steel CONSTRUCTION

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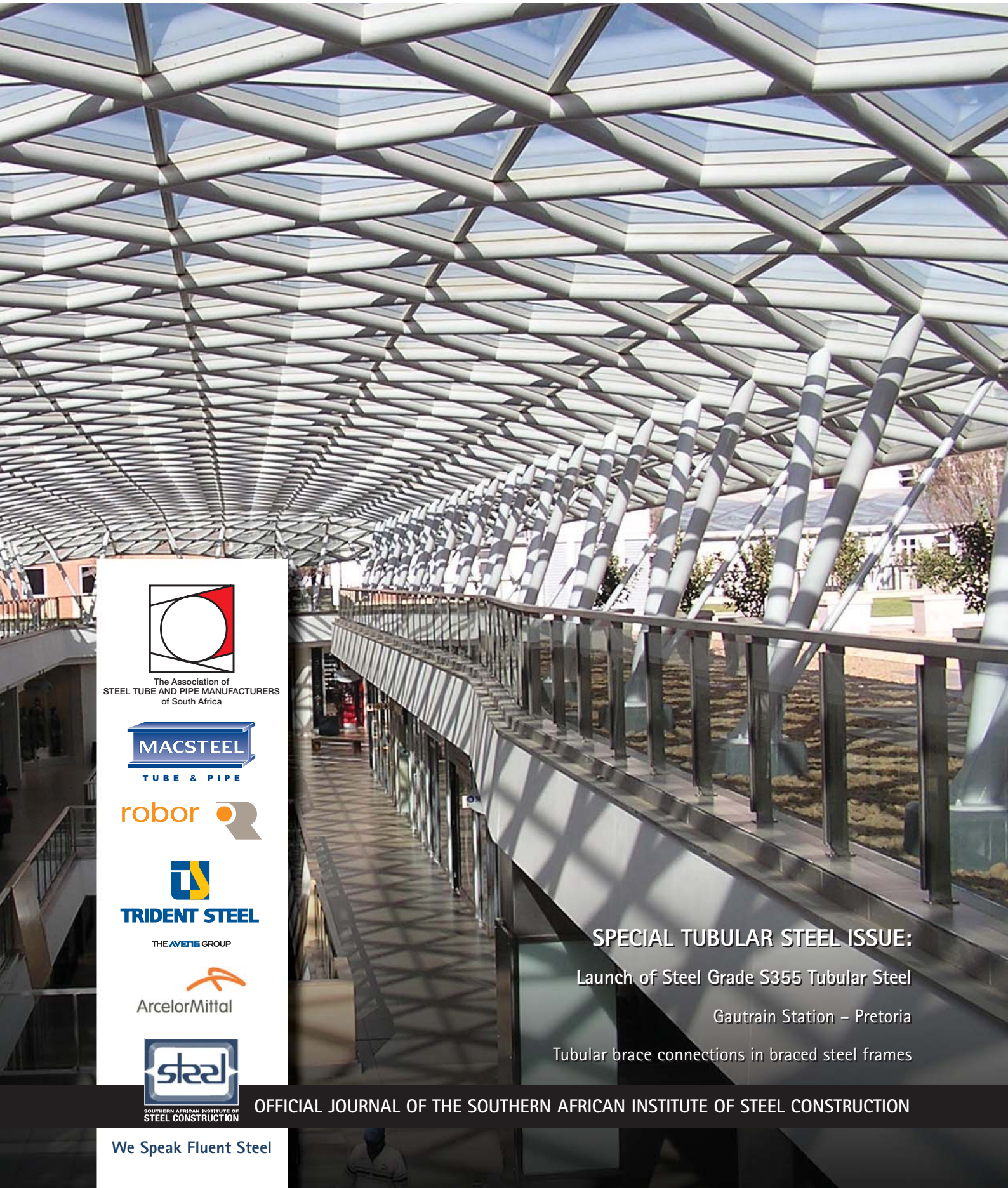

The Association of
STEEL TUBE AND PIPE MANUFACTURERS
of South Africa

MACSTEEL
TUBE & PIPE

robor

TRIDENT STEEL
THE AVENG GROUP

ArcelorMittal

SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

We Speak Fluent Steel

SPECIAL TUBULAR STEEL ISSUE:

Launch of Steel Grade S355 Tubular Steel

Gautrain Station – Pretoria

Tubular brace connections in braced steel frames

OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

EDITOR'S NOTE

While procrastinating, lolling around, pulling my hair out – about what to write for my gazillion-th editors brabble, I stumbled onto the most interesting website http://trendwatching.com/trends.

I was actually searching for a tea-leaf-reader or somewhat forecast of 2010 – since Hennie already doomed us by erroneously bringing 'the end of the world' forward by 2 years in the Steelspeak Newsletter.

Standing with my one foot in the marketing 'cess pool' and the other foot in a very organised, very much engineered world, talking with my Generation X mouth to brainy Baby Boomers – I found the lexicon/ nomenclature/ glossary fascinating.

Have you ever heard of **Nowism**?

Means - *"Consumers' ingrained* lust for instant gratification is being satisfied by a host of novel, important (offline and online) real-time products, services and experiences. Consumers are also feverishly contributing to the real-time content avalanche that's building as we speak. As a result, expect your brand and company to have no choice but to finally mirror and join the 'now', in all its splendid chaos, realness and excitement."* (...could never find the *small print though)

It followed shortly on **Foreverism**

Encompasses the many ways that consumers and businesses are embracing conversations, relationships, and products that are never done. Driving its popularity is technology that allows them to find, follow, interact and collaborate forever with anyone & anything.

And try bite into the meanings of **Functionall; (F)luxury; Embedded Generosity; Sellsumers; Infolust** (since typing about 3 000 more of these have been born into the wacky woolly web).

Suddenly I feel sooo much more comfortable in my hard and mostly square working world. Steel structures seem to defy flippant trends and even after 2012 will still be seen standing.

Stick to steel, I say or at least speak it – fluently.

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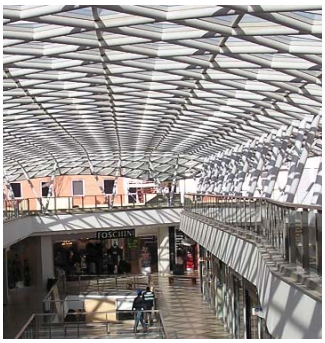

Melrose Arch Galleria – Steel Awards 2009: winner of the Tubular Structures Category

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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:
Please notify us of any changes to the mailing list.
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SAISC CHAIRMAN: MOLEFE KGOMO

Molefe Kgomo, the newly elected Chairman of the SAISC Board, is not a new face to the Institute and industry. Apart from his active involvement in SAISC's activities, he has been chairman of the Membership Committee and has served on the SAISC Board since 2002.

Molefe Kgomo, the newly elected Chairman of the SAISC Board, is not a new face to the Institute and industry. Apart from his active involvement in SAISC's activities, he has been chairman of the Membership Committee and has served on the SAISC Board since 2002.

Molefe holds a Master of Management degree from the University of the Witwatersrand. In the 1994 elections he worked as a financial manager at the Independent Electoral Commission, until he left in March of the same year to work for Denel. From April 1994 he was the business development manager for the new business division of the Denel group. He was also project manager for rural development initiatives in the North West region and KwaZulu-Natal. Furthermore he was instrumental in establishing the initial BEE (Black Economic Empowerment) policy for Denel.

At the Aviation division of Denel (Denel Aviation and Atlas Aircraft Corporation) he continued to be the champion of BEE and SMME (Small Medium and Micro Enterprises) development. During that period he was manager for the Simera trailer project and was also responsible for materials management.

He founded, and was managing director of the first black owned mild carbon steel merchant business, Tshipi S.A. (TSA), in South Africa. TSA was 70% owned by Tshipi Investment Holdings (TIH), a wholly black owned investment company, and 30% by Trident Steel, a division of Aveng. TSA grew from a nil per annum turnover, to a R90 million per annum turnover business in a period of seven years. Finally TIH's 70% share in Tshipi S.A was sold to Trident Steel, and the name of Tshipi Investment Holdings was changed to TIH group, and Molefe left to join Cosira international.

Currently he serves as a director on the Board of Cosira International. His employment at Cosira serves both roles of custodian of the interest of TIH holdings (Pty) Ltd, and that of enhancing value for the operational companies in Cosira International and its subsidiary companies.

Currently Molefe Kgomo is the chief executive officer of Liberty Lane Trading, a company that fabricates, refurbishes, sells and rents scaffolding and shuttering.

Molefe is married to Molemo. They have two daughters, Relebogile (7) and Tshepo (3).

Hennie and Molefe met over coffee and here are some excerpts of their conversation:

...Hennie and Molefe talk about having young kids and working too hard...

Molefe:... It is a due to the amount of time spent with them, especially when your kids are younger, because you only get home at 18.30 – 19.00, you know what it's like and before you have had time to settle down, and spend time with them, they are sleeping.

Hennie: *Oh I know and everybody is running all over the place and there is no time for socialising and that sort of thing. Molefe, where did you go to school?*

Molefe: I matriculated at Sacred Heart College, but when I got there it was called Marist Brothers Observatory.

Hennie: *Tell me a bit about your background. I grew up with the Swazi culture on the farm. Your grandparents were probably still very traditional?*

Molefe: Certainly before my grandparents my family was living in the rural areas, but my maternal grandfather was urbanised - he was a social worker. I am of Ndebele descent.

Hennie: *You come from a vastly more educated background than me. Honestly. I think if you put my two grandfather's education together it won't mount up to two years. And your father?*

Molefe: My father is a medical doctor. I suppose the fact that the black community back then could not access capital and land; education became the only asset worthy of investing in.

Hennie: *What's the difference between a Master of Management degree as opposed to a MBA.*

Molefe: That's a Master of Business Administration while you can get an MM if say you have gone the Marketing or HR route for example. Personally I chose the Development Management route. I started my own little business in all sorts of interesting things including bootlegging and distributing fast moving consumer goods in the townships. But the large institutions such as the breweries did not take kindly to that. These industries have always been aggressive in securing and 'ring fencing' their market-share. I then went back to university on a full time basis.

Hennie: *Was this before the times of anti-competitive behaviour?*

Molefe: (laughs)... It most certainly was. I then studied for a post graduate Diploma in Management, some years later I studied Master of Management part time and at that stage I was already married. You know somewhere and at sometime one has to settle down.

Hennie: *How did the idea of Tshipi arise?*

Molefe: I was working for Denel at the time as a champion of BEE and we were trying to establish key supplies...

Hennie: *And then you saw that in the steel industry there's something.*

Molefe: Well I actually didn't even think that there was merit getting involved in the steel industry and I approached Gift Phenethi and said:"Look there is an opportunity for steel and I don't know how this thing works. See what you can do and maybe you can start a business for yourself." Gift came back to me after about two weeks and said, "look this is actually a great opportunity!" So we approached the then Iscor and they introduced us to three of their biggest clients Macsteel, Trident and Baldwins.

Trident at the time was interested. I was still employed by Denel so I handed in my resignation and decided to try my luck. That's really how we got around to this.

Hennie: *How did you arrive at the name Tshipi?*

Molefe: It's a name for steel in Sotho or Tswana

Hennie: *I noticed that you clearly have spent quite a lot of time on black economic empowerment and the legislation thereof. Where is it going?*

Molefe: I suppose that you will find that with any good initiative some people will use it for personal gain. And that has invariably happened, so the legislation has been put in place, in an attempt to avoid and obviate those kinds of abuses.

Hennie: *It's a sad thing that it had to be legislated.*

Molefe: It's a sad thing, but necessary. The difficulty with it is that on the one hand you want to empower entrepreneurial type people who are unable to develop or establish a capital base for themselves, but because they are historically disempowered it becomes very




difficult to have a capital base, as they are in survival mode. Government was left with no option as there was no voluntary willingness to transform all industries and the ranks of these entrepreneurs were on the increase. On the other hand you have young black professionals that stay in a position for a very short time because they are sought after, and before they can make a meaningful contribution to the company, sometime not having even completed their induction, they have left.

Hennie: *Why are black organised industry organisations not a lot stronger than they are? I think I can understand why not all black people want to belong to SAFSEC or the Master Builders, because they feel they don't look after their interests but what comes in the place of that has never been impressive. What do you think should be done in terms of the Institute and BEE? My question is basically whether you are happy with the fundamental approach in objectives of this institute for example.*

Molefe: I certainly am Hennie. I have a belief that the establishment of representative associations, institutes and organisations should never ever be premised only on racial or cultural criteria, and the reasons why you put these things together is to look after either industry or professional common interests. I would imagine that there are common interests that affect a black contractor the same as a white contractor - there certainly will be those that affect black contractors more than they do white contractors.

I don't believe that we should be continuing with separate institutions, but I certainly think that the professional bodies become champions of their members' interest. Internal resource matters, that may have racial and or cultural undertones to the detriment of grouping with the associations, need be dealt with as such, thus improving the critical mass, and ensure that the gap is narrowed perceptually, conceptually and operationally . I think that in many instances we are not forthright. We don't come out and say I think that there is a problem in this economy in so far as funding is concerned. Or I don't think that in so far as engineering standards and or academic excellence are concerned, that there is no uniformity in standards academically, or resource allocation, throughout our institutions of higher learning as an example. So it is absolutely essential that we speak openly and I don't think that is necessarily a problem of black people or white people, I think it is a problem of South Africa.

Somewhere or another the whole thing must be based on a real will to work together and to do things rather than adding up the points on lists. I am very much for education, training, CSI and all the things that are really important in determining a valid scorecard, but if the whole thing just becomes a mechanism for scoring the necessary points then you are not resolving anything at a real level if you do not fully address equity. The scorecards albeit they were put together to facilitate the closing of the economic, technical and social gaps, have had the unintended consequence of ensuring that organisations without the will to have genuine empowerment, hide behind the veil of the scorecard.

I really cannot purport to know the exact reason, for the inability of black associations to be as successful as their white counterparts, but I would imagine a lot of it has to do with the limited resources.

Hennie: *And how do you see your role as Chairman at the Institute for the next two years?*

Molefe: The Institute has many challenges, and I believe that if we have plans that are manageable on a year by year basis, we shall continue to be successful association. The specific role that I believe I would be able to play would be in ensuring that the strategic objectives of the industry are put onto the agenda of the Institute's board, whose intellect and experience are wide and varied. I also see my role as working closer with you, the executive director, in your implementation of the agreed strategic objective.

The SAISC is an organisation that considers education and training a priority not only for the sake of ensuring that there isn't a skill attrition, but also to ensure that there is continuous improvement on how things have been done in the past. I certainly would like to support these initiatives further. The establishment of engineering, fabrication, and construction standards and methods continues to be an essential role and benefit that members derive from the Institute, and to this end the Institute will continue to do so.

I believe that the industry is willing to further engage in transformation of individual companies, and it is the role of the Institute to provide the guidance in so far as that is concerned for all the companies that would seek its assistance, as it has in contributing to the establishment of the Charter and other interventions.

Hennie: *So what are you ambitions in life like 20 years from now?*

Molefe: 20 years from now I would like to farm. Now I have a few cattle and chickens and I go and see how they are doing on weekends.

SAISC COMMENT

By Dr Hennie de Clercq,
Executive Director, SAISC

But somewhere along the line the structural potential of pipes was recognised. From a structural point of view the fascinating thing about a circular hollow section is that all the material is as far away from the centre point of the section as it can possibly be. That makes this section the very best from the point of view of not buckling under compressive force.

HOLLOW COMMENT

Until the Bessemer converter was invented in the 1850's steel was made in small quantities, and the process of getting the carbon content and the strength and hardness right involved repeated hammering and forging. Thus the process yielded whatever shape one had in mind – anything from a lump to a sword blade blank.

But as soon as the Englishman Henry Bessemer's brainchild yielded large quantities of steel the question became: in what shape should we produce it? Rolling of metal in small machines had been a fairly common process for centuries by then, and it was logical to employ this process on an industrial scale. Bars and rods as well as plates were obvious shapes in which to provide steel, but as soon as steel was being used for structural purposes the steel people started thinking of other shapes. Angles and channels were not the most efficient sections, but they had flat faces that made them easy to connect to each other or to other surfaces. I and H shapes had the advantage of having a lot of material as far as possible from one of the two neutral axes of the section, and the fact that they were symmetric about both principal axes allowed them to take large loads before buckling sideways. They were relatively easy to roll, and engineers soon learned the tricks for connecting them to supports or other members. So we ended up, as far as the structural engineer is concerned, with plates, angles, channels and I and H sections.

In the mean time the steel industry realised that there was a great need for liquid carrying pipes. People have over the centuries made pipes of everything they could think of. Some pipes were ceramic, and the Americans even used wooden pipes in cities, but such pipes could not resist pressure and had lots of other weaknesses. Steel pipes were great conduits and will remain so for many years, although other materials have conquered big segments of that market.

But somewhere along the line the structural potential of pipes was recognised. From a structural point of view the fascinating thing about a circular hollow section is that all the material is as far away from the centre point of the section as it can possibly be. That makes this section the very best from the point of view of not buckling under compressive force. Hollow sections are not very strong in bending, but strong enough to resist the bending moments that occur in most compression members. But they are the champions again when it comes to resisting torsion.

What really set structural engineers' imagination alight was the use of tubes in space frames. The amount of repetition in these structures also allowed the development of specialised connections to overcome the one difficulty with hollow sections: they can be relatively difficult to connect to each other or to other sections.

In other applications the problem of connections for hollow sections remained a vexing one. Solutions like flanges, flattened ends, etc served their purpose but could hardly be said to be elegant. It is thus a great relief to know that the technology is now readily available to prepare the ends of a tubular member precisely for welding to other tubes or other sections. Suddenly designers are free to specify tubes without having to wonder how the connections can be done.

Fully-welded connections are not only superior from a structural point of view – they are also much more attractive than bolted alternatives. This provides architects with the facility of designing tubular structures with their inherent aesthetic appeal without concern about the quality of workmanship and finish that can be achieved.

Bolted connections at the ends of tubular members should not be totally thrown overboard, however. In all cases where tubes are connected to other elements such as columns, and in many connections that are to be completed on site, bolting may be the right solution, and there are some perfectly acceptable connection details.

I am certainly very happy that the steel tube industry now has the facilities in South Africa to provide tube with ends shaped for connection. It is also a great step forward that the quality of steel used for structural hollow sections has been brought in line with that of the hot rolled structural steel available in the country. Engineers and architects will now have the opportunity to use tubes to full effect; in fact, they are faced with the challenge of creating some really innovative and exciting structures using hollow sections.

The Association of
STEEL TUBE AND PIPE MANUFACTURERS
of South Africa

THE ASSOCIATION OF STEEL TUBE AND PIPE MANUFACTURERS OF SOUTH AFRICA (ASTPM)

We are confident that the launch of S355 tubular steel will enable the required hollow sections to be sourced locally, reducing imports and stimulating exports of value added products.

The Association of Steel Tube and Pipe Manufacturers of South Africa (ASTPM) was formed in 1983 to represent the welded carbon steel tube and pipe producers. The members account for 90% of the installed capacity.

The executive of the management committee is made up from a representative of each member with Neil Rose (President), Robert Subotzky (Vice President), Colin Shaw (Executive Director) and Margaret Olivier (Secretary).

During the 27 years of the Association the members have exported in excess of 1 500 000 tons to over 50 countries and this has only been achieved by the members manufacturing a quality product in compliance with international tube specifications.

In 1997 the Association introduced a graded welded steel tube Structatube 300 which allowed structural engineers to specify structural hollow sections. World trends are to use lighter and stronger steel and in February 2010 Grade S355 steel for structural tube will be launched.

Downstream customer exports are growing and in order to improve competitiveness members are investing into value added plasma and laser cutting technology.

We are confident that the launch of S355 tubular steel will enable the required hollow sections to be sourced locally, reducing imports and stimulating exports of value added products.

The product range and relevant information of the members are available on our web site www.astpm.com

Contact Details:
Colin Shaw
PO Box 18587, Sunward Park, 1470
Tel : +27 11 832 2377
Fax : +27 11 823 2377
Email: astpm@astpm.com
Website: www.astpm.com

MEMBERS

Macsteel Tube and Pipe a division of Macsteel Service Centres SA (Pty) Ltd

Contact: Hannes Van Der Walt
P O Box 13640, Witfield, 1467
Tel: +27 11 897 2102
Fax: +27 11 826 6333
Email: hannes.vanderwalt@mactube.co.za
Website: www.macsteel.co.za

MACSTEEL TUBE & PIPE

Macsteel Tube & Pipe is one of the largest tube and pipe producers in Africa, manufacturing products to the highest international quality standards.

Macsteel Tube & Pipe adds further value by galvanizing, cutting and coating its products. State of the art laser cutting equipment is a recent addition to our plant, enhancing our capabilities to provide quality precision low cost tube.

Macsteel Tube & Pipe has been at the forefront of the introduction of the new S355 steel and are fully supportive of its application and sustainability in the market. We are stocked with this exciting new steel and are geared for superior service to you, our valued customers.

Kindly contact us to test our mettle, we look forward to being of service to you.

Robor Tube a division of Robor (Pty) Ltd

Contact: Franco Mordini
PO Box 1229, Isando 1600
Tel: +27 11 971 1600
Fax: +27 11 971 1801
Email: FrancoM@robor.co.za
Website: www.robor.co.za

Robor is a world-class manufacturer and supplier of welded tube and pipe, cold formed steel profiles, and associated value added products. Established in 1922, the company has built its reputation on integrity, trust and experience.

Robor focuses on cultivating relationships with its client base by providing highest quality products and excellent service levels. Coupled with its vast expertise, these factors have enabled Robor to cement its place as a major player in local and export markets. The company is the largest steel tube manufacturer in southern Africa and is active in most industries, including mining, logistics – rail and road, petrochemical, construction, agriculture, energy, water, and automotive.

Trident Sterling Tube a division of Trident Steel (Pty) Ltd

Contact: John Morreira
P.O. Box 124054, Alrode, 1451
Tel: +27 11 908 1806
Fax: +27 11 865 2042
Email: johnm@tridentsterling.co.za
Website: www.trident.co.za

From modest beginnings in 1982, Trident Sterling Tube, a division of Trident Steel, has grown to become one of the foremost producers of mild steel welded tube in Africa.

At our 33 000m² factory, situated in Alrode, South of Johannesburg, we produce an extensive range of round, square and rectangular tube as well as several configurations of elliptical, oval and triangular tubular profiles.

Trident Sterling Tube is ISO accredited and are entitled to display the SABS (SANS) mark on products where applicable.

Barnes Tubing Industries (Pty) Ltd

Contact: Andy Smith
P.O.Box 9411, Kempton Gate,1625
Tel: +27 11 398 2727
Fax: +27 11 974 6326
Email: andy@barnestubing.co.za

Barnes Tubing was established in 1998 to service the needs of Barnes Fencing with its requirements of posts and stays. It was only in 2004 that Barnes Tubing started to market the extra capacity into the domestic market.

Barnes Tubing currently has three mills in production manufacturing the full range of small bore, hot and cold rolled products up to 114mm diameter. Barnes Tubing also received SABS accreditation for the manufacture of scaffolding tube. During the course of this year we will complete the commissioning of a 273mm mill and an additional 76mm mill.

We supply local merchants and high volume end users, we have also been involved in exports to neighboring SADEC countries.

Bosal Africa (Pty) Ltd

Contact: Nic de Waal
Tel: +27 12 810 9326
Fax: +27 12 803 5110
Email: nicdw@bosal.co.za
Website: www.bosal.co.za

Group Five Pipe a joint venture between Group Five Construction (Pty) Ltd and Marine Civil (Pty) Ltd

Contact: Gerald Blackburn
PO Box 6074, Roggebaai, 8012, South Africa
Tel: +27 21 386 1923
Fax: +27 21 386 2514
Email: nicdw@bosal.co.za
Website: www.g5p.co.za

Hall Longmore (Pty) Ltd

Contact: Francois Maurel
Private Bag X024, Wadeville, 1422, South Africa
Tel: +27 11 874 7300
Fax: +27 11 824 2878
Email: francois.maurel@murrob.com
Website: www.hall-longmore.co.za

New Concept Mining (Pty) Ltd

Contact: Charles Hart
PO Box 125000, Alrode, 1451
Tel: +27 11 494 6000
Fax: +27 11 494 1060
Email: charlesh@ncm.co.za
Website: www.ncm.co.za

Neven Matthews (Pty) Ltd

Contact: Brian Engelbrecht
PO Box 1414, Witbank, 1035
Tel: +27 13 699 8100
Fax: +27 13 699 8111
Email: brian@mpumatube.co.za
Website: www.mpumatube.co.za

ProRoof Steel Merchants (Pty) Ltd

Contact: Charles Domingo
PO Box 3407, Vereeniging, 1930
Tel: +27 16 450 5800
Fax: +27 16 450 5884
Email: charles@proroof.co.za
Website: www.proroof.co.za

ASSOCIATE MEMBERS

ArcelorMittal SA Ltd

Contact: Rudolph Steyn
P O Box 2, Vanderbijlpark, 1900
Tel: +27 16 889 4031
Fax: +27 16 440 3205
Email: rudolph.steyn@arcelormittal.com
Website: www.arcelormittal.com/southafrica/

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 2009 for attention Reneé Pretorius

Enter Online:
www.saisc.co.za/steel_awards_2010

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

DATES TO DIARISE

COURSE ON SILO DESIGN
Speaker: Prof Michael Rotter, the world authority on the design of silos
8 – 10 February 2010
Heritage Conference Centre, Rosherville

LAUNCH OF GRADE S355 HOLLOW SECTIONS
Speaker: Prof Jeff Packer
17 February 2010 – Cape Town
19 February 2010 – Durban
22 February 2010 – Johannesburg

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

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

STEEL AWARDS 2010 – DEADLINE FOR ENTRIES
30 April 2010

NORTH AMERICAN STEEL CONSTRUCTION CONFERENCE
12 – 15 May 2010
Orlando, Florida

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

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

SAISC STUDY TOUR
October 2010
Hong Kong, China, Tibet

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

INDUSTRY NEWS IN BRIEF

Zulch Lötter.

CESA APPOINTS ZULCH LÖTTER AS PRESIDENT

Newly appointed President of CESA, Zulch Lötter, says that the presidency of CESA is the most important office he has held outside of UWP Consulting and he regards it as a great honour to be able to plough back into an industry that he has been an active participant in for close to 40 years.

In this role he aims to focus on improving the business environment for consulting engineers. It is important to him that both CESA members as well as their clients conduct business with integrity and in a professional manner. He strongly believes that consulting engineers should not be perceived by clients and the public as commodities, but as their trusted advisors. To this end, CESA and its members must engage with politicians and decision makers to guide, advise and assist them in creating a sustainable South Africa where all our inhabitants work towards the common goal of creating a future for our children.

Zulch, a CSIR bursar spent a few years performing accident research at Transportec. In 1973 he joined Uhlmann Witthaus and Prins, who were at the time, a three man consulting engineering company. In 1976 he studied at the University of California in Berkeley as a Road Federation Bursar, and obtained an MS degree in Transportation Engineering. He is also a member of ECSA and SAICE.

After his return from the USA, Zulch was involved with the planning, design, rehabilitation and construction of roads and runways, as well as traffic engineering. Since 1984 Zulch has been a partner and later a director of UWP Consulting. In April 1999 he was appointed managing director of the company, responsible for approximately 300 staff members situated in 16 offices across South Africa, as well as subsidiary offices in Zambia, Tanzania and Botswana. Zulch has served on the CESA Council and EXCO since 2003. He has been Chairman of CESA's National Liaison, Finance and Staff as well as disciplinary committees. He is also a director of two of two of the Section 21 companies created by CESA including the Project Development Facilitation Alliance (PDFA) as well as the Built Environment Professionals Export Council (BEPEC).

B&T SHARES MESSAGE OF HOPE ON WORLD AIDS DAY

The message was clear: being HIV positive does not have to be a death sentence; but it does involve making the right choices. This was cleverly illustrated in a two-man play presented to B&T staff and management on World Aids Day on 1 December 2009.

"The production by Reality Training Concepts was an effort by the company to make sure that every staff member understands exactly what our company policy is around HIV and Aids," says B&T Steel's CEO, Trevor van Vuuren. "The stigma that exists around this potentially devastating disease means that often people hide from the truth, rather than face it. This play outlined that

Hope and Choice performing at B&T on Aids Day.

there are choices to be made which will make all the difference to your life – both at home and at work. But it also clearly explained what the outcomes could be if the wrong choices were made."

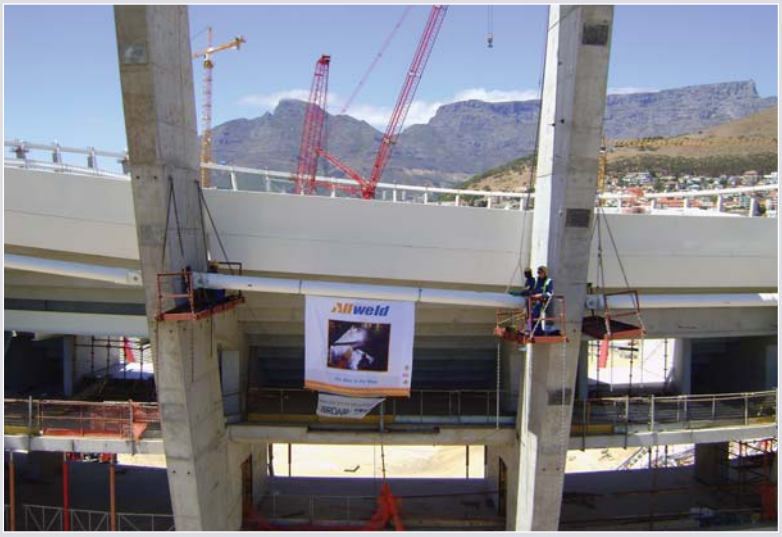
After handing out red ribbons to all, the play opened with the characters, named Hope and Choice, discussing being tested for the HI virus. Choice chooses not to. Hope tries to persuade him otherwise, emphasising that his status would be confidential and that help would be available through the company, but Choice doesn't believe him.

The message was clearly one of hope. Know your status and live a full life – which is possible if you are HIV positive. "We were very impressed with this two-man production and the messages it portrayed," comments Van Vuuren. "Staff members were particularly amused when the two men acted as women, and when a sangoma was portrayed"'

All in all, the feedback from B&T staff has been extremely encouraging, enforced by a brief talk by CEO - Trevor Van Vuuren at the end of the play. A minute silence was observed with each employee lighting a candle as tribute to friends and family who have lost the fight against Aids.

ALLWELD RISES TO STADIUM CHALLENGE

The upcoming FIFA 2010 Football World Cup has not only ignited the construction industry over the past few years, but has also offered tremendous growth opportunities to, amongst others, specialist engineering companies throughout South Africa.



Greenpoint Stadium: The last brace to be welded.

Cape Town-based Allweld Marine & Industrial, a recognised specialist welding company, has been operating throughout South Africa for over 45 years. The awarding of this multi-million rand contract, in late 2008, to install struts and braces between 72 pylons around the Green Point Stadium by the joint venture group of Birdair Inc. (the leading specialty contractor for long-span tensile structures) and Pfeifer (the market leaders in fixing systems and infrastructure technology), afforded Allweld the opportunity to prove their welding and engineering capabilities to these international customers.

The project required highly specialised on-site welding and rigging to be performed since not only were the braces installed at a height of 48 metres, but additional work entailed the installation of 92 horizontal steel struts, 112 tension rods, 28 intersecting plates, 296 gussets with 12mm fillet welds in position and 1 776 stiffener plates with full penetration butt welds. Overall, 110 tons of steel were rigged and welded on the project by a team of 36 qualified personnel – all successfully completed by Allweld safely, within budget and on time.

The initial three-and-a-half month timeframe was subsequently extended due to additional work being secured from other on-site contractors, with Operations Director Wessel le Roux managing the initial project plus all the ancillary work. This project has propelled Allweld to new levels of expertise, safety and quality standards and now positions the company well for future growth.

SAFETY INSTRUMENTED SYSTEMS: THE LAST AUTOMATED BASTION

At Hatch, safety practices and procedures are an essential component of the company's culture and are engrained into the daily lifestyle of the people that work at Hatch. Safety and quality take precedence in all activities, with a company mantra of 'Work Safe and Work Smart'.

Hatch systems and process control consultant, Andy Fourie explains that

the company is directly involved in client processes and risk management as part of project execution.

"Hatch is involved in the full lifecycle of project execution – from concept, through pre-feasibility, feasibility, execution, operations support, to facility closure. This capability is not limited to systems and process control, and extends to all engineering disciplines," explains Fourie.

"Hazard and risk identification and mitigation are applied to all phases of project execution, at a level appropriate to the phase. In the early phases of a project, known hazards may be engineered out of the project scope and/or process."

Control system safety really 'comes home' in the feasibility phase, where detailed process, equipment and plant engineering design has been finalised to the level where process risk and general hazards have been mitigated as far as possible for the operating plant. Further mitigation involves control and/or safety system functionality.

A safety instrumented system may range from a fairly simple hard-wired interlock system to a complex high-reliability system. As it is the final safety mechanism, the emphasis on high reliability is paramount.

Coupled with this is a requirement for the regular testing of that safety system during plant operation. "It is a highly procedural process which guarantees the system. You cannot be in a situation when you have a failure in the lower levels and the final barrier to safety isn't reliable. This is the heart of safety in the control system environment," maintains Fourie.

"Hatch is in an advantageous position to be able to provide its clients with all levels of control, i.e. level 0 to 4, as identified within the ISA standards for engineered solutions for our clients," concludes Loehmer.

Hatch recognises the importance of protecting the health and safety of its employees, clients, visitors and contractors, while caring for the environment and supporting local communities. In addition, the company believes in working together safely so there is no harm to people, the environment and communities associated with projects and activities managed by the company.

ROBOR UNVEILS NEW CLASSROOMS FOR PRIMARY SCHOOL

Robor, the largest manufacturer of steel tube and pipe in Southern Africa, has announced the unveiling of two new classrooms and ablution facilities for Klopperpark Primary School in Isando. As part of the company's corporate social investment initiatives to support its surrounding community, Robor has been supporting the school since late last year.

The official handing over of the classrooms took place on October 17th with staff members, governing body members, parents, pupils, and NGO sponsors in attendance. The buildings were unveiled by Ephraim Tau, Ekurhuleni North District Director and Robor's CEO, Gordon Gilmer.

The classroom project was completed in conjunction with steel grate manufacturer Andrew Mentis.

Two of Robor's business units – Open Sections and Tube – are supporting the ongoing initiative and, in addition to the classrooms, have supplied a number of other items, such as fencing, gate motors, carports, netball posts, soccer posts, a green house, and an intercom system.

The plaque for the unveiling of the new Klopperpark classrooms.

Neels van Niekerk, ISF director.

ITINERARY 2010

In today's economical climate, mining houses tend to put big mining projects on hold, while rather focusing on mine plant improvements and modifications. Smaller fabricators will be able to cut their teeth on these type of projects.

Lhasa Railway Station.

When asked what the plans are for the ISF in 2010 the answers came down to "business as unusual".

The ISF will focus on a number of aspects of the export market while doing some serious travelling.

Firstly, the ISF plans to further extend its scope to smaller fabricators. Historically the ISF focussed on bigger steel construction projects (2 000 – 4 000 tons), but in the last two years has begun to promote the smaller steelwork fabricators as suppliers for smaller projects (200 – 400 tons) with some good results. To align these fabricators with suitable projects, it is necessary to build relationships with smaller sized EPCMs including some Australian EPCMs focussing on projects in Africa.

In today's economical climate, mining houses tend to put big mining projects on hold, while rather focusing on mine plant improvements and modifications. Smaller fabricators will be able to cut their teeth on these type of projects.

Secondly, the ISF also realises the need for standard repetitive business. At this stage OEM (Original Equipment Manufacturers) clients have been identified as a good source of bread-and-butter work for South African steelwork fabricators who will be ideal suppliers for the structural steel part of equipment such as stacker reclaimers.

Thirdly, they will set their sights on European and Canadian based EPCMs that drive the majority of projects in West Africa where South Africa has not been as successful as it could be.

Lastly, infrastructure and transmission line projects in Africa that are backed by reputable financial institutions will be targeted by further cementing relationships with the funding organisations such as the World Bank and African Development Bank.

To achieve these diverse goals for 2010, the ISF has planned a very busy year. Here is just a taste of what lies in store.

February

A visit to the World Bank in Washington D.C. at the end of February has been organised by the ISF. About 15 companies are participating including steelwork contractors, structural engineering companies, architects, quantity surveyors as well as information technology and electro technical companies. The aim is to identify potential projects for the ISF's members that the World Bank are funding, as well as promote South Africa's capabilities to the World Bank task managers.

April

The ISF will attend Expomin 2010 in Chile for the third time since 2006 and will concentrate on the mining developments of Codelco, Barrick and Anglo American in Chile.

May

In May the ISF will further investigate the opportunities of major refinery projects planned for Africa (South Africa, Nigeria and Angola). The delegation will visit relevant EPCMs and attend the OTC (Offshore Technology Conference) 2010 in Houston, Texas.

Trekking further north they will attend the Canadian Institute of Mining's annual conference, where the ISF will also participate in the exhibition at the conference.

June

Euro Mining 2010 takes the ISF to Skellefteå, Sweden to promote their member's capabilities to various European OEMs. They will make use of this opportunity to visit Ugol Rossi in Siberia to investigate opportunities for smaller fabricators in Central Asia.

September

The ISF will visit EPCMs in Eastern Australia and then attend Africa Down Under in Perth.

October

Under the guidance of the ISF, the SAISC is planning a study tour to Hong Kong and China in October and invite all interested parties to participate. The Engineering Committee of the SAISC supports the tour in principal and will advise their specific technical requirements.

This tour will be in typical 'ISF style' – flexible and economical – and will include visits to landmark structural steel projects in Hong Kong; Xian (home of the famous terra cotta soldiers), Beijing and Shanghai. China's leaders in the steel construction industry will also be visited.

The tour centres on the 9th Pacific Structural Steel Conference in Beijing organised by the CSCS (China Steel Construction Society). Visit www.pssc2010.com for more information. Our own Drs. Hennie de Clercq, Geoff Krige, Alex Elvin and Celeste Barnardo will present papers at the conference. Hennie also serves on the international advisory committee of the conference.

An option being considered is an extension to travel with the famous QuinZang Railway line from Xianing to Lhasa and visit the award winning structural steel railway station in Lhasa.

If you are interested in attending the whole or part of this study tour and would like to give your input, please contact Reneé Pretorius at renee@saisc.co.za.

STRUCTURAL STEEL ROOF OVER BLUE DOWNS SWIMMING POOL

The architectural requirements were for the structural steelwork to be exposed and to make use as far as possible of circular tubular members in order to be aesthetically pleasing.

The Blue Downs swimming pool was developed in response to the City of Cape Town's wish to provide a high-quality indoor public swimming pool to serve the Blue Downs community. It is intended that the pool should serve as both a general community facility as well a sporting facility for use during swimming competitions.

The design of the structural steel roof comprises a main roof over the swimming pool area, as well as adjacent subsidiary roofs over two separate public seating areas, an administration block and a lifeguard tower. The requirements of the architectural design were furthermore that the main roof should be supported only at the four corners, standing 35 metres apart on circular concrete water storage 'silos' (the silos are for storing rainwater run-off from the roof for use in the pool). Due to the architectural requirements and the large spans involved, it was considered that no other structural medium other than structural steel would be feasible.

The original architectural design called for a rounded double barrel-vault roof over the main swimming pool area, in accordance with which a thin shell-type roof structure was designed. Due to financial constraints and difficulty in engaging suitable local steel fabricators prepared to carry out the work, which required extensive use of curved members, the design was subsequently revised during construction to the current pyramid shape. In carrying out the re-design, the new design was constrained to an extent by the configuration of the supporting reinforced concrete structure already constructed.

Because of the highly corrosive swimming pool environment, a duplex system of corrosion protection consisting of both hot-dip galvanising and painting was adopted. As the components of the toblerone trusses were too large for the galvanising bed, zinc metal spraying was used for these elements in lieu of hot dip galvanising. Inspection and testing of the zinc spray application was carried out by the Hot Dip Galvanizers Association in order to ensure compliance with the specifications.

The main roof as per the revised design and as constructed comprises the following main structural elements: Pitched 'toblerone'-type trusses forming the four corners of the pyramid shape, edge girders, and sloping secondary trusses.

The toblerone trusses are the primary structural elements, spanning diagonally across the pool between the supporting silos, and intersecting at the roof apex. The trusses work in combined bending and axial loading and rely on the lateral resistance provided by the four support points. The trusses support the ends of the purlins, the ends of the secondary trusses, and the translucent sheeting forming the facetted corners of the roof. Because of the potential for buckling in the slender axially-loaded trusses, diagonal bracing was provided in the plane of the roof to provide lateral stability.

The edge girders are placed along the perimeter of the main roof. Besides supporting the side cladding and the outer sections of the roof, the edge girders assist in resisting the lateral support reactions from the sloping toblerone trusses. The edge girders on two sides of the structure also support the top edges of the subsidiary roofs over the seating areas.

The secondary trusses support the roof purlins, and are in turn supported at their top ends by the toblerone trusses and at their lower ends by the edge girders. In addition to supporting the roof loads, the secondary trusses are also used to provide lateral support to the chords of the edge girders.

The architectural requirements were for the structural steelwork to be exposed and to make use as far as possible of circular tubular members in order to be aesthetically pleasing. All main structural elements with the exception of purlins and sheeting rails, and including all knee braces and diagonal bracing, have therefore been fabricated using circular hollow sections. With the numerous intersecting members, welded connections between intersecting tubular members were in some cases rather complex, requiring careful fabrication.

A number of technical challenges had to be overcome in both the design and the erection of the roof structure. Due to the large span of the main roof, vertical midspan deflections of almost 60mm could be expected in the four edge girders. The interface between the main roof and the side roofs therefore had to be designed to accommodate this relative movement. In the case of the roofs over the administration building and lifeguard tower, this was accomplished by separating the side roofs from the main roof, and accommodating the movement by provision of sliding flashing joints in the cladding.

The erection sequence was established in consultations between the engineer and the steel fabricator, taking cognisance of the requirements of the design. The edge girders and toblerone trusses intersect at common corner elements, and these elements had to be installed at the beginning of the erection process.

The corner elements had to be accurately placed in order to ensure proper fitting of the various trusses and girders. Because the toblerone trusses rely on the edge girders to withstand the lateral support reactions, the four edge girders had to be erected beforehand. This meant that the toblerone trusses had to be installed while working over the edge girders. One of the toblerone trusses was installed, remaining temporarily propped until the intersecting truss could be installed to provide stability.

Once these main members were in place, the secondary trusses and other structural elements such as bracing members and purlins could be installed. Because the design allows little tolerance for dimensional discrepancies, a high level of input was required by the steel fabricator in order to achieve the required accuracies.

project team

Developer/ Owner:
City of Cape Town

Architect:
ARG Design

Structural Engineer:
Bergstan South Africa

Quantity Surveyor:
LWA Quantity Surveyors
(R/A Waterson & Hoosai cc)

Project Manager:
ARG Design

Main Contractor:
Tempani Construction (Pty) Ltd

Steelwork Contractor:
Mazor Steel (Pty) Ltd

NEW BRIDGE LANDMARK GREETS PRETORIA

The new bridge structure was designed to facilitate the widening of the N1 freeway to 12 lanes and after civil work completed later in 2010, the bridge will also support a new water pipeline currently housed on the old cement bridge to be demolished.

The bridge was assembled in one internally bolted and fully welded unit next to the freeway in the road reserve close to the point of erection.

Christmas came to the N1 highway over December and brought a new landmark steel structure to Pretoria, manufactured and erected by Cadcon.

A 142 ton dual purpose, service and pedestrian bridge was erected for the South African National Roads Agency (SANRAL) as part of the Gauteng Freeway Improvement Project (GFIP) between the Atterbury and Lynnwood interchanges.

The new bridge structure was designed to facilitate the widening of the N1 freeway to 12 lanes and after civil work completed later in 2010, the bridge will also support a new water pipeline currently housed on the old cement bridge to be demolished.

The design of the bridge is relatively unique in South Africa as described by the engineer, Mr. Tiaan Kramer.

The actual lifting of the bridge over the N1 highway took 30 minutes – the highway was closed from 05:00 to 12:00.

The Cadcon team: (back) Hendrik Engelbrecht, Barry Barnard, Richard Butler and Abri Barnard; (front) Johan Jonker and Adrian Goodwin.

The structure was manufactured in six abnormal segments in Cadcon's workshop.

"The bottom chord of the bridge is usually supported from the main arch via cables, but in this case we made use of oblong shaped diagonals to give the perception of a truss".

The oblong pipes were purpose manufactured using an outer skin rolled from 3mm plate cladded around a 165 x 6mm internal pipe performing the structural work. This offered the client an architecturally soothing structure and 1st of its kind in South Africa.

The structure was manufactured in six abnormal segments consisting of 4 off 6m wide x 31m long and 2 off 6m wide x 10m long in Cadcon's Centurion works. Due to the scale of the segments fabricated, alterations were done to the workshop exit doors in order to load and transport the 6m x maximum 31m long abnormal segments with individual weight of the heaviest segment 25 tons out of the premises.

A mock-up section was also constructed at Cadcon's premises for the client's lighting specialist to test the affect of the lighting on the oblong bracing. The specialist lighting will ensure that Pretoria's newest landmark lights up the skies over this N1 section.

Cadcon introduced a bolted end connection to the ends of plate box segments to simplify assembly of the huge segments on site with internal bolted connections. After assembly of the segments and lining up on site, the internal bolted connections were closed up with external plates which enabled a smooth external finish on the bridge structure with no visible bolted connections.

31m long abnormal segments with individual weight of the heaviest segment 25 tons were transported to site.

Bolted end connections to the ends of plate box segments were introduced to simplify assembly of the huge segments on site.

A mock-up section was constructed for the client's lighting specialist to test the affect of the lighting on the oblong bracing.

The clean lines of the structure was a brief from the engineers and client and the steelwork contractor through similar and innovative construction details Cadcon used on tubular connections during the construction of the Mbombela 2010 Soccer Stadium. All site welds were tested on site by means of ultrasonic and magnetic particle tests.

A further requirement of the client at tender stage was to minimise the interruption of the N1 freeway during erection as the main public freeway. Cadcon provided an option to the client to assemble the bridge complete in one internally bolted and fully welded unit next to the freeway on the road reserve close to the point of erection. The bridge could then be lifted in one complete unit. For this reason, heavy lifting specialist, Sarens was brought onboard by the steelwork contractor who confirmed the possibility to lift the bridge in one unit as the single heaviest lift ever on the national roads to date. A 850 ton Demag crawler crane was earmarked for this task and method statements were prepared. Establishment of the crane and pre-lift preparation took almost a week before the huge lift and full road closure of the N1 was required. Erection was also delayed by a week to cater for the December holiday peak traffic to settle down and perform erection just before Christmas, when most holiday makers have reached their destinations elsewhere.

Traffic on the N1 highway was brought to a standstill on December the 20th from 05:00 in the morning and re-opened at 12:00, with the actual lifting of the bridge taking about 30 minutes. The public that stayed home in Pretoria, watched in awe as the massive bridge structure was placed into its position just after 9:00 the Sunday morning.

Once completed, the bridge will weigh approximately 400 tons, through the addition of the steel handrails, a concrete walkway and two water mains.

project team

Client:
SANRAL (South African National Roads Agency Limited)

Structural Engineer:
ARQ, Pretoria

Main Contractor:
BRCD (Basil Read, Roadcrete, Chavani and Dipcivils in Joint Venture)

Steelwork Contractor:
Cadcon

Detailing of Steelwork:
Mondo Cane, Cape Town

Paint Contractor:
DRAM Industrial Painters

Transport Company:
Reynecke Heavy Transport and CADCON

CADCON

Further to Cadcon's involvement with the upgrading of the road infrastructure, Cadcon has been awarded a R96 million contract with SANRAL for the steel construction of 43 tolling facility gantries in Gauteng.

CADCON projects in progress for 2010:

ESKOM Medupi ACC Units in JV	(40%) 25 000 tons / R700 million in JV
SANRAL, Tolling Facilities	R 100 million
Kisumu, Kenya Airport Upgrade	R 4 million
BMW (SA) Roof upgrades	R 3 million
House of Football, Nike in JV (50%)	R 1.5 million
William Nicol ROBOT Gantry	R 1.5 million
Plant Moatise, Mozambique	R 500 000

GAUTRAIN STATION – PRETORIA

As could be expected all the Gautrain stations have a similar design theme and closely tie in with each other. The Pretoria station differs in its lay-out in that the platform is in the middle with a train track on each side. Thus it appears that the steel roof structure forms a 'tunnel' enclosing the passing trains.

Regular commuters travelling between Johannesburg and Pretoria cannot wait for the Gautrain to be operational, even more so with all the disruptions to road traffic resulting from the Gautrain construction. We have all seen the above-ground track structures going up, but few have had privy to the beautiful steel structures for the stations.

Spiral Engineering was awarded the tender for the steelwork for the Pretoria station and was involved in the project from an early stage. Based on their performance at Pretoria, Spiral were requested to take over the completion of the Midrand station from the previous appointed contractor.

As could be expected all the Gautrain stations have a similar design theme and so closely tie in with each other. The Pretoria station differs in its design in that the platform is in the middle with a train track on each side. Thus it appears that the steel roof structure forms a 'tunnel' enclosing the passing trains. The structure widens in plan at the end of the station and so takes on the resemblance of a 'traditional' railway station.

Such a widening design would of course present Spiral with a few 'challenges'. The roof structure is supported on tubular tree like structures. The correct positioning of these supports in the flared section had to be carefully calculated as each tree has a unique set-out point and each leg section on each tree has different dimensions.

Fabrication of the tubular steel was made easier by two factors. The Tekla (XSteel) drawings of the tubular connections included interlocking keys to ensure that the developed connections were clean, aligned and 100% correct to

project team

Owner:
Gauteng Provence

Architect:
Bombela Civils Joint Venture

Structural Engineer:
Bombela Civils Joint Venture

Quantity Surveyor:
Bombela Civils Joint Venture

Project manager:
Bombela Civils Joint Venture

Main Contractor:
Bombela Civils Joint Venture

Steelwork Contractor:
Spiral Engineering cc

suit the welding procedures. The tubular sections were laser cut directly from electronic files exported from the detailing package by Tube Laser (a division of Tricom Structures) a company specialising in precision tube cutting. Spiral Engineering fabricated purpose made jigs to double check the accuracy of the tubular connections in the workshop prior to final welding .

As with all projects within the Gautrain project the Pretoria station operated under very stringent quality assurance requirements and procedures. Welding and painting procedures were meticulously overviewed by Bombela. Spiral Engineering compiled documentation for quality procedures that made the project run smoothly enabling them to comply with Bombela's requirements. The Midrand project proved to be more challenging, largely due to the late involvement of Spiral.

The original design for the tree columns was based on site welding of the 'spigotted' slip joints at the bottoms of the tubular tree supports. This was expected to facilitate easier transportation to site. Spiral Engineering rather opted to fabricate the tubular trees as complete units in the workshop at the expense of abnormal transport loads. In the end this proved to be not only more economical but in addition they had much better control over the welding procedures in the workshop. After all, if such complex structures are computer detailed and correctly cut to shape, then the remaining fabrication issue is a welding problem. The decision to opt for complete assembly and welding in the workshop was a key element to meeting the stringent quality requirements of the project.

The completed steel was sandblasted and painted with an epoxy paint system.

The tubular sections were fabricated using 193mm diameter tubes for the tree support structures. The curved rafters are I beam in profile. As rolling the curves into these rafters was not an option due to quality concerns, they were fabricated out of curved web plates, to get the radii correct, and flat bar flanges pulled to the correct shapes. The purlins are IPE sections. In total 137 tons of steel have been used for the roof structure.

The current progress reports tell us that the steelwork for the roof structure has been completed. Spiral Engineering are completing additional work in the form of walkways and bus transit stations in the station precinct.

Spiral Engineering is a well known specialist in architectural steelwork. Colin Kirkland, managing director of Spiral says that these days it is easier to work with tubular steel to achieve the required architectural finish because the new developments in detailing and laser cut technology go a long way to ensuring seamless connections and fabrication.

SANS CODE TRAINING COURSES

MARCH 2010

The SA Institute of Steel Construction and SASFA will be offering two one-day courses on new SANS Standards, to assist practitioners to master the new codes in a short period of time. Both of the courses will qualify for CPD points.

COLD FORMED STEEL DESIGN

Background:

In order to update the South African design standard for cold formed steel structures (SANS 10162:2), it was decided to adopt the Australian Code AS/NSZ 4600:2005, with minor modifications.The SABS are making the necessary changes, and the new standard will be available as SANS 10162-2 : 2010.


Professor Greg Hancock

We are very pleased to announce that the internationally renowned Professor Greg Hancock will present a one day course on the code, aimed mainly at engineers. He is an Emeritus Professor at the University of Sydney, formerly Professor of Steel Structures and Dean of the Faculty of Engineering and Information Technologies at the University of Sydney. His research interests are in the area of cold-formed steel structures for which he was awarded the degree of Doctor of Engineering by the University.

Who should attend?

All designers of cold formed steel structures.

Where and when?

The full day course will be offered in:

- Johannesburg on 9 March,
- Durban on 12 March, and
- Cape Town on 16 March 2010.

LIGHT STEEL FRAME BUILDING

Background:

SANS 517:2009 Light Steel Frame Building was published by the SABS towards the end of 2009.A training course will be presented to assist practioners to understand and quickly implement the new standard.

All the facets of the standard will be covered by Anna-Marie Sassenberg (AMS Civil & Structural Consultants), Barend Oosthuizen (By Design) and John Barnard (SASFA) – from foundations and the steel frame to floors and walls, including insulation and services.

Who should attend?

The course is aimed at engineers, architects, quantity surveyors, developers and builders.

Where and when?

- Johannesburg on 8 March,
- Durban on 11 March, and
- Cape Town on 15 March 2010.

Please contact info@sasfa.co.za or Pamella Mnyanda at 011 726 6111 for more info or registration details

John Barnard, SASFA director.

LIGHT STEEL FRAME INDUSTRY ENDS 2009 ON A HIGH NOTE

By John Barnard, SASFA director

The designers found that LSFB can provide the structural strength required for the 12m high curtain walls, as well as the acoustic and thermal insulation. Using LSFB saved a lot of time, and kept the site clean of building materials and rubble which allowed easy access for other trades.

SANS 517:2009

It is with great pleasure that we can announce that the SABS has finally approved SANS 517:2009 Light Steel Frame Building as the South African national standard for low rise light steel frame building. Using the SASFA building code as basis, the SABS put the document through a rigorous vetting process as part of the normal procedure to develop and approve national standards. Through close co-operation with SASFA, the editing and approval processes were expedited, and the final document was approved in less than two years.

While light steel frame projects will still require a rational design by a competent person for approval by the NHBRC and municipalities, this rational design can now be based on the SABS document, which should facilitate the process.

LSFB FOR SHOPPING CENTRES

Following closely on the heels of the Zambezi Mall, a massive new shopping centre will use LSFB for internal and external walls.

In the Zambezi Mall, north of Pretoria, the developer Capicon chose light steel roof trusses to support the 7500 sq m roof over the complex. Supplied by Mitek, the truss project went so well, that the developers decided to do the walling of the cinema complexes also in light steel framing!

It resulted in a 7 000 sq m walling project – the steelwork was supplied by Silver Falcon Trading, erected by Blue Sands and wall cladding system supplied by Saint Gobain, all SASFA members. The designers found that LSFB can provide the structural strength required for the 12 m high curtain walls, as well as the acoustic and thermal insulation. Using LSFB saved a lot of time, and kept the site clean of building materials and rubble which allowed easy access for other trades.

Some of the LSF wall panels on the 90 000m² The Villa Shopping Centre being built south of Pretoria. The frames are being supplied and erected by GDS (Pty) Ltd. This promises to be the largest LSFB project to date in South Africa!

SOUTHERN AFRICAN
LIGHT STEEL FRAME BUILDING ASSOCIATION

It was therefore no wonder that the developers investigated the possible use of LSFB for the massive The Villa shopping centre being built on the south eastern side of Pretoria. After intensive investigations and trail applications, it was decided that light steel framing offers significant benefits compared with heavy masonry construction, and the contract for 120 000 sq m of walling (internal and external) was won by GDS, a SASFA member. GD Irons is the main contractor.

INDUSTRY GROWTH

Using steel consumption as a barometer, the light steel frame building market grew by 10% during 2009 when compared with the previous year, notwithstanding the sharp declines in both building plans approved and buildings completed during the year. Based on input obtained from industry, a total of some 20 000t of thin gauge high strength galvanized steel sheet was used during the year for roof trusses, wall panels and a range of other structural components such as purlins, battens and floor joists. The growth in demand illustrates the wider acceptance gained by light steel framing for a wide range of applications. We expect similar growth in demand during 2010.

PLANS FOR 2010

SASFA will again focus on training – courses will be presented to building inspectors, builders and developers, as well as designers. A two week course for builders, covering the steel frame, cladding, lining and insulation – including practical work

7 500m² of light steel roof trusses were used in the construction of the the Zambesi Mall.

– will be offered in Midrand from 8 to 19 February 2010. One day courses will be offered to architects, engineers, developers and builders, covering all aspects of the SANS 517:2009 Light Steel Frame Building – the course will be offered from 8 to 16 March 2010 in Johannesburg, Durban and Cape Town (see page 16 or visit www.sasfa.co.za for further details).

SOCIAL SNIPPETS

By Marlé Lötter
Events Manager, SAISC

Outgoing SAISC Chairman, John Swallow. Term of service: 2008 to 2009.

SASFA Committee Members receiving copies of the long awaited SANS 517 at the SASFA year end lunch at Buitengeluk Restaurant, Fourways.

SMMH 2009 in session at Sun City. In attendance were several SAISC 'stalwarts', but also many 'new' faces.

Hennie presents the SAISC's plans for 2010 and beyond.

AGM 2009

19 November 2009

The Institute held its Annual General Meeting (AGM) for 2009 on 19 November at the Country Club Johannesburg, Auckland Park.

Similar to past years the formal SAISC AGM was preceded by a SAISC board meeting, as well as board and AGM sessions of the two divisions of the Institute, the ISF and SASFA. At the SAISC AGM John Swallow of CadexSA was thanked for highly dedicated service as Chairman of the Institute during the two years of his service, 2008 and 2009. Molefe Kgomo was elected as the new Institute Chairman for 2010. SASFA will be chaired by Stewart Murray of MitekSA for a consecutive year in 2010. Kobus Marais of DSE will be the Chairman of ISF in 2010.

The Annual Report for 2009 follows the Institute trend for doing the conventional differently – this edition drew inspiration from visiting French architect, Odile Decq, stating the facts in hues of black and orange with odd bits of humour spliced in.

Following the AGM sessions, guests enjoyed a short presentation by the well-known political and trend analyst, JP Landman, in which he shared some informative (and indeed entertaining) insights into South African issues.

In conclusion, and in true Institute fashion, guests enjoyed networking with industry fellows over cocktails and snacks.

SAISC Board

Molefe Kgomo (Chairman), Charles Dednam (Vice Chairman), Helgaard Meaker (Treasurer), Dave Dawkshas, Mike Lomas, Kobus Marais, John Swallow, Rob Young, Jim Guild, Tipten Terblanche, Michael Mamotte, Stewart Murray.

The Constructional Engineering Association still needs to nominate its representative

SASFA YEAR END LUNCH

3 December 2009

Committee members of SASFA took a break from the hard work of 2009 with a relaxed year end celebration at Buitengeluk Restaurant in Fourways on 3 December 2009. One accomplishment of 2009 that was certainly well worth celebrating was the release of SANS 517, the Standard for Light Steel Frame Building!

SMMH 2009

The first international conference focusing very specifically on Structures for Mining and Related Materials Handling (SMMH 2009) was hosted by the SAISC at Sun City, 9 to 12 November 2009 - Platinum Sponsor Macsteel. The conference attracted 25 presenters and authors from South Africa and as far

afield as the USA and Australia - all with specialist knowledge or experience of various aspects relating to the field of focus. A total of 120 individuals attended the sessions and events offered over 4 days.

The conference comprised three main events:

- A full day workshop on SANS 10208, the acclaimed South African Standard on Design of Structures for Mining;
- Two full days of presentations covering various aspects relating to broad themes such as the design, operation and maintenance of shafts, conveyances, plants, headgears and machine structures, as well as project contracts. (A limited number of the printed Proceedings of SMMH 2009 are available from SAISC at R400 per copy.)
- Very informative site visits to the world's tallest concrete headgear at Shaft 16 (103m) and the world's tallest steel headgear at Shaft 17 (81m) of Impala Mines near Rustenburg.

Throughout the run of SMMH 2009 an exhibition was also hosted with displays by various companies with special interest in this field.

For good measure delegates had added opportunities for some social networking during the opening cocktails at the Sun City Hotel and also during a very relaxed Conference Dinner at the Shebeen Restaurant – the quarts of beer, Amarula in 'blik bekers' , authentic South African cuisine and juke box sounds enjoyed among the thorn trees will remain fond memories for many!

Positive post event feed back of this first-of-kind conference has the SAISC already investigating options for a follow-up in a year or three, this time possibly on foreign soil. Watch this space!

SAISC COMMITTEES BREAKFAST

25 January 2010, Country Club Johannesburg

Under the guidance of SAISC management and the newly appointed Institute Chairman, Molefe Kgomo, 2010 will ring in some changes in how the Institute tends to certain tasks effectively. One specific aim is to avoid lengthy committee meetings scheduled for regular times, which only a few can attend and which typically do not ensure effective results. This was one of the Institute issues deliberated at the SAISC Committees Breakfast at the beginning of this year. Details of changes will be communicated to members throughout the year as they become relevant.

Guests to the event also enjoyed an insightful presentation by guest speaker, Pieter le Roux, General Manager Commercial Enterprises Division, Eskom Holdings, on the subject of ESKOM's commitments and handling of the new Power Station contracts.

FLATTENED ENDS ARE OUT

By Spencer Erling
Education Director, SAISC

The advent of the fact that modern 3D detailing software packages speak to the NC laser cutting machines means that gone are days of making wrap around developments, gone are the days of flattening ends of tubes.

Tubular construction is not exactly a new science. As early as the 1890's iconic bridges such as the rail bridge over the Firth of Forth between England and Wales was constructed using circular hollow like sections for the main components. Of course in those long gone days welding was not in existence so the pipes were made from two halves - each half consisting of extended semi-circles. The halves were joined together by riveting them together through the extension pieces. Today, some 115 years since opening, all be it that the bridge has been reinforced, it is still doing regular and normal rail duty.

The arrival of seam welded pipes made their use in structural applications a given, after all, other than circular solid sections, no other structural profile has an equal strength in every direction making tubes the ideal profile for, especially, compression members.

But the circular hollow profiles were dogged for years by the perception of high prices. These were in many instances of real concern especially when the rate per ton price of tubes was considerably higher than hot rolled profiles. But that of course was not really a true measure as tubes often have a mass much lower than their equivalent alternative hot rolled profile.

The next most commonly raised argument about expensive tubular construction was the expense of joining members together. Yes, when it came to developed profiled connections this was relatively true, especially in pre-computerised drawing times. The effort to develop such connections by hand on paper was laborious and slow. Wrap around templates were made from cardboard or firm paper, and the steel once marked was cut by hand, usually with oxy-acetylene torches, resulting in an enormous amount of grinding and general cleaning before the piece could be used.

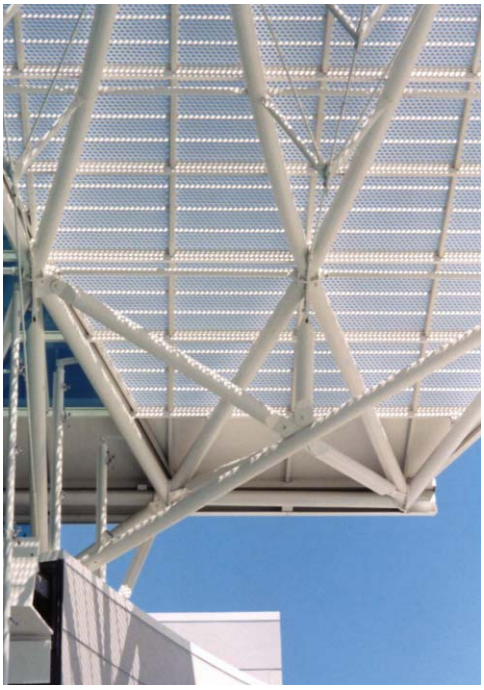
Oh, and if, as quite often happened, the wrap around template at one end of the pipe was not concentric with the other end: imagine the use of strong language; throw it away and start again.

The net result was tubular construction was not what every fabricator wanted to do, few contractors got it right, and as you can expect they charged for their services!

There was an alternative, but that became regarded as an industrial solution by architects. That was the well developed and documented flattened end method of truss construction. In this method the ends of the pipes were flattened so they were no longer round but almost a flat rectangle like and because this end was quite narrow it was now possible to cut these members in a saw (before or after flattening).

So whilst quite a few industrial projects were built using flattened ends, this method really did not do justice to the high quality finish architects had hoped for with tubular construction.

Between the 'industrial look', the partially true perception of high prices, the fact only a few fabricators really 'got it right' tubular construction just did not get its fair share of the market.



Tubular 'boat shaped' trusses under fritted glass.

MODERN TECHNOLOGY ARRIVES...

But this is the second decade of the 21st century. Some wide awake tube manufacturers and steelwork fabricators are keeping up with modern developments and over the last 5 years we find that numerous NC controlled laser cutting machines have made their way to the foot of Africa and now, all that is rapidly changing.

Laced tubular columns to sloping façade of multi storey structure.

The advent of the fact that modern 3D detailing software packages speak to the NC laser cutting machines means that gone are days of making wrap around developments, gone are the days of flattening ends of tubes. Here are the days of NC machines automatically cutting, shaping and preparing the ends of members to accurately allow for pipe to pipe connections in every which way imaginable, in quicker time than it would have taken to use the wrap around template to previously mark a pipe, let alone cut and clean it.

Do not forget that laser cuts clean, so no grinding and cleaning before assembling. The comment of a workshop manager when asked was this a difficult job to put together (on being complemented on his very complex shaped entrance canopy sloping up and curved combination) says it all: "We detailed the steelwork on 3D, we sent the files to our favourite tube maker who delivered the pipes cut and fully shaped a few days later. We did a quick layout and two days later the whole job was assembled and welded."

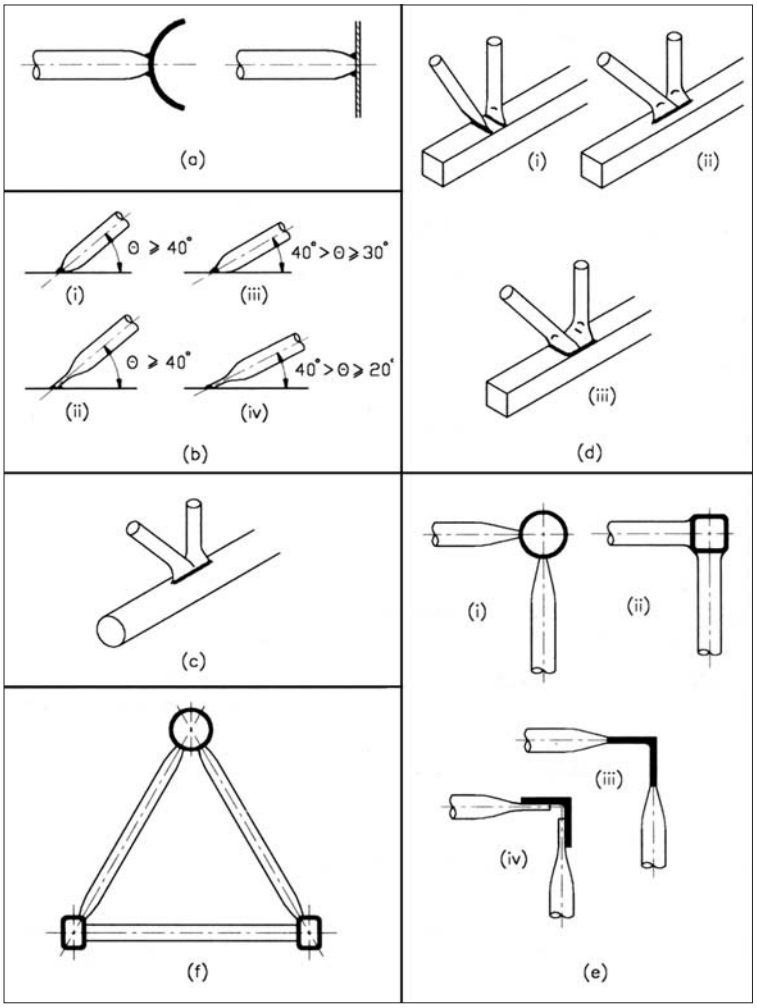
THE WAY OF THE FUTURE

There is no doubt that

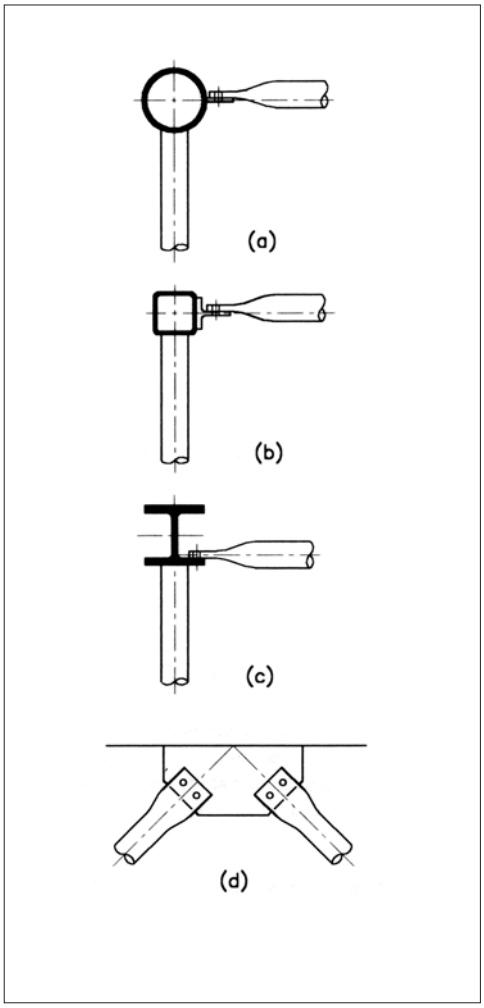
- despite the enormous investment cost in the new equipment;
- the fact that these machines are not available only to the few as some machines sit at service centres;
- the speed with which they cut,
- the cleanliness of the cuts;
- the accuracy with which they cut and so fit when assembled;
- the resulting ability to do clean and effective welds

the new machines are going to be a great boost for the tubular industry.

So, be you architect or engineer, quantity surveyor or developer, or just a fabricator, make it your business to get to grips with this new technology, let your imagination fly because the new technology will eliminate lots and lots of the pain associated with the weird and wonderful projects of the past.



Welded connections of flattened-end members.



Bolted connections of flattened-end members.

TUBULAR BRACE MEMBER CONNECTIONS IN BRACED STEEL FRAMES

By J.A. Packer
Department of Civil Engineering,
University of Toronto, Canada

This paper reviews the current 'state-of-the-art' for the design of gusset-plate connections, under both static and seismic loading conditions, and for fabricated and cast connections.

ABSTRACT: Diagonal bracings are extremely popular elements for lateral load resistance in steel-framed buildings. In turn, the most common shape used for bracing members is the hollow structural section. While the design of such members is straight-forward, the design of gusset-plate connections at the member ends is controversial. This paper reviews the current 'state-of-the-art' for the design of such connections, under both static and seismic loading conditions, and for fabricated and cast connections.

1. INTRODUCTION

The total global output of welded tubes, which rep-resent the manufacturing process used for most of the world's structural tubing, has been approximately constant – despite some fluctuations – over the last 10 years: 40.1 million metric tons in 1995 and 41.1 million metric tons in 2004 (IISI 2005). In this same period, however, the world production of crude steel has increased by 41%, from 752 million metric tons in 1995 to 1 058 million metric tons in 2004. Thus, in 2004 welded tubes represent about 4% of the total steel market, but a very important component of the structural steel sector. While some countries have decreased welded tube output in the last decade (e.g. U.S.A.), there has been a huge increase in production in China (by 245% over the period 1995 - 2004). National production statistics, for the 10 leading countries, are shown in Figure 1 (IISI 2005). These figures do not include other (less-common) types of hollow sections (e.g. seamless tubes and fabricated sections). While not all of these tonnages will be used for structural purposes, the data is indicative of local consumption and export levels.

In steel structures the most common applications for welded tubes are as columns, in trusses and as lateral bracing members, where the structural engineer can take advantage of excellent properties in compression and the architect can utilise aesthetic qualities in exposed steelwork. Simply-connected steel frames are typically laterally-braced with diagonal members as shown in Figure 2. The ends of the Hollow Structural Section (HSS) bracings are then usually connected to the steel frame via gusset plates, as shown in Figure 3. The design of the bracings, as compression or tension members, is performed in accordance with applicable national or regional structural steel specifications. For low-rise structures with lateral loads governed by static (wind) loading, bracing member selection will often be controlled by maximum permitted member slenderness limits. (For example, in Canada $(KL/r)_{max}$ = 200 in compression and, generally, 300 in tension (CSA 2001)). In structures with lateral load design governed by seismic actions, bracing member selection will be further restricted by limits on the slen-

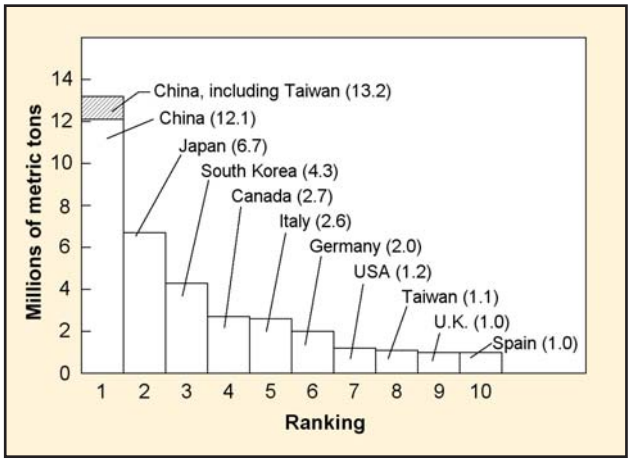


Figure 1: The 10 leading producers of welded tubes, by country, for 2004 (IISI2005).

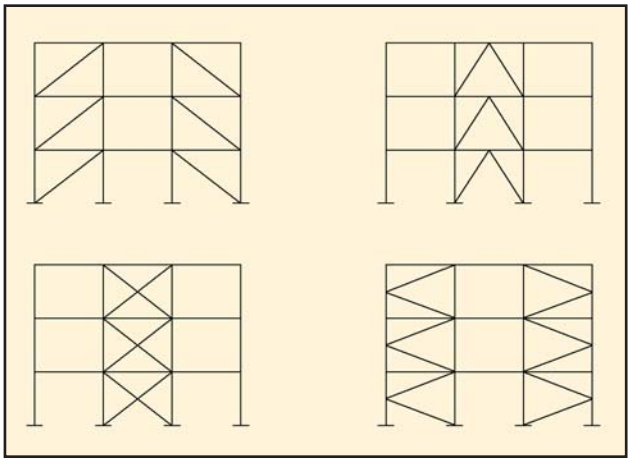


Figure 2: Typical configurations of concentrically-braced steel frames using hollow sections as bracings.

derness of the member cross-section. (For example, for moderately ductile concentrically braced frames in Canada, where moderate amounts of energy are dissipated through yielding of bracing members with (KL/r) ≤ 100, the flat width-to-thickness ratio of square and rectangular HSS must be ≤ $330/\sqrt{F_y}$ and the diameter-to-thickness ratio of circular HSS must be ≤ $10\,000/F_y$. These cross-section slenderness limits, in which the yield stress F_y is expressed in MPa or N/mm², are considerably lower than the normal Class 1 limits (CSA 2001). In current U.S. provisions for 'special' and 'ordinary' concentrically braced frames, these cross-section slenderness limits are even more restrictive: $286/\sqrt{F_y}$ for square/rectangular HSS and $8\,800/F_y$ for circular HSS (AISC 2005a)).

2. GUSSET PLATE CONNECTIONS TO THE ENDS OF HOLLOW SECTIONS – STATIC LOADING

Single plates are often inserted into the slotted ends of a round or square HSS, concentric to the axis of the HSS member, both in roof trusses (typically to avoid round-to-round HSS tube profiling associated with directly-welded members) and in diagonal bracing members in braced frames. This inserted plate is frequently then connected to a single gusset plate, usually by bolting. In such situations a bending moment is induced in the joint by the eccentricity between the plates which must be considered. Under compression loads the plates need to be proportioned as beam-columns, and assuming that both ends of the connection can sway laterally relative to each other. This is frequently overlooked, leading to periodic structural failures, but the American HSS Connections Manual (AISC 1997, Chapter 6) is not guilty of this omission and gives a reasonable and simple design method. Alternatively, the single gusset plate attached to the building frame can be stiffened, typically by adding another transverse plate along one edge of the gusset, thereby giving the gusset attached to the building frame a T-shape in cross-section.

With regard to the performance of the HSS in such connections, load is only transmitted initially to a portion of the HSS cross-section, thereby creating a shear lag effect which may result in a lower HSS capacity in both compression and tension. For tension loading on the HSS member, the effective area (A_e) is determined by the net area (A_n) multiplied by a shear lag factor, U. For the latter, the most recent specification version is given by AISC (2005b). These U factors have been revised by AISC from the previous specification (AISC 2000), where U had an upper limit of 0.9. Based on the work of Cheng & Kulak (2000) the U factor can now be taken as 1.0 for connections to circular HSS with a sufficiently-long inserted plate and weld length (L_w). Table 1 shows the current AISC U factors for circular HSS compared to those from other Canadian codes/guides, and Figure 4 illustrates the geometric parameters used. For the shear lag effect, Eurocode 3 (CEN 2005) only addresses bolted connections for angles connected by one leg and other unsymmetrically connected tension members.

North American specifications have gone through many revisions (Geschwindner 2004) concerning the design methods for the limit state of tensile fracture affected by shear lag. Table 1 illustrates the two main prevailing methods: based on the connection eccentricity (AISC) or based on the distance between the welds (CSA). In this table it can be seen that the Packer and Henderson (1997) approach is just a modification of the CSA (1994) method. Note that the resistance factor of ϕ = 0.75 for AISC (2005b) is approximately the same as (0.9)(0.85) = 0.765 for CSA (2001). The other tensile limit state for these connections is 'block shear' (or tear-out) and the current North American and European design provisions are given in Table 2. As can be seen, all use a design model based on the summation of the resistance of the part in tension (where all use the net area in tension multiplied by the ultimate tensile stress) and the resistance of the part in shear. The latter can be calculated based on the net/gross area in shear multiplied by the shear yield stress/shear ultimate stress, depending on the specification. At present the American and Canadian specifications use a common design model but quite different resistance factors. (The Canadian resistance factor is currently under review).

A study of both concentric gusset plate-to-slotted tube and slotted gusset plate-to-tube connections, under both static tensile and compression member loadings, using both round and elliptical HSS, has been underway at the University of Toronto since 2002. The connection

Figure 3: Statically-loaded steel frame, braced with diagonal hollow sections.

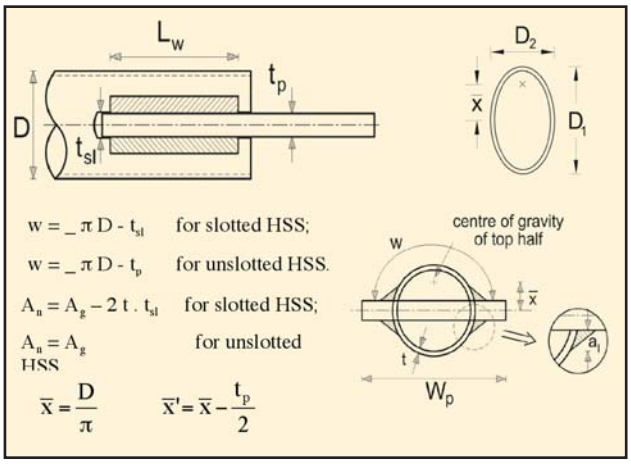


Figure 4: Important geometric parameters influencing connection design.

Specification or design guide	Effective net area	Shear lag coefficients	Range of validity
AISC (2005b): Specification for Structural Steel Buildings	$A_e = A_n \bullet U$	$U = 1 - \frac{\bar{x}}{L_w}$ for $1.3D > L_w \geq D$ $U = 1.0$ for $L_w \geq 1.3D$ (for circular HSS)	$L_w \geq D$
CSA (1994): Limit States Design of Steel Structures		$U = 1.0$ for $L_w/w \geq 2.0$ $U = 0.87$ for $2.0 > L_w/w \geq 1.5$ $U = 0.75$ for $1.5 > L_w/w \geq 1.0$	$L_w \geq w$
CSA (2001): Limit States Design of Steel Structures		$U = 1.0$ for $L_w/w \geq 2.0$ $U = 0.5 + 0.25\ L_w/w$ for $2.0 > L_w/w \geq 1.0$ $U = 0.75\ L_w/w$ for $L_w/w < 1.0$	no restrictions
Packer and Henderson (1997): Hollow Structural Section Connections and Trusses – A Design Guide		$U = 1.0$ for $L_w/w \geq 2.0$ $U = 0.87$ for $2.0 > L_w/w \geq 1.5$ $U = 0.75$ for $1.5 > L_w/w \geq 1.0$ $U = 0.62$ for $1.0 > L_w/w \geq 0.6$	shear lag not critical for $L_w < 0.6w$

$T_r = \phi\ A_e\ F_u$ (AISC (2005b) Specification, $\phi = 0.75$) or $T_r = 0.85\ \phi\ A_e\ F_u$ (CSA (2001) Specification, $\phi = 0.9$), where T_r = factored tensile resistance, F_u = ultimate tensile stress and ϕ = resistance factor.

Table 1: Shear lag design provisions for circular and elliptical hollow sections

Specification or design guide	Block shear strength
AISC (2005b): Specification for Structural Steel Buildings	$T_r + V_r = \phi\ U_{bs}\ A_{nt}\ F_u + 0.6\ \phi\ A_{gv}\ F_y \leq \phi\ U_{bs}\ A_{nt}\ F_u + 0.6\ \phi\ A_{nv}\ F_u$ with $\phi = 0.75$ and $U_{bs} = 1$
CSA (2001): Limit States Design of Steel Structures	$T_r + V_r = \phi\ A_{nt}\ F_u + 0.6\ \phi\ A_{gv}\ F_y \leq \phi\ A_{nt}\ F_u + 0.6\ \phi\ A_{nv}\ F_u$ with $\phi = 0.9$
Eurocode (CEN 2005): Design of Steel Structures - General Rules - Part 1-8: Design of Joints[a)]	$T_r + V_r = \frac{1}{\Upsilon_{M2}} A_{nt}\ F_u + \frac{1}{\Upsilon_{M0}} \frac{1}{\sqrt{3}} A_{nv}\ F_y$ $\Upsilon_{M0} = 1.0$ and $\Upsilon_{M2} = 1.25$

a) Design rule for bolted connections differs slightly.
T_r = factored tensile resistance, V_r = factored shear resistance, A_{nt} = net area in tension, A_{nv} = net area in shear, A_{gv} = gross area in shear and F_y = yield tensile stress.

Table 2: Block shear (tear-out) design provisions.

fabrication details investigated, which include both end return welds and connections leaving the slot end unwelded, are shown in Figure 5. Complete details of the experimental testing programme can be found elsewhere (Willibald et al. 2006) but examples of the two classic failure modes are shown in Figure 6.

The experimental program by Willibald et al. (2006) concluded that the block shear design model (Table 2), although based on limited correlations, was suitable, particularly if predictions were calculated using a theoretical fracture path excluding the welds. Yet another proposal has been recently made to improve the general block shear model in Table 2 (Franchuk et al. 2004) by adjusting the shear resistance term. It should be noted, however, that their recommendations are based only on bolted connection data, and specifically from coped steel beams. These experiments also confirmed that both the AISC (2005b) and CSA (2001) shear lag factors (Table 1) were excessively conservative, as has been noted by other researchers. The better shear lag factor method was that by AISC, but Willibald et al. (2006) suggested that the existing formulation could be much improved by reducing the connection eccentricity $\bar{x}$ term – used to calculate U – to $\bar{x}$ ', as shown in Figure 4. This essentially accounts for the thickness of the gusset plate, which is often substantial relative to the tube size. Interestingly, a very similar conclusion has just been reached by Dowswell & Barber (2005) for slotted rectangular HSS connections, whereby they propose an 'exact' $\bar{x}$ term calculated by using a distance from the edge of the gusset plate to the wall of the HSS. Dowswell & Barber (2005) verify their proposal by showing improved accuracy relative to published test data by others.

Following experimental research on the connection types shown in Figure 5, an extensive detailed numerical study followed on the same connections using non-linear Finite Element (FE) Analysis (Martinez-Saucedo et al. 2005). A full parameter study expanded the total experimental and numerical database to over 700 connections (Martinez-Saucedo et al. 2006). The FE models revealed a gradual transition between the failure modes of block shear/tear-out (TO) and circumferential tension fracture (CF), with the latter sometimes influenced by the shear lag phenomenon (see Figure 7). A continual monotonic increase in the connection capacity was achieved as the weld length increased. The transition point between these failure modes depended on factors such as: the connection type, the weld length, the tube diameter-to-thickness ratio and the connection eccentricity, $\bar{x}$ (the latter having a strong influence for elliptical HSS). This gradual transition between the failure modes is in contrast to the behaviour given by

design models in current specifications, since these specifications do not consider a gradual change between these limit states. Thus, a more unified and less conservative design model for slotted gusset plate HSS connections can be expected in the near future. Figure 7 also confirms that a value of U = 1.0 (hence 100% of A_nF_u) for circular HSS with $L_w/D \geq 1.3$ (AISC 2005b) is indeed correct, and for all practical tube diameter-to-thickness (D/t) ratios. However, the conservative connection capacity predictions by over-estimating the severity of the shear lag effect at $L_w/D \leq 1.3$ are very apparent.

3 GUSSET PLATE CONNECTIONS TO THE ENDS OF HOLLOW SECTIONS – SEISMIC LOADING

If the results in Figure 7 are re-plotted in terms of $N_{uFE}/A_g F_y$, where A_g is the tube gross area, then it can be shown that long plate insertion lengths can achieve tension capacities very close to $A_g F_y$, even for this connection type with an open slot end. However, in tension-loaded energy-dissipating braces the connection will be required to resist an even greater load of $A_g R_y F_y$, where R_y is a material over-strength factor to account for the probable yield stress in the HSS bracing. This value of R_y is specified as 1.1 in Canada (CSA 2001), and 1.4 (for A500 Grades B and C (ASTM 2003)) or 1.6 (for A53 (ASTM 2002)) in the U.S. (AISC 2005a). The Canadian value is too low, based on personal laboratory testing experience, and a realistic value for the mean expected yield strength-to-specified minimum yield strength ratio is around 1.3, for CSA-grade HSS (CSA 2004). Tremblay (2002) reported a mean over-strength yield value of 1.29 for rectangular HSS surveyed, and Goggins et al. (2005) have reported a mean over-strength yield value of 1.49 for rectangular HSS (Europe), but the latter was the result of specifying low grade 235 MPa steel. The high U.S. values were determined by a survey of mill test reports by Liu (2003) and are not surprising because, in a market like North America with several different steel grades and production standards, manufacturers will produce to the highest standard and work to a 'one product fits all' approach. (For example, in her survey Liu's ASTM A500 data all pertained to Grade B tubing, whereas manufacturers will knowingly produce to meet the higher Grade C strengths). AISC, however, has now introduced another material over-strength factor, R_t, to account for the expected tensile ultimate strength relative to the specified minimum tensile strength (AISC 2005a) with these values being 1.3 for ASTM A500 Grades B and C and 1.2 for ASTM A53. This R_t factor is applied to fracture limit states in designated yielding members – such as bracings in concentrically braced frames where circumferential fracture (CF) is a design criterion. Thus, applying capacity design principles to preclude non-ductile modes of failure within a designated yielding member (bracing) and setting the resistance factor $\phi = 1.0$, one obtains the following, to avoid circumferential fracture of the HSS at the gusset plate (refer to the equations below Table 1):

AISC (2005a):
$R_t F_u A_e \geq R_y F_y A_g$, hence for ASTM A500 HSS and setting $F_y \leq 0.85F_u$, $A_e \geq 0.92A_g$

CSA (2001):
$(0.85 F_u A_e) R_y \geq R_y F_y A_g$, hence for CSA HSS and setting $F_y \leq 0.85F_u$, $A_e \geq 1.00A_g$

From the above, one can see that the required minimum effective net area – after consideration of shear lag and application of the U factor – is near the gross area of the HSS bracing.

In compression, type A connections (see Figures 5 and 8) can be shown to achieve capacities that also approach $A_g F_y$, provided the length of the open slot is kept short (in the order of the plate thickness) and the tube is relatively stocky (see Fig. 8). However, despite the achievement of high compression load capacity this is accompanied by considerable plastic deformation in the tube at the connection, which is likely to also render the connection unsuitable for use in energy-dissipating brace members.

Fabricated end connections to tubular braces, in concentrically braced frames, hence have great difficulty meeting connection design requirements under typical seismic loading situations. Reinforcement of the connection is then the usual route. It is difficult to plate

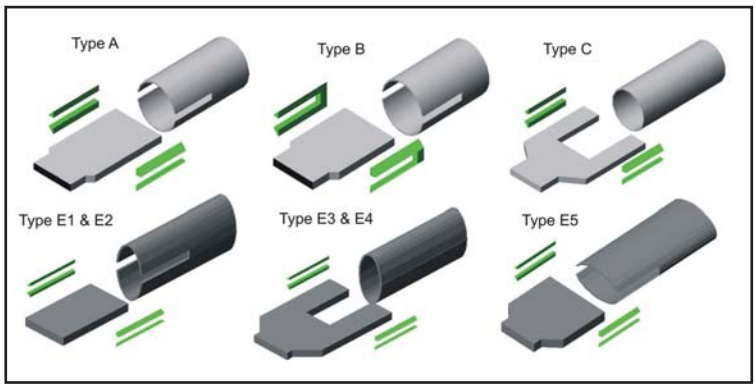
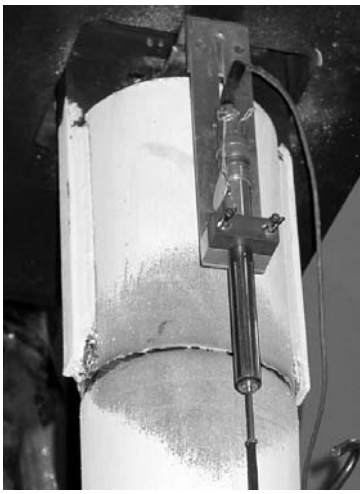
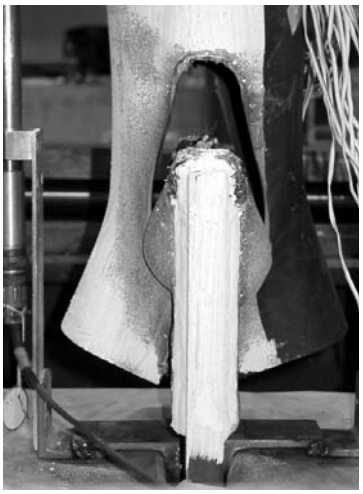


Figure 5: Fabricated connection details investigated.



(a) Typical Circumferential Failure (CF) of the HSS, induced by Shear Lag.



(b) Typical Tear-Out (TO) Failure along the Weld.

Figure 6: Failure modes for gusset plate-to-HSS connections in tension.

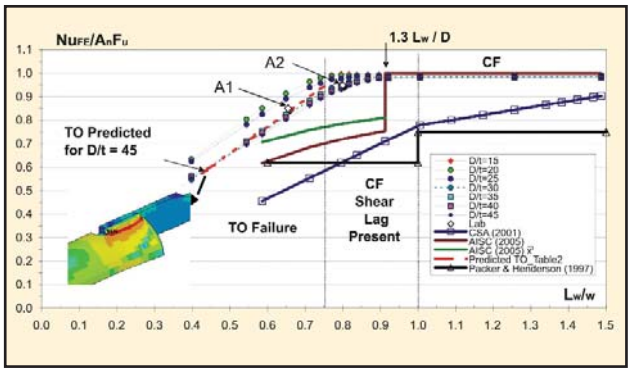


Figure 7: Results of parametric FE analysis and experiments (A1, A2) for connection type A (see Fig. 5).
[Tension loading; circular HSS with the slot end not filled: a very popular bracing member detail in practice.]
N_{uFE} = connection ultimate strength by FE analysis.

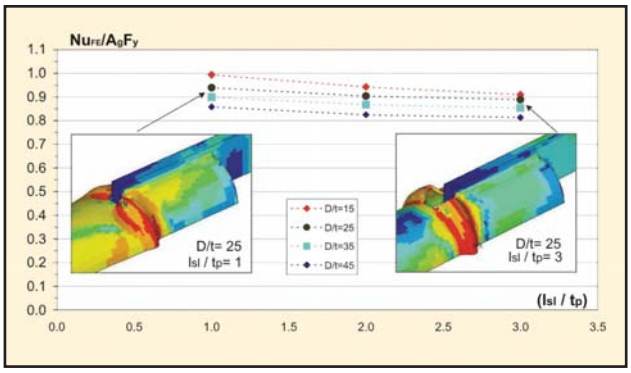


Figure 8: Results of parametric FE analysis for connection type A (see Fig. 5).
[Compression loading; circular HSS with the slot end not filled: a very popular bracing member detail in practice.]
N_{uFE} = connection ultimate strength by FE analysis, l_{sl} = length of open slot and t_p = plate thickness

round HSS members so square HSS with flat sides have become the preferred section, resulting in costly reinforced connections as shown in Figure 9. Moreover, recent research on the performance of HSS bracings under seismic loading *still* concentrates on square/rectangular hollow sections (Goggins et al. 2005; Elghazouli et al. 2005; Tremblay 2002). A drawback of using cold-formed, North American square/rectangular HSS is that they have low ductility in the corners and are prone to fracture in the corners after local buckling during low-cycle fatigue.

A clear improvement is to use cold-formed circular hollow sections, which do not have corners, and to attempt to avoid reinforcement. Yang & Mahin (2005) recently performed six tests on slotted square HSS and slotted circular HSS under seismic loading and highlighted the improved performance of the circular member, which was "much more resistant to local buckling". Additionally, the use of ASTM A53 Grade B (ASTM 2002) pipe, which is readily available in the U.S. but not Canada, provides a suitably low nominal F_y/F_u ratio of 0.58, which makes the connection much more resistant to fracture at the critical net section and a real design option without reinforcement. ASTM A53 Grade B can be compared to the popular ASTM A500 square HSS Grade C which has a nominal F_y/F_u ratio of 0.81. North American-produced square/rectangular HSS are also known to have poor impact resistance properties since, unlike their European cold-formed counterparts, they are normally produced with no impact rating (Kosteski et al. 2005). Regardless of the section shape and steel grade chosen for energy-dissipative bracings, it is clearly necessary to specify a maximum permissible material strength on engineering drawings, as per Eurocode 8 (CEN 2004).

The use of fabricated, slotted circular HSS gusset plate connections, without reinforcement, is hence being further explored at the University of Toronto. Fabrication with the slot end un-welded (i.e. without an end return weld) is a very popular practice in North America, so special details are being investigated which still permit this concept yet provide a net area (A_n) equal to the gross area (A_g) at the critical cross-section, such as shown in Figure 10. As can be seen in Figure 10, a small gap is still provided at the tube end for fit-up, but the weld terminates at the end of the gusset plate which corresponds to a tube cross-section where the gross area applies.

Figure 9: Fabricated square HSS gusset connection for seismic application. *(Photo courtesy of Professor R. Tremblay, École Polytechnique de Montréal, Canada).*

4. CAST STEEL CONNECTIONS – SEISMIC APPLICATIONS

Cast steel joints have enjoyed a renaissance in Europe in conjunction with tubular steel construction, mainly as truss-type nodes in dynamically-loaded pedestrian, highway and railway bridges where fabricated nodes would have been fatigue-critical. Another popular application has been in tree-like tubular roof structures where the smooth lines of a cast node have great architectural appeal. Cast steel connectors to tubular braces under severe seismic load conditions have not been used to date, but cast steel connections represent a solution to the design dilemma of fabricated bracing member connections and these can be specially shaped to provide material where it is particularly needed. Types currently under investigation at the University of Toronto, which are designed to remain elastic under the full seismic loading regime, are shown in Figure 11. By mass-producing cast end connectors, to suit popular circular HSS bracing member sizes, an economic and aesthetic solution can be reached that still allows the use of regular HSS members and avoids the use of alternatives like buckling-restrained braces, which require pre-qualification by testing and a high level of quality assurance (AISC

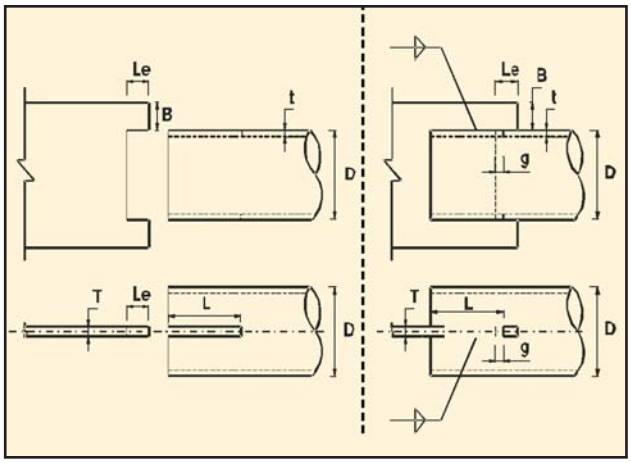


Figure 10: Fabricated connection detail using an over-slotted circular HSS but with $A_n = A_g$ at the weld termination.

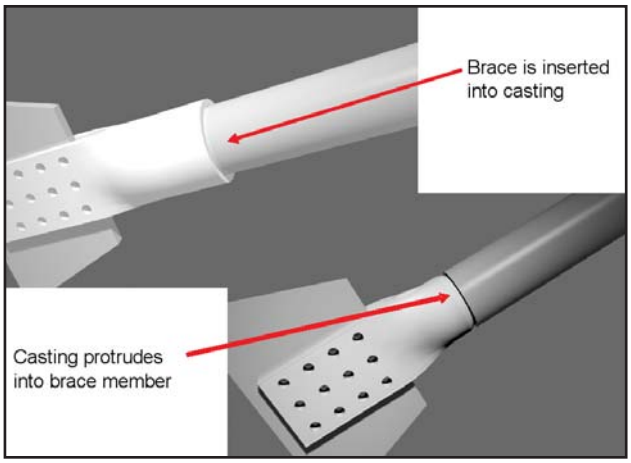


Figure 11: Cast steel connections to tubular braces for seismic load applications.

2005a). Cast end connectors thus represent another exciting development in the evolution of tubular steel construction. Current work in Canada on cast connectors to tubular members is summarised elsewhere by De Oliveira et al. (2006).

Further research on cast steel nodes, oriented to wide flange beam-to-column moment connections and primarily for seismic applications, is also underway at present at the University of Arizona. Another innovative connection solution for wide flange beam-to-HSS columns has been launched by California-based ConXtech Inc., termed the SMRSF. With this, a pre-engineered collar connection is fitted around 4" or 8" square HSS columns and bolted together on site, resulting in very fast construction times. Although it uses machined components that are shop-welded in place, rather than cast components, this connection is also pre-qualified for use as a fully-restrained, Special Moment Resistant Frame connection under the latest FEMA and AISC seismic provisions. Novel connection solutions such as these herald a potential paradigm shift in HSS construction technology.

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Tel: (011) 316 2172 Fax: (011) 316 1645
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richbutler@cadcon.co.za
www.cadcon.co.za

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www.concor.co.za

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www.genreceng.com

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ivma@ivma.co.za
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Karle Steel Manufac. & Constr
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P O Box 7669, Bonaero Park, 1622
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amayer@worldonline.co.za
www.karlesteel.co.za

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

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www.ldc.co.za

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www.linrose.co.za

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Tel: (011) 818 5186 Fax: (011) 818 5185
deon@louwill.co.za

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P O Box 123703, Alrode, 1451
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c/o Cartwright & Petter Street, CE6
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smalinga@malitech.co.za
www.malitech.co.za

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henrys@netactive.co.za

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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
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P O Box 122, Ferndale, 2160
Tel: (011) 474 9140 Fax: (011) 474 7487
dave@osn.co.za
www.omnistruct.co.za

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david@prospan.co.za
www.prospan.co.za

SASSI Metal Innovations cc
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P O Box 1016, Cresta, 2118
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info@sassi-biab.com

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P O Box 1326, Krugersdorp, 1740
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sesteel@icon.co.za

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P O Box 17028, Groenkloof, 0027
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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
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P O Box 699, Kliprivier, 1871
Tel: (016) 365 5327 Fax: (016) 365 5320
trentfab@intekom.co.za

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P O Box 17572, Sunward Park, 1470
Tel: (011) 914 5163 Fax: (011) 914 5165
hotah@nettron.co.za

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P O Box 375, Heidelberg, 2400
Tel: (016) 341 6102/5 Fax: (016) 341 6685
vdriel@mweb.co.za

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P O Box 2331, Bedfordview, 2008
Tel: (011) 454 3405 Fax: (011) 454 5694
colleng@vivaeng.co.za

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

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P O Box 110, Sasolburg 1947
Tel: (016) 976 2592 Fax: (016) 976 0072
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P O Box 28340, Malvern, 4055
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ravellini@iafrica.com

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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

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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

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

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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

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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

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

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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

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Armco Galvanisers (Pty) Ltd
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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

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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: Kas B Lategan
P O Box 1215 Secunda 2302
Tel: (017) 634 4150 Fax: (017) 634 4188
kblategan@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

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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

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Tel: (011) 681 2252 Fax: (011) 680 1810
mbotes@grinaker-lta.co.za
www.grinaker-lta.co.za

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Hannes.basson@mittalsteel.com
www.mittalsteelsa.com

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Andre Schlunz
Tel 011 345 5300
andre.schlunz@za.bpb.com
www.bpbsa.com

Brits Nonwoven
Producer of insulation products
Albert Hoenck
Tel 082 453 7977
alberth@brits.co.za
www.isotherm.co.za

Group Five Manufacturing (Everite)
Producer of fibre cement board
Annemarie Robertson
Tel 011 903 8049
arobertson@g5.co.za
www.groupfive.co.za

Saint Gobain – Isover
Producer of insulation products
Andrew Scott
Tel 011 360 8200
Andrew.Scott@isover.co.za
www.owenscorning.co.za

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mohamed@avlock.co.za
www.avlock.co.za

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Manufacturer of weatherproofing membranes
Langa Nxumalo
Tel 012 683-5607
langalakhe.nxumalo@zaf.dupont.com
www.tyvek.com

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Distributor of fasteners
Reitze Hylkema
Tel 011 941 3170
reitze@kare.co.za
www.interwil.co.za

United Fibre Cement Co (UFCC)
Distributer of fibre cement products
Leon Bekker
Tel 021 933 0052
leon@ufcc.co.za

LARGE MANUFACTURERS

Circle Capital Developments
Profiler and assembler
Nokwazi Mlambo
Tel 011 463 5795
ncm@cicapglobal.co.za
www. icapglobal.co.za

Dezzo Roofing
Profiler and assembler
Brandon Harding
Tel 031 713 6571
brandon@dezzo.co.za
www.dezzoroofing.co.za

Stedone Hazycrest Projects (Pty) Ltd
Construction and profiler
Patrick Swanepoel
Tel 031 713 0737
patrick@stedonehazycrest.co.za
www.stedonehazycrest.co.za

Kwikspace Modular Buildings Ltd
Profiler and assembler
Cole Slabbert
Tel 011 617 8000
cole@kwikspace.co.za
www.kwikspace.co.za

Light Frame Homes cc
Profiler, assembler and builder
Schalk van der Westhuizen
Tel 021 982 6077
schalk@dicksonprojects.co.za
www.steelhomes.co.za

MiTek Industries SA (Pty) Ltd
LSF roof trusses
Richard Bailey
Tel 011 237 8700
richard@mitek.co.za
www.mii.com/southafrica

SA Steelframe Systems
Profiler and assembler of LSF & trusses
Johan Marais
Tel 082 450 0086
info@steelframe.co.za
www.steelframe.co.za

SA Steelframe Systems PE
Profiler and assembler of LSF & trusses
Etienne Van Zyl
Tel 0860 144 155
Etienne@steelhome.co.za
www.steelframe.co.za

Silver Falcon Trading 487 (Pty) Ltd
Manufacture LSF & brick force
Vernon Van Der Westhuizen
Tel 011 908 5250
vernon@silver-falcon.co.za

Siteform Framing
Profiler and assembler
Hendrik Fourie
Tel 051 451 2166
hendrikfourie@vodamail.co.za

Vela Steel Building Systems
Profiler and assembler
Brent Harris
Tel 011 397 8742
brent@velasbs.co.za
www.velasbs.co.za

MANUFACTURERS

Inno Steel
Profiler and assembler
Len Lategan
Tel 011 794 5436
info@innosteel.co.za

InProfile 2000 P/L
Profiler and assembler
Wolfgang Neumann
Tel 011 908 1903
wolfien@mweb.co.za
www.inprofile2000.co.za

Mystic Blue Trading 334 (Pty) Ltd
Profiler, assembler and builder
Gordon Tidboald
Tel 031 461 8224
sfdrum@iafrica.com

Plusko 169 (Pty) Ltd
Profiler, assembler and builder
Frede Van Zyl
Tel 044 695 0237
info@steelframemosbay.co.za
www.steelframemosbay.co.za

Steeltek Systems
Profiler and assembler
Graham Smith
Tel 082 801 5346
graham@steelteksystems.co.za
www.steelteksystems.co.za

SERVICE CENTRES AND DISTRIBUTORS

Arcelormittal Construction South Africa
Technical solution for cladding, roofing and flooring
Thierry Poitel
Tel 011 268 2561
Thierry.poitel@arcelormittal.com
www.arval-construction.com

Bluescope Steel Southern Africa (Pty) Ltd
Manufacture TruecoreTM Steel
Wayne Miller
Tel 021 442 5420
Wayne.miller@bluescopesteel.com

Clotan
Steel service centre
Danie Joubert
Tel 016 986 8000
daniej@clotansteel.co.za
www.clotansteel.co.za

Clyde Steel
Steel service centre
Previn Thambi
Tel 011 363 1960
previn@clydesteel.co.za
www.clydesteel.com

Global Innovative Building Systems
Distributor of cladding and insulation materials
Tammy Bywater
Tel 011 903 7080
tammy@gissa.co.za
www.gissa.co.za

Global Specialised Systems KZN (Pty) Ltd
Distribute and manufacture insulations products and ducted air cons
Carole Tomkinson
Tel 031 468 1234
carole@globaldbn.co.za
www.globalsystems.co.za

Metal Rollforming SA
Distributor of LSFB equipment
Dirk Moolman
Tel 028 316 1291
sales@metalrollformingsa.com
www.metalrollformingsa.com

Proroof Steel Merchants
Steel service centre
Charles Domingo
Tel 016 450 5800
charles@proroof.co.za
www.proroof.co.za

Scottsdale
Distributor of LSFB equipment
Steve Cullender
Tel 011 486 4195
scottsdale_sa@global.co.za
www.scottsdale.co.nz

DESIGN CONSULTANTS

AMS Civil & Structural Consultants
Structural design engineer
Anna-Marie Sassenberg
Tel 058 303 7223
ams@isat.co.za

By Design
Structural engineer
Barend Oosthuizen
Tel 021 883 3280
barend@bydesign.org.za

Entity Engineering
Structural engineer
Andrew Bull
Tel 011 462 8564
entity1@mweb.co.za

Hull Consulting Engineers
Structural engineer
Mike Hull
Tel 011 468 3447
hull@iafrica.com

Martin & Associates
Structural design engineer
Ian Upton
Tel 031 266 0755
ibu@martinjw.co.za

Molapo Projects
Structural engineer
Gert Visser
Tel 016 933 0195
gert@molapo.biz
www.molapo.biz

ASSOCIATE MEMBERS

AAAMSA Group
Promotion of fenestration, insulation and ceiling systems
Hans Schefferlie
Tel 011 805 5002
aaamsa@iafrica.com
www.aaamsa@iafrica.com

CSIR (Built Environment)
National building research institute
Llewellyn Van Wyk
Tel 012 841 2677
lvwyk@csir.co.za
www.csir.co.za

FrameCAD Solutions Limited
Develop and supply end to end LSF
Matthew Day
Tel 00 649 307 0411
md@framecadsolutions.com
www.framecadsolutions.com

HDGASA
Promotion of hot dip galvanized steel sheet
Terry Smith
Tel 011 456 7960
terry@hdgasa.org.za
www. hdgasa.org.za

IZASA
Promotion of the use of zinc
Rob White
Tel 083 456 4989
robwhite@icon.co.za
www.izasa.org

European Light Steel Construction Association (LSK)
www.easysteel.info

National Association for Steel framed housing Australia
Ken Watson
kwatson@nash.asn.au
www.nash.asn.au

Pretoria Institute for Architecture
Institute for architects
Maureen Van Wyk
Tel 012 341 3204
admin.pia@saia.org.za
www.saia.org.za

Standard Bank
Provider of home loans
Johann Strydom
Tel 011 631 5977
Johanjj.strydom@standardbank.co.za

University of the Witwatersrand School of Mechanical Engineering
Educational
Kamil Midor
Tel 011 717 7358
Kamil.midor@wits.ac.za

BUILDING INDUSTRY

AC Group Holdings (Pty) Ltd
LSFB construction, ceilings & partitions
Johan Stoltz
Tel 082 411 0247
0825683011@vodamail.co.za

AMC Land Developments
Developer and builder
Trevor Abrahams
Tel 021 761 6943
trevora@amcld.co.za
www.amcld.co.za

Big Rigging Crew
LSF building
Henry Robinson
Tel 082 898 7693
henryr1@telkomsa.net

Blue Sands Trading 437 CC
Construction and manufacture wooden roof trusses, timber decks and solid doors
Pieter Scheepers
Tel 014 717 3600
pieter@foreverwood.co.za
www.foreverwood.co.za

Blue Water Property Investments
Developer and builder
Gert Engelbrecht
Tel 015 295 2018
bluewater@mweb.co.za

Castle Projects & Consultants
Builder of LSFB and project management
Rob Castle
Tel 032 946 2787
rob@castleprojects.co.za

Chad Construction
Builder of LSFB
Anton Coetzee
Tel 082 715 9411
Anton@chadcon.co.za

Gecko Development Services
Developer and builder
Ryan Hesketh
Tel 083 324 5059
geckodevelopment@telkomsa.net
www.dirasteelhouses.com

Global Design and Build Solutions
Developer and builder of LSFB
Hilton van Deventer
Tel 011 804 9048
Hilton.vandeventer@gdbs.com
www.gdbs.com

Greenframe Construction
Erector and builder
Dewald Lindeque
Tel 082 928 5444
dewald@greenframe.co.za
www.greenframe.co.za

Group Five Housing
Developer and builder
Paul Thiel
Tel 011 253 8833
pthiel@g5.co.za

Overberg Lite Steel Projects
Erector and builder
Basie Oelofsen
Tel 028 312 3047
henjac@telkomsa.net

PR De Beer Properties
Developer and builder
Flip De Beer
Tel 00264 6130 7645
prdebeer@mweb.com.na

SAFINTRA Building Solutions (Pty) Ltd
Construction/production of LSFB
Patrick Swanepoel
Tel 031 702 9683
patricks@safintra.co.za
www.safintra-buildingsolutions.co.za

Shospec (Pty) Ltd
Shopfitting ceilings, partitions and shop fronts
Bjorn Kahler
Tel 033 386 0100
bjorn@shospec.co.za
www.shospec.co.za

Silverline Group
Developer & Construction
Charl Van Zyl
Tel 0861 001 177
charles@silverlinegroup.co.za
www.silverlinegroup.co.za

Steel Frame Homes
Builder of LSFB
Leonard Batt
Tel 021 905 4321
info@steelframehomes.co.za
www.steelframehomes.co.za

Steel Frame Projects
Builder of steel frame homes and trusses
Johan Venter
Tel 074 128 1840
johan@steelframeprojects.co.za
www.steelframeprojects.co.za

Steelworx Homes (Pty) Ltd
Residential builder
Keith van der Linde
Tel 011 465 2612
keithr@accoladepg.co.za

Tec Homes Construction (Pty) Ltd
Building/supply of LSFB
Schalk VD Walt
Tel 021 852 4237
schalk@techomes.co.za
www.techomes.co.za

Velocity Developments cc
Developer and builder
Stuart Grant
Tel 082 553 0987
stuartgrant@mweb.co.za