steel CONSTRUCTION

Volume 35 No. 3 2011

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Tubular Steel Structures

SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

OFFICIAL JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF STEEL CONSTRUCTION

EDITOR'S NOTE

Passion. Apart from the usual romantic connotations, passion is the one ingredient always present in a job well done. If the people doing the job lack passion it rarely succeeds and hardly ever exceeds expectation. You are of course welcome to argue with me.

I see the confirmation of my statement with every project I visit as part of the Steel Awards judging team. At the site we usually meet a person involved in the project be it steelwork contractor, architect, engineer, main contractor or even the facilities manager. Last year we were welcomed by the quantity surveyor of a project.

The people involved in the projects that stand out from the rest have one thing in common – passion for the job that they do. They tell the story of the project with enthusiasm, even the not so good parts. They proudly show us the detail of their work, the challenges they overcame and the lessons they learnt.

Passion is a power that can pull people and projects through when faced with adversity and the world would be a much poorer place without it.

In this issue the LSFB residential project in Bela Bela clearly shows that was it not for the architects' passion for designing honest buildings and using alternative building methods, this house would have been another humdrum Tuscan copy on a South African game farm.

The two other steel projects featured show the versatility and beauty of tubular steel and both these projects also contained the magic ingredient – passion.

Thank you to everyone in our industry who entered their projects for Steel Awards 2011. The mix is definitely different than last year, but not in the least lacking in quality and sassiness. See all the entries on our Facebook page, *www.saisc.co.za* and Steel Construction *(page 23)* of course.

steel CONSTRUCTION

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

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Comair Simulator Building

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INDUSTRY NEWS IN BRIEF

COSIRA (Steel Awards 2011 Partner Sponsor) PARTNERS WITH ALSTOM TO COMPLETE AN ENVIRONMENTALLY-SUSTAINABLE PLANT AT KUSILE POWER STATION

The Cosira Group has partnered with Alstom to complete the construction of South Africa's first wet flue gas desulphurisation (WFGD) system at the Kusile power station. This unique contract, which will significantly contribute towards South Africa's sustainable development in terms of environmental impact, was awarded to the Alstom/Cosira Consortium by Eskom earlier this year.

According to John da Silva, CEO of the Cosira Group, one of the largest structural steel fabricators in Southern Africa, the contract was awarded to Alstom/Cosira, following Alstom's decision to present a consortium bid to Eskom for the Kusile contract.

Eskom awarded the contract to the Alstom/Cosira Consortium which has been contracted to engineer, supply and install a WFGD plant for each of the six coal-fired boilers. The purpose of the WFGD plant is to remove over 90% of the sulphur oxide generated by the boilers.

"We are proud to be associated with the construction of the WFGD plant at the Kusile power station, which represents a landmark for the South African power generation industry, and a first for South Africa," says da Silva. "The removal of the sulphur oxides, makes the power station the most environmentally sustainable in the country today," he added.

According to Richard de Arruda, Commercial Risk Director at the Cosira Group, the primary material used for the construction is Carbon Steel 350WA which is available from local South African sources.

"Cosira will be responsible for the supply, fabrication, delivery and construction of all steel components which are locally available," says de Arruda. "Cosira is also tasked with the full installation of the general mechanical equipment, including major equipment such as mills as well as piping supply and installation. The company will also assist Alstom with commissioning during the final stages of project execution.

Construction of the client supplied foundations has begun. The Consortium's site portion of the contract is scheduled to commence in August 2011. Cosira is required to produce approximately 11 000 tons of structural work and platework for the complete project.

"What makes our relationship with Alstom so unique is that we are privy to the design process from the onset and can help present constructability solutions which are adaptable to the South African engineering environment," says de Arruda.

FIRST CUT'S (Steel Awards 2011 Partner Sponsor) EVERISING BANDSAWS PLAY A MAJOR ROLE AT BHR PIPING SYSTEMS FACILITY

Since 1989, First Cut has been the sole agent for the Taiwan-based Everising Machine Company, which offers a comprehensive range of bandsaw machines known for their reliability and durability.

When Bilfinger Berger Power Services (BBPS), owner of the Steinmüller group

John da Silva, CEO of the Cosira Group.

of companies, built its local production works – BHR Piping Systems – the decision was clear to install an Everising H1100T semi-automatic billet bandsaw and a BS250SSV semi-automatic bandsaw.

"Our parent company BHR utilises a H1100T bandsaw at their primary plant in Dortmund, Germany, so they chose to specify the same model for the South African plant," says Heinz Ott, Managing Director at BHR Piping Systems.

"The First Cut service team installed the machine in March and as a testament to its user friendliness, it was fully operational within one day of arriving at BHR. We now provide a 24/7 maintenance and support facility for the machine," says Steve van Wyk, Sales Director at First Cut.

The Everising H1100T is capable of cutting piping and solid material of up to 1 000mm diameter and will be used in conjunction with a new PB850 induction bending machine to accurately trim the final high pressure piping systems, for the Medupi and Kusile power stations, to their correct length, according to van Wyk.

INDUSTRY NEWS

The 11.1 metre bandsaw blade was supplied by Wikus in Germany and was specifically designed for the pipe cutting application.

"We take pride in the machines we distribute to the local market, and Everising's range of quality bandsaw and circular sawing machines are no exception, exhibiting extremely advanced cutting tool technology in a variety of functions. The range of products is ISO-accredited and they are renowned for their extraordinary rigidity and accuracy, even in the most demanding applications," van Wyk comments.

GROUP FIVE (Steel Awards 2011 Partner Sponsor) SCOOPS ANOTHER ACCREDITATION

After being the first construction company in the country to receive an ISO3834 accreditation and the first site-based company certified in accordance with the Southern African Institute of Welding (SAIW) Welding Fabricators Certification Scheme, Group Five Oil and Gas (GFOG) is now the second company to have two of its divisions separately accredited.

First it was GFOG's Chevron Refinery operation in Cape Town that received accreditation and now it's their Durban Prospecton workshop that has successfully applied and according to GFOG quality manager/engineer Pravin Laljit, the operation went very smoothly.

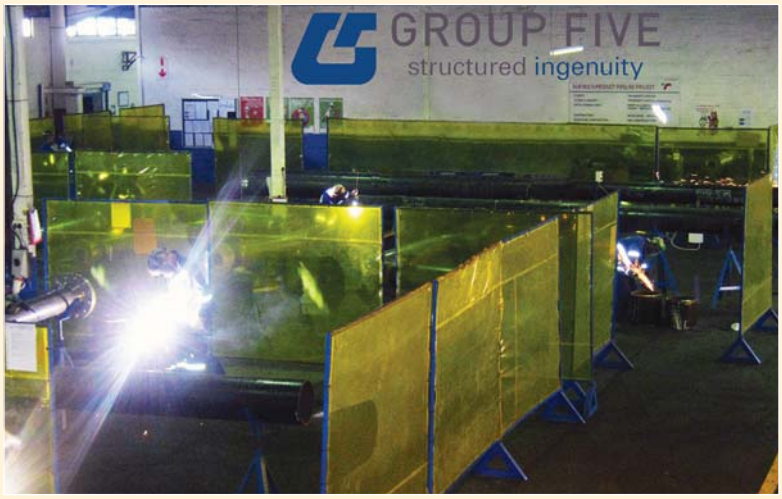
"The SAIW undertook a very comprehensive technical audit of the facility and I am very pleased that there were no 'non-conformance' reports or 'findings' recorded. There were only a few minor observations, which were promptly dealt with," says Laljit.

The workshop specialises in a range of materials and pipe technology for the steam, petrochemical, and pulp and paper industries. It is currently the main fabricator of all the process piping for the Transnet NMPP Pump Stations 1, 3 and 5.

With companies like GFOG, and others in the industry achieving such accreditation, there is little doubt about the positive manner in which fabricators have embraced the SAIW Welder Fabricator Certification Scheme.

"The numbers speak for themselves," says SAIW's Sean Blake. "We have recently accredited 13 more companies, there are more than 30 which are currently in the process of getting accredited and over 50 others that have formally indicated they want to be," says Blake.

SAIW executive director Jim Guild says that while he is encouraged by the demand, there should be no confusion about who the scheme is for. "While many large and well-known companies have embraced it, the scheme is pertinent to all fabricators, no matter their size. The benefits for smaller companies cannot be overestimated, as they compete for work against so many quality organisations locally and abroad," he says.



The GFOG workshop specialises in a range of materials and pipe technology for the steam, petrochemical, and pulp and paper industries.

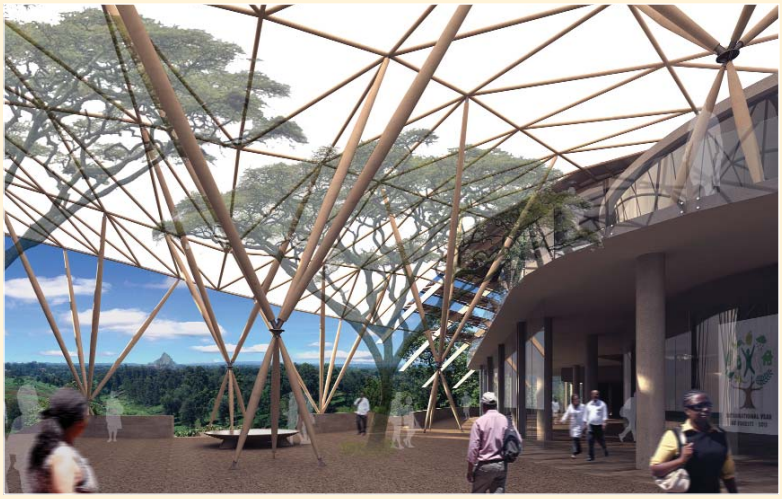
VITAL ENGINEERING (Steel Awards 2011 Partner Sponsor): DESIGN SPECIFICATIONS – VITAL TO STEEL INDUSTRY SAFETY

When engineers design elevated walkways, a variety of factors is taken into consideration to ensure the complete safety of people using them. Dodds Pringle, MD of Vital Engineering – manufacturers of high quality gratings, stair treads, pressed floors and safety handrails – says that when one is walking some 30 to 60 metres off the ground, the last thing one needs is a badly designed and constructed metal walkway.

"We place great emphasis on designing for safety. This means that when the installation is for an industrial application, we design with 350WA steel. The use of this grade of steel naturally affects the design we implement, with the platforms that the walkway rests on being placed further apart than if we were specifying a lower grade or commercial steel," Pringle says.

"At times, however, companies are basing their decisions on price rather than performance. Recommended specifications are sometimes disregarded by customers or contractors.

INDUSTRY NEWS



Architects' rendition of the Wangari Maathai Institute for Peace and Environmental Studies in Kenya.

Likewise, if a customer or specifier has an established relationship with an alternate supplier, it can often be difficult to convince them that the choices they make with regard to inferior material of construction are unwise. Unfortunately, the losers at the end of the day are the people who risk their lives walking at considerable heights above the ground on unsafe walkways," Pringle adds.

Accountability for the safety of the walkway ultimately rests with the end user, who is generally the person who puts his signature next to the order to purchase. "Contractors and customers need to be educated on the dangers of cutting corners with respect to quality of materials used. When engineers design walkways they do so with specifically suitable materials in mind. By replacing this with unspecified material, one is courting disaster.

"We provide our customers with a full consultation service in order to determine the design best suited to achieve maximum safety levels. However, it is contingent upon the customer to undertake a full risk analysis should he decide to ignore recommendations from a structural loading perspective. Customers need to bear in mind that unlike door locks, for instance, which are incidental purchases, walkways constructed from unsuitable material are a recipe for potential disaster. Companies should ask themselves the question: 'How will we deal with loss of life because we insisted on shaving a few hundred rands off the project costs?' before they downgrade the steel strength," Pringle concludes.

DHK WINS INTERNATIONAL ARCHITECTURAL COMPETITION

dhk architects has won the Architectural Competition for the Wangari Maathai Institute for Peace and Environmental Studies in Kenya. The winning design was unveiled by Dr Achim Steiner, Executive Director of UNEP (United Nations Environment Programme) accompanied by Dr Reuben Mutiso, Chairman of the panel of international jurors, at an awards ceremony held in Nairobi.

The 'Green Campus' will be the home of the Institute for Peace & Environmental Studies (WMI) of Noble Peace Prize Laureate Prof Wangari Maathai. Located on a lush and steeply sloping 50-acre site at the University of Nairobi Kabete campus, the WMI is envisaged as a functional and inspiring hub of activities in the area of natural resource management and education for sustainable development. The institute is expected to meet stringent sustainability and conservation criteria, aiming to achieve close to 100% carbon neutrality and self-sufficiency.

The jurors' report commended dhk architects for the boldness of their design and the thoroughness in resolving the different aspects of the scheme from concept to detail. Project Advisor and jury member, Phillip Kungu said "We were particularly impressed with the land use master plan, the sensitive treatment of ecological issues and the extensive handling of sustainable design concepts. The winning design was unanimous," he concluded.

Dr Justin Snell of dhk who lead the design said, "Our aim was to give expression to the vision of Wangari Maathai and to embody the values and principles of the Green Belt Movement by approaching the site, landscape and architecture in terms of long-term stewardship, sustainable management of resources, education and empowerment."

The location, form and massing of the WMI formed one of the key strategic design decisions of the dhk entry. Based upon core sustainable management concepts, the approach was to locate the institute on land with minimal agricultural value while simultaneously nestling the institute into its surroundings and capturing the dramatic views across the valley towards Mt Kenya.

At the heart of the dhk scheme is the welcoming and dignified democratic space sheltered by a tensile canopy roof supported on tripod 'tree-like' columns evoking the tree planting work of the GBM and the three legs of the traditional African stool seen by Maathai as representing 'democratic space, sustainable and accountable management and 'cultures of peace'.

SAISC COMMENT

By Dr Hennie de Clercq,
Executive Director, SAISC

But the biggest subject at the meeting was the role of information technology in the steel construction industry. Large piles of knowledge are sitting on websites of a variety of organisations worldwide. Some of these websites carry so much information that they have become very complex and anybody who is not really familiar with a particular one stands little chance of finding the desired information before deciding that it does not seem to be there.

ISCG NEW ZEALAND – KEEPING UP WITH IT

The Chairman of the SAISC Board, Molefe Kgomo, and I recently attended a meeting in New Zealand of the institutes of steel construction, and some of their members, from Canada, the USA, the UK, Australia and New Zealand. This was not the first meeting of this group by any means, and we also bump into each other at various occasions, so quite a close bond has developed between us and one feels that you are among a group of friends when we are together.

These meetings, and the relationships growing out of them, are of immense value, especially to an institute from a smaller country like South Africa. For example in the field of technology, we would be powerless without the support of the large institutes and without having a base to build on. It occurred to me that the challenge we face is to make sure that the huge amount of resources, in particular those relating to knowledge, that have been built up worldwide can be readily available to our members, in a form where it can be applied to local problems and issues without them having to do a lot of interpretation.

Steel construction is an international business, not only because a piece of steel does not recognise whether it is in the southern or the northern hemisphere, but also because the business environment is similar, at least in the English speaking countries, and we all face similar threats and opportunities. But there are also distinct differences. In South Africa and Australia, for example, there is much concern about the quality of the designs and the documentation provided to steelwork contractors by engineers, whereas the British seem to have no problems with this, largely because there is still a strong culture of fabricators having proper design offices.

We listened to a fascinating talk about the Christchurch earthquake and tried to visualise the mess as huge volumes of mud spouted from the earth, mixed with sewage from the broken pipes and rushed knee-deep through houses. Another talk came in response to the fact that steel construction in Canada and New Zealand is under attack from timber, with the support of their governments.

As everybody 'knows', trees are green, but if you consider that only some 10% of the whole tree actually ends up doing a job in a roof truss or wherever, that the rest (including the trunk and roots) stays behind to rot and form methane, and that methane is about 22 times as potent a greenhouse gas as CO_2, it is easy to conclude that the best place for timber is to stand in the forest and hang onto the carbon sitting inside it.

Actually, what I concluded is that much if not all of what is said about the carbon footprint of different materials is pure PR. If there is no agreed basis on which materials are compared with each other, everybody can make whatever claims and assertions they wish.

But the biggest subject at the meeting was the role of information technology in the steel construction industry. Large piles of knowledge are sitting on websites of a variety of organisations worldwide. Some of these websites carry so much information that they have become very complex and anybody

who is not really familiar with a particular one stands little chance of finding the desired information before deciding that it does not seem to be there. And then there is the information that sits in places where you would never find it if somebody did not tell you about it. There is room for a 'portal' to all this knowledge, but setting a really good one up and maintaining it would be a major job for a knowledgeable person. Note that the knowledge also includes that related to business.

I have dreamt of having some forum where engineers from across the world can share information, have questions answered and contribute insights, links to files and software, etc., but have come to the conclusion that engineers are not the types who like chatting and sharing – the efforts of those who have tried have not been handsomely rewarded. We are among the few who have actually embarked on Facebook, and we still have to prove that it can be really valuable.

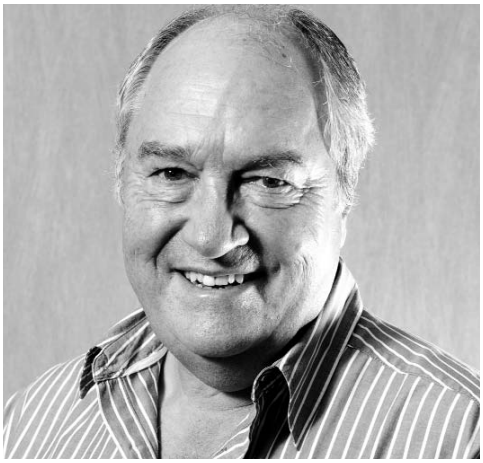
Then there was BIM (building information modelling, or now building information management), which is getting people all excited worldwide. Things are moving fast here and much money is poured into development by software providers.

Yet, not that many projects are running fully on BIM, utilising all its strengths. We decided to form an international group where people involved in the various aspects of BIM for steelwork can share information, especially with a view to telling software developers what we need and what we value.

I hope that members of our institute and designers of steel structures in general will reasonably soon experience that the Institute provides ever growing and better services, among other reasons because we work with sister organisations in other countries.

About the ISCG

The International Steel Constructors Group meeting is the gathering of the English speaking international steel construction associations (American Institute of Steel Construction, Australian Steel Institute, British Constructional Steelwork Association, Canadian Institute of Steel Construction, Southern African Institute of Steel Construction and Steel Construction New Zealand). The intentions of these meetings are to discuss matters of common interest such as imported fabricated steel work, product compliance, sustainability, marketing, new trends and technology etc.



WHAT IS THE STORY WITH POWER PYLONS?

By Kobus de Beer,
Industry Development Executive, SAISC

Power pylons are probably one of the best known structural steel products in South Africa as Eskom's familiar power lines reach into almost every remote part of our country. A power pylon is made from steel angles, channels and plates that are galvanized to protect it from rust and then bolted together to build a latticed upright structure to support the various high voltage power conductors transmitting our electricity.

These lines often hurt large flying birds and different fixtures, such as coloured balls are fitted to make the wires visible. It is probably only fair that these pylons are often used by vultures and other birds to build their nests in. A bird sitting on a power line is fortunately not electrocuted on the spot!

South African companies have been manufacturing these power pylons for at least eighty years. Many different tower configurations were developed over the years, but Eskom's TAP has developed these designs, their spacing, positioning and tie down specifications to a fine art. This means that the specific preferred technical requirements are made available to all local and overseas suppliers.

During the past few years it was found that cheaper power pylons of acceptable quality could be and were imported from the Far East. South Africa had agreed during the 1990's that practically all basic steel products as well as raw steel could be imported free of duty into South Africa. Some 30 000 tons were imported for Eskom's requirements as well as for lines in neighbouring countries. This is enough steel to keep at least two medium sized companies going for a year. What in fact happened was that Babcock Ntukutuku, a

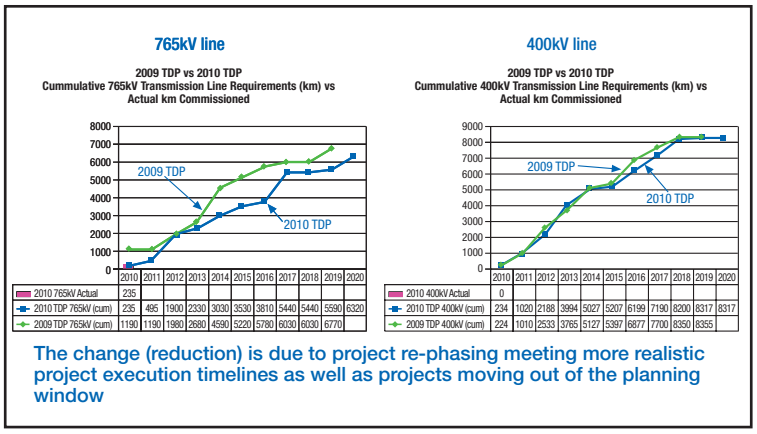
Eskom not only supplies electricity but also housing... to birds.

power pylon specialist for decades, closed their doors and retrenched employees of long standing due to lack of work in 2010. Other companies also reduced staff or did not enter the market. The real concern is that this establishes a pattern for the future.

Eskom does very well to communicate their plans to the industry at regular public forums. During April 2011 they showed the power pylons required country wide to support the new power station programmes. Details of 765kV and 400 kV lines planned spread over the next ten years were provided. A total of some 420 000 tons of power pylon steelwork is required up to 2020, peaking at 80 000 tons in 2012 followed by 50 000 tons per annum in 2013 and 2014. A further peak of 85 000 tons is predicted for 2017.

The SAISC tried to play a role in influencing the buying of locally produced power pylons. It soon became clear that Eskom is under enormous pressure to produce and supply electricity in the most cost effective manner and that no premiums (about 20%) would be paid for local pylons in spite of the clear advantages in terms of job creation and maintenance of decent jobs in the industry. The DTI was then consulted and their advice was to use the established formal mechanisms of ITAC (International Trade Agreements Council) to apply for import protection.

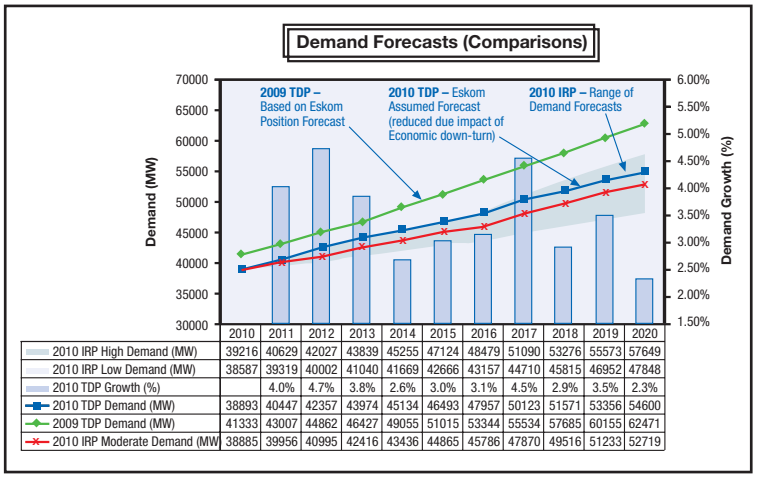
These applications demand extensive details of the industry and its participants, the cost breakdowns of the products and participants as well as details of employment, historical information and the development of a business case for protection – indeed an impressive and comprehensive process supported by visits to some of the companies involved.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2010 765kV Actual	235										
2010 TDP 765kV (cum)	235	495	1900	2330	3030	3530	3810	5440	5440	5590	6320
2009 TDP 765kV (cum)	1190	1190	1980	2680	4590	5220	5780	6030	6030	6770	

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2010 400kV Actual	0										
2010 TDP 400kV (cum)	234	1020	2188	3994	5027	5207	6199	7190	8200	8317	8317
2009 TDP 400kV (cum)	224	1010	2533	3765	5127	5397	6877	7700	8350	8355	

Eskom's cumulative transmission line requirements.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2010 IRP High Demand (MW)	39216	40629	42027	43839	45255	47124	48479	51090	53276	55573	57649
2010 IRP Low Demand (MW)	38587	39319	40002	41040	41669	42666	43157	44710	45815	46952	47848
2010 TDP Growth (%)		4.0%	4.7%	3.8%	2.6%	3.0%	3.1%	4.5%	2.9%	3.5%	2.3%
2010 TDP Demand (MW)	38893	40447	42357	43974	45134	46493	47957	50123	51571	53356	54600
2009 TDP Demand (MW)	41333	43007	44862	46427	49055	51015	53344	55534	57685	60155	62471
2010 IRP Moderate Demand (MW)	38885	39956	40995	42416	43436	44865	45786	47870	49516	51233	52719

Assumed demand forecast and comparisons.

Unfortunately also a costly and time consuming process which took more than a year from initiation to the formal Gazettal on 11 March 2011. A 15% import duty is now applied to imported power pylons and latticed cellular telephone masts.

The way forward is now being mapped out. It is not to sit back and accept that power pylons will from now on be more expensive with our electricity bills also that much higher!

The SAISC is busy getting a working committee of all affected parties together and compiling information on annual requirements for new pylons and the extensive requirements for refurbishment and upgrading of existing lines. The planned power networks, linking the whole of Southern Africa also need to be included. These areas add up to substantial total annual requirements.

We must challenge the South African cost structures, analyse steel prices, pricing of galvanizing and productivity issues in workshops in detail and find improvements and implement it. The objective is to help develop this industry in South Africa to its full international potential to build all our own and most of Africa's power lines. This will allow our indigenous birds to at least rest on our own.

CALENDAR OF EVENTS

SAISC BREAKFAST TALK – ESKOM POWER SUPPLY OUTLOOK
1 June 2011
Country Club Johannesburg, Auckland Park
www.saisc.co.za

SANS 517:2009 LIGHT STEEL FRAME BUILDING CODE TRAINING COURSE
28 – 30 June 2011
www.sasfa.co.za

6th BUILT ENVIRONMENT CONFERENCE
31 July – 2 August 2011
Balalaika Hotel, Johannesburg
www.asocsa.org

LIGHT STEEL FRAME TRAINING COURSE FOR BUILDING CONTRACTORS
25 – 30 July 2011
Saint-Gobain's offices, Durban
www.sasfa.co.za

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

VISITING ARCHITECT TOM KUNDIG (SAISC sponsored)
August 2011
www.saisc.co.za

STEEL AWARDS 2011
15 September 2011

Gauteng:	Emperors Palace, Kempton Park
Durban:	Sun Coast Casino, Durban
Cape Town:	Crystal Towers Hotel, Century City

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

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

COMAIR TRAINING CENTRE – NEW SIMULATOR BUILDING

Tubular steel played a big role in the aesthetically exposed steel of the two glass covered arches on the northern and southern side of the building as well as the link bridge. The covered arched roof is a lattice truss construction and is fitted with a ceiling internally. The façades are fin shaped, fabricated plate girders in-filled with glass.

A view from the 'old' simulator building connected to the 'new' with a covered link bridge.

The Comair Training Centre, and the new simulator building in particular, boasts a non-conventional, dome shaped structure, which clearly sets it apart from the traditional simulator environment.

Strong focus was placed on the use of glass and light steel structures in order to allow for optimal use of natural light.

"Not only does this contribute to energy efficiency, but it also plays a major role from a psychological viewpoint," says Captain Glen Warden, Manager of Commercial Operations & External Training at the Comair Training Centre. "Historically pilots associate simulator training with a rather gloomy, enclosed environment. The modem, light and sophisticated surrounds largely contribute to an overall positive learning experience," he explains.

Comair Limited, operator of British Airways in South Africa and kulula.com, has since its inception in1946 focused on high level training of its airline pilot and flight operations personnel. The first simulator building, part of phase 1 of Comair's training development plan, has been in operation for the past ten years. The need for additional simulator training on different aircraft was identified in 2009 and plans for phase 2 were set in motion. The second simulator building (linked to the existing simulator building) was built and completed in December 2010.

The simulator building accommodates both an internal training department offered to Comair's own Boeing 737 pilots, cabin crew and other flight operation personnel and an external training department for airline operators from 30 different companies.

DESIGN

The design of the new simulator building was based on the same design philosophy as the first building.

The two storey structure was designed to accommodate all the client's training requirements. The curved roof structure provided additional height for the two simulators in the centre of the building as well as the training rooms and offices on the two sides.

project team

Developer/Owner:
Comair Ltd

Architect:
Wim Swart & Partners

Quantity Surveyor:
Schoombie Hartmann Pretoria

Main Contractor:
Edilcon Construction

Steelwork Contractor:
Ferro Eleganza

Detailers/Detailing Company:
Ferro Draughting

The new generation B737-800W simulator.

Tubular steel played a significant role in the intricate egg shaped link bridge.

The structure is orientated directly north with large glass façades on the northern and southern sides. Sun control louvers on the outside of the northern glass façade protect the simulator hall from any direct sun onto the simulator inside the building. The glass façade on the southern side allows daylight to stream into the atrium and this gives it a light and modern feel.

Great care was taken to adhere to the strictest environmental requirements and sustainability practices. The entire building is equipped with energy saving and motion sensor controlled lighting. The simulator building itself is fitted with an uninterrupted power supply (UPS) system that operates independently from the Eskom grid, ensuring that the training capabilities are not compromised in the event of a power failure.

The two storey structure was designed to accommodate all the client's training requirements.

THE LINK BRIDGE BETWEEN 'OLD' AND NEW

The functionality of the two buildings is interlinked and to facilitate easy movement between the two buildings, the design incorporated a covered bridge linking the two buildings. The bridge is far from being only functional but forms an integral part of the aesthetic value of the building.

THE STRUCTURE – ENGINEERING, CONSTRUCTION, FABRICATION AND ERECTION

The engineer, Isak Potgieter, inherited the project from the engineer who originally designed the simulator building. Thus he had to fine tune the engineering drawings at a later stage in the project programme.

He worked closely with the drawing office of the steelwork contractor, Ferro Eleganza, to ensure that the detailed drawings are perfect up to every nut and bolt. The overhang of the egg shaped link bridge was very complex and here Tekla Software, the 3D design package, came to its fore.

Tubular steel played a big role in the aesthetically exposed steel of the two glass covered arches on the northern and southern side of the building as well as the link bridge. The covered arched roof is a lattice truss construction and is fitted with a ceiling internally. The façades are fin shaped, fabricated plate girders in-filled with glass.

The two tubular trusses, with a 21-metre span, were rolled at three variant radiuses and then assembled in the workshop. Each column was fabricated and bolted in the workshop, then spliced in three sections and transported to site by normal load.

This made the erection process a lot easier as it had some challenges of its own. The two tubular trusses are only connected to the concrete foundation on each end of the truss by a pin connection, creating a complex connection at a critical part of the structure.

Shadrack, an experienced erector and manager at Ferro Eleganza, proved his expertise and experience in rigging to erect the structure without any difficulty. With good use of temporary scaffholding only one 25 ton mobile crane was used in the erection process. The whole structure was bolted and minimal welding was done on site.

The structure was painted with three gloss enamel paint coats because most of the roof is covered by a ceiling thus requiring a maintenance free roof that did not need any repainting later.

As with all construction projects the programme was tight, but deadlines were met and the simulator building was officially launched in February 2011.

CLADDING

The building also posed some challenges for the cladding contractors. The link bridge joining the two simulator buildings was especially tricky. The project called for a high roof sheeting specification - Brownbuilt 0.8mm with Globalcoat colour finish, manufactured and supplied by Global Roofing Solutions.

The link bridge comprised two elements, an egg shaped bridge which then flows into a larger curve. The design called for six different radii that continually changed along the curve of the sheet. As the

The two tubular trusses are connected to the concrete foundation on each end of the truss by a pin connection.

The link bridge required a high roofing specification - Brownbuilt 0.8mm with Globalcoat colour finish.

Brownbuilt profile is a concealed fix, which requires the sheet to be in one continuous length, it was decided, together with the architect, Wim Swart, to create breaks in strategic areas in order to achieve the six radii curve.

The intricate cranking operation was carried out by the GRS technical team in order to obtain the critical radii required. Sample sheets were first made and tested on site before final cranking could commence.

Pinnacle Roofing, a GRS approved installer appointed on the project, maintained close supervision and control during installation. Regular site visits ensured that technical detailing was adhered to and that the overall installation ran smoothly. The end result was an aesthetically pleasing design collaboration and quality finish.

ABOUT THE NEW BOEING 737-800 SIMULATOR

The simulator building houses two full flight simulators. One of them is the new generation B737-800W simulator.

Manufactured at an approximate cost of R75-million by Netherlands-based Sim-Industries, the new Level D Certified B 737-800 simulator currently offers the most sophisticated full flight commercial airline simulator platform in the country.

Original aircraft components from companies such as Boeing, Rockwell Collins, Honeywell, Smiths Aerospace and MOOG Industries were used in the manufacturing process, integrating some of the most accurate and reliable world-class simulator control and visual software. This includes an out-the-window display system which offers some of the highest resolution images of any display technology currently on the market.

One of the unique aspects of the Sim-Industries simulator is its electro-pneumatically powered motion system. The use of high-tech components and absence of hydraulic oil systems renders the simulator safe, with increased reliability and higher fidelity. The system is substantially quieter in motion, producing very little noise pollution and making it ideal in this integrated training environment. Another major benefit is its energy efficiency – this simulator uses only an approximate 25% of the electricity used by the older generation hydraulic motion simulators.

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

SAISC STEEL AWARDS 2011 The 30th Event

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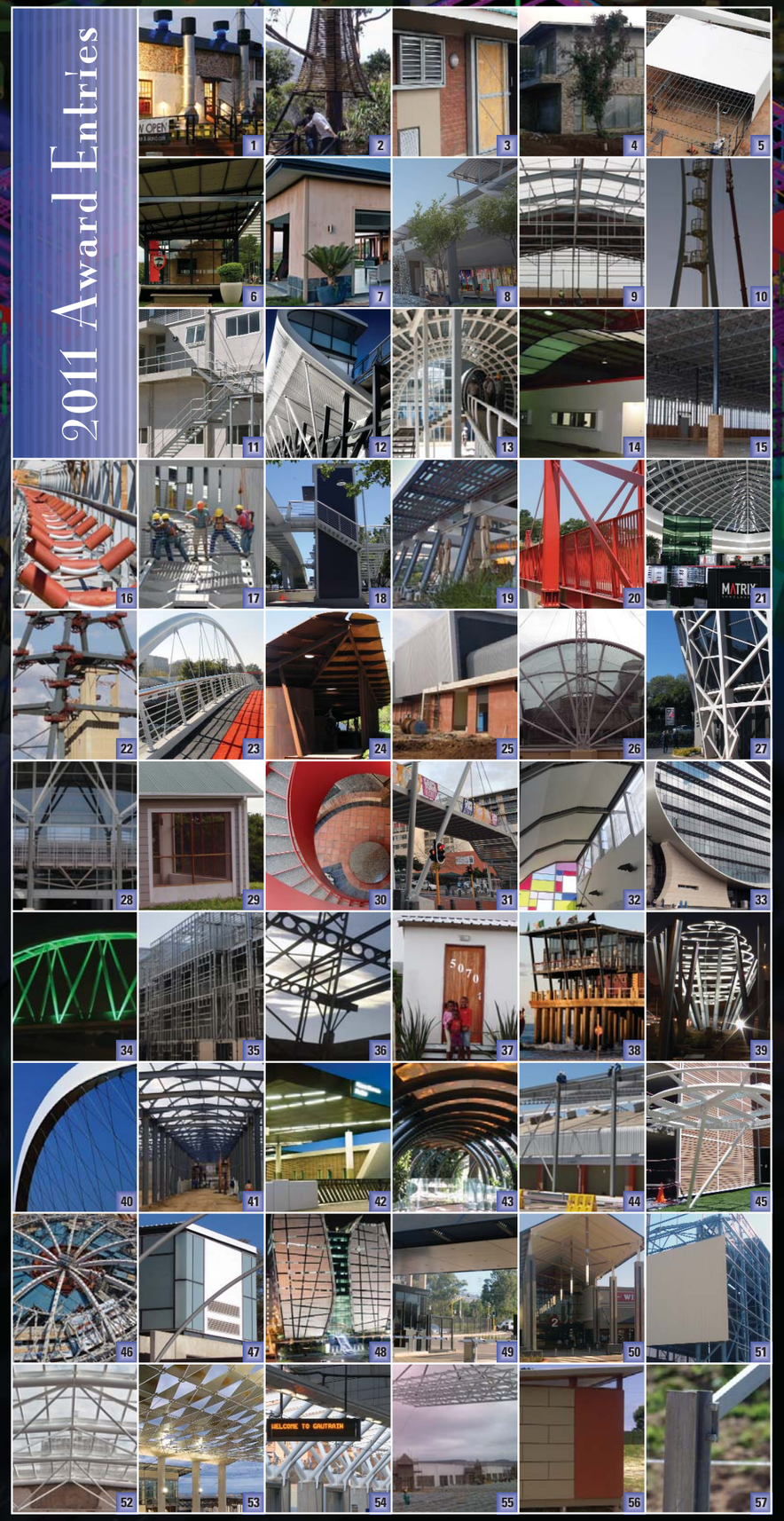
Fax: +27 (0) 11 918 3000
Postal: PO Box 6099, Dunswart, 1509

1 Turbine Hotel and Spa
2 The Treehouse
3 Phuthaditjhaba Stable Block for SAPS
4 House Raubenheimer, Bela Bela
5 Renexcon
6 Laerskool Pretoria-Oos Tennis Clubhouse
7 House Kahler
8 Levy Business Park, Lusaka, Zambia
9 Monsanto
10 Tower for Mascom Wireless Botswana Innovation Centre
11 Novo Packhouse
12 VST for the 2010 FIFA World Cup
13 Comair Simulator Building
14 2010 International Broadcast Centre
15 Eureka DIY Solutions
16 Dorstfontein Overland Conveyor River Crossing
17 Mangaung Intermodal Bridge, Hangar Street
18 Buitengragt Pedestrian Bridge
19 Pick 'n Pay Retail Centre
20 Zwelitsha Pedestrian Bridge
21 Mall of the North
22 New Headgear for Goldfields Southdeep Twinshafts Vent Shaft
23 Markgraaff Pedestrian Bridge
24 Untamed
25 Unilever Distribution Facility
26 Offices for the Gauteng Provincial Government – Economic Development
27 Waterkloof Corner
28 Riverside Mall New Entrance
29 Bela Vista, Mozambique
30 St John's College – Spiral Stair
31 Waterkant Pedestrian Bridge
32 Alzu Petroport
33 MCB Ebene for Mauritius Commercial Bank
34 Lynwood Glen Pedestrian and Pipe Bridge
35 2011 All Africa Games – Athletes Village
36 Facilities at Kisumu Airport
37 Parys Project
38 Moyo on the Pier
39 Fountains Circle
40 Crystal Towers Bridge
41 Strandfoam Kosmosdal
42 Moses Mabhida Station
43 Saxon Hotel, Skywalk Bridge
44 Impilo Entsha: New Building Project Kelloggs, Springs
45 Upper East Side
46 Sandton Protea Court
47 Engineering III Building and Parkade at the University of Pretoria
48 Alice Lane
49 Walker Creek Entrance Canopies
50 Brits Mall
51 South Deep Mine Rock Winder House
52 Pretoria Government Building Rehabilitation
53 Lebone College II
54 Gautrain – Pretoria Station
55 KwaNobuhle Shopping Centre
56 Glenwood House Private School
57 Gautrain High Speed Rail



UPPER EAST SIDE

By Mark Mallin, Senior Structural Engineer, Henry Fagan & Partners

Few of these structures were drawn conventionally by the engineer. Initial designs were communicated to the project team via hand sketches and mark-ups together with 3D models produced in Google Sketchup. Everyone from the client, project manager to the steel-fabricator was versed in finding their way around these models. The 3D visualisations, on which both the client could make overall decisions and alternatives for the 'nuts and bolts' of the detailed connections could be assessed, were essential to the final results achieved.

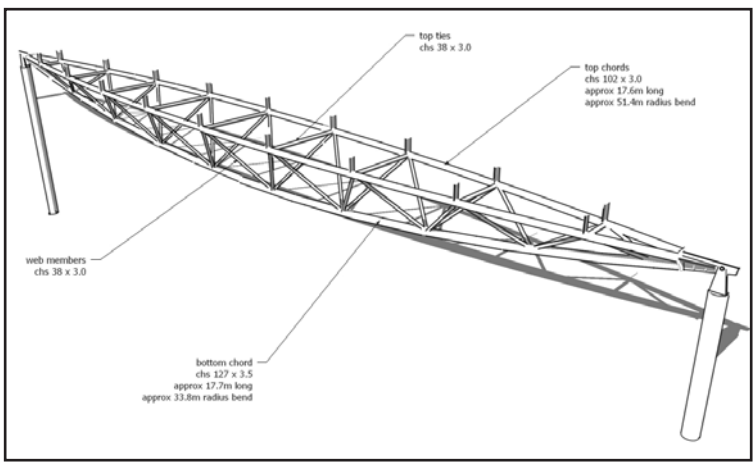
Fish-belly trusses were located directly below the skylights of the podium roof.

Located on the opposite side of the city to the Cape Town Stadium this large mixed-use development took advantage of the buzz created in the run-up to the World Cup with an opening deadline to accommodate the arriving soccer fans.

Upper East Side is the second phase of an initial factory redevelopment in Woodstock. The structural steel elements of this development consist of numerous individual 'feature' items located between the typically 6 – 7 storey RC-framed steel-roofed hotel/office/residential blocks. Tubular steel is used to its best advantage.

Pushing this development through at the hard end of the recession meant the developer had to be 'light on his toes' in adapting to the uses demanded by the market. The design had to be adaptable and practical. 'Light-touch' thoroughly resolved engineering was in many places the answer to achieving the eye-catching elements required.

With a tight budget and little repetition how does one approach these typically design intensive items in a profitable way? In a sense as engineers we were not just looking at efficient use of construction materials and resources but also of our own time and efforts in order to keep our heads above water in a difficult market while achieving designs of which we could be proud.



Engineering drawing of the podium roof fishbelly truss.

The concessions ramp is a torsion tubular structure providing ramp access between the two main internal levels.

Few of these structures were drawn conventionally by the engineer. Initial designs were communicated to the project team via hand sketches and mark-ups together with 3D models produced in Google Sketchup. Everyone from the client, project manager to the steel-fabricator was versed in finding their way around these models. The 3D visualisations, on which both the client could make overall decisions and alternatives for the 'nuts and bolts' of the detailed connections could be assessed, were essential to the final results achieved.

Similarly shop drawings for many of the elements were produced directly from the models.

This design process was used throughout the project from the specific elements to the 'out of the way but essential' air-conditioning unit supports on the roof; all of which benefited from this design approach.

PODIUM ROOF

The courtyard was originally envisaged at the launch of the scheme as open to the sky but the client became keen on the additional uses and flexibility that could be achieved by covering this courtyard area to achieve an 'all-weather' space onto which surrounding shops, restaurants and cafes could open. The space could also be used for product launches, parties etc by the main hotel tenant. The other consequence of having not been included in the original scheme was that there was little budget available.

Consequently a simple, efficient 'diagram' had to be arrived at providing pleasant natural light to the space below. Three strips forming a continuous glazed rooflight were proposed running the full 17.5m width of the roof returning down the north elevation. Fish-belly trusses were located directly below these skylights in order to 'animate' them with daylight. Tubular hollow sections were chosen as the most structurally efficient and aesthetically pleasing members for these trusses weighing approximately 675kg each.

Parallel flange channels were used as purlins for robustness and to avoid sag bars in the exposed steelwork; a simple taper detail was provided at the connection to the trusses minimising the structure in this area and maximising light.

Bracing of the roof was provided by utilising the reinforced concrete upstand balustrades around the perimeter and cantilevering the circular hollow section columns from this robust support.

An unexpected effect of locating the trusses directly under the glazing is that at night the 'mirror' effect in both the roof and elevation gives four trusses for the price of one!

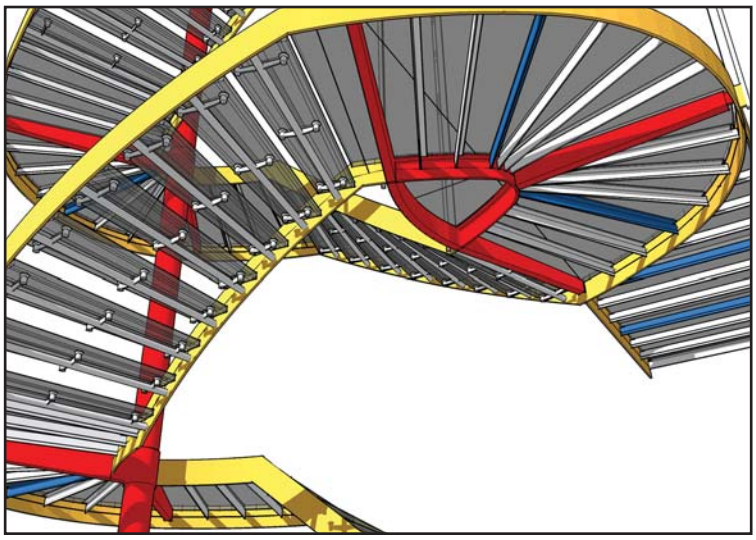
FEATURE STAIR

Designed as the 'centrepiece' of the hotel lobby this structure sits adjacent the main hotel reception desk and provides a dramatic public access to the mezzanine levels and conference rooms on the levels above. Rising two stories high, the solution for this helical stair involved the investigation of numerous 3D geometries to arrive at the most elegant solution.

Specially fabricated tapered box section arms cantilever from an offset tubular column to support the half landings. The main landing is suspended from the concrete slab above and the tapered box sections curve and reduce towards the hanger supports to express the structural forces within. Stringers are simple flat plate rolled appropriately and stairs and landing floors are all laminated glass. In the case of the treads a simple pipe spanning between stringers with six point supports from tapered plate arms provides a 'light-touch' support while the landings sit within the steel framing.

The stair appears to provide the animated talking-point the client was pursuing and features in much of the publicity material of the hotel.

Specially fabricated tapered box section arms cantilever from an offset tubular column to support the half landings.



Initial designs were communicated to the project team via with 3D models produced in Google Sketchup.

CONCESSIONS RAMP

The brief for this element was to achieve a structure that 'threaded' through the concrete surrounding concrete columns providing ramp access between the two main internal levels and that appeared as light as possible when viewed from the main public area. A torsion tubular structure was therefore proposed with the main tubular section offset to the rear of the deck and taper-cut T-sections cantilevering from it to the deck edge. A simple modular balustrading system was designed to attach to the ends of the T–sections supporting glazed screening. Supports from the columns to the main tubular section are articulated to express their structural action and resolve the torsional forces in the main 'backbone' of the ramp structure.

VOLLEYBALL DECK

The deck represents structural engineering at its simplest and most pure in order to achieve a solution within the client's budget while complementing the adjacent café terrace and volleyball court it overlooks. Various basic configu-

Circular hollow sections and tapered steel T-sections are used for the deck structure with a V-shaped CHS pipe supports tapering to a notched end.

rations of deck and stair were modelled in SketchUp for the client to review. Next level details were added as decisions were made. The 3D model allowed the client to visualise the structure 'in-situ'. Unpainted hot-dip galvanized sections are used throughout with a balustrading system of the same language as the concessions ramp with cables replacing the glass for both economy and outside maintenance.

CAR DISPLAY

An amphitheatre seating area was constructed between the new and existing buildings in which outdoor events could be staged. The client saw the opportunity for attracting the launch of new car models to the venue and requested proposals for an appropriately dramatic structure. As an alternative to initial 'sliding platform' ideas a drawbridge solution was proposed consisting of a circular deck that lowered down from the screen structure behind into either a flat or slanted position onto which cars could drive and be displayed for public-viewing. Similarly when not in use it could be raised to leave the space below unobstructed.

The circular shape derived from the possibility of a rotating mechanism to fully display all aspects of a vehicle to the audience. While this has currently not been implemented the possibility is there and the circular shape sits interestingly against the grid module of the timber and steel screen structure behind.

Circular hollow sections and tapered steel T-sections are used for the deck structure with a V-shaped CHS pipe supports tapering to a notched end that allows for the adjustable positioning when the deck is lowered.

The entire deck structure is fabricated to reflect the structural forces within giving an overall futuristic look that suits its purpose without dominating the products above.

3D modelling was essential both in initially selling the idea to the client and working out the various pivot points and support locations in the final design.

project team

Developer/Owner:
Swish Properties/Redefine

Architect:
Design 360

Structural Engineer:
Henry Fagan & Partners

Quantity Surveyor:
Slabber Fick Associates

Project Manager:
Triple C

Main Contractor:
GRIDCO

Steelwork Contractor 1:
Anchor Steel Projects

Steelwork Contractor 2:
M-Rail

Steelwork Contractor 3:
Target *(now Just Engineering)*

Steelwork Contractor 4:
DLE Engineering

Steelwork Contractor 5:
Mass Steel

INDUSTRY NEWS

CASE STUDY: PROTEA HOTEL MAIN CONFERENCE HALL

ABILITY OF CELLULAR FLOOR BEAMS IN INTEGRATING STRUCTURE AND SERVICES

By Paolo Trinchero, Chairman, SAISC Engineering Committee

Clients are continuously demanding flexible and adaptable buildings. Protea Hotel is one such case, and cellular beams proved to be a very efficient solution demonstrating not only the ability to achieve long clear spans, but also an unsurpassed ability to integrate both structure and services.

The client's brief was to extend an existing building to include a 220m² conference hall on the upper floor. One of the stringent requirements was that the overall floor zone to be less than one meter in depth, because of the limited floor to ceiling height. This had to be achieved over a span of 11.25 meters.

Based on the above design requirements cellular beams were used to enable clear spans and the integration of services within the structural depth. The 525mm diameter circular openings ensured the passage of air conditioning ducts and other essential service cables. The result was an overall floor zone of only 960mm, well within the client's requirements.

The 11.25m long clear span was achieved using a 759 x 210 / 210 x 82.2kg/m cellular floor beam, designed for a maximum imposed load deflection limit of 10mm, as specified. To speed up construction precast hollow core slabs were used.

Clients are continuously demanding flexible and adaptable buildings. Protea Hotel is one such case, and cellular beams proved to be a very efficient solution demonstrating not only the ability to achieve long clear spans, but also an unsurpassed ability to integrate both structure and services.

For more information visit www.macsteel.co.za/cellbeam

PROJECT DETAILS

Owner:	Protea Hotel (Stellenbosch)
Structural Engineer:	Element Consulting Engineers (Pty) Ltd
Steelwork Contractor:	Triomf Staalwerke
Main Contractor:	FCS Construction
Cellular Beam Supplier:	Macsteel Trading (Pty) Ltd
Beam Span:	11.25 meters
Precast Floors:	150mm Hollow Core Precast Slabs
Cellular Beam Section:	759 x 210 / 210 x 82.2kg/m (525 @ 775mm c/c)

HOUSE RAUBENHEIMER IN BELA BELA – BELLISIMO!

Some of the aspects of LSFB that convinced the client were a significant reduction in the time it would take to build, and the fact that this building method required only a small team on site.

Craft-Lock Chromadek roof sheet was used for the multi-faceted roof.

The site is nestled in the typical Waterberg landscape of indigenous bush and koppies. The architects are specialists in designing houses with alternative building methods. All that is needed is a client with an open mind to create a luxurious game farm house that blends in with its surroundings and is built using light steel framing technology (LSFB).

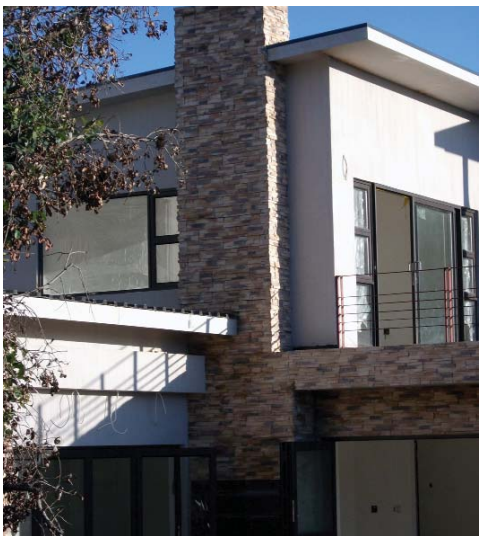
The client approached Christiaan Oosthuizen of Recreate Architects to design a Tuscan style house for his new home on a game farm near Bela Bela. Christiaan gently indicated that they do not apply typical European design styles to their designs as they believe that houses in South Africa should interpret its natural and indigenous surroundings. He offered to investigate some alternative and exciting designs based on the use of alternative energy-efficient materials instead.

Firstly they set to work on a typical South African design which the client warmed to and then they proposed building the house in LSFB, using some local and international examples to illustrate what could be achieved. Although it took some time to finally get the go-ahead to build the house with a light steel frame, the client took no time in admitting afterwards that it was the best choice he could have made.

Some of the aspects of LSFB that convinced the client were a significant reduction in the time it would take to build, and the fact that this building method required only a small team on site. The complexities and cost of transport of building materials to the remote location were also greatly reduced, as the mass of walling materials of a typical LSFB is less than 10% of that of conventional masonry materials.

The 900m² house, including a garage for the owner's helicopter, was designed to open up 'like a heart' to the Bushveld views and open interior. Natural ventilation was a requirement and LSFB was ideally suitable for this.

SA Steelframe Systems (George) carried out the design and detailing of the light steel frame in collaboration with the appointed structural engineer. They acted as the main contractor, assembling and erecting the wall frames, joists and trusses on site, before erecting same. The high strength galvanized steel sheet for the frame was supplied by Clotan, using AMSA's ISQ 550 (3t) galvanized sheet. Another SASFA member, Razorbill, manufactured the light



Stone cladding was used as finishing for some of the external walls.

steel profiles in their Vereeniging factory. The Craft-Lock Chromadek roof sheet for the multi-faceted roof was supplied by Clotan.

Johan Marais from SA Steelframe Systems explained the process: "After erection of the external light steel wall frames, a vapour permeable membrane was fixed to the outside of the frames. As the client specified finishing the external walls with stone cladding, provision had to be made to support the heavier than normal external cladding. Horizontal battens were installed every 600mm, to which 9mm thick high density fibre cement boards (Nutek, from Everite) were fixed. The joints were sealed using Rockcote jointing compound. Plaskey (Saint Gobain product) was applied to the FC board, to enhance the grip of the tile cement used to fix the light weight stone panels (supplied by Inca Stone Veneers).

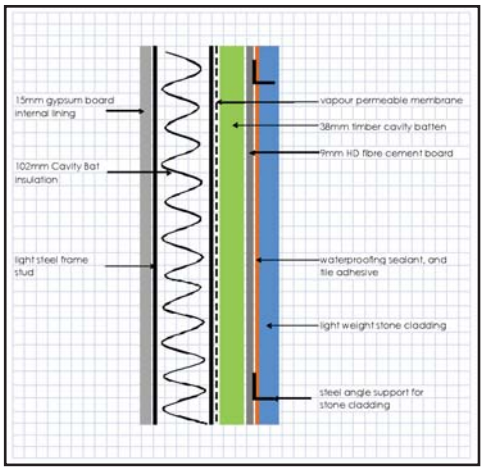
Saint Gobain's Cavity Batt glass wool insulation was used inside the wall cavities, and 15mm thick gypsum board was used as internal lining. Light steel frame joists were used to support the light weight flooring solution for the first floor".

This project turned out to be one where the members of the whole project team bring their experience and knowledge to the project and contribute to its successes, and not its headaches. The architects worked closely with the client through-out the whole process and were able to make changes to the design quickly with the client's approval. They also had the structural engineer on board from the start to ensure that their design was practicable and structurally sound. However, the architects commented that there seem to be a limited number of structural engineers with knowledge of and experience in LSFB.

One of the few challenges that arose was the accuracy of the raft foundation. The contractors discovered that the dimensions of the foundation and slab were about 50mm out and this would create a problem for the rest of the structure. Thus they had to do some extra work on the foundation, and this unfortunately had an impact on their time on site.

The Bela Bela house is a project that illustrates the advantages of LSFB perfectly. The remote setting required minimum loads to the site. The fact that there was very little building rubble also made for minimum loads from the site. The far-off location would also put strain on the amount of time the project team was able to spend on the site using conventional methods, but with the speed of construction of LSFB there was a considerable saving in time and money.

The other advantage was the ease of installing the plumbing and electrical services. The architects feel that



Section through external wall - House Raubenheimer.

House Raubenheimer taking shape.

electricians and plumbers should view LSFB projects in a different light than conventional building projects and apply their costing accordingly.

The client's own words say it all: "I have never regretted going this route!"

ABOUT RECREATE ARCHITECTS

Recreate Architects seem to be one of the few architect firms in South Africa that are constantly looking at alternative building methods, technology and intelligence to apply to their designs.

The two partners Christiaan Oosthuizen and Sheldon Archibald became friends as students, but went their separate ways after their studies. Christiaan went on to specialise in game lodges and boutique hotels while Sheldon went into the commercial field – he also had some experience in the UK where he worked on healthcare and school projects.

In 2009 they met up again and decided to form a partnership. Both of them had an interest in modular systems and alternative building methods. When introduced to the LSFB building method, they immediately saw the advantages of LSFB and how this method could create better living and working spaces for clients in a lot less time with a lot more accuracy than the conventional brick and mortar way.

They feel that awareness of LSFB is growing in the architect profession and that perceptions are changing to applying new methods of construction.

They have done a number of projects in LSFB and are currently busy with 500 units in the Waterberg for a retirement village as well as an 80 unit residential estate on the KZN North Coast where the developer specified using LSFB and appointed the architects because of their experience with the concept.

Visit their website - www.re-create.co.za

project team

Architect

Recreate Architects

Structural engineer

Jaco Richter

Main Contractor

SA Steelframe Systems (Johan Marais, Andy Hall, Johan Kapp)

Material suppliers

Clotan Steel – AMSA galvanized steel for frames and trusses, Craft-Lock roofing

Profiled using Chromadek

Saint Gobain – Insulation and gypsum lining

Everite – Fibre cement sheet

Inca Stone Veneers – External stone cladding

AMSA's ISQ 550 (3t) galvanized sheet was supplied for the frame.

REPORT – LIGHT STEEL FRAME TRAINING COURSE FOR BUILDING CONTRACTORS

By John Barnard, SASFA director

SASFA's aim with the LSFB Course for Building Contractors is to teach attendees to understand and erect a simple steel structure, and for them to learn enough about cladding, lining and insulation to be able to plan and supervise those disciplines.

SASFA's course for builders of light steel frame buildings was again successfully presented during March 2011, at the Samrand premises of Saint Gobain. We received enthusiastic support for the six-day course, from both SASFA members as well as non-members.

The course covers all aspects of LSFB, including practical work – students had to erect a small LSF building.

The theoretical aspect included the following modules:

- Steel frames: properties of steel, manufacturing of steel frames, setting out and erection
- Installation of external cladding, and
- Internal lining, insulation and services.

Registrations for the course were received from 21 applicants, from Gauteng, Western and Northern Cape, the Free State and Limpopo, one from Brazil and another from Mozambique. The current occupation of the applicants ranged from planners, designers, engineers, property valuers and project managers, to MD's of companies.

Four days were devoted to steel framing, and two to cladding, lining and insulation:

7 – 10 March: Steel Frame Erection – *presented by J Barnard (SASFA) and R Bailey (Maxspan)*

11 – 12 March: Lining, ceilings and insulation – *presented by D Schutte and H Stevenson (Saint Gobain, and Cladding – presented by M Crawford (Everite).*

The venue, a 24m² concrete slab, and the lining and insulation materials required for the practical work were supplied by Saint Gobain, while Everite supplied the cladding materials. Mitek provided the steel training structure, fasteners were supplied by Kare, OSB board by Global Innovative Building Systems, and a roll of vapour permeable membrane by Marshall Hinds.

Students learning how to apply the vapour permeable membrane around the outside of the building.

SOUTHERN AFRICAN LIGHT STEEL FRAME BUILDING ASSOCIATION

Speedfit Africa presented their plumbing system, ideally suited for LSFB.

The Lectures were supported by practical work on a training structure. Attendees each received a set of course notes, product literature and a SANS 517:2009 standard.

Hilti demonstrated their laser leveling equipment on our concrete slab, as well as their screw guns, drills and anchor bolt systems.

During the practical work, the attendees had to erect a 6m x 4m structure, with roof trusses. A section of the structure was clad with OSB which was covered with fibre cement (FC) planks, and another area with FC boards. Insulation material and internal lining (15mm gypsum board) were installed to illustrate the process. Joints of the internal lining were filled and finished.

All the attendees were encouraged to 'get their hands dirty', as the practical exposure builds confidence.

Speedfit Africa, a SASFA member, illustrated the installation of their plumbing products, ideally suited to LSFB structures.

The attendees rated the various aspects of the course highly. The evaluation form reflected an average score of 90%.

SASFA plans to present this course again in Durban, from 25 to 30 July, and in Cape Town, from 24 to 29 October 2011. See www.sasfa.co.za for more details.

SOCIAL SNIPPETS

By Marlé Lötter,
Events Manager, SAISC

The winning team, NJR Steel taking the trophy at the SAISC Golf Day (from left) Colin Chapman (also the highest individual score), Matthew Martino, Chris Kothe (host) and Chris Davidson.

2nd place – Hatch (from left) Peter Rhynas (host), John du Plessis, Craig Sumption, Danny Costalos.

Louwill Engineering came in on third place (from left) Manie Fourie, Pieter Kunz, Deon Kotze and Martyn Swanepoel (host).

Exactly what you would expect of the 'men of steel' – perfectly adept at multi-tasking!

NJR STEEL TAKES THE CUP!

The trophy for the SAISC Golf Day 2011 was contested in high spirit and great weather by 31 fourball teams at Houghton Golf Club (Johannesburg) on 11 May 2011. The team of NJR Steel, hosted by Group Managing Director, Chris Kothe, not only took the trophy from the reigning champions (Cosira) , but also had among them Colin Chapman, the player with the best individual score for the day (44).

Congratulations guys – many of our players on the day commented on how challenging this particular course is! Houghton is a preferred venue for the SA Open for exactly that reason.

So these were the results for the day:

The Winning Alliance – NJR Steel (Top score: 93):
Chris Kothe (host), Colin Chapman, Chris Davidson, Matthew Martino

2nd Best Alliance – Hatch (Score: 92):
Peter Rhynas (Host), Craig Sumption, John du Plessis, Danny Costalos

3rd Best Alliance – Louwill Engineering (Score: 88):
(Trophy holders 2008 &2009): Martyn Swanepoel (Host), Manie Fourie, Deon Kotze, Pieter Kunz

4th Best Alliance – Macsteel Coil Processing (Score: 88):
Trevor Cooke (Host), Vince Naidoo, Uwe Krupke, Barry Burton

5th Best Alliance – Macsteel VRN (Score: 87):
Kit Williamson (Host), Ricardo, Christo Theodorou, Mike Hall

6th Best Alliance – Macsteel Trading (Score: 87):
Fabio Renieri (Host), B Whitehead, Fifi Tokarsky, Stan Tokarsky

7th Best Alliance – ArcelorMittal (Score: 86):
Hannes Basson (Host), Adriaan Roux, Lian Lotz, M Boersma

8th Best Alliance – Bulldog Projects (Score: 85):
Mike Book (Host), Armand Labuschagne, Mike Simpson, Craig Fraser

Individual performances:

Nearest-to-pin on 7th – Mervin Joseph (Team: Transnet Capital Projects)

Nearest-to-pin on 9th – Mike Els (Team: Robor)

Nearest-to-pin on 14th – Bob Harvey (Team: Robor)

Nearest-to-pin on 16th – Barry Bruton (Team: Macsteel Coil Processing)

Longest drive on 5th – Logan Lofstedt (Team: Trident Steel)

Longest drive on 10th – Fifi Tokarsky (Team: Macsteel Trading)

A cheerful feature at the prize function was the contribution of the able musos of Frontline. Thank you, Michael Mamotte (bass) and the-other-Michael (acoustic guitar and lead vocal) for turning up the groove for us. ('the secret life of our industry' revealed!) Many thanks also to Gary Jones of AVENG Grinaker-LTA DSE Fabrication for excellent service as MC at the event.

We proudly acknowledge the sponsors of the SAISC Golf Day 2011:

Grating World – Branding the caddies

Macsteel – Branding the carts and hole 9

B&T Steel – Branding the score cards

AVENG Trident Steel – Branding holes 4 and10

Sach-Warr Engineering – Branding hole 1

Stewarts & Lloyds – Branding hole 18

Spiral Engineering – Branding hole 3

ArcelorMittal – Branding hole 12

Robor – Supplying towels for players

EB-LO – Supplying player accessories *(Also our regular vendor for SAISC promotional gear)*

Internet Solutions – Prize sponsor

AVENG Grinaker-LTA DSE Fabrication – Prize Sponsor

Hatch – Prize sponsor

PingPong Communications – Prize sponsor *(Also rendering very efficient management support for this event).*

Pictures of teams were emailed to hosts, but you can also visit the SAISC website www.saisc.co.za for a selection of golf day pictures.

So for next year ...

Please provisionally diarise Wednesday, 11 May 2012, Houghton Golf Club*

* *Date and venue have been reserved, but are subject to final confirmation early in 2012.*

Special request: *If you are interested in playing and/or sponsoring next year please make sure we have you on our mailing list by emailing your details to marle@saisc.co.za – no obligation from your side, just making sure you get the event details in good time.*

STRUCTURAL BOLTING ISSUES IN SOUTH AFRICA

PART 1

By Spencer Erling,
Education Director, SAISC

This article is written in 2 parts.

The first part describes in general terms what the impact of using the newest EN codes for bolt grades and types has and is having on bolts and bolting in South Africa when compared to current and previous South African practice.

The second part is very technical and goes into a fair amount of the detail of the new specifications and will be published in the next issue of Steel Construction.

BACKGROUND

I am sure it is common knowledge that the new Eskom power station developments are largely based on European design codes and bolting requirements.

This has brought to our attention a number of issues where European bolting practice is quite different to those practices we have used in South Africa for a long time.

THE RED BOOK RECOMMENDATIONS

Chapter 6 of the Southern African Steel Construction Handbook covers the existing South African practice in reasonable depth. Issues relating to which DIN or ISO standards bolts are commonly available are quite clear.

You will notice that the mechanical properties shown in Table 6.1 did not call up the hardness requirements for the bolts (because so little emphasis is placed on this in the old versions of ISO898-1). You will read below that hardness has now become the final acceptance criteria for bolts to this standard. The general remark 'Grade 8.8 bolts' usually resulted in the right bolts arriving on site.

Section 6.1.1 covers 'ordinary bolts and nuts' used for structural applications where 'ordinary' means the bolts are neither pre-tensioned nor High Strength Friction Grip (HSFG) applications. We continue to advise that all structural elements should be bolted using Class Grade 8.8 bolts. Only minor elements such as purlins, girts, hand railing, stairs and the like be joined with Class Grade 4.8 bolts.

Our design tables are set up with the assumption that the shear plane is always in the threaded portion of the bolt. In the case of the shear plane being specifically in the unthreaded shank then the design engineer has to determine the value of the strength of the bolt by multiplying the bolt strength (read in the tables) by a factor of 1.43.

It is also assumed that the tightening of such bolts be done by a normal person applying as much effort as he can to a standard spanner for the bolt size in question. No washers are required for standard round 2 or 3mm oversize holes unless there is a need to protect previously applied corrosion protection.

We recommended that pre-tensioned bolts should only be used specifically where required such as in connections where the bolts are in tension (and expect reasonably high stresses in tension) or in vibrating structure applications. The principle behind this application being that when the tension in a bolt fluctuates, once pre-tensioned, the bolt will never be in a loose state that could lead to nuts falling off.

Section 6.1.2 covers HSFG bolts. For non-slip applications we recommended the use of HSFG bolts to Class Grade 10.9 (S) and tightened using the turn of the nut method. The use of a hardened washer under the turning part (usually the nut) is obligatory.

In all of the above the DIN or ISO specification determines the length of thread on the shank of the bolt unless the bolt was ordered as a set screw i.e. one with thread the whole way along the length. This is the South African definition of a set screw *(see photo on page 35)*. The European definition for a set screw is a threaded length of rod without a head but the one end is prepared with a hexagonal indentation to allow for tightening with an Allen key as per *Diagram 1 on page 35.*

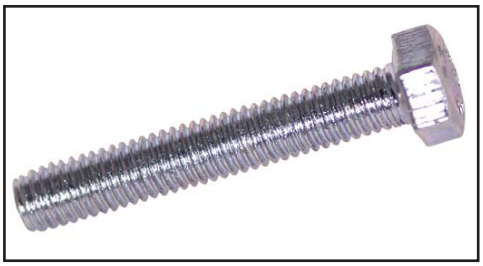
Because of our design approach that the shear plane will always be in the threaded portion of the bolts, set screws (as we define them bolts threaded for the full length of the shank) are perfectly acceptable.

Where for some particular reason the designer chose to insist that the shear plane would be in the unthreaded shank, getting the correct length of bolt to ensure the shear plane will always be in the unthreaded shank could in some instances have been a problem for the unwary buyer who just ordered grade 8.8 bolts and not checking the unthreaded length of the shank due to the specifications bolts are typically made to in SA. Just ordering grade 8.8 bolts and giving a length did not necessarily give you the right unthreaded shank.

THE RESULTS OF THIS PRACTICE

Well, we had no structural failures directly as a result of the bolt qualities supplied and installed (unless as did occur in a few cases Grade 4.8 bolts were used in error in connections where 8.8 bolts were called up.)

We did have some bolt failures usually discovered during the tightening of the bolts. The most common failure situation was when Grade 10.9S (HSFG) bolts in a hot dipped galvanized finish snapped due either to Hydrogen embrittlement or being much too 'hard' so that they were brittle, with occasionally bolts being so 'soft' that they stretched too much in the tightening process. But in general we managed quite well.



Set screw.

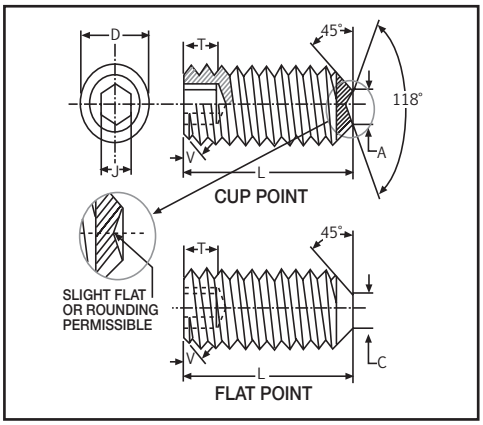


Diagram 1.



Some examples of bolt failures.

What is the impact on our industry in general when structures are designed to European design codes and norms?

One of the first major differences we note when looking into the design and fabrication to the EN suite of documents is that the technical and quality requirements for steel structures designed to EN go up as the 'execution class' goes up.

There are 4 classes – EXC1, EXC2, EXC3 and 4.

To determine the class applicable one would consider the 'consequence classes' (risk profile to humans, economic and environmental failure), hazard profile based on things like stress levels in members, service factors (service categories), complexity of fabrication factors (production categories taking account that higher strength steels are more difficult to work with (460 Mpa yield to 900 Mpa yield)) etc. and by plugging the right numbers into a matrix out pops the Execution Class (EXC).

- EXC1 relates to the simplest of static steel structures, in low seismic areas, using steel grades lower than S355 and would have largely low specification welding requirements. (In SA this would be your typical security type works, car ports and the like)
- EXC2 is the default standard, most of our typical day to day structures would fall into this category.
- EXC3 would be used for dynamic structures with high consequences of failure, bridges etc. subject to vibrations, using steel Grade S355 and higher with important welds done on site including circular hollow section work with developed end welded connections.
- EXC4 would apply to only structures that would have extreme consequences and in Europe would be defined by legislation.

WHAT DO THESE EXECUTION CLASSES MEAN TO THE FABRICATOR?

I will be so bold as to state that for EXC2 and EXC1 there is very little difference between the EN requirements for quality and what our typical SA workshop with an effective quality management system is currently doing using quality plans.

But when we step up to the requirements for EXC3 (Including the power stations!) and EXC4 then the rules become quite demanding...

- For example for EXC3 and 4 standards ***all constituent materials will be traceable back to source (even the bolts!)*** This is something that only the most specialised of work called for in SA!
- Or for EXC2 holes may be punched full size through the steel subject to the diameter being greater than the thickness but for EXC3 & 4 punching full size is not permitted i.e. holes are to be punched 2mm undersize and reamed out to the correct diameter.
- For all classes there is a hole tolerance of 0.5mm on diameter!
- For EXC3 and higher structures all bolts are to be 'pre-loaded (pre-tensioned)' bolts.
- For welding requirements, EN3834 management system registration is a requirement, i.e. to part 3 for EXC2 and to part 2 (the comprehensive requirements) for EXC3 & 4.
- The acceptance criteria for defects in welds are dependent on the execution class. As the class goes higher, the fewer defects are allowed.

LET US NOW CONCENTRATE ON THE BOLT REQUIREMENTS

The mechanical properties of all bolts to European specifications are now to be in accordance with ISO EN 898:1 of 2009. "The mechanical properties of fasteners made from carbon steel-bolts screws and studs with specified property classes – Coarse thread and fine pitch thread". The property classes are from grade 4.8, 8.8 10.9 and 12.9 (there are others but we do not get them in SA).

The 1988 version has been used in South Africa for quite some time. It was also published under the guise of SABS1700-5-1:1996. There was a list of 10 possible tests described in the document. The hardness requirements are specified without any emphasis on their importance (hence not listing them in the Red Book). The 2009 version has very strict requirements for the mechanical properties of the bolts especially the hardness requirements. The list of possible tests has grown to 15! It covers the full range of diameters. It does not cover dimensional requirements. The specification clearly calls up all the mechanical properties of the material including ultimate tensiles, elongation, hardness, Charpy and the like.

The specification then defines which of the 15 possible tests can be carried out on the material (i.e. the finished bolts or parts thereof), what the test is for and acceptance criteria.

The following 'definitive extract' relates to the hardness issues:

Par. 9.9 contains the hardness test requirement. It starts off with the following:

"the purpose of the hardness test is

for all fasteners that cannot be tensile tested-to determine the hardness of the fastener (which shall fall within the range specified in table 3 i.e. this is used to determine the suitability of the bolt or otherwise." So in addition to providing for a test suitable for short length bolts not previously covered, it provides a way of testing bolts when you cannot do tensiles, charpy, elongation and the like such as when a bolt that is already installed and tightened is suspect. This has resulted in a great emphasis on hardness tests when there is reason to suspect the quality of the bolts.

Quote from the spec "- for fasteners that can be tensile tested – to determine the hardness of the fastener in order to check that the hardness is not exceeded."

Hardness can be determined on a suitable surface (prepared suitably) or on a transverse section 1 diameter in from the end of the bolt. In a dispute relating to hardness readings only the latter readings are definitive.

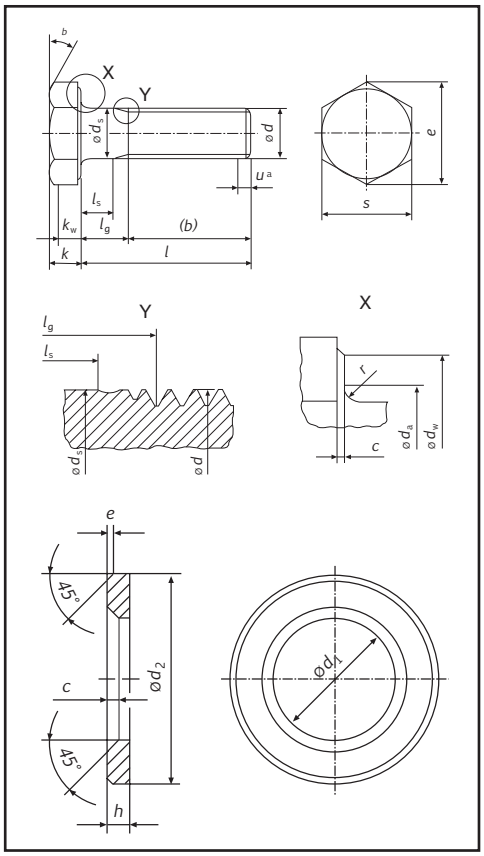


Diagram 2: Dimensions of bolts.

Please go to Part 2 of this article for more technical details of the requirements of ISOEN 898:1

I believe we have covered most of the important issues / differences for the mechanical properties for the material for the different class grades as required for the bolts, what are the requirements for the bolts themselves?

ISO EN 14399 PARTS 1 TO 9:2005 – HIGH STRENGTH BOLTING ASSEMBLIES FOR PRE-LOADING

This is the specification that covers the bolts themselves (i.e. dimensional requirements etc.), calling up ISO EN 898 for material requirements and especially what makes for a usable assembly (i.e. bolt, nut and washer(s)) for preloaded bolts (either in shear or friction grip).

- Part 1 covers general requirements
- Part 2 covers suitability tests for pre-loading
- Part 3 covers system HR (described below) bolt and nut assemblies
- Part 4 covers system HV (described below) bolt and nut assemblies
- Part 5 covers plain washers
- Part 6 covers plain chamfered washers
- Part 7 covers HR system countersunk head bolt and nut assemblies
- Part 8 covers HV system hexagon fit bolt and nut assemblies (close tolerance in SA)
- Part 9 covers direct tension indicators (load indicating washers in SA)
- Part 10 covers TC bolts (torque control bolts in SA)

THE GENERAL REQUIREMENTS AND INFORMATION ABOUT PART 1

The introduction and Table 1 put the whole 9 part specification into context.

"This document on structural bolting reflects the situation in Europe where two technical solutions exist to achieve the necessary ductility of bolt/nut/washer assemblies. These solutions utilise different solutions (HR and HV described below) of bolt/nut/washer assemblies as described in Table 1 (below). Both systems are well proved and it is up to the experts responsible for structural bolting whether they use one or the other system."

NOTES REGARDING THE ABOVE INTRODUCTION TO 14399-1:

1. Pre-loading means the same as pre-tensioning - the term we often use in SA.
2. HR system is the (new) European name for what we in SA used to call HSFG bolts with the name 10.9S. the old specification has been withdrawn and is replaced by EN14399).
3. HV system is a shear/ bearing type connection where pre-loaded bolts (pre-tensioned bolts) are used.
4. The decision of the expert referred to above comes out of the assessment done using Euro design codes leading the expert as to whether or not pre-loaded connections for the whole structure will be used or not. In South Africa we would have decided by joint type as to whether we need pre-loaded bolts i.e. (There are very specific applications where a structural engineer would use pre-loaded structural connections. He is the expert who must decide as inferred by the foreword to 14399)
   - For a bolt with an expected tension in the bolt we would suggest an HV system

	System HR	System HV
General requirements	EN 14399-1	EN14399-1
Bolt nut assembly	EN 14399-3	EN 14399-4
Marking	HR	HV
Property class	Bolt 8.8 nut 8 or 10.9 and 10	Only 10.9 and 10
Washer(s)	EN14399-5 or 14399-6	EN14399-5 or 14399-6
Marking	H	H
Suitability test for pre-loading	EN14399-2	EN14399-2

Table 1: Systems of bolt nut washer assemblies.

- In a vibrating structure HR or HV would be used
- For a non-slip connection we would suggest an HR system (HSFG)

5. It is important to note that for shear/bearing connections designed to SANS 10162 in SA we always assume the shear plane will be in the threaded portion of the bolt (i.e. the weakest part of the bolt). In Europe the shear plane is always designed to be in the unthreaded shank of the bolt. Threads in the shear plane are not allowed in accordance with EN14399 for structural design for pre-loaded applications. This is in conflict with what has been standard practice for designs done in SA.
6. In both parts 14399 3 and 4 which cover the actual dimensions of the bolts and nuts, note that the head of the bolt is 'thickened up' under the head for most of the bolt head area *(see Diagram 2 on page 38)*. In terms of clause 4.4.2 the under head radius shown in the detail X per figure 1 of 14399 3 and 4 is required in class 10.9 bolts to reduce susceptibility to hydrogen embrittlement.

   The Europeans have also engineered out the possibility of hydrogen embrittlement by adopting Zinc Thermal diffusion coatings and eliminating the use of acid for any cleaning operations. Again this places the requirement for the hardness/tensile test as being very high as well as material selection which has been inadequately dealt with previously.
7. Washers to 14399 part 5 are flat washers and intended to be used under the nut where required. The washers to 14399-6 have a chamfer to both the inner diameter and outer diameter on one side of the washer and intended for use under the head of the bolt to clear the radius at the joint of the head of the bolt and the shank.
8. Some of you may be familiar with clause 4.5.1.6. of SANS 2001-CS1:2005

   "Galvanized nuts

   Nuts that are to be hot-dipped galvanized shall be of a higher class than the associated bolt or screw"

Please be advised that there is no such requirement in 14399 and in future updates of SANS2001–CS1 – this requirement will be dropped.

The issue of pre-lubricated nuts, which is a big issue and part of the whole reason EN14399 was introduced has not been covered by this article but will form part of a further article relating to tightening issues for bolts.

We will continue with Part 2 in Steel Construction Issue no 4. This part is aimed at the 'technically minded' and will cover ISO EN 898–1.

INDUSTRY NEWS

TORNADOES NOT TO BLAME FOR DAMAGED ROOFS

By Dr Hennie de Clercq,
Executive Director, SAISC

Why is it then that we have an epidemic of damaged roofs year after year? Well, it can be attributed to carelessness, sloppiness and greed.

Recently we have seen heart-wrenching images of schoolchildren working in the open because the roofs of their schools had been blown off; "by a tornado" we are told. These are not isolated incidents; people who are familiar with the building industry know that many roofs are damaged by wind each year, including those of houses, commercial buildings, factories and other buildings. Low cost houses are particularly susceptible. And the excuse is typically that there was a tornado, or even an 'act of God'. Insurance companies normally seem to be quite happy with this explanation and more often than not they pay out if the building was ensured.

But the reality is that there are preciously few tornadoes in South Africa; on average much less than one per year hits a built-up area. And it is entirely possible and economical to build roofs that are strong enough to survive the winds that are typically encountered in this country. There should not be more than one incident per year in the entire country of a roof blown off by wind.

Why is it then that we have an epidemic of damaged roofs year after year? Well, it can be attributed to carelessness, sloppiness and greed. Carelessness can be seen where the people in charge of building projects don't make sure that good materials and proper workmanship are specified. Sloppiness comes in through poor workmanship and the inability or unwillingness of the people in charge to enforce proper standards.

Greed can in the first instance be seen where substandard materials are used for the roof sheets as well as the screws or other items used for fixing the sheets to the structure. A lot of the poor material is imported, but some substandard goods are also produced by local companies without scruples. Such things can be bought at cheaper prices, but it can safely be accepted that if they are not damaged by wind or people walking on them, they will start rusting within only a few years. We also see greed in action where people take all kinds of shortcuts, for example by appointing contractors who can't do the job properly or not getting professional advice.

A problem with a substandard roof is that the original owner may well be quite aware of the fact that it is a time bomb, but when he sells it on the next owner will assume that the roof is of a good quality, only to find out later that there are big, inherent problems.

How can building owners, property developers, government departments, architects and engineers ensure that the problem with roofs comes to an end? The Institute recommends the following steps. Firstly, for any building bigger than a single dwelling appoint an engineer to take specific responsibility for all aspects of the roof, including the support structure. For houses, make sure great care is taken in specifying the roofing. Secondly, make sure that good quality material is specified and used. Only roof sheets tested in accordance with SANS 10137 should be allowed. Lastly, use roofing contractors that can demonstrate that they can do proper work and check that they do actually adhere to acceptable standards.

If these guidelines are followed, much money and pain will be saved and insurance companies will pay out a lot less, saving everybody on the premiums we pay.

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