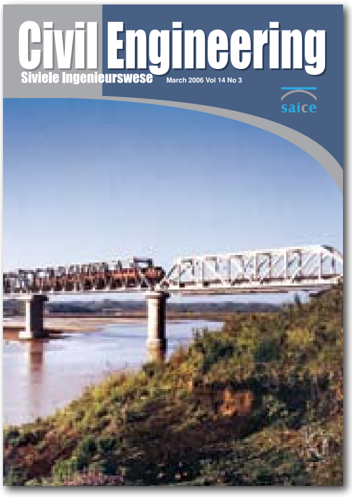
Civil Engineering

Siviele Ingenieurswese

March 2006 Vol 14 No 3

saice



ON THE COVER

The Mfolozi River rail bridge in the north of KwaZulu-Natal was built more than a century ago. It was washed away several times and the second bridge was demolished by cyclone Domoina in 1984. The reconstruction of thi bridge offered unique challenges which called for innovative solutions (see article on page 22)

saice

Civil Engineering
Siviele Ingenieurswese March 2006 Vol 14 No 3

PUBLISHED BY SAICE/SAISI
Block 19, Thornhill Office Park,
Bekker Street, Vorna Valley, Midrand
Private Bag X200, Halfway House, 1685
Tel 011-805-5947/48, Fax 011-805-5971
http://www.civils.org.za
civilinfo@saice.org.za

EDITOR
Sarie Moolman
smoolman@netactive.co.za
Tel 012-804-2754, Cell 082-376-2652

ANNUAL SUBSCRIPTION RATE
SA R525,00 (VAT included), International $110,00

ADVERTISING
Barbara Spence, Avenue Advertising
barbara@avenue.co.za
Tel 011-463-7940, Fax 011-463-7939
Cell 082-881-3454

DESIGN AND REPRODUCTION
Marketing Support Services, Menlo Park, Pretoria

PRINTING
Creda Communications, Johannesburg

ISSN 1021-2000

Text Dawie Botha
Executive Director
SAICE

OPINION

A river runs through it

Or water, water, everywhere – nowhere to go?

THE SEASONS COME and go and, according to Prof Will Alexander's statistics, we will be wet and we will be dry and sometimes, he warns, we will be even wetter.

But rainfall is one thing, and how we deal with the wonderful blessing of water is something else.

Many residents and decision-makers do not make the connection between the results of development and normal rainfall – let alone rain above average from time to time. And it is when it is above average that disaster on disaster starts to manifest itself – every 25 mm becomes a threat.

The placid wetland systems on the West Rand have become vibrant forests of bulrushes and reeds – growth never seen before.

Why? More and more water is concentrated into the Blaauwbankspruit and its tributaries by what seem like unbridled and mismanaged (and maybe under-designed) so-called security villages, and now shoulder-to-shoulder and wall-to-wall townhouse complexes.

And then we have not even mentioned the condition and capacity of streets or roads that were designed and built when the whole area still consisted of plots, small-holdings, nurseries and small farms.

I was highly irritated when I read recently that some of our town planning professional colleagues glibly proclaimed that the development areas of north of the Witwatersrand had sufficient infrastructure capacity to deal with the development – I call it an explosion – of towns. And they continued: 'Remember – these owners have rights to develop.' Wow!

That is not disputed. But rights come with a word that so many people conveniently forget. What about responsibility?

We are living in a world of faceless bureaucrats hiding behind call centres and people centres. We are living in a world of greed, even among professionals who come from a period of lean years. We are living in a world of absolute innocence, 'not my department', denial, musical chairs, or is it touch rugby – where the fastest culprit escapes.

Are we alone in this mess? No, it is typical wherever you go.

So what can we do as civil engineering professionals?

Finger pointing will not help – we have some very adaptable *skilpaaie wat kop intrek*, turtles and chameleons in our midst. But maybe we can make it our professional and civic duty to point out the implications of this development frenzy:

- Faster run-off
- More run-off
- Inadequate retention and slow release of stormwater
- Erosion plus silting up
- Flooding of downstream properties that have now 'graduated' to be below the 20-year, 50-year flood lines because of upstream changes in the environment
- Potential and real loss of lives and property
- Sewer lines overcharged with stormwater and the resulting manhole antics, including gravity-defying floating manhole covers
- Pollution par excellence
- More growth, more (damning) damming, more unsustainable cities
- More filth in the system – we are so lucky to have the venerable old Hartbeespoort Dam to catch everything we flush down from Pretoria/Tshwane and Johannesburg

But should we involve ourselves, make it our business?

Our ethical behaviour is in the firing line, like that of so many other professions. Our professional expertise, which was almost unquestionable, is now being questioned.

When I write about these things, I sometimes get applause and sometimes admonishments. For example, I received a comment saying, what if young aspirant engineers read about our inability to influence, to advise, to succeed with innovative and sustainable solutions? Maybe we should form an expert team who can oversee other colleagues and advise and maybe even criticise? Maybe we should get a team of civils storm hunters like those guys chasing hurricanes. Maybe we could use our millions of hours of experience to offer professional advice to decision-makers about how to deal with the all-powerful business community – the so-called developer with all his or her rights?

What do you think?

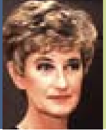
Should the Academy of Engineering play a role?

Should ECSA become stronger?

But somewhere, somehow, 'Somebody and company' should get the message loud and clear: Goodbye! You are the weakest link!

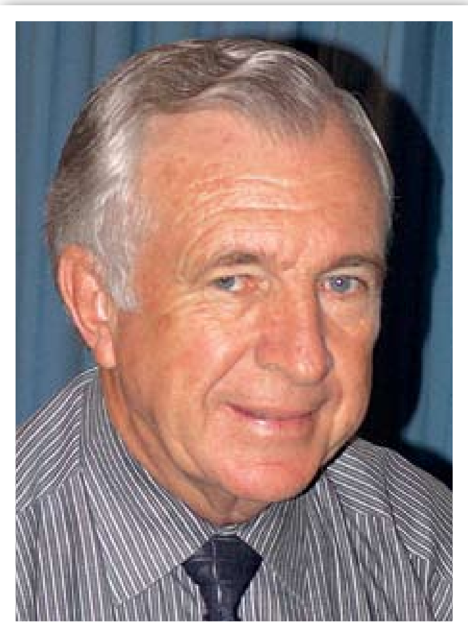
Should we not heed the words of John C Maxwell when he says:

> *Seek to be a plow rather than a bulldozer. The plow cultivates the soil, making it a good place for seed to grow. The bulldozer just scrapes away and flattens everything in its way.* ◻


Text Lorraine Fourie
lfourie99@telkomsa.net

PROFILE

Too valuable a man to



Recognition by one's peers surely rates as the highest honour to be bestowed on a professional. In this respect the acknowledgements conferred on Bob Pullen reflect the esteem he enjoys in South African engineering circles: recipient of SAICE's Gold Medal, ECSA's Merit Medal for Outstanding Service and, most recently, the Institute of Professional Engineering Technologists' (IPET) President's Award for distinguished services to the engineering profession. About the accolades Bob is reticent but he does admit that 'it's not merely because you've become old enough, you actually have to do something in between to earn them'. In speaking to Lorraine Fourie, Bob shows a preference for concentrating on the task at hand

PREFERS TO LEAD UNOBTRUSIVELY

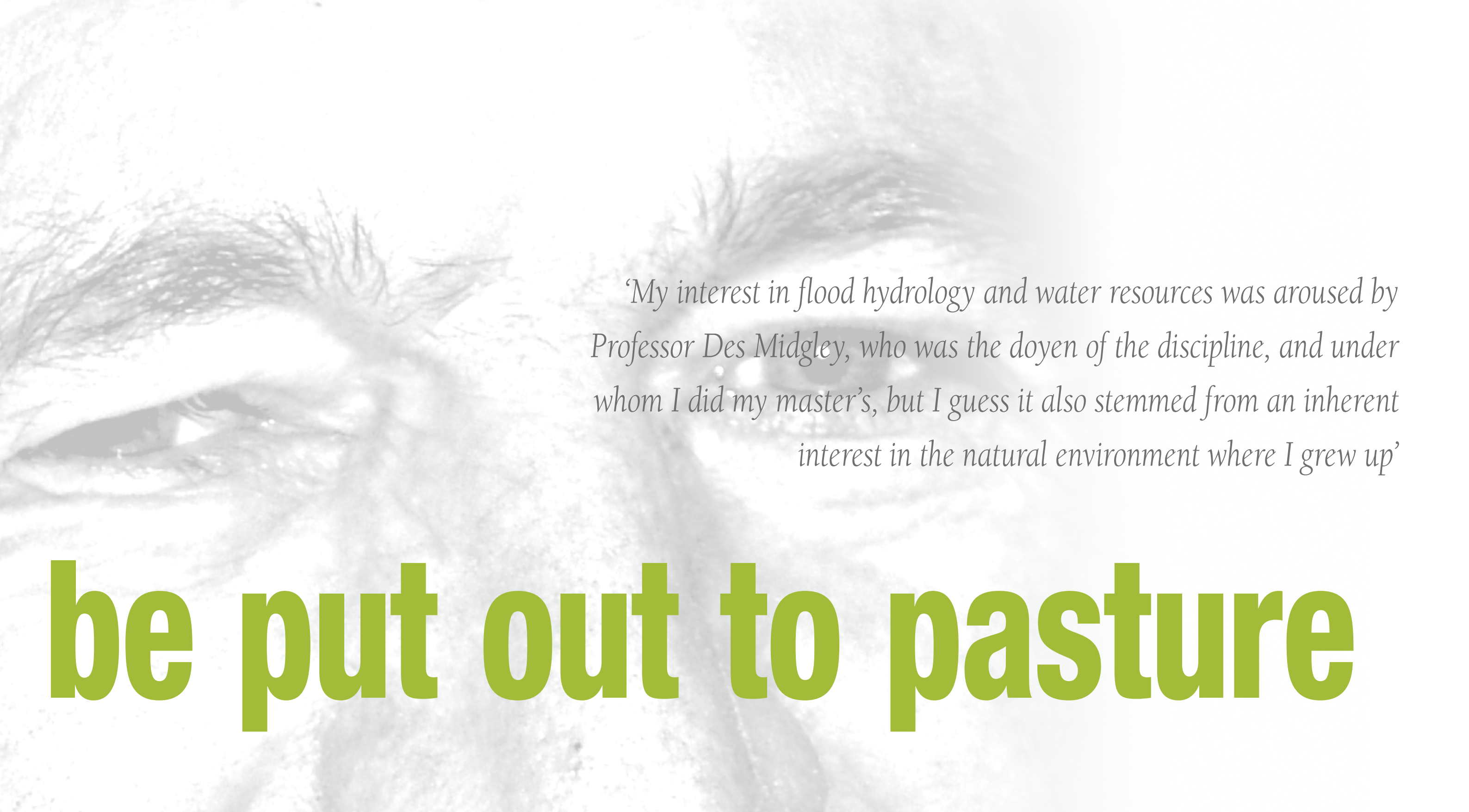
'I've reached the stage where I should be put out to pasture now,' Bob quips. Clearly, this perception is not echoed by his colleagues. After serving three consecutive terms of office as president of ECSA – in each case having been elected unanimously – Bob has just been re-appointed to the Council and elected vice-president for a further term.

Council members are appointed for a four-year period by the Minister of Public Works, whereupon the 50 members elect their office-bearers. Bob first joined their ranks in 1991 as vice-president, but when the then president retired in mid-term, he took up that position for the remaining two years. He was re-elected to the presidency in 1995, which subsequently turned into a six-year term because a new Act was being prepared. 'The new law took a long time to get onto the statute book, and instead of appointing a new council under an old law the Minister decided to extend the term of office of the incumbent members,' he says.

When the new Council finally came into being in 2001 he was elected president for a third term. But at the end of last year Bob said 'klaar en gedaan', this has carried on for much too long. He elaborates: 'Although the Council, and ECSA as a body, has already been significantly transformed, we need to step up the transition. However, I was asked to make myself available as vice-president for the purpose of succession planning, and I'm certainly going to make sure that I don't overdo it. I'll serve in that role until everybody is confident that the new body, under the able leadership of Mr Sipho Madonsela, is running smoothly and then I plan to make way for someone else.'

Bob's involvement with SAICE is even more long-standing – an ordinary member for over 40 years, a council member for 25 years, and president in 1989. For his outstanding contribution to the civil engineering profession and service to the Institution he received their highest honours, the SAICE Gold Medal, in 2001. Since its inception in 1953 the medal has been awarded to only 16 deserving individuals.

In addition to being an Honorary Fellow of SAICE, he is a Fellow of the SA Academy of Engineering, a body of people who make their expertise available to government in the interest of the country. In conjunction with its American sister academy, Bob is currently participating in a project researching and advising on the sustainability of cities in developing countries.



'My interest in flood hydrology and water resources was aroused by Professor Des Midgley, who was the doyen of the discipline, and under whom I did my master's, but I guess it also stemmed from an inherent interest in the natural environment where I grew up'

be put out to pasture

Whether leading from the front at the highest level, or chairing the local school committee (when his children were still at school), or captaining the golf club, Bob's reaction to the respect which he garners is simply: 'Committee members seem to be happy with the way I do things and I find it very encouraging that they give me their support and put their trust in me to direct their affairs.' That's why he is equally gratified by the award he received from the Rotary Club of Pretoria for his service to society. 'It was in recognition of what I'd done as an ordinary professional engineer towards the development of South Africa's water resources, which has been my area of work for 43 years. By doing that kind of engineering, society benefits.'

LIFELONG CAREER IN WATER

Bob's career in water started in 1963 as a research engineer in the Hydrological Research Unit at the University of the Witwatersrand after he had completed his BScEng studies at Wits. His research included water resources development, flood and storm studies, and design flood estimation, which led to an MSc in 1969. He also acted as consultant on flood estimation for river diversion design for dam construction, such as at the Cahora Bassa Dam on the Zambezi River.

'My interest in flood hydrology and water resources was aroused by Professor Des Midgley, who was the doyen of the discipline, and under whom I did my master's, but I guess it also stemmed from an inherent interest in the natural environment where I grew up,' Bob reflects.

Bob grew up in the bushveld, in the small town of Rustenburg. He wanted to become a pharmacist, but his interest in engineering grew after talking to a neighbour who worked as a civil engineer in Johannesburg. His first contact with the Big City was when he went for an interview for a bursary at the now defunct JCI.

Thus the natural environment was always part of the equation for Bob. 'Long before the term environmental sustainability had been defined, our mentors in the late 'fifties and early 'sixties imprinted its importance on us as young engineers,' he elaborates. 'Later, in the 'eighties, a group of us formed a specialist interest division within SAICE which promoted environmental engineering. We tried for many years to inculcate in the engineering profession a sense, or rather a value system, which says that we will manage the environmental consequences of our work in such a way that it need not be legislated. We would do it any way because it is the right thing to do.'

Whether clients necessarily followed the advice was another matter. 'That's the clients' prerogative – to seek advice and then to do with it what they like. It's still like that nowadays, even though there is legislation in place now,' Bob comments.

'In looking back at the time when I first worked on the planning and then the construction of the Thukela-Vaal project in Natal in the 'seventies, there was a logical connection between the earlier part of my career and how it followed on later into the environmental field. In reality, what we, in conjunction with what was then the Natal Town and Regional Planning Commission, were doing at that time was a proper environmental impact study in today's terms,' he says.

In due course Bob became involved in the social environment. As project leader on the relocation action plan for the Nandoni Dam in the Luvuvhu River in Limpopo Province, his role was to define the scope of the relocation of affected people and to manage its planning and execution.

'I've been involved with the planning of the dam since 1992. That was followed by a feasibility study and then I was appointed to do the planning for the management of the impact on the people.'

The project has already won several awards from the environmental fraternity, which he finds extremely satisfying. A similar smaller project in the Steelpoort River, north of Lydenburg, where archaeological sites and people have to be moved before construction can start, is also under way. 'It's a time-consuming exercise and the developer needs to recognise that the "soft" engineering side takes time.' Both these projects are undertaken for the Department of Water Affairs and Forestry (DWAF).

Bob knows the working of the department well because he spent 12 years of his working career there. As principal engineer in the Planning Division (1969–1972) he was responsible for the long-term planning of water resource development, supply augmentation, and project feasibility studies and implementation plans. In this period he investigated a number of major floods in South Africa, from the meteorological causative factors to the behaviour of floods in the country's river system. Then followed the stint as resident engineer on the construction of the Thukela-Vaal inter-basin transfer scheme (1972–1975), after which he returned to water resource planning (1975–1980), with the main responsibility of administering a national water allocation policy and permit system. 'This involved permits, or licences as it is known today, for irrigators and industries to abstract and discharge water,' he explains.

'I've tried to pass on to my colleagues some kind of sense of what engineering is all about – to have a professional approach to engineering. And above all, to enjoy what you're doing, because if you don't enjoy your work you're not going to achieve maximum output and job satisfaction'

NOT CUT OUT TO BE A PUBLIC OFFICER

A promotional transfer to the Office of the Prime Minister in 1980, co-ordinating capital budgets for physical infrastructure development, didn't leave Bob overjoyed. 'I didn't mind being a government official using my expertise as a civil engineer, but working in a political environment wasn't my kettle of fish, because I didn't always agree with politicians.' He left the public service in 1981 to join the consulting practice of old university friends Steffen, Robertson and Kirsten (SRK) as a director and the manager of their Pretoria office.

While in the private sector he continued to work for the Department of Water Affairs as a consultant on specific projects and it was in this capacity that he was appointed leader of a team of specialists responsible for reviewing the flood management policy for South Africa.

'Actually there was no real policy on the table to review, but it had to be called that for good order,' he recalls.

It was a major assignment examining the legal context, compiling an inventory of historical events and their evaluation and interpretation, assessing policy provisions, compiling flood damage functions, and investigating insurance and other options for damage compensation. 'The task called for detailed analysis, planning and design of legal and institutional aspects which formed the basis of thinking at the time on non-structural flood management strategies to complement economically feasible structural measures,' he elaborates.

An important outcome of the team's recommendations was the establishment of the national disaster management centre which currently handles all major disasters in South Africa. 'New legislation was introduced in the last five years to include all disasters, not just floods, but the principles that were identified in the 1980s still apply.'

Bob continues to play a hands-on role in this field, such as his participation in a conference on environmental protection and disaster mitigation held in Shanghai, China, last year.

Having to commute to Johannesburg several times a week to manage the environmental engineering division at SRK's head office finally played a role in Bob's decision to join Pretoria-based Consultburo as director and CEO in 1985.

He remembers that being called upon during this time to handle the technical production of the publication *Water Resources Management in Southern Africa* – once again for Water Affairs – was very challenging for him. 'It was the first time that any government department had published such a major policy document. Since its publication 20 years ago, water resource management in the country has improved and the book has been updated, but the essence thereof has not changed and much of the content is still valid today,' he says.

The project led to Bob's continued significant involvement in this field in later years, such as his work as specialist consultant on the development of a national water resources management strategy from 2001 to 2003.

Consultburo merged with BKS in 1997 and he has been with the firm ever since. He is currently deputy CEO of the BKS Group.

Because of his management role he tries to limit the amount of other responsibilities he takes on, but he remains very involved in the project management side. With his wide background in water resource management he works from time to time on related projects, whether it is on policy level or organisation design. 'We are in the process of establishing a regional water resource management structure for a river basin in the northern part of Mozambique. We look at aspects like water quality, groundwater, physical infrastructure, and the organisation design, to recommend to the Mozambican government what kind of structure should be created, what the staff complement should look like, the budget, and so forth,' he says.

BKS is currently involved in close on 20 projects in countries on the African continent and in the Middle East. The company's foreign business component, BKS Global, last year received an award in consulting engineering for foreign business, and Bob is justifiably proud of that. Yet, he doesn't want to be drawn out on his part in the company's success and would only say: 'My colleagues have given me their support and they seem to be comfortable with my leadership style.

'I've tried to fit people into the right places in the company, and to motivate them to use their capabilities to maximum capacity. I've also tried to pass on to my colleagues some kind of sense of what engineering is all about – to have a professional approach to engineering. And above all, to enjoy what you're doing, because if you don't enjoy your work you're not going to achieve maximum output and job satisfaction.

'Somehow or other I seem to enjoy being involved in the organisational side of things. I would like to continue using my expertise in this regard and not to stop working. Of course, there will always be time for a round of golf.' ◻

Viewpoint 1

Registration of 'competent persons' on the cards?

THIS VIEWPOINT is addressed to all civil engineers and civil engineering technologists in South Africa and is particularly relevant to those persons with an interest in structural engineering.

The Joint Structural Division (JSD) of the South African Institution of Civil Engineering (SAICE) and the Institution of Structural Engineers (IStructE), with its worldwide head office in London, is typical of many equivalent cooperation agreements worldwide, formed to look after the interests and development of all structural engineers in South Africa and internationally.

The previous year has been a big challenge for structural engineers in South Africa, owing to the economic upturn and general shortage of skills, and apparently this will continue into 2006. This has put pressure on all divisions of civil engineering, particularly those involved in building structures, where there is a significant lack of skills capacity. With the growth of computer design commercial software as a readily available tool for producing final design details, designs may be undertaken by people who do not possess structural engineering skills in order to make up this shortfall.

This situation is not developing only in South Africa, and there is global concern about the lowering of standards of engineering competence to the level that inexperienced structural engineers have been certifying the structural stability of buildings.

We also understand that the New National Building Regulations SANS 10400 (to be published mid-2006) will require certification by a 'competent person – structural' for building structures.

There is an international tendency, owing to the strictures of occupational health and the safety of buildings, to identify and acknowledge competent persons in structural engineering. Many countries already have legislation in this regard. In South Africa, however, all disciplines of engineering fall under the Engineering Council of South Africa (ECSA), and therefore statutory registration outside this body is not an option. It is the intention, however, to work together with such bodies.

The JSD committee has been addressing this issue on behalf of South African structural engineers and has proposed a peer-reviewed list of competent structural engineers.

As a first step, a system has been set up with a secretary and Internet access (www.jsd.co.za) and we have written initially to IStructE chartered members to confirm the local IStructE database. The proposed next step will be to contact all JSD members and other identifiable structural engineers to achieve the desired outcome.

We understand that this initial approach has caused some concern from structural engineers who are not IStructE members. We confirm, however, that there is no intention to preclude non-IStructE chartered members from the proposed list, provided that they are CPD compliant and actively engaged in structural engineering.

The list will be accessible on the web so that municipalities and client bodies can obtain direct reference.

This list will be non-prescriptive and is not a statutory requirement. It should be seen as the JSD list of competent structural engineering members, as being the representative body of structural engineers in South Africa.

Practising structural engineers who do not wish to participate in this process will be obliged to prove their competency direct to the respective authority or client body.

The summary requirements for inclusion in the JSD list are proposed as follows:

- Registration as either a professional engineer or professional engineering technologist
- Recognition by an institution that requires specialist expertise of its members in the field of structural engineering

The JSD will coordinate this process through two routes, as follows:

- **Option 1** A peer-reviewed or interview process to identify practising structural engineers with substantial experience. As a guide we have proposed in the order of ten years continual experience.
- **Option 2** Owing to our association with the IStructE and its expanding international areas of recognition, we have benchmarked the passing of its Chartered Membership Exam as the entry level. This will maintain a high standard of South African structural engineering and will give recognition in other countries such as the UK, China, New Zealand and parts of the US, Canada, Australia, Europe, Africa, India and the Caribbean.

The JSD by its mandate strongly encourages all practising structural engineers to become chartered members of the IStructE and thereby benefit from global interaction to achieve and maintain excellence and high standards in our local environment. The committee is in the process of setting up a more accessible local procedure, together with guideline lectures, for writing the Chartered Membership Exam.

We trust we are representative of all groups of structural engineers in South Africa. Your committee is certainly not closed to other proposals that lead to the same objective, that is, the consolidation and enhancement of the structural engineering profession in Southern Africa.

Although this viewpoint has developed through the concern of structural engineers, the issues are similar for all divisions of engineering. It may therefore be appropriate in the future to develop a series of engineering lists for the benefit of the public and client bodies to identify engineers competent in their field of specialisation.

Rob Young, Chairman JSD.
Issued by the Joint Structural Division of the South African Institution of Civil Engineering and Institution of Structural Engineers

IStructE Awards 2006

IStructE invites you to submit entries for the Structural Awards 2006. These annual awards are the world's pre-eminent awards for structural engineering excellence, recognising and rewarding the work of the world's most talented structural designers and their indispensable contributions to the built environment. Categories have been changed to better reflect the breadth of projects for which structural engineers are responsible.

The deadline for submissions is 7 April 2006. Structures entered must have been completed between 7 April 2005 and 7 April 2006.

Contact details (for category definitions, judgement criteria, and details on how to enter)
Lucy Pile
T +44 (0)20 7201 9104
pile@istructe.org.uk
www.structuralawards.org

Viewpoint 2

Registration of 'competent structural engineers'

THE PURPOSE OF the proposed register needs to be defined more clearly.

Perceptions of the creation of an elitist society or club can provoke negative sentiments that will erode any positive intentions. One negative aspect is that members of the register could for example utilise membership/non-membership of a competitor, in a context of negative marketing. In addition, the local authorities who have to comply with SANS 10400 could decide that it would be too onerous to review a submission by a professionally registered person and to judge whether this person is competent or not, and there is real danger that they would have carte blanche to refuse submissions from such persons.

The proposed method of compiling a register of competent structural engineers is in principle not unsound, but some aspects need to be carefully considered before implementation.

PROCESS

The inclusion of clauses in SANS 10400 for publication later this year is not only premature, but also unacceptable at this stage, since it is believed that proper consultation has not taken place. Several aspects of concern were raised in communication with SANS, including the definition of a competent structural engineer, as well as a competent geotechnical engineer regarding dolomitic areas. These inputs have gone unheeded and unanswered, leading to great frustration on the part of the correspondents.

It is vital to define and recognise the statutory role of ECSA and registration as a professional engineer or technologist with reference to the creation of a separate competency register. Dualism of any form can lead to considerable latitude of interpretation by the general public, decision-makers and other professional bodies. The question remains as to which would take preference: ECSA registration or listing in a separate register. If this matter remains unresolved at the time of publication of SANS 10400, it will evidently lead to confusion and possibly also to unfair and unjustified judgements of the competency of individuals by decision-makers both in terms of clients and local authority officials.

EVALUATION OF APPLICANTS

A self-appointed panel of any form can compromise any measure of credibility to the process, however pure their motives or professional their approach. The constitution of such a panel can be valid only if extensive consultation with practising structural engineers, ECSA and other decision-making bodies is involved. In compiling a suitable panel, consideration needs to be given, but is not necessarily limited to, the following:

- Experience of a wide range of structures would have to be represented. A panel member who specialises in one field only, for example housing, cannot, under any stretch of the imagination, be judging the competency of, for example, a bridge engineer
- Academic qualifications. Tertiary academic qualifications represent considerable investment in terms of time and money and should be taken into consideration in the review process
- Standing with other professionals and contractors
- Registration as a professional, whether with ECSA or another recognised organisation

The review panel will only be considered fully credible if a consultative process such as the following is followed:

- Ascertain what types of structural experience would have to be judged
- Publicly invite nominations of panel members. Nominees would have to be screened by a representative panel of key stakeholders and decision-makers related to the profession and the industry
- Establish a suitable panel of representative size and distribution

To prevent major problems and embarrassment to the profession, the review process should be transparent and the criteria clearly outlined, agreed upon and eventually communicated. Failing this, a tedious and unsavoury process may result from appeals by unsuccessful candidates. Objective criteria should constitute most of the review process.

CONCLUSION

Compiling and implementing a list without due process being followed is a recipe for professional disaster. The health and safety of the public is the ultimate aim of regulating engineers, technologists and technicians. However, the rights of competent individuals who are currently registered with ECSA cannot be compromised 'merely' because some individuals may choose not to apply to be listed separately.

Since ECSA, SANS and the voluntary learned societies have a responsibility to look after the public as well as the professionals, the way in which failures in structures are reduced to zero and sustainable and good quality structures are achieved is paramount.

Wally Burdzik and Nick Dekker

Viewpoint 3

View of the SAICE Executive Board

THE PROFESSIONAL registration of its members has always been of major importance to SAICE and its governing structures. SAICE members and office bearers indeed played leading roles in establishing the South African Council for Professional Engineers (SACPE) about forty years ago, and later transforming SACPE into the Engineering Council of South Africa. The status and credibility of ECSA have remained top priorities for SAICE, and therefore SAICE members are regularly nominated to serve in ECSA structures.

With the promulgation of the new built environment suite of Acts in 2000, a host of long-awaited opportunities became a reality for the engineering professions. The following two are possibly the most pertinent to this debate:

- Compulsory CPD as a prerequisite for renewing professional registration
- Identification of work for professionals in the built environment

These two issues are interlinked, because both are related to the objectives to ensure professional competency at all times, and to ensure that only competent professionals will be allowed to perform work identified in the various categories of built environment professions. The ID of work process is advanced at ECSA, and to ensure integration and fairness in the process,

▶ To page 11

Viewpoint 3: From page 9

the Council for the Built Environment will ultimately consider the proposals received from, for example, the councils dealing with engineering, architecture, project and construction project management, quantity surveying, and so forth.

In parallel, the need to identify and define specialist and/or special expertise groups has been evident for some time. An example of such a field of expertise or area of specialisation is large dams. In the past, most of these areas of expertise were dealt with by specific legislation. In the mining and manufacturing environment there are other examples, and in some cases the term 'ticket' has been used to define the competency requirement.

The SAICE Structural Division, commonly known as the Joint Structural Division (JSD) owing to its relationship with IStructE of the UK, has for many years lobbied that separate registration of structural engineers would be advantageous to support progress towards a safer structural environment and a reduction in failures. This would, of necessity, impose more stringent requirements on people who wish to practise structural engineering.

However, the professional environment has not been conducive or receptive to such a separate registration. It is against this backdrop that the JSD took the initiative to embark on a process to create a special list for competence in structural engineering. The main aim is obvious, and there is nothing to say against enhanced competency, quality and standards. The challenge for the initiative was and remains: How does it fit into the broader scheme of regulation and how does it affect current rights?

For example, what are the distinctions that such a list would draw between a 'specialist' structural engineer and a 'generalist' civil engineer who also does structural engineering? Is the engineering human capital population of South Africa sufficiently 'mature' in terms of, for example, number, age profile and experience, for such specialist lists? Will clients understand the distinction between routine and specialist structural engineering tasks? What is the risk of such a list discriminating unfairly against competent civil engineers? If such a list is warranted, what process should be followed to initiate it?

In the past six months various presentations and communications were made by the JSD, including those to the SAICE Executive Board and the SAICE Council. Discussions were also initiated with ECSA and other bodies. In the meantime South African National Standards have also embarked on an initiative to change the old building regulations to make provision for a new approach when competency of structural design and supervision in the local authority environment has to be assessed.

The SAICE governance structures recognised that this issue has to be dealt with carefully and with the necessary circumspection and at the Executive Board meeting of 9 February 2006 decided on the following course of action:

- To invite the JSD, as well as opponents of the proposed competency list for structural engineering professionals, to submit viewpoint articles to advance the debate
- To publish background information in order to ensure better understanding of the current debate
- To invite SAICE members to submit their views, suggestions and comments about the proposals by the JSD, as well as the need for similar initiatives
- To communicate to ECSA and SANS that SAICE would request that no final steps should be taken regarding the creation and implementation of special competency lists before the implications have been dealt with in a transparent and inclusive way, and that SAICE offers to create a common platform for interested and affected parties and to play a facilitating role
- To convene a SAICE workshop in May 2006 where stakeholders, role players and affected parties, including ECSA, SANS, SAFCEC and SAACE, as well as SAICE divisions and individual members of SAICE, can discuss the way forward regarding the creation of specialist competency lists or registers, not only in structural engineering but also in other specialist areas

Dawie Botha

SAICE members are invited to submit their **views, comments, suggestions and input** to SAICE National Office at dbotha@saice.org.za or fax 01-805-5971 or write to The SAICE Executive Director, Private Bag X200, Halfway House, 1685 or deliver to SAICE House, Block 19, Thornhill Office Park, Bekker Street, Midrand.
Deadline for submissions 25 April 2006

Text Spencer Erling
Education Director
Southern African Institute of Steel Construction

Structural steel for the next decade

THE YEAR 2005 WAS the year when it almost all came together when it comes to new codes and specifications for structural steel.

The starting point was the issue in May of SANS 10162-1:2005 The Structural use of steel, Part 1: Limit-state design of hot rolled-steelwork.

This was the long awaited tenth year review of the previous limit-state code issued under the guise of SABS 0162-1:1994.

As in the recent past, this code has been largely based on the Canadian S16 design code. The S16 code underwent its ten-year review in the early 2000's and the updates included many of the comments generated in South Africa for the review committee. There are numerous changes which include the definition of class 1 to 4 sections, effective lengths, new requirements for truss design, effective lengths of welds, etc.

Perhaps one of the more important side issues is that the code now ties all welding requirements to the American Welding Society's Structural welding code AWS D1.1.

The bad news is that with the publishing of this new code, allowable stress design codes are no longer recognised in South Africa.

SANS 10094:2005

The use of high strength friction grip bolts has also been issued. The update has tidied up a few of the loose issues that have been around for a while arising from the old document.

A new design code needs to be supported by relevant specifications and so also released for use were two documents, namely SANS 2001-CS1:2005 Construction works, Part CS1: Structural steelwork and SANS 1921-3:2004 Construction and management requirements for works contracts, Part 3: Structural steelwork. The documents were prepared in line with government procurement requirements.

The former document spells out very clearly the technical requirements to achieve a good quality structural steel project whilst the latter document covers all the 'who does what' issues and allows for the engineer to set up project specific requirements.

2001-CS1 has clarified a few issues that arose between the printing of the now defunct SABS 1200H specification, the interim South African Structural Steelwork Specification and present-day requirements.

Fabrication and erection tolerances are clearly spelt out, welding to AWS D1.1 is again referenced, and a change to the allowable stick out of thread behind the nut in bolted construction has important bearing on the range of bolts that fabricators will need to purchase for future projects.

But from Industry's point of view the most exciting development of 2005 was the introduction of a new basic steel grade, that is, 350WA now replaces grade 300WA as the readily available steel grade for construction. The higher yield strength (17%) steel was made available by the mills at no extra cost to the end user. The 350WA steel is now readily available at suppliers for all structural profiles (ie greater than 50 leg length angles, 50 wide flats and all I, H and channel profiles). Grade 300WA has been discontinued for profiles but will continue to be available in plates for some time to come.

A new design code and new higher strength steel together require that new design aids should be published. This also happened in 2005 with the release by the Southern African Institute of Steel Construction (SAISC) of the 5th edition of the *South African Steel Construction Handbook* – which has now been rightfully given its informal name, that is, the Red Book. In addition to all the tables being recalculated based on the higher-grade steel and the new code requirements all the editorial sections have been updated, corrected and in many cases improved. The new chapter on welding explains how the AWS D1.1 welding code can be used to Industry's advantage.

SAISC tell us that this is not the end of new documentation as they expect to release a definitive handbook on their method of measurement, which has been in use for the last three years.

A new corrosion protection code is in final draft form and SAISC expect to start to look at regularising light-weight steel framing for use in housing projects with a new code for that new industry.

Finally, the SAISC are running numerous courses to help practising engineers keep up to date and to understand the issues in the various codes and standards.

Info

More information is available on www.saisc.co.za

Text Winston Onsongo
Director of Undergraduate Engineering Education
Faculty of Engineering and the Built Environment
University of the Witwatersrand

Structural engineering coverage in undergraduate civil engineering degree programmes

THE MODERN PROFESSIONAL engineering environment requires a regular review of degree curricula to keep pace with the new developments and requirements. Because of this, significant modifications of curricula have taken place over the last twenty years. Some of the changes have had a negative impact on the structural engineering sub-discipline. The content of structural engineering courses has either been trimmed down or moved to post-graduate level, to which only a limited number of graduates ever obtain exposure.

The major wave of change to the civil engineering curricula was owing to the recognition about two decades ago that the coverage on environmental issues was not adequate. National and international demand to train more experts in this area accelerated the introduction of new courses and the upgrading of existing courses. It quickly became evident that the already overloaded degree content would not take on much new material. It therefore became necessary to reduce content or drop out courses from other areas. Structural engineering courses that traditionally made up a major component of the degree programme were specifically targeted.

It is also interesting to note that at about this time convenient and fast computing electronic calculators were introduced. These calculators greatly reduced the time spent in doing tedious structural analysis calculations. Faster and more sophisticated computers and powerful analysis software quickly transformed structural engineering analysis and design. This unfortunately produced the impression (and this still persists) that anybody with a rudimentary understanding of structural engineering can perform the functions of a professional structural engineer, given the right software and a computer.

Unfortunately the accuracy, efficiency and sophistication enabled by the use of computers have not been matched with the necessary understanding of structural behaviour of material under load. Ingenious methods developed over many years that helped to develop this understanding, together with realistic structural modelling and the ability to sketch and detail in design, have been largely reduced or dropped out of the curriculum. It is therefore not surprising that the modern civil engineering graduate has a significantly reduced 'feel' for structural response to load. Modelling for approximate analysis to enable a quick check on the computer analysis output is almost non-existent.

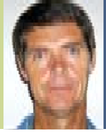
As an example, the approach adopted at Wits to accommodate environmental engineering courses was to introduce a special degree programme with the emphasis on environmental engineering. This programme was developed by essentially replacing the third- and fourth-year structural analysis and structural design courses with environmental engineering courses. On the basis of assigned course weights, the graduate with an environmental engineering degree in 2005 had structural content of about 16.1%. This content consisted of introductory courses at first- and second-year level. This level of structural content is very low compared to that of the traditional degree in civil engineering. A graduate in the 'standard' civil engineering programme at Wits in 2005 had about 41,5% structures content.

It is of interest to review the structures content twenty years ago, that is in 1985. The graduate in civil engineering from Wits in 1985 had a structures content of about 48%. Note that this content would translate to student nominal time of at least 50% because design structures courses are generally more time consuming and challenging to the average student than comparable courses in other sub-disciplines.

The author had the privilege of studying at Canterbury University in Christchurch, New Zealand, for his undergraduate degree programme. On the basis of scheduled time for courses, over the final three professional years, the minimum structures content at graduation was 57,7% in 1985. In the University of Nairobi in Kenya where the author taught structural engineering for many years, the structures content at graduation was 54,8%.

It is reasonable to assume that to develop adequate grounding for modern professional structural engineering, the profession will have to rely on post-graduate studies. This is because optional advanced courses at undergraduate level attract very few students and hence the number of graduates with potential to develop into first-rate professional structural engineers in limited. The average graduate with a first degree in civil engineering will need additional well-structured and initially sustained mentoring to develop the required expertise. □

Text Jan Wium
Professor of Civil Engineering
University of Stellenbosch



Seismic loading research at the University of Stellenbosch

RESEARCH IN structural engineering at the Department of Civil Engineering at the University of Stellenbosch is performed through the Institute of Structural Engineering (ISE).

RESEARCH IN CONCRETE MATERIALS AND STRUCTURES

The ISE has defined three themes for research on concrete materials and structures.

- Under theme 1, development work is performed on modern fibre-reinforced cement-based composites.
- Under theme 2, advanced modelling techniques and material characteristics are applied to specific problems.
- Utilising knowledge and techniques gained from themes 1 and 2, the structural behaviour and design of structures are addressed under theme 3. These include deflections of structures, water-retaining structures (an addition to the programme), hybrid construction, and the seismic behaviour of structures.

SOUTH AFRICA AND SEISMIC DESIGN OF STRUCTURES

The seismic behaviour of structures receives a great deal of attention internationally nowadays and questions are often raised about South Africa's position.

South Africa is generally considered a region with limited seismic activity, but certain areas have been identified as having moderate seismic activity, and structural design needs to make provision for such events.

These areas are divided broadly into two groups: those due to natural seismic events; and those due to mining activity. Mine tremors are not likely to produce any significant structural response for buildings with natural frequencies of vibration less than 2 Hz. Stiff structures such as low-rise load masonry structures are therefore influenced most by mining tremors.

The University of Stellenbosch (US) is located in the Western Cape, where one of the areas for natural seismic events is mapped, so research at the university is currently focused on design of structures for natural seismic events.

The current South African code of practice for general procedures and loadings to be adopted in the design of buildings (SABS 0160), commonly known as the 'loading code', includes a section on seismic design of structures. At a meeting in 2003 with representatives from the civil engineering industry in the Western Cape, it became clear that there is a general lack of support for the provisions of the code. There is also general lack of understanding of the requirements and concepts of seismic design of buildings. Reasons varied, but in general it was believed that the current loading code was unrealistic and that it had been published without a broader consultation process and without adequate allowance for comments by practitioners.

Feedback from this meeting initiated participation by the university in the revision of the section on seismic loading in the code, a general process that had been in progress for some time on the loading code as a whole. The ISE now chairs a Western Cape sub-group of the SAICE loading code work group, tasked with updating and reviewing the seismic loading provisions.

The focus of research at the university is currently on the problems and perceptions of the engineering fraternity of seismic design as they relate to South African construction and design practice. The aim is to participate in the revision of the loading code and thereby to identify those items that require further attention in the South African context.

SEISMIC RESEARCH AT THE US

A report on the Erzincan earthquake in Turkey in 1999[1] states that sophistication of calculations and designing for a greater total base shear force do not necessarily lead to improved earthquake resistance. At the US we believe that for South African seismicity the correct structural concept and appropriate detailing of structural elements may be more effective than extensive calculations on a flawed concept.

It is therefore important that South African structural engineers should be educated in the basic concepts of seismic design. This education needs to be extended to architects, building developers and local authorities.

To complement the principle that seismic design requires a suitable design concept and appropriate structural detailing, research is being performed at the US that will assist in evaluating existing structures and in addressing the specific building practice in the region.

Masonry infill in structural frames

Many buildings in South Africa are constructed as flat-slab, framed reinforced concrete structures. Reinforced concrete shear walls are often required to resist lateral loads (wind and earthquake), but sometimes designers rely on masonry infill partitions in low-rise buildings to provide lateral resistance. But masonry is known to have very little ductility, an important requirement for seismic resistance of structures. In general, depending on the extent of masonry infill in the building versus the size, loading, height and layout of the structure, this type of construction does not provide adequate structural capacity in seismic zones. Also, infill panels may cause unwanted torsional sway of a structure.

Research at the US is examining the behaviour of masonry infill panels, and simplified design methods are being investigated. Currently, research is focused on the development of equivalent springs to represent the masonry infill in a frame analysis of the structure. Once reasonable springs with correct stiffness, ductility and capacity have been developed for various wall thicknesses, heights and lengths, these will be used in simulations of buildings to develop design rules for practitioners (see figure 1).

The simplified springs will also allow a study on the behaviour of masonry panels in existing buildings subjected to seismic loading. It will provide a means of determining wall capacity and of studying the sway effect induced by infill panels.

1 *Earthquake Hazard Centre Newsletter* 3(1), July 1999.

Figure 1 Masonry infill panel (a) modelled with diagonal springs (b)

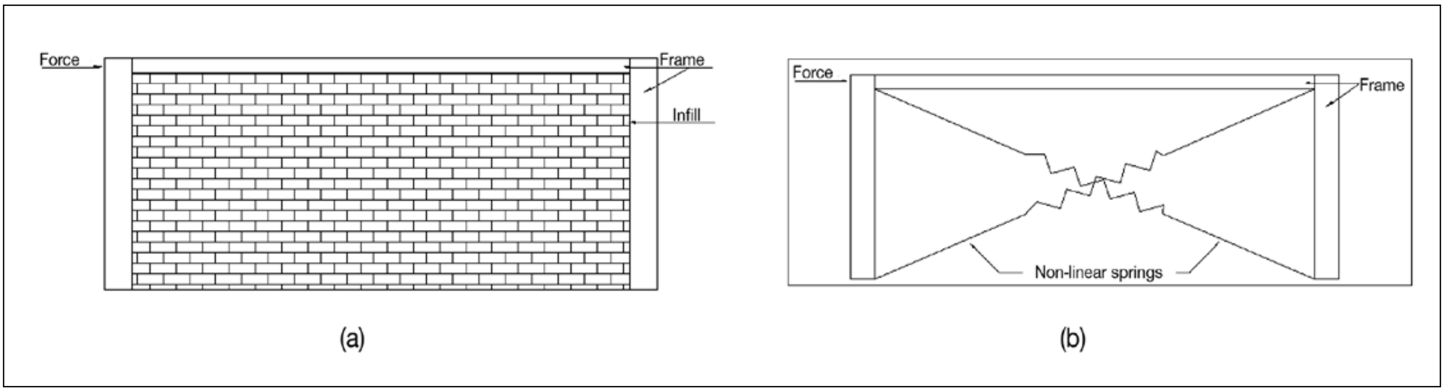


Figure 2 Beam and column test specimen

The aim is to provide practitioners with design tools to evaluate the contribution of masonry panels in new and existing buildings.

Slab repair

Flat slab construction is normally designed to support vertical loads, with lateral loads resisted by shear walls or other bracing systems. However, increased shear may develop at column-slab connections when lateral deformations introduce bending moments and shears owing to imposed deformations. In a final-year undergraduate project, parameters were investigated for which enhanced punching shear may become a critical design condition. These parameters included building height and the ratio between floor area and shear wall cross-sectional area. Increased shear at column-slab connections may also be a critical design condition for one- or two-storey structures without shear walls when such structures are subjected to earthquake loads. This may specifically apply to existing structures where seismic loading had not originally been regarded as a design condition.

To address this situation, a strengthening method is investigated where engineered cement-based composites (fibre-reinforced concrete) can be used to replace the upper section of concrete at a column-slab connection. For this study, finite element analyses are performed of slab sections, using material characteristics of engineered cement-based composites as developed in the Department of Civil Engineering. Some initial laboratory tests on small-scale specimens of slab-column connections have been performed (figure 2). The purpose of the investigation is to develop a repair or strengthening procedure that can be used in the assessment and strengthening of existing structures.

Masonry walls

Un-reinforced masonry walls have very brittle behaviour and therefore do not represent an ideal material for seismic loading. Many structures in the Western Cape are constructed as load-bearing masonry – even up to three storeys and beyond. Often seismic design codes require reinforced masonry when this type of construction is used, depending on the height, floor area/wall section ratio, etc. It is common knowledge that contractors have major objections to the concept of reinforced masonry where vertical bars are used.

As part of a study to find alternative, practical ways of providing reinforcement in masonry walls, preliminary tests were performed on wall specimens subjected to lateral loads. Wall specimens had various amounts of horizontal brick force, and one specimen was tested with vertical mesh between two skins of a 220 mm brick panel. Tests on the panels with brick force confirmed that no additional capacity against lateral loads is obtained by placing horizontal brick force. However, the results on the panel with vertical mesh did prove that some benefits may result from such an arrangement, notably in narrow wall panels where the vertical mesh can prevent the rotation of the masonry panel (uplift) when the mesh is anchored into the foundation.

Displacement based vs forced based design

Seismic design in SABS 0160 is currently based on force design methods. Static loads are applied to the structure to represent earthquake response in a method with which practitioners are familiar. Inelastic capacity of structural systems is accounted for by reducing applied forces, recognising that members can deform past their yield point, depending on the amount of ductility inherent in the system. Codified provisions for force-based design are easy to implement and, although rather crude, perform adequately in the high-uncertainty environment of seismological predictions. However, it is recognised that actual seismic response is dynamic and related primarily to imposed deformations rather than forces. This is in line with recent international developments where displacement-based design is being recognised as the more appropriate technique.

We believe that designing towards a target drift displacement gives an opportunity to control earthquake damage levels, with damage being measured in terms of displacement. This allows for rational adjustment of earthquake design criteria to suit acceptable post-earthquake damage levels for buildings in South Africa, and can be achieved by implementing displacement-based approaches whereby the structure is designed to reach a certain maximum displaced state, with limited degradation of member strengths. For the collapse limit state (relevant to South Africa), survival of the building depends on the gravitational load-carrying capacity of the deformed and partially damaged members being maintained. The challenge will be to present such a design procedure in a suitable format for codification and make it unique to South African conditions. A study is now commencing that will investigate displacement-based design approaches to find more rational design procedures that apply to the specific magnitude of event, type of construction, and other local conditions.

The study is also intended to create better awareness and intuitive understanding among practitioners of expected structural response under earthquake action so that pitfalls and ineffective/uneconomical designs can be avoided. □

Text Peter Dunaiski
Professor of Structural Engineering
University of Stellenbosch

Research programme in structural steel and related fields

A COMPREHENSIVE research programme which consolidates research in structural steel undertaken in the Structural Division was initiated at the Institute of Structural Engineering (ISE) of the Department of Civil Engineering, University of Stellenbosch.

The research programme is aimed at developing advanced modelling techniques for application in the design and engineering for construction projects that involve a significant component of steel structures and is led by Professor Peter Dunaiski, with contributions by Professor Johan Retief, Dr Gert van Rooyen and Dr Philippe Mainçon.

The programme provides stimulating opportunities for research that could lead to PhD and MScEng degrees, and its support by industry has made it possible to successfully take part in the THRIP programme of the Department of Trade and Industry (DTI) for research in collaboration with industry.

The strategic and detail planning of the research are co-ordinated on a continuous basis in collaboration with a steering committee consisting of the research team members and representatives from the industry partners in order to maintain relevancy and to assess and review the activities and results of the programme.

MAIN OBJECTIVES

- **Development of advanced technologies in structural steel** The primary objective of the programme is to enhance the effectiveness and efficiency of the application of steel structures. This affects not only the steel construction industry (including steel production, manufacture, construction and design), but also society, which benefits from these facilities.
- **Development of future technology practitioners and leaders in the steel construction industry (human capital)** A complementary objective of the programme is to provide an environment that is conducive to the development of future specialists and leaders in the steel construction industry. This takes place through the training and development of structural engineers who are not only conversant with structural steel, but who also have a background in the innovative and comprehensive application of advanced technologies such as structural engineering informatics, computational mechanics and structural reliability.

TECHNOLOGY BASIS

The technological merits of the programme consist of the application and development of a number of conventional structural engineering and design modelling techniques. Each of these conventional techniques would enhance the effectiveness of steel structures in their own right. These modelling techniques are taken to a higher level of development by the inclusion of structural engineering informatics in the modelling process.

Conventional structural engineering topics included in the programme are aspects of structural steel design, develop-

ELECTRIC OVERHEAD TRAVELLING CRANE SUPPORT STRUCTURES

Experimental facility

A 5 ton semi-full scale crane supporting structure test facility was built with the support from DSE, DEMAG and Gantrex. The facility provides for the adjustment of a number of structural parameters (for example the lateral stiffness of the structure) and geometric lay-out parameters of the crane (for example the crane wheel base on the end carriages). These variations of parameters allow for the experimental investigation of a broad spectrum of support structure/crane configurations.

- **Wheel/rail/girder interaction** 'Investigation of overhead crane wheel/rail/girder interaction' (MScEng thesis, A R Pérez-Winkler)
- **Deformations in a crane girders** 'Investigation into the top flange and web deformations in a crane girder panel' (MEng thesis, P de K Viljoen)
- **Impact forces** 'Impact forces on end stops for overhead travelling crane support structures' (ISE Report, S Kohlhaas)
- **Experimental facility** 'Concept, design, construction and implementation the experimental facility for crane/support structure interaction' (MScEng study, H Barnard)
- **Calibration of experimental facility** 'Calibration of experimental facility and investigation of various load models for the crane/support structure interaction' (MScEng study, J H de Lange)

Numerical modelling

Various load models for loads applied to the support structure by the overhead travelling crane are developed taking the interaction between the crane and the supporting structure into account. Theoretical analyses of the response of the structure to these load models are performed. The theoretical results are verified through experimental investigations.

- **Numerical model** 'Development of numerical model of crane and supporting structure using the finite element method' (PhD study, T Haas; MScEng study, K Mackenzie)

Reliability analysis

Reliability models for crane loading and the capacity of the supporting structure are developed for future codification.

- **Reliability based codification** 'Reliability based codification for the design of overhead travelling crane support structures' (PhD dissertation, J S Dymond)
- **Production demands** 'Measuring production demands on the supporting structures of overhead travelling cranes' (MScEng study, S J van der Walt)

COMPUTATIONAL MECHANICS

Inverse finite element method

Research on inverse finite element methods (iFEM) has resulted in algorithms for the identification of structural response, structural loads and structural parameters, based on response measurement data. Algorithms for non-linear static problems and for linear dynamic problems have already been implemented and tested, while an algorithm for non-linear dynamic inverse problems is under development.

In practice, such an algorithm will allow processing non-linear dynamic response data measured on a structure, and assess, for example fatigue stresses, also at location inaccessible for measurements.

- **Vortex-induced vibrations** Acceleration and strain measurements, as supplied by Norsk Hydro, Marintek and the Norwegian University of Science and Technology, are processed using iFEM algorithms to determine forces caused by vortex-induced vibrations over time along offshore riser pipelines.
- **Fatigue monitoring** In this project iFEM algorithms are developed to estimate time to fatigue failure or time to the next inspection based on Palmgren-Miner sum of fatigue damage through monitoring measurements at certain points and relating these measurements to the stresses at all critical points in the structure.
- **Measurement sensitivity** 'The inverse finite element method: sensitivity to measurement setup' (MScEng thesis, J Maree)
- **Modelling errors** 'Sensitivity of the results of inverse finite element analysis to modelling errors and application to damage detection' (PhD study, C Barnardo)

Development of the iFEM models and algorithms has reached a stage where a spin-off company, Safran Engineering Algorithms, has been registered to undertake further development and exploit the opportunities commercially.

Non-linear structural analysis

Stability considerations are of critical

ment of design guidelines, application of computational mechanics both in the design of structures using the finite element method and the assessment of experimental and operating structures applying the inverse finite element method.

Two main informatics-based technologies are developed in the programme, namely the integrated performance of engineering and design of steel structures and the computational modelling of the engineering process.

INDUSTRY SUPPORT

Industry has recognised that the programme not only incorporates specific research and development goals for the industry partners, but also results in attaining industry-wide objectives such as the education and training of future practitioners and experts.

KNOWLEDGE BASE

The programme builds on a sound knowledge base which includes the results from earlier programmes on industrial steel structures, overhead travelling crane support structures, and structural reliability. Experience in these programmes serves as motivation for renewed support from industry partners. The base is broadened through extensive collaboration with foreign academic institutions.

DEVELOPMENT OF CONVENTIONAL STRUCTURAL ENGINEERING TECHNOLOGY

- **Design-related techniques** Since structural design is the basic feature determining the performance of steel structures, activities in the programme are directed towards improving the design process and content. These activities include generic activities such as design standards, as well as specific design situations such as industrial buildings housing overhead

RISK AND RELIABILITY IN CIVIL AND STRUCTURAL ENGINEERING

Research projects in the field of risk and reliability in civil and structural engineering contributing to the research programme on structural steel considers aspects of structural reliability modelling and its application to codified structural design, within the context of risk assessment of structures and risk management of construction projects.

Projects on risk and reliability formed part of the programme for the following reasons:

- Core activities of the general research program are addressed.
- Maintaining expertise in the field was considered to be of strategic importance.
- It provides a fertile field for innovative research for graduate studies.
- It facilitates international cooperation and exchange.

Applications of reliability modelling

Reliability modelling of structures provides the basis for assessing the performance of design procedures, which in turn leads to reliability calibration for structural design standards. Projects on structural reliability modelling are therefore closely related to the development of design standards and include the following:

- **Reliability calibration** 'Development of a methodology for structural code calibration' (ISE Report, T R ter Haar and J V Retief)
- **Load combination schemes** 'Reliability assessment of alternative Eurocode and South African load combination schemes for structural design' (*SAICE Journal* paper, M Holický and J V Retief)
- **Imposed roof loads** 'Imposed loads for inaccessible roofs of light industrial structures' (master's thesis, P J de Villiers)
- **Geotechnical design** 'Reliability based foundation design, with special reference to pile foundations' (PhD study, M Dithinde)
- **Structural reliability framework** 'Derivation of guidelines for a reliability framework for structural design standards from the application of risk assessment of structural performance' (J V Retief, P E Dunaiski and T R ter Haar)

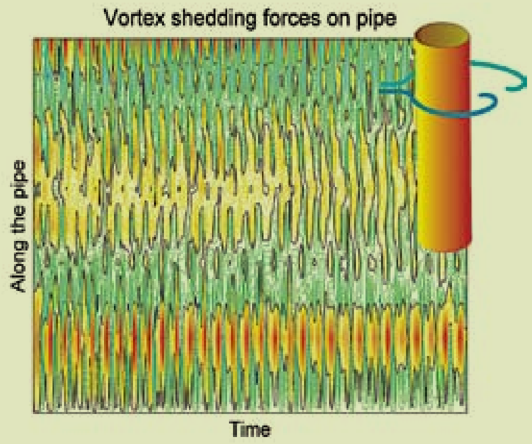
Development of standards for structural design

The main activities in the field of the development of structural design standards are directed towards contributions to the SAICE Working Group on the revision of the loading code SANS 10160. Acknowledging the contribution of other members of the working group, the contributions by members of this research programme are presented here:

- **Basis for revision of SANS 10160** The general basis for the revision of SANS 10160 including the scope of provisions, extension of the basis of structural design and actions provided for and the use of reference standards were investigated in a study by J V Retief, P E Dunaiski and T R ter Haar. An assessment of Eurocode to serve as reference for the revision process is made in 'The Eurocode Standard for structural design – an overview from the perspective of SANS 10160' by M Holický, J V Retief and P E Dunaiski
- **Basis for structural design** Provision is made for the incorporation of all material-independent requirements in SANS 10160, including an extended reliability framework, appropriate schemes for combination of actions together with partial action and combination factors, using EN 1990 Basis for the design of structures as reference. The conceptual framework for this process is based on calibration using reliability modelling and formal comparison with existing practice, to improve the consistency of reliability, whilst maintaining present general levels of reliability.
- **Imposed loads** Following an extensive comparison of present provisions for imposed loads with those of other standards, adjusted specified values are presented in a revised format based on Eurocode EN 1991-1-1 General actions: Densities, self-weight and imposed loads for buildings. Partial and combination factors for imposed loads are being assessed, using reliability models for imposed loads.
- **Crane-induced actions** Provisions for actions induced by overhead travelling cranes were revised, using the load models of Eurocode EN 1991-3 Actions induced by cranes and ma-

importance in the design process of steel structures. The accurate determination of the geometrically non-linear behaviour of 2-D and 3D structures ensures the stability of slender structures.

- **Non-linear structural analysis** 'Non-linear analysis of 2D and 3D truss and frame structures' (G C van Rooyen and P J Pahl)



Right: This figure illustrates the complexity of the forces caused by vortex-induced vibrations which make them so difficult to account for in design

travelling cranes. (see box on page 17).

The research has resulted in contributions to the review and revision of existing standards such as the South African loading code. The results of the assessment of emerging international standards such as Eurocode are also considered. Extension of standard industry practice, for instance by introducing recent developments in fire engineering design, is complemented by advanced techniques such as reliability modelling (see box 'Risk and reliability' on page 18).

- **Computational modelling and analysis** Computational modelling tools have been developed for various applications aimed at complementing design in the pre-construction phase through finite element modelling (FEM) as well as to assist in the interpretation of experimental results and assess the performance in service of constructed installations through inverse FEM (iFEM) techniques. The development of analysis procedures to investigate the geometrically non-linear behaviour of structures is not only of critical importance to structural steel performance, but also has the potential to be integrated into structural engineering informatics applications (see box 'Computational mechanics' on page 18).

DEVELOPMENT OF STRUCTURAL ENGINEERING INFORMATICS-BASED TECHNOLOGY

- **Integrated structural engineering design** The generic objective of the development of structural engineering informatics (SEI) models is to integrate the various design, planning and engineering processes into an information technology-based platform, using powerful mathematical tools. Computer network-based structural engineering and design models and tools are developed to provide for the interaction between the planning and draughting of structures on the one hand and structural analysis and design on the other. The research is mainly aimed at enabling design team members, separated in time and space, to perform these tasks collaboratively with the support of a communication network (see box on page 20).
- **Computational (project) management** The digital modelling of the pre-construction engineering process is based on mathematical theory that ensures consistency of its planning. The modelling techniques cover the three most important aspects of engineering processes, namely quality of data sets, time and money (see box on page 20).

chinery. Investigations include assessment of the design implications of the revised load models in comparison to the existing code, and appropriate load and combination factors for crane-induced actions.

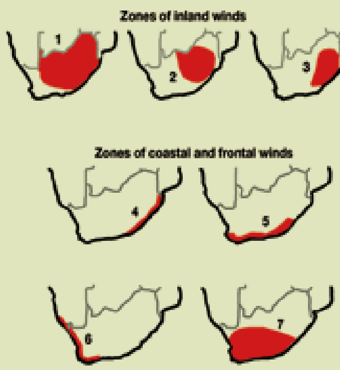
- **Additional provisions** Inclusion of additional provisions into SANS 10160 based on Eurocode were considered and evaluated. The following sections are being developed for this purpose: Thermal actions (EN 1991-1-5 General actions: Thermal actions), actions during execution (EN1991-1-6 General actions: Actions during execution), accidental actions (EN 1991-1-7 General actions: Accidental actions due to impact and explosions) and design assisted by testing (EN 1990 Annex D (Informative) Design assisted by testing).
- **Serviceability criteria** Provisions for serviceability deflection criteria are being revised, by considering provisions from other standards, changes in proposed serviceability design situations and associated actions and combination schemes, and the relative importance of deflections to structural design. A project 'Serviceability specifications for structural design deflections' is currently being prepared as a Diplom study by F Warmuth.
- **Contributions to various WG activities** Support is given to the activities considering provision for wind actions in SANS 10160 based on EN 1991-1-4 Wind actions, particularly in comparisons between actions from existing and proposed procedures. Assistance is also given from the program for considering geotechnical actions on structures based on EN 1997-1 Geotechnical design – General rules, in addition to provisions for geotechnical action combination schemes.

Risk assessment and project risk management

The following projects on risk assessment of civil engineering facilities which specifically relate to structures and construction project risk management form part of this programme.

- **Project risk management** 'The limit state cost function as a risk management tool for construction projects' (master's thesis, GM Ker-Fox)
- **Project risk modelling** 'Reliability modelling of performance functions containing correlated basic variables, with application to construction project risk management' (PhD dissertation, G M Ker-Fox)
- **Project risk decision support** 'Risk based decision support in civil engineering: a methodological approach towards improved data acquisition and utilisation' (PhD dissertation, A Bester)
- **Wind disaster management** 'Development of a wind damage and disaster management model for South Africa' (PhD dissertation, A M G Goliger)

Characteristics of strong wind events as applied to a wind disaster management model for South Africa



STRONG WIND EVENT	ZONE	Footprint		Wind speed (m/s)	Occurrence $(km^2)^{-1}$ $(year)^{-1}$
		Width (km)	Length (km)		
Moderate	1, 2, 3	10	20	20–25	15
Strong	2, 3	12,5	35	20–30	10
Intense	3	17,5	100	20–30	0,5
Downburst	3	3	15	30–50	Not known
Tornado	3	–	–	40–70	10^{-4}
Coastal low	4	850	55	20/30	20/10
Cut-off low	5	350	100	20–30	3
Shallow SE	6	500	50	20–30	13
Mid-lat low	7	700	700	20–35	8

CONCLUSIONS

Integration of advanced technologies

An important feature of the programme is that it incorporates related topics such as computational mechanics, structural engineering informatics and reliability analysis in an integrated manner so as to maximise synergy in the advancement of the technological base for structural steel practice. Outcomes cover the range from cutting-edge development such as the application of mathematically based models for the engineering process of large construction projects or inverse FEM modelling for fault detection on structures, to practice-related topics such as the revision of structural design standards and procedures based on appropriate reliability modelling.

Formation of specialists and potential future leaders

Another important output of the programme is the continuous stream of engineers entering engineering practice and academia, bringing with them not only an advanced qualification, but also the experience of participating in an active research programme and being exposed to an international network. To date, most of the five PhD and ten master's graduates have realised the promise of being recognised as experts or advancing to positions of leadership. Currently four PhD and ten master's students are enrolled in the programme.

International cooperation and exchange

An important feature of the programme is that it provides the basis for an elaborate international network for cooperation and exchanges. Cooperation and exchanges at student and lecturer level regularly take place with universities such as the TU Berlin, TU Delft, TU Darmstadt, Bauhaus University Weimar, Czech TU Prague, and the Norwegian Technical University, Trondheim. Other international activities include contact with learned organisations such as the Joint Committee on Structural Safety, as well as involvement with code development committees such as ISO TC 98, CEN TC 250 on Eurocode, specifically SC 1, which is responsible for the basis of design and actions on structures within CEN TC 250. Students get the opportunity to spend time with international partners as part of their research activities and enjoy multiple benefits from these exchanges.

Acknowledgement of industry support and participation

The vital support and participation of industry partners in the programme has to be acknowledged.

- To a large extent the programme was initiated by the progressive and positive interaction of the SA Institute for Steel Construction with undergraduate and graduate studies and research.
- Iscor was sufficiently visionary to see the programme as related to their market – a position that is being maintained by Mittal Steel.
- BKS (Pty) Ltd, through their Structures Division, continually participates and interacts with the activities of the programme. Not only did DSE make a major contribution during the initiation of the programme but their contribution – together with that of DEMAG and Gantrex – to the construction of the laboratory crane installation was invaluable.
- As an international role player in the provision of engineering and project management services for large industrial and mining installations, Hatch (Africa) provided a stimulating environment and support for the development of informatics-based process modelling technology.
- Subvention of industry contributions by the DTI-funded and NRF-managed THRIP programme not only provides motivation for such contributions, but also makes a key contribution to the resources of the programme. ◻

STRUCTURAL ENGINEERING INFORMATICS

Collaborative structural engineering

Object oriented computer application frameworks are developed for conceptual structural design, structural analysis, member and connection design of steel structures. The underlying implementation architecture of the framework supports the deployment of the applications in a network-based distributed collaboratory. The specific aim of this activity is to integrate the three functionalities (analysis, member design and connection design) into a multi-model application within which seamless information exchange and distributed collaboration can take place.

- **Structural analysis** 'Structural analysis in a distributed collaboratory' (PhD dissertation, G C van Rooyen)
- **Database** 'Data modelling of industrial steel structures' (MScEng thesis, D R Oosthuizen)
- **Finite element analysis** 'Object-oriented finite element framework' (MScEng thesis, A H Olivier)
- **Steelwork connections** 'Object-oriented connection design framework' (MScEng thesis, G E Willemse)
- **Structural steel members** 'An object-oriented framework for design of hot-rolled structural steelwork' (MScEng thesis, C Hewetson)
- **Collaborative structural design** 'Network-supported collaborative structural design' (MScEng, M-J Deacon)
- **Column forces** 'Efficient determination of column forces in multi-storey structures' (MScEng study, E Lourens)

Computer-aided design in structural engineering

CADEMIA is a software-kernel for CAD applications which is developed at the Bauhaus University Weimar, Germany. It provides general graphical functionality and tools for the engineering environment. StructuralCAD, developed by PhD student A H Olivier, is an example of effective utilisation of the draughting and modelling tools provided by CADEMIA to capture the geometric concepts required for structural design applications.

- **StructuralCAD** 'Consistent models for structural design' (PhD study, A H Olivier)

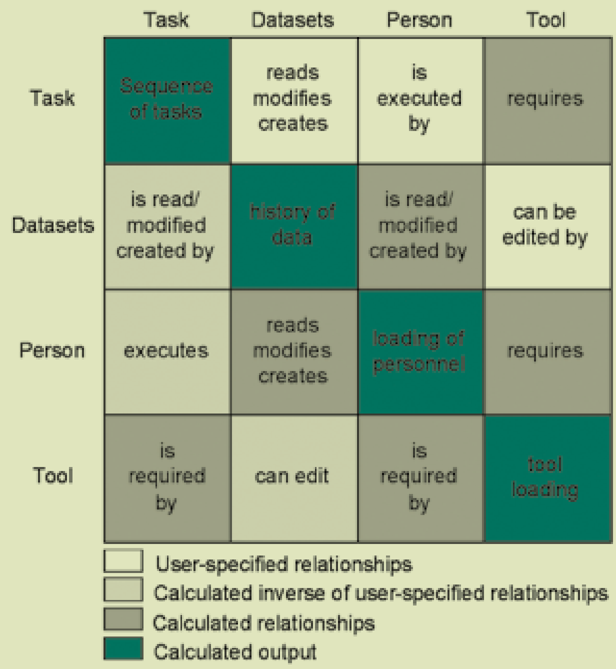
Engineering process modelling

The engineering process for large construction projects requires an extensive preparation phase. Fundamental aspects are:

- A complete description of the datasets, such as technical drawings, three-dimensional digital models or partial models, which have to be produced during the execution of the engineering process
- Engineering tasks which have to be executed to produce these datasets
- Information about persons involved in the process
- Tools which are used to execute the processes

The process model has a robust mathematical basis which ensures consistent evolution of the datasets through the project steps.

Process modelling



Full membership of the Joint Structural Division

MEMBERSHIP OF the JSD is open to both SAICE and IStructE members. Full membership is, however, confined to those who are members of both institutions. In order to encourage full membership, IStructE offers a discount on its membership subscriptions (currently 45%) to those of its members who are also members of SAICE.

Members of IStructE (FIStructE, MIStructE, AMIStructE and AIStructE) who are registered with the Engineering Council (UK) are eligible to become SAICE members (MSAICE) provided that they are active in civil engineering at the time of their admission. Such persons once admitted will be entitled to use the letters MSAICE to designate their grade.

The revised IStructE bylaws establish the following requirements for MIStructE, AMIStructE and AIStructE as follows:

Grade	Requirements at time of admission to the grade	Comments
Member (MIStructE)	■ Hold either an institution-accredited degree in civil or structural engineering, or an institution approved equivalent qualification, and ■ Be engaged in the profession of structural engineering, and ■ Have completed appropriate initial professional development, and ■ Have passed the Professional Review (comprising an Interview and either the Chartered Membership Examination or the submission of research and/or development work) (There is also a Technical Report Route, an Associate Member to Member Route, and an European Directive 89/48/EEC route)	Members may describe themselves as Chartered Structural Engineers and may be registered with the Engineering Council UK as a Chartered Engineer (CEng) should they so wish The requirements for academic qualifications are aligned with the Washington Accord as is the case for those associated with registration as a Professional Engineer
Associate Member (AMIStructE)	■ Hold either an Institution-accredited qualification in civil or structural engineering, or an Institution-approved equivalent qualification, and ■ Be engaged in the profession of structural engineering, and ■ Have completed appropriate initial professional development, and ■ Have passed the Professional Review (comprising an interview and either the Associate Membership Written Examination or the submission of research and/or development work)	Members may describe themselves as Incorporated Structural Engineers and may be registered with the Engineering Council UK as Incorporated Engineers (IEng) should they so wish The requirements for academic qualifications are aligned with the Sydney Accord as is the case for those associated with registration as a Professional Engineering Technologist
Associate (AIStructE)	■ Hold either an Institution-accredited degree in civil or structural engineering, or an Institution-approved equivalent qualification, and ■ Be engaged in the profession of structural engineering, and ■ Be domiciled outside the European Economic Area, and ■ Be in a qualified grade of membership of a body with which the Institution has a joint membership agreement, and ■ Have passed the Professional Review Interview	SAICE members who are registered as Professional Engineers are eligible for admission through this route Members may describe themselves as Chartered Structural Engineers and may be registered with the Engineering Council UK as Chartered Engineers (CEng) should they so wish The requirements for academic qualifications are aligned with the Washington Accord

The JSD conducts the Professional Review Interview on behalf of the IStructE and facilitates the sitting of the membership examinations. □

Text Ralph Travers
Bridge Engineer (Retired)
SA Transport Services (now Transnet)
With input from Charles Strydom and Henry de Wet
Photographs Albie Vos, courtesy of Spoornet

The Mfolozi River rail

THE FIRST BRIDGE

The Mfolozi River in KwaZulu-Natal is one of the major rivers in the Republic, having a catchment of 9 300 km^2 upstream of Mtubatuba, which is about 25 km from the river mouth. The North Coast railway line (Empangeni–Golela) was built during the Anglo-Boer War (1899–1902) as far as Somkele, just north of Mtubatuba, and opened to traffic in 1902. It crossed the Mfolozi over a 14-span bridge 8 m above the river bed at a point where the flood plain was roughly 2,4 km wide.

The bridge construction was simple, with piers consisting of two 380 mm cast iron screw pile bents connected at the top by a box girder, while the 9,1 m spans were made up of two plate girders 863 mm deep.

In the years up to 1911 one flood washed away the northern embankment and a second in 1909 removed part of the southern approach embankment. During the repair work after the 1909 flood two 10,4 m spans were added to the bridge at the south end. A larger flood in 1911 washed away one pier, leaving the spans on either side suspended by the railway track. The flood did not overtop the bridge, the damage being caused by a build-up of trees and undergrowth against the pier.

Temporary repairs were carried out using timber trestles, but the work was made more difficult by the fact that the river was 'infested with crocodiles'. A temporary footbridge for passengers was made available.

A proposal to raise the bridge by 760 mm was made in July 1911 by the 'Engineer in Chief'. This included the replacement of eight of the 9,1 m spans by four 18,2 m spans, the latter being half-through spans. The then estimated cost of the bridge works was £4 700. However, before final approval, another flood in September removed pier 6 and one of the temporary timber trestles.

Approval was given to the scheme by the General Manager on 25 October 1911. Contracts for the supply of structural steelwork (A Findlay & Co for £1810 at £11,6 per ton) and for the cast iron pier bents (Horsley & Co for £747,5) were awarded in May 1912 to UK companies and the material was shipped in November of that year.

Tenders were invited for the reconstruction of the bridge in August 1914, but the lowest tender of Richie & Greener for £4 999,7 was considered too high. In spite of negotiations with the firm which resulted in the offer being reduced to £4 420 no agreement was reached and it was decided to carry out the work departmentally. A revised estimate for the whole work of £9 222 was approved in March 1915.

Work on site started in February 1915 and proceeded until January 1916, during which period several floods caused difficulties and delays and it was decided ultimately to temporarily abandon construction work until the end of the rainy season in May 1916. In the meantime a proposal to add two spans at a cost of £2 150 was approved and when work started again as planned it continued until the reconstructed bridge was opened to traffic on 10 March 1917.

On 14 February 1918, just 11 months later, the reconstructed bridge was washed away.

Temporary bridges were totally submerged on 30 January 1923 and 24 December 1924, and washed away on 11 March 1920, 17 November 1921 and 2 March 1925.

The General Manager on 6 April 1925 was driven to call for urgent action to be taken to avoid further interruptions to traffic, mentioning that during that rainy season traffic had so far been interrupted seven times for an average of three days on each occasion.

The 1929 bridge withstood all floods, many of which could be considered of major extent, until the advent of cyclone Domoina during the last days of January 1984. The design life of bridges as required by the SA Transport Services (now Transnet) Bridge Code is 120 years. The railway bridge had reached nearly half of this theoretical life and could therefore, in view of the extraordinary nature of the Domoina flood, be considered to have achieved its design purpose

bridge

THE SECOND BRIDGE

Two proposals were formally put forward in August 1925, namely:

- Make the existing line reasonably flood proof by raising the formation level to 1,5 m above the 1918 flood level (or 2,5 m above the 1925 flood) and providing a total of 27 spans of 45,7 m (150 ft clear) at a cost of £271 240, including earthworks and track.
- Deviate the line north of the Eteza lake and provide a total of 22 spans of 45,7 m over the Msinduzi and Mfolozi rivers at a cost of £235 528, including earthworks and track. A site on the Mfolozi 2,4 km upstream of the existing bridge, where rock outcropped, showed promise.

At this time planning and construction of the line north of Somkele up to Golela on the Swazi border had commenced and it was obvious that a more reliable crossing of the Mfolozi had to be found to suit the added importance of the line.

Drilling started at the new bridge site in June 1925, the proposed bridge consisting of 13 spans each of 45,7 m clear, using riveted steel trusses. Various alternatives for a road crossing were at the same time being investigated by the Provincial Roads Department, culminating in a request for a roadway to be provided on cantilever brackets on the downstream side of the railway bridge spans.

Doubt about the wisdom of the choice of the deviation and new bridge site as against improvements to the existing route continued to be expressed, however, and in September 1926 a report was prepared for the consideration of the Minister and the Railway Board. The recommendation for the deviation must have been approved because the matter was not raised again after this date.

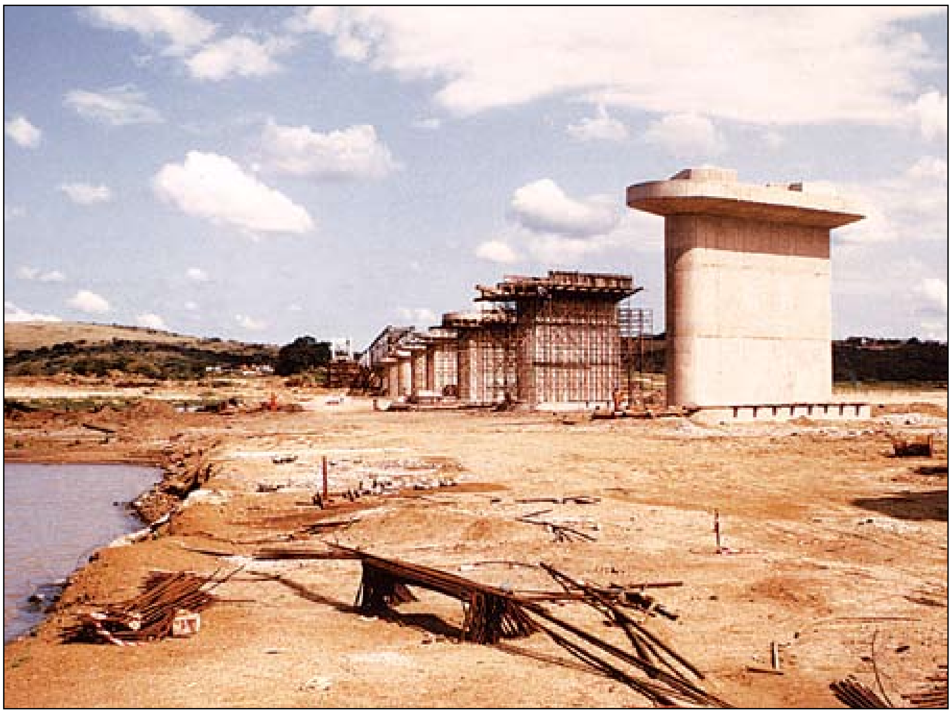
A detailed estimate of £260 400 for the deviation was approved in November 1926. It included an amount of £132 715 for a bridge over the Mfolozi.

Tenders for the construction of the substructure, which consisted of solid dumbbell shape cross section piers 9 m in height on twin 3,6 m diameter cylinder caissons up to 30 m deep, together with straightforward concrete abutments, were invited, closing on 19 May 1927. The contract was awarded to the firm J Dunn, Ingram, Anderson & Co to the amount of £44 545,63, excluding cement, re-enforcing, cutting edges, etc, and allowing for 'Native labour'. The firm's price for 'white labour' was £57 388,75 and was not accepted owing to 'climatic conditions'.

Tenders for the supply of structural steelwork for 13 spans of 45,7 m (150 feet) clear, weighing in total 2 296 tons, were invited, closing on 23 June 1927. Twenty-one tenders were received, evidence of keen competition. The contract was awarded to Guest, Sykes and Chapman of the UK to the sum of £41 186, which works out at £18 per 2 240 lb ton, somewhat less than today's price.

In January 1927, when it was found that the general rock level on the south bank was much higher than was previously thought due to information which became available as a result of foundation excavation, the acting Resident Engineer proposed that the two southernmost spans of the bridge be omitted. The proposal was agreed to after an investigation of the report for borehole No 9, which gave a misleading

From left to right:
Breached embarkment behind northern abutment (Mtubatuba end)
Path of destruction! 10x160 t spans lie strewn out downstream
Here we go! Launching process of new spans commences



Construction of five new piers nearing completion

impression. The steelwork erection contractor offered a saving of £4 182 and the saving in steelwork was worth £2 154,35.

Tenders were invited, closing on 13 August 1928, for the erection of steelwork and the contract was awarded to the same firm who were doing the superstructure work, for the sum of £11 008,63. The tender allowed for the use of 'unrestricted' labour and the firm's price for 'civilised' labour of £16 491,88 was, again due to 'climatic conditions', not considered suitable. The price represents a rate of £5,7 per ton.

The work on site proceeded as scheduled, but shortly before completion of the bridge an anonymous letter was received by the Chief Civil Engineer from a 'Resident' of Mtubatuba, alleging that the cylinders of pier 2 were built 3 to 4 feet out of position and that the pier rested on dummy cylinders. The matter was investigated in some detail and it was found on opening up that the cylinder was indeed out of line, but by 33 inches (838 mm) on the centreline of the truss – a serious matter. The cylinder was, it was said, deflected by a tree trunk during early sinking, but investigation showed that it was probably set out incorrectly in the first place, presumably by the contractor, who subsequently had to carry out remedial work at his own expense.

In spite of the cylinder incident at pier 2, the work on site proceeded on schedule and the bridge was opened to traffic in May 1929 without any fuss or fanfare. The main North Coast road, supported on cantilever brackets attached on the downstream side of the bridge, was opened at the same time. The road surface was a narrow single lane and consisted of hardwood planks, which were very noisy under traffic. It cost the Roads Department, inclusive of approach earthworks and concrete work in abutments, the sum of £9 890. This roadway was in use until 1966 when the new bridge 1,6 km upstream was opened to traffic.

CYCLONE DOMOINA – 31 JANUARY 1984

The 1929 bridge withstood all floods, many of which could be considered of major extent, until the advent of cyclone Domoina during the last days of January 1984. An impression of the extent of the flood may be gained from the following figures:

- Estimated 100 year return period flood at road bridge (Zwamborn – 1964): 5 600 m^3/s
- Estimated max flood in Mfolozi during cyclone Domoina (equal to the highest ever recorded in southern Africa – Directorate of Water Affairs 1984-08-03): 16 000 m^3/s

The design life of bridges as required by the SA Transport Services (now Transnet) Bridge Code is 120 years. The railway bridge had reached nearly half of this theoretical life and could therefore, in view of the extraordinary nature of the Domoina flood, be considered to have achieved its design purpose.

From flood marks on site the maximum flood levels were:

- **South abutment** 400 mm below rail or 1,23 m above soffit of span
- **North abutment** 1 m above rail or 2,63 m above soffit

As the bridge was level, this meant that the maximum water level sloped upwards from the south to the north end of the bridge, a distance of 533 m, by 1,4 m. There is a bend in the river at the bridge site and the observed super elevation is consistent with the estimated velocity (average 2,5 m/s) and the radius of curvature.

A difference in level of 1,9 m between water levels on the upstream and downstream sides of the south approach embankment, indicating a very rapid lowering of water level, was determined from flood marks. This serves to emphasise the effect on the river caused by the sudden broadening of the stream as it spreads out over the flats below the bridge and begins to dump its load of silt as a result of reduced velocity.

Eyewitnesses stated that the bridge failed at approximately 15:30 on 31 January 1984 and that the spans rolled over, tending to indicate that at moment of failure they could still have been attached to the piers. A reconstruction from available evidence indicates that one or both piers 2 and 3 failed first (numbering from the north end). The spans were structurally connected by two short railbearing stringers, which were fixed at one end and hinged at the other. In addition the track, consisting of 48 kg running rails and two safety rails, was bolted to the longitudinal stringers.

With the failure of piers 2 and 3 the spans were dragged downstream together like the pearls of a necklace, except for span 1, which remained in position. The weakest link in the connecting structure holding the spans together was between spans 1 and 2, where fish-plated rail joints were located within a few metres of the pier. The break occurred at this point and span 1 was left undamaged.

Subsequent investigations have confirmed the impression of eyewitnesses, namely that the spans 'rolled over'. Caissons were found to have fractured at various depths between 5 m and 22 m below the base of the piers. This was determined by locating the remaining lower caisson stubs by drilling, except for those at pier 2 where washboring through the deep imported berm material (brought in for construction access) would have been too time consuming and prohibitively expensive. The piers with the upper caisson stubs still attached were found by washboring immediately downstream of the bridge.

A video film taken by a local resident half an hour before the failure of the bridge indicates that water level at that time was well below soffit level. The rise in water level immediately before failure must therefore have been extremely rapid, because eyewitnesses of the failure described water levels as being higher than rail level, with waves and spray reaching the upper steelwork. The mode of failure has been determined to have been fracture of the cylinders due to hydraulic forces against the super and substructure, under severe conditions of scour reaching to a depth of about 16 m below normal riverbed.

Seven of the ten spans washed off (mass 160 tons each) were located at varying distances up to 3 km downstream but only one of these, that closest to the bridge at 60 m away, was considered worth recovering. The missing spans, probably the three northernmost where water velocity was the highest, have no doubt settled to the bottom of the main channel and were covered by transported material.

RECONSTRUCTION 1984

Temporary crossing

Two possibilities for the rapid restoration of traffic were a temporary bridge or a causeway. Whilst the provision of a temporary bridge would have accommodated larger flows without disruption to traffic, the higher cost and more significantly, the longer delay in re-opening the line militated against this alternative. An additional and perhaps overriding factor in choosing the alternative of a causeway was the availability of emergency steel spans, which, it was considered, could be erected on a new substructure before the onset of the following rainy season. It was therefore decided to proceed with the construction of a causeway, thereby saving the cost of a temporary bridge and minimising the cost of disruption to traffic.

The causeway design comprised 77 ungalvanised Armco pipes, 2 m in diameter. The causeway provided a waterway of 242 m^2, being 5% of the bridge waterway, as an acceptable temporary measure. Construction of the causeway commenced on 6 February and the line was opened on 26 February.

Planning for reconstruction

Meanwhile, a departmental design team was evaluating alternatives for the reconstruction of the bridge. Detailed design was hampered by lack of information regarding the following:

- The extent of the damage to the substructure. Piers 2 to 6 had been lost, but the damage to the foundations, which comprised two 3,6 m diameter cylinders per pier founded 30 m below riverbed level, was unknown.
- The depth to bedrock. Washborings had been carried out to depths of 50 m in 1925. These borings had established that the profile consisted essentially of sand, but the depth to bedrock had not been plumbed and there was no indication of the density of the materials.
- The depth of scour. It was clear that the scour depth had been greatest towards the outside of the river bend where the piers had been lost, but quantitative information regarding the depth of scour was not available.

The muddy condition of the flood plain hampered the access of drilling rigs at least a fortnight after the floods and exploratory drilling could only be commenced after the construction of a berm from the south bank. The stubs of the caissons were found by departmental drilling rigs. Consideration was given to the reconstruction of the cylinders (caissons), which had snapped at the comparatively shallow depth of 5 m at pier 5. Cost and time considerations as well as the risk that the caisson stubs would be found to be structurally unsound led however to the abandonment of any recovery effort.

Professor D C Midgley was briefed on 16 February to investigate scour aspects and his quick response with a preliminary report by 20 February and a final report by 24 February enabled the piling design to be completed by 29 February. Midgley's predicted scour depth of 18 m was subsequently substantiated when pier 2 was encountered during piling operations at a depth of 16,5 m below riverbed level. It was lying in a horizontal position, still attached to the upper caisson stubs.

The superstructure alternatives, which were investigated for reconstruction, included concrete decks, to be incrementally launched from both embankments simultaneously, and reconstruction in steel along the lines of the previous structure. Informal quotations for the concrete structure comprising 22 spans of 23 m were obtained by 27 February. Although the estimates thus obtained were lower than that for the steel alternative, the eigth-month construction deadline could not be met, and as the projected consequential losses associated with the later completion exceeded R1 million, the steel alternative was chosen. This alternative involved the recovery of the one span of the ten, which had washed away, was close enough at 60 m and not irreparably damaged. The remaining nine spans were to be replaced by steel spans designed by Callender Hamilton, for which emergency stock was in hand.

Detailed design and the preparation of tender documents for reconstruction of the substructure commenced at this point.

Substructure

The decision to use piled foundations for the reconstruction was straightforward in the light of time constraints. The probability of encountering obstacles in the form of caisson stubs, later confirmed, in any event ruled out the possibility of sinking new caissons.

In view of the relatively long 18 m lengths of pile, which would be exposed to flow forces, the dynamic stability of the piles became a factor, which pointed to the need for large diameter piles. The design was therefore based on 1,5 m diameter piles, this being the maximum size of casing for which oscillating pile driving equipment was available. To facilitate the earliest possible start to pile installation it was decided to leave exploratory drilling to the piling contractor and to base the design and piling specifications on the 1925 drilling results. Because of the deep scouring and lack of information regarding the density of river sediments it was decided that the piles should be driven down to bedrock, estimated to lie between 55 m and 70 m below bed level. In order not to exceed the capacity of available pile rigs the specification called for 1,5 m diameter raked piles to be installed to a depth of 45 m, with smaller 1,2 m diameter piles to be telescoped through the larger casing to bedrock.

Documents and tender drawings were ready for the invitation of tenders on 1 March. The return date was 9 March and a contract for piling and reconstruction of the substructure to the value of R2,6 m was awarded to Frankipile on 13 March. The successful tender was based on the specified design except that the offer of permanent casings to the 1,5 m pile sections was accepted as being less risky in the unconsolidated scour zone than the temporarily cased piles specified. Exploratory drilling was commenced on 20 March. Sandy sediments and isolated clay lenses with a virtual absence of boulders were found to terminate abruptly on hard bedrock at a depth of 55 m at pier 2 and at a depth of 62 m on the balance of the pier positions.

During the actual piling operation this clean contact with the hard 180 MPa migmatite bedrock created difficulties in sealing the cutting end of the temporary pile casings. An excessive loss of time due to the inflow of sand as a result of the plunger action of the bailer led to the abandonment of the specified rock socketing, which was not considered essential in view of the dense sand found in the lower profile.

Piling on the first of 20 piles commenced on 10 April on an upstream pile, whilst washboring and jetting was concentrated on downstream pile positions in order to locate the limits of the obstructions presented by the fallen sediment covered piers and caissons. The location of the piers is consistent with the presumed mode of failure of the structure, that is, the slewing of the decks from the north end, which will have pulled the piers over about their weak axis in a southerly direction.

In some instances it was possible to avoid obstructions by altering the pile location, rake angle, direction of rake or some combination of these. Where such relocation would have been detrimental to the pile loads the obstructions were chiseled through in advance of the piling.

Progressively shallower scour depths at piers 4, 5 and 6 prompted a reduction in the length of 1,5 m sections from 45 m to 25 m at these locations. An unforeseen consequence of this change was that the concreting of the increased length of 37 m of 1,2 m pile became difficult to execute successfully. Notwithstanding the use of retarders, an extended concreting time of 10 hours resulted in the reinforcing cage being extracted with a plug of concrete in the temporary casing when the latter was extracted. After the loss of a pile, which set the programme back by up to a week, it was decided to complete the remaining seven piles with permanent casings to the 1,2 m diameter pile sections. This change enabled time to be made up, and the piling was successfully completed on 14 August.

The pile caps and piers were of conventional design with bullnosed ends, the only unusual feature being the large pier heads measuring 5 m by 13 m to accommodate the deck launching system. The bearing sill levels were raised by 1 m at the south abutment and by 2 m at the north abutment, yielding a gradient of 1 in 500, which approximated the observed water gradient at the river bend during the flood. In addition to enlargement of the waterway this had the advantage of reducing the length of the steep gradient immediately north of the bridge. It did however require that the only remaining span, that at the north abutment, be raised by 2 m and that the supporting abutment and pier be extended in confined working conditions underneath the deck.

Superstructure

Central to the decision to attempt reconstruction of the bridge within one dry season was the availability of modular steel spans stockpiled for precisely this type of emergency. Stocks of predrilled bridge components, sufficient for the erection of three complete spans and the trusses of a further four spans, were on hand for immediate dispatch to the site. An order for additional steelwork and replacement stocks was placed on the firm Electric Transmission of SA (Pty) Ltd, holders of the license to manufacture the British-designed Callender Hamilton bridging system in South Africa, who in turn appointed the firm Cape Steel Ltd to fabricate and galvanise the 1 100 tons of high tensile grade 50B steel required. The new spans have a mass of 116 tons per span compared to the 160 tons per span of the original bridge, a reduction of 27%. Erection and launching into position of the nine replacement spans as well as the recovery and re-erection of the southernmost span, that toppled by the flood, was undertaken by departmental bridge gangs.

Callender Hamilton spans

Erection of the Callender Hamilton spans was completed in an erection yard adjacent to the track on the south bank. The assembled spans were side launched on to a launching track in line with the piers and consecutive spans were then temporarily joined into sets of three continuous spans for launching. The Callender Hamilton system makes use of bolted joints with M20 high strength close fitting bolts and the bridge trusses are of the Warren type.

Special steel members were necessary to accommodate the 32° skew of the piers and temporary steelwork was required to couple the spans together for launching.

In addition, the double channel bottom chord of the trusses could not accommodate launching supports except at node points, so that it was necessary to provide removable bracing to halve the node spacing from 5 m to 2,5 m in order to limit the length over which the spans had to be supported on the piers. The 6 m width of the pier heads was designed to suit the reduced 2,5 m node spacing.

Each set of three spans was then launched into position, where the coupling steelwork and temporary bracing was removed for use on the next set.

The launching system

The launching system consisted of the following elements:

- A longitudinal jacking system consisting of two 60 ton centre hole jacks pulling on a 26 mm dywidag bar attached at the other end to a 'pullstick' clamped to a cross girder. The tandem centre hole jack system allowed a continuous forward movement.
- Capacity skates (100 ton) rolling on 'roqtuf' steel plate tracks laid on the pier tops, two tracks per truss. The skates were fitted with rocker bearings, rubber pads and plates that were sized to fit between the bolts at the truss node points. The tracks were sloped at both ends to facilitate the insertion and removal of the skates from each node point as it crossed over the pier.
- A vertical jacking system. A set of three spans is self-balancing and a launching nose is thus not necessary. The vertical jacking system was found to be the most feasible solution to cope with the 950 mm deflection of the spans at maximum cantilever.

The launching system was further developed and improved on site and it was found possible to accurately steer the launch by slightly altering the direction of the skates and, as the crews gained experience, to reduce the launching time per span length from one span in two days to one span in half a day, thus gaining five days by the time all Callender Hamilton spans had been launched.

Recovery of span 11

Meanwhile span 11, the only one of the old spans in the riverbed close enough and relatively undamaged to justify recovery economically, had to be recovered and raised ready for side launching into position as soon as the last Callender Hamilton span had passed over. It was lying 60 m downstream, upside down and buried to half its height in silt.

The 160 ton structure was dug out, turned over, rotated horizontally, slewed, raised vertically by 11 m and lastly slewed diagonally (to suit the skew piers) into position at pier top level. The recovery of this span is a story of its own, but needless to say, the final positioning took place on time.

Raising of span 1

Meanwhile the existing span 1 at the north end of the bridge was being raised by 2 m. This work was carried out over water at a height of 12 m as the berm could only be taken to midway between piers 1 and 2. Some delay was caused by an attempt to drill through pier 1 and stress the top of the pier to the lower portion of the caissons, but as it was not possible to find adequate anchorage in the caisson hearting the stressing was abandoned and the cables were grouted in position unstressed. Similar problems were found at the old piers 7 to 10, and it is clear that the original contractor was able to get away with a very poor substitute for what was shown on the detailed plans of the 1929 bridge as 1:4:8 concrete in the caisson hearting.

The complete bridge

All phases of the bridge reconstruction except for the footwalk and final tightening of bolts were complete by 26 October 1984 and access was then given to earthwork and tracklaying teams. All work was completed by 14 November and the bridge was opened to traffic on that day.

The General Manager of SA Transport Services formally declared the bridge open on 20 November 1984, just eight months and R10,5 million after the start of exploratory drilling on the site. The time spent on the actual reconstruction of the bridge was 6 months and 10 days and the elapsed time between the washaway and opening to traffic was 9,5 months.

UNIQUE CHALLENGES

The reconstruction of this bridge offered unique challenges and by the time it was complete the effort had engendered a strong element of teamwork among all who took part. This bridge is probably the largest railway bridge ever to have been lost and restored in southern Africa.

A summer flood occurred in February 1985 which removed the remains of the railway causeway and washed away the temporary causeway on the N2 national road upstream. The complete railway causeway would not have survived this flood. □

Notes

1 All titles of railway personnel used in this paper applied in the organisation SA Railways and Harbours, later SA Transport Services, and do not apply to personnel of Transnet owing to a complete re-organisation from 1987 and the creation of Transnet in 1990.

2 To simplify matters for readers not familiar with earlier monetary terms, fractions of pound sterling have been written in decimals rather than the correct pounds, shillings and pence.

COSIRA TO FABRICATE SASOL PLANT

STRUCTURAL STEEL FABRICATOR Cosira International has been appointed to fabricate all structural steel components, including equipment support steelwork and pipe rack steelwork, for Sasol's new 1-octene process plant in Secunda.

This will be the petrochemicals group's third 1-octene plant in Secunda, and is being constructed in order to meet growing demand for 1-octene by plastic manufacturers.

Cosira will be fabricating between 1 200 and 1 300 t of steel for the structure at its ISO-accredited plants in Heriotdale, Johannesburg. Fabrication of the structural steel on this fast-track project began in mid-January. The practical completion date is set for 1 December and the plant will be commissioned early in 2007.

In addition to being fast track, the facility is being constructed on a confined and congested site, where a large number of contractors have to interface with each other.

German engineering group Linde is handling the design and construction of the facility – one of many such projects which it has undertaken for Sasol. Engineering information is being shared electronically between Cosira in South Africa and Linde in Germany, thus eliminating the need to recreate drawings or similar documentation unnecessarily.

Cosira won the bid to fabricate all structural steel for the plant on open tender. John da Silva, managing director of the Cosira Group, says that the company's appointment on the project will further enhance the reputation that Cosira established with Sasol following the successful completion of the Sasol Turbo Project.

In addition to having an excellent safety record, the company has established skills development programmes in place. Cosira is also BEE compliant, with its empowerment partner, Tshipi Investment Holdings, having a 30% equity shareholding.

Top: Filling of gabions at Selembao
Bottom: Six metre high Green Terramesh wall

AFRICAN GABIONS SOIL REINFORCEMENT FOR CONGO PROJECT

SOIL-REINFORCEMENT PRODUCTS supplied by the South African operations of Maccaferri/African Gabions played a major role in the anti-erosive measures installed in the Selembao ravine in Kinshasha, Democratic Republic of Congo (DRC).

Adriano Gilli, Sales & Marketing Manager of Maccaferri/African Gabions, said the gully of Selembao was a 'natural disaster' which had in the past extensively damaged human settlements, electricity networks, roads, and the environment. To restore the ravine, the government of the DRC appointed the French engineering consultancy BCEOM to spearhead the anti-erosive project.

The remedial measures proposed by BCEOM involved the restoration of stable slopes, supporting the embankments with retaining structures, re-profiling the banks, and installing effective vegetative protection cover (adapted to the local situation).

PVC-coated gabions and Reno mattresses were used to create a stilling basin with AG400 geotextile serving as a filter. Maccaferri/African Gabions' MacDrain 2L was installed as a high-capacity drain behind the Green Terramesh-reinforced walls,' explained Gilli.

'The Green Terramesh reinforcement will restore stability to the slopes by minimising material contributions. The sandy terrain of the site was used as granular fill behind the Green Terramesh. This eliminated the need to import expensive quarry materials. The flexible wall structure will accommodate embankment reconstitutions, while the bio-degradable mat behind the façade will allow vegetation to grow through after hydro-seeding.'

The soil reinforcement structures specified by BCEOM involved a 345 m long wall (between 5,4 m and 6 m high), and a 200 m wall (between 7,8 m and 8,55 m high). The Green Terramesh walls were made out of Galfan and PVC-coated steel mesh, for increased durability. The compacted fill was separated and kept dry with MacDrain 2L geo-composite material, placed in front of the excavated soil to allow seeping water to drain through perforated pipes.

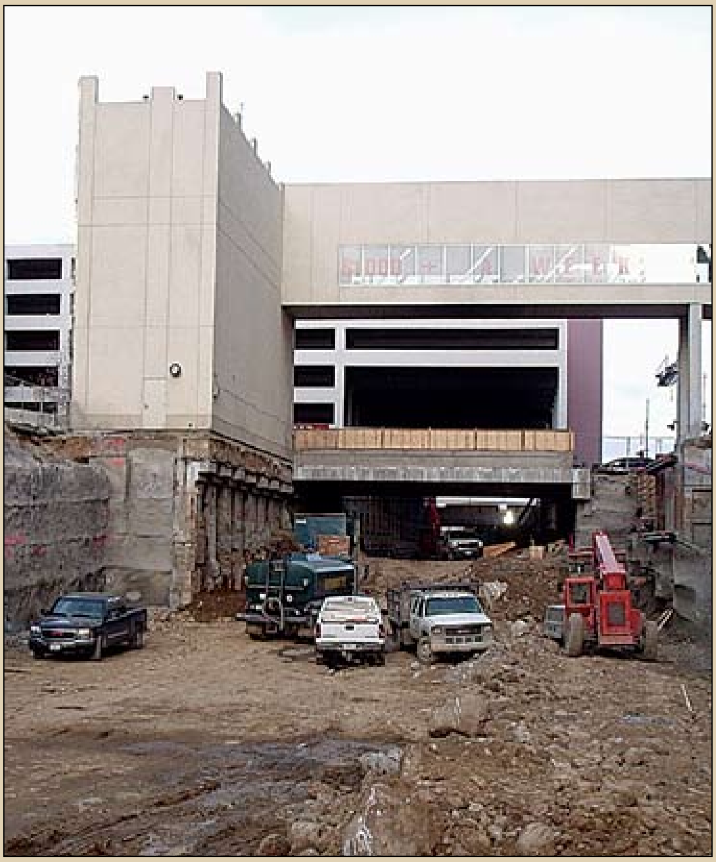
The World Bank provided the finance for the approximately R50 million two-year project, which was completed recently .The main contractor was General Malta Forrest of Lubumbashi.

WIRELESS TILT MONITORING ANSWERS TRENCH QUESTION

COULD THEY DIG IT – without undermining support for adjacent large buildings? That was the question faced by Granite Construction Co (Granite) in planning to dig a 27 ft deep trench for two miles of dual rail lines through downtown Reno, Nevada.

Begun in 2004, the $282 million Reno ReTRAC Project has required highly detailed planning to achieve its 20-month construction schedule. Granite also required close monitoring of the stability of multistorey build-

A detailed view showing the Men's Club building that was underpinned



The ReTRAC rail trench is up to 33 feet deep, abutting sensitive buildings in downtown Reno, Nevada

ings and historical structures located directly adjacent to and – in two instances – overarching the giant trench.

To ensure that construction would not damage or cause adverse movement of these buildings, Granite specified tiltmeters from Applied Geomechanics Inc (AGI), configured to communicate directly with the Project's wireless Ethernet (Wi-Fi) system extending the length of the Project corridor. AGI's tiltmeters, modified to incorporate radio transmitters, include a 'drive-by' data query/download capability: from virtually any location within several hundred feet of the tiltmeters, a Granite technician can connect wirelessly to the tiltmeters, query and download data, and move immediately to the next instrumented structure.

The network of 36 AGI Model MD900-TH tiltmeters was installed before trench excavation began in order to establish the baseline position of the sensitive structures. The tiltmeters continue to provide a record of each structure's movement and position as construction proceeds.

Appropriate enough in this application, AGI's catch-phrase 'Did it move, or didn't it?' captures the essence of the Reno ReTRAC monitoring challenge. Applied Geomechanics was founded in 1982 to design and manufacture engineering/scientific grade tiltmeters and inclinometers. AGI's continuing goal is unexcelled price/performance based on sensor precision, robust electronics and housings, and expertise in remote data acquisition technology.

In addition to the Reno ReTRAC wireless monitoring system, recent AGI installations worldwide have included solar-powered cellular and radio frequency (RF) data telemetry. On the other end of the scale, some AGI customers require only one or a few standalone tiltmeters for manual data reading and recording.

Among its larger projects, AGI's tiltmeters and systems have been used on more than 45 major tunnel, dam and bridge projects, as well as on large-scale slope stability and seismic monitoring jobs, historical structures and critical buildings, and many underwater installations.

www.geomechanics.com

THE FUTURE OF WATER STORAGE

THE SOUTH AFRICAN-DESIGNED FUTURE TANK is a step forward in the most cost-effective water storage tank available. The tank is locally designed and manufactured according to a recognised code of practice known as ANSI/AWWA D103-97 (D103). The standard is the highest standard available for bolted steel tanks in South Africa.

The tanks are suitable for storing liquids of varying densities. A heavy duty PVC/LLDPE liner ensures that there is no leakage and that there is no contact between the liquid and the steel sheets that make up the shell.

The tanks may vary in diameter from 3 m to 28 m, in height from 1,2 m to 9,6 m, and from 8 kℓ to 3 000 kℓ in capacity. The variation in tank diameter is made possible by bolting together steel sheets to achieve a 'ring' of the desired diameter. Similarly, the height of the structure is determined by the number of rings that are bolted together on top of each other.

For a given density of liquid the thickness of the shell will depend on the diameter and height of the structure. The shell thickness may vary from 1 mm to 6 mm. To achieve these thicknesses we make use of two plate thicknesses, 1 mm, 1,5 mm and 2,0 mm, which may be nested into each other in any combination. Thus, for example, a 5 mm shell is constructed of two 2,0 mm thick plates and one 1,0 mm plates nesting into each other.

During the manufacturing stage the required hole configuration is punched at either end of the sheets. They are then rolled into the correct curvature to suit the diameter of the tank. In addition, two 10 mm deep ribs, 120 mm wide are formed into the sheets during the rolling forming process. This provides the necessary stiffness against buckling during wind loading when the tank is empty.

A computer program based on the recommendations of D103 is used to obtain the correct shell thickness. The program also fascilitates correct bolt selection.

The program further provides the essential dimentions of the dome shaped roof. This roof plays an important role when the tank is empty, preventing the shell from deforming under wind loading. Note that tanks that are open at the top (no dome roof) require a suitable steel girder arround the circumferance at the top to prevent deformation when subject to severe wind in their empty state.

The factors of safety recommended in D103 have been adopted throughout. For example, the zincalume sheets used to manufacture the shell have a yield stress of 300 MPa, whereas the design program limits the stress in the sheets to a maximum 136 MPa, as recommended by D103. Similarly the bolts have an ultimate strength of 800 MPa (grade 8) while the design program limits the maximum shear stress in a bolt to 200 MPa.

Generally a perfectly horizontal reinforced concrete ring beam will suffice as a foundation for the shell. The main function of the beam is to provide a lasting level surface for the shell, and to prevent overturning of the tank when it is empty. It follows that the 'footprint' of the beam must be large enough so that the applied presure does not exceed the bearing capacity of the ground. Aquadam is able to provide an engineer approved design for the shell, roof and ring beam on request.

COULD ENGINEERS HAVE KNOWN HOW MUCH PRESSURE THE NEW ORLEANS LEVEES COULD WITHSTAND?

COULD ENGINEERS HAVE KNOWN ahead of time exactly how much pressure the levees protecting New Orleans could withstand before giving way? Is it possible to predict when and under what conditions material wear and tear will become critical, causing planes to crash or bridges to collapse? A study by Weizmann Institute scientists takes a new and original approach to the study of how materials fracture and split apart.

When force is applied to a material (say, a rock hitting a pane of glass), a crack starts to form in the interior layers of that material. In the glass, for example, the force of the striking rock will cause the fracture to progress through the material with gradually increasing speed until the structure of the glass splits apart. The path the forming crack follows and the direction it takes are influenced by the nature of the force and by its shape. As cracking continues, microscopic ridges form along the advancing front of the crack and the fracture path repeatedly branches, creating a lightning bolt or herringbone pattern.

Physicists attempting to find a formula for the dynamics of cracking, to allow them to predict how a crack will advance in a given material, have faced a serious obstacle. The difficulty lies in pinning down, objectively, the fundamental directionality of the cracking process: From any given angle of observation or starting point of measurement, the crack will look different and yield different results from any other. Scientists all over the world have experimented with cracking but, until now, no one has successfully managed to come up with a method for analysing the progression of a forming crack.

Professor Itamar Procaccia and research students Eran Bouchbinder and Shani Sela of the Chemical Physics Department set out to find a way of analysing data from experiments in cracking that would avoid the direction problem. First, they divided the cracks' ridged surfaces up into mathematically determined sectors. For each sector they were able to measure and evaluate different aspects of the crack's formation and to assign it simple directional properties. After some complex data analysis of the combined information from all the sectors, the team found their method allowed them to gain a deeper understanding of the process of cracking, no matter which direction the measurements started from. The team then successfully applied the method to a variety of materials – plastic, glass and metal.

From the concrete in dams and buildings, to the metal alloys and composites in airplane wings, to the glass in windshields, many of the materials we depend on daily are subject to cracking. The team's method will give engineers and materials scientists new tools to understand how all of these basic materials act under different stresses, to predict how and when microscopic or internal, unseen fractures might turn life-threatening, or to improve these materials to make them more resistant to cracks' formation or spread.

Newswise

'NANO SKINS' SHOW PROMISE AS FLEXIBLE ELECTRONIC DEVICES

A TEAM OF RESEARCHERS HAS DEVELOPED a new process to make flexible, conducting 'nano skins' for a variety of applications, from electronic paper to sensors for detecting chemical and biological agents. The materials, which are described in the March issue of the journal *Nano Letters*, combine the strength and conductivity of carbon nanotubes with the flexibility of traditional polymers.

'Researchers have long been interested in making composites of nanotubes and polymers, but it can be difficult to engineer the interfaces between the two materials,' says Pulickel Ajayan, Henry Burlage Professor of Materials Science and Engineering at Rensselaer Polytechnic Institute. 'We have found a way to get arrays of nanotubes into a soft polymer matrix without disturbing the shape, size, or alignment of the nanotubes.'

Nanotube arrays typically do not maintain their shape when transferred because they are held together by weak forces. But the team has developed a new procedure that allows them to grow an array of nanotubes on a separate platform and then fill the array with a soft polymer. When the polymer hardens, it is essentially peeled back from the platform, leaving a flexible skin with organised arrays of nanotubes embedded throughout.

The skins can be bent, flexed, and rolled up like a scroll, all while maintaining their ability to conduct electricity, which makes them ideal materials for electronic paper and other flexible electronics, according to Ajayan.

'The general concept – growing nanotubes on a stiff platform in various organisations, and then transferring them to a flexible platform without losing this organisation – could have many other applications, all the way from adhesive structures and Velcro-like materials to nanotube interconnects for electronics,' says Swastik Kar, a postdoctoral researcher in materials science and engineering at Rensselaer and lead author of the paper, along with Yung Joon Jung, assistant professor of mechanical and industrial engineering at Northeastern University and a recent doctoral student in Ajayan's Rensselaer lab.

For example, with researchers at the University of Akron, Ajayan is using a similar process to mimic the agile gecko, with its uncanny ability to run up walls and across ceilings. The team recently reported a process for creating artificial gecko feet with 200 times the sticking power of the real thing, using nanotubes to imitate the thousands of microscopic hairs on a gecko's footpad. Ajayan's team is also working with Ali Dhinojwala, associate professor of polymer science at Akron, to develop a range of products with nanotubes and flexible substrates.

The researchers also envision using the process to build miniature pressure sensors and gas detectors. 'There are a lot of possibilities if you have an easy way to transfer the nanotubes to any platform, and that is what we have developed,' Ajayan says.

The team has shown that the flexible materials demonstrate an extremely useful physical property called 'field emission'. When a voltage is applied to certain materials, electrons are pulled out from the surface, which can be used to produce high-resolution electronic displays. 'Nanotubes are very good field emitters because they have a low threshold for emission and they produce high currents,' Kar says. 'But when you lay nanotubes very close to each other, each tube tends to shield its neighbor from the electric field.'

This effect has limited the development of field emission devices based on densely packed, aligned nanotubes, but it seems to go away when the nanotubes are embedded in a polymer, according to Kar. Tests showed that the team's 'nano skins' are excellent field emitters when compared to some of the best values obtained by other research groups.

Newswise

SA CONSTRUCTION FACES HEAVY WORLD CUP DEMANDS

ALTHOUGH SHORTAGE of resources, materials and skills could pose problems, the South African construction sector had the necessary sophistication to cope with the enormous workload required by the 2010 Soccer World Cup, according to Professor Ronnie Schloss, Financial Manager of the Premier Soccer League (PSL).

Addressing the annual general meeting of the Gauteng Master Builders Association (GMBA) in Midrand, Schloss said some of the many overseas construction companies looking for 2010 business were amazed that the local building sector could have completed a major new stadium such as Soccer City in just one year. 'One overseas company seemed proud that it completed a new European stadium in two and a half years,' he observed.

But Schloss conceded that time would be extremely tight for South Africa to meet a deadline that called for large-scaled infrastructural development, as well as the major upgrading of six stadiums and the provision of four new stadiums by December 2008, before the venues are tested by global competition in 2009 in a 'dress rehearsal' for the 2010 World Cup. 'To date, no plans have been drawn up and only a few consulting firms have been appointed. But I have no doubt that central government will exert the necessary pressure on local authorities to perform in accordance with schedules.'

New soccer stadiums will be built in Cape Town, Port Elizabeth, Durban and Nelspruit. Most of these stadiums will be multi-purpose stadiums. Among the facilities to be upgraded will be Soccer City in Johannesburg (R600 million project with a roof over and seating for 98 000), Ellis Park (minor upgrade), Royal Bafokeng in Rustenburg (R30 million upgrading), Free State Stadium in Bloemfontein (new grandstand to raise capacity from 30 000 to 45 000), Peter Mokaba in Polokwane (R360 million upgrade), and Loftus Versfeld in Pretoria.

In addition, 32 training stadiums spread throughout South Africa will have to be provided. In some cases, these will represent the first major sports stadium for centres such as Vereeniging, where R30 million to R40 million will be spent. 'The original estimated cost of improving existing stadiums to comply with the minimum standards for training venues was R800 million but it will probably be higher eventually.'

Some of the interesting statistics Schloss provided for the GMBA members included:

- Up to 20 000 media representatives will visit South Africa for the event.
- The media will require 6 000 seats for the semi-finals and finals.
- Around 130 000 new jobs will be created by the event.
- Spectator spending is likely to amount to about R10 billion.
- 1 800 lux lighting will be required for the opening and closing ceremonies and major matches; 1500 lux for the other matches.
- Between 50 and 70 security cameras will be installed at all major match venues.
- 20 video replay screens will have to be installed at the major venues.
- Standby power generators to prevent potentially disastrous power blackouts will have to be installed at all match venues.
- All the venues will have to feature uniform pitches with extensive drainage and irrigation systems in place.
- A global TV audience of 40 billion will watch the event.
- Ticket sales are likely to exceed 2,78 million.
- The insurance South Africa will have to take out to cover possible cancellation of the event locally amounts to R50 million to R60 million.
- An additional police force of 50 000 will have to be operational before the competition starts.

Schloss said the Soccer World Cup would enable the South African construction sector to leave an important legacy to future generations. 'The intention is not to build facilities that will become obsolete after 2010 but rather to erect stadiums with seating capacities that could be reduced to become important community sports facilities in future.'

MAY DEADLINE FOR CMA AWARDS ENTRIES

THOSE WISHING TO PARTICIPATE in this year's Concrete Manufacturers Association (CMA) Awards for Excellence competition have until May 26 to submit entries. This does not leave much time, especially if participants have not yet chosen which projects will be submitted.

The event presents anyone involved in the design, manufacture or application of manufactured concrete products with an opportunity of gaining national recognition for their achievements. Winning a CMA award provides the winner with an invaluable marketing tool, as architects, specifiers and property developers pay close attention to the results.

CMA director John Cairns says there are several factors at play when it comes to judging the competition and that it is crucial for entries to be professionally presented.

'The creative use of manufactured concrete products, innovative design and aesthetic appeal will form the basis of the judging which is conducted using photographic and written submissions. Time and budget constraints preclude judging on site – a process which would take up to six months or longer.

'This approach works extremely well provided the photography is of a professional standard and the written submissions clear and factual. The better the quality of the photography the greater the chances are of gaining an award,' notes Cairns.

The competition is open to all individuals, partnerships and companies in South Africa and neighbouring countries, and entries may be submitted in the following categories:

- Concrete block paving
- Concrete roof tiles
- Concrete masonry
- Concrete retaining block walls
- Suspended concrete floor slabs
- Infrastructural products
- Other innovative products

Each of these categories contain between two and eight sub-categories, which are broken down in the entry form.

Entry forms
Pam Zukor
T 0110-805-6742
cma@mweb.co.za

CONSTRUCTION INDUSTRY MOU

A MEMORANDUM OF UNDERSTANDING (MOU) between four major Construction Industry bodies was signed at a ceremony in Midrand in January. The agreement was concluded in order for the bodies to speak with one voice on matters of best practice, standards, and approaches among members in matters affecting professional service providers in the marketplace.

The Construction Industry bodies involved are The South African Black Technical and Allied Careers Organisation (SABTACO) an organisation committed to black advancement; The South African Association of Consulting Engineers (SAACE); the South African Institute of Architects (SAIA); and the Association of South African Quantity Surveyors (ASAQS), who all provide business support to member firms in private practice.

The aim of the MOU is for each party to develop and foster communication, liaise and influence policy and to link their respective knowledge platforms in order to grow mutual business opportunities among members. Wherever possible they will undertake joint client liaison, particularly among public sector clients in all spheres of Government on matters of common interest. They will ensure the creation of a sustainable built environment professional services industry which is relevant, vibrant and sought after by all.

Each organisation has committed their members to sustainable transformation processes which encompass true empowerment objectives thus avoiding the negative consequences of tokenism and fronting. They will ensure that best practice standards and procedures prevail among all client bodies in the selection and appointment procedure for professional service providers. Each organisation commits itself to promoting the use of realistic procurement policies among all members and their clients ensuring that this sector of the construction industry becomes attractive to investors, students and all other stakeholders. They will ensure that the quality of services rendered will be such that the image of the built environment consultant is always protected and enhanced.

This MOU presents a synergy – a meeting of minds. 'This MOU signals the dawn of a new era of trustworthiness, sincerity and confidence expected from white consulting companies to view and accept black consultants as equal and very important partners in the development of the profession in South Africa, not only in the public sector, but also in the private sector, which still remains the preserve of white consultants in South Africa,' is the view of Paul Kgole, president of SABTACO.

LANXESS MARKETING CHIEF WELCOMES NEW LOCAL DISTRIBUTION

LANXESS' MOVE TO APPOINT Chryso South Africa to handle the distribution of its Bayferrox pigments for the construction sector would bring Lanxess products closer to the fast-growing local pre-cast industry, according to Simon Bowker, Lanxess Head of Pigment Marketing in the Middle East and Africa.

The German-based Bowker, on a recent visit to South Africa, said Chryso's direct contact with the pre-cast industry – particularly in outlying areas – would be extremely useful to the company in future. 'It will enable Lanxess to offer improved levels of service to the important building and construction sector which, with the coatings industry, forms our biggest market,' he stated.

Bowker said the pigments market is showing steady growth worldwide with the USA market particularly buoyant. 'In the concrete sector, the application of pigments for roof tiles and block paving is rapidly gaining popularity. South Africa is an important market and we intend maintaining and growing our presence here. Chryso's extensive national distribution network – and knowledge of the local market – will be vital in this regard,' he stated.

The Bayferrox range (previously distributed locally by the Bayer Group) is produced in Germany, China and Brazil. Lanxess was floated as a separate entity on the German Stock Exchange at the beginning of last year.

NEW MIDRAND HEADQUARTERS FOR C&CI

THE CEMENT AND CONCRETE INSTITUTE (C&CI) will at the end of March this year move to new headquarters about 3 km away from its present base at Portland Park in Midrand.

C&CI's new home will be in Block D in the Lone Creek section of Waterfall Office Park, Bekker Road, Midrand.

'Our new offices are conveniently close to the Allandale off-ramp on the Ben Schoeman Highway, and the new location also has the advantage that all the various departments of C&CI will for the first time be based in one building,' Dr Graham Grieve, C&CI managing director, stated.

The Institute's telephone and fax numbers, as well as its postal address, will remain the same.

BLOEMFONTEIN, A MODERN AFRICAN RENAISSANCE CITY

VELA VKE, IN CONSORTIUM WITH the University of the Free State, are currently finalising a master plan for the regeneration of the Bloemfontein CBD.

The objectives of the plan are to rehabilitate the historical CBD to its original splendour; to create the image of a modern African Renaissance city with neat pedestrian walkways criss-crossing the city; to repair or rehabilitate old buildings (many of which are of historical or architectural value); to raise public awareness of the rich cultural heritage of the city; and to stimulate the development of new buildings.

The city council of Mangaung appointed the consortium as part of a national initiative to regenerate South Africa's inner cities and to establish their image as modern African cities. The aim is to re-establish the importance of the inner city and to regenerate the CBD. Problems which are typically associated with very rapid urbanisation, such as littering, uncontrolled informal trading, neglected buildings, safety and security, crime, empty buildings, accessibility, squatting, relocation of business out of the inner city, insufficient parking, etc, will be addressed, following a holistic approach.

Cobus Botha, the Vela VKE project leader, said that the consortium relied heavily on the cooperation and support of businesses and the public in collecting data for various studies being conducted as part of the master plan. Students from the university's Department of Town and Regional Planning were extensively involved in planning and conducting various surveys. International and South African case studies and research on rapid urbanisation, inner city flight and inner city regeneration are being consulted extensively as part of the studies.

The proposals for physical improvements to the inner city will be tested though a public participation programme. Some of the features for which specific proposals are being developed are Hoffman Square, Floreat pedestrian mall, Bloemfontein station, and Russell Square. Measures will be implemented to make the city more pedestrian friendly. Carefully designed signage will also be utilised to raise public awareness of their cultural heritage, indicating landmarks such as the Tweetoringkerk and President Brand Street.

IRISH BRIDGE CONTRACT FOLLOWS LOCAL SUCCESS FOR COSIRA

SUBSEQUENT TO THE SUCCESSFUL COMPLETION of the Desmond and Leah Tutu Bridge, which spans Houghton Drive and links the schools of St John's and Roedean in Johannesburg, Cosira International has been commissioned to complete a similar pedestrian bridge in the Irish town of Skibbereen.

Cosira's success with the Desmond and Leah Tutu Bridge project led to the opportunity to work on this international project. Photos of the bridge were published on Cosira's website, and sufficiently impressed the client – the Levis Quay Partnership – to result in contact being made with Cosira, and ultimately, in the award of the contract.

The R854 000 contract was awarded in December last year. According to Ken Smith, manager (structural) at Cosira's Cheetah Team, the scope of the work includes design, detailing, fabrication, corrosion protection and delivery of the steel superstructure for the bridge. Having worked successfully with UWP Consulting on the Desmond and Leah Tutu Bridge, Cosira has once again partnered with the consulting engineering firm to design the structure.

The 42 m long, 2,32 m wide suspension bridge will span the river Ilen to link a retail facility with a nearby residential area. 'Access by road is a long distance around via the nearest bridges,' says Smith, who visited the site in mid-January to ascertain the cranage requirements and look at erection procedures.

According to the current programme, fabrication is expected to commence at the beginning of April. Dieter Silbernagel of UWP, who worked on the design of the structure, says that the bridge consists of a steel superstructure resting on a reinforced concrete substructure. 'The bridge rests on two abutments on the river banks, and the single pylon helps to support the deck,' he explains.

The space truss type structure forming the deck is made up of hollow tubular steel sections, which Silbernagel says were chosen for structural reasons, as well as for durability and aesthetics.

Once fabricated, the structural steel will be shipped to Cork. This is the nearest major port to Skibbereen, which is situated near the southern tip of Ireland. From Cork, the containers will be transported by road to Skibbereen.

'The girders will be sent to Ireland in four 10,5 m sections, which have had to be designed to fit into the 12 m open top containers in which they will be shipped,' Smith notes. Everything is marked with item numbers so that the final product can be accurately reassembled. The sections will be assembled on site using the splice method, after which the bridge will be erected.

Adjustable tension suspension cables attached to the pylon will be used to give the required support to the deck structure. Macalloy suspension cables will be imported from England directly to site.

Silbernagel notes that it is important that should any of the cables need to be removed, the bridge must still remain operational. Certain guidelines also need to be adhered to in order to prevent uncomfortable vibrations of the structure under traffic loading. The structure has been designed in accordance with the South African loading codes as well as with the British quality standards.

John da Silva
Cosira Group
T 011-626-2317
www.cosira.com

SIMPLE YET EFFECTIVE EVACUATION SLIDE

WHAT IS REPORTEDLY THE FIRST helicoidal emergency escape slide has been designed by Brazilian civil engineer Jason de Carvalho Gomes.

The slide may be applied to buildings as well as to oil extraction platforms where a fast flow of evacuation is of vital importance. It is intended to avoid the trouble and difficulty of stairwells and to prevent panic among its users. The slide can be used in buildings of any height.

Some of the advantages of the slide are as follows:

- The slide system is fast and allows an uninterrupted flow of up to 100 persons without the risk of injury.
- Being on the outside of the building, the slide is not affected by smoke, thereby allowing free airflow and ample visibility.
- The slide does not depend on electricity or any equipment that might be subject to malfunction or failure in the event of an emergency.
- It presents several exit alternatives at all levels of the building.
- Evacuees slide down on a thin layer of water, thereby decreasing heat and abrasiveness and thus avoiding injuries. At ground level, the evacuee ditches into a shallow pool.
- The slide is customised to fit in with the building's architecture and can be shared by neighbouring buildings to lower maintenance costs.

Jason de Carvalho Gomes Jr
T 55-41-344-5803
jasonCGJr.@terra.com.br

Members' Banquet

THE ANNUAL Members' Banquet was held in Midrand on 24 February.

At the event the SAICE President for 2006, Sam Amod, was inaugurated and delivered his presidential address to an appreciative audience.

Several awards were also made: the 2005 SAICE Gold Medal Award went to Allyson Lawless, the Honorary Fellowship for 2006 to Professor Will Alexander, and the 2005 SAICE Award for Meritorious Research to Dr Kevin Wall.

Left: Dawie and Ria Botha, Michèle and Mike Deeks
Opposite page in the usual order:
Sam Amod (incoming president), Mike Deeks (2005 president)
Mike Deeks, Sam's wife, Lekha, Mike's wife, Michèle
Jones Moloisane, Zina Girald (SAICE National Office)

Awards

The following awards were made:

Allyson Lawless, Sam Amod

2005 SAICE GOLD MEDAL AWARD: Allyson Lawless

The SAICE's Gold Medal was awarded to Allyson Lawless, who has become very well known in the South African civil engineering environment, as well as in national and local government circles.

Allyson was born in Durban and attended Maritzburg Girls High School, where, at a crucial point in her life, she was advised to 'not become an engineer', since that was deemed to be a man's world. Fortunately Allyson did not listen to this advice and graduated from Natal University in 1973. She became a student member of SAICE in 1972, a graduate member in 1974, a member in 1980, a fellow in 1999, and then, in 2000, the first SAICE lady president.

Her versatility ranges from structural engineering to municipal services, from leader in SAICE professional matters to a deep-seated drive to assist and help others in many ways. Her testimony is there for all to see:

- SAICE president 2000, focusing on 'Making a difference', for which she became known as the MAD president
- Leading a delegation to the 150th Anniversary ASCE Convention in Washington and chairing a session on 'Why the world needs Africa'
- Reaching out to government ministers and government structures and leading many delegations in this regard
- Reaching out far and wide during the 2003 SAICE Centenary Celebrations
- Directing the SAICE Brochure of 2003
- Receiving one of the nine prestigious awards of the SAICE Projects of the Century in 2003. Allyson Lawless's pioneering civil engineering software had made her an engineering household name over the years
- Featuring as a role model in the SAICE book *Foundation for the future*
- She has been and still is the promoter, driver, facilitator and manager of numerous capacity-building programmes
- Researching *Numbers and needs.* This well-received civil engineering research and recommendation project was one of the biggest projects she had ever handled

Allyson Lawless: a worthy recipient.

Professor Will Alexander, Sam Amod

HONORARY FELLOWSHIP 2006: Professor Will Alexander

SAICE conferred an honorary fellowship on William J R Alexander, fondly known to most of us as Prof Will.

Will Alexander decided to become a civil engineer while still at school, but his tertiary education was interrupted by World War II, during which time he served in North Africa and Italy as a member of the South African Engineering Corps, gaining invaluable experience in practical engineering, particularly the use of explosives.

After the war he resumed his studies and graduated from the University of the Witwatersrand in 1949. He joined the Department of Irrigation, where he displayed not only a practical aptitude for dam building and canal construction, but also an increasing awareness of the need for research as he developed better hydrological methods to replace traditional empirical formulae.

Eventually his experience and expertise led to his appointment as resident engineer in charge of the construction of the enormously complex Orange-Fish Tunnel, which diverts water from the Orange River to various dams and irrigation schemes in the Eastern Cape. This is still the longest continuous tunnel in the world, and its construction required the coordination of several consulting engineering firms and three major contracting consortiums, as well as extremely detailed decisions on construction techniques. Will Alexander performed this task with distinction, and included several of his own innovative features.

He was then promoted to Chief of the Division of Hydrology, where, after further studies, he established a vibrant research team that sought improved knowledge of rainfall patterns, river flow and climate change, often questioning existing beliefs.

When he retired from the

PRESIDENTIAL ADDRESS

In his address, Sam Amod focused on the 'Ecology of Construction' after giving a fascinating account of the history of the metre, currently the world's (almost) universal standard of measure.

Ecological sustainability

Sam pointed out that, as an industry, we must strive for continuous improvement, while understanding that our role in society cannot continue to be purely as purveyors of technology.

'As the boundaries between professions become increasingly blurred and the public better informed, engineering professionals are required to interact at a human, not technical, level and to persuade, not simply specify. It is no longer sufficient for the technical expert to explain by saying *'because it is so …'*.

Sam asked how, if poverty and prosperity were both properties of an ecological system, we would characterise a healthy and sustainable construction ecology.

'We are obliged to fundamentally review our patterns of work and organisation to address the challenges of poverty and inequity. Procurement, transformation, human and organisational development must turn away from a purely competitive and compliant mindset to the paradigm of ecological sustainability characterised by cooperation and mutual development.'

In closing, Sam paraphrased the words of his holiness Tenzin Gyatso, the 14th Dalai Lama: 'Just as the world of business has been paying renewed attention to ethics, the world of (engineering) would benefit from more deeply considering the implications of its own work. [Engineers] should be more than technically adept; they should be mindful of their own motivation and the larger goal of what they do: the betterment of humanity.'

The full text of **Sam Amod's presidential address** can be found on the SAICE website: www.civils.org.za/pa2006.pdf

Department of Water Affairs and Forestry in 1984, he was immediately invited to join the Engineering Faculty at the University of Pretoria. Here scores of undergraduate and postgraduate students passed through his hands, as well as numerous practitioners whom he updated on modern hydrological methods. Prof Will retired from the university in 1999 as professor emeritus, but continued his research in the field of flood and water resources.

In his time Prof Will has published two books, delivered some 200 papers at conferences throughout the world, was appointed to United Nations scientific committees, and served as expert witness at international court cases. He has striven tirelessly to ensure that scientific evidence is used as the basis for theories on climate change and related hydraulic calculations. His analysis of the 1981 Laingsburg flood attracted national attention, while his investigations into the 2000 Mozambique floods have led to a reassessment of the design parameters for such extreme events.

Prof Will is that rare combination of a practical engineer who understands the value of research and an academic whose teaching and research relate directly and usefully to the wider profession. He has been a role model and inspiration for hundreds of young engineers, an ambassador for his country, and an innovator whose ideas will continue to enrich the widespread beneficiaries of his knowledge.

Prof Will Alexander has undoubtedly brought a unique distinction to, and made a noticeable impact on, the civil engineering profession.

Kevin Wall, Sam Amod

2005 SAICE AWARD FOR MERITORIOUS RESEARCH: Dr Kevin Wall for 'water services infrastructure operation through franchising'

The capacity of many local governments in South Africa to adequately operate even basic levels of water services for all their citizens on a sustainable basis is in question. There is a great need for institutional innovations aimed at improving access to basic services, and sustaining that improvement. The challenge of exploring a range of provider options represents an opportunity to selectively incubate innovations on an experimental basis, including innovative public sector-driven partnerships with the private sector, for heightened development impact.

An alternative service provision option or method, but one that is little known or understood, is franchising the operation of water services.

The research for which the SAICE Meritorious Research Award was made reviewed current water services provision mandates and methods in South Africa. It found that there is a great need to investigate new water services operator institutions as alternatives to those currently in use.

The characteristics of franchising, the process, success and failure factors, and the extent to which franchising can achieve its delivery objectives profitably, but without excess profit being taken, were explored by the research, as was the well-developed consumer product franchising industry in South Africa, and its highly creditable track record in the creation of jobs and in small, medium and micro enterprise (SMME) development.

A literature survey revealed that the World Bank is the only other institution that has worked on developing the concept of water services franchising.

A review of local economic development in South Africa concluded that the strong need for the creation and nurturing of SMMEs is further motivation for the development of franchising as an institutional model for water services operation in addition and complementary to the current models.

The research found that a franchise model for water services infrastructure operation should be developed and made available to emerging entrepreneurs as the basis of a viable business, and to water services authorities as a viable alternative water services provider. The franchising would involve components of the water services value chain that are suitable for small business in that they can be readily systematised.

The concept of water services infrastructure operation through franchising is both innovative and appealing. The research by the CSIR, with the support of the Water Research Commission, has been thoroughly and competently done, extensively published, and recognised by professional peers as being of outstanding merit. It is now being extended to a developmental stage. It is therefore fitting that the researcher, Dr Kevin Wall of CSIR Knowledge Services, should be granted the SAICE Award for Meritorious Research for 2005.

Thank you and good bye!

IT IS IN THE NATURE of engineering professionals to have strong and individualistic views on almost every subject. It is therefore a rare occasion when a large number of the recognised voluntary associations agree on something, which is what happened when these associations agreed that a special 'thank you' should be said to Paul Roux for his guidance and contribution to the engineering profession over a period of 29 years, 19 years of these as registrar and chief executive officer [of ECSA]. The voluntary arm of the engineering profession, under the leadership and initiative of Mike Deeks, President of SAICE (2005), therefore compiled a Certificate of Meritorious Service to put our appreciation on record.

These words were addressed to Paul Roux, retiring CEO of ECSA, on 24 November 2005 during a joint meeting of the outgoing ECSA Council and the new incoming Council, by Johan de Koker, SAICE Vice-President Growth & Participation.

The wording on the certificate that Johan handed to Paul echoes these sentiments:

We, the institutes recognised by the Engineering Council of South Africa (ECSA), hereby place on record our sincere appreciation and admiration for the dedicated service afforded by Paul Roux, Chief Executive Officer of ECSA. Paul has served the engineering profession and the interests of our members with distinction and dedication from 1977 to 2005, placing the profession on a sound footing and enhancing its reputation both within South Africa and internationally.

Paul Roux was visibly touched by this gesture and expressed his appreciation in a letter to Mike Deeks the next day:

I understand that the idea of the award to me was conceived and coordinated by you as President of SAICE … It was only moments [after the award had been announced] that the sheer momentousness of your gesture really struck home!

Having had time to reflect on the significance of the message from the voluntary associations, I find it impossible to express my gratitude in words! Not only do I have a deep sense of appreciation, I am filled with a sense of humility that my commitment to the engineering profession was not just notionally perceived as a 'good day at work' but that my contribution was tangibly recognised by those who I thought merely regarded Paul Roux as an 'arms-length' official and a distant servant of the profession.

Through your action, I now experience a real sense of belonging. This singular gesture brings home the realisation that my efforts were not only appreciated by the inner circle of ECSA, but by the profession at large!

If I thought my imminent departure from ECSA resembled something like an anti-climax to my career, your gesture made all the difference to my psyche – as I prepare for closure!

Paul, SAICE hereby wishes you everything of the best for the future. Your dedication, your inspired leadership, and your particular sense of humour will be fondly remembered!

Ray Fone – a very special civil engineer

IT IS SELDOM that, when shopping for a birthday card for someone special, one is able to find wording that is genuinely appropriate among all the cards with their trite messages. However, when shopping for a card for Ray (and by the way, it's amazing that not only can you find in the card shops a 90th birthday card, but you can find a selection – that says something for the longevity of our population), I did manage to find a card that wasn't too far off from what I wanted to say. First, on the front it refers to 'a heart that cares, one person can make a difference in so many lives'. And inside it says: 'You make the world a nicer, brighter place to be!'

Isn't that an apt description of a civil engineer, and of the civil engineering profession? The slogan promoted by a recent president of SAICE was 'civil engineers make a difference!' And we do make a difference. Through civil engineering services such as water, roads, and so on, we make the world a nicer, brighter place to be.

Ray epitomises the difference that civil engineers can make. In his years of service to the municipal engineering profession, especially as the town engineer of Vereeniging, he made a difference to all the inhabitants of the area, making their world a nicer, brighter, place to live, work and play in.

For SAICE, Ray has been a link between the future and the past. Once he had retired from the town council, he did not retire from the profession, but for a decade or more worked hard for his chosen profession. He worked on a revision of the National Building Regulations, and other tasks. But his major contribution was reading every single Government Gazette that was published, scanning for anything that SAICE ought to comment on, and then drafting that comment. He reportedly reviewed over 14 000 gazettes! And then he wrote meticulous reports to National Office indicating areas of interest or importance for SAICE and its units, over scores of years. Formal acknowledgement by SAICE of this great contribution culminated in him being awarded an Honorary Fellowship of SAICE in 2002.

Shortened version of speech delivered by Kevin Wall on behalf of SAICE at Ray's 90th birthday party in October 2005.

Kevin Wall handing Ray's card to Ray's daughter, Felicity

RAY'S RESPONSE

In his response, Ray mentioned that he still regretted having to give up the work he was doing in the Institution because of defective vision. He also regrets the loss of contact with his colleagues.

He said that he was still in good health despite having spent his birthday in hospital due to dehydration from gastroenteritis, and was looking forward to visiting New Zealand to attend his granddaughter's wedding.

Finally, he sent his best wishes to all who still remember him. ◻

OBITUARY

Everett C Carter

PROFESSOR EVERETT CARTER died in Reno, Nevada, last August, at the age of 72. Many in South Africa will remember him for the well-attended SARF Transportation Engineering course which he presented at the universities of Cape Town and Pretoria in July 1979.

Ev earned a bachelor's degree at Virginia Tech, a master's at the University of California, Berkeley, and a PhD in transportation under Professor Don Berry at Northwestern University, Evanston, Illinois, in 1962.

He taught at West Virginia University from 1963 until 1970, when he moved to the University of Maryland. He taught there for 28 years, and chaired their Civil Engineering Department in the mid-1970s.

Besides his university responsibilities, Professor Carter was active in the Institute of Transportation Engineers, the American Society of Civil Engineers, the Transportation Research Board, the American Road and Transportation Builders Association, and the American Public Works Association. In 1995 he received the Steinberg Outstanding Educator Award from ARTBA – a signal honour.

I knew Ev at Northwestern when Pip Grove and I, SARF Fellows both, were battling to earn our master's degrees, and when he came here to give his SARF course. At a later date, when I was doing a study tour of people movers in North America, he kindly let me make free use of his university facilities and also hosted me around Washington, DC.

Ev was a pleasant, dedicated and always helpful transportation educator who should be remembered for making his contribution to transportation engineering knowledge in our country as well as in the US.

Graham Ross

Top: Ev lecturing at UCT
Bottom: On the top of Table Mountain: Graham Ross, Everett Carter, Gerry van Alphen and Louis de Waal. Graham was president of the South African Road Federation (SARF) at the time and Gerry was chairman of the SARF Education Committee. Louis was on the SARF National Council and was also active in the Automobile Association and SAICE (he was president of AASA in 1983/1984 and SAICE president in 1990). He was also chairman of the Table Mountain Cableway Company, so had got them all free passages on the cable car!

GAUTRAIN
THE DEBATE CONTINUES

DAWIE AND MIKE'S VIEWPOINT in the January 2006 issue of *Civil Engineering* discussing the statement supporting the Gautrain proposal that was issued by the Transport Forum (FTPA) raises a very important point, namely: Should members of the forum, who represent constituent bodies, not seek the views of their parent bodies before supporting, or otherwise, a statement on such a major issue in our country?

I definitely do think so and accordingly (as a member of the forum representing SARF) did not support the issuing of the statement. However, the chairman of FTPA accepted that the majority view prevailed and the statement was issued.

Apart from the procedural issues, such as (as you pointed out) that the Council and Executive Board of SAICE had not taken a standpoint on the matter, nor for that matter had the SARF, I personally have problems with the contents of the statement. These are many, but to deal with only one as an example, the statement suggests that if the high speed, but limited access Gautrain project did not go ahead, 'a unique opportunity will be lost (perhaps forever) for a paradigm shift in public transport in South Africa'. I find that this to be strange logic since a normal speed mass transit system (busway or rail) would fulfil the same purpose, with probably far better penetration and at considerably less cost. I am not sure if the forum members who supported the statement are aware of the extent to which an injection of R20 billion or more (as appears likely) would improve the current public transport system in the region.

An integrated public transport system will not stand or fall on the presence, or otherwise, of a spatially limited, high-speed rail segment of the total system. Interestingly enough, a far more extensive rail-based system for the 'PWV' area was proposed in 1986, the Masstran Project. This was a rail-based mass transit system with a total cost in 1985 rand values of R1,6 billion, embracing a network considerably greater than the Gautrain system, and serving areas such as Soweto, Alexandria and Baragwanath, among others.

Is it too late to revisit the Masstran project in the light of apparently unlimited funds being available for public transport in the region, and are similar funds perhaps available for the Durban and Cape Town regions as well?

Malcolm Mitchell

I HAVE READ THE VARIOUS ARTICLES regarding the Gautrain and would make what I consider to be certain valid points as a British registered highways and transportation engineer, and as an internationally registered civil engineer, now retired.

The Gautrain is alleged to be going to be part of the 'public transport system of Gauteng'. What viable public transport system, as none currently exists?

It is my opinion, and apparently the opinion of many other people, that Gauteng does not have a public transport system that can be termed safe, acceptable and viable under any internationally accepted norms. Note the following:

- **Kombi taxis** It would appear that the current 'taxi' system consists mostly of an ancient fleet of Kombis, most of which, if tested, would almost certainly be found to be totally un-roadworthy, and are a danger to the public that they serve. In addition, it has been stated that apparently many of the drivers do not hold the correct driving licences and, owing to pressure of work, are expected to drive for long hours, probably above the legal limit.
- **Metrobus** Where have all the Metrobuses gone? Many years ago there was a semblance of a bus service from the suburbs into town, though it was totally inadequate. However, today there are fewer buses and an even poorer service to the public.
- **Metrorail** From the recent programme on Carte Blanche it is obvious that this service is totally unacceptable and a considerable danger to the public.

Comments

First, the government should be totally ashamed of the current situation, as it is obvious that they have little, if any, idea of running, maintaining and upgrading public transportation systems.

We are advised that the Gautrain is a necessity, even at the current cost of R20 billion, as it is hoped that it will relieve congestion on the roads between Johannesburg and Pretoria. The freeway between Johannesburg and Pretoria factually serves only the limited percentage of the public who regard travelling considerable distances to work as acceptable. The Gautrain will not serve the vast majority of commuters or the public.

The Gautrain is merely a status symbol for a government that refuses to accept that there is no acceptable, safe, viable public transport system in Gauteng, or possibly in South Africa. That the roads are congested with cars carrying one or two people at peak traffic periods in all our cities and 'urban freeways' is direct proof that acceptable, safe and viable public transport does not exist in Gauteng, and almost certainly in none of the large South African cities.

Obviously many people in government, the construction industry and associated industries would like to see the Gautrain constructed, as that would provide work for that particular sector of the economy, but reason must prevail.

The current estimated R20 billion cost of the Gautrain would certainly be better spent on providing a truly viable, safe and acceptable public transport system for all the major South African cities, and in particular Gauteng Province.

The funds that would be used to build the Gautrain 'pie in the sky' could be used to totally upgrade the current Kombi taxi fleet, train the drivers of those taxis correctly, considerably improve the Metrobus system, and improve and replace, where necessary, the current Metrorail system, so that we finally have a public transport system that operates for the majority of the public, safely and acceptably within international norms, and all almost certainly at a cost less than that of the probable final Gautrain cost.

It is considered that this greatly upgraded public transport system can be in place before 2010, in time for the Soccer World Cup, when it is hoped that it will be able to transport the mass of soccer fans from around the world to the venues for the matches. South Africa almost certainly has the technical expertise to carry out this major upgrade without having to bring in 'expat technical staff' at enormous cost to the taxpayers.

Only after the basic public transport system has been totally upgraded to become acceptable and viable, and has been proven to be operating in a satisfactory manner in keeping with international norms, should consideration be given to the Gautrain. In the interim, make the freeway to and from Pretoria an 'expensive' toll road for daily commuters, banking the toll monies to help to pay for the required upgrade of the total public transport system, thus encouraging those commuters to consider the following:

- Forming lift clubs to contain the personal toll costs, thus reducing the number vehicles on the freeway
- Moving home so that the daily commute is limited, that is, if you work in Pretoria, reside in Pretoria, and if you work in Johannesburg, reside in Johannesburg

Why should taxpayers' money be used merely to attempt to bolster the egos of certain members of government and other organisations and to make life easier for the people who reside in Johannesburg and work in Pretoria, and vice versa.

In addition, it is essential that Spoornet management should be changed in total and made entirely accountable for the efficient running of this freight service, which should be upgraded, and made to perform efficiently, thus removing much of the heavy goods that are currently transported by road onto this rail network that is currently inefficient and underutilised.

George N Gray

I AM A RETIRED CIVIL ENGINEER who has spent his whole life in South Africa with a lot of experience in the circumstances and developments in this beautiful country of ours. I appreciate the opportunity to add my 'viewpoint' to the Gautrain concept.

To repeat Dawie and Mike's first 'maybe': What is best for the country as a whole – for all and not only for some? The Gautrain project is certainly not for all, but only for some – and only a very few at that – only those for whom it may be a practical option and who may be able to afford it. I must agree that a development like this is a very exciting project that involves all disciplines of the engineering profession. Any engineer can become very enthusiastic about such a project. It is also a very prestigious project that may increase respect for South Africa in other developed countries. It may even alleviate the traffic congestion between Pretoria and Johannesburg to some extent. But it is certainly not the most viable solution to the problem.

We must remember that we are in South Africa, where most of the population cannot afford such a sophisticated luxury and the culture of the majority is still at the 'destructive' stage. It will take many, many years for this culture to grow into a constructive one – if ever. This means that a project such as the Gautrain becomes extremely vulnerable. Masses of people who apply destructive measures to obtain what they want and who have lots of experience in burning trains will be offered a golden opportunity to hit the government where it hurts most.

No, we must be practical. Let we rather utilise that money to improve the road system and combine it with a very efficient bus service, including certain traffic priorities for buses. The bus service envisaged to serve the Gautrain can be extended to collect passengers in demarcated areas and transport them to the locations that were planned as Gautrain halts. The fast lane on the Ben Schoeman highway can be reserved for the buses. The congestion in the remaining two lanes on this highway will soon force commuters to opt for the bus service. An efficient bus service can also be extended to cater for larger areas and involve many more of the population than the Gautrain. Should a couple of buses be burnt out by the masses, it will not even be a fraction of the disruption or damage experienced if the Gautrain were to be vandalised.

Of course the road system will also have to be improved. I remember that in the seventies BKS brought out a report called the proposed 'PWV road network'. Maybe we can have another look at that report and establish some of the recommendations in order to provide an efficient bus service and serve the motorists at large.

Another aspect that we should not forget is that this country possesses an extensive railway system that is not nearly operating at its full potential. Should this system be improved with competitive rates for transporting goods, it may alleviate the large volumes of heavy trucks encountered on South African roads which, by the day, pose a greater menace to road users.

My best wishes go to those who are involved in finding a solution for our problem and may they be blessed with the wisdom of Solomon.

Izak de Villiers

BEFORE WE CAN DREAM UP innovative solutions to the vehicle congestion on our roads we have to recognise what we are not.

We are not a Singapore, a Bangkok or a Hong Kong, with very high populations and office densities that are well suited to mass transit systems. We are not a European city, where there is strict town planning and all income groups mix on public transport.

We have an incredibly low-density city, based on the American model of full car ownership (even when 70 per cent of the population do not have cars), and high income earners who only use cars, and are not willing to walk on the streets for fear of crime, and have a complete disrespect for traffic laws. What we also have is a minibus taxi system that is well suited to a low density city, but is uneconomical, owing to the continuation of the apartheid planning of pushing the poor far from work and economic opportunities. and a rail network that has been largely ignored in planning developments over the past 30 years. In addition, many of the roads that were utilised by the rich to move out of the city, and hence undertake long distance commutes to work, were paid for out of national and provincial budgets, not directly by the ratepayers or commuters, and represent a market distortion (Western Bypass, N1, William Nicol Drive, etc). Most of the interchanges were not designed for the current volumes of traffic and now represent major bottlenecks on the road network, both on the freeways and for traffic crossing the freeway.

So what can we do to change this? First we must recognise that transportation is about the movement of people and goods, and not the movement of vehicles, and that there is a constant interchange between the various modes of transportation. (These include walking, bicycles, cars, buses, road freight, rail, aeroplanes and shipping.)

When looking at the movement of people, this makes the N1 between Pretoria and Johannesburg one of the most underutilised sections of road in the country, as there is one person per vehicle, compared to the M1 South in Johannesburg, where there are six people per vehicle.

So what can be done? First it must be recognised that change occurs gradually and an integrated public transportation system is built over many years. It is not a sudden 'big bang' such as the Gautrain. To make public transport attractive it must have a time advantage over a car. It is not an attractive option if you simply sit in a bus in a traffic jam instead of your own car, or if the time to get to the train doubles the length of your journey.

So how do we achieve this?

In the very short term and at minimal cost:

- Introduce congestion charges on the N1, R21, N12 and N3 for any car that contains only one person to encourage car sharing. Since the main problem is people travelling from low density residential to low density office parks, free car parks need to be constructed along the freeways so that people can combine their journeys. At present this charge would need be levied for only two hours in the morning to reduce the traffic flow to the point where it moves freely. (This happens anyway in school holidays.)
- Introduce 'stations' at each interchange on the N1 so that high occupancy vehicles (HOV) can drop off pedestrians without leaving the freeway. The

pedestrians would then have a short walk to adjacent areas where they would pick up the next service. The New Road interchange and the Shell Ultra City in Midrand could have this function introduced at minimal cost.

- Introduce HOV lanes on interchanges so that these vehicles can bypass the congestion. (These would need to be manned to prevent abuse.)
- Traffic laws must be enforced far more strictly, particularly when people use the hard shoulder as an extra lane. The most effective method is to park the cars and not let them proceed until the traffic is flowing freely in addition to fining them.

In the medium term:

- Tax open parking spaces as these encourage dispersed development.
- Enforce far stricter town planning to prevent the uncontrolled spread of office development.
- Upgrade rolling stock, track and signalling on the existing Metrorail network and distinguish between heavy rail (long distances between stops) and light rail (short distances between stops).
- Focus office and residential development around the stations and develop seamless exchange between the various modes of transport. Often stations are situated in remote locations and have no integration with other forms of transport.
- Develop an integrated transport system that combines walking, bicycles, taxis, buses and trains. (This has been achieved in many countries and even in cities that had a taxi system similar to South Africa (Hong Kong).)

In the long term extend the rail network to relieve the areas of heaviest congestion. Some initial suggestions would be:

- Connect Belle Ombre to Pretoria Station with a station underneath Church Square.
- Link West Street Station to Park Station in Johannesburg with a new City Centre Station.
- Use the Faraday Branch as the basis for a new north–south link running from Rosentenville in the south through the city into Hillbrow, down to Killarney, then to Rosebank, Illovo, Sandton and Rivonia. As was done in Brussels, this can be done section by section using trams (pre-metro) until sufficient length and passenger volumes justify a switch to light rail. A single running tunnel can be constructed until volume justifies the construction of the second.
- Extend the Tembisa line through to Woodmead, then under the Ben Schoeman until Strathavon, before swinging it across to Sandton, where it will link with the north–south line. The Tembisa line would need a north link and a new station with extensive parking should be built at Botha Avenue interchange on the N1 to allow a modal switch of transport.
- Link the new Tembisa–Woodmead line to the existing rail corridor into Modderfontein, through to Johannesburg International, onto the East Rand Shopping Mall, and finally to the Daveyton line.

What is proposed has been tried and tested in many cities and would minimise risk, unlike the Gautrain, which places all the eggs in one basket and does nothing for the vast majority of Gauteng's six million commuters.

Richard Holden

I DO NOT WISH TO ENTER the Gautrain debate *per se* as the subtleties will undoubtedly escape an observer from the Cape. However, the general consideration for SAICE and its engineering fraternity in such matters should be confined to engineering issues. If transport engineering has identified a need and the engineering design meets that need then that's an engineering closure. Surely, in the case in hand, the Transport Forum have effected that closure.

Engineers should not dabble in matters in which they have no professional competence. Any considerations not of an engineering nature such as ecological damage, pollution, societal issues and broader economic requirements are implied and contained in the client's brief to the engineer. We belong to a discipline and the noun is appropriate, to step outside it as an engineer is an act of ill discipline, it is undisciplined.

This is particularly important in a developing country such as South Africa because any deviation from the purely engineering solution of a problem in order to address issues outside that solution must, *ipso facto*, entail an extra cost. It is essential that society, the taxpayer, the government are made aware of that premium in such a manner that they can weigh up the merits of that premium. Any considerations apart from the purely technical which the engineer includes in his proposal and design simply cloud the issue. The consequences of ill-considered additions and qualifications as a result of pressure from extra-disciplinary groups will thus never be known, let alone measured.

In similar vein, as illustration, the importation from the developed world of the concept of 'sustainable' development is to introduce an oxymoron into a developing country, confusing and distracting. Even against the background of the best definition I have read so far, being 'development that meets the needs of the present without compromising the ability of future generations to meet there own needs,* I see no relief from a contradiction. Engineers develop the physical environment to mankind's present gain as his discipline sees it. There will almost certainly be engineering projections in the plan but there can be no forecast as to future generations' needs and preferences. The engineer is not trained, certified or competent to make such projections. (Indeed, one wonders where such competence can be found.)

We tend to follow and copy developed economies because South African civil engineers are part of and well up to world standards and practices, in some areas leading the technology. We tend to forget we serve an underdeveloped economy where there is little room for considerations of future needs.

R H Kingdon

*Bruntland report (Focus on the World Summit, *Civil Engineering*, August 2002).

SHORTAGE OF ENGINEERS

I WOULD LIKE TO ADD to Ian Swartz article on 'Shortage of engineers' in the October 2005 issue.

If there is this enormous shortage, surely we would be seeing a rapidly escalating improvement in the package of the required civil engineer. I do not see this happening. And this brings me to the root of the problem.

The hard fact is that we need to wield some power to affect our conditions. As much as we would like it not to be, the shortest recognised route to power is money. Historically we have been hoodwinked to be rather shy about money and are paying dearly for it today.

I remember when I was at Natal University in the 'sixties that professional engineers were bleating about lack of recognition and prestige. With all those brains, why couldn't they see that recognition and prestige and, for that matter, authority are all tied up with money?

Worse was to come when engineers became so wrapped up in their work that they allowed accountants and bean counters to ease them off board seats and financial committees. Our prestige has waned to the point today when in many instances we are treated more as the hired technical hand than the revered and respected professionals we once were. This is continuously aggravated as engineers haggle and compete over fees and costs.

We have a perfectly sound and reasonable ECSA recommended scale of fees. How many engineers can claim to adhere strictly to this?

I don't know for sure, but I am willing to bet that there is no dire shortage of doctors and lawyers in the country. Can you imagine arguing with either practitioner about his or her fees? Half of the answer is that you normally refer to these professions in times of distress and are not inclined to argue. Other arguments are to do with tradition, prestige, etc.

The point is that these professions have taken great care of their financial standing and arrangements and are consequently quite comfortable. Nevertheless, they provide a lesser service to the community in terms of the risks and responsibilities they take, not to mention a much easier degree.

Sadly it's really all our own fault. Our leaders should have picked up on this perhaps forty years ago but didn't. Perhaps we have been handing out prizes for the wrong things!

(PS: Don't pick on me. I have worked outside the country practically all my working life.)

Brad Rutherford

New Fellows

CARL GRIM is currently chief executive of Aveng Ltd and chairman of Grinaker-LTA Limited, Trident Steel Holdings (Pty) Ltd, McConnell Dowell Corporation Ltd (Australia) and director of Holcim (South Africa) (Pty) Ltd.

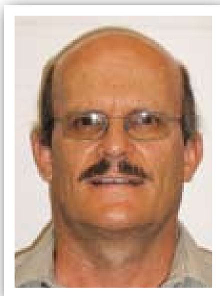
Carl is a civil engineer with twenty years of senior line management experience in the construction and construction materials industries, including stints as chief executive of Darling & Hodgson Limited and Blue Circle Limited.

Following the unbundling of Anglovaal in 1998, he was recruited to head up its engineering businesses, which were subsequently listed on the JSE as Aveng Ltd in July 1999.

He is a past president of SEIFSA and the SA branch of the Institute of Quarrying and has served on the Construction Industry Development Board. Carl is also a director of the National Business Initiative.

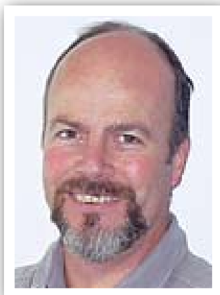
KEITH BARNETT graduated from the University of Natal, Durban, in 1970 with a BSc(Eng)(Civil). After working for the CSIR for a short period he joined the Durban City Engineer's department in 1972. He gained wide experience in matters relating to water supply, stormwater, river works and coastal engineering including the early development stages of the beach sand pumping scheme as well as project management and land development matters.

Keith was appointed to the position of City Engineer, Durban, on 29 April 1999 on a fixed-term contract until 2003. After further restructuring he was appointed as project executive with a wide range of diverse, non-line duties. He has presented papers at various seminars and is currently an external examiner in Environmental Engineering to the Civil Engineering Department at the University of KwaZulu-Natal, Durban.



KOBUS GROBLER begin na voltooiing van sy BSc Ing Siviel by Tukkies sy loopbaan aan die einde van 1977 by Raadgewende Siviele Ingenieurs Van Wyk & Louw. Hy begin KGConstruction cc in 1987 (later Concrete Structural Engineers cc) wat spesialiseer in 'turnkey'/ontwerp en bou van gewapende-betonstrukture. Hy studeer vanaf 1996 na-uurs aan RAU en behaal sy MIng (cum laude) in 1999. Daarna doen hy voltyds navorsing en behaal in 2001 sy DIng, ook aan RAU. Hy publiseer verskeie tegniese artikels en twee internasionale referate: 'Causes and solutions to lack of quality and structural failures' en 'An evaluation of cultural differences between designers and contractors in the building and civil engineering field in SA'. Tans is hy algemene bestuurder van Cerimele Construction.

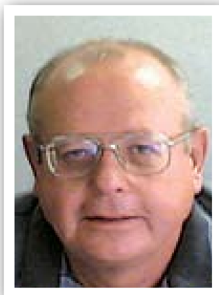
MARK DUCASSE started his career in 1977 at the Natal Roads Department. He attended Technikon Natal and graduated in 1989 with a Master's Diploma in Civil Engineering, specialising in Roads and Transportation. He received his PrTech Eng in 1990 (ECSA). Mark left government and joined a consultancy in Durban and after a short while was promoted to the position of associate. In June 1997 he set up his own consultancy, where he still practises today. Mark has lectured at Technikon Natal for the Bachelor of Technology Degree: Roads and Transportation. He specialises in all aspects of urban and rural township civil infrastructure and provides specialist support to clientele pre-project implementation.



PETER FISCHER was born in 1960 and matriculated from Cape Town's German School in 1977. He completed his national service in 1979 and graduated from UCT in 1983 with a BSc in civil engineering. In 1984 he joined LTA Civils (South) and from 1985 he worked for SS&O in Queenstown as a structural and water engineer/generalist. Peter moved to Pinetown in 1991, becoming a principal of Stewart Scott in 2002. Peter's main activities are in municipal water engineering, with specialisation in large reservoirs, pipelines and pump stations. He is currently the KZN Water Sector area manager. He is married with two sons, and is a keen weekend road cyclist.

JOHANN RAUCH received a BSc (Civil) Eng degree from the University of the Witwatersrand in 1979, a Graduate Diploma in Civil Engineering from the University of the Witwatersrand in 1982, and an MBL from Unisa in 1991. He started his career as an assistant engineer in the Structural Design Office of the South African Transport Services in 1982, after completing two years in the National Defence Force. He then worked at Reef Construction between 1983 and 1986, where he was involved in the doubling of the Union–Vooruitsigt and the Bank–Welverdiend railway line projects. He was promoted to assistant personnel engineer in 1986, where he was responsible for recruitment, training and personnel assessment of technical staff. In 1991 he transferred to Transnet Housing where he was responsible for the development of Transnet's low cost housing projects. In 1997 he resigned from Transnet to join the South African Rail Commuter Corporation Ltd, where he was involved in suburban rail planning projects and the management of commuter rail station projects nationally. In 2003 he joined Arcus Gibb as director of the Rail and Ports Division.

PETER VILJOEN graduated from the University of Natal in 1982 with a BSc in Civil Engineering and in 1990 obtained a MSc (Project Management) from Wits. He initially worked for SA Railways as a resident engineer on a perway relaying project and later on Tunnel 2 on the Richards Bay coal-line. In 1988 Peter joined Keeve Steyn Inc in Johannesburg and was involved in various large mining, dam and roads projects. In 1993 he relocated to Durban to start a roads department in KZN. Recent projects include the new Nandi Drive Interchange and, in a return to tunnelling, the Durban Harbour Tunnel project. Peter is currently a director of Goba (Pty) Ltd and is regional manager for KwaZulu-Natal. He also sits on the boards of the soils laboratories Civilab and Soilco.



ED ELTON graduated from the University of Witwatersrand in 1975 with a Bsc(Eng)Civil and obtained a BCom from Unisa in 1981. He began his career with SAR&H (now Spoornet) and worked in the fields of engineering design, construction, maintenance and general management in various capacities in the railway environment. During his career he was also involved in the training of technical staff from trade hand to engineer in the field of railway engineering from the viewpoint of a multi-disciplinary engineering approach to maintenance.

FELIX NDLOVU has over twenty years postgraduate experience, principally in the field of infrastructure development, road design and railway engineering. He is a registered professional engineer with a BSc (Civil Engineering) degree from the University of Dar es Salaam and an MBL from Unisa. Felix started his engineering career in 1983, when he worked for the Zimbabwe Department of Roads. Until 1989 he worked for the Harare City Council. From 1989 to 1997 he was employed by TTCS/VWL (Africon) Consulting Engineers on various infrastructure development projects in Botswana and North West Province. He spent four years with Plasserail as projects engineer before joining Protekon, where he is the current executive manager for the company's railway business unit.

SID TURNER was born in 1953 in Somerset East, matriculated in 1971 at Kingswood College in Grahamstown, and graduated from UCT in 1976 with a BSc in Civil Engineering. After completing his national service in the Corps of Engineers he joined LTA Construction for a two-year period before moving to consultants Ninham Shand in Cape Town in 1980. In 1982 he relocated to Durban to join Bosch and Associates (now Stemele Bosch Africa) and in the same year he registered as a professional engineer. After a number of years in the water and wastewater division he was promoted to divisional manager and to the board in 1989. With the merger of the infrastructure projects companies in the B&A Group in 2001 to form Stemele Bosch Africa, Sid took up the position of national operations director, which he currently holds. He also sits on the board of the B&A Group of companies comprising SBA, Bosch Projects and Munitech.

BRIAN HOLDRIDGE is a professional engineering technologist who studied at Cape Technikon (now Cape Peninsula University of Technology). He has worked for the railways since 1969 in various divisions, including the coal line project in 1974/5, and was involved in the Cape Flats rail expansion in early 1980. He now looks after the provision and maintenance of Spoornet property over a vast area extending from Cape Town to East London in the east and Kimberly in the north, and has recently taken over the iron ore line property maintenance. Brian's involvement with SAICE started with SAICET (South African Institution of Civil Engineering Technicians/Technologists) in 1998. In 2004/05 he was chair of the Western Cape branch and of BTT (Board for Technicians and Technologists) and was instrumental in obtaining full recognition for professional technicians and technologist as members of SAICE.

THEO ADAMS matriculated in 1985. In 1989 he graduated with a BEng degree from the University of Stellenbosch. He commenced his career with Africon, and was responsible for the design of various civil engineering projects. In 1993 he obtained his MEng degree from Stellenbosch University and later a BCom degree from Unisa. In 1997 he co-founded Lyners Adams Partnership and later Maxplan, which merged with Stewart Scott in 2001. He has been actively involved in municipal services, roads and project management. Since 2002 he has been Stewart Scott's area manager responsible for the Western Cape region.

FRIK RIEDEMANN matrikuleer aan die Paul Roos-Gimnasium, Stellenbosch, voltooi sy militêre opleiding aan die Leërgimnasium, en behaal BSc BIng aan die Universiteit van Stellenbosch. Hy sluit in 1972 aan by Liebenberg & Stander en word in 1974 aan Clifford Harris gesekondeer as terreiningenieur vir die brugstrukture van 'n groot padbouprojek. Frik word in 1981 'n medewerker in die struktureafdeling van Liebenberg & Stander en word in 1987 aan Offshore Design Services gesekondeer tydens die ontwerp en vervaardiging van die aflandige gasproduksieplatform digby Mosselbaai. Hy word in 1997 'n direkteur van Liebenberg & Stander Western Cape (Pty) Ltd en is tans sektorleier vir geboue en stadions asook vir kus- en marienestrukture in Bergstan Suid-Afrika (voorheen Liebenberg & Stander Western Cape (Pty) Ltd). ☐

DIARISE THIS!

Date	Event	Presenters	Contact details	CPD validation number	Where
3–7 April	Stormwater Drainage	Peter Pearse	Angie Wallace T 011-403-5603 sarfuse1@acenet.co.za	To be confirmed	East London
2–5 April	Unsaturated Soils Mechanics in Waste Management	G Blight, S Wheeler, R Lyton	Jim Dailey jdailey@asce.org.za		Arizona
April	Soil Stabilisation	Graham Selby	Angie Wallace T 011-403-5603 sarfuse1@acenet.co.za	To be confirmed	Bloemfontein
7–9 May	3rd South African Construction Health and Safety Conference	Prof J J Smallwood	T 041-504-2790 john.smallwood@nmmu.ac.za		Cape Town
8–8 May	SCT 35 Concrete Structures Analysis and Design	Various specialists from Cement & Concrete Institute	Rennisha rennisha@cnci.org.za	SAICEcon06/00002/09	Midrand
25–26 29–30 May	Highway Capacity Manual (HCM) Course	Prof Ken Courage (previously from University of Florida)	Sharon Mugeri cpd.sharon@saice.org.za and SAICE Transportation Division	To be confirmed	Cape Town Gauteng – SAICE House