle	1.80	71.1	0.12
I	533 x 210 x 122 I-Section	1.81	122.0	0.07
H	254 x 25 4x 107 H-Section	1.75	107.0	0.08

Table 2: Relative torsional strength.

RELATIVE PAINT AREAS			
		mm^2/m	Area ratio
○	CHS 177.8 x 6.0	559	1.00
□	SHS 150.0 x 6.0	600	1.07
L	200 x 200 x 16 Angle	800	1.43
⊥	152 x 152 x 37 Universal Column	912	1.63
⊥	100 x 100 x 10 Star Angles Strut	800	1.43
I	150 x 90 x 12 Back-to-back Angles	960	1.72

Table 3: Relative paint areas.

can result in a major enhancement of the ease with which corrosion resistance design may be achieved. Particular benefits can be gained on structures where access is difficult for maintenance painting such as footbridges or sign structures over motorways.

CONCRETE FILLED TUBES – AN INTERESTING OPTION

Tubes offer an option to increase their load carrying capacity by filling them with concrete. This capacity can further be increased by the addition of reinforcement. Not only does the additional strength come with little extra cost, the fire resistance is increased significantly. Internationally this method has found favour with columns in high rise construction.

The new machinery provides the fabricator with a clean ready to assemble component that can be simply welded together with ease

Guidance with regard of designing of concrete filled hollow sections is comprehensively covered in SANS 10162 Part 1.

AESTHETICAL ATTRACTIVE APPEARANCE

Aesthetically pleasing solutions are possible using tubular construction. This is derived not only from the simple outline of the profiles themselves, but also from the absence of such items as gussets, battens, lacing, sub-bracing, lateral ties, bolts and the like. Curving of members is easily facilitated with circular hollow sections, and to a lesser degree with square and rectangular hollow sections. Please be reminded that thicker profiles are less likely to suffer from secondary distortion during curving.

OTHER BENEFITS

Reduced paint areas, refer to *Table 3*, and reduced wind resistance, refer to *Table 4*.

In *Table 3* the paint areas are compared for the above previous design example. The circular hollow section has 43% less surface area than the equivalent star angle strut configuration resisting the same load. The relative ease with which the painting maintenance can be done is also apparent when one studies the various member configurations.

Similarly *Table 4* compares the wind force for the same design example. A star angle strut attracts

64% more force than the equivalent circular hollow section.

GRADE 355 TUBE SIZE RANGE

In *Table 5* the size range is shown. Stocking of the sizes varies from manufacturer to manufacturer.

TECHNOLOGICAL DEVELOPMENTS IN PROCESSING OF STEEL

Modern high definition plasma and laser profiling machines have arrived in South Africa, simplifying the assembly of connecting profiles radically. This, ever developing, technology makes the profiling of tube intersection simple. The machinery provides the fabricator with a clean ready to assemble component that can be simply welded together with ease. The machines not only profile and/ or make slots at the ends of the members but can cut any shape that may be required along the length of the member.

Plasma and laser machines are supplied with either a 2D head or a 3D head. The 3D head is typically required for thicker material where weld preparation is required at the end of the tube.

CONCLUSION – ECONOMIES OF TUBULAR STRUCTURES

We have presented a strong case for using hollow sections in steel structures. The argument against their more general utilisation is of course based on cost. There is no debate that the purchase price per ton of hollow sections is higher than that of hot rolled conventional long sections. The previously often quoted "high labour costs" have significantly reduced but will still be higher than for hot rolled labour. But these increases will in many instances be more than offset by the lower mass of tube profiles needed when compared with the equivalent hot rolled profile solution.

The case for tubular construction, for members subject mainly to compression forces, for example columns and bracing, is well documented and surely will be cheaper in tube construction.

However for other structural components, in the final analysis, if all the aspects are carefully considered and properly assessed, in a great many applications tubular construction will be very competitive. Is it not time for you to do the exercise on your next project?

RELATIVE WIND RESISTANCE

		C_f*		C_f x b	Wind resistance ratio
1 → ○	CHS 177.8 x 6.0	1	1.20	213	1.00
1 → □ 2	SHS 150.0 x 6.0	1 2	1.65 1.60	248 339	1.16 1.59
1 → L 2	200 x 200 x 16 Angle	1 2	2.00 1.80	240 509	1.12 2.39
1 → ⊥ 2	152 x 152 x 37 Universal Column	1 2	2.10 1.80	319 273	1.50 1.28
1 → ⊥ 2	100 x 100 x 10 Star Angles Strut	1 2	1.75 1.62	420 275	1.64 1.07
1 → I 2	150 x 90 x 12 Back-to-back Angles	1 2	1.50 1.60	180 384	1.05 1.35

* Based on Tables 15 and 22 of the SABS 0160-1989.

Table 4: Relative wind resistance.

SIZE RANGE OF 355MPa STEEL STRUCTURAL HOLLOW SECTIONS IN SOUTH AFRICA

Rounds

Outside diameter (mm)	Wall thickness t (mm)									
	2.5	3	3.5	4	4.5	5	6	8	10	12
48.3 SA	■	■	■	■						
60.3 SA	■	■	■	■						
63.5 SA	■	■	■	■						
76.2 SA	■	■	■	■	■	■				
88.9 SA	■	■	■	■	■	■				
101.6 SA	■	■	■	■	■	■				
114.3 SA	■	■	■	■	■	■				
127.0 SA	■	■	■	■	■	■				
139.7 SA		■	■	■	■	■				
152.4 SA		■	■	■	■	■				
165.1 SA		■	■	■	■	■				
177.8 SA			■	■	■	■				
193.7 SA			■	■	■	■				
219.1 SA			■	■	■	■	■	■		
273.1 SA							■	■	■	■
323.9 SA							■	■	■	■
355.6 SA							■	■	■	■
406.4 SA							■	■	■	■
457.0 SA							■	■	■	■
508.0 SA							■	■	■	■

Rectangles

Size dxh (mm)	Wall thickness t (mm)								
	2.5	3	3.5	4	4.5	5	6	8	10
50 x 25 SA	■	■	■						
60 x 40 SA	■	■	■	■					
76 x 38 SA	■	■	■	■					
80 x 40 SA	■	■	■	■					
76 x 50 SA	■	■	■	■	■				
100 x 50 SA	■	■	■	■	■	■			
120 x 60 SA		■	■	■	■	■	■		
160 x 80 SA		■	■	■	■	■	■	■	
200 x 100 SA				■	■		■	■	■
200 x150 SA				■	■		■	■	■
250 x 100 SA				■	■		■	■	■
300 x 140 SA							■	■	■
320 x 200 SA							■	■	■
340 x 180 SA							■	■	■

Squares

Size dxh (mm)	Wall thickness t (mm)								
	2.5	3	3.5	4	5	5	6	8	10
38 x 38 SA	■	■	■						
50 x 50 SA	■	■	■	■					
60 x 60 SA	■	■	■	■	■				
75 x 75 SA	■	■	■	■	■				
80 x 80 SA	■	■	■	■	■				
100 x 100 SA	■	■	■	■	■	■	■	■	
120 x 120 SA		■	■	■	■	■	■	■	
150 x 150 SA				■	■	■	■	■	■
175 x 175 SA				■	■	■	■	■	■
195 x 195 SA						■	■	■	■
220 x 220 SA						■	■	■	■
260 x 260 SA						■	■	■	■
285 x 285 SA						■	■	■	■

Table 5.

HOLLOW SECTION PROFILE DESIGN – SOME IMPORTANT POINTERS

By Spencer Erling,
Education Director, SAISC

Jeff presented his design course to some 175 candidates. His course was full of very important rules of thumb and snippets some of which I would like to share with you, especially those who did not make the course.

Wow, what a month of top flight international visiting professors we have had between February and March 2010.

It started with Professor Michael Rotter from Edinburgh University doing a three day course on silos. This was followed by Professor Jeff Packer from the University of Toronto doing a road show to Cape Town, Durban and Johannesburg to launch the new S355 material for structural hollow sections (tubes) and to present a one day design course on tube design and connection. Professor Greg Hancock from Sydney University presented a course on cold formed profile design (also in the three centres!).

Jeff presented his design course to some 175 candidates. His course was full of very important rules of thumb and snippets some of which I would like to share with you, especially those who did not make the course. Jeff drew our attention to the CIDECT range of books which have much more detail (available to view at the SAISC Library or can be ordered on www.cidect.com website) as well as the Packer and Henderson book on truss design (also in the SAISC Library).

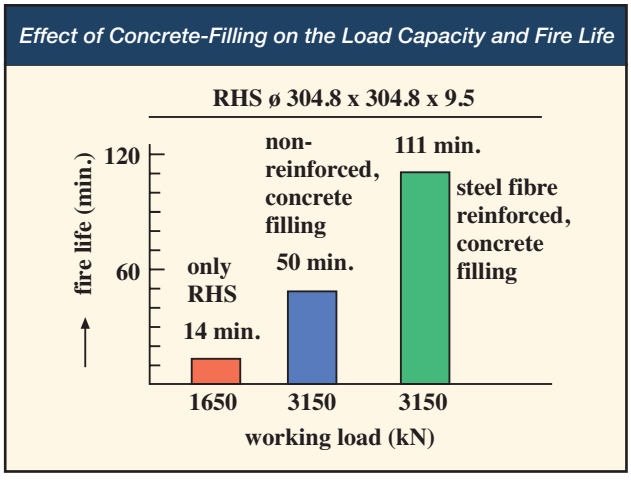
WHAT DOES THE 355 MPA YIELD REALLY MEAN?

In South Africa we start with a 355 yield strength mother coil. We do not rely on cold working of the steel (as in North American countries) to increase the yield strength and thereby achieve the 355 MPa yield strength. Other countries start with a lower than 355 yield coil and end up, after cold working with a 355 yield strength. So the South African process is actually a conservative approach. *(See Jan Kotze's article on page 36)*

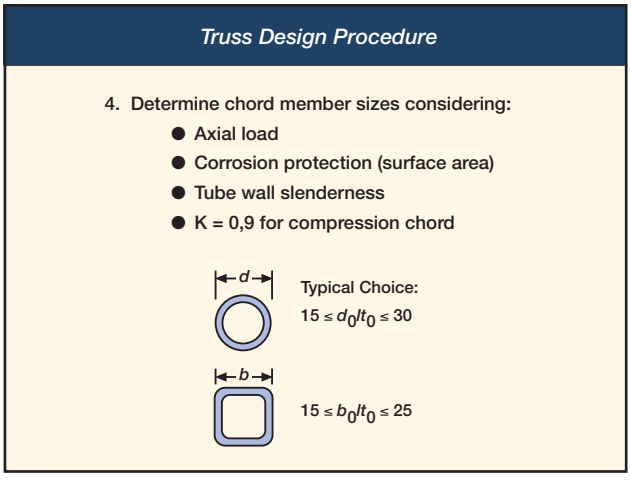
He highlighted the fact that Chinese materials imported into the USA has resulted in a series of Californian 'Division of State Architect' bulletins warning of poor welding and bending procedures resulting in various tube failures.

WHAT ABOUT CONCRETE FILLED COLUMNS?

Filling of square hollow section columns with concrete results in major increases in strength (30 - 50% depending on effective length). Fire resistance also improves for example 15 minutes unfilled, 50 minutes filled with concrete and an amazing 111 minutes filled with steel fibre reinforced concrete *(slide 1)*.



Slide 1.



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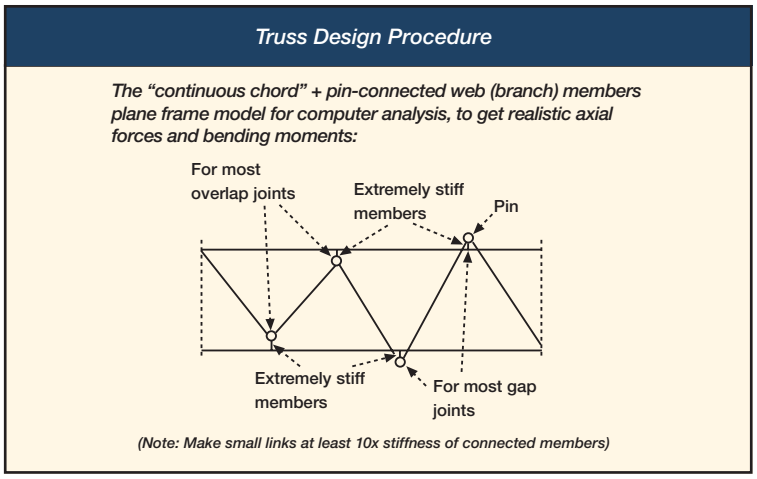


Slide 3.

I do not think there was one engineer in the courses who knew that if you fill tubes with concrete it is necessary to have breather holes in the tubes to allow steam to escape in fire conditions. (It is obvious when you think about it...)

That for the standard range of tubes produced in SA no shear studs are required to ensure that composite action occurs. The pinching action of steel on concrete during deformation/deflection is sufficient. Jeff pointed us in the right direction for large bore permanent shuttered steel and concrete filled columns.

GOLDEN RULES FOR THE DESIGN OF TRUSSES WITH WELDED CONNECTIONS

- Choose chunky profiles for the top and bottom chords (b/t of 15 to 25 for squares, d/t of 15 to 30 for CHS) *(slide 2).*
- Make the chords continuous using computer methods, make the internals pinned *(slide 3).*
- Use k= 0.9 for effective length for the chords.
- Make the internals as big as possible but ensure that they land on the flat portion of the (square) chords, allowing enough room for welds to happen without encroaching on the radii in the corners.

- k=0.75 for compression members!
- The only time the internals (only verticals) should be the same size as the chords would be in a Vierendeel frame so that the moments can be transferred around the corners (e.g. the birds nest Olympic Stadium in Beijing).
- All chord members for Vierendeel frames should be stocky (b/t < 16). This largely eliminates difficulties in joint design from unexpected issues (secondary bending et al).
- Standardise internal member sizes, because if different wall thicknesses, it will be possible to get the wrong wall thickness in the wrong place, which is something that cannot be easily checked after welding.
- That the introduction of eccentricities will not affect the internal (pinned) member design, but must be accounted for in the chord design *(slide 4)*.
- A lot of time and explanation went into correctly identifying whether a joint is a K, T, Y or cross joint or combinations thereof.
- K joints always have a compression and tension member meeting the node of the chord i.e. vertical components cancel each other out (up to 20% difference acceptable).
- That the HSS-connex software to design and perform all the checks is available from Franco Mordini at Robor tube.
- What the rules are for welding the hidden parts of overlapped joints *(slide 5)*.
- That gapped joints are easier to fabricate.

BOLTED CONNECTIONS

Numerous bolted connections were considered. The design of flanged tension connections and how to deal with prying action were covered (for both circular and rectangular flanges).

- The golden rules here are to keep the bolts as close as practical to the tube, the edge distance to the plate should be the same or marginally larger.
- Keep the bolts within the outer dimensions of rectangular tubes *(slide 6)*.
- For plated connections between bracings and other members circumferentially oriented plates are much stronger than longitudinally oriented members.
- For axially loaded members with tubes slotted for plates to be let in, the most

Truss Design Procedure

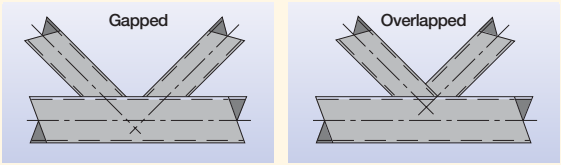
Bending Moments to be considered in truss design

Type of moment	Primary	Primary	Secondary
Moments due to	Nodal eccentricity ($e \le 0.25d_0$ or h_0	Transverse member loading	Secondary effects such as local deformations
Chord design	Yes	Yes	No
Design of other members	No	Yes	No
Design of connections	Yes – affects the chord stress effect function	Yes – affects the chord stress effect function	No – provided parametric limits of validity are met

Slide 4.

Gapped vs. Overlapped Truss Connections

- Design tips to optimize welded hollow section connection design
  - Select relatively stocky chord
  - Select relatively thin branch
  - Consider virtues of gapped K-connections



- Easier and cheaper to fabricate
- Higher static and fatigue strength, generally
- Produces stiffer truss (reduces truss deflections)

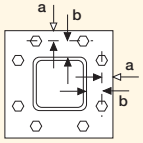
Slide 5.

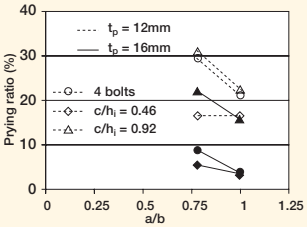
Bolted Flange-Plate Connections to Rectangular Hollow Sections

- With bolts along 4 sides of the hollow section
- Ratio of edge distance "a" to distance from bolt line to tube face "b"

⇒ ↓ Prying action

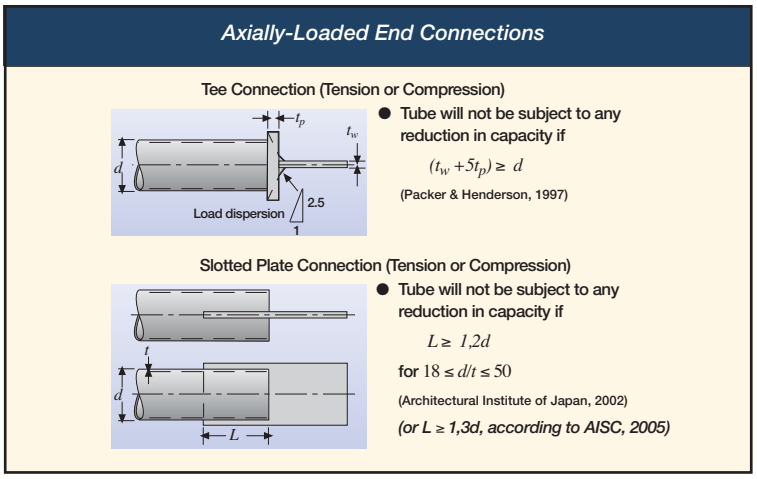
⇒ ↑ Connection capacity





- Bolts should be located as close to the hollow section walls (low b) as practical

Slide 6.



Slide 7.

appropriate minimum length of the inlet plate shall be 1.3 x diameter of tube (to avoid shear lag issues) *(slide 7).*

- Where a 'Tee' connection is welded to the end of a tube, the thickness of the flange part welded to the tube should be determined such that the web thickness plus 5 x the flange thickness exceeds the diameter of the tube. This is to ensure the load gets spread all the way around the tube (and is not concentrated near the web causing failure) *(also slide 7).*
- If slots are too long, cracking always starts at the end of the welds, not at the end of the slot. So roughly cut slots are 'ok' for non fatigue members.

WELD PROCEDURES AND SEQUENCING

There is a separate article in the next Steel Construction covering pre-qualified weld procedures for tube to tube welds.

In conclusion, just by sticking to the above rules for the preliminary design, there is very little chance of coming off the rails when the detailed design and connection checks are undertaken.

Thanks Jeff for pointing us in the right direction in your quiet but authoritative manner!

THE DEVELOPMENT OF S355 TUBE

By Jan Kotze
Product Manager; Plate & Hot Rolled,
ArcelorMittal South Africa

The significant role that ArcelorMittal played together with the ASTPM in the development of the new 355 tube material has been vital to its successful launch. This product is now not only aligned with the rest of the structural- and plate steel grades, but also conforms to international standards. YS300 tube was phased out the end of February 2010. As from March 2010, only S355 tube will be available.

YS300 HISTORY

YS300 was the first structural tubular steel grade to be developed in South Africa and was introduced to the market in 1997. This development started with the 300WA analysis as a base. Due to welding problems in the tube making process, it had to be re-designed to a leaner analysis.

From a low base, the demand for this product grew to approximately 75 000 ton in 2008.

WHY CHANGE?

The focus in the entire steel industry has steadily become 'stronger and lighter'. During the same period, the truck and trailer industry managed to reduce the mass of trailers by almost 50% by moving to high strength steels.

The next logical step was to follow the hot rolled structural steels move from 300MPa to 350MPa. In 2008 the 'Red Book' was updated to specify S355 as the base design grade for hot rolled profiles. In 2009 SANS also adopted the Euro Norm structural specifications (EN 10025). Thus only the tubular steel grade remained on 300MPa.

THE DEVELOPMENT PROCESS

The first trial coils were based on the S355 structural analysis (Tensile 470MPa min). During the tube making trials, it was found that the product had good welding and forming properties, but that the strength was too high. The product was therefore re-designed based on the EN 10219 specification (Tensile 450MPa min). On completion of the second trials, the entire industry was convinced that this product is a huge success.

PRODUCT COMPARISON

Properties	YS300	S355 Tube
Min Yield strength	300MPa	355MPa
Chemistry	Carbon-Manganese	Micro alloyed
Galvanizing	Low Si; 0,03%	Si = 0,15 – 0,25%
Carbon equivalent	±0,34	±0,20
Weldability	Acceptable	Good
Formability	Acceptable	Good
Toughness	Good	Excellent

CONCLUSION

ArcelorMittal is proud to be part of the development of this steel for the tube industry. The S355 tube specification is definitely an improvement on the YS300 product in many ways. This product is now not only aligned with the rest of the structural- and plate steel grades, but also conforms to international standards. YS300 tube was phased out the end of February 2010. As from March 2010, only S355 tube will be available.

SAISC MEMBERSHIP

STEEL PRODUCERS

ArcelorMittal South Africa
Representative: Charles Dednam
P O Box 2 Vanderbijlpark 1900
Tel: (016) 889 9111 Fax: (016) 889 5668
charles.dednam@arcelormittal.com
www.arcelormittal.com

Davsteel (Pty) Ltd
Representative: Coen Otto
P O Box 54 Vanderbijlpark 1900
Tel: (016) 980 2121 Fax: (016) 988 3760
ottoc@capegate.co.za
www.capegate.co.za

Scaw Metals Group
Representative: Chris Booysen
P O Box 61721 Marshalltown 2107
Tel: (011) 842 9364 Fax: (011) 842 9705
millsales@scaw.co.za
www.scaw.co.za

STEELWORK CONTRACTORS

Eastern Cape

Project Services
Representative: Arthur R White
P O Box 1783 Port Elizabeth 6000
Tel: (041) 452 2151 Fax: (041) 456 1121
arthur.w@projectservices.co.za

Gauteng

A Leita Steel Construction (Pty) Ltd
Representative: Claudio J Leita
P O Box 912758 Silverton 0127
Tel: (012) 803 7520 Fax: (012) 803 4360
claudio@aleita.co.za
www.aleita.co.za

Bessemer Steel Construction (Pty) Ltd
Representative: Fritz Hoogendyk
P O Box 4102 Luipaardsvlei 1743
Tel: (011) 762 5341 Fax: (011) 762 5345
bessemer@iafrica.com

Betterect (Pty) Ltd
Representative: Heidi Zechner
P O Box 4486 Luipaardsvlei 1743
Tel: (011) 762 5203 Fax: (011) 762 5286
betterect@betterect.co.za
www.betterect.co.za

Boksan Projects cc
Representative: L Boksan
P O Box 33 Olifantsfontein 1665
Tel: (011) 316 2172 Fax: (011) 316 1645
laszlo@boksan.co.za

Branch Engineering (Pty) Ltd
Representative: Shannon Van Den Heuwel
P O Box 38092 Booysens 2016
Tel: (011) 493 1197 Fax: (011) 493 7884
shannon@branchengineering.co.za

Cadcon (Pty) Ltd
Representative: Richard Butler
P O Box 35042 Menlo Park 0102
Tel: (012) 664 6140 Fax: (012) 664 6166
richbutler@cadcon.co.za
www.cadcon.co.za

Carbon Steel Fabricators
Representative: Gerhard Van Zyl
P O Box 3150, Witbeeck 1729
Tel: 011 762 5209 Fax: 011 762 7723
gerhard.vanzyl@vbvholdings.co.za
www.vbvholdings.co.za

Central Welding Works
Representative: Stephen Horwitz
P O Box 3013 Pretoria 0001
Tel: (012) 327 1718 Fax: (012) 327 1727
stephen@cwwpta.co.za

Concor Engineering
(a Division of Concor Holdings (Pty) Ltd)
Representative: Jean Charoux
P O Box 823, Johannesburg, 2000
Tel: (011) 249 7800 Fax: (011) 249 7984
jcharoux@concor.co.za
www.concor.co.za

Cosira International (SA)
Representative: John da Silva
P O Box 16390, Dowerglen, 1612
Tel: (011) 626 2317 Fax: (011) 626 2917
john.dasilva@cosiragroup.com
www.cosiragroup.com

DSE Structural Engineers & Contractors
Representative: Kobus Marais
P O Box 68, Germiston, 1400
Tel: (011) 871 4111 Fax: (011) 871 4141
kmarais@grinaker-lta.co.za
www.dse.co.za

Fabricated Piping Systems SA (Pty) Ltd
Representative: Craig Fyall
P O Box 19188, Fishers Hill, 1408
Tel: (011) 828 4388 Fax: (011) 828 2147
craig@fabpipe.co.za

Ferro Eleganza (Pty) Ltd
Representative: Chris Narboneses
P O Box 470 Silverton 0127
Tel: (012) 803 8035 Fax: (012) 803 5645
chris@ferroe.co.za
www.ferroe.co.za

Genrec Engineering (Pty) Ltd
Representative: Michael Mamotte
P/Bag X035, Wadeville, 1422
Tel: (011) 876 2300 Fax: (011) 827 1733
michael.mamotte@murrob.com
www.genreceng.com

Impact Engineering Gauteng cc
Representative: Robert Mylroie
P O Box 511, Nigel, 1490
Tel: (011) 818 1343 Fax: (011) 818 4330
robmyl@webmail.co.za

IVMA Engineering cc
Representative: Mauro Munaretto
P O Box 91, Nigel, 1490
Tel: (011) 814 3124 Fax: (011) 814 1505
ivma@ivma.co.za
www.ivma.co.za

Karle Steel Manufac. & Constr
Representative: Andreas Mayer
P O Box 7669, Bonaero Park, 1622
Tel: (011) 422 4637 Fax: (011) 845 2867
amayer@worldonline.co.za
www.karlesteel.co.za

Khombanani Steel (Pty) Ltd
Representative: Tim Tasioulas
P O Box 3781, Kempton Park, 1620
Tel: (011) 975 0647 Fax: (011) 970 1694
accounts@khombanani.co.za

L & D Contracting cc
Representative: Donald Koertzen
712 Pretoria Main Road, Wynberg
Tel: (011) 786 2429 Fax: 0865 082 543
donaldk@icon.co.za
www.ldc.co.za

Linrose Engineering Gauteng (Pty) Ltd
Representative: Jorge Pereira
P O Box 1153, Bedfordview, 2008
Tel: (011) 827 0314 Fax: (011) 827 0878
linrose@icon.co.za
www.linrose.co.za

Louwill Engineering cc
Representative: Deon Kotzé
P O Box 10834, Springs, 1570
Tel: (011) 818 5186 Fax: (011) 818 5185
deon@louwill.co.za

MAC Engineering cc
Representative: Mino Carniel
P O Box 436, Nigel, 1490
Tel: (011) 814 1834 Fax: (011) 814 6620
maceng@maceng.co.za
www.maceng.co.za

Magnet Engineering (Pty) Ltd
Representative: Paul G Catalo
P O Box 123703, Alrode, 1451
Tel: (011) 908 3500 Fax: (011) 908 2723
paulocatalo@snet.co.ao

Malitech Engineering
Representative: Sipho Malinga
c/o Cartwright & Petter Street, CE6
Vanderbijlpark 1900
Tel: (016) 931 2069
smalinga@malitech.co.za
www.malitech.co.za

Mfana Projects cc
Representative: Henry Schoeman
P O Box 269, Alberton 1450
Tel: (011) 900 2489 Fax: (011) 900 2328
henrys@netactive.co.za

Midvaal Structures (Pty) Ltd
Representative: Christo Van Dyk
P O Box 1411, Henley On Klip 1962
Tel: (016) 365 5961 Fax: (016) 365 5951
christo@steelstructures.co.za
www.steelstructures.co.za

Moco Steel Engineering cc
Representative: Merlin Labuschagne
P O Box 4310, Dalpark 1453
Tel: (011) 914 5608 Fax: (011) 914 5612
merlin@mocogroup.co.za
www.mocogroup.co.za

MPW Steel Construction (Pty) Ltd
Representative: Paolo Visentin
P O Box 392048, Bramley 2018
Tel: (011) 887 8430 Fax: 0866 856 543
paolo@sgiuricich.co.za

Nancy Engineering
Representative: Ricardo Adriano
P O Box 38508, Booysens, 2016
Tel: (011) 493 1585 Fax: (011) 493 1564
nanceng@mweb.co.za

Nicholas Structures cc
Representative: Nico Venter
P O Box 1448, Henley On Klip, 1962
Tel: (016) 366 1605 Fax: 086 610 7993
info@nicholasstructures.co.za
www.nicholasstructures.co.za

Okirand Construction
Representative: Rowan Forte
Postnet Suite 70, Private Bag X153,
Bryanston 2021
Tel: (011) 463 1423 Fax: (011) 463 1240
rowan@okirand.co.za
www.okirand.co.za

Omni-Struct Nkosi (Pty) Ltd
Representative: Dave van Asche
P O Box 122, Ferndale, 2160
Tel: (011) 474 9140 Fax: (011) 474 7487
dave@osn.co.za
www.omnistruct.co.za

Prospan Structures cc
Representative: David Paola
P O Box 1755, Bramley 2018
Tel: (011) 440 2116 Fax: (011) 440 2135
david@prospan.co.za
www.prospan.co.za

QM Steel cc
Representative: Quintin Venter
P O Box 563, Henley-On-Klip 1962
Tel: 076 275 7006 Fax: 086 594 2008
info@qmsteel.co.za

Renlyn Engineering
Representative: Willie Fourie
P O Box 68, Westonaria 1780
Tel: 011 757 1705 Fax: 011 757 1587
willie@renlyn.co.za
www.renlyn.co.za

SASSI Metal Innovations cc
Representative: Ignazio Plumari
P O Box 1016, Cresta, 2118
Tel: (011) 795 4049 Fax: (011) 794 4684
info@sassi-biab.com

SE Steel Fabrication (Pty) Ltd
Representative: David J Essey
P O Box 1326, Krugersdorp, 1740
Tel: (011) 953 4584 Fax: (011) 660 5855
sesteel@icon.co.za

Sectional Poles (Pty) Ltd
Representative: Phil M Koen
P O Box 17028, Groenkloof, 0027
Tel: (012) 348 8660 Fax: (012) 348 9195
pkoen@sectionalpoles.co.za
www.sectionalpoles.co.za

Spiral Engineering cc
Representative: Colin Kirkland
P O Box 1966, Florida Hills, 1709
Tel: (011) 474 9119 Fax: (011) 474 6528
colin@spiralengineering.co.za
www.spiralengineering.co.za

Steel Band Construction cc
Representative: Steven Smit
P O Box 6030, Dunswart, 1508
Tel: (011) 918 2454 Fax: (011) 918 3252
stevesmit@icon.co.za

Steinmuller Engineering Services (Pty) Ltd
Representative: Bob Stevens
P O Box 1537, Rivonia, 2128
Tel: (011) 806 3254 Fax: (011) 806 3224
bob.stevens@steinmuller.co.za
www.steinmuller.co.za

Tass Engineering (Pty) Ltd
Representative: Tim Tasioulas
P O Box 3781, Kempton Park, 1620
Tel: (011) 975 0647 Fax: (011) 970 1694
tim@tasseng.co.za

Tegmul Engineering (Pty) Ltd
Representative: Toby Esterhuizen
P O Box 1602, Meyerton, 1960
Tel: (016) 362 2007 Fax: (016) 362 1188
tobie@tegmul.co.za

Trentbridge Engineering cc
Representative: David Hunter
P O Box 699, Kliprivier, 1871
Tel: (016) 365 5327 Fax: (016) 365 5320
trentfab@intekom.co.za

Tudor Engineering & Draughting cc
Representative: Braam Beukes
P O Box 17572, Sunward Park, 1470
Tel: (011) 914 5163 Fax: (011) 914 5165
hotah@nettron.co.za

Van Driel's Steel Construction
Representative: Robby van Driel
P O Box 375, Heidelberg, 2400
Tel: (016) 341 6102/5 Fax: (016) 341 6685
vdriel@mweb.co.za

Viva Steelfab Engineering (Pty) Ltd
Representative: Collen Gibbs
P O Box 2331, Bedfordview, 2008
Tel: (011) 454 3405 Fax: (011) 454 5694
colleng@vivaeng.co.za

WBHO Services North
Representative: Andrew Breckenridge
P O Box 531,Bergvlei, 2012
Tel: (011) 265 4000 Fax : (011) 310 3578
andrewb@wbho.co.za
www.wbho.co.za

Free State

Engski Manufacturing (Pty) Ltd
Representative: Dawie van der Merwe
P O Box 110, Sasolburg 1947
Tel: (016) 976 2592 Fax: (016) 976 0072
engski@mweb.co.za

KwaZulu-Natal

Avellini Bros (Pty) Ltd
Representative: Pietro Avellini
P O Box 28340, Malvern, 4055
Tel: (031) 464 0421 Fax: (031) 464 0966
ravellini@iafrica.com

BNC Projects (Pty) Ltd
Representative: Sunthosh Balchund
P O Box 40188, Redhill, 4071
Tel: (031) 902 3777 Fax: (031) 902 6798
balchunds@bncprojects.co.za
www.bncprojects.co.za

Churchyard & Umpleby
Representative: Mark Ferreira
P O Box 719, New Germany, 3620
Tel: (031) 705 4008 Fax: (031) 705 5815
mark@candu.co.za
www.candu.co.za

Impact Engineering
Representative: Douglas Nidd
P O Box 174, Shakaskraal, 4430
Tel: (032) 947 1054 Fax: (032) 947 2017
impact@saol.com

NIK Steel
Representative: Nico Reddy
P O Box 2128, New Germany, 3620
Tel: (031) 705 6878 Fax: (031) 705 9216
nico@niksteel.co.za

Ogilvie Engineering
Representative: Allan Olive
P O Box 369, Gillits, 3603
Tel: (031) 700 6489 Fax: (031) 700 6488
ogilvadmin@lantic.net

Pro-Spec Steel Structures
Representative: Tony Jugmohan
P O Box 428, Howick, 3290
Tel: (033) 330 2295 Fax (033) 330 2295
tonyj@telkomsa.net

Rebcon Engineering (Pty) Ltd
Representative: Warren Butler
P O Box 444, New Germany, 3620
Tel: (031) 705 5851 Fax: (031) 705 5855
warren@rebcon.co.za
www.rebcon.co.za

Redfab Engineering cc
Representative: Jayram Reddy
P O Box 562171, Chatsworth, 4030
Tel: (031) 463 1673 Fax: (031) 463 1659
redfab@iafrica.com

Robsteel Structures cc
Representative: Rob Drysdale
Postnet Suite 207, Private Bag X0001
Ballito 4420
Tel: (032) 946 1922 Fax: (032) 946 2138
rob@robsteel.co.za

SpanAfrica Steel Structures (Pty) Ltd
Representative: James Pinnell
P O Box 100606, Scottsville, 3209
Tel: (033) 346 2555 Fax: (033) 346 1242
pinnell@sai.co.za

Mpumalanga

B & T Staalkonstruksie cc
Representative: Trevor van Vuuren
17 Flambojant Ave, Delmas, 2210
Tel: (013) 665 1914 Fax: (013) 665 1881
marketing@btsteel.co.za
www.btsteel.co.za

Da Costa Construction Welding cc
Representative: Vivian Swart
P O Box 2025, Bethal 2310
Tel: 082 874 6374 Fax: (017) 647 6091
vivian@dcconstruction.co.za

Powerstation Engineering Services
Representative: Henro Pretorius
P O Box 247, Standerton, 2430
Tel: (017) 712-4837 Fax: (017) 712-4803
pse@pseservices.co.za
www.pseservices.co.za

Quality Steel
Representative: Andre D Potgieter
P O Box 12442, Nelspruit, 1200
Tel: (013) 752 2723/4 Fax: (013) 752 2407
andre@qualitysteel.co.za
www.qualitysteel.co.za

Tecco Engineering cc
Representative: Neels Welsh
P O Box 284, Middelburg, 1050
Tel: (013) 246 2261 Fax: (013) 246 2262
tecdraft@lantic.net

Tubular Technical Construct (Pty) Ltd
Representative: Jorge Bonifacio
P O Box 222, Witbank, 1035
Tel: (013) 690 2335 Fax: (013) 656 2408
jorge@tubular.co.za
www.tubular.co.za

Witbank Engineering
Representative: Flip J. Van Rensburg
P O Box 806, Witbank, 1035
Tel: (013) 690 1379 Fax: (013) 656 4920
weas-lc@mweb.co.za

North West

Rutherfords
Representative: Cecil Rutherford
P O Box 2591, Potchefstroom, 2520
Tel: (018) 293 3632 Fax: (018) 293 3634
cecilr@rutherfords.co.za
www.rutherfords.co.za

Western Cape

Inenzo Water (Pty) Ltd
Representative: Jan Cloete
P O Box 1381, Sanlamhof 7532
Tel: (021) 948 6208 Fax: (021) 948 6210
jcloete@inenzo.com
www.inenzo.com

Konti Industries
Representative: Costa Kontopirakis
P O Box 242, Somerset Mall 7137
Tel: (021) 852 2559 Fax: (021) 852 3115
steel@jkpg.co.za
www.jkpg.co.za

Mazor Steel cc
Representative: Shlomo Mazor
P O Box 60635, Table View, 7439
Tel: (021) 556-1555 Fax: (021) 556-1575
judy@mazor.co.za
www.mazor.co.za

Prokon Services (Pty) Ltd
Representative: Martin Lotz
55 Muscat Ave, Blackheath, Cape Town
Tel: (021) 905 4448 Fax: (021) 905 4449
martin@prokonservices.co.za
www.prokonservices.co.za

Scott Steel Projects
Representative: Dave N Scott
P O Box 2344, Clareinch, 7740
Tel: (021) 671 3176 Fax: (021) 671 8736
dave@scottsteel.co.za

Triomf Staalwerke Bk
Representative: Willie A du Plessis
P O Box 1367, Paarl, 7624
Tel: (021) 862 1630 Fax: (021) 862 4899
tristaal@mweb.co.za

Union Structural Engineering Works
Representative: Mike N Papanicolaou
P O Box 55, Epping, 7475
Tel: (021) 534 2251 Fax: (021) 534 6084
michael@unionsteel.co.za
www.unionsteel.co.za

DEVELOPING MEMBERS

Arctex cc
Representative: Lenin Kiviet
P O Box 146299, Bracken Gardens, 1452
Tel: (011) 900 4136 Fax: (011) 900 1837
arctex@netactive.co.za

Bathehi Engineering (Pty) Ltd
Representative: Gregory Ramphore
8 Delmas Street, Klippoortjie, 1459
Tel: (011) 452 7633 Fax: 0866 649 550
greg@bathehi.co.za

Blue Brambles Engineering Services
Representative: Rudzani Mposi
24 Oakhurst, Whitney Gardens, Lyndhurst,
Johannesburg 2192
Tel: 073 191 8943 Fax: 086 542 6095
blue.brambles@gmx.com

DAVCON Construction
Representative: David Nel
P O Box 77142, Eldoglen 0171
Tel: 012 658 5123
mwdalnel@mweb.co.za

Four Tops Engineering Services cc
Representative: Essau Motloung
P O Box 485, Tlhabane 0309
Tel: 072 229 9128 Fax: 0866 911 619
fourtopseng@vodamail.co.za

Sach-Warr Construction cc
Representative: Kesavan Moonsamy
P O Box 238, Roodepoort, 1725
Tel: 083 283 6636 Fax: (011) 760 2595
sachwarr@polka.co.za

Tinthlarhi Steel Construction
Representative: Collins Mabena
P O Box 167, Denneboom 0160
Tel: (071) 050-3810 or (082) 854-8825
mabena@tinthlarhi.co.za
www.tinthlarhi.co.za

Zamani Engineering Services cc
Representative: David Nkosi
P O Box 1806, Witbank, 1035
Tel: (013) 656 1978 Fax: (013) 656 1979
admin@zamaniengineering.co.za

STEEL MERCHANTS & SERVICE CENTRES

Gauteng

Argent Steel Group
Representative: Leon Coetzee
P O Box 14461 Wadeville 1422
Tel: (011) 876 4000 Fax: (011) 876 4014
phoenix1@argent.co.za
www.argent.co.za

Clotan Steel
Representative: Danie Joubert
P O Box 2614, Vanderbijlpark 1900
Tel: (016 011) 986 8000
Fax: (016 011) 986 8050
daniej@clotansteel.co.za
www.clotansteel.co.za

General Profiling (Pty) Ltd
Representative: Gavin Poplak
P O Box 471, Crown Mines, 2025
Tel: (011) 839-2917 Fax: (011) 837-1617
sales@generalprofiling.co.za
www.generalprofiling.co.za

Kulungile Metals Group (Pty) Ltd
Representative: Mike Spies
P O Box 995, Isando, 1600
Tel: (011) 929-5000 Fax: (011) 929-5062
mikesp@kulungile.co.za
www.kulungile.co.za

Macsteel Service Centres SA (Pty) Ltd
Representative: Dave Dawkshas
P O Box 7729, Johannesburg, 2000
Tel: (011) 871-0000 Fax: (011) 824-4994
dave.dawkshas@macsteel.co.za
www.macsteel.co.za

Macsteel Trading Germiston South
Representative: Granville Rolfe
P O Box 7729, Johannesburg, 2000
Tel: (011) 871-4677 Fax: (011) 871-4667
granville.rolfe@mactrading.co.za

Macsteel V R N
Representative: Mike Hall
P O Box 123813, Alrode, 1451
Tel: (011) 861-5200 Fax: (011) 861-5203
Mike.Hall@vrn.co.za
www.vrnsteel.co.za

NJR Steel Holdings (Pty) Ltd
Representative: Chris Kothe
P O Box 58337, Newville, 2114
Tel: (011) 477 5515 Fax: (011) 477 5550
ckothe@njrsteel.co.za
www.njrsteel.co.za

Stewarts & Lloyds Holdings (Pty) Ltd
Representative: Ronnie Turner
P O Box 79458, Senderwood 2145
Tel: (011) 553-8500 Fax: (011) 553-8510
ronniet@sltrading.co.za
www.stewartsandlloyds.co.za

Trident Steel (Pty) Ltd
Representative: Alan van Rooyen
P O Box 124054, Alrode, 1451
Tel: (011) 861-7111 Fax: (011) 865-2042
Tel: (011) 908-4686 Fax: (011) 864-7629
alan.vanrooyen@trident.co.za
www.trident.co.za

KwaZulu-Natal

BSI Steel Limited
Representative: Lee Daff
46 Eden Park Drive, Murrayfield Park,
Pietermaritzburg
Tel: (033) 846 2222 Fax: (033) 846 2233
lee.daff@bsisteel.com
www.bsisteel.com

Macsteel Trading Durban
Representative: Paul Simpson
P O Box 1757, Durban, 4000
Tel: (031) 913-2600 Fax: (031) 902-2345
paul.simpson@mactrading.co.za

Western Cape

Macsteel Trading Cape Town
Representative: Marinus Muilwijk
P O Box 824, Bellville, 7530
Tel: (021) 950-5500 Fax: (021) 950-5600
Marinus.muilwijk@mactrading.co.za

Transcape Steels (Pty) Ltd
Representative: Carl van Rooyen
P O Box 210, Eppindust, 7475
Tel: (021) 534-3211 Fax: (021) 534-5890
carlvr@transcape.co.za
www.transcapesteels.co.za

STEEL PRODUCT MANUFACTURERS

Gauteng

Augusta Profiles (Pty) Ltd
Representative: Rory Whelehan
P O Box 131176, Northmead, 1511
Tel: (011) 914-4628 Fax: (011) 914-4748
augsteel@iafrica.com

Bolt & Engineering Distributors
Representative: Mike Giltrow
P O Box 14190, Wadeville, 1422
Tel: (011) 824-7500 Fax: (011) 824-0890
mike@bolteng.co.za
www.bolteng.co.za

Cavotec Gantrex (Pty) Ltd
Representative: Johann M Jankowitz
P O Box 16897, Atlasville 1465
Tel: (011) 963-0015 Fax: (011) 963-0064
gantrex@netactive.co.za
www.cavotec.com

CBC Fasteners (Pty) Ltd
Representative: Rob J. Pietersma
P O Box 670, Paardekraal, 1752
Tel: (011) 767 0000 Fax: (011) 767 0150
rob@cbc.co.za
www.cbc.co.za

First Cut (Pty) Ltd
Representative: Steve Van Wyk
P O Box 623, Germiston, 1400
Tel: (011) 872 1138 Fax: (011) 873 3066
stevev@firstcut.co.za
www.firstcut.co.za

Geo Stott & Co (Pty) Ltd
Representative: Dennis Dedwith
P O Box 43134, Industria, 2042
Tel: (011) 474 9150 Fax: (011) 474 8267
dennis@geostott.co.za
www.geostott.co.za

Global Roofing Solutions (Pty) Ltd
Representative: Johan van der Westhuizen
P O Box 6461, Dunswart, 1508
Tel: (011) 898 2902 Fax: (011) 892 1455
johan@globalroofs.co.za
www.globalroofs.co.za

Grating World (Pty) Ltd
Representative: George Whittle
P O Box 9748, Edenglen 1613
Tel: (011) 456 5250 Fax: (011) 452 2536
george@gratingworld.co.za
www.gratingworld.co.za

Horne Hydraulics cc
Representative: Bernadine Teessen
7 Bronze Road, Spartan X16 1619
Tel: (011) 974 1004 Fax: (011) 392 5650
bernadine@horne.co.za
www.horne.co.za

Integrated Business Construction (IBC)
International (Pty) Ltd
Representative: Vernon Lucas
P O Box 131560, Northmead, 1500
Tel: (011) 425 3190 Fax: (011) 425 4308
vernonlucas@myconnection.co.za

Le Blanc Communications SA
Representative: William Brough
P O Box 1592, Nigel, 1490
Tel: (011) 814 1404 Fax: (011) 814 1444
rosstan@worldonline.co.za
www.lightingstructures.co.za

Macsteel Roofing
Representative: Dennis White
P O Box 14085, Wadeville, 1422
Tel: (011) 878 7500 Fax: (011) 827 1890
dennis.white@macroofing.co.za

Macsteel Tube and Pipe
Representative: Peter Curr
P O Box 13640, Witfield, 1467
Tel: (011) 897 2100 Fax: (011) 826 6333
peter.curr@mactube.co.za

Mentis Sales
Representative: Chris Green
P O Box 8045, Elandsfontein, 1406
Tel: (011) 255-3200 Fax: (011) 828-1463
cjgreen@mentis.co.za
www.mentis.co.za

MiTek Industries SA (Pty) Ltd
Representative: Richard Bailey
Private Bag X22, Halfway House 1685
Tel: (011) 237 8700 Fax: (011) 314 3978
rbailey@mitek.co.za
www.mitek.co.za

Project Materials Southern Africa (Pty) Ltd
Representative: Nishal Sheoprosad
P O Box 73412, Fairland 2030
Tel: 082 567 2844 Fax: 086 605 7194
nishal.sheoprosad@pmpiping.com

Rivet & Weldstud Manufacturing cc
Representative: Adriaan Fourie
P O Box 9263, Cinda Park, 1462
Tel: (011) 914 5103/4 Fax: (011) 914-5106
adriaan.fourie@stud-weld.com

Robor (Pty) Ltd
Representative: Franco Mordini
P O Box 263, Isando, 1600
Tel: (011) 977 2029
francom@robor.co.za
www.robor.co.za

Robertson Ventilation International (RVI)
Representative: Eric Whelan
P O Box 296, Modderfontein, 1645
Tel: (011) 608 4640/1 Fax: (011) 608 6443
ericw@robventind.co.za
www.robventind.co.za

Safintra (Pty) Ltd
Representative: Lyle Jeffery
P O Box 26060, East Rand, 1462
Tel: (011) 823 4027 Fax: (011) 823 4288
lyle@safintra.co.za
www.safintra.co.za

Steel Fabrication Consultants & Allied Services
Representative: Alan Armitage
P O Box 144, Bedfordview 2008
Tel: (011) 615-7240
Fax: (011) 615-8913
alan.armitage@mds-skills.co.za

Vital Engineering & Angus Mcleod (Pty) Ltd
Representative: Dodds B Pringle
P O Box 6099, Dunswart, 1508
Tel: (011) 898 8500 Fax: (011) 918 3000
dodds@gratings.co.za
www.gratings.co.za

Northern Cape

Rufco Engineering cc
Representative: Gandeloro Ruffini
P O Box 50, Postmasburg, 8420
Tel: (053) 313 1651 Fax: (053) 313 2081
info@rufco.co.za
www.rufco.co.za

Vonmeg Staalwerke cc
Representative: Jacques Goosen
44 Voortrekker Road, Springbok 8240
Tel: (027) 712 2606 Fax: (027) 718 1015
vonmegbk@telkomsa.net

North West

Almec Manufacturing
Representative: Joan Basson
P O Box 20017, Matlosane, 2575
Tel: (018) 469 3202 Fax: (018) 469 3200
joanalmec@gds.co.za

PEL Construction
Representative: Ben Delport
P O Box 11098, Klerksdorp, 2570
Tel: (018) 469 3894 Fax: (018) 469 2783
ben@pel.co.za

WJ Engineering (Pty) Ltd
Representative: Bert J Werkman
P O Box 20985, Noordbrug, 2520
Tel: (018) 294 3395 Fax: (018) 294 5472
bwerkman@wjengineering.co.za
www.wjengineering.co.za

TRANSMISSION LINE MANUFACTURERS

Africa Cellular Towers (Pty) Ltd
Representative: Nick VD Mescht
P O Box 11666, Randhart 1457
Tel: (011) 907 7364 Fax: (011) 869 9107
nickv@africacellular.co.za
www.africacellular.co.za

Andrew Satcom Africa
Representative: Steve Low Gavin Hishin
P O Box 78611, Sandton, 2146
Tel: (011) 719 6000 Fax: (011) 444 5393
steve.low@andrew.com
www.andrew.com

Babcock Ntuthuko Powerlines
Representative: Damiano Pavan
P.O. Box 274, Nigel, 1491
Tel: (011) 739 8200 Fax: (011) 739 8201
damiano.pavan@babcock.co.za
www.babcock.co.za

Tricom Structures cc
Representative: Udo Topka
P O Box 1725 Silverton 0127
Tel: (012) 803 0041 Fax: (012) 803 6040
udo@tricom1.co.za
www.tricom1.co.za

CORROSION & FIRE PROTECTION TO STEEL

Gauteng

Armco Galvanisers (Pty) Ltd
Representative: Dave Fensham Andre de Bruyn
P O Box, 63 Isando, 1600
Tel: (011) 974 8511 Fax: (011) 974 8510
mail@armco.co.za
www.armco.co.za

Barloworld Plascon SA (Pty) Ltd
Representative: Graeme Carr
P O Box 1227, Johannesburg, 2000
Tel: (011) 951 4500 Fax: (011) 955 2841
gcarr@plascon.co.za
www.plascon.co.za

Bulldog Projects cc
Representative: Mike Book
P O Box 82741 Southdale 2135
Tel: (011) 827 4221 Fax: (011) 827 4561
mike@bulldogprojects.co.za
www.bulldogprojects.co.za

Hot Dip Galvanizers Association of SA
Representative: Terry Smith
P O Box 2001, CLAREINCH, 7740
P O Box 2212, Edenvale, 1610
Tel: (021) 797-4735 (011) 456 7960
Fax: (011) 454 6304
terry@hdgasa.org.za
www.hdgasa.org.za

Pyro-Cote cc
Representative: Trevor Miller
P O Box 124114, Alrode, 1451
Tel: (011) 864 5205 Fax: (011) 908 6636
pyrocotejhb@pyrocote.co.za
www.pyrocote.co.za

CONSULTING ENGINEERS & PROJECT MANAGERS

Eastern Cape

Uhambiso Consult (Pty) Ltd
Representative: Forbes Kamba
P O Box 12385 Centrahill PE 6006
Tel: (041) 373 0180 Fax: (041) 373 0102
fkamba@uhambiso.co.za

Gauteng

Acecad Software Ltd
Representative: Paul Marais
Hanover Square, Cnr 7th & Hendrik Potgieter, Edenvale, 1609
Tel: 011 452 0811 Fax: 086 552 5129
p.marais@acecad.co.za
www.acecadsoftware.com

Aurecon
Representative: Tomme Katranas
P O Box 905, Pretoria, 0001
Tel: (012) 427-2470
Fax: (086) 607-7838
Tomme.Katranas@af.aurecongroup.com
www.aurecongroup.com

Arup (Pty) Ltd
Representative: Ric Snowden
Private Bag X38, Benmore, 2010
Tel: (011) 997-9025
ric.snowden@arup.com
www.arup.com

Bateman Projects Limited
Representative: Kurt Waelbers
P O Box 7737, Johannesburg, 2000
Tel: (011) 899-9111
Fax: (011) 899-2660
kurt.waelbers@batemanengineering.com
www.batemanengineering.com

Bigen Africa Services (Pty) Ltd
Representative: Johann Human
P O Box 29, INNOVATION HUB, 0087
Tel: (012) 842 8751 Fax: (012) 843 9000
johann.human@bigenafrica.com
www.bigenafrica.com

BKS (Pty) Ltd
Representative: Alwyn Truter
P O Box 3173, Pretoria, 0001
Tel: (012) 421 3500 Fax: (012) 421 3501
alwynt@bks.co.za
www.bks.co.za

Clearspan Structures (Pty) Ltd
Representative: Jeff Montjoie
P O Box 26495, Eastrand, 1462
Tel: (011) 823 2402 Fax: (011) 823 2582
jmo@clearspan.co.za
www.clearspan.co.za

DRA Mineral Projects
Representative: Leon Uys
P O Box 3567, Rivonia 2128
Tel: (011) 202 8600 Fax: (011) 202 8807
luys@drasa.co.za
www.drasa.co.za

Fluor SA (Pty) Ltd
Representative: Carlo Zambon
P O Box 784850 Sandton 2146
Tel: (011) 233 3400 Fax: (011) 233 3522
carlo.zambon@fluor.com
www.fluor.com

Goba (Pty) Ltd
Representative: John Cowden
P O Box 180 Sunninghill 2157
Tel: (011) 236 3300 Fax: (011) 807-8535
johnc@goba.co.za
www.goba.co.za

Group Five Projects (Pty) Ltd
Representative: Greg Heale
P O Box 26807, East Rand, 1462
Tel: (011) 899 4697 Fax: (011) 918 2707
gheale@g5.co.za
www.g5.co.za

Hatch Africa (Pty) Ltd
Representative: Francois du Toit
Private Bag X20 Gallo Manor 2052
Tel: (011) 239 5300 Fax: (011) 239 5790
fdutoit@hatch.co.za
www.hatch.co.za

Holley and Associates cc
Representative: David Haines
P O Box 664, GALLO MANOR, 2052
Tel: (011) 803 1159 Fax: (011) 803 0970
david@holleyassociates.com
www.holleyassociates.com

Pollock Williams James & Partners cc
Representative: Tim James
P O Box 73245 Fairlands 2030
Tel: (011) 679 2282 Fax: (011) 679 384
pwp@iafrica.com

Roymec (Pty) Ltd
Representative: Malcolm Royal
P O Box 41335, Craighall, 2024
Tel: (011) 804 5123 Fax: (011) 804 5185
malcolm.royal@roymec.co.za
www.roymec.co.za

SH Services
Representative: Simon Du Toit
P O Box 26177, East Rand, 1462
Tel: (011) 918 1991 Fax: (011) 918 1994
shsccs@global.co.za

SRK Consulting (Pty) Ltd
Representative: Jaya Omar
P O Box 55291, Northlands, 2116
Tel: (011) 441-1111
Fax: (011) 880 8086
jomar@srk.co.za
www.srk.co.za

TWP Consulting (Pty) Ltd
Representative: Mushir Khan
P O Box 61232 Marshalltown 2107
Tel: (086) 123-1542 Fax: (011) 356 7500
mkhan@twp.co.za
www.twp.co.za

Walker Ahier Holtzhausen (WAH) Engineering Consultants cc
Representative: Graham Cross
P O Box 48529 Roosevelt Park 2129
Tel: (011) 888 2150 Fax: (011) 888 2296
grahamc@waheng.co.za

WSP Group of Companies (LC Consulting)
Representative: John Truter
P O Box 98867, SLOANE PARK, 2152
Tel: (011) 300-6000
Fax: (011) 361 1595
john.truter@wspgroup.co.za
www.wspgroup.co.za

KwaZulu-Natal

Young & Satharia Structural & Civil Eng
Representative: Rob Young
P O Box 37070 Overport 4067
Tel: (031) 207 7252 Fax: (031) 207 7259
rob@yands.co.za
www.yands.co.za

WSP Structures Africa (Pty) Ltd (KZN)
Representative: Deon Du Plessis
P O Box 1815, Westville 3630
Tel: (031) 240 8950 Fax: (031) 240 8951
deon.duplessis@wspgroup.co.za

Mpumalanga

Ijubane Projects (Pty) Ltd
Representative: Kobus Badenhorst
P O Box 2360, Middelburg 1050
Tel: (013) 243 4390 Fax: (013) 243 5005
kobus@glps.co.za
www.glps.co.za

Lategan Bouwer Civil & Structural Engineers
Representative: Anton Van Dyk
P O Box 1215 Secunda 2302
Tel: (017) 634 4150 Fax: (017) 634 4188
avandyk@latbou.co.za
www.latbou.co.za

Neda Engineering Group
Representative: David Naude
Neda Building, 21 Brander Street, Nelspruit 1200
Tel: (013) 755 4093 Fax: (013) 755 4094
davidn@neda.co.za
www.neda.co.za

Western Cape

ASCH Professional Services (Pty) Ltd
Representative: Anwar Davids
P O Box 51121 V & A Waterfront 8002
Tel: (021) 418 4988 Fax: (021) 419 5187
adavids@asch.com
www.asch.com

Bergstan South Africa
Representative: Alan Davies
P O Box 4733 Cape Town 8000
Tel: (021) 487 4900 Fax: (021) 424 7653
alan@bergstan.co.za
www.bergstan.co.za

Kwezi V3 Consulting Engineers
Representative: Pravesh Naidoo
P O Box 398 Bellville, 7535
Tel: (021) 912 3000 Fax: (021) 913 3222
pnaidoo@kv3.co.za
www.kv3.co.za

Mondo Cane cc
Representative: Rob Chalmers
P O Box 3106 Somerset West 7129
Tel: (021) 852 2447 Fax: (021) 852 2447
rob@mondocane.co.za
www.mondocane.co.za

Vela VKE Consulting Engineers (Pty) Ltd
Representative: John Anderson
P O Box 8022, Roggebaai 8012
Tel: (021) 417 2900 Fax: (021) 417 2999
andersonj@velavke.co.za
www.velavke.co.za

MINING HOUSES

Anglo Operations Ltd American Corporation
Representative: Geoff Krige
P O Box 61587, Marshalltown, 2107
Tel: (011) 638 2061 Fax: (011) 638 4636
gkrige@anglotechnical.co.za

SASOL Mining (Pty) Ltd
Representative: Pieter Van Heerden
P O Box 10375, Secunda 2302
Tel: (017) 614 5033 Fax: (011) 522 2691
pieterschalk.vanheerden@sasol.com
www.sasol.com

SUPPLIERS OF GOODS AND SERVICES TO THE INDUSTRY

Grinaker-LTA Metals & Minerals
Representative: Marius Botes
P O Box 920 Southdale 2135
Tel: (011) 681 2252 Fax: (011) 680 1810
mbotes@grinaker-lta.co.za
www.grinaker-lta.co.za

Skotia International Metals Limited
Representative: Richard Calveley – Scotland
Tel: 0044 189 980 8650
Fax: 0044 189 922 1683
r.calveley@skotiametals.com
www.skotiametals.com

Traceability Solutions
Representative: Kyls Parker
P O Box 1499, Olivedale 2158
Tel: 011 794 5299 Fax: 011 794 2844
kyle@tracesol.co.za