STEEL AWARDS:
Celebrating 26 years of structural steelwork excellence
The structure behind one of the world’s largest lyric theatres
Design and construction of the ICC Arena in Durban
COMMENT: THE ESKOM DISASTER
by engineers, for engineers

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ON THE COVER
In an industry whose lifeblood is innovation, Franki stands out head and shoulders above the rest. The most recent envelope push for Franki is the use of the full displacement screw-type pile on the King Shaka International Airport project at La Mercy just north of Durban (see article on page 26)

Franki pushes envelope at King Shaka! 26

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- Mbombela Stadium, Nelspruit
- Nelson Mandela Bay Multi-purpose Stadium, Port Elizabeth
- Greenpoint Stadium, Cape Town

CREATING UNIQUE SOLUTIONS TOUCHING EVERYDAY LIVES
Eskom disaster

NEWSPAPER HEADLINES DURING JANUARY likened the electricity crisis to living in the netherworld. Indeed! The country-wide chaos caused frustration, dark despondency, and a general feeling of doom and gloom.

Eskom’s near non-communication with the man in the street, and its denial or mis-representation of the reasons for the crisis, resulted in many people developing symptoms similar to those suffering from severe trauma. This phenomenon was highlighted by psychologists in the programme ‘Three Talk’ on SABC 3 on Tuesday 5 February at 17:45.

With a properly executed emergency communication strategy, which one would have expected of a huge body like Eskom dealing with a catastrophe of this magnitude, the traumatic effect on ordinary citizens could have been minimised substantially and their future support ensured, albeit only conditionally.

Eskom should immediately have considered the declaration of a disaster situation, informing citizens about the cause and extent of the crisis, and indicating to them what to expect in the near and more distant future. Informed people are less likely to jump to unsubstantiated, often ‘paralysing,’ conclusions.

Eskom should, in other words, have had a standard media strategy in place, a plan that could have kicked in the moment the crisis occurred. The obvious lack of such a strategy resulted in the public experiencing Eskom’s attempts at communication as a lame cover-up. Eskom’s Communication Department should have borne in mind that, in the current climate of infrastructure and services failures, non- or ill-informed citizens very quickly become suspicious and unsupportive.

Specific and clear communication from Eskom regarding load-shedding schedules, for example, would have contributed greatly to easing citizens’ frustration levels at the time. The question remains, however, did Eskom have a schedule or was it all done randomly?

The lack of adequate communication by Eskom inevitably led to the media turning to professional bodies for answers. In only two days SAICE featured in eight radio interviews, while various newspapers also contacted the Institution for professionally informed views on the crisis.

As SAICE spokesperson, I said in these interviews that, although an electricity shortage had been predicted by our Institution already in 2006 (via the SAICE Infrastructure Report Card for South Africa), the current crisis has also created substantial positive opportunities. We could argue that the crisis is in fact a blessing in disguise. This disaster is at long last making decision-makers in particular, and the public in general, aware of the crucial role of infrastructure, including its maintenance, and of the engineering profession and the industry supporting it.

The civil engineering profession, and in particular our Institution, has for many years been at the forefront of providing solutions and tools to decision-makers, fellow professionals and members of the public. Much of this work is pioneering in its purest form, and most of it is internationally recognised to be firsts of its kind. Examples of recent research done, and of programmes that aim to address problem areas, are the following:

- **Numbers & Needs: Addressing the imbalances in the civil engineering profession** (2005)
- 2006 SAICE Infrastructure Report Card for South Africa

■ Sustainable Infrastructure for South African Towns and Cities. Through this programme local authority council-lors are empowered to make informed decisions about the provision of infrastructure
■ The ENERGYS programme (Engineers Now Ensuring Roll-out by Growing Young Skills). This programme aims at assisting local authorities to attract and retain the staff required to design, deliver, manage and operate infrastructure. Engineering students who need to complete their practical training, together with young graduates, are teamed up with retired senior engineering professionals and sent to local authorities struggling with infrastructure bottlenecks. Under the mentorship of the senior engineer, these youngsters acquire valuable experience, while at the same time getting the job done for the particular local authority.

I believe that if these and other capacity-building tools are properly utilised, we could face a bright future in South Africa. It would, however, require a genuine willingness at all levels of government to accept the advice, assistance and expertise offered by our Institution and our profession regarding the development and maintenance of infrastructure in particular, and capacity building in general.

In all fairness it needs to be stated that a number of decision-makers in government are increasingly valuing the contribution of the civil engineering profession and of our Institution. We salute these individuals for the bold steps that they have already taken to acknowledge and support our efforts! A round of sincere applause should also go to those sectors of government and statutory structures that are currently providing funding worth millions of rands per annum for some of our capacity-building programmes.
Celebrating 26 years of structural steelwork excellence

The annual Steel Awards have become, without doubt, the structural steel industry’s premier social event. Established 26 years ago to enable ‘our peers to share in our projects and to celebrate excellence in the use of steel’, the reason for the Steel Awards has not changed. But what has happened is that the event has grown into an important networking occasion. In 2007, some 600 people in Johannesburg and 250 in Durban representing every aspect of the steel construction chain – developers, planners, designers, draughtspeople, quantity surveyors, fabricators, steel makers and retailers, erectors, civil and building contractors and just interested people and their spouses/partners – gathered on the same evening for the announcement of the winners.

THE 2007 ENTRIES DREW the usual, quite varied, range of category types. But different from the past few years, we had a good crop of steel pedestrian bridges. Pedestrian bridges offer lots of scope to the professional team to offer something architecturally special to the client in keeping with the surrounding areas. And this year, two out of the three entries did just that.

Surprisingly the ‘urban’ bridge was not selected for a category award, but had we given runner-up prizes, this would definitely have been one of them. This was the pedestrian bridge erected over one of the man made canals joining the park areas at the Century City development in Cape Town.

The winner of the BRIDGE CATEGORY was the pedestrian bridge built over the N2 highway at Plettenberg Bay, which gives access to pedestrians living north of the highway to the centre of the town. The ‘challenging to the engineers’, complex design is curved in both plan and elevation. The trapezoidal box structural walkway is supported from an off-vertical arch. The net result is a very elegant bridge which has been complemented by exceptionally good workmanship and welding so essential in this form of construction. The bridge is highly visible from both the easterly and westerly approaches.

The bridge that really caught the attention of the judges because of its innovative and thus simple solution was the bridge constructed on pontoons that links an island in a lake in northern
Zambia at Chiluba Island to a more accessible second island. The interesting background is that turmoil over the years led to a whole community leaving the Congo and setting up home on this island. Access other than by water – which was not possible on windy days – was non-existent. The Zambian government were unable to offer any services to the community. The difficulties facing the project team were:

- The water levels can rise and fall by as much as 2 m
- The span (gap, really) was about 100 m
- There is no access whatsoever for heavy civil engineering equipment, neither piling, cranes or the like. Needless to add, the ground is very swamp-like and thus deep-piled foundations would be required for any ‘long-span’ solutions.

The floating pontoon solution shown here was ideal, as it accommodates the different water levels with ease. The components were made in Lusaka, transported by truck to the shore of the lake, assembled in sections, and towed into position by motorised boat. This is a truly outstanding, cost-effective engineering solution – a great South African engineering solution to a ‘darkest Africa’ problem.

Another of our exciting category winners was the only really ‘HEAVY STEEL’ STRUCTURE entered this year and that was for the extensions to the Durban

The EXPORT CATEGORY award winner this year was unusual in that a complete diamond plant was exported to Canada. The plant was fully assembled in South Africa and all components when disassembled were the size of a standard shipping container complete with the attachments that would allow for shipping on a standard container ship. Once in Canada they were transported to Yellow Knife on normal roads and then in winter on the now famous (courtesy of Discovery Channel) ice roads to the site at Snap Lake. A project of this nature goes way beyond the realm of good engineering into the demanding world of tight logistics where delays might mean a delay of a year in the project. South Africa incorporated engineering prove we can do it under the most stringent requirements for locations throughout the world.

Snap Lake diamond plant
Durban International Convention Centre

The 100 m pontoon bridge connects Chilubi and Nsumbu islands
The Watermaster played an invaluable role during assembly
The Watermaster amphibious vehicle
International Convention Centre (see also article on page 12). With large spans carrying enormous roof and sliding door loads being the order of the day, chunky steel trussed construction was the ideal solution. Exciting architecture adds to this special structure with a unique timber ceiling and glazed walls to the lobby areas to make the project really special.

Amidst all this high-tech modern material and structure, the developer has recognised a piece of history immediately outside the structure, which he has preserved ... an amazing old wall and group of ‘ficus’ trees so intertwined over the years that even to the trained structural eye one is not quite sure does the wall hold the trees up or vice versa.

STEEL STRUCTURES have featured strongly in recent years, either by way of finish to reinforced concrete structures or by way of atrium or glass façade supports. This year featured no fewer than seven such entries, two of which were special or unusual. The ABSA Bank head office building in Durban underwent a major refurbishment and upgrade in which a 30 m high atrium, visible only to occupants in the building, called upon the team to create massive but elegant supports in steelwork to the atrium. Once again, exceptional quality of workmanship to the Toblerone-shaped tubular steel trusses was the order of the day. The biggest challenge for the steelwork contractor was undoubtedly overcoming access issues to enable the erection to happen.

The Standard Bank new head office in Durban once again presented an opportunity for the architects to create special entrance glazed façade details. This time planar glass was used. But unlike most planar glass solutions, thinner glass, supported further into the panels than usual, was all supported on chunky bow string columns. The result is very pleasing to the eye, and very cost effective because of the thinner glass. Once again an inordinately high standard of fabrication contributes to the overall success of the project.

But for the writer, the most surprising result from this years steel awards is just how amazing architecture can convert the simplest of steel structures, namely the good old basic portal frame, into very special projects.

The first of the projects – a winner in the category UPGRADE AND REFURBISH – was an extension to a farmhouse in Touws River in the Karoo. The project was an extension to an old-style farm-house with a stoep around it. The basic structure used for the extension (mainly the lounge and dining areas) was a typical portal farmshed structure. But clad this with basic cottage windows, brick walls clad with local river rocks,
a modern ‘mis-type’ floor, reed ceilings and especially light fittings made up from dried-out Karoo bushes and wow ... a magnificent and exciting home is the result. The whole structure has a new stoep all the way around it to tie the old and the new together.

The SECOND AND OVERALL WINNER FOR THIS YEAR’S STEEL AWARDS was the new offices that architectural practice Elphick, Proome and Associates built for themselves. Once again using (in this case goal post style) portal frames for the structural elements, sophisticated treatment and exposing of the steel, the attachment of the cladding, windows sliding doors and the like led our judges to comment ‘what an advert for steel’. There was never any doubt among the judges just which project would win. George Elphick stated that he really loved steelwork and that if he used steel construction he always exposed it and showed it off for all to see and enjoy. This is a classic example of timeless construction that will be just as fresh and exciting in 10, 15 or 20 years as it is today.
The structure behind one of the world’s largest lyric theatres

THE R350 MILLION LIFESTYLE
Extension to the Montecasino precinct north of Johannesburg was completed in March 2007 with WSP Structures Africa (as LC Consulting) in joint venture with Ndodana Consulting providing the structural design services to this demanding project.

In late 2005 the second phase of one of Johannesburg’s most popular tourist destinations began on site and continued with the original Tuscan theme to include an outdoor piazza with specialist musical fountain surrounded by five restaurants, a conference facility and 170-room hotel over additional basement parking. Leading off the piazza was the jewel of the development, the 1 900-plus seat Teatro Lyric Theatre, the largest of its kind in the southern hemisphere and one of the top eight in the world.

The theatre was developed under the guidance of a team of world-class consultants headed up by international theatre consultant and President of the Society of London Theatre Martin McCallum and The Arts Team of RHWL Architects London. Locally the implementation of the design was carried out by MDS Architecture and Blacksmith Africa Interior Design, and constructed by Grinaker-LTA.

After only 18 months of construction the 10th anniversary of Disney’s The Lion King opened the Teatro in mid-June 2007 with an audience of local and international dignitaries. The production played six days a week to a full house and extended its run to mid-February 2008 due to the unprecedented demand. The show is known for its spectacular scenery changes, wardrobe and props – all 165 tonnes of it – and provides one of the most demanding tests for any theatre.

To facilitate Broadway/West End productions of this kind, the theatre must satisfy a particular specification sheet. The Teatro not only meets these

1. Full reinforced concrete model of the theatre
2. Interior Design, and constructed by Grinaker-LTA.
3. Kevin Webber
   Director, WSP Structures Africa
   (formerly LC Consulting)
   Kevin.Webber@wspgroup.co.za
Flexible seating configurations with a maximum of 1,962 seats on two levels, the lower level stalls and upper level circle. No seat is further than 30 m from the stage creating its unmistakable intimacy and the entire auditorium area is column free to provide an unrestricted view of the stage.

- The Teatro measures 7,700 m² with a 25 m wide by 13 m deep stage behind a 14 m wide by 8,5 m high stage or proscenium opening.
- A height adjustable sunken orchestra pit in front of the lower stage pit that can be dropped to house the orchestra, raised to an intermediate height to add two rows of seats to the auditorium when an orchestra is not required or extended to its full height to increase the stage area.
- An eight-storey fly tower over the stage incorporating a series of steel galleries and upper steel access grid for the comprehensive mechanical scenery bar system, with a capacity of 12 t hung off 55 individual scenery bars running off a pulley system.
- Three high-level steel bridges, a slatted forestage grid and side access bridges hung off the roof above the auditorium.

### Main auditorium transverse beam specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span</td>
<td>31.4 m</td>
</tr>
<tr>
<td>Beam width</td>
<td>1.200 mm</td>
</tr>
<tr>
<td>Beam depth</td>
<td>2,900 mm to 3,400 mm</td>
</tr>
<tr>
<td>Beam self-weight</td>
<td>360 t</td>
</tr>
<tr>
<td>Additional dead load</td>
<td>600 t</td>
</tr>
<tr>
<td>Maximum live load</td>
<td>280 t</td>
</tr>
<tr>
<td>Concrete strength</td>
<td>30 MPa</td>
</tr>
<tr>
<td>Aggregate size</td>
<td>13 mm (base) and 19 mm (remainder)</td>
</tr>
<tr>
<td>Reinforcement yield strength</td>
<td>450 MPa</td>
</tr>
<tr>
<td>Reinforcement weight</td>
<td>21.4 t</td>
</tr>
<tr>
<td>Total length of 40 diameter bars</td>
<td>1,230 km with 76 full-strength couplers</td>
</tr>
<tr>
<td>Total final displacement</td>
<td>50 mm</td>
</tr>
</tbody>
</table>

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for lighting and sound installations with a total load capacity of over 40 t
■ A solid concrete roof to assist acoustic insulation of the theatre from external noises, including the famous Johannesburg thunderstorms
■ Front of house facilities including entrance foyer, two bars, toilets and VIP function rooms
■ Back of house facilities including 18 dressing rooms, Green room, offices, multifunction rooms for wardrobes, physiotherapists and technical teams
In order to accommodate these requirements the structure of the theatre was developed under constant coordination with the 20-plus specialists and consultants on the project. The final structural system incorporated the following:
■ Foundations were cast in situ auger piles ranging in diameter from 450 mm to 1 200 mm and with an average depth of 9.5 m
■ A lower-level reinforced concrete frame with sealed basement areas for the various service and stage pits
■ A five-storey teardrop shaped auditorium and front of house incorporating a RC frame up to roof level. To provide a column-free area the upper circle level is formed by precast seating panels, individually curved, supported on five radial beams cantilevering over 8.0 m off the main transverse beam, which in turn spans the full width of the auditorium over the lower stalls seats. The 140 mm thick concrete auditorium roof on steel decking is supported by the steel roof structure consisted of I beam purlins and six trusses spanning between 22 m and 32 m over the auditorium. Hung off the purlins and trusses are the three curved lighting bridges, side access bridges, forestage grid and ceiling panels, all constructed out of structural steelwork to provide the necessary lines of sight for spot lights and hanging capacity for sound and special effects equipment
■ The sprung timber stage floor is supported by a grillage of steel beams over the stage pit, all fully demountable to allow various stage opening configurations as and when required by future production teams. The stage floor has a capacity of 750 kg/m² imposed live load
■ Above the stage is the eight-storey fly tower structure, surrounded by the various back of house facilities. The comprehensive mechanical scenery pulley system designed and supplied by specialists in the UK is accessed and supported off a series of steel galleries and the upper grid. There are three counterweight galleries to stage right, two clearing galleries to stage left and one rear cross over gallery, all accessed by a network of cat ladders. The galleries hang off the upper steel grid covering the full stage area. The grid is constructed out of a series of channel sections creating a slatted floor allowing the numerous pulley lines for the scenery bars to penetrate the grid floor and connect to the high level pulleys bolted to soffit of the roof plate girders. The six 1 012 x 250 x 125 kg/m roof plate girders span 14 m across the fly tower supporting the galleries, upper grid, scenery pulleys and the 140 mm thick concrete roof above
As with all such developments, the structural design was carried out according to a tight construction program and within a closely monitored budget, yet this unique building was completed on time and within budget allowing the grand opening production of The Lion King. WSP Structures Africa is proud to have been involved in the development of all phases of Montecasino, in particular the Teatro, which is sure to play host to the best productions the world and South Africa can offer.
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Sustainability

Less columns = More space

Cobiax flat slab

Conventional flat slab

Department of Social Dev.
Bethlehem

Diamond Pavilion Centre
Kimberley

Mr Price Home
Bloemfontein
SINCE PAST PRESIDENT NELSON Mandela opened the ICC Durban in August 1997, the International Convention Centre in Durban has been the venue for over 125 international conferences with 160 000 delegates.

The centre has been voted by World Travel Awards as 'Africa’s Leading Conference Centre' for five consecutive years. In addition, the ICC has been ranked as one of the top ten conference centres in the world.

In keeping with international trends and the demand for larger conference facilities, the ICC embarked on an expansion project at the beginning of 2004. Apart from providing more space, the construction of the new world-class ICC Arena was required to be a major drawcard for the centre and the city.

With a covered area of 32 000 m² at one level, and a further 12 000 m² of open area, the Arena is the only venue in the country which is able to accommodate events for more than 10 000 people.

Like the existing ICC, the new indoor Arena boasts flexible space, providing 6 000 additional raked seats for concerts and sporting events. State-of-the-art technology was employed to allow the ICC to compete on a worldwide basis with facilities of this kind, as the new Arena gives Durban the expanded ability to host a range of international events.

Not only does the Arena make the ICC the biggest conference facility in the country, it impacted positively on the community. During the construction phase, contractors employed and trained previously disadvantaged staff to provide them with new opportunities.

The design of the Arena roof structure was controlled principally by service ability requirement – the most demanding being, together with the coincident support of exhibition and service loads, some 250 m or 300 t of movable operable walls suspended from it, with limiting deflection. Furthermore, owing to previously installed foundations for a previous structural support system, only eight support points were available for the Arena section of the roof system. These basic parameters demanded innovative and cost-effective solutions in the design stage.

The sheer magnitude of the main roof supporting elements dictated a site bolted
assembly method of erection. The sequencing and control on a restricted site was excellently executed.

It is considered that the structural steel supporting systems to the Arena roof, concourse roof, and window walls represent current international trends in steel construction and utilised state-of-the-art technology in their design and detailing.

The ICC Arena complex was officially opened in March 2007.

**DESIGN CONCEPT**

Extensive workshopping involving city officials, ICC management, stakeholders and professionals took place to identify the type of expansion to the existing ICC that would benefit the eThekwini region. A multipurpose flexible venue to accommodate both ICC and a variety of local and international events constructed over the existing ICC basement car park to the south was the result.

The architectural concept of a ‘box within a box; to identify the Arena as a unique venue with a differing external façade treatment to the existing ICC building gave rise to the dominant peripheral glass façade structure. The Arena raked tiered seating is positioned within the space, surrounded by the deep foyer and concourses.

The acoustic requirements played a significant role in the internal planning, requiring movable mass partitions to subdivide the Arena into optional separate venue areas. This became particularly significant in the design of the Arena roof, which supported the hanging operable walls.

The resulting building possesses an iconic quality.

**FOUNDATIONS**

Foundations and a basement garage had previously been constructed as an extension to the original ICC complex. The layout of the foundations was established by an efficient parking grid of 8,4 m by 7,8 m with appropriate capacities where the future extension over were anticipated. As was to be expected, a non-coincident loading pattern arose, which led to extensive underpinning and strengthening to the existing foundations.

The soils below the site comprises estuarine sands with clay layers and owing to the depth to the cretaceous rock at some 20 m, a friction pile solution was considered the most appropriate.

**REINFORCED CONCRETE FRAME**

The existing Arena floor had previously been constructed as part of the basement parking garage extension, as a post-tensioned slab with an imposed load allowance of 15 KPa, being adequate for the future floor use.

Extensive modification was required to the slab to accommodate the new configuration, however, requiring de-stressing and innovative epoxy dowling solutions.

The concrete frame constructed over this slab – which is essence provides the building stability up to the 12,5 m roof internal clearance level – utilises conventional in situ shuttered reinforced concrete work.
In South Africa, reinforced concrete frame and slab construction has a lower construction cost than structural steelwork and in this case the concrete tiered seating gave the additional benefits of providing mass for the acoustic containment of the Arena activity.

The option of using pre-cast concrete sections for the seating was investigated, but because of the construction time period available and potential interference from the roof erection, an in situ stepped seating form was chosen.

**STRUCTURAL STEELWORK COMPONENT**
The structural steelwork subcontract of some 2,000 t may be considered as three distinct sections.

**Upper roof to Arena**
Besides supporting the enclosing roof and cladding fabric of the building, the predominant loadings arose from the technical requirement and the internal arena section.

The challenge to support these substantial loads over long spans without compromising the service ability of the building was further focused by the limiting support points available.

An orthogonal system of deep structural steel lattice girders and trusses were provided for this section.

From the onset of the design, the buildability of the complex roof system within a cost-effective constraint was considered. A three-dimensional electronic model of the structure was developed and extensively used in the construction planning stage. Close liaison between the designer, shop-detaileer, fabricator and erector was an ongoing process until completion. This process was driven by the principal building contractor, being integrated into the overall demanding project construction programme, the concrete support work and roof cladding overlapping the steel erection time.

The design of the Arena roof structure was controlled principally by a serviceability requirement, the most demanding being together with coincident support of exhibition and service loads some 250 m or 300 t of moveable operable walls suspended from it, with limiting deflection. Furthermore, due to previously installed foundations for a previous structural support system, only eight support points were available for the Arena section of the roof system. These basic parameters demanded innovative and cost-effective solutions at the design stage.

The components are considerably of greater size and magnitude than normally encountered in structural steel roofs and special consideration was required in the design to allow for practical delivery, assembly and erection. The two main roof lattice girders – for example over the Arena area – are 78 m long, more than 8.0 m deep and weigh up to 100 t. This dictated a site-bolted assembly method of erection.

**Concourse and foyer roofs**
This level links into the existing ICC building to the north and forms the basic roof structure to the foyer and east and west concourse areas.

The roof supports the peripheral services to the Arena and in effect encloses the building to the structural steel framed peripheral window wall.

An orthogonal system of lattice trusses and plate girders spanning between the upper roof girders and the window wall were provided for this section.

**Glass façades**
The Arena and Concourse areas are in effect enclosed in glass to provide a visual link between the internal and external spaces.

Conventional profiled hot-rolled steel sections are featured, together with the varying glass surface planes, as the external façade of the building.

This component required extensive façade engineering input.

**CLOSING REMARKS**
The structural supporting systems to the roof, upper level cladding and window walls are considered to be cost effective considering the extent and magnitude of the imposed loading combinations. They represent current international trends in steel construction and utilised state-of-the-art technology in their design.

The final configuration evolved from a detailed consideration of the ‘buildability’ as a result of the large component sizes and tight construction programme. This required innovative structural solutions and a close working relationship between the consultant and contractor.

The challenge of integrating the aesthetics of the new Arena, being a southward extension of the original award-winning building, was met by extending the roof form but continuing the external façade as a transparent glass window wall under. This achieves a relationship with the interior public spaces of the Arena and the external environment when compared to the enclosed form of the existing secure Convention Centre Building.

The project met the client’s brief of providing a world-class amenity, comprising a flexible indoor Arena that caters for a wide range of events for the community of eThekwini.
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The case for the Eurocodes for South Africa

The future direction of South African structural design standards is now the subject of intense debate (and speculation) in South Africa, following the recent introduction of the Structural Eurocodes throughout all countries of the European Union, including the UK. This article attempts to clarify the issues which engineers are most concerned with and proposes a way forward.

THE BIGGEST DEVELOPMENT in codified structural design that the world has seen in recent times is probably the introduction of the Structural Eurocodes, which are now at various stages of implementation across the countries of the European Union and are set to replace the existing national standards. There are ten of these, covering basis of structural design; loadings on structures; design of concrete, steel, steel-concrete composite, timber, masonry and aluminium structures; geotechnical design; and seismic design.

WHY THE EUROCODES ARE RELEVANT TO SOUTH AFRICA

The Structural Eurocodes are considered to be the most technically advanced suite of structural engineering design codes in the world today. Many countries outside the EU have begun putting together measures and resources for the implementation of the Eurocodes, or the adaptation of their own national codes to take advantage of the technical benefits of the Eurocodes. These countries include Singapore, Malaysia, Hong Kong (now part of China, of course) and some Middle Eastern states, with China, Russia, India and Australia also giving the matter serious consideration.

South Africa cannot afford to be left behind in this, especially as a number of its structural design codes are based on the British Standards (BS), which will soon be replaced by the Eurocodes. In preparation for this shift in basis, and to remain internationally competitive, South African structural designers require to familiarise themselves with the essential provisions of the Eurocodes.

An important point is that the Eurocodes have flexibility that allows us to accommodate any aspects of our own national codes that we wish to retain (for example we may wish to prescribe our own factors of safety to suit our particular circumstances in South Africa, or to adopt certain parameters that are unique to the geographic and climatic conditions in South Africa), while operating within a fairly general framework provided by the Eurocodes.

GETTING INFORMED ON THE EUROCODES

Knowledge of the Eurocodes is clearly necessary for all South African structural engineers required to design any projects in accordance with the Eurocodes, or to check any designs for compliance with the requirements of the Eurocodes. This will increasingly become the case as local involvement on international projects increases, or as more South African firms bid for design work in EU countries.

A second reason why knowledge and familiarisation with the Eurocodes is necessary is in the context of the revision of our national standards. Even if it looks almost certain that our national standards will have to be aligned with the Eurocodes, the process of consultation with all stakeholders and constituencies cannot be bypassed, and it is important for key people to have sufficient prior knowledge of the Eurocodes in order to be in a position to make informed decisions on how we should proceed.

The University of Cape Town (UCT) has taken the initiative to begin informing as many structural engineers in South Africa as possible, through its programme of one-day courses on the Structural Eurocodes. The convener of this programme is the writer, who leads the Structural Engineering and Mechanics Group at UCT, and is also head of the
has already been done in South Africa to revise certain structural standards along the lines of the Eurocodes, but it appeared that there is no general framework yet for a proper switch to a Eurocode basis. It was also observed that there is no common national policy providing guidance on the usage of the Eurocodes, or on their incorporation into our national standards.

THE WAY FORWARD FOR SOUTH AFRICA

A possible set of steps for the evaluation and implementation of the Eurocodes in South Africa are outlined below:

- Trying to develop our own standards from scratch is obviously out of the question (we do not have the resources for this). We need to review the whole position of structural standards in South Africa with the view to adopting a Eurocode basis for these.
- The Eurocodes are a set of standards intended to be used in conjunction with each other. If we are going to align our national standards with the Eurocodes, it is necessary to have a similar structure for our standards, and a co-ordinated programme of revision of all the structural standards will be necessary.
- A National Eurocodes Committee (NEC) needs to be set up with the mandate to evaluate and make decisions on adopting the Eurocodes as a basis for all our structural and geotechnical standards. This committee would be the overall authority on the matter. It would establish a framework for revisions (including setting a timetable), oversee the revisions of the various standards, and co-ordinate these to ensure harmony.
- The membership of the NEC would be representative of all major stakeholders such as the Joint Structural Division, the Geotechnical Division, the Southern African Institute of Steel Construction, the Cement and Concrete Institute, the Timber Association, the Masonry Association, the Southern African Bureau of Standards, the University of Stellenbosch, the University of Pretoria and Wits University.
- Working groups would need to be appointed, to evaluate each Eurocode and its Parts, and make recommendations to the NEC on whether or not the Eurocode or the Part should be adopted. Furthermore, the WG will make recommendations on how much of the Eurocode or the Part can be adopted as it is, and what should be adapted to suit local conditions. Each Eurocode should have its own working group, and in the case of the larger Eurocodes (such as EC2 or EC3), separate working groups may be assigned to a part or cluster of parts.
- The actual work of revising current standards in line with the corresponding Eurocode parts, and drafting any required new standards, shall be undertaken by specialist technical committees, which will need to include at least some members of the original working group.
- A Co-ordinating Technical Committee (CTC) will co-ordinate the revisions of the various Eurocodes and their parts, to ensure harmony. The CTC will report to the NEC, and its membership should include some NEC members.

The above work will require considerable amounts of human resources and technical expertise. Substantial funding will be required. One of the key tasks of the NEC will be to approach industry and government (specifically the Department of Trade and Industry) with a proposal for the funding of this initiative. The strong argument is that the international competitiveness of South African structural engineering (construction and design services included) can only be significantly enhanced if the country shifts towards a Eurocode basis, something which strong economies elsewhere (Hong Kong, Singapore, Malaysia, etc) are already doing. It will also be the responsibility of the NEC to allocate funding and resources in the first instance to the working groups (evaluative phase), and later to the technical committees (coding writing phase).

THE ROLE OF THE JSD

The Joint Structural Division, as the body incorporating all structural engineering members of the South African Institution of Civil Engineering, must play a leading role in all this and initiate the whole process. The majority of the Eurocodes are of a structural nature and concern all structural engineers, so the JSD is the most legitimate body to take charge of this process. Specifically:
- The JSD should set up the NEC and invite representatives from all stakeholders as indicated above. Ideally,
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THE MILLIONAIRE

I nearly missed the acquisition of my Millionaire calculator. I had been offered the machine by the owner of an antique shop at R100 some twenty years ago. On my way to the shop I had thought of making a counter offer of R75, but when I opened the lid I changed my mind and wrote out a cheque for exactly R100,00. When the deal was done and I confessed to the dealer that I had thought of bargaining the price his response was that he had expected me to do so and then he would have had the privilege of showing me the door to his shop.

Swiss engineer Otto Steiger (1858–1923) invented the ‘Millionaire’ – the first commercially successful machine based on the principle of direct multiplication – and patented it in 1893. It was manufactured and marketed by the Hans Egli Company of Zurich, beginning in 1899. By the early 1900s, two thousand were in use, and the last of 4 655 ‘Millionaire’ machines was sold in 1935 – more than 129 per year. Compare this with the number of computers produced in a single year these days!

Its system of operation was unique among mechanical calculators from then on until replacement by electronic calculators some 70 years later. Whereas all other mechanical calculators were glorified adding machines – multiplying by 6 (say) required the turning of a crank 6 times for 6 successive additions – the Millionaire simply needs a single turn of a crank with a multiplier lever being set to a 6.

Shown in figure 1, it weighs in at some 20 kg and is therefore not something that one would carry around. My machine together with another in the Transport Museum are the only two that I know of in the country. Both had been used by the old SAR & H and judging from the wear shown on the operating surface, mine must have done stalwart service, probably in the surveying department where its 16-figure result would have been put to good use.

Figure 2 shows the operating surface of the machine. Key features are:

- The AMDS lever and the fact that the crank is always rotated clockwise
- The ‘successive multiplier’ lever, moved to the required multiplier figure for each turn of the crank
- The 16-digit Result ‘field’

THE THACHER SLIDE RULE

Engineers of my generation will generally have worked with (in old terms) a 12-inch slide rule. For field calculations a 6-inch unit sufficed. Tony Goldstein – a stickler for some greater accuracy – preferred an 18-inch version and the late Lou Collins used a spiral version (to which end I am not quite sure) which was equivalent to a 21-inch unit if straightened out. I was fortunate to add a ‘Thacher’ unit to my collection some years back. It was purportedly owned by a teacher in the Transkei, inherited by his quantity surveyor son who saw no use for it in the computer age.
Acquisition by KMG of 100% of Global Roofing Solutions for a cash consideration of R190 million.

KMG is a stockist, distributor and processor of carbon steel, stainless steel and aluminium.

GRS comprises metal roofing manufacturers Brownbuilt Metal Sections and H H Robertson.

The strategic acquisition represents a significant step in KMG’s strategy to build a substantial group in steel and related products, with a view to a JSE listing.

Although some 18 inches in readable length, it packs the power of a 32-footer. (Bear in mind, these machines were in use before decimalisation and their lengths are, perforce, still spoken of in imperial units.)

The different accuracies that could be obtained with units of different length can roughly be summarised as follows:

- **6 inch** Acceptable three-figure accuracy in the range of 1 to 2 and weak three-figure accuracy in the range of 2 to 10
- **12 inch** Good three-figure accuracy in the range of 1 to 2 and acceptable three-figure accuracy in the range of 2 to 10
- **18 inch** Marginally better than a 12 incher
- **21 inch** Good four-figure accuracy in the range of 1 to 2 and good three-figure accuracy in the range of 2 to 10
- **Thacher** Acceptable seven-figure accuracy in the range of 1 to 2 and good six-figure accuracy in the range of 2 to 10

The unit comprises an outer hollow cylinder on which are mounted 18 vanes inscribed in logarithmically divided markings. Inside this outer cylinder is a rotatable sliding cylinder similarly marked (but not vaned) (see figure 3).

Figure 4 shows one end of the unit with the inner cylinder slid out. Space does not permit of an explanation of the ‘workings’ of this instrument, as the manual takes four pages to discuss the philosophy of the instrument, six pages to describe it and six pages explaining the rules of multiplication and division. Thereafter a further 51 pages are devoted to examples including (nogal) the formulae for the calculation of the bending moments of a singles span beam with different loadings and end fixities. The third last page is devoted to a table of trigonometric functions while the last two pages provide decimal values of a pound from a ha’penny to 18 shillings, decimal values of a shilling in ha’penny increments and finally the decimal equivalents of a cwt in 1 lb increments. (No prizes offered for those of you who know what a ‘cwt’ and an ‘lb’ is – you’ll be giving your ages away …)
New loading code SANS 10160 to be published for comment by mid-year

THE REVISED SOUTH AFRICAN loading code, SANS 10160 (Draft) Basis of structural design and actions for buildings and industrial structures, has reached an advanced stage of development and will soon be published for review by the profession. This code will provide a suitable introduction to a new generation of codes of practice for design and construction in South Africa.

In 1998, the South African National Conference on Loading recommended that SABS 0160:1989 should be revised. A SAICE working group was subsequently set up for this purpose with representation from the Joint Structural Division, the Geotechnical Division, and the various structural material design codes. This group acts as a working group of StanSA committee SC 5120.61M. Its brief was to act on the guidelines from the SANCL, namely that the revised loading code should:

- Comply with ISO standards, in particular ISO 2394 General principles on reliability for structures
- Be harmonised with international structural design practice
- Be compatible with current South African material design codes
- Be compatible with future South African material design codes derived from international standards
- Make provision for geotechnical design
- Maintain the scope of SABS 0160:1989

The revised SANS 10160 (Draft) consists of eight parts compiled into one code to be published as a single volume. Part 1 contains the basis of design and provides an extensive reliability framework. It includes provision for geotechnical actions, accidental actions and design assisted by testing. Three new parts are introduced – geotechnical actions on structures, thermal actions and actions during execution of construction works. The four remaining parts are updated versions of the current code dealing with self-weight and imposed loads, wind actions, seismic actions and actions induced by crane and stationary machinery. In accordance with the guidelines from the SANCL, SANS 10160 (Draft) is compatible with the present material design standards. More importantly, it provides the platform for the development of the next generation of South African material design standards or the adoption of international standards.

Eurocodes EN 1990 Basis of structural design, EN 1991 Actions on structures, EN 1997 Geotechnical design and EN 1998 Design provisions for earthquake resistance of structures were used as primary reference codes during the revision process. Compliance with ISO 2394 was achieved through the reference to EN 1990. While consistency is maintained with Eurocode 1990 and 1991, the limited scope of SANS 10160 (Draft) allowed for substantial simplifications. For example the complex array of options for load combination in Eurocode EN 1990 was reduced to one set of load combinations with appropriate load combination factors. Sufficient compatibility with EN1990 and EN 1991 is maintained to allow use of the Eurocodes for design situations beyond the scope of SANS 10160 (Draft).

It is envisaged that the revised SANS 10160 (Draft) will be published by Standards South Africa for comment from the profession in April 2008. This will be accompanied by the release of comprehensive background information in the form of scientific papers and a compilation of reports.

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THE JSD (Joint Structural Division) was established by an agreement between the Structural Division of SAICE, with some 600 members, and the UK-based Institution of Structural Engineers, with some 22,000 members worldwide in over 100 countries.

The IStructE has similar agreements in many other countries and initiated a branch in South Africa some 70 years ago, providing support to develop skills in South Africa. The IStructE celebrates its centenary this year and, as part of its centenary programme, the president, Sarah Buck, will be visiting South Africa in August.

South Africa now has two elected representatives on the IStructE Council, which provides us with an international perspective on the status of structural engineering.

Without doubt there is a worldwide trend to protect public safety. This has led to an increased awareness of the role of structural engineers in building and civil engineering structures. There is therefore a need to identify those so skilled, either by regulation, or professional membership, in their specific discipline practice areas.

This situation is becoming increasingly relevant in South Africa, in the light of our present shortage of skills. It is essential therefore that an evaluation system be set up to maintain and monitor both the local and imported proficiency levels of persons entering the structural engineering design field. At this stage in South Africa there is no statutory provision to register the separate discipline practice areas of engineering, as our system relies on professional ethics and a disciplinary body reacting to public complaint. There is a view that this system should be augmented by further definition, and the JSD is taking up the initiative on behalf of structural engineers.

This concern led to the JSD committee in 2006 to establish a website providing a peer reviewed list facility for those professional engineers and engineering technicians who wished to be identified as ‘Competent Structural Engineers’ (refer www.jsd.co.za).

Besides giving confidence to our client base, the identification of competent persons in structural engineering is essential when certification of the structural stability of buildings is required in terms of the National Building Regulations.

For an individual to be listed, a high benchmark has been set – either having passed the internationally rated IStructE Part 3 Corporate Membership exam, or a peer reviewed 7-10 year active experience period in structural engineering.

A concern was expressed that the entry level would exclude a ‘generalist’ civil engineer or engineering technologist from this specialised list and the JSD are exploring options to deal with this issue, particularly as far as certification of smaller structures is concerned.

The Engineering Council of South Africa (ECSA) has, in the meantime, defined the specific statutory category areas of practice in their Identification of Engineering Work document that covers Professional Engineers, Professional Engineering Technologists and Professional Certificated Engineers, and Professional Engineering Technicians. While being an excellent document in terms of categories of engineering work reserved for professionals, it is not practice area specific at this stage. Competence in any type of engineering activity, for example structural engineering, would still require self-certification. The document does, however, anticipate the development of codes of practice for practice areas. The JSD and the SAICE national governance structures are contributing to the process within ECSA to develop a code for structural engineering. This should be seen as distinct from a code of conduct which is already defined within the Act.

In due course, to stay within the present framework of the Engineering Professions Act, this code could become the structural engineering benchmark for the listing of competent structural engineers in South Africa and is aimed at maintaining and promoting quality and excellence, as well as recognition of our practice area within the civil engineering profession.

Likewise, a parallel process concerning the practice area of geotechnical engineering is being developed.
Some of the research projects on concrete materials and behaviour of structures at the Institute of Structural Engineering (ISE) in the Department of Civil Engineering at the University of Stellenbosch are reflected in projects performed in the final undergraduate academic year. Very often, these undergraduate research projects serve as initial investigations or as stimuli for research projects developed at postgraduate level.

The undergraduate research projects are performed during the final semester of the undergraduate curriculum over a period of 280 hours. The project must be of an investigative nature and reflects the ability of students to work independently.

During the final semester of 2007, projects addressed the following topics on concrete materials and design:

- Design of concrete water-retaining structures
- Modelling of deflections in concrete flat slab structures
- Seismic design of structures
- Wood-cement structural elements
- Slender reinforced concrete (RC) column with fixed foundations

These undergraduate projects serve as a probe for further, deeper investigations, as well as support for parallel MScEng and PhD projects. Such projects concluded in 2007 are:

- Experimental and computational characterisation of strain-hardening cement-based composites-concrete (SHCC-concrete) interfacial bond
- Mechanical and structural characterisation of extrusion moulded SHCC
- Time-dependent behaviour of SHCC

In the following paragraphs a short description is provided of the above subjects.

The South African Practice for the Design of Concrete Water-Retaining Structures

Designers of water-retaining structures in South Africa make use of the British design code BS8007:1987 to calculate crack widths. This code will in the very near future be superseded by the new set of Eurocodes, and specifically prEN 1992–3.

The main aim of a broader departmental project is the compilation of a South African design code for the design of water-retaining concrete structures, taking into account South African practice, materials and environment.

The first part of the undergraduate project covered information regarding typical South African conditions. This was gathered by means of interviews with designers, contractors and owners of water retaining structures.

The second part of the project provides a detailed comparison between the crack width calculation methods of both the British and European design codes. It was found that very good correlation exists between the different codes when the width is approximately 0.2 mm. For other crack widths, the correlation between the codes differs and increases as the target width moves away from 0.2 mm.

Modelling of Concrete Flat Slab Structures for Calculation of Deflections

The deflections of reinforced concrete flat slabs can be controlled in the design process by either of several methods.

One of the methods uses an equivalent stiffness in a finite element analysis of the slab by allowing for the cracked condition. This method, probably preferred by most designers apart from the simple length/depth checks, poses difficulties in defining the correct second moment of inertia for the various parts of the slab. Boundary conditions at the column support and the associated assumptions also play an important role. It was demonstrated that quite large discrepancies can be expected when the results of this method is compared to laboratory tests as performed by others.

Design of Structures for Seismic Loads

Earthquake loads need to be considered in the design of structures for certain regions of South Africa. The most common structural configuration for medium to high rise structures, is the use of reinforced concrete shear walls which are designed to resist the resulting lateral loads. The remainder of the structure is often designed as a flat slab system supporting gravity loads only.

When this approach is followed, it is found that the shear wall foundations can become excessively large to prevent foundation failure and subsequent ‘overturning’.

The first project investigated options for a structural system where the foundation size can be reduced. Options considered included the use of stiff ground beams between shear wall foundations and column foundations, and by making use of the capacity of the flat slab system to resist a part of the seismic load. In order for the flat slab to provide any resistance, it is however important that the necessary deflection capacity exists, that the increased punching shear can be resisted, and that second order moments due to lateral deforation of the structure do not become excessive.

The conclusion was that the option of considering the flat slab as part of the lateral load resisting system may, under specific conditions, be a method that merits further investigation.

In a separate study one of the clauses in the draft South African loading code SANS 10160 was evaluated. A redundancy parameter is used where the designer is ‘rewarded’ with a lower lateral design load for an increased length of structural shear wall.

This project studied a number of structural configurations including varying sizes and building heights. It was shown that the redundancy factor which is designed to ‘reward’ the designer for an increase in wall length, does not in all cases provide the designer with a more economical structural solution.

Wood-Cement Structural Elements for Infrastructure Products

Wood-cement boards are applied widely internationally in applications ranging...
from internal cladding/ceilings to structural application. These boards simply consist of wood particles, cement and water, often with low percentage of chemical additives for stabilisation and durability. They are formed under pressure in the fresh state and subsequently cured under circumstances depending on the particular product and use.

This research project focused on the type of wood and particle shape to produce boards of flexural strength (modulus of rupture) of the order of 10 MPa and stiffness (elastic modulus) 6 GPa. Methods were devised for producing wood particles of various sizes and shapes from locally available eucalyptus and pine. Simple processing and manufacturing methods were devised to prepare academic specimens for mechanical testing. Such methods hold promise but require further development for commercialisation. The parametric study of particle shape and size indicated trends which will be studied further for optimisation.

**SLENDER RC COLUMN WITH FIXED FOUNDATION MODELLING AND DESIGN**

Industrial structures with limited lateral stability are more frequently relying on foundations for support against overturning forces. Large footings are provided to fix the columns of these structures against translation and rotation at the base. The soil-concrete interface has a complex interaction that has a large influence on the behavior of the footing under critical loads.

Non-linear finite element analysis (FEA) was performed on a relevant industrial structural design to study this interaction accurately, using commercially available software. Nonlinear interaction between founding soil base concrete was incorporated via interfacial elements with Coulomb-friction and tensile cut-off ability, to allow separation and frictional interaction to be considered appropriately. A limited range in soil conditions was considered to limit the scope, but nevertheless considered appropriate for a wide range of applications.

The main focus was on the level of rotational rigidity within the design load range. Clear trends in nonlinear increase of base rotation were found for high lateral loads. Further research is required to verify and validate the computational results and subsequently devise simple modeling strategies for design purposes.

**EXPERIMENTAL AND COMPUTATIONAL CHARACTERISATION OF SHCC-CONCRETE INTERFACIAL BOND**

Fibre-reinforced strain-hardening cement-based composites (SHCC) hold promise for structural use and repair of structures of cement-based materials. These materials can be engineered to have tensile and compressive strengths in a range from moderate to high, but ductile behaviour in tension, shear and compression despite the initiation of cracks.

Of particular importance is the inherent crack control of these materials. In overlay repair or other composite application with for instance reinforced concrete (RC), the design process requires information about the interfacial interaction between SHCC en RC. In an MScEng research project, different substrate preparation methods, namely sandblasting, mechanical roughening and subsequent moistening were applied to RC specimens prepared in the laboratory. SHCC was subsequently cast on these substrates. Push-off, as well as direct tensile/debonding tests were performed to characterise the interfacial behaviour. Finite element analysis was subsequently performed, using commercial software, but using nonlinear constitutive laws for interfacial behaviour as well as SHCC developed at the ISE. Through inverse analysis the appropriate interfacial model parameters were characterised. This enables design of appropriate applications of SHCC in combination with RC.

**MECHANICAL AND STRUCTURAL CHARACTERISATION OF EXTRUSION MOULDED SHCC**

SHCC structural elements can be prepared by various processes, including casting, spraying and extrusion. For prefabrication, extrusion holds particular promise. In an MScEng project an extrusion process was designed and developed to academic level.

With the aid of the extruder, academic specimens of SHCC were prepared, both with and without reinforcing steel bars. By a range of direct tensile, compressive and flexural tests the mechanical behaviour of this extruded SHCC was characterised. Significant differences with normal cast SHCC were observed and their mechanisms investigated and described. Further research is required to exploit the characterised behaviour for structural design. Design models of appropriate level of reliability for tensile, flexure as well as shear, but also flexure and cracking of extruded SHCC and R/SHCC structural elements are in development.

**THE TIME-DEPENDENT BEHAVIOUR OF SHCC**

SHCC is a particular class of fibre-reinforced concrete (FRC) with particular characteristic its large tensile strain capacity of up to 5 % with full inherent crack control. This large strain capacity has lead to the nick name of ‘bendable concrete’. SHCC consists of cement and cement extenders, fine sand, water, workability admixtures and a relative low volume of fibres. PVA fibres with a diameter of 40 μm and a length of 12 mm are commonly used for SHCC.

In addition to design models for mechanical behaviour, the time-dependent behaviour of SHCC – that is, the effect of the loading rate, creep and shrinkage - must be understood and cast into sound design guidelines. In a PhD project this was studied by performing tests over a large scale range, ranging from single fibre pull-out to flexural testing of beams. A comprehensive finite element material model has also been developed that can predict the mechanical behaviour of SHCC. The prediction of the time-dependent behaviour has been initiated, but requires further research, development and implementation.

The project found that the time-dependent behaviour of SHCC is significantly different to ordinary concrete, due to the fibre-matrix interaction. Fibre slip during sustained loading was found to be the primary source of tensile creep of SHCC. Different mechanisms of time-dependent behaviour have been successfully identified for further investigation and quantification.

**ACKNOWLEDGEMENT**

Research at the ISE is supported financially, but also by direct participation by the following members of the South African civil engineering industry are acknowledged: Africon Engineering International, BKS, the Cement and Concrete Institute, Element Consulting Engineers, Grinaker-LTA Civil Engineering, Holcim (Afrisam), Infraset Infrastructure Products and AfriTechnologies. Their support as well as the supplementary funding by the Department of Trade and Industry through the initiative Technology and Human Resources for Industry Programme (THRIP) under project SAPERCS is gratefully acknowledged.

J A Wium, G P A G van Zijl and W P Boshoff
SPECIALISTS IN EROSION CONTROL, RETAINING STRUCTURES & ROCKFALL PROTECTION
In an industry whose lifeblood is innovation, Franki stands out head and shoulders above the rest in terms of not only its willingness to try new ideas, but also its unparalleled success in their implementation.

The most recent envelope push for Franki is the use of the full displacement screw-type pile on the King Shaka International Airport project at La Mercy just north of Durban.

According to Gavin Byrne, Franki technical director, Franki in Belgium developed the Atlas piling system some 25 years ago. The Atlas pile was the pioneer of the now numerous Screwpiling systems, but Franki at the time was unable to produce a piling machine that could manufacture the piles economically.

‘Unusually high torque is required to make this technique work and we have now found in the Bauer MBG24 the right technology at the right price. This rig produces 48 tonne meter torque through a unique hydraulic motor and so far the results are exceeding our expectations,’ says Byrne.

Better known as the full displacement screw (FDS) pile, Byrne says its well-established track record in other parts of the world shows it to be a fast and economical piling methodology with no vibrations and limited noise levels.

He adds that the FDS has overcome many of the negative features of the continuous flight augur (CFA) piles.

While CFA piles, also known as auger cast piles, have become increasingly popular since their introduction some fifty years ago in North America, because of the high production rates that can be achieved with them and their excellent cost-efficiency, there is still room for improvement.

‘The success of the CFA method is universally acknowledged but a glance at the positive attributes of the FDS methodology shows that many of the shortfalls of the CFA can be overcome,’ says Byrne.

The positive features of the FDS method are:

- High production levels attainable in suitable soil conditions
- The soil displacement technology delivers good pile performance at significantly shallower depths to CFA and bored piles
- The system is vibrationless
- Noise levels are low and limited to the engine noise of the piling rigs
- The pile shaft can be reinforced over its full length using a variation to the normal installation methodology
- Pile load capacity can be ensured on each pile by monitoring the installation energy
- No soil removal is required with the soil displacement technology

INSTALLATION TECHNIQUE

As already mentioned, the piling rig used to install FDS piles has a high torque rotation head (up to 50 tonne metres), a crowd and removal capability for the hollow stem screw pile flight.

The displacement auger tool is carefully designed to ensure full displacement during the downward pushing and rotation of the tool. The tool comprises...
a lower tapered augured portion of the flight, a central displacement section and an upper auger section with reverse flighting.

The hollow stem of the flight is blocked off at the toe by means of a suitable plug prior to the flight being lowered onto the pile position. The piling rig mast is adjusted for verticality or rake. The flight is rotated and at the same time pushed to penetrate the soil and the rate of penetration, torque and crowd are fully recorded on the rig’s data-capturing system. The installation energy is calibrated against trial pile test data to ensure satisfactory pile load capacity during installation.

When the required installation energy and penetration depth has been achieved, concrete is pumped through the hollow stem and the flight removed during concrete pumping process. The rate at the flight withdrawal is carefully monitored against the volume of concrete pumped thus ensuring satisfactory pile shaft integrity. Modern piling rigs provide this essential record, which is made available to all necessary parties.

The flight is rotated during the concreting and flight extraction process and the full length of penetrated pile shaft is concreted.

Once the concreting operation has been completed, the rig moves away from the pile position and the head of the pile is cleaned up. The reinforcement cage is then lowered into the fluid concrete and vibrators attached to the cage can be used to ensure the required length of reinforced pile shaft.

The maximum depth to which the FDS pile can be installed is dependent on the size of the piling rig, rotary drive torque and the soil profile. A maximum depth of 25 m is achievable with Franki’s Bauer MBG24 piling rigs. The pile shaft working loads are limited by a maximum pile shaft stress of 8 MPa with regionally available.
aggregates. The piles uplift capacity is governed by the pile shaft length but will generally be 30% more than a bored pile in comparable soil and similar pile geometry.

**SCREWPILE INSTALLATION SEQUENCE**

Where the full pile shaft length must be reinforced and high durability in the form of well-controlled cover is required, the pile can be installed using a disposable tip to the auger tool. The reinforcement cage can be placed into the hollow auger stem down to the pile toe level before commencement of the pile concreting operations. A self-compacting high slump concrete is placed into the empty hollow stem and the auger flight is removed as outlined above on completion of the concreting operation. A diagrammatic illustration of the installation sequence is shown in figure 3.

**KING SHAKA AIRPORT**

Byrne says that he expects the FDS method to increase productivity on the King Shaka Airport project. ‘The soil conditions are ideal for the FDS method and with the very large number of piles required, I expect significant time-saving with our new rigs working in tandem with our more traditional ones.’

Franki brought the first piling rig onto the Airport site in October 2007 and the new airport is expected to be operational in late 2009 and will ultimately replace the existing airport south of Durban.

At peak production, Franki will have nine piling and pre-drill rigs on site to install approximately 2 500 piles. The terminal building will be founded on approximately 1 000 Franki Supers while the multi-storey parkade will rest on 750 Franki Heavies.

Work on this site first began in the late 1970s but was halted after the earthworks stage for political reasons. ‘Some 30 years later,’ says Franki project manager, Greg Hall, ‘all piles will be pre-drilled through the original engineered fills and founded in the horizon of soft rock and boulders overlying bedrock.’

Beyond 2009 there will be the Trade Zone to the north and west of the airport site of industrial properties and office parks. No doubt experience gained by Franki on the airport site will benefit future developers of these adjoining properties.

**CONCLUSION**

Franki, part of the listed ESOR group, has recently received widespread acclaim not only for its local work but also for several prestigious cross-border contracts.

Locally, apart from its innovative solutions on the King Shaka Airport project Franki has received high praise for its innovative design solutions and efficient implementation under difficult conditions at the new Central Terminal Building (CTB) and surrounding areas at O R Tambo International Airport as well as for its work on Gautrain.

Cross-border, Franki has shown exceptional skill at being able to work in Africa, one of the few companies in its field that has been able to do so. In fact, Franki has developed a reputation throughout sub-Saharan Africa and the Indian Ocean Islands for its excellent service and cost-effective geotechnical solutions.

‘Franki is extremely busy right now both here and abroad and expect the pace to continue. We are putting in place the infrastructure and personnel to cope with an ever-burgeoning order book,’ concludes Byrne.

| Table 1 | Displacement screw pile details |
| Nominal pile diameter | Working load (kN) | Minimum pile spacing (mm) | Typical reinforcement |
| 300 | 300–500 | 750 | 6Y12 |
| 400 | 700–900 | 1 000 | 6Y16 |
| 500 | 1 000–1 500 | 1 250 | 6Y20 |
| 600 | 1 600–2 000 | 1 500 | 8Y20 |
| 700 | 2 000–2 500 | 1 750 | 6Y25 |
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Driving himself hard has paid off handsomely for Eduard Vorster: bachelor’s degrees obtained magna cum laude, scholarships galore to cover undergraduate and postgraduate studies, and several noteworthy prizes and awards recognising his research excellence and accomplishments in the field of geotechnical engineering. What is the forceful energy that propels the 33 year old civil engineer towards achievement? To find out, Lorraine Fourie visited Eduard at the offices of Africon in Pretoria where he is Technical Director (Geotechnical Engineering) of the company’s Municipal Development Business Unit.

‘MY WIFE TELLS ME that I’m somewhat of a perfectionist, but I don’t think so. It’s just that I push myself very hard – and then I expect other people to perform to their maximum too,’ he says. ‘But this quality also has a downside, especially when you reach a point where the realities surrounding a situation force you to reconsider whether the amount of energy you have poured into the subject is worth the end result,’ he says pragmatically.

NOT GOOD ENOUGH JUST TO PASS
Performing to the best of their ability was key to Eduard and his brother Wim’s upbringing. ‘My father also instilled in us qualities such as well-considered opinion forming and expression, sound decision making, decisive action in advancing towards one’s goal, and respect for others’ viewpoints,’ he calls to mind.

Eduard’s early childhood days switched briefly from Bronberrik, Centurion, to Göttingen, Germany, when his theologian father continued his research at the university there in 1979. He streamlined the German he had picked up in kindergarten when he returned to that country in 1990 as a 16 year old foreign exchange student, and after matriculating he went back for a third time. ‘Of all things I worked as an au pair for a family in Gütersloh, northern Germany,’ he laughs. He still speaks German and says that in spite of his leaning towards the sciences, he easily picks up a basic knowledge of a foreign language when his work takes him to different countries.

In 1994 he enrolled at the University of Pretoria (UP) for the BEng (Civil) degree. ‘I tend to immerse myself in the task at hand, but I enjoyed university life in its entirety,’ he says. ‘I make friends quite easily and although I’m not a very good sportsman I played social rugby and golf. So I like to think of myself as a rounded person.’

An Africon scholarship funded most of his undergraduate studies in full and Eduard didn’t disappoint his sponsors. In the run-up to graduating magna cum laude, he collected UP academic honorary colours, a UP Department of Civil Engineering silver medal, and SAICE’s Barry van Wyk Award for the best final-year project in geotechnical engineering in 1997.
The following year he started working at Africon and was employed on various projects, large and small. ‘I had my christening as a geotechnical engineer during a spell of almost two years on the upgrading and partial rebuilding of the N3 toll road between Heidelberg and Cedara. To be exposed, without interruption, for a considerable period of time to the modus operandi of a group of consultants operating within a consortium was an invaluable experience,’ says Eduard.

He was subsequently seconded to Africon’s transportation division, where geotechnics remained an important sub-field of focus. ‘In transportation I became involved with project management and I learnt a lot on the contractual side, which was very necessary for my professional development. So in a sense it was a good break.’ As part of the independent engineer’s team working on the Platinum toll highway north of Pretoria in 2002, Eduard coordinated the efforts of Africon’s specialists in advising on the designs of the concessionnaire, Bakwena Platinum Corridor Consortium.

In 2004 Eduard rejoined Africon’s geotechnical group where he furthered his experience in the geotechnical design of light and heavily loaded structures above ground, such as the Madinat Jumeirah Resort in Dubai. He also participated in the design, installation and interpretation of monitoring projects such as ground movements at the high embankments of the Kruger Mpumalanga International Airport at Nelspruit.

OFF TO CAMBRIDGE

By this time he had obtained his BEng (Hons) (Geotechnical Engineering) degree through part-time studies at UP. An Africon scholarship again covered full tuition, and again he graduated magna cum laude. While enrolled for master’s studies, he applied for two overseas scholarships: one granted under the Overseas Research Student (ORS) Awards Scheme for PhD studies at the University of Southampton, the other a Cambridge-MIT Institute (CMI) scholarship. Both his applications were successful and he had to decide which to accept.

‘The ORS award was designed to attract high-quality research students to universities in the United Kingdom, but it provided only partial funding, whereas the CMI scholarship included university and college fees. So from that point of view it wasn’t a difficult decision,’ Eduard says. ‘With my specialist field of interest being soil structure interaction, Cambridge, to me, was the academic hub of geotechnical engineering,’ he continues. ‘The close collaboration between the University of Cambridge and MIT’s department of engineering proved another plus.

Eduard and his wife, Lizelle, who were married in 1999, left for a three-year stay in Cambridge in October 2002. ‘If it wasn’t for her, Cambridge would probably not have been such a great success. She was my support system in more ways than one. She still maintains that I was a kept man, because, while I was studying, she was working as a radiographer at the National Health Service,’ he laughs.

‘Because of the CMI scholarship I didn’t complete my master’s studies at UP, but I was allowed to go straight into my PhD at Cambridge,’ he continues. The subject of his doctoral thesis was the complex interaction between underground pipelines and the surrounding soil during soft-ground tunnel construction. ‘This involved researching the effect of soft-ground tunnelling on existing buried pipelines through a combination of centrifuge modelling on the Cambridge beam centrifuge, numerical analyses and field testing,’ Eduard explains. His research improved existing knowledge of pipe-soil interaction during tunnelling by identifying interaction mechanisms, formulating the understanding of relative pipe-soil rigidity, and quantifying the effect of tunnelling on continuous and jointed pipeline behaviour. He subsequently published a number of papers on the subject, including a new design method for estimating pipeline forces when subjected to ground movement.

‘A big part of knowing what is happening during soil structure interaction is being able to monitor the process. In Cambridge I was fortunate to be involved with a group of people from the MIT side who had wide experience of the application of wireless and fibre optic sensor technologies in monitoring. Fibre optics, as such, is old technology, but in terms of civil engineering it was new, and for my PhD it had an immense implication,’ he says. ‘He had the opportunity to work, as part of a team of researchers, with London Underground, monitoring the effect of tunnelling for the Channel Tunnel RailLink (CTRL) project on a section of the existing Victoria Line. ‘We successfully installed and monitored wireless hydraulic pressure-based sensors
which enabled us to determine the effect the 8-m diameter tunnel, which formed part of the CTRL, had on the existing pre-cast concrete segment of the Victoria Line tunnel at Highbury and Islington station, as the new tunnel passed below the Victoria Line,’ he elaborates.

Seconded to Cambridge University Technical Services (CUTS), a university-affiliated consulting company, Eduard did some work for RWE Thames Water (TW), monitoring a pre-stressed concrete pipeline in Chingford, North London. ‘This was an outcome of the CTRL project, resulting from the successful results we reported to the chief engineer of London Underground. On the TW project we used combined novel BOTDR fibre optics and conventional settlement rod monitoring systems to monitor a sensitive 1 m diameter, 6 bar pre-stressed concrete (PSC) water main affected by pipe jacking. It was the first time that the structural response of jointed water mains was measured by means of combined sensor systems and modelled by means of centrifuge experiments,’ he adds with satisfaction.

**TANGIBLE REWARDS**

The keen application of his investigative mind brought tangible rewards. Having had his PhD in Engineering (Geotechnical) conferred at the end of 2005, he was also awarded the University of Cambridge’s Turner Prize for research excellence in the use of the Cambridge geotechnical beam centrifuge.

On the Vorsters’ return to South Africa, Eduard resumed work at Africon. ‘The company probably gave me the longest unpaid leave that anybody could wish for,’ he says. He was made an associate of the firm in January 2006 and became technical director (geotechnical engineering) shortly after. In that year he also received SAICE’s Jennings Award for the best paper in geotechnical engineering for co-authoring ‘Estimating the effects of tunnelling on existing pipelines’.

Since then, much of his time has been devoted to the geotechnical investigation and design of the Gautrain Rapid Rail Link where it traverses dolomitic ground in Centurion. Eduard is discipline leader, geotechnical engineering, for Africon’s design team on Gautrain. ‘This project is particularly challenging as we have to find solutions to founding the railway line and bridges on highly variable soil, water table and rock head conditions. The project will surely be remembered as one of the watershed projects for South African civil engineering. Not only is it an important step towards bringing public transport in South Africa to a world-class standard, but it forces South African civil engineers to apply their minds to solving complex engineering problems such as infrastructure development on difficult dolomitic ground conditions in areas which many previously perceived to be “undevelopable”. Innovative practices include the use of novel investigation methods, full-scale testing, inventive founding solutions, and monitoring to ensure that any geotechnical risks to the railway line are minimised,’ he says.

Recognition for his work kept coming in. In 2007 he travelled to Brussels to receive the Jacques Verdeyen Prize for soil mechanics for the period 2002 to 2006, sponsored by the Belgian Bureau de Contrôle Technique pour la Construction (Office of Control for Construction Techniques) and presented by the Technical Council of SECO, a body which strives to develop practical knowledge that can be applied in the technical control of construction activities in Belgium and other parts of Europe. He was awarded the prize for his PhD research work, which contributed most to SECO’s objectives, namely design, monitoring and execution of construction activities. ‘To me it’s a coveted prize because SECO is such a practical-oriented society,’ Eduard says.

‘Such acknowledgements make me feel as if all the hard work has been worthwhile. In a way one feeds on these successes to go forward. If you can’t achieve these highs, you might stagnate.’

It’s hard to imagine that Eduard will ever allow himself to stagnate.
Meeting the infrastructure challenge

FOLLOWING THE CURRENT ELECTRICITY supply crisis, media attention has turned to questioning the sustainability of South African water and other essential infrastructure systems. The civil engineering profession is now in the limelight as the country turns to those with the knowledge and skills necessary to answer and provide solutions to these questions.

Graham Pirie, the SA Association of Consulting Engineers’ (SAACE) chief executive, recently said that without trying to underplay the severity of the Eskom crisis, perhaps it was time ‘we had the wake-up call, because it makes us think in new dimensions’. Political decision-makers are now beginning to understand and act upon these critical issues.

The FIFA World Cup and the capex (capital expenditure) programmes of Transnet and Eskom in particular have placed huge demand on the infrastructure industry to grow, but without the necessary skills and expertise this simply cannot happen. Much political attention has been given to South Africa’s critical and scarce skills shortages. Felix Fongoqa, SAACE’s president, supports the view that the skills shortage is the biggest issue that might limit the industry’s ability to refurbish, maintain and develop infrastructure.

Whilst numerous government programmes have been set up to increase numbers in FET colleges and to encourage learners to enter higher education, it is the strategic alliances between educational institutions and industry that have been identified as the means of addressing higher education’s role in economic development.

Partnerships between higher education institutions and industry provide the basis for effectively addressing the skills shortage crisis precisely because education and industry are mutually dependent.

Partnership initiatives serve to enthuse and enlighten learners in various subjects and provide the first contact between an industry and its future. Much emphasis has been placed on the importance of mathematics and science at school level and the urgency for learners to become engineers, technologists and technicians in the various scarce skills. Research has shown that it is often the exposure to the exciting application of these subjects at an early stage that motivates a learner to persist in subjects which they might otherwise have dropped.

It was for this reason that SAACE first introduced the Young Professionals Forum (YPF) in 2005. The YPF was formed in order to promote the built environment profession, to identify problems which the industry may be facing and to train and develop young professionals. Since its inception the YPF has provided an effective platform for networking opportunities and has gone some way towards bridging the gap between industry and education.

Internships, bursaries, award programmes and competitions are often the means by which industry and education are able to synergise effectively. Knowledge Base, the developers of civil infrastructure design software programs Civil Designer and AllyCAD, have seen the benefits of these programmes through their involvement with various educational institutions. ‘We have always invested in the emerging generation of engineers by supporting the award programmes at the various universities of technology. It’s rewarding to see students successfully handle realistic projects that encompass all the day to day challenges of the civil engineering profession. These range from problem solving to design presentation thereby ensuring the relevance of engineering curricula,’ explains Knowledge Base CEO Vincent Bester.

Knowledge Base has also recently partnered with SAICE to host our annual Schools Water Competition. The competition was introduced in 2003 as part of Rand Water and SAICE’s centenary celebrations. It has demonstrated Rand Water and SAICE’s commitment to the upliftment of the South African society by stimulating interest in the engineering profession and the study of mathematics and science amongst senior high school learners. It also serves to create an awareness of the complexities of providing water and the importance of the issues surrounding water and infrastructure development and maintenance.

Internships, bursaries, award programmes and competitions go some way towards bridging the education and industry sectors and provide a solution to the skills shortage challenge. The extent to which these initiatives begin to make an impact on our nation’s skills resources will however depend on the extent to which both sectors really begin to invest in such programmes. Young engineers are the solution to the country’s infrastructure challenge but the effectiveness of this solution depends on the industry and education partnerships of today.
Towards developing a new terminology in Setswana

Simply finding out more about the word ‘consulting engineer’ in Setswana influenced me to choose a career in engineering. My dream to become an engineer was realised when I completed my university studies.

This goes to show how important it is to be taught in your mother tongue, although a lot of terms do not have Setswana equivalents yet. It is imperative that we should start developing a Setswana terminology for these terms.

I will give you two more examples to illustrate my point. First, in our country we have universities that offer engineering courses in Afrikaans. Some graduates from those universities speak English more fluently than any of those who regard English as their mother tongue. Second, it took long for us Batswana to understand Aids until a Setswana word was found for it. People began to understand Aids better after it came to be called ‘Sephamo’ in Setswana. (‘Sephamo’ would literally mean ‘something that takes your life away’.)

Let us all promote the language Setswana and begin to use it in fields such as science. I will give the example: How about calling the periodic table the ‘tafole ya ditlhaka’ (literally, the ‘letters table’)?!
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IN BRIEF

STEEL INDUSTRY BUOYANT DESPITE ECONOMIC LULL

UNTIL RECENTLY THE BOOM in South African construction industry, thanks to developments for FIFA World Cup 2010 and other government infrastructural projects, has helped to drive higher prices and volume for the steel industry – despite the general lull in the economy. However, the recent blackouts and impending electricity rationing could have a negative effect on supply in the coming months.

Hennie Bothma, Trade Credit and Political Risk Business Unit Head for Aon South Africa, says that in addition to the 2010 developments, increases have been as a result of the good results in the mining sector as a result of high commodity prices.

‘The majority of companies in the construction and manufacturing industries are now purchasing their materials from local steel companies,’ says Bothma. ‘However, because of the general price increases, we could see more companies starting to import steel from other countries – a trend which will probably continue if local supply is negatively affected by South Africa’s current electricity crisis. Importing steel to overcome the lack of supply is not an ideal answer, because there is an eight to twelve week lead time for delivery – so we predict production will still be negatively affected. Costs of imports will also increase due to the weakening of the rand.’

‘Unfortunately, there is not much that can be done at this stage – other than to warn clients that the supply of steel will be affected by the blackouts, and to work within the limits. However, it must be noted that all industries will be experiencing similar problems.’

Additionally, the steel industry could still suffer the fallout of the credit crunch in 2008. ‘The spike in interest rates across the wider economy means that steel users’ finances will inevitably be squeezed and potentially bring about an upward blip in insolvencies,’ says Bothma.

‘Suppliers are vulnerable on two fronts. On the one hand, increased demand is forcing suppliers to expand where they are facing interest rate hikes and restrained cash flow. On the other, they could run into problems with customers defaulting on payments as a result of unexpected insolvencies, especially among companies with high gearing.’

Bothma says the risk of insolvency is also heightened by the unbundling of parent companies, allowing subsidiaries, in some instances, to fail.

‘The credit crunch means it’s harder to access capital and could ultimately lead to increased bad debt in the steel industry. Credit insurers could respond by increasing premiums due to the risks of the wider economy or any bad claims history in this sector,’ says Bothma.

A further risk factor, specifically for the South African steel industry, is that smaller, less-established construction companies in the emerging market are winning more and more of the larger contracts, even though they have less experience and may not always have the capacity to complete the project. ‘This pushes up the risk levels of both the underwriters and the steel suppliers,’ says Bothma. ‘To combat this, steel suppliers should insist on more guarantees and ensure they thoroughly research the construction company’s capabilities.’

To protect your balance sheet and prevent the backlash from industry insolvencies, Aon recommends taking the following actions:

- Keep a tight sales ledger and monitor for evidence of overdue payments
- Commit more time and energy to collecting payments

SOUTH AFRICA’S ENERGY SOURCE AT A CROSSROADS

SOUTH AFRICANS NEED TO URGENTLY start generating their own electricity and take it out of the hands of one single utility. Rather than being reactive by purchasing an expensive generator, which costs a fortune in diesel, be proactive and invest in solar power systems which will ultimately save our businesses and South Africa’s economy billions in the future.

Generators run on oil-based fuel and further increases our dependency on a finite resource. It also exacerbates another potential problem which will occur when global oil production passes its production peak and goes into permanent decline. Liquid fuels are the next chapter of the energy crisis we can foresee.

We recently reached a devastatingly significant milestone when the price of oil reached US$100 a barrel, just under the inflation adjusted all time high of US$101.70. While there are many factors that may influence the price of oil, there are strong indications that we may have reached the peak of global oil production. As a result, our oil producing nations will be unable to meet or produce enough oil to meet the global growing demand.

Simon Ratcliffe, chairperson of the Association of the Study of Peak Oil South Africa (ASPO), who is studying the peaking of global oil production and the implications of this for South African society, will be highlighting these key concerns and discussing the impacts of the US$100 a barrel of oil and its impact on Africa and its oil industry at the 3rd Sub-Saharan Oil Africa 2008 oil, gas and petrochemical exhibition and conference, which will be taking place at the Cape Town International Conference Centre, on 17–19 March.

Over the course of the last century we have become increasingly dependent on oil in many aspects of our lives. Not only are our global and personal transport systems heavily reliant on oil, but so too is the production of food needed to feed a growing world population.

According to ASPO, the increasingly high prices we pay for our oil filters rapidly throughout our economy creating ever greater economic hardship as prices rise. It goes without saying that high oil prices impact heavily on the poor. However, as the price continues to rise, and as production starts to decline, the associated costs will begin to have a greater more penetrating impact on our society and will slowly move up the income ladder.

Likewise, it will move up the economic hierarchy of nations, as each country’s threshold of price tolerance is breached, leaving profound change in its wake. If we have passed the peak in global oil production, we can look forward to ever decreasing rates of production and therefore continually higher oil prices which will continue until there is sufficient demand destruction to cause it to flatten out in the energy available to do the things that we currently take for granted.

In an article recently published in BusinessDay, the effects of the oil decline on the economies of global players were highlighted. Ghana,
Senegal, Costa Rica and the Dominican Republic have all suffered severe blackouts as a result of a lack of fuel supplies. Sri Lanka, Zimbabwe and Nepal had critical fuel shortages hindering transportation and affecting food and medical supplies.

‘The poor are going to be hardest hit by this situation, as the oil price increases, so will interest rates, which in turn will affect transportation, food, property and energy sectors,’ says Ratcliffe.

Realising what the situation is, businesses and consumers alike should seriously start taking a look at alternative energy supplies. Consumers and businesses need to lessen their dependence on the use of oil and transform their lifestyles from energy hungry to a more conservative approach and to start considering the use of alternative energy supplies.

‘As a society we sit with two choices,’ says Ratcliffe. ‘One is to increase our dependency on oil, which is inevitably a dead-end approach and has no future. The alternative is to lessen our dependency on finite fossil resources, which will result in long-term sustainability.’

South Africa has an abundance of resources to offer. Ratcliffe suggests that Africans should start considering switching to solar power as the best alternative energy source due to the huge amount of sun we receive. There is an initial capital cost to installing solar power but thereafter the feedstock is free, abundant and can be used for both business and domestic use.

‘It is astounding that we are so clearly on a collision with the finiteness of our valuable resources and yet we are so badly prepared for the inevitable decline in oil production and all that it is going to bring. The manner in which we manage our way through the turbulent times ahead will shape the societies our children will inherit. In order to make a smooth transition to the world they will inhabit we need to be doing the serious groundwork today. Waiting for the crises to happen, is not an option,’ says Ratcliffe.

THE COST OF POWER OUTAGES TO SA AND THE WORLD

THAT UNCERTAIN ELECTRICITY supply in South Africa has the potential to damage our own economy is stating the obvious. Not so obvious, however, is the impact of South Africa’s interrupted power supply on the global economy.

Debbie Geraghty, head of Alexander Forbes Risk Services’ Metals and Minerals Division, says: ‘Eskom has announced that load shedding, up until now occurring in four to six hour periods, will for certain industries, be increased to between three and six weeks downtime per interruption. This has sobering implications for both the national and international economies.’

Explains Geraghty: ‘Most insurers have a cap or sub-limit, that is, the maximum amount that policy holders can claim under their business interruption cover. Furthermore, this sub-limit usually includes a time limitation.’

For example, businesses can generally only claim up to, and no more than, R250 million per interruption. This is also usually subject to a 30 day time limit. In other words insurers will provide a maximum of 30 days’ cover (per interruption) or R250 million, whichever is the lesser, she says.

Despite these limitations, if hundreds of South African mines were each to claim up to R250 million for business interruption caused by

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You’d be surprised
power outages, the impact on the local and international insurance markets would be profound.

Given that South African mining and industrial debt is re-insured globally, in this worst case scenario, the potential sums called upon to cover South African power-related loss could cause a global re-insurance shock.

Either way, the cost of re-insuring South African risk going forward is likely to increase – driving up the cost of investing in South Africa.

Global insurance concerns aside, the industrial impact of power shortages in South Africa pose further threats to the industrialised world.

Says Geraghty: ‘Smelters, or any kind of business that operates furnaces, can’t simply be switched off. If they are switched off, this needs to happen slowly over a number of days, ensuring that molten metal does not solidify in the furnace and destroy the whole plant. Similarly, once switched off, furnaces need weeks to be restarted as they heat up in several stages, slowly building up temperatures along with volumes. If things are instantly switched on again there is a high risk of explosion.’

The same applies to underground mines. If a mine is closed for three or six weeks, it is often very dangerous to re-enter and expensive to re-start.

Explains Geraghty: ‘While Eskom has provided most mines with sufficient electricity to keep pumps going, if this power were to fail mines would flood. Furthermore, mines abandoned for a number of weeks need to be made safe with additional supports to prevent collapses resulting in injury, damage, production interruption – and further claims.’

If one looks at other industries like shipping, says Geraghty, ‘power outages preventing efficient loading and unloading of vessels could cause extensive demurrage costs. If these were caused by deliberate power interruption, like load shedding, insurers would not make good the extra expenses incurred.’

Blackouts would also compromise the ability of South Africa’s rail system to deliver coal and other ores and minerals. If trains, which run on electricity, or mines stopped producing due to electricity failure, South Africa would run through its limited stockpiles of coal and other ores within weeks. Mines would lose sales and receiving smelters and other industries the world over experience supply shortages, rising input costs, production interruption, decreased sales, and reduced profits.’

Says Geraghty: ‘Ores and metals critical to certain economies, like coal to China, or chrome, palladium, platinum and gold to the entire industrialised world will be produced in smaller quantities, become harder to procure and more expensive.’

Increased costs will, ultimately, be passed on to consumers in South Africa and the world – driving inflation and disinvestment locally, while increasing production costs, prices and supply uncertainty globally.

And much of this cannot be covered by insurance. While most insurers will cover loss resulting from unplanned mechanical interruption, planned breakdowns, like load shedding, are generally not covered. Similarly if power failures are found to have been caused by an interruption in the fuel supply to power stations, any damage caused by the resulting power interruptions will not be covered by insurers.

Hence the importance of companies closely examining the details of their cover at a time like this cannot be over emphasised. Given that insurers look at the cause of any power failures that prompt a client to lodge a claim, industrial policy holders need to be 100% sure of what they are covered for. If not properly covered, policyholders should have the relevant clauses of their policies rewritten even though this may increase their premiums.

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### A GAP ANALYSIS OF WATER QUALITY TESTING LABORATORIES IN SOUTH AFRICA

A NATION-WIDE CALL IS GOING out to all laboratories engaged in water quality testing to participate in the compilation of a database which will provide potential clients with information of testing services in their areas.

The initiative is being spearheaded by the Water Research Commission (WRC) who has appointed a research team from Jeffreys & Green, Umgeni Water and the National Laboratory Association to undertake the investigation.

The WRC are seeking to implement an accepted and practical water quality testing standard for all laboratories in South Africa, thereby preventing the irregularities and occasional health risks currently experienced in water quality.

In order to produce such a standard, an investigation is being conducted into the existing conditions, problems and capacities of all water testing laboratories. A comprehensive picture of the current situation is vital as various issues have been reported as stumbling blocks to improving the quality of laboratory results and these need to be addressed.

The first step will be to undertake a survey of laboratories and gather information on expertise, accreditation status, geographic location, procedures and infrastructure.

A geographic information system (GIS) will be developed and will provide basic information such as laboratory name, location, contact details and the type of testing services provided. The WRC will make this information available to interested parties so that potential clients can find information relevant to a laboratory in their area.

The Department of Water Affairs and Forestry (DWAF) hopes to utilise the GIS to develop and maintain an up-to-date database on laboratories so as to provide information when requested, thus ensuring that this research remains current and relevant.

The results of the investigation will provide insight into the value of SANS 17025 accreditation and perhaps assist in the formulation of practical alternatives to validation and control through self-regulation within the laboratory fraternity. It is anticipated that, following the analysis of

![Laboratory technicians testing water samples](image)
the survey results, the research team will be better positioned to present information on the status of water quality testing challenges and basic training needs.

One of the greatest challenges for the project team is to build a comprehensive database of all laboratories that undertake water quality testing. The project team would like to encourage any laboratory that tests for water quality to contact them and be a part of this valuable exercise.

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B&KM COMPLETES CHALLENGING IRON ORE RAIL SIDING CONTRACT

LOCAL CIVIL ENGINEERING CONTRACTORS Botes & Kennedy Manyano (B&KM) has completed a challenging R12.7 million contract for the concrete structures required for a new iron ore export railway siding for the new Khumani Iron Ore Mine in the Northern Cape.

Morné van der Merwe, director of B&KM, says the project involved the construction of a rail-over-road bridge with post-tensioned, precast beams as well as all the other concrete structures including in-situ culverts, precast pipe and portal culverts on the siding. Work started on the Assmang contract in July last year and was completed in May this year.

Van der Merwe said the bridge is one of few in South Africa with the capacity to carry the individual loads of 120 t iron ore wagons, or full train loads of 41 000 t, over the R325 road to Dingleton onto the Sishen-Saldanha railway line.

‘These exceptionally heavy loads, and the long 20 m span of the bridge, called for a 1 m wide bottom flange for the beams as well as more reinforcing and cable sleeves for post-tensioning. B&KM had to get the required 50 MPa concrete fully compacted to all corners of the beams. This was achieved through a special concrete mix designed by Chryso SA, and a special Chryso admixture for self-compacting concrete.’

Suspended formwork allowed construction of the bridge deck and parapet walls to continue while the road was open to traffic.

SAFEGUARDING THE FUTURE

For over 60 years, CHRYSO has specialised in quality admixtures and additives for the building and construction industry. Respecting the environment, CHRYSO continually conceives and produces innovative and safe solutions for cement production, and the formulation of the most effective concrete for prestigious construction sites.
Hennie van Heerden, Chryso SA technical services manager, says the project called for self-compacting concrete because of the intricate shape of the structure and highly congested reinforcement at very narrow spacing. ‘The available local aggregates were not suitable for pouring the concrete and distributing it without vibration, or other means of consolidation. The admixture selected was Chryso’s proven Chrysoplast Optima 100, which is specially formulated to provide a concrete mix that is cohesive without being sticky. Optima 100 also extended concrete workability up to three hours, which was essential in view of the congested steel reinforcement, and the sweltering Northern Cape temperatures – prohibitive conditions for other admixtures,’ Van Heerden explains.

B&KM’s Van der Merwe said the admixture had played an invaluable role and achieved maximum concrete density into the one meter wide flanges at the bottom of the 1.36 m deep beams. Describing the other challenges involved in the project, van der Merwe said high temperatures, no running water and electricity were available on site which necessitated special temporary arrangements. ‘The bridge structure was entirely constructed on site, as well as the 11.3 m and 20 m precast post-tension beams. This was achieved with 70% local labour from Dingleton, Olifantshoek, Postmasburg, Kathu and Kuruman and the rest from other parts of the Northern Cape. All materials were locally sourced, except the bearings from Freyssinet Posten and VSL post-tensioning system from Tsala-RMS on site, under supervision from R&H Railway Consultants.’

Other challenges include the fact that rock was encountered to a level of 4 m below the base levels and that one of the 4 m deep excavations was within a metre of the Department of Water Affairs and Forestry (DWAF) regional water supply pipeline.

In addition, the abutment foundation of the bridge partially fouled the Gamagara DWAF main water pipeline which itself posed challenges to both contractor and consultant,’ stated Henk Bester, R&H Railway Consultants.

The scope of the contract was changed to include 794 m³ mass concrete and a new DWAF culvert constructed over, and under, the existing pressurised water pipeline next to the western abutment. To minimise the time delay of the scope change, BKM constructed the bridge piers, abutments and DWAF culvert simultaneously. The temporary bypass road was then removed to start earthworks and the installation of the precast beams. ‘Stop-go’ traffic controls were used during the day until the suspended cantilever scaffolding was in place to bring traffic back to normal under the bridge while earthworks, deck slab and parapet walls were completed, Bester added.

Concor Roads was the main contractor and handled all earthworks.

THE NEED FOR HUMANKIND to curb its profligate and toxic lifestyle becomes more urgent with each passing day.

Sustainable development is more than just another worthy cause and the more people who attune themselves living less wastefully, the better the prospects for nature and the environment.

Although most of us support the notion of sustainable development, as yet only a few have taken up the cudgels with genuine long-term commitment.

Concrete Manufacturers Association (CMA) member Cape Brick, a concrete brick manufacturer based in Cape Town, is one of the few. Located in Salt River, it manufactures what they call the ‘only truly environmentally friendly bricks’ in South Africa. It is claimed that their concrete masonry units hold the lowest embodied energy content of all the bricks manufactured in this country.

Embodied energy is defined as the energy consumed in the manufacture and transportation of construction materials. To manufacture a masonry product with a low embodied energy, raw materials need to be sourced as close to manufacturing plants as possible and contain a high percentage of recycled material. Energy consumption during the manufacturing process should also be low.

Often selected as the product of choice for green building by the leading experts on sustainable energy, Cape Brick’s recycled bricks are engineering grade, load-bearing and structural concrete masonry units and are approved by the CMA.

It was one of the first masonry manufacturers to use recycled aggregates, which it obtains from construction and demolition waste material. Waste material is recycled into crushed aggregate, which is used as the main ingredient in all the company’s products at a rate of 60 000 tonnes per year. For instance, its 14 MPa concrete plaster brick consists of 96% recycled materials and only 4% virgin cement.

As the use of recycled aggregates is crucial to lowering the embodied energy of masonry products, Cape Brick has teamed up with Bradis Demolition to ensure it has access to a reliable supply of demolition rubble. In addition to recycled crushed aggregate, its concrete bricks consist of a mixture of sand, stone, cement, and granulated correx slag, a waste by-product of the steel manufacturing industry. The use of slag in the concrete mix further reduces...
Recycled aggregate is produced in a crushing and sieving process, using reinforced concrete from demolished structures. After an initial crushing, materials such as reinforcing steel and other contaminants are removed. The remaining material is then sieved, filtered and re-crushed, yielding the original sand and stone that was used in the composition of the concrete.

The direct environmental benefits of green masonry are:
- Fewer virgin aggregates have to be quarried, reducing the impact on the environment.
- Most quarries are located far from their markets, and not using freshly quarried materials results in reduced transport requirements.
- 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 results in reduced transport requirements.
- Cape Brick’s own waste material is reprocessed and therefore does not have to be dumped, easing pressure on landfill sites and reducing transport requirements.

From manufacture to transport to construction, recycled material-based concrete masonry is modest in its energy needs and generous in its payback. No change in construction technique is required when specifying the product and it is also cost-effective. Not only does it help to promote sustainable building practice, but it realises cost savings in the process.

The use of recycled material also has a hugely beneficial effect on product quality. It is actually superior to that of quarried materials, available at a similar price, offering higher compressive strengths. The end product is a truly green building material, a recycled brick with a low embodied energy which is itself fully recyclable.

Concrete masonry has other sustainable development attributes. It is naturally thermally efficient and it assists in moderating ambient temperatures so that buildings retain warmth in winter and keep the heat at bay during summer, thereby lessening the need for artificial climate control and its concomitant energy requirements.

The secret of concrete masonry’s energy efficiency lies in its mass. The thermal mass of concrete acts as a buffer, absorbing the excesses of external temperatures as they move through a wall, making the insides of buildings more comfortable.
Two CMA members, Western Cape-based False Bay Bricks and Columbia DBL, recently gained NHBRC approval for a range of thermally efficient single-leaf hollow-core concrete blocks which can be used without plastering.

Rigorous testing by the South African Bureau of Standards (SABS) on these blocks demonstrates conclusively that they comfortably exceed the NHBRC’s thermal performance requirements for concrete masonry in single-leaf walls and then don’t require plastering for additional thermal insulation.

CMA director John Cairns says the 140 mm hollow core block is the most widely used masonry unit for low-cost and affordable housing in the country, and that prior to the SABS tests very little work had been done to establish a thermal properties standard.

‘It was mainly a concern about condensation, especially in the Western Cape, which prompted the NHBRC to call for the tests. Condensation causes mould growth which is unhealthy and the thermal properties of walling material is a factor which affects condensation. Based on the thermal model of a clay brick “standard house” the NHBRC recommended certain minimum thermal properties for hollow core blocks.

‘We were confident that the tests would prove satisfactory, as the SABS conducted a thermal test on our behalf in 2001. However, the NHBRC was concerned that units could vary over time or that units from different companies might not have the same properties. This is why they have stipulated that each manufacturer must submit its own product for testing,’ observed Cairns.

The thermal testing was conducted over a four-month period at the SABS laboratories in Pretoria. Blocks were measured against a thermal resistance R-Value m2.K/W and on this basis the required value was to be no less than 0,232 K/W. The 140 mm block comfortably met this standard – the equivalent of a 230 mm clay brick wall.

‘Although the thermal performance of the 140 mm block is almost equal to the 190 mm block, it presents several advantages. It is about 2 kg lighter and production output is approximately 50 % greater, which obviously results in cost savings. It is also easier to lay and it provides more floor space.

‘It is these factors which account for the popularity of the 140 mm block. The unit is very economical to manufacture and gives the best labour and layout efficiency.

‘The fact that a less expensive block has similar performance attributes and certain advantages over its larger sibling indicates that demand for the block is likely to strengthen, especially in the wake of these tests,’ says Cairns.

Other CMA manufacturers are currently in the process of analysing the physical characteristics of concrete blocks in order to ensure consistent thermal resistance values and comply with the NHBRC’s monitoring requirements.

JV APPOINTED TO DEVELOP UMHLATHUZE MULTI-PURPOSE SPORTS STADIUM FOR 2010

CONSULTING ENGINEERING and project management group SSI (a DHV company), as part of the Sifiso Sibisi Consortium and together with joint venture partners dgit architects, Glam Architects, SVP Quantity Surveyors and Visipro Project Managers, has been awarded a multi-million rand contract by the uThungulu District Municipality in KwaZulu-Natal to provide architectural and engineering services for the development of the 8 000-seat Umhlathuze Multi-purpose Sports Stadium at the Veld and Vlei Sports Complex in Richards Bay.

SSI’s Rodney Green says although Richards Bay has not been earmarked as an official FIFA match or training centre, the stadium is expected to be used as a base camp by national teams preparing for World Cup 2010.

‘There is currently no sports stadium of any significance in the greater Richards Bay/Umzumbe area and, apart from providing a training base for World Cup 2010 teams, the new stadium will meet a much needed requirement for a multi-purpose facility that can be used by a variety of local sporting codes for many years to come,’ he says.

The 36-month contract calls for the JV to provide design, engineering, construction supervision and overall project management services during the development of the stadium. SSI will provide the engineering services, comprising civil and structural engineering, electrical/electronic and mechanical building services.

‘The projects now under way in preparation for World Cup 2010 must leave two important legacies for South Africa,’ says Green. ‘The first comprises facilities and infrastructural elements that can be converted to serve local communities after the event - and the second is durable, flexible tourism structures. Skills transfer and the creation of new manufacturing facilities are also part and parcel of the sustainability philosophy.

‘The tremendous investment in finance, time, materials, technology and expertise called for by World Cup 2010 must continue to render benefits that will advance our nation for years into the future.’

SSI is involved in a variety of other World Cup 2010-related projects, including the Nelson Mandela Sports Stadium in Port Elizabeth and the Orlando Sports Stadium in Soweto, as well as road and planning in KwaZulu-Natal and Gauteng.

‘ALARMING’ MASONRY STANDARDS IN CLAMOUR TO PROFIT FROM 2010

THERE IS AN ALARMING LACK of knowledge about concrete quality standards among the increasing number of players entering the industry to profit from the 2010 FIFA World Cup, says Alan de Kock, MD of leading concrete testing laboratory Beton-Lab.

De Kock says the situation is the worst he has encountered in 30 years in the industry – and all too clearly shows the lack of skills in the construction sector in South Africa today.

‘The masonry sector, in particular, has been adversely affected when it comes to the selection of materials for the manufacture of masonry units. When you consider that the horrific quality we are referring to stems from material that, commendably, was at least brought to Beton-Lab for testing, the standard of some of the rest of the masonry units being produced out there at the moment, is truly alarming,’ he states.

De Kock believes that the demand-exceeding-supply situation that has spawned these fly-by-night masonry contractors could have severe consequences for South Africa. Long- or even medium-term durability will simply not be achieved by some of the materials now being included in the masonry mix. Some of the materials used as aggregates are simply not suitable for brick making.’
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He says it is essential that property owners, specifiers and developers now insist on proof of a recognised quality system being adhered to by suppliers of masonry products. ‘It is also essential for new masonry producers to attend suitable training courses, such as those offered by the Cement and Concrete Institute. Otherwise the rush to make maximum profits from 2010 could have serious repercussions.’

**ENERGY-EFFICIENT SEALING SYSTEM FOR PVC PIPES**

BY FAR THE MOST POPULAR jointing mechanism for municipal pipelines is by way of spigot and pipe-end socket which has made PVC the preferred material by consulting engineers, installation contractors and municipal end users.

The popularity of PVC pipes can be attributed to the many advantages offered by this sealing system: the ease with which pipelines can be installed at relatively low costs, allowance for angular deflection at joints, allowance for axial movements according to temperature and pressure changes, and allowance for ground movements.

Rieber is a generic name used to describe a steel-reinforced rubber seal that is incorporated in the pipe socket during manufacture, making the seal an integral part of the pipe. Being firmly fixed in the pipe socket ring groove, the steel reinforcing provides structural support and precompression of the rubber ring against the pipe wall, as shown below. The tight anchoring of the seal prevents the ingress of soil and other foreign particles into the sealing zones.

The Platinum Rieber seal is the newest generation to be marketed in South and Southern Africa, with special designs for pressure and non-pressure sewer and drainage pipes. The seals are manufactured by S&B Hultec in a facility with ISO 9001-2000 accreditation and are exported to more than 50 countries around the world.

For the pipe manufacturer the socket forming process used with Rieber seals means better and more consistent quality pipe joints, especially on the more problematic thicker wall, higher pressure classes of pipe. For the contractor this means improved quality of the installation, and for the consulting engineer, proven trouble-free performance long-term with no water leaks or water loss and more efficient use of energy.

The fact that a third or more of potable water is lost in many cities and towns in South Africa represents an incalculable loss of this precious resource as well as the energy used in pumping it. Thus modern integrated, steel reinforced pipe seals, guaranteeing no leaks long-term, are essential to water authorities and consumers.

The integrated Rieber sealing system has already established a reputation as the most reliable PVC pipe-jointing system in the world and is continuously increasing market share worldwide.

The Platinum seal is available in sizes from 50 mm to 1 200 mm. It meets the requirements of SANS/EN 681-1, SANS 966 Parts 1 and 2, SANS 791 and SANS 1601.

**PPC CEMENT USED TO DAM BERG RIVER**

PPC CEMENT SUPPLIED 43 500 tonnes of cement during the construction of South Africa’s first major concrete faced rock fill dam near Franschhoek in the Western Cape. Nearly 145 000 m³ of concrete was cast to complete the new Berg River Dam’s kilometre-long wall, intake tower and spillway.

The impoundment of the dam took place on 26 July 2007, with the dam filling to 50% within a record three and a half months. Owing to the lack of suitable terrain, it is unlikely that another dam of this size will be built in the Western Cape in the foreseeable future.

At a cost of R1,5 billion, the dam and accompanying infrastructure, designed to last a thousand years, has been one of the largest civil engineering projects in South Africa to date.

When full, the dam holds almost 130 million cubic metres of water, equivalent to 52 000 Olympic-sized swimming pools, making it the...
second largest dam in the region after the Theewaterskloof dam. With a depth of 65 m, it covers an area of 600 ha, or roughly 595 rugby fields, when filled to capacity.

The dam is a concrete-faced rockfill dam with around 3.3 million cubic metres of rockfill. The concrete face slab on the upstream side is 25 000 m². At its base the wall is roughly 200 m wide and narrows to 12 m wide at the top.

Cement for the dam was delivered in bulk tankers from PPC’s De Hoek factory, 140 km away.

CONCRETE RETAINING BLOCK WALL
SPECIFICATION AND BILL OF QUANTITIES
EXAMPLES NOW AVAILABLE ON AUTOSPEC

THE CONCRETE MANUFACTURERS ASSOCIATION (CMA) has announced that samples of a detailed standard specification document and a standard bill of quantities layout for concrete retaining block walls (CRB) are now available on AutoSpec, the web-based product specification tool for the construction industry.

CMA Director John Cairns says this should help specifiers prepare proper job specifications for CRB wall construction.
In many instances South African CRB wall contractors are being issued with job specifications which lack essential information and are quite inadequate, and the posting of sample specifications and bills of quantity documents on AutoSpec will help alleviate this situation.

There should be no excuse for the submission of inadequate CRB wall specifications, nor for the omission of drawings. All CRB wall specifications should be accompanied by a set of drawings showing heights, and all the other pertinent information.

In addition to AutoSpec, the CMA has published a CRB wall installation manual which includes a typical bill of quantities and covers all the requirements for constructing a CRB wall. The Association has also produced a film (available on CD) which provides step-by-step construction guidelines.

CRB wall specifiers should also refer to two SABS standards, SANS 207 for geofabric material used to stabilise CRB walls, and SANS 508:2007, a specification for retaining blocks. The latter is in its final draft form and should be approved during the first half of 2008,’ advises Cairns.

1 This is an excellent example of a CRB wall which has been properly specified and then constructed according to those specifications.

2 The unfortunate consequences of what can and does happen if a CRB wall is not properly specified are clearly demonstrated in this picture.

THE RELATIVELY RECENT TECHNOLOGY of self-compacting concrete (SCC) is the topic of a new book from Whittles Publishing.

Written by four of the key players in the field – Geert de Schutter, Peter Bartos, Peter Domone and John Gibbs – who have been instrumental in both the research and practice, Self-Compacting Concrete provides essential information on the subject from the materials, mixes and properties to testing, use in construction, durability and applications.

From its development in Japan and first significant applications in the early 1990s, SCC has rapidly been adopted worldwide in construction but it requires new techniques and understanding for successful implementation. This book explains that the new concept of SCC requires a re-evaluation of traditional material models and presents in detail, through a balanced mix of theory and practice, how and why fresh and hardened SCC behaves as it does.

Although some experience of traditional vibrated concrete (TVC) and an understanding of classical concrete technology is assumed, most of the chapters can easily be understood without a very detailed knowledge of cementitious materials. As such, the bulk of the book is accessible to all readers, from consulting engineers or practitioners involved in daily casting operations on-site to students desiring an introduction to modern, state-of-the-art concrete technology. For chapters dealing with, for example, hydration, microstructure or durability, some more advanced knowledge is required. However, the advanced parts of the book are presented such that they may be bypassed without impairing the reader’s understanding of the subject.

The breadth and depth of coverage means that Self-Compacting Concrete will be essential reading for many in the construction industry whether from the perspective of the site operator, the design engineer or the architect.

As stated in the foreword by Dr Åke Skarendahl, RILEM president from 2003 to 2006: ‘It is now very timely to gather the underlying knowledge and practical experience gained thus far to provide a guide for future work. Thus this book is welcome. The extensive experience of the authors in both research and practice ensures that this will be a valuable publication.’

INDISPENSABLE NEW BOOK FOR THE CONSTRUCTION INDUSTRY

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CLAY FACE BRICK HAS IT ALL!

THE GROWING CONCERN ABOUT environmental sustainability has led to research towards establishing the value that different building materials are adding to or detracting from the environment. Much research has been done on the contribution of clay brick in the context of the life-cycles of buildings.

Environmental sustainability and energy equation

An ecological lifecycle assessment conducted in Europe on clay brick wall construction in terms of global warming potential and primary energy input for various fuels and systems over a period of 90 years – the assessed lifecycle of clay brick buildings – found that the choice of energy for heating and cooling of buildings had a significant influence on the outcome of the assessment.

In South Africa, electricity is the primary energy source for heating and cooling of buildings and, given the predominant use of coal to generate electricity, CO₂ emissions are very high with a resultant notable degradation of the environment.

Reducing energy consumed over a building’s life is the key

Research on energy usage has concluded that over the life of a building material, roughly 5 % of energy is taken up in its manufacture. The other 95 % of energy is in the subsequent cost of heating and cooling and the magnitude of that heating and cooling is what has the greatest long-term impact on the environment.

While clay face brick produced in continuous kilns has low embodied energy and therefore less of an impact on the first 5 % than most other building materials, it is towards energy usage in the latter 95 % where clay brick has a major positive contribution to make, due to the material’s exceptional thermal qualities.

Clay bricks add value to the thermal performance of the building envelope, reducing energy for heating and cooling. Clay brick walls can reach U-values as low as 0,20 W/m²K.

The U-values of solid and cavity clay brick walls support heating and cooling reductions, providing for quality habitable space and low greenhouse emission.

Also, much of the value clay brick affords in reducing energy consumption over time comes from the material’s high thermal mass, or rather its ability to absorb heat energy.

Research in various countries has shown that the correct use of thermal mass can delay heat flow through the building envelope by as much as 8-10 hours – naturally moderating temperature changes – producing a warm house in winter and cool house in summer.

Heat which is absorbed and stored by materials with high thermal mass such as clay bricks is released at night when it is needed to offset heat losses from lower outdoor temperatures. Well-positioned internal brick walls in effect act like thermal batteries – slowly charging up with heat during the day and releasing the heat at night – at no cost!

Relative to low thermal mass materials, this greatly reduces energy usage for artificial heating and cooling over the life of the building, contributing positively to the reduction of greenhouse emissions.

The contribution of low maintenance to energy reduction

While thermal benefits of clay brick when translated into energy savings over the lifecycle are substantial, the maintenance saving provided by clay face brick and its contribution to the environment are as noteworthy.

The utility of clay face brick is unsurpassed. The typical lifecycle of buildings built with clay bricks is set at around 90 years.

The exceptional durability of the material circumvents the need for rendering and continuous painting (typically every four to seven years) over the life of a building, thereby reducing costs over time. No energy is consumed in producing finishing products required to clad and decorate, and greenhouse emissions are understandably reduced.
MULTI-DISCIPLINARY SERVICES FOR AFRICA

STEMELE BOSCH AFRICA (SBA) plays a crucial role in assisting local government authorities to meet service delivery obligations, by providing multi-disciplinary consulting engineering and project management services throughout Southern Africa and the African continent.

‘SBA offers effective solutions for water, sewage and waste management needs for millions of people in rural and urban areas and also has a significant roads capability up to national roads level,’ says Sid Turner, national operations director for SBA, part of the B & A Group. ‘The company is currently involved with the provision of essential engineering services for a number of residential developments throughout the country, including low cost housing, as well as industrial development projects.

‘With the challenges of skills shortages in the construction industry concurrent with the economic boom, we believe a structured approach to quality management is imperative for any professional service provider. The company’s ISO 9001/2000 certified internally recognised quality management system, which provides clients with the assurance of quality engineering and project management services, has been central to SBA’s sustained growth of nearly 30 % per annum over the last six years.’

SBA’s Port Elizabeth office is currently involved in prestigious projects that include civil, structural, mechanical and electrical engineering at the Nelson Mandela Bay Logistics Park in Port Elizabeth, where the Coega Development Corporation (CDC) is increasing warehousing and production facilities within the Coega IDZ.

The company has also been appointed to design bulk and internal services for the new Royal Palm Estates development in KwaZulu-Natal, just north of Durban. The brief includes all the water and irrigation reticulation planning, sewer outfall mains, internal services and earthworks.

Another significant project that impacts on developments on the North Coast of KwaZulu-Natal involves the civs, mechanical, electrical and instrumentation for the new Sheffield wastewater treatment works, near Ballito.

In East London, Buffalo City Municipality has appointed SBA’s local operation to plan, design and call for tenderers for the construction of necessary sewage infrastructure of the Mdantsane Bufferstrip housing development.

Another important project for SBA near East London is the construction of the Mbashe North Water Supply scheme. The first phase of this project – construction of the water treatment works on the banks of the Mgwali River – is nearing completion. The next phase, comprising the rising main was recently awarded.

‘This facility will initially treat 3,8 Mℓ/day and is expected to ultimately treat 7,6 Mℓ/day supplying potable water to some 35 000 people,’ says André Naudé, director of SBA’s East London office. ‘Local communities are benefiting from this project which is providing desperately needed employment in the area. New skills are being learned and transferred to the community. It is expected that in the 15 month construction period, a minimum of 5 000 man day jobs will have been created. This financial injection will impact positively on households in this poverty stricken area.’

SBA is also providing civil and electrical engineering services for the government’s current clinic revamping programme that will ensure communities in the former Transkei have access to healthcare facilities.

The company is also playing an important role in the Bridge City development in Durban – a joint venture between Tongaat Hulett Developments and eThekwini Municipality. This new destination for the Inanda, Ntuzuma, KwaMashu and Phoenix areas, is gathering momentum as the Phase 1 civils contract nears completion.

Bridge City will serve as a new town centre for the region and will include a subterranean Metro-rail station with associated inter-modal transfer facilities, a 40 000 m² shopping centre, a regional Magistrate’s Court and a 450-bed hospital, as well as residential apartments.

SBA is currently overseeing the completion of the Phase 1 infrastructure contract, which covers the main spine routes through the development, the re-modelling of the earthworks platforms and the installation of services to the initial stages of the development. The R40-million Phase 1 contract is expected to be complete early in 2008.
GEORGE ON THE WORLD CONSULTING MAP

SRK CONSULTING HAS ESTABLISHED a George office to further develop its activities in the Southern Cape. Apart from conducting numerous environmental impact assessments (EIAs) in the region, SRK has compiled strategic development frameworks and state of environment reports for local authorities and has an excellent understanding of local conditions.

‘We pride ourselves on being one of the most innovative consulting companies in South Africa. By opening a George office, we aim to provide Southern Cape clients with access to SRK’s wider resource base,’ says Chris Dalgliesh, a partner of SRK and Principal Environmental Management Consultant.

Tana Scott, an experienced environmental scientist, heads up the George office. Her consulting experience covers EIAs, environmental management and environmental site supervision. She is directly supported by colleagues in SRK’s offices in Cape Town and Port Elizabeth, who have a long history of working in the region.

SRK Consulting comprises over 700 employees worldwide, offering expertise in a wide range of disciplines.

---

FIVE THOUSAND IDEAS TO BUILD A SUSTAINABLE FUTURE

THE CHANGE FROM PNEUMATIC drilling to electrically powered Hilti rock face drills in many South African mines has created a demand for a safe electric cable that will in addition stand up to the rigorous underground conditions experienced in hard rock mines.

Aberdare Cables has introduced SafeEarth Copyright R cable, a low-voltage 16 mm² five-core mining cable comprising three phases, a neutral and a reduced 10 mm² earth conductor for use in underground applications where, for safety reasons, earth integrity is critical. SafeEarth is PVC insulated and bedded, SWA armoured and PVC sheathed, and manufactured to the SANS 1507-3 standard.

The voltage rating is 600/1000 and the core identifications are red, yellow and blue for the phases, black for the neutral and green/yellow for the earth. The one-second short circuit ratings for the three-phase conductors, the neutral conductor and the earth conductor, are 1,84 kA, 1,84 kA and 1,15 kA respectively. SafeEarth cable has a mass of approximately 1 660 kg/km and is supplied in 500 m lengths on wooden drums.

Louis Steyn, mining products manager at Aberdare Cables, says the presence of an earth conductor overcomes unreliable earthing problems associated with cable joints between gully electrical boxes and the rock face, and considerably improves safety in the stopes. The cable is also ideal for carrying electricity supplies to mine winches, which also require a reliable earth.

He adds that a significant order for SafeEarth has recently been received from a major platinum mining organisation, and that many more customers are expected to use this product when its safety advantages are realised.

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NEW LOW-VOLTAGE POWER CABLE FOR MINES

AFRICA ROADS 2008 will take place from 12 to 15 May at the Sandton Convention Centre in Johannesburg.

It will bring together a number of leading road experts from across the African continent to discuss new ideas, innovations and best practice techniques that can be used for the development, improvement and maintenance of Africa’s road networks. As well, it will provide delegates with an excellent forum to meet the best in the industry, form lasting relationships and do business.

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DIARY DATE

AT THE CLOSE OF ENTRIES on 29 February, 4 774 submissions were registered for the second US$2-million Holcim Awards for sustainable construction projects and visions.

The competition focuses the minds of students, architects, planners and engineers on creating innovative construction projects that truly champion sustainability and promotes innovative ideas and solutions round the globe.

The competition is run by the Swiss-based Holcim Foundation to promote ground-breaking projects already at an advanced stage of design, and encourage ‘blue sky; concepts from the next generation.

An Internet-based entry form was used for the competition in the five regional awards. Asia Pacific and Latin America each account for roughly 30 % of the submissions, followed by Europe (24 %), Africa Middle East and North America.

The countries where the projects are planned and concepts are proposed are not necessarily the origin of the authors, showing that sustainable construction is of truly international concern and is being promoted across borders and regions. Submissions were entered by authors from 90 countries for projects located in 121 countries.

The competitions will be evaluated by independent juries using a proven definition. The ‘target issues for sustainable construction’ serve to compare each submission and cover environmental impact, social responsibility, and economic performance as well as architectural and contextual quality and the contribution towards quantum change and transferability.

The results of the regional competitions will be announced in five ceremonies in late 2008 in Madrid, Montréal, Mexico City, Marrakech and New Delhi. Winners of the gold, silver and bronze awards from each geographic region are automatically qualified for the global Holcim Awards to be announced in 2009 following an additional in-depth evaluation by a jury comprised of international experts.
JOHN BOURNE LEFT a smaller im-
print on this country than was intended,
and his most lasting memorial is not in
the field of his chosen expertise.

The first railway line in the Cape
Colony was built from Cape Town to
Wellington by a private company, but
the government had underwritten the
construction and operating costs by
guaranteeing the shareholders a 6% re-
turn on their investment. The apparent
intention was to nationalise the line
once it was up and running, and in an-
ticipation of this the governor, Sir Philip
Wodehouse, appointed Bourne as the
Cape’s first Colonial Railway Engineer.

Bourne hailed from Lincolnshire
where he was born in 1816, and he
gained early engineering experi-
ence serving articles on the original
Liverpool to Manchester railway.
During this time he invented and pat-
tenated a wrought iron railway wheel,
which was in use for many years as the
‘Chamber’s Wheel’.

He then had a change of heart and
took holy orders, and was sent to take
charge of a parish in British Guiana.
However, he soon returned to engi-
neering and spent some time on railway
work in the United States. He returned
to Guiana and in 1854 was appointed
Superintendent of Public Works, and
was responsible for constructing the
railway to the sugar plantations at
Demerara. He obviously impressed the
local governor, Wodehouse, who in 1861
was promoted to succeed the hugely
popular Sir George Grey at the Cape.

Wodehouse lost little time in
sending for his competent colleague
Bourne, who arrived to take up the
newly created post of Colonial Railway
Engineer in 1863. However, he had little
to keep him occupied. The Wellington
line opened later in the year, but the
government – which was at loggerheads
with Wodehouse about other issues –
changed its mind about taking over the
railway and dallied about extending the
line to Worcester. Bourne investigated
the prospects for some other routes and
did some research on the suitability of
local timber for sleepers, but he had no
railway to administer. Eventually his
post was abolished and he returned to
the West Indies in 1867, where he served
in Barbados and Trinidad. He passed
away in office as Superintendent of
Works in Barbados in 1879.

While Bourne was at the Cape,
the British government decided to
erect lighthouses at Cape Point and on
Roman Rock, just off Simon’s Town. The
Board of Trade appointed Alexander
Gordon to design the structures.
Gordon was an engineer, but he was
also a scrap iron merchant who had
developed a system of building light-
house towers using prefabricated cast
iron rings. The success of the system
depended on a well-prepared, level base
to receive the rings – and the conditions
at Roman Rock made such preparation
far from perfect. Shortly after erection
the foundation rings cracked, and the
stability of the lighthouse was gravely
endangered. Various overseas experts
were consulted but could offer no solu-
tion, until someone suggested that John
Bourne was on hand with time to spare.

No doubt he was glad of something
to challenge his active mind, and he
proposed that a four metre high wall
of granite blocks, each weighing three
tons, should be built around the base
of the tower. Included in the work was
landing gantry, which made access to
the light a good deal easier. The out-
come, built under his direction, was a
complete success and the lighthouse
is still standing firmly some 140 years
later, with its ‘skirt’ clearly visible from
the shore (see photograph).

John Bourne should have been the
father of the South African Railways.
Instead his memorial is the doughty
little lighthouse which, despite the gales
and surging seas, is still operating be-
cause of his resourcefulness.

Tony Murray
THE DE SMIDT FAMILY have played a prominent role in public service in the Western Cape for several generations, and members of the clan have been involved in civil engineering up to present times.

The progenitor of the South African family, Abraham (1755–1809), came to the Cape as first officer on the Middelburg and was responsible for blowing up the ship when the Dutch fleet was trapped by the British in Saldanha Bay in 1781. He then settled at the Cape.

His son, Willem Anne Janssens de Smidt (1804–1855), became Assistant Colonial Secretary and was secretary to the Central Road Board from 1844 until its abolition, and as such played an important part in the first great road-building programme under Michell (PM 2) and Pilkington (PM 9). Quite possibly this influenced his family to join the technical field, for the eldest son, Abraham de Smidt (1829–1908), was Surveyor-General from 1873 to 1889, as well as being a noted artist. A daughter, Johanna Hermina, married Thomas Bain (PM 8) while another son, Henry, became head of the Treasury and father of the South African College. He joined the civil engineering up to present times.

Between 1867 and 1879 Adam was the supervising engineer on the formidable 75 km George to Knysna route known as ‘The Passes Road’ because of the eight passes which had to be built through the deep ravines which cross the coastal plain. The project engineer was Thomas Bain, and the brothers-in-law spent over three years trying to find a suitable route through the beautiful but often impenetrable landscape.

Besides the technical difficulties there were tortuous negotiations with landowners, and the road had to be built in detached sections. Adam felt that it would be easier to locate the route closer to the mountains, where the river crossings would be less arduous, but Bain insisted on the eventual alignment which included the frightening and challenging Homtini Gorge. During the construction period there was a short-lived gold rush to the fields at Millwood and the road was deviated to serve the expected development – which with hindsight may have added weight to Adam’s proposal. Sadly, however, the differences of opinion led to bitter and wounding arguments which eventually caused the pair to part company, and they never spoke to each other again. The spectacular route is still a welcome alternative to the national road, however, and a great credit to both engineers.

In 1879 Adam’s eyesight began to fail and he retired from engineering. He bought the farm Pampoenkraal, where he had sited the main construction camp when building the Passes Road, and renamed it Woodifield, possibly after another colleague, the enigmatic Matthew Woodifield (PM 12). Over time he added adjacent portions to his property and lived there until he died after a short illness in 1910.

In the period following his retirement he accepted appointments on several public commissions and was elected to the Legislative Assembly and later the Legislative Council. Locally, he was a Member of the Divisional Council. A part of the farm was later acquired by the government to become Saasveld, the training college for the State Forestry Department. Adam de Smidt ‘was a fine type of the gentleman of the old school. Upright and blameless in his daily walk. Courteous at all times to all, rich and poor. Quiet but cheerful, and ready to assist where possible. And yet underneath this gentle and kindly exterior there lay an unflinching and fearless determination which enabled him always to be scrupulously conscientious and faithful in the performance of duty … What he did for his constituency he did quietly and unostentatiously, but effectively’ (quoted from his obituary).

He died on 14 November 1910 on his farm, greatly esteemed for his contributions to the progress and development of the Cape Colony. He is buried in the Anglican church yard in George.
PEOPLE

New faces at Arcus Gibb

A NUMBER OF HIGH-PROFILE people have recently joined Arcus Gibb.

Dr Hubert Joynt (Director, Freight Logistics and Transport Economics) is a transport economist with more than 15 years’ experience. He has previously been with Realplan, the City of Tshwane and Pretoria City Council, among others.

Dr Chris Goldenhuys (Director, Transportation) is a professionally registered civil engineer specialising in transportation / urban engineering and business management. He has worked at BKS Group, the City of Johannesburg and Ingérop SA.

Beyers Havenga (Director: Special Projects (Water)) is a registered professional engineer and joins the team with over 33 years’ experience in the engineering field.

Gerhard de Beer (Senior Associate, Freight Logistics and Rail) is a civil engineer specialising in freight logistic solutions for existing businesses and industries, new business development, transport planning and railway engineering. He has 29 years of experience and has previously worked for Transnet.

Werner Jerling

WERNER JERLING obtained a degree in civil engineering from the University of Stellenbosch in 1987 followed by a BComm from Unisa in 1993. A career start in construction with LTA Civil Engineering was followed by nearly two years in the Consulting Engineering offices of GFJ Inc. After returning to the construction field at Grinaker-LTA Civil Engineering, he has been involved in the design and construction of many significant signature and heavy industrial construction projects. Werner is at present the general manager of Stefanutti & Bressan Civils (Pty) Ltd and serves on the board of the company as director.
WITH CPD NOW THOROUGHLY entrenched in South African engineering, lessons have been learned and experience has been gained.

There are also some points to ponder:
- CPD is intended to keep you abreast of developments in your field
- CPD courses are validated, not approved
- Beware of ‘diluted’ CPD events that start or end with a social gathering and that offer little or no meat
- Members who claim credits but who fail to attend the entire event may just get a nasty surprise when the ECSA auditor calls to check on the validity of credits claimed

Organisers of validated CPD events should be aware that there may be an undercover agent in the audience who observes attendees signing in late or leaving early. Maybe a register should be kept for signing in and out ...

CPD events can have wonderful value-added elements if they are used to:
- Announce upcoming events
- Supply information about books or publications relevant to the course or material available from the SAICE Bookshop
- Discuss what is needed and expected of CPD
- Facilitate feedback sessions on material and content

YOUR CPD TEAM AT SAICE NATIONAL OFFICE
- Denver Siebritz, SAICE Operations Manager dsiebritz@saice.org.za
- Dawn Hermanus, SAICE Education and Training Officer dhermanus@saice.org.za
- Sharon Mugeri, SAICE Education and Training Officer cpd.sharon@saice.org.za
The SAICE Education and Training Department can also be contacted by phone on +27-(0)11-805-5947 or by fax on +27-(0)11-805-5971.

A knowledge-enhancing 2008 lies ahead!
Do you have the strength to stand?

Before your next major construction project, make sure you know your strength!

At Geosynthetic Laboratories we have the expertise to test the performance of products you may use in the construction of roads, dams and other major projects. We offer a professional, confidential service to manufacturers and engineering designers, and our services are according to international standards.
THE INSTITUTION OF CIVIL ENGINEERS (ICE) and the South African Institution of Civil Engineering (SAICE) first signed an agreement of co-operation in October 1992. Over time the agreement has been reaffirmed and expanded to include the establishment of a SAICE-ICE Liaison Committee to co-ordinate services to members between the two institutions.

Discussions on how best the two institutions could work together, given that the majority of ICE members who reside in South Africa are members of both institutions, commenced with the ICE Presidential visit to South Africa in November 2004. The end result of the dialogue between the two institutions was the establishment of the Joint Civils Division of SAICE and ICE, following the ICE presidential visit in January 2007. The Joint Civils Division has been established along the lines of the very successful joint Structural Division established between SAICE and the Institution of Structural Engineers (IStructE) in 1993.

This document identifies the grades of membership offered by the two institutions, highlights the benefits of such membership, outlines admission requirements, establishes the membership fees and subscriptions associated with each grade of membership and indicates what mutual exemption arrangements are currently in place regarding professional registration.

### Grades of ICE and SAICE Membership and Affiliation

The grades of membership of ICE (www.ice.org.uk) and SAICE (www.civils.org.za) and their approximate equivalence are shown in table 1.

ICE is a licensed member engineering institution of the Engineering Council UK (ECUK). Provided that their educational qualifications are acceptable to ECUK for the required grade, ICE members are eligible to register as a Chartered Engineer (CEng) or an Incorporated Engineer (IEng). Similarly, a Technician Member is eligible to register as a Chartered Engineer (CEng) or an Incorporated Engineer (IEng). Similarly, a Technician Member is eligible to register with the Engineering Council UK as an Engineering Technician (EngTech). (ICE members have to pay a once-off entrance fee and annual subscription fee to ECUK for these titles, in addition to the ICE fees.)

SAICE members (MSAICE) are required at the time of admission to be professionally registered with a South African statutory council or an international body recognised for this purpose by SAICE’s Council. The Engineering Council of South Africa (ECSA) registers those engaged in civil engineering. (Those engaged in the management of civil engineering projects may alternatively be registered by the South African Council for the Project and Construction Management Professions, SACPCMP).

Accordingly, ICE membership is the route to registration with the ECUK. Registration with ECSA, SACPCPM or ECUK is the route to membership with SAICE.

### Benefits of ICE Membership

The benefits of professionally qualified ICE membership are:

- Free New Civil Engineer (NCE) magazine or New Civil Engineer International (NCEI) magazine
- Free access to NCE+, the online version of the NCE magazine
- Ask Brunel a question on any civil engineering topic and get a reply within 24 hours
- Free access to and loans from ICE’s library, one of the world’s most comprehensive civil engineering libraries
- Eligibility to apply for QUEST continuing education awards and travel scholarships
- Eligibility to apply for ICE prizes and awards
- Annual programme of social and learning events in the UK and worldwide
- Free access to MyICE – a range of online services exclusive to registered members
- Regular e-newsletters for those registered with MyICE
- Download papers from ICE proceedings at discounted rate
- Access to ICE UK regional support teams and country representatives in over 60 countries
- Use of a related institution’s facilities if you are a temporary resident in another country

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### Table 1 Grades of ICE and SAICE membership and affiliation

<table>
<thead>
<tr>
<th>ICE membership</th>
<th>SAICE membership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Student</td>
</tr>
<tr>
<td>Graduate</td>
<td>Associate (AMSAICE)</td>
</tr>
<tr>
<td>Companion</td>
<td>(Non-registered engineer, technologist, technician. Other non-engineering qualified individuals working in civil engineering environments)</td>
</tr>
<tr>
<td>Associate (AMICE)</td>
<td>Member (MSAICE) (Professional Engineer, Professional Technologist, Professional Technician)</td>
</tr>
<tr>
<td>Technician (TMICE)</td>
<td>Fellow (FSAICE)</td>
</tr>
<tr>
<td>Member (MICE)</td>
<td>Affiliate</td>
</tr>
</tbody>
</table>

*See overview of the grades for SAICE and ICE membership for more information*
The right to vote in ballot and council elections

Eligibility to sponsor applications from candidates seeking a professional qualification with ICE

Student members get reduced rate subscription to New Civil Engineer (NCE) or New Civil Engineer International (NCEI) magazine and discount on specialist journals. Graduates and members get a free NCEI magazine every month as well as access to NCE+ (the online version of the New Civil Engineer magazine). They are also able to download papers from ICE proceedings at discounted rates.

The New Civil Engineer International is a monthly magazine which provides informative articles on a wide range of topics that are of interest to all types of civil engineers including innovative features of major projects in various parts of the world, brief reports on collapses, failures and disasters wherever they may occur, and feature articles dealing with the issues of the day. This magazine provides valuable insights into global civil engineering practices.

BENEFITS OF SAICE MEMBERSHIP

The basic benefits of SAICE membership are:

- Access to SAICE’s geographic branches and focus-specific division activities
- Access to nation wide CPD events hosted by SAICE, frequently at a reduce rate
- Networking and information sharing opportunities

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### Table 2 Accords and categories of ECSA and ECUK registration

<table>
<thead>
<tr>
<th>Accord*</th>
<th>Categories of registration associated with the various accords</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECSA</td>
</tr>
<tr>
<td>Washington</td>
<td>Professional Engineer</td>
</tr>
<tr>
<td>Sydney</td>
<td>Professional Engineering Technologist</td>
</tr>
<tr>
<td>Dublin</td>
<td>Professional Technician</td>
</tr>
</tbody>
</table>

* See [http://www.washingtonaccord.org/](http://www.washingtonaccord.org/) for full details of these accords

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### Table 3 Overview of the various grades of SAICE membership

<table>
<thead>
<tr>
<th>Grade</th>
<th>Outline of admission requirements</th>
<th>Comments</th>
<th>Current fees (2008)*#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Applicant is registered at a tertiary educational institution with the intention of obtaining an academic qualification in civil engineering or is undergoing a regular course of training recognised for this purpose</td>
<td>First year is free and a second year free student membership can be applied for</td>
<td>R285 per annum</td>
</tr>
<tr>
<td>Associate</td>
<td>Applicant &lt;br&gt; - does not satisfy the requirements for admission as a Member but has achieved a comparable status in the profession which is comparable to that of a member and is connected with civil engineering; or &lt;br&gt; - is not eligible for election as a member but is actively engaged in civil engineering and/or has a suitable civil engineering qualification</td>
<td>This grade is intended for those persons who &lt;br&gt; - have obtained a degree or diploma in civil engineering and have not yet registered with ECSA, SACPCMP or a recognized international registration body such as ECUK; or &lt;br&gt; - work in fields connected with civil engineering ICE Graduate Members and ICE Associate Members should consider applying</td>
<td>R720 per annum &lt;br&gt; Graduates with more than five years’ post-graduate experience pay R1 120 per annum</td>
</tr>
<tr>
<td>Member</td>
<td>Applicant is actively engaged in civil engineering and &lt;br&gt; - either holds an academic qualification from a recognised tertiary educational institution or is a corporate member of a recognised engineering institution or society; and &lt;br&gt; - is professionally registered with a relevant South African statutory council or recognised international body</td>
<td>ICE Technician Members and ICE Members should consider applying for this grade of membership</td>
<td>R1 120 per annum</td>
</tr>
<tr>
<td>Fellow</td>
<td>Applicant &lt;br&gt; - has achieved sufficient status in the civil engineering profession to justify his or her election; &lt;br&gt; - is not less than thirty-six years of age; and &lt;br&gt; - has been a corporate member for at least five years, provided that the Executive Board may in exceptional circumstances waive this requirement.</td>
<td></td>
<td>R1 575 per annum</td>
</tr>
</tbody>
</table>

* Based on early bird payment, that is, before 31 March. Late payments are 25% higher. Fees for retired members are discounted
# Membership of the first division is free. The membership fee of subsequent divisions is R145 per annum (early bird payment)
signed the Washington Accord in 1989 and 1999 respectively. Both councils signed the Sydney and Dublin accords in 2001 and 2002, respectively. For example, if a person obtains a degree after 1999 from a South African university that is accredited in terms of the Washington Accord that person’s qualifications will be recognised by ECUK.

It should be noted that the academic qualifications associated with these accords are linked to the categories of ECSA and ECUK registration as shown in Table 2.

**MUTUAL EXEMPTION AGREEMENT**

ECSA, SAICE and ICE have signed a mutual exemption agreement (www.ecsa.co.za – see International Affairs). In terms of this agreement, members of SAICE who are registered with ECSA as Professional Engineers of at least one year’s standing and members of ICE who are registered with the Engineering Council UK as Chartered Engineers of at least one year’s standing will be accorded corresponding membership and professional registration of the other on receipt of a duly completed acceptable application form and supporting documents (see ICE website www.ice.org.uk/joining/joining_mea.asp and ECSA website www.ecsa.co.za/ for more information).

Application via this route is only available to Professional Engineers/Chartered Civil Engineers who qualified via the ECSA/ICE standard route (that is, by having the required academic qualifications for that grade, by completing the required training and development and by passing a professional review).

The Joint Civils Division has requested ICE and SAICE to engage with ECSA to explore the possibility of expanding the mutual exemption agreement to cover Incorporated Engineers / Professional Engineering Technologists and Engineering Technicians / Professional Technicians.

**AN OVERVIEW OF THE VARIOUS CATEGORIES AND SUBSCRIPTION RATES OF SAICE MEMBERSHIP**

Table 3 provides an overview of the various grades of SAICE membership.

SAICE charges an entrance fee of R470. The ECSA professional engineer application fee is R2 000. ECSAs annual registration fee for members of a recognised voluntary association (such as SAICE) is R988 and R1 588 for those who are not members.

**AN OVERVIEW OF THE VARIOUS GRADES OF ICE MEMBERSHIP**

Table 4 gives an overview of the various grades of ICE membership.

Other than Professional Engineers applying under the mutual exemption agreement, applicants will need to apply for an academic assessment (if their qualifications are unaccredited for their desired grade of membership) and a career appraisal before applying for professional review. The fees for these are £35 and £165 respectively. ICE has a number of professional review centres outside the UK, but not currently in South Africa. SAICE applicants must therefore be prepared to travel to one of the established centres to sit their review. Locations and application dates for the UK international centres are published on the ICE webpage www.ice.org.uk/joining/joining_keydates.asp.

This article was submitted by the JCD. Any specific enquiries should be directed to the relevant council or institution – Ed
<table>
<thead>
<tr>
<th>Grade</th>
<th>Outline of admission requirements</th>
<th>Comments</th>
<th>Current fees and subscriptions** (2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affiliate</td>
<td>Applicant works in fields relating to civil engineering such as law and finance, rather than in civil engineering itself</td>
<td>Affiliate membership is open to those who have an interest in, or work in, the field of the built and natural environment</td>
<td>Free to apply £121*</td>
</tr>
<tr>
<td>Technician member (TMICE)</td>
<td>Applicant must ■ have a Dublin accord or equivalent qualification in civil engineering; ■ have completed the ICE3005 Development Objectives to EngTech level and have passed an ICE career appraisal; and ■ pass a professional review (See ICE 3002: Route to Technician Membership for full details)</td>
<td>Technician members may register with the Engineering Council (ECUK) as Engineering Technician (EngTech). Persons registered with ECSA as Professional Engineering Technician should consider applying</td>
<td>£100 *</td>
</tr>
<tr>
<td>Associate member (AMICE) or member (MICE)</td>
<td>Applicant must ■ have a UK bachelor’s degree or equivalent; ■ have completed the ICE3005 Development Objectives to AMICE/MICE level and have passed an ICE career appraisal; and ■ pass a professional review (See ICE 3003: Route to Associate Membership for full details)</td>
<td>These grades can be awarded to a wide range of people who are engaged in a profession that directly supports or is closely allied with, the work of a civil engineer operating in the built environment or who are working as a civil engineer. Registration with The Engineering Council (ECUK) is not possible in these grades of membership. Quantity surveyors, engineering geologists and project managers may consider applying for this grade of membership</td>
<td>£177*</td>
</tr>
<tr>
<td>Incorporated Member (IEng MICE)</td>
<td>An applicant must ■ have a BSc or BEng degree or equivalent in civil engineering (Sydney accord qualification); ■ have completed the ICE3005 Development Objectives to IEng MICE level and have passed an ICE career appraisal; and ■ pass a professional review (See ICE 3001: Route to Membership for full details)</td>
<td>The member will also qualify for registration with the Engineering Council (ECUK) as Incorporated Engineer (IEng) Persons registered with ECSA as Professional Engineering Technologist should consider applying</td>
<td>£177*</td>
</tr>
<tr>
<td>Chartered Member (CEng MICE)</td>
<td>An applicant must ■ have a BEng plus MSc or MEng degree in civil engineering or equivalent (Washington Accord qualification); ■ have completed the ICE3005 Development Objectives to CEng MICE level and have passed an ICE career appraisal; and ■ pass a professional review (See ICE 3001: Route to Membership for full details)</td>
<td>The member will also qualify for registration with the Engineering Council (ECUK) as Chartered Engineer (CEng) Persons registered with ECSA as a Professional Engineer are eligible for this grade of membership and should apply under the Mutual Exemption Agreement</td>
<td>£177*</td>
</tr>
<tr>
<td>Fellow (FICE)</td>
<td>Applicant has made a significant contribution to the civil engineering profession or advancing the practice of engineering (See ICE 3007: Fellowship of the Institution of Civil Engineers)</td>
<td>This is the highest class of membership. Applicants should have around 15 years’ experience, five of which at a senior level of responsibility related to civil engineering</td>
<td>£228*</td>
</tr>
<tr>
<td>Companion</td>
<td>Applicant works at the same level as Fellows, but in fields relating to civil engineering such as law and finance, rather than in civil engineering itself</td>
<td>Companion membership is open to those who have an interest in, or work in, the field of the built and natural environment</td>
<td>£177*</td>
</tr>
<tr>
<td>Chartered Environmentalist (CEnv)</td>
<td>Applicant must be an Associate, a Member or Fellow and pass an independent Chartered Environmentalist professional review (See ICE 3008: Chartered Environmentalist)</td>
<td>Professional title available to those who are already professionally qualified with ICE</td>
<td></td>
</tr>
</tbody>
</table>
THE ENGINEERING Council of South Africa (ECSA) was recently granted an interdict against the Tshwane Metropolitan Municipality to stop all disciplinary actions against one of its members, Mr A J Weyers.

Weyers, a registered professional engineer and employee of Tshwane Metropolitan Municipality, reported in writing to ECSA that the Tshwane Metropolitan Municipality appointed inexperienced candidates in a quest to accelerate transformation. These candidates were appointed as systems operators at the Tshwane Power Control System while they tested poorly prior to their appointment.

Following his action, Weyers faced disciplinary action at the municipality. Weyers’ concern about the appointments stems from his belief that it imposed a danger to public safety as well as to the lives of these system operators. System operators are exposed to substantial and defined dangers whilst performing their duties.

The Court’s ruling was that it was the duty of a professional engineer, as is stated in the Engineering Professions Act (EPA), Act 46 of 2000, to pay due regard to public safety considerations as per Section 39(2) and 27(3) of the EPA. This duty entails that a professional engineer needs to satisfy himself on the strength of his qualifications, skills and experience that his employer does not embark on acts or omissions likely to endanger the safety and/or health of either the public or his fellow employees.

A professional engineer (or other registered person in terms of the EPA) who has the substantiated belief that his employer is intent on doing so, is not only indemnified against disciplinary action for disclosing irregularities, but is obliged to make such a disclosure.

In addition, the Court disapproved of acceleration of transformation at all costs while disregarding safety considerations. The Court requires a sensible balance between transformation and safety.

While ECSA is fully committed to transformation, this ruling comes as clear confirmation that standards in engineering can under no circumstances be compromised. It also reaffirms ECSA’s mission to set and maintain internationally accepted standards in ensuring the quality and competence of the profession.

Professional engineers and other registered persons should pay attention to the correct procedures when reporting about any person or company’s intent to endanger the lives of its employees or the public.

This case is a major breakthrough in terms of uncompromisingly pursuing the conditions of the EPA while following the mandate ECSA received from government.
How easily a WOW week can turn into a What-A-Week!

In November 2007 SAICE Executive Director Dawie Botha attended a meeting of the World Federation of Engineering Organisations in India. He shares his observations and experiences with us.

ENGINEERS ARE OFTEN the same as those whom they like to criticise – the politicians. This became very clear at the November 2007 meeting of the World Federation of Engineering Organisations (WFEO) when it came to whom to elect to run the show.

Hours of precious time went by as voting for the next president took place. The voting processes were formal and complete with proxies, but at one stage even a proxy was contested when a delegate thought he should be able to vote, regardless of the proxy. And time passed as countries were called to cast their votes in a big ballot box …

In addition, hours of precious time were spent debating which country would chair, co-chair or not co-chair a committee. More often than not, only the two main contenders had a real interest in the debate. And unfortunately it seemed voting took place in blocks - as Africans, Arabs, or Europeans.

After all, this was a group of engineers, not the United Nations, and to me it simply does not make sense to let the world of politics spill over into the engineering world.

The debate on who would be hosting the next General Assembly and the next World Engineering Congress is a case in point. It seemed as if hundreds and thousands of rands and hours were spent to develop brochures and videos to showcase all the wonderful sights of the host country. But then, for five days most of the delegates would only see the inside of their hotels.

Maybe we should arrange more educational field trips during meetings to demonstrate how various countries deal with poverty and basic infrastructure, for example.

DELI – INTEGRATED TRANSPORT
Running, walking, cycling, rickshaws, tuc-tucs, taxis, buses, a new metro, some trains – this is Delhi transport. Hooters rule, and driving and walking are not for

Kamel Ayadi of Tunisia, outgoing president of the WFEO, handing over to the new president, Barry Geers of Australia
Dawie Botha, executive director of SAICE and secretariat of the AEF (Africa Engineers Forum), presenting a motivation for the AEF to be allowed as member of the WFEO
Ravi Nayagar, CEO of ECSA, and Dawie Botha
Civil Engineering

March 2008

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white. As you would have guessed, this is an ‘open’ sewer …

In the old market – a fascinating place – a fire would surely kill and destroy, but there is no indication that anybody thinks about fire. The two metre wide walkways are crowded to capacity, so there would be no escape if something goes wrong.

And then the electric wiring … see the picture! But here, as at home, here and there a shiny red Honda generator was ready to start up when all else fails!

Nevertheless, like Athol Fugard said, ‘People are living there.’ And it works. I wonder what lessons that hold for us South Africans …

Parts of the city was without water for days, because the ammonia level in the river was ten times higher than it should have been and they could do nothing to get the water ‘cleaner’ other than releasing more water from an upstream dam.

I am not criticising India. I am merely sketching a situation which seems to be out of control – 15 million people in a city designed for 5 million.

No wonder India’s president welcomed us at the meeting with the words: ‘Engineers, we have to find solutions for urbanisation woes.’

LESSONS FOR 2010

For my flight to Delhi I chose Emirates because they offered the cheapest flights – SAA was five times as expensive!

The problem is, I eventually paid the price because of delayed flights, lost luggage, and of course the knock-on effect on the rest of my itinerary.

In all fairness it must be stated that in flight Emirates are wonderful. But on land, unfortunately, I experienced their staff as arrogant, unhelpful and incompetent.

On my return trip to South Africa, fog in Dubai caused my flight from Delhi to be delayed. But we still landed in Dubai with 55 minutes to spare to transfer. A rather undignified and nervous rush by passengers trying to find their connecting flights followed, but they only landed up in front of a chaotic information desk. There was no flight information for us on-screen. Push, shove, and ultimately a pleasant Afrikaans-speaking guy behind the counter uttered the dreaded words: ‘Mnr Botha, jou vlug is gekanselleer.’

That resulted hundreds of people cramming into a chaotic ‘Customer Services’ area. Seven and a half hours in the queue meant no refreshments and
no chance to go to the toilet. In addition, the air conditioning in this section of the airport was not working and no progress announcements were made.

To me, the last straw was when a woman fainted. The passengers found a doctor among them to attend to her while the Emirates official who approached observed the situation somewhat dispassionately and then retreated.

With no hotel accommodation left in Dubai, I had to sleep on the airport floor, and queue together with hundreds of other unhappy travellers for more hours for a complimentary meal.

It would have been so simple to inject a little project or disaster management and crowd control and comfort into this situation.

South Africa, are we ready? Do we have contingency plans for when Cape Town or Johannesburg fogs up? Do we want to hear the equivalent of ‘First time Dubai – last time Dubai’? Of course not – we would rather hear ‘We will be back’.

And we thought Eskom was a mess!

Delhi transport: The tuc-tuc has seen better days …

Dubai Airport: shopping instead of flying!
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<td>Dawn Hermanus <a href="mailto:dhermanus@saice.org.za">dhermanus@saice.org.za</a></td>
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