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INAUGURATION OF 2011 PRESIDENT
SAICE’s 109th president receives standing ovation

PRESIDENTIAL ADDRESS
Credo of the African engineer for a sustainable future

JOINT STRUCTURAL DIVISION
Chairman’s Report

STRUCTURAL ENGINEERING
Highlights of best ever Steel Awards
King Shaka International Airport: structural engineering and construction features
Warwick Triangle Viaduct
Selection of concrete sand for high quality structures
Status on the revision of SANS 10100-1

BOOK REVIEW
Practical Design of Steel Structures

MARKET CONTRIBUTION
What every specifier should know about hot dip galvanising deemed for use in architectural steel work
Five new bridges to increase access to southeastern Lesotho
Gabion Walls at Hospital Bend
New generation infrastructure

IN BRIEF
Global construction industry cautiously optimistic about 2011
Tekla professional BIM application freely available to everyone in construction
Guaranteeing hot water with hot savings
Retrofit office lighting for reduced energy consumption
Demolished cooling towers resurrected
Concrete Society appoints first full-time CEO

SAICE AND PROFESSIONAL NEWS
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FROM THE CEO’S DESK

ON THE COVER
The Mtwalume District pedestrian bridge, one of a series of bridges in rural areas built by the KwaZulu-Natal Department of Transport for safe crossing when rivers are in flood

STEEL AWARDS 2010

The curved-roofed SA Container Depot warehouse in Cape Town
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IN AFRICA, as in the rest of the world, the collective voice has a greater impact than the most fervent solitary opinion. SAICE offers exactly that vehicle for the civil engineering community. As a representative for the group, SAICE is able to say with authority and influence what the individual civil engineer is unable to say.

How do we empower the individual entity through collective unity, and how do we give the individual a measured and authenticated voice? The answer is easy – provide meaningful representation, worthy products and excellent benefits to our members. The satisfaction of answering this question is diminished by the challenge of meeting these requirements, as interpreted by some 9 000 engineering voices. Mind you, I have also learned that a few individual members singularly have the mighty voice of legions.

But it can be done. We can represent our members to achieve common and appropriate goals. We can make faster decisions through more effective executive, committee, and other administrative meetings. We can incorporate and amalgamate enthusiastic young energy and innovative thinking with the proficient wisdom and experience of our senior campaigners. We can achieve membership participation in worthy SAICE projects and activities. We can achieve South African demographic representation in our membership and in our operations. And if SAICE wishes to retain its rank and relevance in civil society, and indeed elevate itself to the next level of significance, then we must.

It has been a tremendous six months at SAICE – like any other engineering business, there is never a dull moment. I have learned that the perception I once held of SAICE – that entity, that phantom that appeared on my radar once a year that took two grand from my company on my behalf and sent me a magazine every so often – is far from the truth. I wish to change this perception for those who have not yet converted. It is satisfactory to join SAICE as a member, but to truly enjoy the benefit of SAICE’s offerings, and to partake in the legacy of an evolving industry in South Africa, one needs to be a participative member.

In this time, among other activities, we have voiced an opinion about government’s call for 30 000 engineers; contributed to the Identification of Work with the Council for the Built Environment; and very successfully inaugurated our 109th President, who carries a message of anti-corruption and pride in the engineering profession, and who also introduced the Credo of the African Engineer – indeed messages for such a time as this. We will furthermore be launching our Infrastructure Report Card for 2011 during the first half of this year.

In the interest of a professional image for SAICE, we are also undergoing operational changes at this stage. We are, for example, in the process of:

- creating systems to lend extensive administrative, financial and institutional support to our members through our branches and divisions
- developing a quality management system for SAICE
- revamping our website into an aesthetically appealing, and highly functional and interactive facility
- providing a first-class book shop with online interfacing
- adopting a more corporate image at our offices.

Amidst these activities and changes, what does not alter is that SAICE exists for its members. As SAICE is a learned society, albeit a voluntary one, I would like to focus on those activities that give learned societies definition and character. It is our intention to encourage public debate and discussion on hot issues relating to civil engineering. We need to get people talking and engaged; as much as we target all tiers of the built environment sector, we should start with our members first, taking into account that the dynamics and makeup of our membership have been transforming over the years.

We have an eventful year ahead, and I am certainly immersed in and enjoying being a change agent in SAICE. In summary then, SAICE needs to become a decentralised powerhouse, invoking the collective power of our individual members, for the benefit of our members, for the enhancement of the built environment profession, and then finally for the greater good of the broader recipients of socio-economic development. I am looking for that vibrant engineering spirit, that individual who initially thought that SAICE belonged to others, that proudly South African engineer who wants to leave a mark, who up until now only stood on the periphery looking in on the action. I am extending an invitation to that individual to help me sail this ship through the winds of change.

*India Arie (R&B Soul Singer, Voyage to India, 2002)
On 8 February a visibly happy but modest Seetella Makhetha was inaugurated as SAICE’s president for 2011, amidst warm support from SAICE members, family and friends, and staff who flew in from Port Elizabeth for the occasion. He delivered an impassioned address which moved many to tears and prompted a standing ovation. We know that Seetella is looking forward to meeting with SAICE members on his visits during the course of this year, and we wish him all the best!

1. Seetella receiving the chain of office from outgoing president Ali Naidu
2. Seetella being congratulated, with past president Bob Pullen looking on
3. Past president Neil Macleod proposing a toast to South Africa, with SAICE CEO Manglin Pillay sharing the stage
4. Past presidents taking wine with the new president
5. Guests enjoying the festive atmosphere
6. Seetella with family and special friends – daughter Motheba left, Kushal Pal Singh who specially flew from India to attend the inauguration with his wife Deepa (far right), Seetella, wife Martha, son-in-law Fanile and daughter Matseliso
7. Meeting old friends and acquaintances again were from left: Max Stemele, Kathleen Hay, Viola Goba, Trueman Goba (past president) and Chris Roth
8. Seetella with members of his staff, from left: Mark Hallowes, Sthandwile Mkhize, Seetella, Brendan O’Connell, Stembiso Mduli, Umec Matshingana and Adriaan van Tonder
receives standing ovation
Credo of the African engineer
for a sustainable future

Credo of the African Engineer

I am an engineer and in my profession I take deep pride.
To it I owe solemn obligations.
Since the origins of humanity on the continent of Africa,
human progress has been spurred by the engineering genius.
Engineers have made nature’s vast resources of material
and energy usable for humanity’s benefit.
Engineers have vitalised, and turned to practical use,
the principles of science and the means of technology.
Were it not for this heritage of accumulated experience,
my efforts would be feeble.

As an engineer, I pledge to practise integrity and fair dealing,
tolerance and respect, and to uphold devotion to the standards
and the dignity of my profession, conscious always that my skill
carries with it the obligation to serve humanity by making
the most sustainable use of Earth’s precious resources.

As an engineer I shall participate in none but honest enterprises.
When needed, my skill and knowledge shall be given
without reservation, for the public good.
In the performance of duty and in fidelity to my profession,
I shall give the utmost.

INTRODUCTION

It is indeed an honour and privilege to deliver this presidential address and
to accept the duties and obligations of President of SAICE for 2011. It is a duty
to which I do not come unprepared. Past-President Ali Naidu has prepared
and coached me well, and for that I am grateful. The staff of SAICE and especially
our young and new Chief Executive, Manglin Pillay, have badgered me over the
past several months regarding tonight’s event. I am delighted that the preparation
and planning are working so well.

Former South African President, Thabo Mbeki, started his first opening of parliament by reciting his famous “I am an African” speech. This immediately led to a reaction by all parliamentary speakers, including staunch members of the opposition, to proudly embrace their African-ness and to commit to the implication thereof.
In beginning my address with this adaptation of the “Order of the Engineer” creed, which was first recited at a ceremony at Cleveland State University in June 1970, and which is modelled on the Canadian “Ritual of the Calling of the Engineer” initiated there in 1922, I hope to have a similar reaction to former President Mbeki’s recital where all engineers who read, or hear this address, will proudly embrace our...
profession as engineers and undertake to serve the profession with utmost dignity, integrity and impeccable ethics.

I have decided to speak on the “Credo of the African Engineer for a Sustainable Future”. As many of you know, it is not a new issue to our institution. It is a matter that Past-President Sam Amod raised several years ago following a visit he had made overseas.

In 2006 Sam Amod approached Baba Credo Mutwa to draft such a pledge. Sadly, despite Sam’s strenuous efforts, Credo Mutwa’s personal circumstances and fragile health impeded his contribution. I do not have the time to go through the entire history of this process, but I wish to state my conviction that the sincerity and morality that Sam Amod brought to this matter cannot be dismissed. Suffice it to say that it was not until 2010 that the matter again received attention from the Membership Committee.

It may be useful at this juncture to pause and reflect on the matter, so that we appreciate the momentous decision to create a credo for African engineers. A number of issues are involved.

ETHICS
Ethics has been a subject matter within the scope of philosophers and is regarded as important for the few. Ethics, however, is anything but that. It involves everyday life choices by all living on this planet. It enables reflection on what we have done and what we wish to do. It enables us to reflect on whether we have acted for the good of others or in self interest.

Ethics has been defined as the rules or standards governing the conduct of a person or the members of a profession. The dictionary definition of a profession is a vocation or calling, involving some branch of advanced learning or a science. Ethics is the science of morals in human conduct. Politicians have often misled citizens by stating that we live in a world of endless possibilities. They do not consider, however, that these endless possibilities are limited by the earth’s inability to regenerate itself. To ensure ethical and sustainable development, it is our duty as engineers to constantly bring to the attention of politicians that, whilst possibilities are endless, our resources are not limitless.

OATHS
Many an engineer is known to swear on a construction site when things go wrong. These are not the oaths I wish to discuss. The oath I have in mind is a solemn declaration, or undertaking for truth, or a commitment to a future action. As we explore

Oaths of Office undertaken before assuming duties of office
Oaths of Allegiance
Professions of faith by religious bodies
More specific examples include:
The Scouts Promise and Law
The Declaration of Sendai on Social Infrastructure and Civil Engineering Technology by the Japan Engineering Society
The Thunderbird Oath of Honour
The Harvard MBA Oath
The South African School Pledge
UKZN Pledge for first year law students
Three of these pledges call for further discussion, namely, the Declaration of African and Asia, we will discover that oaths, sworn by rulers, teachers or professionals on these continents were steeped in a spiritual knowledge of their Maker. The Oath of Hippocrates is the oldest professional oath known in western history. It has been updated and adapted to be modern and applicable to our times and to the advances in the sciences.

There are various types of oaths sharing core values which can be listed here:

Africa and Asia, we will discover that oaths, sworn by rulers, teachers or professionals on these continents were steeped in a spiritual knowledge of their Maker. The Oath of Hippocrates is the oldest professional oath known in western history. It has been updated and adapted to be modern and applicable to our times and to the advances in the sciences.

There are various types of oaths sharing core values which can be listed here:
South Africa missed an opportunity to grow a new generation of South Africans, united under a new Constitution, flag, anthem and pledge.

**The UKZN pledge for first year law students**

More positively, the University of KwaZulu-Natal held its first pledge-swear ing ceremony at the Howard College Theatre in February 2010. First year law students were led by Professor Reddi, Dean of the Faculty, in a pledge to, ".... conduct themselves with decorum, respect fellow students and staff, and to act with integrity....." Afterwards the students received copies of the South African Constitution.

A credo shares values with all of these and is defined as a personal statement of belief and conviction.

**EduCATING FOR DEVELOPMENT**

Educating young people to serve humanity includes the objective and value of internationality and seeing things in a global context.

Universities are instrumental in creating the highest knowledge, expertise and innovation. Universities must also ensure that knowledge and expertise promote the welfare, culture and sustainable development of surrounding society. Adhering to ethical principles, however, becomes increasingly difficult when faced with the realities of the working environment. It is in this area that learned societies can make a huge contribution by providing the impetus for morality and sustainability through the introduction of a credo.

At this juncture I would like to take a personal moment to thank the Commonwealth Fund for Technical Cooperation (CFTC) for the scholarship that allowed me to study civil engineering. I thank also the government of Lesotho for organising the scholarship, and that of India and its citizens for their generosity and vision, in helping me qualify as a civil engineer.

The generosity of the citizens of India was demonstrated to my wife, Martha, and me in a personal way by the family of Mr Jai Singh Panwar, who, although he was a man of meagre means working as a clerk in a government department, adopted us as his own children and provided a home for us in a place so far away from our home in South Africa. After becoming friends with his son, Mr Singh and his family treated us as their own, and when, like all students occasionally do, we ran out of money, he provided for us just like he did for his own son who was studying with us.

That family is represented here tonight by that same son, Mr Kushal Pal Singh, and his lovely wife Deepa who have flown all the way from India to be with us on this occasion. Memories of this kindness will stay with us all our lives and our links to India will remain strong. It is a kindness we can only repay by honouring the ethical and moral principles of shared international experience. Both Martha and I are products of this generosity.

It is during those dark days of apartheid when science, medical and technical education was being denied to black South Africans that several countries across the world opened their hearts and universities to black South Africans to study at institutions in their countries, sometimes displacing their own students to accommodate foreign students who were denied opportunities in the country of their birth.

**Sustainable development**

At the World Summit in Rio de Janeiro in 1982, more than 120 countries signed the paradigm of “Sustainable Development”. They agreed to develop in a sustainable way and to strive for the best possible combination of environmental, socio-cultural and economic goals, in their development achievements. The so-called triple bottom line of people (society), planet (environmental) and profit (economic) has to be aimed at and achieved, through the creation of products, services, infrastructure, institutions and organisations, without losing sight of the long-term impact on the environment.

Without these sustainable considerations, northern corporates and governments exploit the mass markets of Africa, India and China. They pay no consideration to the fact that the exploited continents and countries cannot simply adopt the catastrophic lifestyles of industrialised countries. This results in unrecoverable consequences for our natural capital and social environment. Governments appear to be unable to control or restrict this kind of negative “globalisation”.

To develop solid and reputable national and continental engineering capacity, every nation on the continent needs to provide for planned and sustained engineering capability. To this end, in South Africa, ECSA (the Engineering...
Council of South Africa) has already identified four main areas of focus. These are:
- Upgrading of engineering lecturers, facilities and teaching
- Development of a national system of academic standards and accreditation procedures for international recognition
- The establishment and resourcing of a professional association for the engineering profession of technicians, technologists and engineers
- Fostering the development and identification of engineering work

Former SAICE President Trueman Goba identified sustainable development as a goal and challenge for the industry. This has presented opportunities to form partnerships with other voluntary associations and government departments under the vision of the New Partnership for Africa’s Development.

The Africa Engineers Forum (AEF), initiated by SAICE in 1995, is aimed at promoting and facilitating networking and liaison within Africa, through bilateral and multi-lateral cooperation agreements. The AEF has identified 26 key objectives based on eight key principles. These are:
- Exclusivity
- Transformation
- Transparency
- Responsibility
- Community Awareness
- Commitment
- Professionalism
- Networking

In March 2010 the AEF session, held in parallel to the Engineering Planet Future event, witnessed a formidable gathering of African engineers, committing to these key principles. During my term of office, it is my intention that the ideals of the AEF be operationalised to the extent that a developmental state is one which the South African government has accepted. It is the paradigm against which government’s policies should be measured. It is, however, the ethical framework that society uses to govern its relationship with all other life that will balance economic benefit and social and environmental impact.

Sustainable engineering then, is a process of using energy and resources at a rate that does not compromise the natural environment, or the ability of future generations to access these resources to meet their own needs. Hence there is a need to examine the policies that govern the actions of a developmental state.

Amartya Sen, in his work, Development as Freedom, states that “...development can be seen...as a process of expanding real freedoms that people enjoy....” (1999:3) He asserts that “...development requires the removal of major sources of unfreedom: poverty as well as tyranny, poor economic opportunities as well as social deprivation, neglect of public facilities as well as intolerance or over-activity of repressive states....”

In defining the South African concept of a developmental state, Sen’s concept of removing poverty and tyranny is central. Expanding economic opportunities and fighting social deprivation are critical, and providing public facilities and services to the poor is paramount.

Fundamentally, the developmental state must balance the promotion of economic growth with social development. It must also balance investment such as human capital development in the long term with shorter-term investment in economic infrastructure.

INTEGRATED DEVELOPMENT PLANS: LOCAL GOVERNMENT AND DEVELOPMENT

The 1998 White Paper on Local Government from the Department of Provincial Affairs and Constitutional Development, defines developmental local government as being committed to working with citizens and groups within the community to find sustainable ways of meeting their social, economic and material needs, to eventually improve their quality of life.

In reforming local government and consolidating white towns with black townships, the then Department of Provincial and Local Government legislated for Integrated Development Plans (IDPs). Philip Harrison, Professor of Urban and Rural Planning at the University of the Witwatersrand, and member of the National Planning Commission, in his assessment of 2006, concluded that the IDPs have strengths, but also serious flaws as instruments for:
- Cooperative governance
- Participatory government
- Efficient administration
- Creativity and innovation, and
- As civil instruments of developmental local government.

SAICE INFRASTRUCTURE REPORT CARD FOR SOUTH AFRICA

Following the resounding success of the Infrastructure Report Card for South Africa in 2006, SAICE will launch its latest Report Card within the next few months. The Report Card on the state of South Africa’s infrastructure assigns grades to each of the infrastructure sectors such as water, sanitation, roads, railways and harbours, and so on. Infrastructure and its maintenance underpin quality of life and economic development. If infrastructure, new and old, and the operation and maintenance thereof are inadequate, it will impede social and economic growth in South Africa – something our country cannot afford.

Without pre-empting its findings, we are aware of government’s attempts to address the apartheid deficit.
Leaders and managers must lead and manage by example, as must engineers who have in the public eye a distinguished and honourable reputation. Their conduct and attitude must remain beyond reproach and above suspicion of selfishness in their service rendition to the public. Everyone in government, too, must pass this test to champion public service delivery. The public interest must supersede private and personal interest, if government is serious about turning service delivery around for the good of the public.

To this commendable end SAICE has embarked upon an anti-corruption campaign that includes a drama, performed by the Young Members Panel, as well as a training programme that focuses on ethics and anti-corruption. The drama, adapted from the American Society of Civil Engineers’ Ethicana, depicts facets of corruption in the civil engineering industry and provides solutions for its eradication. This drama was performed so successfully that the group was invited to perform in Tanzania in November 2010. Subsequently the team has been invited to Ghana and Zimbabwe, and has also received an invitation from our own National Science and Technology Forum.

While corruption and unethical behaviour in the public service is highlighted because it is in the “public eye”, the private sector is by no means immune to dishonest practices. In fact, often the private sector and individuals conducting business for the public sector are the initiators of corrupt practices, offering bribes to public officials, as well as acceding to officials’ requests for unscrupulous benefits.

It was a well-known and documented practice for European companies working in Africa to “budget” for bribes in project costs. The exemplary stance of the Lesotho Government in the corruption cases of Acres International and Lahmeyer International GmbH in 2003 has had to be lauded as one of Africa’s greatest victories over corporate corruption. This led, in addition to heavy fines, to debarment of these companies by the World Bank from participating in any World Bank funded projects.

AN ETHICAL LEADERSHIP APPROACH TO PUBLIC SERVICE DELIVERY

Is government capable of combating and preventing fraud and corruption? The effect of fraud and corruption is that it eats away at the tax collected from the public, in the process eating away at the moral fabric of society. In turn, corrupt practices result in non-delivery of essential public services, so denying communities their right to an improved standard of living.

JS Wessels and PC Pauw stated in 1999, in Reflective public administration: Views from the south, that public officials without personal morality and the necessary sense of public duty will either themselves be prone to abusing their positions or will fall prey to being abused by corrupt elements. Either way, the corruptor and the corrupted must be viewed in an equally serious light and brought to book.

THE CREDO OF THE AFRICAN ENGINEER

It was Mahatma Gandhi who said: “The things that will destroy us are: politics without principle, pleasure without conscience, wealth without work, knowledge without character, business without morality, science without inventing and worship without sacrifice.”

This is apt for South Africa and the world right now.

So with these words ringing in our ears, I present you with the proposed “Credo of the African Engineer” [upon which Seetella again recited the Credo. Ed]. SAICE has had a long journey in reaching this point and we do not claim to have arrived yet, as the input of our fellow engineers in other disciplines still needs to be sought before we finalise the Credo. We also strive towards the adoption of the Credo by engineers in other African countries.

VOTE OF THANKS

I thank my predecessors for their guidance, wisdom and selflessness. I wish to convey special gratitude to Past-President Allyson Lawless, who in 2000 first expressed confidence in me as future President of SAICE and made me promise to take up the presidency. She reminded me of my promise consistently every year for ten years. I also thank the SAICE Council for the support and confidence they have shown in me to lead the institution, as well as the staff and the new CEO for their magnificent effort to make this inauguration a splendid occasion.

I am grateful to the shareholders of Makhetha Development Consultants, who have graciously agreed to release and support me during this year.

On a very personal note, and most importantly, I would not be standing before you were it not for the love, support and sacrifice of my precious family. I am deeply indebted to Martha, my wife, who has generously agreed that I accept this mantle – she has supported me throughout my various roles in SAICE. My gratitude also goes out to my daughters, who have understood my “addiction” to SAICE and have supported me. Finally, I honour my mother for her sacrifice for my development – my mother who “went to church in her twisted pair of shoes” to ensure that her children got the best education they could. To my entire family, I thank you for your support.

I thank you all.
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This advertisement is in support of Seetella Makhetha who was inaugurated at the 109th President of SAICE on the 8th of February 2011.

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Chairman’s Report

INSTITUTIONAL MATTERS
I have been privileged to attend a number of Executive Board meetings of SAICE, as well as the two Council meetings, during the course of 2010, and I have found these meetings of value and of assistance in making some of the concerns and needs of the JSD known to the wider body of the organisation.

I have also attended three Council meetings of the London-based IstructE (Institution of Structural Engineers, UK). One of the main topics of the year 2010 was the introduction of compulsory reporting of CPD (Continuing Professional Development) activities to the Institution.

I was able to make a positive contribution on the subject based on the South African experience over the last five years, and this was well received. Specifically the issue of professionals lecturing to their peers was not covered in the original ECSA proposals, which focused primarily on full or half-day courses.

Five years ago I took this matter up with ECSA and SAICE and it was agreed that professionals lecturing to their peers would not warrant a R5 000 fee in order to obtain recognition for the CPD points. This means that we can award CPD points for our Tuesday night lecture series which otherwise had not been provided for in the original CPD concept.

Another area that had not been considered in the original formulation was awarding CPD points for individuals attending computer training courses. For example, ECSA was originally unwilling to recognise attendance of a five-day course on solids-modelling as a CPD activity. This was primarily due to ECSA being afraid that software suppliers would try and validate mere demos of their software with CPD points, but this is clearly unlikely as a demo would not last five days. Fortunately this position was reversed on my persuasion, and it is now possible to obtain CPD points for training on top-end computer software packages.

Compulsory CPD reporting for IStructE will come into operation in the near future, but where professionals such as ourselves are already reporting CPD to other organisations, such reporting will be recognised in terms of IStructE requirements.

The IStructE has always used its Part 3 examination as the doorway to Corporate Membership of the Institution. Consideration is presently being given to the possibility of having a top-up exam for those countries where structural engineers already write a professional exam to be recognised as structural engineers. This is the present situation in China, for example.

In his chairman’s report last year, Spencer Erling mentioned that Martin Powell had been appointed as new CEO of IstructE. I can now report that SAICE also has a new CEO, Manglin Pillay, who has been at the helm since the beginning of October 2010. The previous CEO (then known as the Executive Director), Dawie Botha, retired at the end of March 2010 and an acting CEO, Phiroshe Kamay, took over for six months. I have enjoyed building relationships with all these newly appointed individuals.

TUESDAY AFTERNOON TALKS
Our popular Tuesday afternoon talks on the third Tuesday of each month have continued to be well attended, but I would encourage more of you to be prepared to make a contribution.

Such contribution need not be a highly academic treatise or erudite technical exposition, but if you have worked on an interesting project and overcome challenging design requirements, we would be delighted to hear of your experiences and would no doubt be enriched by your contribution.

My thanks go to John Duncan, Victor Booth and Steve Mackey for their ongoing services in making these meetings happen. Although we do not make vast profits from these activities, we are able to cover the costs of rental and refreshments.

I am also pleased to report that during 2010 the JSD was able to start an
CODE OF PRACTICE

The new Code of Practice is due to go out for public comment and might probably have done so by the time this report appears in print. My thanks to Rob Young for his ongoing efforts to shepherd this document through ECSA, even under trying conditions.

We will have to wait and see whether the Code of Practice will address all or merely some of the JSD’s concerns in the area of structural safety and the competence of those attempting to practise in the area of structural engineering.

In this regard, the dark side of 2010 revealed that the engineer responsible for a serious structural failure in 2008 was struck off the registration role at ECSA. This is only the second time that this has happened in the history of ECSA. The previous time also involved a structural engineer.

The greatest concern that the JSD has, is that of inadequately qualified people dabbling in the area of structural engineering and causing loss of life. I am hopeful that with SAICE and ECSA support going forward, this issue will find a positive solution.

A QUESTION AND ANSWER DATABASE

Recent communication dealt with the concept of a question and answer database which could be housed on the website and to which members could turn for answers to commonly asked questions around the subject of structural engineering. Whilst experienced engineers may not need such a service I believe that the question and answer method might provide a very valuable tool through which up and coming young engineers could broaden their experience with very little cost or effort. It will take time and effort, though, to create, develop and expand such a question and answer database. This is a project that my committee will be looking to implement during 2011. We will be asking senior engineers to share little gems of experience in this format for the website equivalent series of lectures in Pretoria on the first Tuesday of the month, once again ably led by John Duncan, with active assistance from Marelize Visser.

It has been a concern of mine for several years that engineers in Pretoria would find it extremely difficult to travel to the lecture at the War Museum in Johannesburg during the late afternoon. Given the road system and traffic patterns, moving the lecture to a midpoint between Johannesburg and Pretoria would not have improved the situation.

The better solution is to move a lecturer to Pretoria rather than trying to move a large number of people over a greater distance. I am therefore delighted that it has been possible to start these lectures and my hope is that engineers from the Pretoria area would come forward and present their material at the Johannesburg meeting as well.

The JSD, in association with other organisations, provides many different kinds of training to structural engineers in terms of materials, and codes of practice and other general professional practice issues. I believe that the members of the division are presently adequately served in that regard, although I will mention another initiative later.

THE WEBSITE AND OTHER COMMUNICATIONS

My thanks to the vice-chairman, Tony Smith of Durban, for the updating of the JSD website, and also for the distribution of irregular communications with the JSD membership.

Instead of being bound by the time pressures of a regular newsletter, I felt that it would be better to communicate on an irregular basis whenever information of interest to structural engineers becomes available. It is hoped that these communications will occur at least once a month if not more frequently.

After having done a lot of work in updating the e-mail lists, Tony Smith, assisted by others, had a good rate of success in sending out e-mails to members – the response from the membership was one of overwhelming support for the concept.

Now that the idea and the process have been established I hope that the JSD will be able to have more frequent communications with its members.

YOUNG PEOPLE

Frederica Herbert from Durban is getting the young structural engineers group off the ground and I thank her for her efforts in this regard. The encouragement and development of younger engineers is the responsibility of all of us if we are going to maintain a structural engineering capability in South Africa.

One of my greatest fears is that the current pressure on structural engineers as a result of fee-cutting, pressure of work and the unjustifiable expectations of clients, etc, could effectively reduce the structural engineering capability of this country to a point where developers will have to start to import these skills.

Mention should also be made of the sterling work done by Allyson Lawless, a previous vice-president of IStructE and corresponding member of the JSD, in terms of the efforts being made to assist young engineers towards various categories of registration at ECSA and their general professional development.
Whilst experienced engineers may not need such a service I believe that the question and answer method might provide a very valuable tool through which up and coming young engineers could broaden their experience with very little cost or effort.

As a simple example of such a question and answer service, the following would be appropriate:

Q. Why should the weld between the web and flange of a plate girder be a continuous full penetration weld?
A. Because the ordinary fillet weld or space fillet weld leaves this critical joint exposed to fatigue cracking which would split the flange from the web and drop the crane on the floor.

If one were to imagine a young engineer reading the above on a website and encountering such a situation later in his career, he would be likely to remember that there was an issue about the welding of plate girders for cranes even if he did not remember the specifics. By being able to research and recover the information he would avoid serious and costly errors.

It will take time and effort, though, to create, develop and expand such a question and answer database. This is a project that my committee will be looking to implement during 2011. We will be asking senior engineers to share little gems of experience in this format for the website.

THE BANQUET
A pleasant evening with colleagues and friends was held on 15 October 2010 at the Johannesburg Country Club. My thanks to our sponsors Arup, the Southern African Institute of Steel Construction, and TWP for their generous donations towards the financial success of the evening, and again to Steve and Pat Mackie for their behind-the-scenes labours in making the banquet happen. Thanks also to Bruce Raath for acting as Master of Ceremonies in his inimitable style.

IN CLOSING
I would like to thank all the members of the committee for their support during 2010, and especially on occasions where difficult waters had to be navigated.

It would be difficult to thank all the members individually for their contributions during the year, but I would particularly like to thank Spencer Erling for having taken on the role of treasurer and keeping us on the financial straight and narrow.

I look forward to working with the committee during 2011 to consolidate the gains that have been made during 2010 and to implement the vision that we hold for 2011.

Our vision for 2011 can be summed up simply as a desire to promote the health of structural engineering in South Africa.

As part of two learned societies we see our role not as looking after the financial and business interests of our members, because that would amount to being a trade union, but of supporting the development of our members.

We see our role as that of finding ways in which we can promote best practice, connecting people via communication and networking, and providing ways in which the technical competence of each member can be raised.

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Highlights of best ever Steel Awards

AT THE RISK OF THESE articles starting to sound like a cracked record, the Southern African Institute of Steel Construction’s 2010 Steel Awards, with Grinaker-LTA as main sponsor, once again resulted in a year of records. There were 73 entries which were whittled down to 69. The gala evening comprised three live events in Johannesburg, Durban and Cape Town, which were attended by a total of just over 1 200 persons – a real ‘Who-is-Who’ of the structural steel and built environment industries.

There is absolutely no doubt that one of the main reasons for holding these functions is to create an exceptional ambience for networking opportunities. The Steel Awards continues to score ten out of ten in this regard.

So how did we fare in celebrating success and recognising the cream of our peers’ efforts?

The judging team consisted of representatives from the steel-making industry, the steel-converting industry (tube makers and the like), structural engineers representing the JSD, CEA and CESA, and to bring an artistic assessment, a representative of the architectural industry.

What amazed our judges was the influence that the FIFA 2010 World Cup and its requirements had on the Steel Awards entries this year. Many of the projects entered were brought to completion and into use many years earlier than would have been the case had we not had the World Cup. Examples are the new Durban and Cape Town airport upgrades. I am sure many of our readers have used one or both of these airports already and would probably agree when I say, “Wow! What a difference!”

Could another football stadium take the overall award again, as in 2009? Read on to find the answer.

Other projects that were beneficiaries of acceleration in meeting the World Cup deadline included the BRT bus stations in Cape Town, the Nike Training Centre in Soweto, of course all the stadiums and their facilities, associated projects such as foot bridges, Gautrain stations, and so forth, all of which would not have happened as rapidly as they did, if at all. Even the Freedom Park museum was largely completed in time for international visitors to enjoy. So the Steel Institute owes
FIFA a big thank you for influencing the quality of entries received this year. It is not surprising therefore that, together with the increased number of entries, we had more categories than ever before to accommodate the extremely high quality of entries received. Space does not allow us to review all the category winners in detail, so this article will rather concentrate on those structures that stood out as representing exceptional use of structural steel, but for unusual reasons.

ARCHITECTURAL CATEGORY
The first category winners announced were for structures of an architectural nature. The category featured a wide range of structures from the Supreme Court extension in Cape Town to shopping mall extensions, some pretty fancy houses, and a university registration building.

But it was the super-fast fast-track project, the Nike Training Centre in Soweto, that received a commendation. If any project displayed just how fast a project can be built, especially using steel framing, this was an exemplary example that showed just how strong and quickly our contractors and professionals can produce. The ‘A-team’ of all the parties involved were on display and did they just relish in the pressure! The great quality and fantastic art works added to the end result. So much so that our judges ‘bent the rules’, because most of this project was built from January to May 2010, while our ‘rules’ call for the steelwork to have been largely completed in 2009. The judges’ logic was that, had we made the entry go forward to 2011, the impact of the speed on this project would have been lost.

The category winner for architectural projects was the structure for the Freedom Park Museum. It was one of those ‘no-brainer’ category winners. Designed to resemble a highveld rocky outcrop, the copper-clad ‘rocky’ parts of the structure have, true to nature, very irregular shapes. The fact that the architect and engineer were able to
conceive these enormously complicated structures, and that the contractor was able to execute them, speaks volumes about this professional and contracting team. If we had a category for complicated structures this would have won hands down by a mile.

**BRIDGE CATEGORY**

It is not often that steel awards has a bridge category. It is common knowledge that most bridges are built from concrete, apparently because ‘direct’ costs are cheaper than their equivalent steel bridges. So we were happy to have received quite a few foot bridge entries, where steel framing seems to dominate. The category winning 7th Avenue Bridge over the N1 motorway in Weltevreden Park, Roodepoort, was just one of several great architectural statement foot bridge entries that lend themselves to steelwork. The amazing mix of steel and concrete in the 7th Avenue Bridge demonstrates why the two materials complement each other so well, resulting in a gateway feature to Johannesburg that we can all be proud of.

**MINING AND INDUSTRIAL CATEGORY**

One of the less visible, but most important categories for the structural steel industry is the mining and industrial category. This work is the ‘bread and butter’ of the steel construction industry. Often it is in far-off places (this year some in Zimbabwe, the DRC, etc) where these projects epitomise the joint efforts of all sectors in the built environment, pulled together by amazing planning and project management to really show off what ‘South African Engineering Inc’ can and does do on a regular basis.

After several years of mining-type projects it was the curved-roofed SA Container Depot warehouse in Cape Town that stood out. This project exemplifies the synergies between steel and concrete, resulting in a functional and aesthetic structure that is a testament to the skills of the team involved.

**WINNER IN THE MINING AND INDUSTRIAL CATEGORY:** the curved-roofed SA Container Depot warehouse in Cape Town

**COMMENDATION IN THE MINING AND INDUSTRIAL CATEGORY:** the 16 km Zibulo Overland Conveyor at the Zibulo Colliery near Ogies

**WINNER IN THE LIGHT STEEL FRAME BUILDING CATEGORY:** the extension to the Zambezi Shopping Mall in Pretoria North; at the time this was the biggest lightweight steel roof in South Africa
Reflections of a champion


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Town that stole the honours. Great architectural work to understand the client’s requirements, with low roofs in the unloading and loading bays, high roofs in the storage areas, and as column-free as possible – truly sound engineering resulting in an exceptionally cost-effective structure, and all of this under a ‘design and build contract’, which shows that this industry is alive and well and performing strongly, delivering good quality work, and very quickly to boot.

A commendation award was made to a 16 kilometre curved conveyor system at Zibulo Colliery – the Zibulo Overland Conveyor, which is the longest single-flight overland conveyor in Africa and the second longest in the southern hemisphere, and which traverses sensitive environmental areas.

**LIGHT STEEL FRAME BUILDING CATEGORY**

The light steel frame award was made to the Zambezi Shopping Mall extension, which is a new kind of application for the product, showing off just how versatile steel can be. The sheer size of the roof – three separate roofs covering an area of 7 700 m² including overhanges – ensured that at the time this was the biggest lightweight steel roof in South Africa.

**TUBULAR STRUCTURE CATEGORY**

Gosh, we are well into the categories and so far a football stadium has not had a leg in? Well, the Mbombela Stadium took the tubular category award. Boy, does that stadium deserve its award! You steel-work experts out there, think about a node connection with eleven, yes eleven, pipes framing into the node, and think about enormous toblerone-shaped cantilevered trusses, etc, etc, and all of this erected from outside the stadium. What a ‘Proudly South African’ achievement!

**Winner in the Tubular Structures Category:**

the Mbombela Stadium in Nelspruit

**Commendation in the Community Upliftment Category:**

the series of foot bridges built in rural areas of KwaZulu-Natal by the KZN Department of Transport for safe crossing when rivers are in flood; this photo shows the Mtwalumi District pedestrian bridge

**Winner in the Community Upliftment Category:**

the Meetse-a-Bophelo Primary School in Mamelodi
COMMUNITY DEVELOPMENT CATEGORY

This year’s Steel Awards gave us the opportunity to recognise community upliftment projects, something that I guess the whole of civil engineering is really striving to do. The commendation award was for a project that community service providers at province and municipal level should take note of and should benchmark their service projects against. They should always ask themselves whether a particular project really uplifts the lives of the community in question. There is absolutely no doubt that the series of foot bridges in rural places, built by the KZN Department of Transport to enable locals to cross flooding rivers, really do make the lives of the community better. Good engineering, repetitive in their nature and readily erectable over rivers in remote places, explains our judges’ thinking.

The category winner was for a school in Mamelodi, the Meetse-a-Bophelo Primary School, donated by Arcelor Mittal, which potentially has the technology to change the way we will build schools in the future. Steel-framed, metal sandwich panel-clad, quality-assured, speed-assured, fit for purpose, and comfortable – this approach ensures that schools like these could be a definite ‘win-win’ for education and industry in future.

Other upliftment of community projects were (a) local football stadiums which, although they were just
training grounds” for FIFA, remain standing as projects that the community can be proud of and will enjoy for years to come, and (b) new Metrorail station structures at Rhodesfield to connect to Gautrain and Orlando for access to the soccer stadium.

INFRASTRUCTURE CATEGORY
The last of the category awards were made for infrastructure type projects. It was proving to be a tough call to separate the new King Shake International Airport in Durban and the upgrade at the Cape Town International Airport, and so once again breaking with Steel Awards tradition they were jointly awarded the category prize. Both projects are excellent examples in the use of steel, each with its own pressures, each with its own deadlines (and in Cape Town’s case, multiple deadlines) – magnificent projects expressing their steel structures for all to see and enjoy.

OVERALL WINNER
So, now that you are nearing the end of this article, which ‘bigggg’ project have we missed? You guessed it, the overall winner, second year running, a football stadium – the Cape Town Stadium steelwork was the overall winner of the 2010 Steel Awards. This is a magnificent structure, the result of great international cooperation, both at professional consulting levels and contractor levels. Just imagine it – a floating glass roof that the ‘Cape Doctor’ causes to rise and fall by as much as a metre. Indeed, elliptical developments aplenty. Just getting the layout geometry and the detailing right was a mission on its own. A truly deserving overall winner!

IN CONCLUSION
And finally, just a parting thought – had you been one of our judging team and the Cape Town Stadium, the Moses Mabhida Stadium in Durban and the Soccer City Stadium in Johannesburg were all entered in the same year, which would have been your choice for overall winner? Our judges would not commit themselves.

Joint winner in the Infrastructure Category: the King Shaka International Airport in Durban
Joint winner in the Infrastructure Category: the Cape Town International Airport
Overall winner of the Steel Awards 2010: the Cape Town Stadium
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OVERVIEW

The King Shaka International Airport and the Dube Trade Port, located some 35 km north of the Durban City Centre, is a strategic and critical infrastructure development which will serve as a catalyst for economic growth in the KwaZulu-Natal region and South Africa.

Following an invited bid process to design and construct the airport, the Ilembe Consortium bid was accepted in November 2006 with construction commencing in September 2007.

The 2 000 ha site, with a runway length of 3 700 m (sufficient for the latest wide-bodied aircraft), and with runway and taxi areas of 400 000 sq m, can initially handle 7,5 million passengers with an extension provision to 45 million passengers per annum.

Besides the terminal of 100 000 sq m, other buildings include a 15 500 sq m cargo handling building for 150 000 tonnes of cargo per annum, a 60 m high control tower, a multi-storey parkade, and airport ancillary buildings. Access to the complex is principally by means of a new three-level interchange from the nearby N2.

The whole project, with a total value of around R8,4 billion, was completed in 32 months, being an outstanding achievement and setting a new benchmark for the South African construction industry. The project was awarded a Commendation in the Technical Excellence Category of the 2010 SAICE Awards, and was the joint winner in the Infrastructure Category of the SAISC 2010 Steel Awards.

Four structures, being unique features of the airport complex, are described here.

TERMINAL AND AIRSIDE CORRIDOR

The most significant building on site is the passenger terminal and associated airside corridor complex. The 100 000 sq m building comprises a basement, arrivals level, baggage handling, departures level, lounges and offices, and plant room block within the envelope. The airside corridor of some 560 m length, facing the apron, taxiways and runway feeds 14 fixed bridge links to the aircraft.

Foundations

The original geotechnical surveys, together with further boreholes and dynamic probes, indicated that the building was located over a filled valley arising from earlier earthworks. The engineered fill was satisfactory for surface beds, pavements and light buildings, but was not suitable to support large foundation loads. Soft to hard rock was anticipated at depths varying from 5 to 15 m below existing ground level. For the terminal, “Franki” proprietary 610 mm diameter pre-drilled cast in situ piles of 225 tonnes capacity were based above bedrock, in a cohesive fill or residual material comprising predominantly sandy clays.

For the airside corridor, a similar but lighter solution using 90 tonne 410 mm diameter piles were used. Reinforced concrete pile caps, comprising pile groups up to 15 piles, support all structural column loads.

Basement

The 8 m deep basement was determined by plant clearance requirements and a service transfer zone located directly below the arrivals level slab.

The concrete surface beds were designed to accommodate loads on an imported subbase layer over the fill, being independent of the building shell. Specific air-conditioning plant machinery foundations were isolated. Although there is no water table as such, perched water could develop over impervious fill or rock. A basic subsoil drain system was therefore installed at surface bed level, discharging into a pumped tank system.
In certain storage rooms where condensation or minor weeping on the internal concrete face due to temperature differential could be a concern, an independent brick skin separated by an air gap was built internally, with associated drainage into the subsoil drain system.

Suspended slabs
The arrivals and departures suspended floors of over 60,000 sq m comprised the largest portion of the structure. Value engineering the optimum spans with available building systems, in conjunction with architectural building module requirements, indicated a 725 mm overall reinforced cast in situ concrete slab beam and coffer system supported on a 15 m by 15 m grid. This system utilised the proprietary and readily available quick strip coffer system on a 900 mm module, with 525 mm deep coffers and 200 mm slab over. The slab depth was sized to accommodate heavy plant and cranage wheel loads during construction.

This section of the structure remained on the critical path for a considerable period of the construction programme, leading to concrete pours of up to 1,100 cu m being achieved from the site batching plant.

In certain areas the public assembly loading was enhanced to provide support for a mezzanine office framework comprising a structural steel frame, 32 mm plyboard floors and drywall partitions. On the airside portion of the first level departures slab, the baggage handling system was hung from under the slab.

The levels of suspended slabs providing the arrivals and departures corridor links to the terminal, together with associated ramps, were constructed with a conventional reinforced concrete-framed structure. These structures comprise in situ reinforced concrete flat slabs, 250 mm thick at typically 7.5 metre support centres. This system was chosen to eliminate all downstand beams, in so doing facilitating rapid construction.

Roof structure
The architects’ brief to express the primary elements of the roof support was developed into a system of ranking structural steel tubular struts springing from structural grid points, supporting deep tubular “toblerone” triangular girders as the primary featured system. Above this level, a conventional structural steel lattice truss and purlin system provided the secondary roof cladding, service and ceiling support. The structural system is in essence a series of primary one-way continuous girders spanning up to 60 metres. The girders are spaced at 35 m centres, with a secondary orthogonal system supporting the purlins and roof fabric.

Due to the strategic nature of the roof structure, it was considered good practice to build a level of redundancy into the structural system using continuity over support points.

The office block is located at approximately one third of the building length, which laterally braces the roof, with the
main girders being tied into the upper plant room level as continuous elements. All in-service longitudinal movement was then controlled by sliding teflon pad bearings at the peripheral support points.

Fabrication of the girders into large elements that were erected from the slab levels, facilitated a rapid and cost-effective erection process.

An elevated roof light monitor structural portal frame beam structure was located above the roof line centrally between the main girder axis grids of the building.

The glass façades are typically supported by an independent structural steel mullion system, at 6 m centres, to tie in with the roof module. Due to their overall length at the air and landside, careful consideration of the building movement was required. The landside departures façade is the entrance feature into the departures hall utilising glass and steel integrated with the main roof girders.

All fabricated structural steelwork, other than purlins, was Grade 300 W hot-rolled, including the tubes (large diameter tubes imported from the United Kingdom). The purlins were fabricated from cold-rolled sections and galvanised.

Quality control of the welded site-assembled connections was strictly enforced, using X-rays and ultra-sound testing non-destructive techniques. All steelwork was sand-blasted, primed with organic zinc primer, a barrier intermediate coat and finished with polyurethane enamel.

A careful evaluation of the suitable roof materials available, considering the long run-off length, low roof pitch and long-term durability, led to the selection of colour-coated aluminium sheet, roll-formed on site, clip-fixed without penetration to the purlins. The sheet is laid over an acoustic layer comprising two layers of gypsum board and mineral wool to attenuate sound penetration.

CARGO HANDLING BUILDING
This 15 500 sq m facility provides the transfer point of the Dube Trade Port with storage direct to the apron of 150 000 tons per year at this stage.

Foundation
Evaluation of the original geotechnical surveys, together with recent dynamic probes, indicated that the building was located within a zone of deep fill material, placed during the original site development. The boreholes indicated consolidated granular but varying fill material, to a depth of up to 40 metres over natural ground.

It was not economically feasible to pile to that depth, considering the relatively light magnitude of loading. An engineered fill layer of G5 material of 1 m thick provided a stable founding system with acceptable small differential settlement. This had particular relevance to the structural surface bed supporting the cargo handling systems.
For founding of the heavier office block section and relatively light loading of the building structural frame, the predominant loading being due to wind stability, pad footings founded into the engineered fill material with a bearing pressure of 100 kpa were utilised. Small order differential settlements along the length of the building, due to the varying nature of the existing soils, were within the limit of normal building tolerances.

The degree of consolidation evident from in situ testing undertaken, indicated that the founding material was suitable for the support of the cargo storage rack loads, being transferred through unreinforced concrete pavements.

Surface beds
Significant specified loading conditions are applied to this area, due to the storage racking and fork lift wheel load applications. The independent “floating” slab system comprised unreinforced concrete in situ slabs, with jointed panels, cast over the 1 m thick imported G5 material on a 150 mm G4 layer compacted to 98% mod AASHTO density subgrade layer. Three cases of loading were applicable:

1. ETV rail area
The movement of the storage modules within the rails was by means of an electronically controlled rail-supported transfer vehicle with a 680 KN dynamic load on each wheel at 8,64 mm centres using two wheels on mono rail.
ULD racking post loads of 230 KN per post at 3,4 m by 3 m centres were designed for. Vertical deformation under load became the major design consideration, due to local slope deformation being limited to 0,5 mm per 1 000 mm or 1 in 2 000.

Global settlement of the building was anticipated to be in the order of 120 mm, but uniform, and was ignored. However, due to the surcharge loading of the ETV area, a differential settlement of 23 mm was estimated along the 180 m length of the rail.

The design of the founding for the ETV rail was typical stiffened cellular raft configuration with a bending deformation in the order of 12 mm, resulting in a total deformation under load in the amount of 35 mm (i.e. 23 + 12 mm) which is less than the acceptable 54 mm over the 108 m length.

2. Static high bay racking area
The post load of 100 KN per post at 3,7 m by 1,05 centres was designed for. The forklift tyre load assumed a forklift load of 38,7 KN per wheel. Slab thickness utilised varied from 420 mm of 30 MPa concrete.

3. General floor storage area
The forklift tyre load assumed a forklift load of 38,7 KN per wheel. Slab thickness utilised was 235 mm, of 30 MPa concrete.

Building structure
The framework to support the enclosure of this large building comprises in effect two systems – a reinforced concrete beam and coffer slab system for the landside office section, and a structural steel framed lattice truss and girder system over the cargo handling area. The structural module of 6 m and the large clear span layout of 34 m were driven by the cargo handling operation.

The use of deep structural steel lattice trusses and girders gave the opportunity to provide large clear spans over the racking section, with major internal columns at 24 m spacing.

All steelwork was sand-blasted, primed with organic zinc blast, a barrier intermediate coat and finished with polyurethane enamel.

In keeping with the long-term life span and low maintenance of all buildings, colour-coated aluminium sheet was selected, roll-formed on site to a continuous length for each span, and clip-fixed to the purlins.

CONTROL TOWER

The highest point on the new airport site is the control tower cab – now a defined iconic landmark. The operational requirements dictated a three-floor module, comprising 360˚ clear uninterrupted sight lines at the top controller level of 20 m diameter, at an eye level of 55 m, with service and equipment levels located on the two floors below. It was agreed that aesthetically the tower shaft should be as slender as practical, with the cab expressed as a clean tapering module clad with glass and aluminum panels.

The challenge for the design and construction team was how to position this cab module at that height, within the time constraints of the project programme.

Foundation

The original geotechnical surveys indicated that the tower was located over a deep filled valley, arising from earlier earthworks, with the bedrock level in excess of 20 m.

The solution comprised “Franki” proprietary-type driven 610 mm diameter cast in situ piles, of 225 tonnes, based in the upper dense sand layer, of 8 m, which acted as a soil raft to distribute the load through the clay layer beneath.

A single 15 m x 11,5 m x 1 500 mm deep pile cap supports the main tower shaft on 24 piles, with the adjacent relatively light-weight single storey sheeted roofed structure simply founded into the consolidated fill material on pad foundations.

Structure

Due to the relative height of the tower, the method of construction became the principal consideration. Structural material stiffness was also required to provide stability and limit deflections at the control room level. The dominant loading in this case was wind with a return period of 100 years considered. The characteristic
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wind speed was based on category 2 terrain for a 5 second gust.

A 35 MPa reinforced cast in situ concrete shaft using the slip-forming technique was used with the internal shaft providing stair access, services fixings and lift guides, post-fixed using structural steel.

A detailed dynamic analysis was undertaken modelling the pile foundation, pile cap, shaft and cab lumped mass, to evaluate wind load response and serviceability performance.

To facilitate a cost-effective buildable solution, the structure for the three accommodation levels and roof comprised a structural steel framework fixed to the shaft.

A three-dimensional analysis was undertaken of the conical "doughnut" form in the fully assembled erected stage, thereafter being braced by the tower in the final fixed position.

The complex three-dimension steel structural framework consisted of four radial trusses free of the shaft core, braced circumferentially about the tower at each floor level. The shop details were created using a proprietary modelling package, which contributed immensely to understanding the layout of the system and provided the accuracy required for the erection.

Conventional hot-rolled sections and plate were used, covered with high quality coating systems, and all connection sites were bolted.

The three upper floor slab levels were formed in in situ reinforced concrete due to durability, cast on bondek permanent formwork over the steelwork.

The roof covering comprised an acoustically rated ply-board and fibreglass system with trapdoor access, to accommodate lightning and aerial masts. The external façade cladding was formed from corrosion-resistant prefabricated aluminium and glass curtain wall system.

**Construction**

The shaft being of ribbed profile to control staining of the constant cross-section, was therefore constructed using reinforced concrete placed using the sliding-shutter technique. The shaft was cast within a single 3 m shutter length, continually lifted by jacking off the sections cast below.

Now, how to construct the cab at the top of the shaft – some 50 metres and 18 storeys above the ground!

The solution was to firstly erect the structural steelwork frame about the shaft at ground level, but independent of it, supported on four symmetrically balanced points just clear of the shaft. In this configuration, the external façade cladding was installed, together with a stability portion of the concrete floors, cast on permanent steel-profiled sheeting.

A structural steel-lifting frame was then erected at the top of the shaft, designed such that it became part of the final structure at the control floor level.

Although the erection procedure was simplified by being carried out from ground level using conventional craneage, a high level of survey accuracy was required to relate the ground level framework to the future four matching bolted support beams at the top level. This was achieved thanks to the excellent coordination between the surveyor and the erection crew. The focus of the project then became the actual lifting of the cab to the final level.

The partially constructed cab of some 350 tonnes was then hung from the four support points, using a conventional proprietary post-tensioning jack and strand system. The technique involved jacking some 100 mm, wedging the cable strands to maintain position, retracting the jacks, wedging the cable strands and then repeating the cycle.

This process took in the order of 5 minutes, which gave an achievable rate of 1 m per hour, but was, however, severely influenced by persistent wind gusting up to 90 km/hour. Although the assembly was aligned by polyurethane wheels to run against the shaft face, lifting was shut down for wind speeds in excess of 30 km/hour. The complete lift was undertaken in seven days.

A jacking pressure equalising control module was developed for the project, relying on skilled operation to maintain an out of level differential requirement set at 20 mm across the lifting points. This was considered an achievable limit approved by the façade engineers, to avoid distortion to the already installed glass panels.

Incremental monitoring was undertaken throughout the lift from a...
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continually manned station at the top of the shaft due to the high risk of this operation. After reaching the final level, the cab weight was finally transferred directly to the shaft by bolting to the jack support beams and at the level of the lower floors by means of steel corbel brackets, bolted to the cab structure and then grouted into previously located pockets within the shaft wall.

The structural steel framework was then completed by erecting the central portion of the radial roof truss structure above the shaft using the adjacent tower crane.

From this stage onwards, normal building techniques were used to complete the control tower – although at 60 m into the air, careful coordination was required.

This unique “one-off” project required extensive innovative skills at every level, covering concept, design, detailing, fabrication, erection and implementation.

**ACCESS ROAD N2 INTERCHANGE**

The N2 interchange provides access to and from the airport. A late start to construction in May 2008 resulted in the monumental task of delivering a fully operational interchange within 22 months.

Rapid construction without compromising the quality of the end product, with minimum disruption to traffic along the busy route, were the main objects of the implementation of the design.

The design included four ramps, a 222.5 m incrementally launched bridge deck, an 80 m conventionally reinforced bridge, and a toll plaza. The bridges were constructed by Stefanutti Stocks Civil KZN as a major subcontractor to the Ilembe Civil Construction Joint Venture.

The most significant structure is the upper ramp bridge carrying outbound traffic to the south, comprising seven spans of 40 m maximum, founded on 900 mm concrete auger piles into the sandstone bedrock.

A unique feature of this bridge is the common pilecap in the median of the N2, due to the restricted area of the median. The two bridges share a pilecap which was specially designed to take the axial forces and bending moments from both bridges.

The ramp bridge was designed to be constructed by the incremental launching technique using a 24 m nosing girder launched in 15 stages. Apart from facilitating rapid construction, this method minimised disruption of traffic on the N2 freeway. The safety risks were also reduced by using incremental launching, as the workforce was predominantly away from the road traffic. Incremental launching was also a well-suited construction method, as most of the bridgeworks were confined to a single work area. The fixing of reinforcement, casting of the deck, pre-stressing and launching, were all carried out in a designated area. This allowed for roadworks and construction of the second bridge to continue unhindered and be completed on time.

High early strength concrete, which was designed to achieve concrete cube strength of 35 Mpa in 60 hours, facilitated high-speed construction of the bridge deck while still being economical.
Warwick Triangle Viaduct

BACKGROUND
The Warwick Triangle precinct is the busiest transport hub in Durban. The major access to the CBD from the west passes through the precinct and the precinct is the location for the main rail terminal, as well as bus and taxi ranks. To mitigate against the conflicting traffic movements it was necessary to separate, as far as possible, traffic within the precinct and traffic that was passing through. The best way to achieve this was to build a viaduct that would carry outbound traffic over the existing Eilat Viaducts, Market Road and Warwick Avenue before merging with the Western Freeway.

National government made funds available to the host cities to improve transport-related infrastructure in the lead up to the 2010 FIFA World Cup. A condition of the funding was that the improvements had to be in place before the start of the tournament in June 2010.

To procure the viaduct in the shortest possible time it was necessary to proceed with the project on a design-and-construct basis. Tender documents were made available on 26 November 2008 after four tenderers had been shortlisted following a prequalification process. Distinguishing features of the tender included the following:

- Beneficial occupation of two of the three lanes of the viaduct was required by 28 May 2010. Thereafter a temporary suspension of the work would take place during the World Cup, with final completion mooted for September 2010. Assuming a starting date at the beginning of February, this left the contractor with only 16 months to the first milestone.
- An onerous allowance of 110 days for adverse climatic conditions had to be allowed for. This was far in excess of the normal provision of approximately 40 days for a similar length contract and again highlighted the importance the client had attached to meeting the first milestone date.
- The contractor was responsible for all service relocations and would be paid on a dayworks / proven cost basis for all work involved in moving and rein-stating these services.
- A preliminary layout of a viaduct was included. The tenderers were, however, encouraged to consider alternatives that would still meet the basic requirements.

SITE CONSTRAINTS
The proposed viaduct was required to be three lanes wide and approximately 370 m in length, commencing just west of the Russel Street and Leopold Street intersection before rising steeply over the inbound Eilat Viaduct. The viaduct then had to cross over an office block, the outbound Eilat Viaduct, Market Road, the Victoria Bus Station, Warwick Avenue and a taxi rank before joining with Canongate Road and the Western Freeway.

CONCEPTUAL DESIGN
The primary challenge that had to be addressed at tender stage was to develop a concept that would meet the difficult geometric constraints and that could be built within the extremely short construction
An unusual design concept was developed that had a variable depth superstructure comprising a balanced cantilever-type pier head together with an infill deck of precast concrete U-beams. This novel structural configuration had the following critical advantages:

- The variable depth of the superstructure, which was achieved by having a greater structural depth at the supports and the thinnest possible depth at mid-span, meant that it would be possible to provide the necessary clearance over the Eilat Viaduct and limit the grade from the Russell Street intersection to not more than 10%.
- The construction of the pier heads would in general not interfere greatly with infrastructure below.
- Construction could progress at any of the pier locations in any order, subject only to the limitations of the contractor’s resources.
- Construction of the precast U-beams could be carried out simultaneously with the pier heads.
Following submission of the tenders on 28 January 2009 and a short adjudication period, the contract was awarded to the Group Five Pandev JV on 6 February 2009.

FOUNDATIONS
The construction of the foundations invariably is one of the riskiest activities during construction, as unforeseen obstacles or ground conditions can cause serious delays to the project. The Warwick Triangle project was no different, as a number of challenges arose during the installation of the piles. Chief among these was the massive obstruction encountered 6 m underground at the east abutment. Attempts were made initially to chisel through the obstruction. However, it soon became apparent that the obstruction was just too large, and it was decided to excavate and remove the obstruction. The excavation was promptly carried out and revealed a massive 3 m thick concrete slab. A search through the municipality’s archives revealed that the slab probably formed part of a workshop for the city’s tram station dating back to the early part of the last century. Once the foundation had been demolished, the excavation was backfilled and piling recommenced. Over 4,8 km of precast concrete piles were required for the nine piers and two abutments, with an average pile length of 23 m.

PIERS
The nine piers were spaced uniformly at 39 m centres. Pier heights ranged from 9 m to 19 m. The column section of the pier comprised a hollow box, 2 m wide in the longitudinal axis of the bridge and 6 m wide in the transverse direction, with 300 mm thick walls. The pier head has a variable radius bottom slab with 600 mm wide webs and a hollow box cantilever section to match the profile of the U-beams in mid span. A three-dimensional model was created by the supplier of the formwork and this assisted greatly in visualising the completed pier head. The complex geometry resulting from the vertical and horizontal curvature of the road was dealt with by keeping the bottom slab geometry constant at each pier and manipulating the arc length and slope of the initial radius at the root of the pier head.

The fast-track nature of the project, together with the desire to limit differential shrinkage cracking between subsequent concrete pours, led to a somewhat unconventional process for bridge construction. This involved casting the bottom slab of the pier head together with the lower portion of the webs. Polystyrene void formers, together with hardboard sheets, were then installed to create the internal formwork. This enabled the contractor to create the intricate formwork in only three days, with the net result that the top slab and upper portion of the webs could be cast within a week of the bottom slab. Whilst this was expensive, the decision
contributed significantly to accelerating progress on site and virtually eliminating differential shrinkage cracking. After the concrete had gained a strength of 35 MPa the pier head was prestressed in the longitudinal direction.

Seven of the piers were constructed on conventional falsework. The pier heads for Piers 4 and 5 extended over the existing Eilat Viaduct and a different formwork arrangement was required. This took the form of a substantial structural steel gantry with a maximum depth of 4 m that cantilevered 10 m off the pier. The gantry weighed 65 tons and was constructed from plate girders and heavy-rolled sections. The steel gantry was supported by leaving a hole through the front wall of the pier and thickening the side walls. The concentrated load applied by the gantry required a large quantity of bursting reinforcing to distribute the stresses throughout the pier.

An important feature of the pier head was the connectivity between the precast beams and the pier head. To reduce future maintenance requirements, joints and bearings were eliminated as far as possible. The resulting structural system was a series of portal frames with only three internal joints required in the 372 m long bridge. Two end conditions were therefore required at the ends of the pier head. In most cases a monolithic connection was made between the pier head and the U-beams. This required careful detailing of the heavy reinforcing present to prevent a clash between the reinforcing projecting from the end of the U-beam and that projecting from the diaphragm at the end of the pier head. Allowance also had to be made for the jacks required to stress the post-tensioning tendons.

At the free end of the deck a halving joint was created to accommodate the pot bearings and a single gland and claw type expansion joint. The surface of the halving joint was treated with a silane-siloxane water repellent as a precaution against water leaking through the joint. The halving joint is easily accessible for inspection and maintenance due to the gaps between the U-beams. The lower portions of the piers were constructed from 30 MPa concrete, with the head itself constructed from 40 MPa concrete.

### U-BEAMS

A total of 80 precast concrete U-beams were required for the bridge. The average beam length was 20 m, with minor differences in length required to suit the horizontal curvature of the bridge. A small side cantilever of varying length was used to match the horizontal alignment of the road. Beams were 1.1 m high and were normally reinforced. The beams were constructed in a precast yard adjacent to the site camp while the piers were being constructed. The beams were constructed from 40 MPa concrete, and retarding agents and high-pressure washing were used to create a sandpaper-like surface for all surfaces that were subsequently cast. Beams weighed up to 35 tons and were transported from the precast yard into position on Sundays during road closures. A 275-ton mobile crane, the largest available in Durban, was required to lift the beams into position. The team fine-tuned...
CONSTRUCTION SEQUENCE
One of the primary benefits of the structural scheme that was adopted was the relative flexibility in working areas during the early stages of construction. The piers and abutments could be constructed in any order and simultaneously with the construction of the precast beams. This meant that the challenges encountered during the relocation of services and installation of piles had very little impact on the critical path.

There was far less flexibility during the final stages of construction, because stresses could be locked into the structure once the connecting diaphragms had been cast. This required careful consideration of the construction sequence. A number of detailed analyses were carried out in Strand 7 finite element software to determine which sequences of construction could be accommodated. These sequences were then verified by carrying out independent checks using RM2000 bridge analysis software.

PROGRAMME
The programme of just 16 months to complete a large viaduct over the busiest transport node in Durban was extremely challenging. The condition of the funding meant that the completion date of 18 May 2010 was non-negotiable. Detailed programming and continuous monitoring of progress, together with experience gained on previous fast-track industrial projects, meant that the site team could quickly identify when additional resources would be required. The teamwork from all role-players that characterised the project, together with the skill and dedication of the construction staff, were instrumental in the practical completion of the project one month ahead of schedule at the end of April 2010 – a fantastic achievement.

SUMMARY
The completion of this technically complex project over the busiest transport node in Durban is a noteworthy achievement. The design-and-build approach adopted by the eThekwini Municipality was fundamental to constructing the bridge in a short period. The project was completed safely, with minimal disruption to traffic, ahead of schedule, achieving the highest quality and well within budget. The municipality has realized an asset that is aesthetically pleasing, functional and low-maintenance, and the passage of commuters through this congested area has improved dramatically.

PROJECT TEAM
Client
eThekwini Municipality, Roads Provision Department
Project Manager
SSI
Designer
Goba (Pty) Ltd
Contractor
Group Five / Pandev JV

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Selection of concrete sand for high quality structures

INTRODUCTION
Many structural designers seem to start the design process with a major assumption – that the materials to be used in the eventual construction will behave in a manner prescribed in a code of practice. With a prefabricated material as predictable as steel, this is a reasonable assumption; concrete is, however, a very different proposition, whether it is bought ready-mixed or mixed on site.

Not every reinforced concrete structure requires the same intrinsic properties from its concrete. They are not all constructed in the same geographic area, at the same time of year, with the same ambient conditions or local materials. Specification of concrete, however, frequently remains a simple reference to a compressive strength somewhere on the drawings. Many of the concrete properties essential to the proper performance of the structure are left to the constructor, who will primarily be guided by price as compelled by tender procedures.

Determining, specifying and producing the properties of the concrete that are required by the designer for a particular structure are very complex procedures that require the investigation of many variables, particularly the selection of the aggregates. This article is intended to highlight only one, the selection and specification of sand for concrete, but this material is considered by many concrete technologists to be the most important ingredient in a concrete mix design.

PROPERTIES THAT SAND BRINGS TO CONCRETE
Sand provides many very important properties in the concrete as follows:

1. Perhaps the most important property of concrete is its compressive strength. Most engineers are familiar with the concept of the water/cement ratio, which inversely predicts the strength that will be achieved. The sand grading, or rather the cumulative surface area to be wetted, determines the amount of water required to achieve the desired workability, and this has a direct impact on the amount of cement required.

Sand is able to contribute to workability by getting between the pieces of coarse aggregate and separating them, so that the friction is reduced and the workability of the concrete is increased. The sand will act as small “ball bearings,” and will decrease the friction between the coarse aggregates.

In this way, the sand contributes very significantly to the lubrication of the concrete mix, and the amount of water that would have been required for lubrication. This reduction in water allows the amount of cement to be reduced without altering the water/cement ratio, and hence achieve the specified strength at a lower cost. Another advantage of water reduction in concrete is the consequent reduction in shrinkage and the greatly reduced risk of cracking.

2. A sand that has many different particle sizes (i.e. well graded), will have a dense packing pattern and form an impermeable matrix. Aggressive materials, such as acidic gasses and moisture will be prevented from moving through the matrix to corrode the steel reinforcement.

3. An adequate proportion of very fine particles is necessary to provide a cumulative wetted surface area so that water does not migrate too easily to the surface of the concrete. This migration is known as bleeding and will affect the finishing of concrete surfaces by floating, often resulting in weak surface layers and resultant severe abrasion.

4. The sand and concrete paste will fill the voids between the pieces of coarse aggregate. The proportion of the concrete that is made up of sand/cement paste is largely dependent on the shape and size of the coarse aggregate and the grading of the sand. The lower the proportion of sand/cement paste, the better the qualities of the concrete, such as cost, shrinkage and permeability.

5. A very significant difference between a natural sand mined from a pit or a river, and manufactured sand derived from crushing rock is the shape of the particles. River sand is rounded by rolling down a river bed under the influence of the water flow; manufactured sand tends to be irregular and flaky.
Because of its rounder shape, typical river sand acts more like a ball bearing and gives better lubrication, with a greater reduction in water requirement. It tends, however, to have been washed clean of all fine particle sizes, resulting in a poorer grading, i.e. more particles of a similar size instead of a range of sizes. This results in greater bleeding and much lower permeability.

Because of its more angular shape, manufactured sand gives poorer lubrication and has a greater proportion of dust. Consequently, more water is required when this sand is used and a blend of river and crusher sand frequently gives the best performance in concrete.

The most critical characteristic of sand for use in concrete to gain all of the above benefits is that it should be well graded (i.e. it should have many different particle sizes as opposed to being single-sized), which is usually only achieved by blending two or three different sands.

**WHAT TO BE CAREFUL OF IN SAND SELECTION**

A sample of the sand to be used in any concrete should be taken to a competent laboratory for grading and a test for organic substances. The following indicators should be used when interpreting the suitability of the sand:

1. A particular sand grading should satisfy the specified grading envelope given by the engineer. The grading envelope may be taken from SANS 1083, but this grading envelope only specifies an allowed percentage passing two of the seven sieves used in grading of concrete sand. This sand grading is a minimum requirement and should not be used where high quality concrete is required. Under these circumstances, a more stringent grading should be used for specification and construction.

2. A clay component in concrete sand is undesirable, but is not frequently measured. A maximum proportion of fine material passing the 0.75 μm sieve is all that is specified and the proportion of clay in that fraction is not significant. Allowed maxima usually accepted are 5% for natural sand where clay is more likely to be found, and 10% for crusher sand where the fines are likely to be rock flour.

A high clay component will have an unacceptably high cumulative surface area and the consequent high water demand will require more cement (for a given water/cement ratio), resulting in high cost and high shrinkage for the same strength.

As explained above, if the sand lacks fines, the concrete could bleed excessively, making it difficult to finish floors or pavement surfaces, and will create bleed channels that will destroy impermeability. The concrete may be prone to segregation and will lack the cohesion necessary for proper placement.

3. Too much very fine sand or dust will result in too little bleeding and plastic shrinkage cracking. Rapid evaporation of water from an unprotected surface will set up tensile stresses that can tear concrete at an early age. Another effect of a high proportion of very fine material is stickiness or too much cohesion, making it difficult to place and compact the concrete. Care must be exercised with a high fines content, that a high cement content is not also required, as the combination can make the concrete impossible to place.

4. Organic substances such as sugar, urine and fertilisers can have a major retarding effect on the hydration of cement. Comparative mortar setting times and rate of gain of cube strength tests should be carried out to establish the presence of these materials.

Be very careful of where sand stockpiles are located as contamination can occur during storage and seeds dropping from trees can have a deleterious effect.

5. Is the source of natural sand sufficiently large to provide sand for the entire structure? Mix proportions are largely determined by the properties of the sand, and a change in sand properties will result in a change in concrete properties.

6. Will the characteristics of the sand remain constant for the entire construction period? A change in sand properties may occur after heavy rains when the energy in a river is capable of carrying a larger sand particle, and sharp variations in strength may be the result.

7. A cardinal rule which is too often ignored is that concrete mix proportions that have been very successful on one site, may not necessarily be so on another, where a different source of sand is used.

8. The colour of concrete is strongly influenced by the colour of the sand. If a uniform colour is required for an entire structure then all of the sand must be stockpiled before construction commences to avoid any changes that may occur.

**CONCLUSION**

Sand is a very important component of concrete, but space does not permit a more detailed discussion. The article above is intended to stimulate an awareness of the complexities of concrete, and will be the first in a series of articles on the selection of materials for, and the properties of, concrete.
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Status on the revision of SANS 10100-1

A StanSA working group was formed in 2007 under SC 5120.61A Construction Standards to proceed with a next revision of SANS 10100-1:2000: The structural use of concrete Part 1: Design.

Following a trend set by the working group for the revision of SANS 10160, which was finally published in 2010, the working group for the revision of SANS 10100-1:2000 Part 1 decided to use the Eurocode EN-1992-1 as reference document for the revision.

The group embarked on a systematic evaluation of EN-1992-1 to determine the implications and possible impact on the industry if this code is to be adopted as the revised standard. A number of items were identified which need to be considered for the South African context. These include but are not limited to:

- The readiness of the South African industry for designs using high-strength concrete
- The use of characteristic concrete strength based on cubes rather than cylinders as in the Eurocode
- Reported non-conservative shear resistance values of the Eurocode across certain ranges of shear stress
- The L/d ratios to be used for slab design
- The fact that allowance for fire design is treated in a separate Eurocode
- Advances made in South Africa on performance-based durability design

Design of light-weight concrete elements

Cross-referencing by Eurocode to other European standards and the compatibility of South African specifications.

The working group set a target to submit a Draft Code to StanSa by 30 November 2011.

In a concurrent exercise, a separate working group is also in the process to revise SANS 10100-2: Materials and execution of work.

INFO

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BOOK REVIEW

Practical Design of Steel Structures

Author: Karuna Moy Ghosh
Publisher: Whittles Publishing/CRC Press, Taylor and Francis Group
Price: £40
To order: Refer to note at end of review

The South African steel design code is based on the Canadian S16 steel design code. The five-year review of that document has commenced. There are numerous research activities going on at South African universities about the possibility of replacing the S16-based code with a Eurocode-based document.

So it was of particular interest to the reviewer to have a close look at the book, which certainly would help with understanding the amount of detail that is required to do design calculations to comply with Eurocode, by hand without computer-aided methods, compared with the effort required at present.

What makes the text even more inviting is that the structure under consideration is “a multibay melting shop and finishing mill building”, something no local texts or basic design books go into. This is the type of structure found at typical steel-making plants of which there are numerous examples in South Africa.

There is a basic problem that South African designers who are used to South African codes need to overcome before becoming comfortable with Eurocodes, and that is the different symbol meanings and X, Y and Z axes that Eurocodes use. It is a fact of life that we will just have to get used to!

The author has structured his text in such a manner that he covers the basic principles with a written introduction to the relevant item. This includes the overall structure, as well as the structural elements that make up the structure. These basic descriptions are enlightening, both to the young inexperienced designer and for the more experienced designer to ensure that old ‘bad habits’ are not brought forward to new projects by old hands. Once these background principles are understood for each structural element the designer will understand what design checks need to be done for that particular element. Where necessary the author explains what the structural behavior is that the design check is about.

The understanding and use of the Eurocode wind load requirements is very well explained and laid out. Thereafter individual elements are designed in detail. What is most useful for inexperienced designers are the numerous rules of thumb and techniques that the author uses to get that “initial selection of sizes done” such that when the design is done in detail it is most likely that the design will work. In this regard dimensions related to span (e.g. one tenth or one twelfth of the span for the depth of the girder) are used, as well as using limiting equations from the codes.

In the case of the crane columns the author does the design using both Eurocode and BS5950. It is apparent that by hand the Euro calculations are a bit more laborious than by computer.

There is a most useful section on relevant connection designs that would be valuable to all designers.

The calculations are very detailed, and when carefully reviewed, will be understood by the most junior or inexperienced designer, save for one major problem which could lead to frustration for the reader.

The book has many lack-of-proof-reading and/or typing errors. Many are obvious to the experienced eye, but some will leave the reader scratching his head and asking “now where on earth did he get this from?” Despite the fact that the reviewer did not check every calculation in blow by blow detail, errors just seemed to jump out. Examples include the wrong thickness of plates in calculations, incorrect yield strength used in calculations, incomplete beam size descriptions, extra or too few zeros, etcetera.

In a few instances the reviewer felt that a few more diagrams than verbal descriptions would have rendered the book more user-friendly.

Nevertheless, the reviewer still believes that this would be a valuable text for any designer, who needs to design heavy crane structures, to study before setting out with the design. The background descriptions and pointers would be useful even if the design had to be done to South African codes.

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What every specifier should know about hot dip galvanising deemed for use in architectural steelwork

THE MAIN INTENTION of hot dip galvanising, or painting exposed steelwork for a building, is to prevent the steel from rusting, ideally lasting for the service life of the building. (Performance of the two systems is not up for debate in this article.) The method of application of the two systems is vastly different.

Hot dip galvanising is a metallurgical reaction between molten zinc and steel where bond, coating thickness and appearance is less dependent on the galvaniser and more dependent on a law of metallurgy and the type of steel. Paint on the other hand is bonded to the substrate mechanically via a number of surface preparation methods, some less successful than others. Abrasive blasting to obtain a surface profile is seen to be the optimum method of substrate preparation for painting.

The appearance of the former from the outset is hugely dependent on the chemical composition of the steel, with silicon and phosphorus playing the major roles, whereas the appearance and performance of the latter in the medium to long term is dependent on the specified paint system and hugely dependent on the many application variables, including the expertise of the painter.

So when it is decided by the architect/specifier that exposed steelwork is to be hot dip galvanised and the steel arrives at the galvaniser, it is not merely incumbent on the galvaniser to reach over and flick the magic switch which says ‘Architectural Galvanising’ so that the steel exits the bath in perfect quality, but rather it is a function of proper planning and participation by all parties.

The concept of using hot dip galvanised mild steel for architectural use in South Africa most probably began informally a
number of years ago, but as far as we at the Hot Dip Galvanisers Association Southern Africa (HDGASA) are aware, it really started in 2000 when Al Stratford, of then Stratfords Architects, extensively used it on Stratford’s Bed & Breakfast and Conference Centre in East London, which is now 10 years old, and in 2002/3 when the first phase of the MTN Head Office in Fairlands, Johannesburg, was well on its way.

Our involvement with the latter project started when I was called to the MTN site by an irritated architect to view a mock-up handrail system that was hot dip galvanised. The intention of the mock-up was to allow the clients to choose between a hot dip galvanised mild steel and a stainless steel handrail system.

I, too, was disappointed at the hot dip galvanised handrail, as it had some rough surfaces and lumps, and some small coating repairs (while the mock-up was well within the requirements of SANS 121, it was not what the architect had envisaged). These areas were within the view of the client standing in front of the mock-up. Needless to say the stainless steel sample won the day! 

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In some aggressive marine and polluted industrial applications, the additional barrier protection provided by a duplex coating (hot dip galvanized plus paint), together with the sustained sacrificial protection performance provided by the hot dip galvanized coating will invariably solve most steel protection problems.
When I enquired about how the order was brought about, it was obvious to me that the component had just been delivered to the galvaniser from the steelwork contractor with no formal written instruction as to the purpose of the component.

Hot dip galvanising has been around in South Africa for about 50 years, primarily as an effective corrosion control medium. Besides its use along the coast, mainly for structural steel, gates and burglar bars, etc, on the Reef it is extensively used in the industrial environment, and above and below ground in mining applications. So, when it is specified for a more refined type of application, extraordinary things need to be put in place.

I subsequently approached the architect and requested that the HDGASA be involved from the start of the second phase, which happened some two years later.

Turning to the internet I found that the Galvanisers Association of Australia (GAA) had a specification called, “Galvanising as an Architectural Finish – Procedures for Design Detailers”. Using some of the guidelines from the GAA and the Association’s combined experience of in excess of about 50 years in the industry, a check list was developed where the architect, steel designer/fabricator and galvaniser all had joint responsibilities for the successful roll-out of the quality of the hot dip galvanised coating.

The GAA has in the interim decided to recall their architectural specification. Rosemary Scott, Executive Director of the GAA, said the following:

"Re ‘architectural finish’ – the GAA now specifies the use of the Australian/New Zealand Standard 4680, Section 7 Appearance and Freedom from Defects which refers to a ‘superior’ surface finish and the provision of acceptable type samples or methods of test. It is important that the specifier works with the galvaniser in the early stages of the project."

Points 2, 3, 4 and 5 of Section 7 of AS/NZS 4680, which in our opinion are not as explicit in SANS 121 (ISO 1461), are set out below for consideration.
“2. Advice on the transport and storage of galvanised articles is given in Appendix F.

3. Where a superior surface finish is required or the presence, size or frequency of any defects in the coating is considered to be of concern, appropriate arrangements should be made between the purchaser and the galvaniser. This may be achieved by the provision of acceptable type samples or methods of test.

4. Articles galvanised after fabrication have a thicker, less smooth coating when compared with continuously galvanised products such as sheet or wire.

5. If the galvanised product is to be subsequently painted or powder-coated, the galvaniser should be advised at the time of order, as extra work may be required to ensure that the agreed finish is obtained.”

Our experience, regarding the requirements of architects wanting different finishes, is no different to that of the GAA. Some architects only want the varying spangle appearances, see photos 1 and 2, with the aged spangle condition shown in photo 3. (Photos 4 to 7 show the mottled/matt grey appearance.) Occasionally one has a steel with both finishes (see photo 8).

If one remains with an aluminium-killed steel where the silicon is 0.04% or less, and the phosphorus is less than 0.02%, the finished surface will generally always be a variegated spangle type of appearance. The resulting galvanised coating thickness will conform to the standard. Some of the more controlled silicon-killed steels also fall into this category.

If, however, the steel is silicon-killed where the silicon content is greater than 0.25 and the phosphorus slightly greater than 0.02%, the resulting coating could be dull grey or have a mottled coating appearance and this would not necessarily be evenly distributed along the length of the steel. The resulting galvanised coating thickness will generously exceed the requirements of the standard.

Some galvanisers have looked into alloying the molten zinc with elements such as nickel and tin to enhance the finished appearance. (As alloying of the zinc is more expensive than the traditional melt, the development of alloying other than with a small amount of aluminium in South Africa has been slow to take off, mainly due to the
perception from the general customer that price, and not service, rules at the end of the day.) See photos 9 and 10.

Therefore, should one want to ensure a specific finish for aesthetic reasons after hot dip galvanising, up-front communication with the HDGASA and the selected galvaniser, who is a member of the Association, is of prime importance!

While discussing the subject of architectural galvanising with Jeremie Malan of Jeremie Malan Architects, who were the architects for the new National Library in Pretoria, Jeremie said that an extensive amount of external steelwork that had been hot dip galvanised was used for the library in accordance with SANS 121 (ISO 1461) and the Architectural Check List.

Jeremie commented that, when requiring hot dip galvanising of an architectural standard, one of the most important factors is that greater attention must be levied on steel detailing by all involved parties, thereby greatly reducing or avoiding the inevitable coating repairs due to alterations on site.

Jeremie also concedes that up-front communication with technical staff of the Association during the planning stages of the project, as well as regular participation in the project team by the selected galvaniser, is of extreme importance to the success of any major architectural steelwork project.

To view the check list that was developed for “Architectural Hot Dip Galvanising” please refer to our website (www.hdgasa.org.za).

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**Civil Engineering | March 2011**

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PROPOSED ROAD NETWORK
The main access road to this area is provided by Road A2 from Maseru to Quthing and Road A4 from Quthing to Qacha’s Neck. Road A4 travels in an easterly direction following, initially, more or less the Senqu River (Orange River) before ending at the border post at Qacha’s Neck. The government of Lesotho, together with funding assistance from the World Bank, intends to improve the area’s road network as follows:

■ Upgrading and extending the Maseru-Roma-Semonkong road. In future, this road will link up with the road to Qacha’s Neck, shortening the Maseru to Qacha’s journey by roughly 140 km.

Critical crossings involved in this project are the high-level bridges over the Senqunyane River near its confluence with the Senqu River, as well as that over the Senqu River.

■ Two low-water river crossings with single lane width and sub-standard road approaches on the road from Quthing – Qacha’s neck require replacement. The rivers concerned are the Qhoali and Sebapala Rivers.

■ Providing vehicle access to the area north of the Senqu River by constructing two high-level bridges with access roads from the main route over the Senqu River.

SENQUNYANE RIVER BRIDGE
Funded by the government of Lesotho, the World Bank and other development partners, this bridge, with a length of 112,5 m, has three spans of 37,5 m each and crosses the Senqunyane River at an angle of skew of 30 degrees.

The bridge deck is 11,95 m wide and consists of eight precast post-tensioned beams per span with an in situ cast reinforced
concrete slab. The deck makes provision for 3.5 m lanes, a verge and a sidewalk on each side. In addition, a solid concrete balustrade has been provided to safeguard the traffic.

Because this bridge is in a deep gorge, a construction solution which would have the least impact on the natural flow of the river and which would achieve a bridge deck level compatible with the vertical road alignment had to be sought. To achieve this, piers approximately 28 m long were required, with each consisting of two circular columns with a seating beam on top. The abutments are 28.6 m and 28 m high respectively. Accordingly, a combination abutment with 7 m high closed walls with mechanically stabilised walls (Terratrel cladding) was adopted. These 7 m high concrete walls will ensure that the 1:100 year flood level does not interfere with the gabion-type cladding. The bridge is founded on 1 200 mm diameter piles socketed into the rock bed.

Current status
This bridge is close to completion.

SENQU RIVER BRIDGE

Also funded by the government of Lesotho, the World Bank and other development partners, this bridge, with a length of 150 m, consists of four 37.5 m spans which cross the river at an angle of skew of 30 degrees.

With a similar deck to that of the Senqunyane bridge, the three piers of this bridge vary in height from 21.6 m to 26 m. Each pier consists of two circular columns with a seating beam above.

The very steep and high rock face on the northern embankment of this bridge made the northern approach extremely difficult. Due to road alignment problems, substantial rock cutting was needed, which determined the northern abutment height of 20 m, while the southern abutment is only 14 m. To secure the structure, mechanically reinforced approach fills were constructed.

Current status
This bridge is fully completed, aside from the deck joints and pavement.

MOHLAPISO RIVER BRIDGE

This bridge, funded by the government of Lesotho, provides access over the Senqu River roughly 80 km upstream from the Senqu bridge mentioned above.

The bridge is 150 m in length, with four spans of 37.5 m, while the deck is 11.95 m wide. In this case the vertical road alignment dictated the deck level. A very steep northern approach required an 8% vertical slope on the last span.

China Geo-Engineering Corporation, who constructed the Senqu and Senqunyane bridges, were successful in their tender. The company evaluated the original bridge design, which called
for large-diameter caissons, proposing an alternative design of 1 200 mm diameter piles which vary in length from 14 m to 15 m. This cheaper design solution was accepted.

**Current status**
This bridge is close to completion.

**SEBAPALA RIVER BRIDGE**
The government of Lesotho also funded this 98 m long bridge which crosses the Sebapala River at a degree of skew of roughly 45 degrees.

The deck is a continuous, voided, reinforced concrete slab. The single 1 300 mm diameter columns vary in length from 5,5 m to 8,2 m, while the deck is 11,5 m long.

Complications during construction included that traffic had to be accommodated on the existing single-lane low-water bridge just downstream of the new bridge. The bridge configuration adopted was a five-span configuration with single pier supports in the streambed. The abutments are of the closed type and positioned on shallow rock bed while the piers are founded on short 1 200 mm diameter piles.

**Current status**
The bridge is completed and has been handed over to the client.

**QHOALI RIVER BRIDGE**
This bridge crosses Qhoali River on Route A4 near Mphaki. The deck is a continuous, voided, reinforced slab. This bridge is 50 m long and has three spans of 15 m, 20 m and 15 m.

The road alignment required this bridge to achieve a very specific vertical and horizontal curve. Accordingly, the abutments are of the closed wall type and mechanically stabilised earth walls were used at both approaches to retain the fill. The piers are 9 m long and founded with spreadfooting on the rock bed.

**Current status**
This bridge, funded by the government of Lesotho and constructed by a local Lesotho contractor, Lesotho Consolidated Civil Contractors (LCCC), was completed in 2008.

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**INFO**

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THE FINAL PHASE of the planned upgrading of the N2 freeway between the Cape Town International Airport and the City Centre required the upgrading of the Hospital Bend interchange. The area occupied by the interchange is very restricted and needed to be well utilised as the intention was to eliminate extensive weaving manoeuvres. The potential impact on the adjacent Table Mountain National Park and Rhodes Trust Land, and the accessibility to the Groote Schuur Hospital, as well as the need to confine improvements within the existing road reserve, were major concerns.

This created a need for long stretches of retaining walls all along the toe of the mountain slope. An important requirement was that these walls would be aesthetically pleasing and that the structure becomes a landmark befitting the high profile that Cape Town has achieved in the international tourism market.

Maccaferri SA were approached by consultants BKS and Orrie Welby Solomon to investigate the use of gabions to construct the required walls, owing to the possibility that they could be packed with good selected Cape Sandstone, which would not only provide the mass required in a mass gravity design, but would also create a stunning visual feature rather than a bland industrial-looking solution offered by alternative methods.

Maccaferri are manufacturers of wire products in general and gabions in particular. The gabions for this project were manufactured using double-twist hexagonal woven mesh, which complies locally with SANS 1580:2005, thereby ensuring the durability of the structure. The wire used to manufacture the mesh is Class A zinc-galvanised, manufactured according to SANS 675:1997, and can be provided with heavy-duty heat-bonded PVC coating of nominal 0.5 mm wall thickness.

It was suggested that a PVC coating be provided owing to the proximity to the coast. The PVC coating on the wire mesh ensures a certified life of at least 120 years. Maccaferri are able to offer, in addition to the standard grey PVC coating, a brown PVC which was felt would blend in well with the natural colour of the Cape Sandstone. This option of a brown PVC is well suited to the rocks available in the Cape and can be seen in many gabion projects in the province.

Gabions are very versatile building elements owing to the concept that light 1 The completed wall has become a landmark visible to all those entering Cape Town from the inland areas and the airport
2 Construction of the wall in progress
3 Gabions blend in well with the beautiful Table Mountain scenery
Photos: Courtesy the City of Cape Town
empty wire mesh cages can easily be placed into position under restricted working conditions, and then these cages, once wired up and fixed into position, can be filled by hand with the rocks that, in conjunction with the wire mesh, form a structural unit.

The operation requires no plant, making it easy for the contractor to work within the restricted confines of the project. There is no propping or formwork required, unlike in other methods of construction, such as reinforced concrete, which needs weeks of temporary support while the concrete cures and slowly develops its design strength.

Gabions provide instant strength and each unit becomes stable and capable of working within the structure the moment it is filled with rock. The flexible nature of gabions enables the completed structure to absorb, without sudden failure, any unanticipated additional loads accidentally imposed on the structure.

Gabions are also easy to erect, which assists project management to keep with contractual time constraints. Gabions provide a natural finish which blends in well with the mountainous surroundings and, with carefully placed and well-selected rocks, can provide a very attractive architectural feature.

The technical reasons that determined the choice of the gabion structure at Hospital Bend were:
- Capability to absorb any unanticipated increase in loadings without sudden failure (good flexibility)
- Exceptional ability to blend into the natural environment.
- The low technology involved, resulting in the low cost of the structure.

The contractor appointed to do the construction was Haw & Inglis, who is very experienced in working with gabions and has completed similar projects at Chapman’s Peak and Knysna Lagoon. The workmanship provided by the subcontractors, Keystone Landscapes, played a vital role in the success of the project, providing a stunning visual impact produced by the perfectly packed rocks within the gabions.

Gabion Product Manager, Errol Jenkinson, says the 3 400 m³ gabion walls are not only a key element for the preservation of the road and for the safeguarding of traffic but has become a landmark visible to all those entering the city from the inland areas and the airport.

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FOCUSED INVESTMENT in vital infrastructure projects has been the government’s strategy to boost South Africa’s economy and create employment and investment opportunities.

The past 17 years have seen billions of rands overhauling rail, road and port networks to create competitive, state-of-the-art facilities that ensure South Africa’s position as one of the continent’s economic leaders.

Its location on the southernmost tip of Africa means that it is perfectly positioned for access to SADC markets and as a trans-shipment point between the emerging markets of Central and South America and South and Far East Asia.

In keeping with the overarching national transport strategy, Transnet, South Africa’s largest rail, port and pipeline company, has invested approximately R71.8 billion over the past five years to March 2010, with R28 billion earmarked for port-related projects.

MODERNISING CAPE TOWN’S PORT

The recent upgrade of the Cape Town Container Terminal, a R4.2 billion expansion project, aimed at the provision of a modern facility with doubled cargo capacity, will now be equipped to enable a new generation of vessels to enter and moor safely at the container facility.

As part of their two-year contract worth R35 million, Nelcor Civils were subcontracted to carry out the civil works on sections of the container terminal, working with WBHO Construction, the principal building contractors, and HHO Africa, the consulting engineers on the project.

“This is the biggest project we have done to date,” says Dale Meyer, Administration Manager and part owner of Nelcor Civils, sister company to Nelcor Earthworks and Demolition.

Nelcor’s engineering expertise, combined with the appropriate software, was drawn from as part of a project that aimed at converting the terminal’s container stacking yard from a straddle carrier operation to a rubber-tired gantry (RTG) operation.

According to Meyer, the functionality of Civil Designer, software developed and supplied by Knowledge Base, has been an invaluable tool. It also helped streamline the data exchange process because it was used across the consulting spectrum on the project.

“HHO use Civil Designer and so do we. What that means for us is that if they push out a design, we can work with it,
generate information and send it back in the same format. Having all the data on the same platform makes the process more streamlined."

"Also from a measurement perspective, it is a valuable asset. For quantities and calculations of work done, it makes the whole quantity surveying process faster and more accurate."

As Meyer has emphasised, the need for time-saving measures is a priority for consulting firms working to tight deadlines.

**REVITALISING CAPE TOWN STATION**

Also involved in the R418 million upgrade and expansion of the Cape Town station, Nelcor Civils were responsible for the upgrade of the station forecourt, an area that comprises three sections: the "Creative" Cape Town space, Station Square, and Station Corner.

The refurbishment and upgrade of the station, which was first constructed in the early 1960s, forms part of a broad vision to create a world-class transport hub with a retail and entertainment centre.

The key stakeholders involved in transforming the site into an incubator for small businesses and a destination in its own right are Metrorail, the Passenger Rail Agency of South Africa (PRASA), the City of Cape Town, the Central City Partnership, the provincial government and property management company Intersite.

Intersite’s regional manager, Lindelo Matya, says that this new-generation transport hub will result in improved operational efficiencies and a safer and more secure urban environment.

Within the broader framework of the renewal of the Cape Town Central Business district and the move towards establishing urban public spaces, the Cape Town station precinct plays an important role in the economic life of the city.

In the future the station will feature a transport museum, art gallery and travel agency, a bureau de change and Internet Café, a local crafters market, convenience stores, restaurants and fast food outlets in addition to a small conference centre and medical service facilities.

Using Civil Designer’s Survey and Terrain Module for this project, Meyer says that they were able to carry out calculations and basic design work for GIBB, the consulting engineers on the project. With both companies using the software, seamless interchange of information was facilitated.

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The past 17 years have seen billions of rands overhauling rail, road and port networks to create competitive, state-of-the-art facilities that ensure South Africa’s position as one of the continent’s economic leaders.
IN BRIEF

GLOBAL CONSTRUCTION INDUSTRY CAUTIOUSLY OPTIMISTIC ABOUT 2011

DESPITE THE SLOW pace of economic recovery to date, many leading global engineering and construction (E&C) companies have a somewhat bullish outlook for 2011. Having repositioned their businesses during the downturn with sustainable models better suited to manage risk and expand into new markets and services, these firms are leaner, stronger, and more strategic, a recent study from KPMG International has found. “This cautious optimism is not shared in the South African market, as many of the large infrastructure projects are yet to gain momentum and, with long lead times, it is unlikely that 2011 will show an improvement,” says Gavin Maile, KPMG Africa Construction Leader.

Optimism and repositioning

Findings from the KPMG 2010 Global Construction Survey, Adapting to an Uncertain Environment, indicate that the lingering economic downturn and associated constraints have generated a growing movement among global E&C companies to create stronger, more resilient business models that can weather change and manage risk. Seventy-seven percent of respondents said they have in place sophisticated systems to effectively manage risk.

Another outcome of the opportunity to redefine their businesses is that many of the global players are creating new integrated services offerings or expanding overseas to increase market opportunities. South African construction companies are looking to the rest of Africa for growth and opportunities.

“The willingness of contractors to move into new markets, and possibly to evolve their value proposition, could be the difference between thriving and merely surviving,” says Geno Armstrong, international sector lead for KPMG’s Engineering and Construction practice. “With margins unlikely to rise for traditional business, such a repositioning could be vital.”

Close to half of respondents have forecast rising backlogs (secured orders) in 2011 that would come from pent-up demand; expansion into new services, such as power; or moving into additional geographies, such as the Middle East, Asia, Australia, Africa and India. Asia Pacific demonstrated the most promising outlook in backlogs in 2011 with 21 percent of respondents confident of a significant increase.

Other findings include indications that few companies expect to lay off workers in 2011, while 31 percent said they would likely hire more direct labour in that period. “The opposite is expected to occur in South Africa after the slow pickup with new projects after the Soccer World Cup, both from a public and private sector point of view,” explains Gavin Maile. Employment in the construction sector has already fallen by over 10 percent in 2010.

Margins have taken a cut over the last year, as most respondents said they had to reduce prices. However, the impact has been lessened due to cost-cutting measures. Looking ahead, more than 30 percent of respondents said they are bidding on new projects with lower margins but that factor is offset by the sentiment that backlogs are predicted to rise dramatically.

Meanwhile, government stimulus initiatives around the world have had varying levels of success, with more than 35 percent of respondents from Asia Pacific stating that stimulus efforts have had a significant impact. In contrast, the majority of respondents from the Americas and Europe, the Middle East and Africa said that stimulus packages did not improve market opportunities.

Improved risk and compliance measures

With risk management an even higher priority in the new environment, most respondents said they continue to improve efforts with new programmes to train employees, analyse their bidding and planning processes, and develop a more formal risk approach.

The survey also showed that more than a third of companies based in North America are further ahead than other regions with risk management plans, due to increased regulatory pressures. Nearly 50 percent of the companies polled in the survey said that their policies and procedures on accountability need to be more effective. Regulatory compliance, though, may be delivering some unforeseen benefits.

“The more enlightened operators are realising that a strong set of values can enhance their reputation and help win new business,” Armstrong says. “Shareholder value is increasingly linked to intangible assets, such as a company’s safety program, and customers are looking closely at whether contractors are responsible corporate citizens.”
With signs of economic improvement on the horizon, E&C companies are looking at ways of funding their geographic expansion and new offerings. Credit is still tight with 47 percent saying that financing is still very difficult to obtain. Many respondents – mostly those outside the US – consider public-private partnerships (PPPs) to be a good bet for the industry if there is government backing.

“The global E&C industry’s optimism and notable progress on making major improvements to become leaner and more focused provides a strong foundation for the years to come,” says Maile. “The future is far from certain, but continuing to invest in risk management, expanding into new areas and building a skilled staff are critical steps that can help weather any change.”

Survey scope
The above-mentioned KPMG 2010 survey polled 140 senior leaders of major global engineering and construction companies in 25 countries to gauge their views on their business outlook for the sector. Forty-six percent of the respondents were based in Europe, the Middle East and Africa, 30 percent in Asia Pacific (AsPac), and 24 percent in the Americas.

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TEKLA PROFESSIONAL
BIM APPLICATION FREELY AVAILABLE TO EVERYONE IN CONSTRUCTION

TO MAKE AN IMPACT on the construction industry, 3D modeling software provider Tekla is launching a new advanced application for building information model-based project communication and cooperation. Tekla BIMsight is ready for everyone in the industry to download and share over the internet for free. Now contractors, designers, architects, MEP detailers and fabricators can combine their models, check for clashes, and collaborate using new and unique BIM software.

Tekla BIMsight is a new collaboration tool that lets construction industry professionals step into the BIM (Building Information Modeling) process for free. This software application makes it easy to combine and understand 3D models created by different AEC disciplines with different software, to interpret the design intent, check for clashes, and comment and mark changes. Tekla BIMsight presents a centralised way to maintain and communicate shared construction information: project participants can see the big picture, as well as every important detail in the same, illustrative and easy-to-grasp 3D model. Tekla BIMsight can be used throughout the workflow of construction, from the design phase of the building to its erection and site management.

“Tekla’s mission is to drive the evolution to digital information modelling, multiplying our customers’ potential to think and achieve big in their projects and businesses,” explains Tekla Executive Vice-President Risto Räty. “Understanding BIM as a centralised process rather than ‘just a model’ requires cooperation and goodwill between the construction disciplines. This is exactly what we want to achieve with the new Tekla BIMsight software, and our part of the goodwill is to distribute it for free for the whole industry to easily take into use.”

Tekla BIMsight has been described as ‘the missing link’ BIM software application because it enables accurate and effective 3D building information model-based project collaboration and management for everyone in the industry. BIM-based way of working supports the modern requirements of sustainability and green building, for example, by optimising prefabrication and site management, and enabling a paperless process. Accurate, model-based communication enables better constructability through finding, reacting to and correcting possible design errors early, before on-site construction. All this motivates people working in engineering and construction to centralise their data and to make requests for information accurately and efficiently through one shared application that presents the combined model of a whole construction project from every possible angle.

Tekla BIMsight software is ready to download for free (http://www.teklabimsight.com/). Video tutorials and an online user community make it easy for anyone to get started, visualising and communicating with building information models. At the moment, Tekla BIMsight is only available in English.

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Our global experience is your global experience.
The new Tekla Structures 17 provides even more interoperability

Tekla has also launched a new version of its main product, Tekla Structures, simultaneously with the launch of Tekla BIMsight. Tekla Structures 17 introduces many improvements for project collaboration, such as better project managing tools and even more interoperability with other software systems.

The most noticeable new features of Tekla Structures 17 are improved clash checking, organising, viewing, snapping, commenting and project managing tools, including easy input to the free-of-charge Tekla BIMsight collaboration application.

Tekla Structures 17 provides even more interoperability than before with leading software systems, such as Unitechnik, BVBS 2.0, and BETSY for those operating in the precast concrete industry. For the steel industry there is now an improved DSTV connection to CNC machinery. Tekla Structures 17 allows higher accuracy with more customisable and automated drawings. Visualisation of parts and objects in the model has been enhanced. Tekla Structures 17 functions are more and more Windows-like to make its use more intuitive and standardised. The development of user experience and assistance is continuous at Tekla. In addition, Tekla Structures 17 is now certified to support the use of 3Dconnexion mouse.

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GUARANTEEING HOT WATER WITH HOT SAVINGS

THE CONSTANTLY LOOMING threat of power cuts and the need for improved energy efficiency have pushed ITT Water & Wastewater’s Ecocirc® DS Solar Pump into the forefront of the market as the first DC spherical motor pump which can be connected directly to photovoltaic panels, reducing any reliance on the power grid.

Highly compact, with extremely low power consumption and Maximum Power Point (MPP) tracking, the shaft-less, spherical motor provides a maintenance-free and quiet service life in excess of 50,000 hours, making it suitable for residential applications. The lack of conventional shaft bearings or seals eliminates bearing noise and seal leaks.

The design includes a soft start-up feature which reduces high in-rush current...
and minimises cycling due to unsuccessful attempts. Even after prolonged shutdown, the pump will start reliably on less than 1 watt. An over-temperature safety device ensures that pump electronics are shut off when reaching temperatures in excess of 110°C. Should the temperature of the pumped fluid drop below 95°C, the pump functions normally.

The Ecocirc® Solar Pump incorporates a process which modifies the operating point on the voltage-current curve of the PV panel to find the MPP, reaching maximum rpm and maximum performance. This best operating point is achieved under any given light and temperature conditions.

The Ecocirc® solar pump can be used for most circulation pump applications with connection to the power grid. The Lowara Ecocirc® solar pump is available from ITT Water & Wastewater.

SOUTH AFRICA’S COMPLETE lighting solutions provider, Lighting Innovations, offers clients who are looking to improve their buildings’ energy efficiency an innovative retrofit lighting technology that is ideal for office environments and delivers outstanding benefits for both the company and the carbon footprint.

Lighting Innovations’ newest, optimally designed Pinnacle recessed luminaire ensures efficiency in excess of 93%. A simple switch from outdated fittings to the new Pinnacle range can comfortably account for 40% of the total lighting energy reduction that can be achieved on any commercial building. This translates into substantial financial savings for the building owner or tenant.

“Although energy efficient lighting may be costly, cheaper alternatives will not be able to achieve the desired energy savings,” explains Hennie Combrink, Technical Consultant at Lighting Innovations. “For such retrofit projects, the payback period is medium to long-term and the effects are generally only evident after around 18 months when the lamps reach their rated life.”

The latest fittings available from Lighting Innovations can boost efficiency, previously obtained with the implementation of the Demand Side Management programme, by a further 30%, over and above previous energy efficiency related retrofits, ensuring even lower electrical costs.

Lighting Innovations’ Pinnacle recessed luminaire ensures a luminaire efficiency in excess of 93%
An introduction to occupancy, daylight harvesting and step-dimming sensors is another means of contributing to lower energy consumption. Combrink says: “While this energy saving method is difficult to quantify, it can realise great savings by overcoming poor habits – like not switching off electrical apparatus when rooms are unoccupied – formed during the days of low-cost energy.” These sensors are ideal for commercial applications, such as office blocks and parks. They are being utilised worldwide to eliminate the human element and thereby boost electrical energy savings.

More energy saving specific, building management programmes are also recommended by Lighting Innovations, as they allow the control of all light fittings through a single source – programmable logic controllers (PLCs). Ensuring the most effective electricity usage, building management systems help to minimise expenses by taking into account consumption patterns and daily tariff variations.

Combrink continues: “By importing AutoCAD drawings of a customer’s premises into our in-house Relux simulation program, we can create comparative watts per square metre calculations that illustrate to building owners, tenants or consulting engineers the energy savings that can be realised.” Customers also have the option of applying for an ESKOM DSM subsidy of an average of R5,2 million for every megawatt saved: “Once a building pre- and post-implementation audit has been performed, the proposal gets passed on to ESKOM’s project evaluation committee for approval.”

INFO

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DEMOLISHED COOLING TOWERS RESURRECTED

THE COOLING TOWERS of Cape Town’s old Athlone Power Station, which were imploded last year, have made a substantial contribution to reducing the carbon footprint of a concrete masonry and paving block manufacturer in the heart of the city.

The company is Concrete Manufacturers Association (CMA) member, Cape Brick, which has been sourcing up to 75% of its raw material from demolished buildings and other structures with a high percentage of concrete for the past eleven years.

The Athlone cooling towers yielded roughly 16 000 m³ of rubble, equivalent to 20 000 tons of concrete, which provided Cape Brick with enough raw material to last them approximately four months.

CMA director, Hamish Laing, comments that considerably less embodied energy is required to produce concrete masonry units using recycled concrete than using freshly quarried sand and stone aggregates.

“Embodied energy is defined as the energy consumed in the manufacture and transportation of construction materials. It is measured in megajoules per kilogram (MJ/kg),” says Laing.

The use of recycled material does not mean that product quality suffers, as its properties are equivalent to quarried materials. It offers comparablepressive strengths and is a truly green material which is itself fully recyclable.

According to Laing the following are direct environmental benefits of green masonry:

- Fewer virgin aggregates have to be quarried, reducing the impact on the environment.
- Reduced transport costs as most quarries are located far from their markets.
- Construction and demolition rubble is normally dumped, so using it as a raw material source eases the pressure on landfill sites.
- Most landfill sites are located far from the demolition site, so using these materials further reduces transport costs.
- Cape Brick’s own waste material is reprocessed and therefore does not have to be dumped, easing pressure on landfills.

Cape Brick managing director, Anthony Gracie, says it requires approximately half a megajoule to produce a kilogram of masonry or paving block using recycled material, whereas close on a full megajoule, i.e. twice as much energy, to produce the same product using original material.

“In other words, our 190 masonry block, which weighs 16 kg, has an embodied energy of 8 MJ, whereas a conventional block of the same weight, but manufactured with original materials, has an embodied energy of 15,04 MJ. This energy usage can be further extrapolated into kilowatt hours (Kw/h) per brick, which in the case of Cape Brick’s 190 block is 2,22 Kw/h. The rating for an equivalent conventional block is 4,17 Kw/h.

“Looked at another way, the energy saved in producing 40 000 green bricks would provide 90 houses with enough electricity for a month,” says Gracie.

Gracie says demolition material varies depending on the source, and that the challenge is to achieve a material split, grading and shape to provide a consistent aggregate as close to or better than original as possible.

“During the crushing process we aim to achieve a rounded aggregate. If the material is long and flat or flaky, more cement is required and the strength of the final product is compromised. Rounded aggregate yields far better strength and cement usage is also more economical. We aim for a density of 2 100 kg/m³ in our brick production. Providing we achieve a nicely cubed aggregate we can achieve this with ease. We have also found that the strength of our blocks shoots up exponentially as soon as the density exceeds 2 100 kg/m³.

Laing adds that a good brick producer should produce no more than 2,5% wastage.
by mass including sweepings. “Some brick manufacturers are operating on the basis of 15% wastage which is quite unnecessary, providing that proper processes and quality procedures are followed.”

Additional references on the calculation of embodied energy can be viewed on the following websites:
http://www.translatorscafe.com/cafe/units-converter/energy/calculator/-kcal-to-megajoule-[MJ]/
http://www.youtube.com/watch?v=kI4Eedogyec

INFO

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Managing Director
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INFO

John Sheath
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CONCRETE SOCIETY APPOINTS FIRST FULL-TIME CEO

THE CONCRETE SOCIETY of Southern Africa (CSSA) has announced the appointment of a full-time Chief Executive Officer.

John Sheath, chartered marketer and well-known figure in the cement and concrete industries, has relinquished his responsibilities as National President of the Society for 2010/2011 to take up the position of CEO from January this year. For the remainder of the presidential term, Nick van den Berg, structural engineer and Associate with Goba (Pty) Ltd, will be assuming the duties of the National President.

The creation of a CEO position for the Society was in line with the strategic plan agreed to by the CSSA National Council early in 2010 and is aimed at strengthening the drive and growth of the Concrete Society, in terms of both membership and activities.

John Sheath, first full-time CEO of the Concrete Society of Southern Africa

INFO

John Sheath
012 348 5305
www.concretesociety.co.za

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email:  cindy@ashak.co.za
eville@epoxerite.co.za
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CONTACTS: Cheryl-Lee Williams (cheryl-lee@saice.org.za) or Dawn Hermanus (dawn@saice.org.za)
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PLEASE NOTE THAT COURSE DATES AND PRICES ARE SUBJECT TO CHANGE
The current process of registration with the Engineering Council of South Africa (ECSA) was implemented in January 1998. The ECSA "Discipline-Specific Guidelines for Civil Engineering" of February 2003, Clause 6.5, indicates that two essays will have to be written by candidates:

■ The first essay will be on one of two technical subjects set by the reviewers in the context of the training report and the interview.
■ The second essay will be on one of two topics selected by the interviewers from a list published in advance by SAICE. Guidance notes for the assessment of essays are set out in the Guidelines for Professional Registration of Civil Engineers, available from the Institution.

The topics for the second essay for 2010 are listed below, and have been approved by the Professional Advisory Committee on Civil Engineering at ECSA:

1. Referring to your own experience discuss the way in which the resources required for either a design project or a construction contract should be organised and managed in order to ensure that technical objectives are met and that work is completed on time and within budget.

2. Discuss the most significant influences, attitudes and strategic issues relevant to the total project cycle.

3. In projects for developing countries emphasis is often placed on the need for transfer of technology. How can this best be achieved in practice?

4. Discuss the importance of environmental regulations on the design, documentation, and construction of civil engineering projects. Use your own experiences to illustrate your argument.

5. Although failures may be a disaster for the individuals concerned, many have led to advances in theory, design and construction methods. Discuss how failures should be dealt with so as to ensure the maximum benefit to society and the engineering community.

6. Discuss the opportunities and threats inherent in industrial and infrastructure projects which impact on local communities, and the role civil engineers can play in delivering value to society through their involvement in such projects. Use your own experience where appropriate.

7. Discuss the difference between 'Quality Control' and 'Quality Assurance'. Discuss the requirements for quality management by clients, designers and contractors, and their respective contributions to the success of a project.

8. Describe how you have implemented health and safety legislation on the projects you have worked on, and detail what opportunities you think there are for improving health and safety performance.

9. Discuss the principle of whole life asset management with specific respect to municipal infrastructure using a single service to illustrate your argument.

10. Risk is inherent in most civil engineering work. Discuss the ways in which such risks can affect the employer and the contractor, and how they can influence the form of contract and the contract price.

11. "The estimation of costs of schemes and their budgetary control is one of the key functions of the engineer". Discuss how engineers should be trained to fulfil this function in design and construction?

12. Identify the areas in which disagreement between a Resident Engineer’s staff and the Contractor’s staff may develop. How can good relations be achieved between these parties? Illustrate where possible from your own experience.

13. Describe the authority of the Engineer to delegate decisions to the Engineer’s Representative under the General Conditions of Contract (GCC) 2010. In what circumstances could an Engineer vary the level of delegation during the construction period?

14. Discuss how the application of ethics in civil engineering projects or contracts should be regulated in order to ensure that the negative impact of corruption and similar practices are eliminated or at least minimised.

15. Discuss the role that the civil engineering profession has to play with respect to poverty alleviation.

16. Discuss the impact the Environmental Conservation Act has on the planning, design and construction of a civil engineering project.

17. Discuss whether the civil engineer of the future should become more of a specialist or a generalist.
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