saice

CIVIL ENGINEERING

Civilution

Isivili Enjiniyering

April 2014 Vol 22 No 3

PICA AWARDS 2012 WINNER

PICA AWARDS 2013

Profiles: Dr Johan Lourens
Dr Desmond Webb

Focus on Geotechnical Engineering

Managing Flood Risk on the Orange River

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I'm a believer

Being an engineer is like being South African – we don't stop being South African if the crime rate is high or if our rugby team loses. Likewise, by virtue of being engineers, we should not stop innovating because of being paid less. In fact, if you are not innovating, you shouldn't be calling yourself an engineer.

> Where there is work that requires professionalism, accuracy, diligence, trust, reliability and ethical values; where the task summons for the services of men and women of honour, the petition should be: "Find me an engineer." ~ *Civilution Congress 2014*

It is not inaccurate to declare that we live in a different South Africa compared to 20 years ago. In many ways this is the new South Africa that our freedom fighters talked about – new government, advanced legislation, diverse economy, open social structure, liberal society, free communication and multicultural young people. Everything is new.

At the Civilution Congress earlier this month, Thuli Madonsela, in her address, made reference to Egypt and Israel. She mentioned that it took 40 years for the Israelites to cross the desert into the Promised Land, and that we as South Africans should be proud that we have taken half that time to establish and make democracy tangible.

With narrative licence, I want to elaborate on this chronicle.

Almost 3 500 years ago, a famous revolution took place. It started with a mass group of Hebrews living in Egypt for more than 400 years. In the final quarter of that time they lived in oppression and slavery under the iron hand of the ruling Pharaoh.

But at some point, under their leader Moses, the Hebrews fled Egypt and traversed the Sinai desert to the Promised Land. As Madonsela rightly said, and backed by holy writ and encyclopaedias of Israel, it took 40 years for the emancipated Hebrews to cross the desert.

The first interesting fact of this liberation story is that the 40-year journey, under normal, organised and coordinated circumstances, takes 11 days.

The second interesting fact, as documented in literature, is that those who were 20 years or older when they fled Egypt, did not make the triumphant entry into the Promised Land. In fact, Moses himself, after leading his people for more than 40 callous years was not permitted the grand entrance. He stood on a hill, on the eastern escarpment of the Jordan River overlooking the majestic western planes of the Promised Land spread out before him, reached out his hand, touched the cool mid-morning air, and with a distant searching gaze, keeled over and died.

From commentary on why these seniors didn't enter the Promised Land, I learned that it was not because they were elderly, tired or grey. It wasn't because they were physically weak – they had evidently endured an arduous desert crossing. Neither were they intellectually destitute or experientially shy. It unfolds that they were prevented because they were grumpy, murmuring, complainers, soaked in pessimism. In fact some were so uninspired that they asked Moses to return to Egypt because life was better there, despite slavery.

Herewith my poetic licence: Egypt was better. There were no service delivery strikes. They preferred service delivery the Egypt way. In Egypt the traffic lights worked, and potholes never emerged. ESKOM was efficient in the land Pharaoh – in Egypt there was no load shedding. In Egypt, the municipalities were organised and structured and cadre deployment was nonexistent. There was neither corruption nor Nkandla-type scandals. Egypt had engineers who ruled the show, had status and respect and wore suits.

The reason why these Hebrews, who ironically were the favoured ones, did not enter the Promised Land, was their lousy attitude.

In our deliberations at the Civilution Congress, Minister Trevor Manuel asked us to be engineers and do engineering differently. Ketso Gordan of PPC challenged us engineers to respond to our environment, that environment which encompasses an inherent political, social and economic dynamic that is not going to change for a while. CEO of SANRAL, Nazir Alli, and NPC Commissioner, Mike Muller, encouraged engineers to be innovative and ethical in their work. Another NPC Commissioner, Bobby Godsell, said that many of the issues faced by engineers are not technical – they are issues of the heart, of philosophy, and belief.

An optimistic, solution-framed and enthusiastic attitude is what is going to take us into the Promised Land – the right attitude about our government, our institutions and our future, coupled with our existing world-class engineering competence and the training of our incredible young engineers. Reinventing ourselves – this is the door that leads to the new South Africa.

I challenge every engineering practitioner never to return, in thought or deed, to Egypt, but to press towards the Promised Land – the New South Africa. ◻

Isivili Enjiniyering = SiSwati

ON THE COVER

Franki Africa has received widespread acclaim for its foundation and general geotechnical work on several basements in the Sandton area. The most recent include the mammoth 170 000 m³ basement for Sasol's new Sandton premises, and the 60 000 m³ basement for the new head office of legal firm Webber Wentzel.

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Winner of the 2009 Pica Award
in the Construction, Engineering and Related Industries category for the third year running

ON THE COVER P9

▶ Extensive demolition work made on-time delivery of geotechnical works on two huge Sandton projects a challenge

Franki showing their mettle in Sandton

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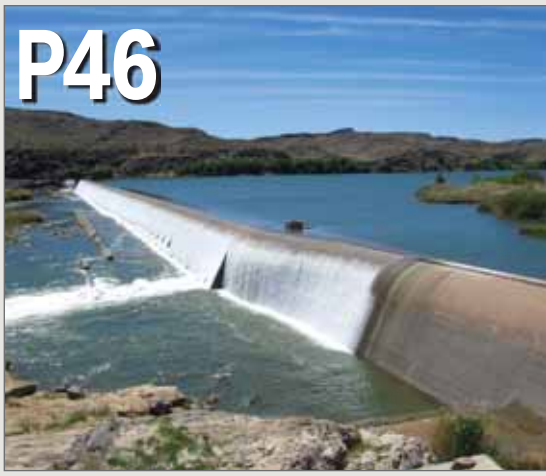


Stefanutti Stocks Geotechnical sets a high standard for a **Rural Upgrade Project**

Stefanutti Stocks Geotechnical, a division of Stefanutti Stocks (Pty) Ltd, was appointed by Namandla Roads and Civils to install the deep foundations for the Nyalazi River Bridge.

This project forms part of the KwaZulu-Natal Department of Transport's special projects. These projects focus on the improvement of infrastructure in rural areas, which is accomplished by providing better access to schools and clinics, better employment as well as business opportunities for local communities.

Busy with the quality control procedures.

The contract is located in a region of KwaZulu-Natal which has been historically impoverished by a lack of infrastructure. The new bridge is located at the Nyalazi River crossing, on the main road P745 between Mispah and MR 495, in the Hluhluwe/Mtubatuba area. This is approximately 2 km northwest of the village of Mpukunyoni. The project entails the construction of a 45 m long, three span bridge. The bridge will consist of two traffic lanes and a walkway. The newly constructed bridge will replace the existing low level, six cell, precast box culvert that is regularly submerged by flood water.

The two bridge abutments and piers were founded on 21 vertical and 18 raked piles. All the piles were installed utilizing 1 180 mm diameter Bauer temporary casings and 900 mm diameter galvanized permanent casings. The pile holes were formed using a 20 t metre torque, Casagrande B200 auger piling rig to depths ranging between 4,5 m and 10,3 m in highly variable soils.

The piles were designed and installed to carry their loads in a combination of side shear and end bearing. Rock sockets 1,5m in length were formed by employing specialized pile driving techniques, which included coring with specialized core barrels into rock with an unconfined compressive strength ranging between 20 Mpa and 103 Mpa.

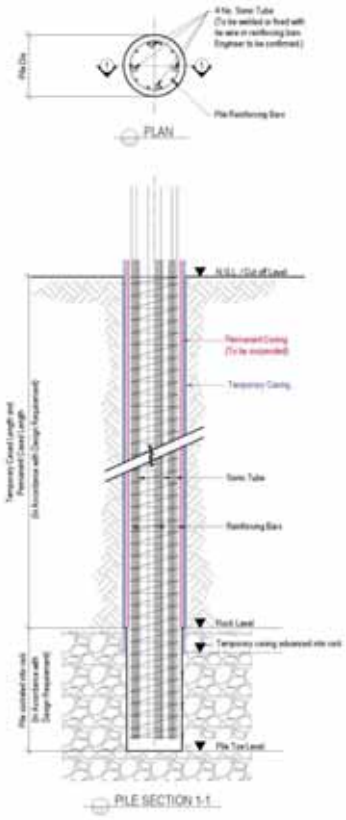
The end bearing was established by means of airlifting and handcleaning, depending on the degree of groundwater inflow.

Preparation for the pile cleaning process by airlifting.

Pile cleaning process by airlifting.

Once the pile base was clean, a permanent casing and reinforcing cage were placed in position. Conventional direct concrete pouring could not take place due to the presence of groundwater in the preformed pile holes; thus, the concreting operation had to be carried out under water, using a full length tremie pipe. At this stage during the concreting operation the temporary casing was then removed, leaving the completed pile behind.

Four sonic tubes were installed per pile through which sonic integrity testing could be conducted in order to verify the concrete shaft integrity. In addition, the concrete/rock socket contacts were cored by means of diamond drilling and core recovery after which these cores were physically inspected to confirm their clean transition.



Typical Permanent Cased Auger Cast in Situ Pile detail

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The birth of a new era

At the time of going to print with this edition of *Civil Engineering*, the built environment industry was basking in the aftermath of Civilution Congress 2014. From its inception, *Civilution* as a concept had invoked hope of regaining the level of respect and recognition once enjoyed by engineers, so that engineers, in partnership with government, could help turn our country back onto a road that would lead us out of failing infrastructure into a future of long-term sustainable development and prosperity for all.

When it was coined, the novelty of the word *Civilution* very quickly caught the attention. The concept, with its immediate and long-term implications, soon started gaining momentum with engineers and like-minded politicians and industry leaders who are united in their determination to see a change in thought and action and the status quo, and who are campaigning for working relationships and open communication channels between engineering professionals and government.

Civilution Congress 2014 happened magnificently during the second week of April, but that was really only the beginning. As we now stride forwards into this new era of transformation and progress, many more participants in the *Civilution* 2030 movement from across Africa and elsewhere in the world, all with an interest in improving the future outlook of the industry, are joining to be part of the change, small or large, that they want to see. They want to be part of this movement that aims to once again reinstate engineers as vital role players in industry.

As the anticipation of the upcoming Congress grew, the weight of the *Civilution* movement was manifested by people of stature, such as Trevor Manuel, Nazir Alli, Ketso Gordhan and Thuli Madonsela, coming to the fore in support of the Congress to lead discussions that had already started changing attitudes, and would lead to reinstating dynamic leadership in the country.

Opening the Congress discussions with his plenary address on the National Development Plan was Trevor Manuel, Minister in the Presidency, widely respected for his independent thinking. Coming from a civil engineering background before he entered politics, Trevor Manuel has an appreciation of the fact that it is engineers' sense of practicality and their view of process-orientated metrics that will help the country make great strides towards realising the National Development Plan.

Trevor Manuel's address was supported by heavy-weights such as Ketso Gordhan (CEO of PPC Cement), Mike Muller (former Director-General of the Department of Water Affairs and Forestry) and Nazir Alli (CEO of SANRAL). As civil engineers themselves, these gentlemen have substantial influence in their respective work environments, which bodes well for the future of the civil engineering profession in our country.

In line with the *Civilution* theme of the Congress, panel discussions and breakaway sessions focused on how to implement much needed infrastructure development in South Africa, putting forth that infrastructure bottlenecks by both the public and private sectors need to be addressed through implementable plans with clear roles, responsibilities and deadlines.

Rounding up the first day's discussions, Advocate Thuli Madonsela (Public Protector) addressed what is on everyone's mind at the moment – corruption, tenderpreneuring and unethical business practices, and what the engineering industry can do differently in this regard to meet the goals of service.

On the last day, Bobby Godsell (former CEO of Anglo Gold Ashanti) brought the Congress proceedings to an inspiring close with his talk on matters philosophical.

A comprehensive position paper, which will capture the salient features of all the Congress discussions and debates, will be published in due course to serve as a map into the future, showcasing the service that our industry can offer to develop our great country and the rest of Africa.

In the coming months, readers of *Civil Engineering* who were unable to attend the Congress can look forward to sharing in a number of the presentations, as we will be publishing these piecemeal. It is our hope that our readers will be equally inspired and motivated by these presenters' innovative, constructive and practical ideas for improving the industry, and for facilitating further debate and cutting-edge thinking.

Civilution – indeed the engineer's revolution, and hope.

Prepared by SAICE's editorial team

technocad

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Datum Conversion (WGS 84) of Drawings

WaterMate

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Final touches being applied to the mammoth Sasol basement in Sandton

Franki showing their mettle in Sandton

Franki Africa has received widespread acclaim for its foundation and general geotechnical work on a host of different basements in the Sandton area in Gauteng, South Africa. Two of the most recent include the mammoth 170 000 m³ basement for the new Sandton premises of petrochemical giant, Sasol, and the 60 000 m³ basement for the new head office of legal firm Webber Wentzel.

SANDTON MAGIC

"This is not just another building," says Franki Africa's Paulo Alves of the Sasol premises. "The building will have a massive footprint of about 6 500 m² and will be 67 000 m² in total."

"Our main challenge on this job was to excavate 170 000 m³ – of which 100 000 m³ were decomposed granite rock – to a depth ranging between 14 m and 18 m, and still complete the job in seven months, which is extremely tight from a time perspective. The granite required drilling and blasting, which is challenging in such a densely populated area as Sandton. We were of course considerate of our neighbours who were notified well in advance every time there was to be a blast."

Alves adds that this was a two-phase contract, which meant that Franki Africa did not have immediate access to the entire site. "It is fairly difficult to work under partial-access circumstances, which were in this case exacerbated by the fact that there were also five large buildings on the site that had to be demolished. We had to work while the demolition was taking place, and on only half the site at a time. This left us very little room to manoeuvre."

But ultimately this project went off smoothly, starting with the fact that the original soil investigations were, according to Alves, "pretty accurate", with "no surprises".

The scope of works included 170 000 m³ of excavation, 6 600 m² of lateral support, 169 (no) 600-diameter soldier piles, 550 strand anchors, 400 rock-bolts and a 6 600 m² gunite face area. The works also included approximately 85 (no) structural piles and the diversion of existing stormwater and sewerage lines that ran through the site. The Sasol project began in May 2013 and was completed by the December 2013 annual industry shutdown.

The other basement, that of Webber Wentzel's new head office, while considerably smaller than the Sasol excavation, turned out to be much more challenging. Of the total excavation of 60 000 m³, no less than 20 000 m³ were extremely hard blue granitic rock, which required extensive drilling and blasting. According to Alves, the biggest

challenge on this job was the diabase dyke that they came across along the Rivonia Road face when they were busy installing the soldier piles.

"This was unexpected and required a completely different piling application and technique, which entailed replacing 40 (no) auger drilled soldier piles with 610 mm diameter percussion-drilled piles, which took in excess of a month to install.

"This, too, was a tight job with respect to time, and in this regard we were put under pressure with the discovery of the dyke and when the demolition of the existing structure took longer than had been anticipated, thus limiting the lateral support and earthworks access on site."

Alves nevertheless feels that the contract, which was started in June 2013 and was completed by mid-November 2013, was still completed in an acceptable timeframe. The scope of works included 60 000 m^3 of excavation to a depth ranging between 8 m and 14 m, 96 (no) 600-diameter soldier piles, 240 (no) strand anchors and 250 (no) rock bolts, and a total gunite area of 2 900 m^2.

TEAMWORK

Alves says that, to complete, in seven months, two significant basements totalling 230 000 m^3 of excavation and requiring drilling and blasting, and the installation of hundreds of piles, is no mean feat and one which could not be achieved without exceptional teamwork.

"Our team and our partners on these jobs, Zero Unlimited Earthworks and Pro-Frag Blasting, went way beyond the call of duty in order to get the job done professionally and on time. They often sacrificed weekends and never complained about the extra hours that were needed when the pressure was on," says Alves.

He adds that, unless there is harmony and teamwork among all the players on complex geotechnical sites, all the expertise and experience in the world can mean very little. "From our project managers to the Zero and Pro-Frag on-site managers, these jobs were shining examples of how engineering and related teams can work together to produce world-class results."

For both jobs Franki Africa utilised three lateral support teams and two Soilmec SR 30 drill rigs, which proved to be invaluable in the speedy and efficient drilling and installation of the soldier piles. "Balance between quality and time is always the issue in projects with tight timing, and these machines as usual proved to be significant in us maintaining this balance," Alves remarks.

PART OF THE KELLER GROUP

Meanwhile Franki Africa Managing Director, Roy McLintock, says that being part of the Keller Group is a

More than 9 000 m^2 of gunite area were covered in both contracts

The diabase dyke on Rivonia Road was unexpected and necessitated a fairly drastic change in plans

tremendous boon. "The Keller Group is the world's largest independent geotechnical engineering contractor. Being part of an organisation like this has obvious and significant benefits for Franki Africa, including access to a wide range of innovative technologies, finance for future growth and, of course, a wealth of geotechnical intellectual property and experience.

"On the other hand, Franki Africa brings to the group its vast experience of working in Africa, and this will help to accelerate Keller's growth into mainly sub-Saharan construction markets, where significant growth, fuelled by major infrastructure and resource-related projects, is expected over the medium to long term.

"But those who will benefit the most are our clients who will now be able to get an even better all-round service from us, including the most effective geotechnical solutions the world has to offer," explains McLintock.

Keller, which acquired Esorfranki Geotechnical (now Franki Africa) from JSE-listed Esorfranki towards the end of 2013, has approximately 8 000 members of staff worldwide and global annual revenues of around £1.5 billion. Keller is the clear market leader in the United States, Canada and Australia, and has prime positions in most established European markets, as well as a strong profile in many developing markets.

Justin Atkinson, Chief Executive of Keller, is very optimistic about the acquisition. "The combination of Franki Africa's local knowledge and resources with Keller's scale, experience and broad range of techniques, will make us ideally placed to undertake complex major projects requiring design expertise and multi-product solutions in a region where we expect the longer-term opportunities to be significant."

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Project Management
International

CONE PENETRATION TESTING
RUSTENBURG AND PHALABORWA

INTRODUCTION

Project Management International (PMI) is a dynamic Project Management company specialising in tailor-made construction and engineering services to the marine, civil, oil and gas and mining industries. Furthermore,PMI is also equipped to carry out a wide spectrum of onshore and offshore surveys and site investigations and has offices located in Stellenbosch, South Africa and in Accra, Ghana, toprovide the possibility for full continental exposure.In the recent past, the Ghanaian office has been actively involved in geotechnical investigations involving the method of Cone Penetration Testing (CPT) around Western Africa. CPT is a quick, efficient and cost effective method used to determine the geotechnical engineering properties of undisturbed soils and the recent acquisition of a CPT rig in South Africa has allowed PMI to expand CPT operations into Southern Africa.

CONE PENETRATION TESTING EQUIPMENT

PMI has recently purchased a 200kN CPT rig. The CPT machine, manufactured by Geomil, has a pushing capacity of 20 ton and is trailermounted for easy transportation. During testing, the trailer is fitted with 4 ground anchors for resistance support. The assembly also employs an additional counter weight on skids of approximately five tons made of concrete weights to ensure sufficient dead weight to counter the reaction forces.

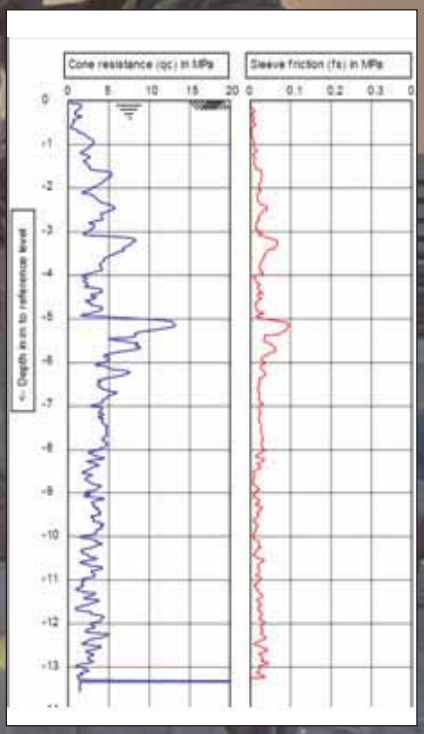
A combined reaction weight of approximately 10 tons is estimated when all components are utilised. CPT tests are performed using an electrical Piezocone, which is able to provide a variety of valuable data, including end resistance (qc), sleeve friction (fs) and pore water pressure (u) throughout the soil profile. This machine, not only performs CPT's, but also allows for piezometer installations and the retrieval of soil samples.

RECENT PROJECTS

PMI has recently executed two projects in South Africa at Bafokeng Rasimone Platinum Mine in Rustenburg and inPhalaborwa. PMI was employed as a sub-consultant to Knight Piésold Consulting Engineers who were undertaking site investigation work on the tailings dams of both facilities. These projects were executed during the months of August and September 2013. In total, 8 tests were performed inRustenburg and 16 tests were performed in Phalaborwa.

TYPICAL RESULTS

Typical results of CPT tests show graphs of the continuously recorded data, where the required data is plotted against depth. CPT results are illustrated, where the end resistance (qc) and sleeve friction (fs) are displayed for the entire soil profile. From these soil properties, the friction ratio can be deduced, which facilitates in providing an estimation of the type of soil in the full soil profile.



CONCLUSION

CPT is a quick and cost effective method used to determine the geotechnical engineering properties of undisturbed soils. CPT is also the most efficientand accepted in-situ test method for soil investigations worldwide. PMI aims to expand CPT operations in Southern Africa and in doing so, has recently purchased a 200kN CPT rig for operations within the area. Modern equipment provides PMI with a competitive advantage in this growing market and recent projects in Rustenburg and in Phalaborwa are testament to the success of CPT operations.

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An innovator of note – Dr Johan Lourens

Towards the end of 2013 the SAICE Geotechnical Division awarded its prestigious annual Gold Medal to two of its deserving members – Dr Johan Lourens and Dr Desmond Webb. On the following pages SAICE readers have the opportunity to learn more about these two exceptional engineers.

Rebekka Wellmanns
rebekka@saice.org.za

Johan, joint recipient of the Geotechnical Gold Medal, being congratulated by SAICE 2013 president, Peter Kleynhans

REACHING FOR THE SKIES

Growing up in Pretoria's northern suburbs, much of Johan Lourens's playtime was spent using firecrackers to blow up conical leaves and other suitable plants in the garden. Fortunately for his distraught father, and a chemistry set, he proceeded on to more controlled experiments, with his crowning engineering achievement soon to follow – successfully constructing a two-stage rocket from commercial fireworks, complete with satellite and astronaut – a grasshopper (never harmed) chosen for its ability to withstand sudden acceleration.

He knew back then already that some kind of scientific profession would follow.

In his later school years he became increasingly more interested in science and biology, and a career as a veterinary surgeon was ever more appealing. With help from the University of Pretoria's aptitude tests – which indicated that veterinary science should be the first choice, but that both engineering and veterinary science could be tackled – he decided on civil engineering, as bursaries for aspirant engineers were plentiful at the time; and with no NASA of sorts in South Africa, it seemed to him the only branch of engineering where large and challenging structures could be designed.

NEVER A DULL MOMENT

In 1969 he graduated from the University of Pretoria (UP) with a BSc (Civil Engineering), embarking on his first job at the South African Railways and Harbours (SAR&H) where he was deployed to Stanger in KwaZulu-Natal to assist a team of engineers working on the new Durban–Richards Bay railway line. This is where he was first introduced to some demanding geotechnical engineering problems – the founding of several bridges, amongst them the Tugela river railway bridge, as well as the construction of embankments on the hippo muds near Richards Bay.

Here he would see the importance of effective stress and consolidation, of which lecturers only ever spoke, when, despite soil being imported by scrapers at an alarming rate for an embankment being built on the mudflats, the embankment was not increasing in height. Still to this day Johan can see the water spurting some metres into the air when a standpipe piezometer was installed!

During that year, a UP classmate (the late Johan Diedericks) told Johan about an inspiring new firm, Bruinette Kruger Stoffberg Hugo (BKSH, later BKS and now AECOM), which he had recently joined. Johan was intrigued, and after an interview with Dr Bingle Kruger and Fred Hugo, and an offer from them to take over his SAR&H bursary, he joined the firm in July 1969. This is where he would spend 37 years, as well as meet his wife, Veronica, who was working as a secretary at the time.

"Right from the start, what most impressed me was the value BKSH put into investing in expensive software and hardware to enable research into unique analytical techniques in geotechnical engineering. I was encouraged to perform innovative engineering, fulfilling a vital role in successfully applying novel solutions."

Johan initially did not have a specific preference as to the discipline in which he should be involved, so Fred Hugo persuaded Johan to join him and Dr Dirk van der Merwe (of heave prediction fame) in the newly established geotechnical section.

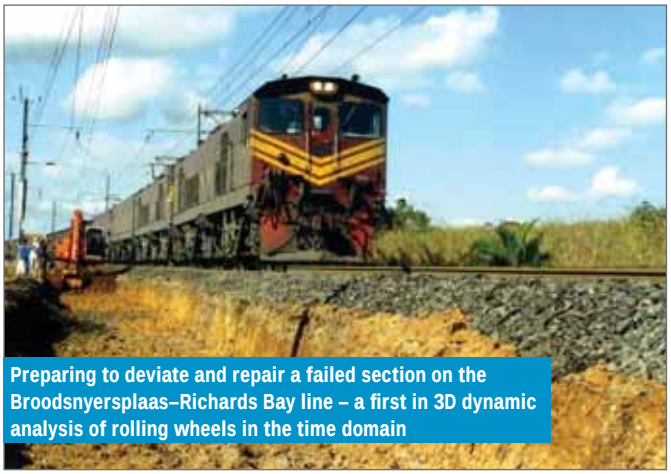
"Fred and Dirk, who had a great influence on me during the early mentoring years with their vigour for work, uncanny ability to motivate, and quiet, unpretentious manner and professionalism, threw me in at the deep end, and during the early 1970s I was virtually on my own to perform the entire Rand Afrikaans University's (now the University of Johannesburg), and the SABC TV building's geotechnical investigations and pile designs. This was also my baptism of fire regarding the descent into deep auger holes. The thick layers of red transported collapsing sands overlaying deeply weathered diabase at the university necessitated profiling in the 760 mm diameter auger holes to nearly the full depth of which the Williams LLDH120 digger was capable – about 37 m!"

"The fact that the work was challenging and interesting contributed to my decision to stick to geotechnical engineering. Geotechnical engineering is notorious for its many problems for which closed-form solutions do not exist, and a geotechnical engineer is therefore often tasked to perform analyses and designs which require original and innovative thinking. The gratification upon successfully completing such assignments is grand and gives me a sense that I am making a difference."

And he would! He not only authored 20 papers (two of them winning three awards for innovation, best technical paper and best overall paper), but used and generously shared all the resources that were made available to him, thereby enabling growth within the geotechnical engineering sector for the benefit of others. Johan indeed became an example of the vital role that the engineer plays.

"The fact that the work was challenging and interesting contributed to my decision to stick to geotechnical engineering."

Mud pumping from the formation on the Broodsnyersplaas–Richards Bay heavy haul export line



Preparing to deviate and repair a failed section on the Broodsnyersplaas–Richards Bay line – a first in 3D dynamic analysis of rolling wheels in the time domain

Skillful measurement of layer deflections under rolling wheels as a function of time for the 3D dynamic analysis on the Broodsnyersplaas–Richards Bay line

ANALYTICS

Having a bent for the analytical side of engineering and enjoying challenging analyses, the 1980s saw him involved in the investigation and analysis of the SA Railways' tower block and its 30 m deep basement excavation, which would have resulted in significant deflections on the neighbouring high-rise buildings, and which was to be built in 1982 in central Johannesburg in deeply-weathered lava. Although never constructed, the publication of the analysis did earn him SAICE's award for the best paper dealing with innovative design/construction of a project and was published in the Institution's transactions in 1985. After reading this exhaustive paper, the head of the UP's Department of Civil Engineering in 1988 (the late Prof Archie Rohde) decided that Johan's analysis and its publication were sufficient to be awarded an MSc thesis straight off.

In addition to enjoying the analytical side of engineering, he appreciated that clients were more inclined to employ specialists (those with PhDs), so in 1988 he embarked on the road towards a PhD in soil structure interaction at UP, which was awarded to him in 1990.

Soon he was a well-known specialist in road research and rail track formation design, being entrusted with many firsts in geotechnical engineering, such as the dynamic analyses in the time domain of rolling wheels on pavements and rail tracks, as well as the soil structure interaction between heavy haul railway tracks and formation layers.

One such project was the investigation, analysis and rehabilitation design of structures on the Broodsnyersplaas–Richards Bay heavy haul coal export line during the 1994 – 2004 period.

The serviceability of the line's formation layers (below the stone ballast) was degraded, indicating distress in the form of large deflections of the tracks, pumping of mud from the formation, skewing of sleepers and powdering of ballast. All the distress symptoms showed an accelerating trend in terms of number of occurrences and severity of degradation, resulting in unacceptable escalation in maintenance costs.

Johan was appointed to establish the cause of the degradation and to design rehabilitation measures. A sophisticated 3D finite element model was used to investigate the problems, in particular to simulate the actual rolling action of the truck wheels and their interaction with the formation, providing realistic stresses and strains and an understanding of the structural interaction and reasons for failure of the various layers. Measurements by Spoornet on instrumented bogies on the 104-ton trucks (26-ton axle loads) at various speeds supplied the dynamic forces induced by the wheel on the tracks. The dynamic parameters of the layer works in the formation, such as dynamic stiffness moduli and damping ratios, had been back-calculated by means of the finite element model, using the measured deflections (non-symmetrical deflection bowls) of the various layers under the action of trains at speed. The in situ measurements were done by means of multi-depth deflectometers and pressure meter tests, the tests conducted by a crack Spoornet laboratory team under the leadership of Hannes Maree and Mike Tomas.

These calculations were to show large horizontal strains in stabilised layers, leading to progressive failure, a major reason for failure on the coal line at the time. Redesign of the stabilised sections could be performed, as well as a new design of unstabilised formations 100 mm thinner than previously.

This application of advanced technology in the rehabilitation designs resulted in various novel and cost-effective measures being implemented on different sections of the track.

A young Hannes Gräbe (nowadays Prof Gräbe of the University of Pretoria), was also seconded by Spoornet to work on this project with the BKS geotechnical team, and later used the model for his PhD research.

Johan recalls: "The problems of formation and high embankment failures were the most challenging, both from an analysis point of view and the implementation of designs. The latter because some of the failures threatened disruption of the traffic, temporarily interrupting or delaying the export of coal carried by twenty 200-truck trains per day (400 000 tons). Decisions had to be made, for instance, to keep the heavy traffic going while soil nails had to be installed in vertical failure surfaces only metres away from the tracks – it was definitely an experience standing next to the track while the ground vibrated under the impact of the heavily loaded bogies! Certainly the analyses, particularly of the track formation, were exhilarating, as the 3D dynamic analysis of rolling wheels in the time domain was implemented – a first on an international level."

Not least for Johan during this unforgettable project was the cooperation of Hannes Maree of Spoornet – his invaluable crash-course in track technology during the many site visits, the support from him and other Spoornet personnel when difficult decisions had to be made urgently, and his contributions to the results when they became available from the new analysis, without which this project would not have been such a success.

GETTING DOWN DEEP

Meticulous, sharp, down to earth, and with extensive knowledge, Johan is also never one to keep his knowledge to himself, nor to shy away from getting his hands dirty or crawling into holes to get to the bottom of a problem, as Dave Purnell, a friend and colleague of 35 years, can attest to.

Dave chuckles as he relates one of his memories of Johan from the early 1980s. "Needing some reassurance while checking 3 m deep foundation excavations in weathered andesite for a multi-storey structure, I phoned Johan requesting his experienced input. Johan arrived, in suit and tie from the office, wholly unprepared for site! Despite the excavation floors being covered with wet, sticky mud from recent rains, there was no hesitation from Johan – he immediately entered the excavations, prodding around in the mud with his geological pick! I was impressed to say the least and can still picture it 30 years later."

In May 2005, Johan retired from BKS to start work a day later in his own company where he wanted to rather focus on the technical aspects of engineering, leaving the management and administration components to a younger generation.

After 40 years in the civil engineering industry, what has he learnt? "Do not implement off-the-shelf solutions to problems, unless you are confident that you really understand the reason for distress in a structure. I have had an experience where large crescent-shaped cracks and settlement on the surface of a high road embankment in a mountainous area were deemed to be the symptoms of classical slope failure, and the solution offered was to stabilise the "imminent failure" by means of a berm at the toe of the embankment – a perfectly acceptable solution on the face of it, and a classic rehabilitation measure often successfully implemented, although costly for mountainous terrain. The silty, sandy composition of the fill, however, raised questions, and after a thorough investigation and analysis, the cracks were shown to be caused by uneven displacement due to collapse settlement. What's more, no further significant collapse of the grain structure would occur and the embankment was safe from slip failure. The solution was to simply seal the cracks, fill up the depression and construct a new blacktop. Understanding the problem resulted in a huge saving!"

PROUD FAMILY MAN

Johan, though, has never forgotten his first love – animals – and has coupled this with another passion (film making), assisting his daughter Karin, a veterinary surgeon, with an animal caesarean section while filming it all in HD and surround sound.

His wife, Veronica, the kingpin around whom family life revolves, describes his relationship with their two daughters as being "bostiked" to them, finding both his daughters' professional work particularly interesting, accompanying Karin to Free Me, a non-profit rehabilitation centre for indigenous wildlife, and getting lectures from Tanya, a biokineticist.

He is also blessed with three grandchildren who make up an important part of their lives, not the least of which is the physical fitness aspect and compulsory pyjama drill when they come to visit. ◻

From left: Veronica, daughters Tanya and Karin, Isak (Karin's son), Clarice (Tanya's daughter), and Johan

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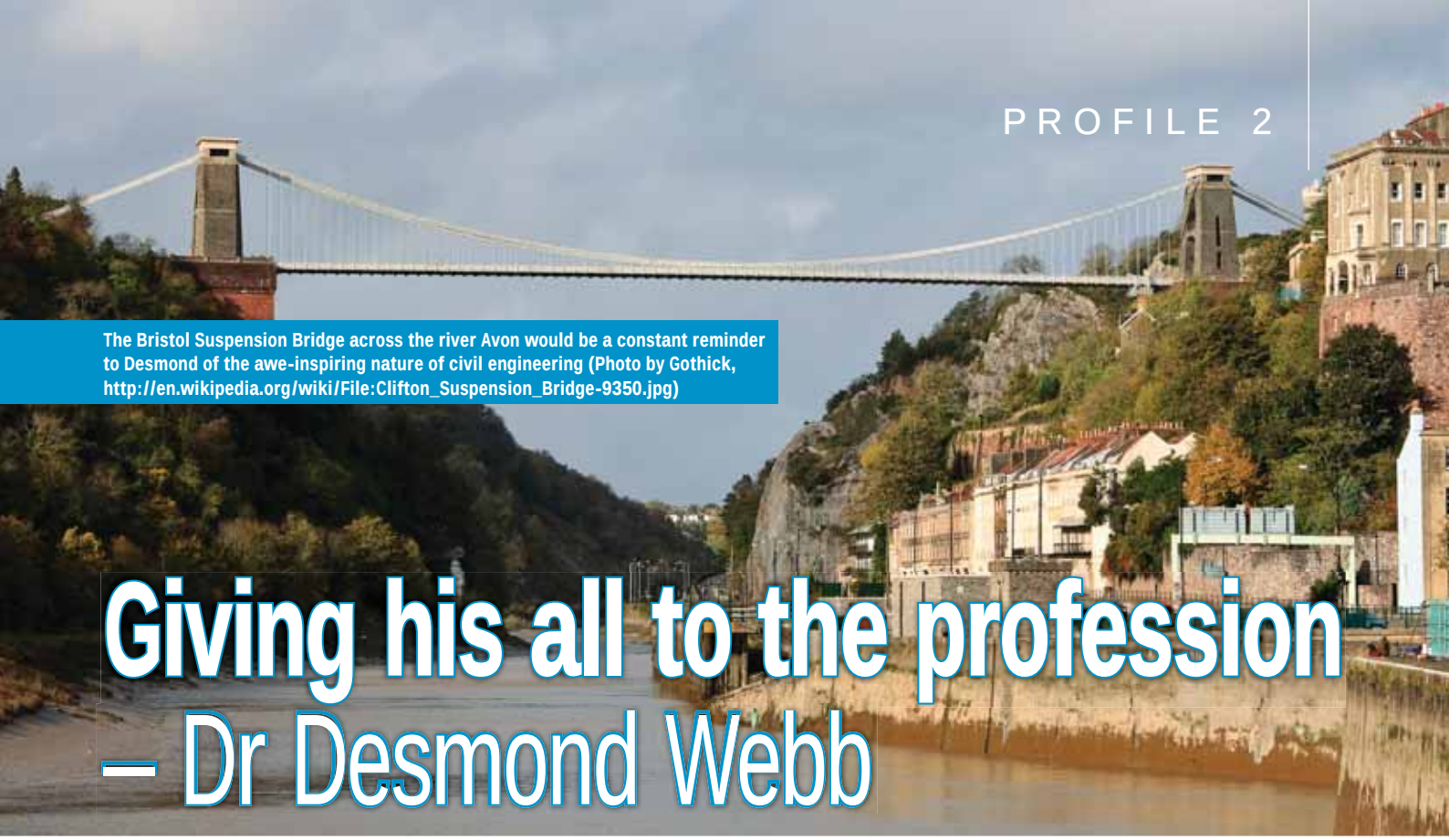


The Bristol Suspension Bridge across the river Avon would be a constant reminder to Desmond of the awe-inspiring nature of civil engineering (Photo by Gothick, http://en.wikipedia.org/wiki/File:Clifton_Suspension_Bridge-9350.jpg)

Giving his all to the profession – Dr Desmond Webb

Rebekka Wellmanns
rebekka@saice.org.za

A MAN OF INSATIABLE CURIOSITY

Desmond Webb has always enjoyed sharing generously of what he knows, following his philosophy that whatever you put your hand to, do it well, make it worthwhile and help others where you can. This philosophy has carried him far, and has seen him rise as a foremost expert in the early years of the emerging geotechnical profession.

There is not much which he has not seen or experienced while building up his specialist knowledge, as is evidenced by his vast collection of civil engineering books and papers – from geotechnical engineering and dams, to stability of slopes and earth dams, and innovation in foundation engineering.

Born in 1924 he grew up in Rustenburg, spending his early teen years travelling between Rustenburg and Bristol, England, as the tobacco firm for which his father worked as the chief accountant required him to spend part of his time in South Africa and part in Bristol.

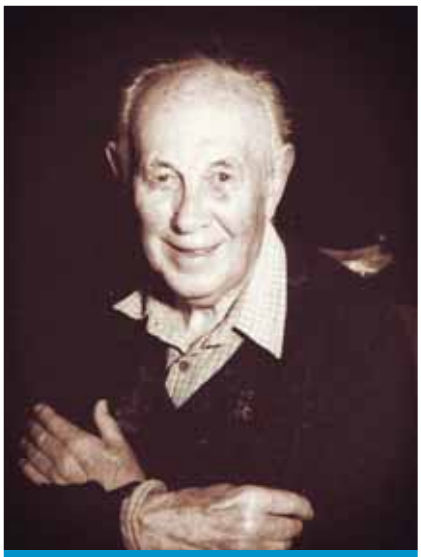
In Bristol the family lived close to Isambard Brunel's classic Bristol suspension bridge spanning the deep gorge of the Avon River, and Desmond would on many an occasion visit this landmark, as well as the many bridges, tunnels and earthworks of the Great Western Railway between London and Bristol. Fascinated and awed by the extent of the engineering, and having always been surrounded by the many dams and irrigation works in Rustenburg, from a young age civil engineering began to be of great interest to him.

"Being a naturally curious person, even from early on dams in particular fascinated me and I would often contemplate the wonder of how dams stood up and didn't get washed away. Later during my career I would do extensive research and apply a lot of what I had learned about structural stability and slope stability."

LAYING THE FOUNDATION

Never idle for a moment and always intrigued by how things worked, on one of their trips to England he built a number of radio sets which enabled him to listen to programmes from countries as far afield as Holland. This would be the start of a lifelong love for investigation and design.

Back in South Africa, nearing the end of his school career at Michaelhouse, Desmond felt that a career in engineering would be suited to him, given his interest in maths and science, so he registered at the University of the Witwaterstand for mechanical and electrical engineering. However, he soon realised he had made an error in his choice, and after two years he switched to civil engineering to align



Desmond Webb
joint recipient of the Geotechnical Gold Medal

with his deep interest in outdoor life.

Obtaining his BSc (Civil Engineering) in 1947, he went on to join the in-house consulting engineering staff of African Consolidated Investments Corporation (a real-estate and business services company) becoming involved in large township development projects and commercial and industrial buildings, and particularly with the design, construction and operation of irrigation dams and canal systems.

The company would also provide Desmond many opportunities for further education, which saw him travelling to Europe to study developments in the field there.

"One of my particularly interesting assignments involved spending some time in Switzerland to study methods of controlling the siltation of hydroelectric dams. When I returned to South Africa I designed a special type of suction dredger which was similar to the ones used in Switzerland, with the discharge pipe and the 3 000 volt electric cable being supported on steel floats."

During this time, the head of the Corporation, John Schleisinger, would also be a great source of early encouragement.

"John was a wonderful man to observe. He was in his early 30s when I started working there and he was already head of a family business – the Schleisinger Organisation which was world-renowned for constructing shops, factories, farms and film studios. He was decisive, fair, respected and he managed to get the best out of people, his age never being a factor in commanding respect. It was also fun to travel with him – we met British film stars on several occasions during our work travels!"

At 40 Desmond was appointed head of the engineering department at African Consolidated Investment Corporation, working closely with consulting engineers Hawkins Hawkins and Osborn on dams, canals and pumping stations for irrigation purposes.

A SERIES OF FORTUNATE EVENTS

Having a special interest in dams and a hankering to gain further experience, 1959 saw him fortuitously awarded a scholarship by the Confederation of British Industries where he would go back to London, dividing his time between carrying out research at Imperial College University of London, and working for Halcrow and Partners on projects such as the Piccadilly underpass and access shafts for the Metropolitan Water Board.

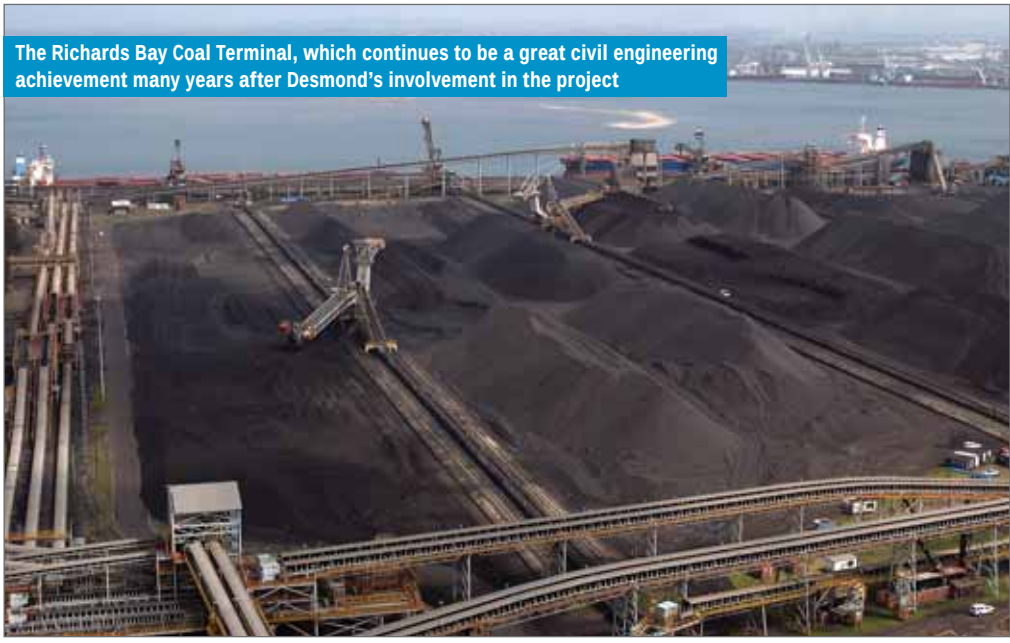
"I have been fortunate in my life that I always seemed to meet the right people and lucky enough to be in the right place. On top of this I've also always had good people encouraging me – lecturers, fellow consulting engineers, who helped me greatly."

At Imperial College Desmond was also fortunate to work very closely with Professor Alan Bishop, Professor Alec Skempton and Dr Dave Henkel, gleaning a lifetime of invaluable knowledge and skills in the process.

For his research carried out at Imperial College, the CSIR in Pretoria and the Civil Engineering Council of Great Britain awarded him two further research scholarships, and in 1966 he was awarded his PhD in soil mechanics by Imperial College.

During his time there he also enjoyed getting involved in sport – playing squash with the university's team and becoming a member of the British Mountaineering Association which afforded him the opportunity to make expeditions to several glaziers and snow-capped peaks in Austria and Switzerland.

London would also be where he married his wife, Margaret, in 1960, a fellow graduate of Wits who had a degree in psychology. They have two sons, a daughter and six grandchildren.



The Richards Bay Coal Terminal, which continues to be a great civil engineering achievement many years after Desmond's involvement in the project

Majuba Power Station, Amersfort, where Desmond did much of the foundation design

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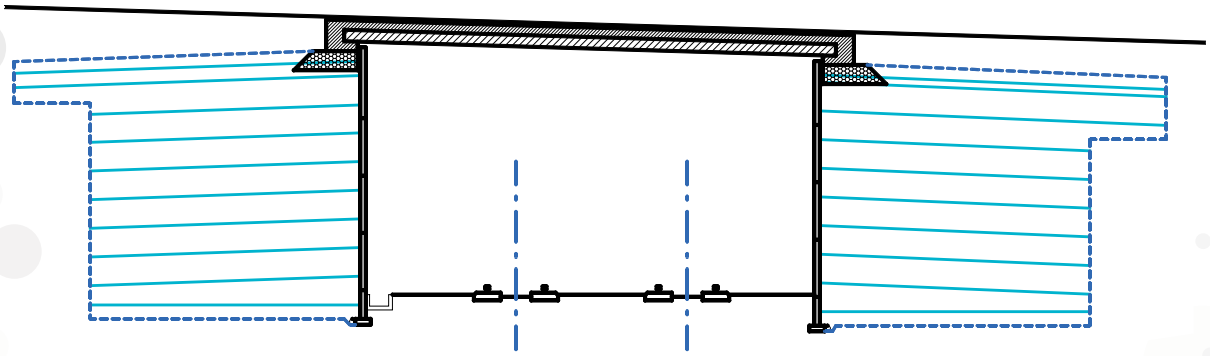

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COMING TO THE FORE

Deciding to return to South Africa after completing his PhD, he started his own specialist geotechnical consultancy practice in Durban (DL Webb and Associates) where he could focus on his passion – civil and geotechnical engineering. The company grew to almost 300 people at one point, and he networked with engineering geologists the world over.

"Running my own firm was a time when I gained great experience with working on big projects, and realised the importance and joys of working with competent people."

Here he would undertake some major South African projects, including the Sasol 1 and 2 projects, where he was responsible for the design of nearly all the earthworks and foundations, which included tension piles for 250 m high smoke stacks, the design and supervision of the construction of more than 50 000 piles (some piles being 1.5 diameters cast in place), piles for 300 m high chimney stacks and foundation design for the Majuba Power Station in Amersfort.

During this period he also received SAICE's award for Excellence in Civil Engineering for the geotechnical and civil works on the Richards Bay Coal Terminal.

"I investigated the possibility of economising on the embankment construction costs for the railway line across parts of Richards Bay. This involved end-tipping of sand material directly into the water to displace the underlying silt and clay. The rate of end-tipping and its height above water level were controlled by the permeability and shear strength of the underlying clay and silt, which was carefully monitored. This innovative procedure was adopted and construction proceeded without any problems."

Building up his reputation as an undoubtable specialist after having been involved in the design and construction of 53 dams in South Africa, the UK and the USA, his other activities included carrying out major geotechnical investigations and designs for a petrochemical facility in Durban, being an expert witness in a number of supreme court cases, attending specialist workshops and seminars in South Africa and the USA, and carrying out the site investigations for, and design of, foundations for large gas compressors and other vibrating machinery. He has also been responsible for the design of slime dams for retention of a fine-grained quarry.

Despite his involvement in over 30 projects of great significance during this time, he still found time to publish in excess of 50 papers at regional and international conferences, dealing with theoretical soil mechanics and soil structure interaction from observations during and after construction.

"When I started out in civil engineering, geotechnical engineering was an emerging profession with not much known, but in the last 30 years this field of knowledge has progressed by leaps and bounds. I would therefore publish all my work and results so that this emerging speciality, on a small, 'unsophisticated' scale, could grow in stature. The research one does is so important in geotechnical engineering, as projects often need innovative engineering to be carried out – one size does not fit all. There was never a question of trying to find the time to publish so many papers – it was just necessary."

THE IMPORTANCE OF GREATER KNOWLEDGE

Desmond continues to emphasise the importance of research. He contends that, "geotechnical engineering will face many challenges in the future, one being solutions for rapidly depleting land for urban development. It's also so necessary for geotechnical engineers to carry out designs for difficult ground conditions and for increasingly large buildings. This requires increased confidence in the method of design and construction, and research and structure interaction, and as such published results will certainly be required for all of this."

FUTURE TRAILS

At 89, he is still passionate about his profession. He is a SAICE Honorary Fellow, Life Member of the American Society of Civil Engineers and Member of the Institution of Civil Engineers, UK.

Now retired and enjoying spending time with children and grandchildren, he looks fondly on his time spent more recently as an external examiner for final-year students at the University of KwaZulu-Natal's Civil Engineering Department, as part-time lecturer in applied geotechnical engineering at the Durban University of Technology, and also as external examiner for undergraduate students and postgraduate research students in geotechnical engineering. The manner in which he shared his extensive knowledge would see many students inspired over the years.

And his hope for the profession? "To see the professional integrity of the engineer recognised and appreciated by the client. For this it is essential for engineers and those operating in the profession to have verifiable and accepted qualifications from respected institutions, as should always be the case. At present there seems to be too many people operating on the fringe of the profession, running businesses, jobs and projects with little experience or with inadequate qualifications or training, resulting in an unacceptable number of engineering failures." ◻

"... geotechnical engineering will face many challenges in the future, one being solutions for rapidly depleting land for urban development. It's also so necessary for geotechnical engineers to carry out designs for difficult ground conditions and for increasingly large buildings. This requires increased confidence in the method of design and construction, and research and structure interaction, and as such published results will certainly be required for all of this..."

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Repairing a failing rail embankment

Jan Norris
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Pietermaritzburg
Jeffares & Green (Pty) Ltd
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AN INTERESTING PROJECT that required cooperation between Jeffares & Green's Johannesburg and Pietermaritzburg offices was undertaken for Transnet Capital Projects. The project involved the geotechnical investigation of and lateral support design for Km 137 of the Dumbe bypass near Paulpietersburg on the Transnet coal line that runs from Richards Bay to Durban.

The Johannesburg office was responsible for the geotechnical investigation and the Pietermaritzburg office did the design for the rehabilitation of the slope. The existing fill embankment is 27 m at the highest point, and has been showing signs of progressive failure along the upper 6 m, resulting in the failure of the embankment shoulder and the tilting of the mast poles adjacent to the railway line. The objective was to assess the stability of the embankment and to design remedial measures to repair the damaged section and prevent further failures.

Geotechnical investigations were carried out by means of trial pits and DCP (dynamic cone penetrometer) tests, as well as through the retrieval of disturbed and undisturbed block samples for specialised triaxial testing to determine the parameters of the subsoils.

Getting started on repairing the failing rail embankment at the Dumbe bypass near Paulpietersburg

The project posed severe challenges, because at no time could there be any interference with rail traffic on the line. In order to ensure safety during construction, restrictions were placed on the contractor in terms of limiting the extent of any unsupported excavations both laterally (maximum 10 m) and vertically (maximum 1.5 m) at any one time. Space available for installing the upper row of nails was also very limited owing to the proximity to the railway line.

Using the results of the geotechnical investigation, the stability of the embankment was analysed with the aid of the software package SLIDE, which uses the Morgenstern-Price and Bishops methods of 2D limit equilibrium analysis of circular slip surfaces. Various iterations were undertaken to determine the location of the slip circle with the minimum factor of safety (FoS). Once this had been established, lateral support was incorporated into the SLIDE model to determine the optimum configuration to ensure that the FoS of the slope was equal to or greater than 1.5, which is generally taken as an acceptable value for long-term support.

To repair the slope, J&G recommended that soil nails be installed on a 1.5 m grid, both horizontally and vertically spaced, with an optimal nail length of 7 m. Since the embankment was showing signs of progressive failure because the slope angle was too steep and the material making up the embankment was poorly compacted, once the soil-nailed section was completed, it was mesh-reinforced and then shotcreted. Wick drains were installed to run diagonally between the soil nails and connect into a horizontal drain running along the toe of the wall, so as to drain moisture away from behind the face.

One of the client's requirements was that J&G should


The embankment was mesh-reinforced and then shotcreted


First part of the project completed


Qualified abseiling crews were used to drill and install the soil nails


A gabion wall was constructed in front of the soil-nail wall

ensure that the final design solution resulted in a one-metre increase to the embankment crest, to ensure that the masts were protected, and to provide pedestrian access. To achieve this, a gabion wall was constructed in front of the soil-nailed wall, the top of the gabions being shotcreted to provide a platform. The excavated material from the cut face was then used to flatten the slope below the soil-nailed face.

The project posed severe challenges, because at no time could there be any interference with rail traffic on the line. In order to ensure safety during construction, restrictions were placed on the contractor, Penny Farthing, in terms of limiting the extent of any unsupported excavations both laterally (maximum 10 m) and vertically (maximum 1.5 m) at any one time. Space available for installing the upper row of nails was also very limited owing to the proximity to the railway line, so Penny Farthing came up with an innovative way of installing the soil nails – they drilled a series of anchors into the edge of the crest of the embankment, and then used qualified abseiling crews to drill and install the soil nails. Both the personnel and the drill rigs were secured via the anchors and abseiling ropes.

Project investigations started in September 2012 and construction was completed by the end of 2013. ◻

At no time could there be any interference with rail traffic on the line

Reshaping of the lower slopes in progress

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A brief comparison of **geotechnical soil classification standards and the limitations of "factual" soil descriptions**

Simon Owens-Collins CPEng
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This article briefly discusses some of the soil description parameters of the soil classification guideline used in South Africa, and compares this with global soil logging standards used in the geotechnical engineering community. Emphasis is placed on the methodology for primary soil type classification, and the limitations of this "factual" information when used in geotechnical design.

SOUTH AFRICAN GUIDELINES

In South Africa, the *Guidelines for Soil and Rock Logging in South Africa*[1] (South African guideline) is most commonly used in the geotechnical engineering community when describing soil. The South African guidelines are based on the *Revised Guide to Soil Profiling*[2] and is encapsulated in SANS 633[8].

This guideline recommends that soil be described in terms of moisture condition, colour, consistency, structure, soil texture and origin (MCCSSO). The guideline gives significance to the so-called "pebble marker", which is a characteristic gravelly feature of the typical African soil profile. The pebble marker is defined as the gravelly marker forming the boundary between transported soils above and residual soils/rock underlying. This is unique amongst the standards described in this article.

The primary soil type is described as part of the soil texture parameter, which also includes a description of the angularity and grain size. The soil type is described based on the proportion by mass of the material components, with the primary soil name based on the soil type forming the majority (largest soil type component by mass) as determined from a tactile assessment, or when available, from a particle size distribution laboratory analysis. The South African guideline states: "In describing a soil, the adjective is used to denote the lesser type, e.g. a silty clay is a clay with some silt.

A silt-clay, however, has approximately equal proportions of silt and clay." Some ambiguity exists in the South African guideline and SANS 633[8], as well as in the *Revised Guide to Soil Profiling*[2] on which it is based. In practice, most engineers classify the soil type based on the interpreted geotechnical engineering behaviour rather than on the primary soil component by mass.

There is no comment provided in the South African guidelines on the quantitave method to differentiate the classification of silt from clay.

The consistency of cohesive soils is based on tactile inspection and the unconfined compressive strength of the material, whilst the consistency of non-cohesive soils is based on typical dry density, SPT blow counts and tactile inspection. The requirement for assessment of plasticity of fines is not mentioned in the South African guidelines.

Whilst some of the other classification systems in this article discuss soil origin, the South African guideline is unique in that the soil origin forms an essential part of the soil description, as this may impact on the engineering behaviour of the soil and aid in the identification of problem soils.

Like all classification systems, the South African classification system relies on laboratory test results to confirm the classification, particularly in the case of silt and clay fractions.

AUSTRALIAN STANDARD

The Australian soil classification method is described in AS 1726[3]. AS 1726 also classifies the primary soil type based on proportion (>50% by mass). The classification of soils with a majority of fines material (silt or clay) is based generally by plotting the results of Atterberg limits test results against the A-Line on the plasticity index:liquid limit chart (where this information is available).

Descriptive terms for secondary and less fractions are provided using a defined set of percentages, which vary for coarse- and fine-grained soil components.

AS 1726 is the only system discussed in this article which quantifies a medium plasticity nomenclature for clay materials (liquid limit of 35% to 50%), in addition to a low and high plasticity.

The consistency of cohesive soils is based on the undrained shear strength. This nomenclature differs from the South African guidelines classification. For instance, a very stiff clay (AS 1726) approximately correlates with a stiff clay (South African guidelines) and a very high strength clay (BS EN ISO 14668-2[4]).

The consistency of non-cohesive soils is based on density index (%), which, whilst different to the South African guidelines[1], generally correlates similarly.

EUROPEAN STANDARD

The European (including British) standard description of soil and rock is presented in BS EN ISO 14688-1[5] and BS EN ISO 14688-2[4]. Notwithstanding the comments below, the standard indicates that, in general, the interpreted geotechnical engineering behaviour of the soil is used to classify the soil type. Thus, for instance, where the material is considered to behave as a clay, it should be named a clay.

The soil type is named after the majority (>50% by mass) principal fraction where the soil has a majority of very coarse

material (gravel, cobbles or boulders). The soil type is described as a sand where the material has a minority (<50% by mass) of very coarse material and is non-cohesive. The soil type is described as clay or silt after testing for dry strength, plasticity and dilatancy, where the soil has a minority or very coarse material and is expected to behave as a cohesive material.

No defined fraction proportions are provided in the European standard for the description of the secondary fractions, i.e. "slightly" and "very" are qualitative descriptors and not defined by percentages. The European standard defines an intermediate plasticity, but does not provide a quantitative classification of this.

BS EN ISO 14688-1 presents a qualitative and quantitative classification of the consistency of cohesive soils based on tactile and undrained shear strength assessment, and a classification of consistency for granular soils based on density index.

AMERICAN STANDARD

The American Standard uses ASTM D2488[6] for identification of soils from a field or tactile assessment, and ASTM D2487[7] for classification of soils using laboratory test data. These standards use a proportional-based (>50% by mass) classification system, with the primary soil type based on the majority fraction.

Proportions of soil fractions based on defined percentages are provided for secondary or less material descriptors. The classification of fines dominant soils (silt or clay) is based on the A-Line, as well as tactile assessments of dry strength, toughness and dilatancy.

The standard defines a medium plasticity based on a tactile assessment, but does not provide a quantitative classification of this. Likewise, there is a qualitative assessment on the consistency of cohesive soils, but there is no comment on the consistency of granular soils.

DISCUSSION

When using a proportional basis for soil type naming, as used by the South African, American and Australian systems, there is a potential risk. A situation could arise when the granular (non-cohesive) fraction is greater than the cohesive fraction, however the soil may behave as a cohesive material in terms of its interpreted geotechnical engineering behaviour. Take, for example, a soil with 40% clay (cohesive fraction) and 60% sand (granular fraction). In this instance, the material would typically be described as a clayey sand, using a proportional-based naming convention (although some may describe it as a clay-sand), but the geotechnical engineer should generally assume that this material is likely to behave as a cohesive material, that is, as a clay. Where the proportion of clay is not estimated, the designer reviewing the data will have little means to correctly interpret the material behaviour.

Largely due to the above discussion, engineers in South Africa commonly use a behaviour-based methodology when classifying soil type. The Australian AS 1726 classification system has been in place since 1993. The AS 1726 standard is currently being debated by a geotechnical panel of professionals, and a major revision to the classification system is expected in the next few years. The revised system will likely present a soil classification on the basis of soil behaviour, rather than the current proportional-based system.

The South African guideline does not require the assessment of plasticity in the soil description, and does not provide comment on the laboratory classification of silt versus clay. As a result, the design engineer may utilise different published methods, such as using the A-Line or the hydrometer grading. Though alignment is common, differing interpretations of soil type could result from the use of different methods.

The South African, Australian and American standards present nomenclature for descriptors of secondary or less soil fractions based on percentages. This has the benefit that laboratory test results should always yield the same soil name and descriptor, such as "silty clay with some sand", irrespective of the engineer interpreting the laboratory results.

The consequence of the above discussion is to make the interpretation of the ground conditions and the engineering behaviour of these by the designer more difficult. To aid the designer, the soil profile should rather present more detail than is specifically required by the standard or guideline, such as providing notes estimating the percentage (as a range) of material components, plasticity of fines, moisture content relative to plastic limit, or observations on ground conditions, water, infrastructure or anything else of significance near to the test location.

The soil profiles and laboratory test data are commonly considered to be "factual" information, even though there is almost always some interpretation and tactile judgement involved. Due to limitations of the standards, there is the possibility of different interpretations in the compilation of this factual information. The risk of unforeseen ground conditions, inappropriate footing or drainage designs, or other issues could arise where the classification system has inherent limitations, or where the "factual" information is based on tactile assessment and little or no laboratory testing. The risk of this should be fully understood and appreciated by all parties.

NOTES

1. Guidelines for Soil and Rock Logging in South Africa; 2nd Impression 2002; Proceedings of the Geoterminology Workshop (1990); AEG – SA Section, SAICE and SAIEG; ABA Brink and RMH Bruin (ed.).
2. Revised Guide to Soil Profiling for Civil Engineering Purposes in Southern Africa; 1973; JE Jennings, ABA Brink and AAB Williams; Die Siviele Ingenieur in Suid-Afrika – January 1973.
3. AS 1726: Geotechnical Site Investigations; 3rd Ed., 1993; Standards Australia.
4. BS EN ISO 14688-2: Geotechnical Investigation and Testing – Identification and Classification of Soil – Part 2: Principles for a Classification; 2004; British Standards Institution.
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6. ASTM D2488: Standard Practice for Description of Soils (Visual-Manual Procedure); 2009; ASTM International.
7. ASTM D2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011; ASTM International.
8. SANS 633: Profiling, Percussion Borehole and Core Logging in Southern Africa; 2007; Standards South Africa. ◻

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INTRODUCTION

Advances in technology now allow newfound speed in tackling previously time consuming and tedious geotechnical investigation and information gathering tasks. As our ability develops to process ever increasing amounts of data at the click of a button, real-time information corroboration, correlation and even evaluation further make the task of the investigator progressively more efficient.

An opportunity to apply such technology was recognised when ARQ (Pty) Ltd was appointed by N3 Toll Concession (Pty) Ltd (N3TC) to conduct a cutting and embankment inspection along the N3 Toll Route from Heidelberg to Cedara.

THE PROJECT

The objective of the project was to assess the stability of the cuttings and embankments along the route, as well as to comment on maintenance requirements pertaining to issues such as erosion and drain blockage. A total of 793 cuttings and embankments were assessed along the 425 km route, which can be seen in Figure 1.

The objective of the project was to assess the stability of the cuttings and embankments along the route, as well as to comment on maintenance requirements pertaining to issues such as erosion and drain blockage.

Figure 1: The route investigated

THE SOFTWARE

Reviewing available tools and systems, an opportunity to develop project-specific software was identified. For this purpose a skilled software developer was consulted. Software development occurred in close collaboration with ARQ, and the end product accommodated all the requirements set down by the geotechnical engineers involved. The software is capable of functioning on a Windows Operating System (OS), and on the Android OS typically found on portable devices and tablets.

Portions of the route under consideration had previously been investigated by other consultants, and the first portion of the project involved capturing the previous findings into the software's database. This would allow comparison between the current state of the inspection points and previous observations.

With the previous inspection results captured into the database, the fieldwork portion of the project commenced. The inspection was undertaken by three geotechnical engineers equipped with a tablet device. The software (which had by this time become known as GeoRAD–Geotechnical Route Assessment Database) was installed on the tablet, and linked to a remote database housing all the information. The start and end chainages of the 800-odd inspection points were pre-loaded on the database (see Panel 1 – Inspection point list in Figure 2). Upon arriving at a given inspection point, the relevant inspection point profile is opened for editing. The user populates (or simply confirms) information relating to the locality of the inspection point, slope height and batter angle (see Panel 2 – General information in Figure 2). As a third step, a photograph is taken of the inspection point utilising the tablet's built-in camera. The GPS within the tablet is also used to record the coordinates of the inspection point under evaluation. This is all accomplished from within the software package, and does not require the user to exit the software at any time. The fourth and final step in the assessment process involves commenting on the performance of the cutting or embankment. On this tab (see Panel 4 – Comments in Figure 2) the engineer logs a comment and provides a "hazard rating" for the inspection point. The comments from previous assessments are visible in this window and allow the engineer to ascertain whether previous recommendations have been implemented.

The information gathered during the evaluation is uploaded from the tablet to a remote server during the assessment to ensure the safety of the information should the tablet suffer any misfortune.

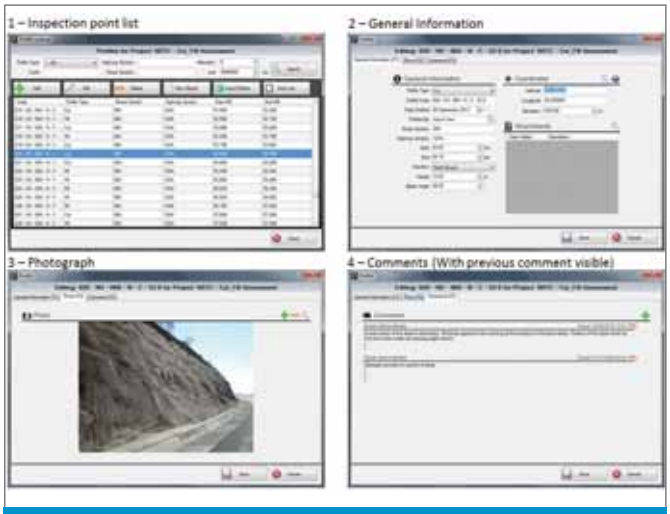

Figure 2: Software layout

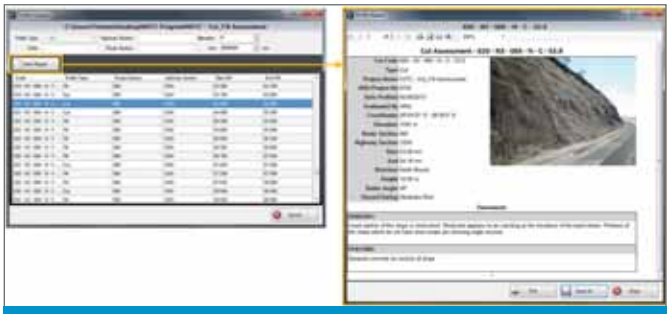

Figure 3: Viewer version

Figure 4: Map-based capabilities

THE END PRODUCT

On completion of the work, the client is provided with a "viewer version" of the software, which essentially provides read-only access to the data. A list of the inspection points is visible, as seen in Figure 3. By selecting an inspection point, and then selecting the "view report" option, a .pdf report detailing the cutting or embankment is generated. On this report all the general information is provided, in addition to the chronologically ordered comments and photos.

As was previously mentioned, the built-in GPS in the tablet is used to record the coordinates of all the inspection points. These points are saved as .kmz files and can be viewed through Google Earth. The pins representing the inspection points are coloured green, yellow or red depending on the hazard rating determined during the inspection. This allows problem areas to be recognised at a glance. General information regarding the inspection point is accessed by clicking on the pin, which opens the summary block seen for point 317 in Figure 4. The full report is generated when the "view report" option in the summary block is selected.

SUMMARY

The N3 cutting inspection study has demonstrated how modern mobile technology can now greatly simplify repetitive geotechnical fieldwork, while also enhancing information quality. With an enhanced ability to access, review, manage and present data, the client is also provided with a product of significantly improved value. ◻

The information gathered during the evaluation is uploaded from the tablet to a remote server during the assessment to ensure the safety of the information should the tablet suffer any misfortune.

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An aerial overview of the Jeffreys Bay Wind Farm

Handover of Jeffreys Bay Wind Farm

Construction in progress on one of the 60 concrete foundations for the wind turbines at the Jeffreys Bay Wind Farm

Due to the sheer weight of the turbine and its components, careful consideration was given to the concrete mix used for the turbine foundations. Each turbine foundation required approximately 330 m^3 of concrete, most of which was produced in an on-site batching plant.

THE 138 MW JEFFREYS BAY WIND FARM is scheduled for handover at the end of April 2014. This project forms the first phase of the government's plan to promote investment in 17 800 MW of renewable generation capacity by 2030.

A consortium comprising Murray & Roberts Construction and Consolidated Power Projects was responsible for the provision of civils and electrical infrastructure respectively.

The wind farm is owned by a consortium comprising Globeleq, Mainstream Renewable Power, the IDEAS Fund managed by Old Mutual Investment Group, Thebe Investment Corporation, a community trust and local engineering firms Enzani Technologies and Usizo Engineering. It involves the erection of 60 turbines on a 3 700 ha site that was selected due to the good wind conditions, its relatively flat topography, minimal environmental constraints and its proximity to a 132 kV Eskom grid line.

The wind farm project has allowed Murray & Roberts Construction to showcase its capabilities in tackling logistically difficult undertakings within extremely tight timeframes. Joe Nell, project manager for the consortium, says that Murray & Roberts Construction's scope of work for the project included the construction of 50 km of gravel road, 60 concrete foundations for the wind turbines, route modifications on the N2 highway and the building of a 350 m^2 operations and maintenance building, together with the trenching for the installation of 200 km MV cabling to the substation.

Apart from the stringent time constraints, one of the largest challenges encountered by the construction team was the very rocky terrain. With most of the rock being close to the surface, the team was forced, in most instances, to make use of hydraulic hammers mounted on excavators.

Work nearing completion on the 138 MW Jeffreys Bay Wind Farm

Due to the sheer weight of the turbine and its components, careful consideration was given to the concrete mix used for the turbine foundations. Each turbine has a capacity of 2.3 MW and a rotor diameter of 101 metres. The nacelle weighs in at 86 tons and the tower comprises three sections. Each turbine foundation required approximately 330 m^3 of concrete, most of which was produced in an on-site batching plant.

The project called for a total of 290 000 m^3 of earthworks and 26 000 m^3 of concrete, together with 2 700 tons of steelwork. The majority of the road building materials was sourced on site, with the aggregate for the concrete and bedding being sourced commercially.

Nell points out that the civils and electrical infrastructure project consortium was allotted ten milestone dates which were all met timeously and efficiently. "The success of the project can be attributed to the finite planning of each step in the process, the ability to remain flexible in the face of adversity, and the strong level of teamwork and participation by all stakeholders."

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Cultivation of the South African Young Geotechnical Engineers Conference

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HISTORY OF INTERNATIONAL SOCIETY

The first International Conference on Soil Mechanics and Foundation Engineering (ICSMFE) was held at Harvard in 1936. Twenty countries, represented by 206 delegates, attended the conference. In 1948 the second ICSMFE was held in Rotterdam with a total of 596 delegates attending, followed by the third ICSMFE in 1953 in Zurich. In 1997 the Council approved a name change to the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) to reflect more accurately the activities of the Society.

The ISSMGE membership grew from 32 member societies and 2 500 individual members in 1957, to 50 member societies and 11 500 individual members in 1977, to 71 member societies and 16 500 individual members in 1998. The most recent numbers indicate that there are now more than 80 member societies and more than 18 000 individual members.

INTERNATIONAL YOUNG GEOTECHNICAL ENGINEERS CONFERENCE (iYGEC)

The iYGEC is an official conference, held every four years under the auspices of the ISSMGE. The aim of the conference is to encourage young geotechnical engineers to get actively involved

Table 1 Summary of Young Geotechnical Engineers Conferences since 1990

YGE	Year	Venue	Theme	Best paper & best presentation	Number of papers submitted
1st Young Geotechnical Engineers Conference	1990	Halfway House, Johannesburg, Gauteng	Innovate Don't imitate	Beric Robertson	
1st Young Water, Environmental & Geotechnical Festival Conference	1996	Bothas Hill	-		
Young Geotechnical Engineers Conference	2000	University of Stellenbosch, Western Cape	Geotechnics – into Africa	Jan Vermaak Nico Vermeulen	38 papers
1st African Young Geotechnical Engineers Conference	2003	National Marine Aquarium, Swakopmund, Namibia	Mining and civil geotechnics – foundation for an African tomorrow	Julia Venter Emrich Hamman and David Johns	39 papers of which 21% came from other African countries
Young Geotechnical Engineers Conference	2005	Swadini Aventura Resort, Limpopo	Environmental geotechnology	Megan Little Lourence Tshabalala	
2nd African Young Geotechnical Engineers Conference	2007	Yasmine Hammamet, Tunisia			36 papers from seven countries
Young Geotechnical Engineers Conference	2008	Camelot, Durban, KZN	Geotechnics – 2010 and beyond	Richard Puchner Trevor Green	31 papers and 73 delegates
Young Geotechnical Engineers Conference	2011	Kruger National Park, Mpumalanga	Big 5 of Geotechnics	Jacobus Breyl Gerrit Smit	28 papers 85 delegates
3rd African Young Geotechnical Engineers Conference	2012	Cairo, Egypt			41 papers and 40 delegates with 10 African countries participating
The 8th South African Young Geotechnical Engineers Conference (SAYGE)	2014	Spier, Stellenbosch, Western Cape	Cultivating the future of geo-technics		69 abstracts re-ceived to date

in research and development, to develop a broader scope in geotechnical engineering, and to provide an informal and friendly environment in which to present findings and research to their like-minded peers.

The first such conference was held in 2000 in Southampton in the UK. The conference, which was sponsored by the ISSMGE and the British Geotechnical Association, promoted the development of future geotechnical engineers and international exchanges between them. The second iYGEC was held in 2003 in Mamaia, Romania, the third in 2005 in Osaka, Japan, and the fourth in 2009 in Alexandra, Egypt. The latter was attended by 82 delegates from 41 different countries. The most recent iYGEC took place in Paris, France, in 2013. The author of the best paper and the best presenter from the previous South African Young Geotechnical Engineers Conference (YGEC) were sponsored by the SAICE Geotechnical Division to attend this prestigious conference.

The next iYGEC will take place in Seoul, Korea, in 2017.

SOUTH AFRICAN AND AFRICAN YOUNG GEOTECHNICAL ENGINEERS CONFERENCES

To date nine YGECs were held on the continent of Africa, of which seven took place in South Africa. The winners of the best paper and the best presentation delivered at these conferences are usually sponsored to attend the next International YGEC. The first South African Young Geotechnical Engineers Conference was held in 1990. Table 1 (based on Nicky Smit's 2011 research) was updated to summarise the events up until the present.

NEXT YOUNG GEOTECHNICAL ENGINEERS CONFERENCE (SEPTEMBER 2014)

Fourteen years after SAICE hosted the 4th YGE in Stellenbosch, 2014 sees the return of the much anticipated event to the "City of Oaks", aka the "Eikestad". This year the SAICE Geotechnical Division accepted a proposal to change the name to the "South African Young Geotechnical Engineers Conference" (SAYGE). The 8th SAYGE Conference will be hosted by the SAICE Geotechnical Division at the Spier Wine Estate from 17 to 19 September 2014. It will provide an opportunity for interaction between delegates from different geo-related institutions between and after conference sessions – geotechnical engineers, engineering geologists and rock mechanic engineers from SAICE, SAIEG and SANIRE under the age of 35 (at the time of submission of abstracts) were invited to submit papers. All geo-practitioners younger than 35 years of age, as well as those who are still young at heart, are invited to attend the conference. In keeping with the venue, the theme for this year will be "Cultivating the Future of Geotechnics". The "godfather" of the year 2014 SAYGE will be Dr Ken Schwartz of the Department of Civil Engineering at the University of Pretoria.

REFERENCE

Smit, N 2011. The History of the Young Geotechnical Engineers Conference, *Civil Engineering*, 19(3):58

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Dolomite Seminar 2014 – forerunner to 2017 revision of SANS 1936

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DEVELOPMENT ON DOLOMITE LAND can be an emotive issue, particularly when you have just been told you cannot develop your stand in Centurion, or that you have to compile a Dolomite Risk Management Strategy for your office block in Olifantsfontein. Isn't the risk of being killed in a road accident far greater than the risk of developing on dolomite land? That may be so, until a sinkhole occurs in your back garden!

Regulating development on dolomite land is all about managing risk. There needs to be a balance between the potential hazard and precautionary measures required. *SANS 1936 (2012) Development on Dolomite Land* attempts to achieve this balance, but has it succeeded?

It took about five years to develop SANS 1936. Many important players were involved, including SAICE, SAIEG, SABS, NCRS, universities, the Council for Geoscience and the Department of Public Works. One of the requirements for acceptance of a National Standard is consensus on the content of the standard, i.e. an absence of sustained opposition to substantial issues. This does not mean, however, that the final product is not without controversy, and that compromises were not made along the way to achieve such consensus.

It is now eighteen months since the four parts of SANS 1936 were issued. Many owners, developers, regulators (local authorities, CGS and the NHBRC), engineers and geologists have had to plough their way through the requirements of the standards and may have found some of the requirements particularly onerous or even downright impractical. Some would have made a serious effort to comply with the requirements while others may have been tempted to throw the standard out the window.

It is now time for informed debate on the issues surrounding development on dolomite land. SANS 1936 is due for revision in 2017 and preparations for this revision should start soon. This is one of the motivations for holding the **Dolomite Seminar 2014.**

The seminar will take place over two days (25 and 26 June) at the University of Pretoria. The first day of the seminar will concentrate on briefing the industry on the contents and application of SANS 1936 and recounting the experience of various key role players in the implementation of the standard. These include local authorities, the NHBRC, the NDPW and the Council for Geoscience. The second day will be more forward looking. It will look at developments in our understanding, including current research, rational methods for hazard assessment, the use of geotechnical/geological models and what we can learn from an analysis of the sinkhole database. Issues that require reconsideration during revision of the standard will be identified, including, for instance, the practicality of certain requirements and issues surrounding development on land with a D4 dolomite area designation.

Development on dolomite is an emotive issue, especially when sinkholes form in your back garden

Delegates may choose to attend either one or both days of the seminar.

Professional engineers and geologists, contractors, developers and officials who deal with planning, investigating, constructing or regulating development on dolomite land are encouraged to attend and have their say. ◻

KEY INFORMATION

Dolomite Seminar 2014
25 & 26 June 2014
University of Pretoria
E: register@rca.co.za
W: www.geotechnicaldivision.co.za/news/107/83/Dolomite-Seminar-2014

A brief history of transport infrastructure in South Africa up to the end of the 20th century

Chapter 3: The first roads – building the foundation for a country-wide road network

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Herewith the third chapter in our series of around ten chapters (the first two chapters appeared in our January/February and March 2014 editions). This résumé of the development of transport infrastructure in South Africa is not intended to be a comprehensive one, but it might encourage readers to participate and add additional value to an understanding of this facet of our history. Readers are therefore invited to communicate with the author in sharing anecdotes and further relevant information.

INTRODUCTION

The early development of road infrastructure in South Africa up to current times falls broadly into four phases. As mentioned in Chapter 1, the first was the period from 1652 to 1806 in which the Cape was considered valuable only as a service station for its owners' East Indian trade. Apart from a small length of street-work in Cape Town, no roads were built. Making the sands of the Cape Flats and the mountain barriers beyond passable by road transport was altogether beyond the financial ability or the needs of the settlement. Tracks of a sort led to Van Rhynsdorp, Tulbagh, Uitenhage and Graaff-Reinet, but these were not used by vehicles if pack animals or riding horses would do.

The second phase was the nearly 100 year period from 1806 to 1895 during which South Africa was opened up as the permanent home of a large and rapidly increasing settler population. Under various governments, ambitious and expensive road schemes, for that time, were undertaken, linking all parts of the country. The roads were rough at best, but they were developed in a very short time, they carried an immense amount of traffic, and they established the basic route system for the Transvaal, the Orange Free State, Northern Natal and the Northern Cape, which prevails to this day.

By 1875 there were 500, and 2 750 by 1893, miles of made road in the country, and 34 bridges.

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The third phase extends from the start of the 20th century, until approximately 1950. The economic development of the country that had produced a remarkable growth in road transport brought about its virtual extinction in the early part of the third period up to circa 1925, with the start of the large-scale construction of railways, which deprived transport riders, stage coaches and wagons of their custom, and soon destroyed them altogether. The construction of road infrastructure was held in abeyance in favour of this new form of transport, the steam locomotive.

By 1925 there could be no doubt that South Africa had lagged behind other countries in the provision of good roads. Whilst £125 million from the National Debt had been spent on the development of railways and harbours, virtually nothing from the Union Government, formed in 1910, had been spent on the building of roads. The total expenditure on roads by the other authorities since 1910 had been less than £20 million, most of which had come from revenue. Of the approximately 70 000 miles of road that had officially been recognised, nowhere did any continuous stretch of improved roadway exceed 40 miles in length.

The dependence on rail transport and the neglect of roads continued until the end of the First World War, when the combined effect of railway systems, which had suffered from the war, the ready availability of comparatively cheap and reliable mass-produced cars, and a fair amount of surplus money started the fourth, or motorised, phase of early road development (1920–1950).

In 1919 the roads were in a state of neglect; the road authorities had hardly any staff, money or technical knowledge; and legislators had no appreciation of the revolution that faced them, and were inclined to be hostile toward motor transport, so that a state of chaos was rapidly developing. The first gleam of hope was the discovery that large sums could be raised by motor taxation, and by 1925 all four provinces had their licensing systems in good working order, and had instituted the beginnings of sound roads departments. Unfortunately, construction continued to fall further and further behind demand, and the "we want good roads" campaign gave place to a preoccupation with the "low cost" road.

INTRODUCING LOW-LEVEL BRIDGES

The first successful step towards this was the development of the submersible or "low-level" bridge, which gave 99% service of the orthodox high-level bridge for about 10% of its cost so that an adequate bridging programme became financially possible. The next step was the discovery that suitable sand, clays and natural gravels were not merely as good as, but were actually superior to the very much more expensive water-bound macadam for fast (in terms of the time) light motor traffic. This was

In 1919 the roads were in a state of neglect; the road authorities had hardly any staff, money or technical knowledge; and legislators had no appreciation of the revolution that faced them, and were inclined to be hostile toward motor transport, so that a state of chaos was rapidly developing.

followed by the introduction of the road grader from the USA – at first animal drawn, then tractor drawn, and finally self-propelled on pneumatic tyres. At about the same time (late 1920s) the idea of patrol or section maintenance was introduced, which subsequently was developed very successfully in the Orange Free State. By 1930 there seemed to be some hope of coping with the situation if the financial backlog could be made up, and if some method of dealing with road corrugations could be found.

1935 NATIONAL ROADS ACT

In 1935, with the passing of the National Roads Act, South Africa took a forward step, which not only put this country ahead of other Commonwealth countries, but which was to lay the cornerstone of the present vast network of high-standard national roads, setting a course of forward thinking in the sphere of roads in South Africa, and heralding the onset of the "getting out of the mud" era for road building in South Africa.

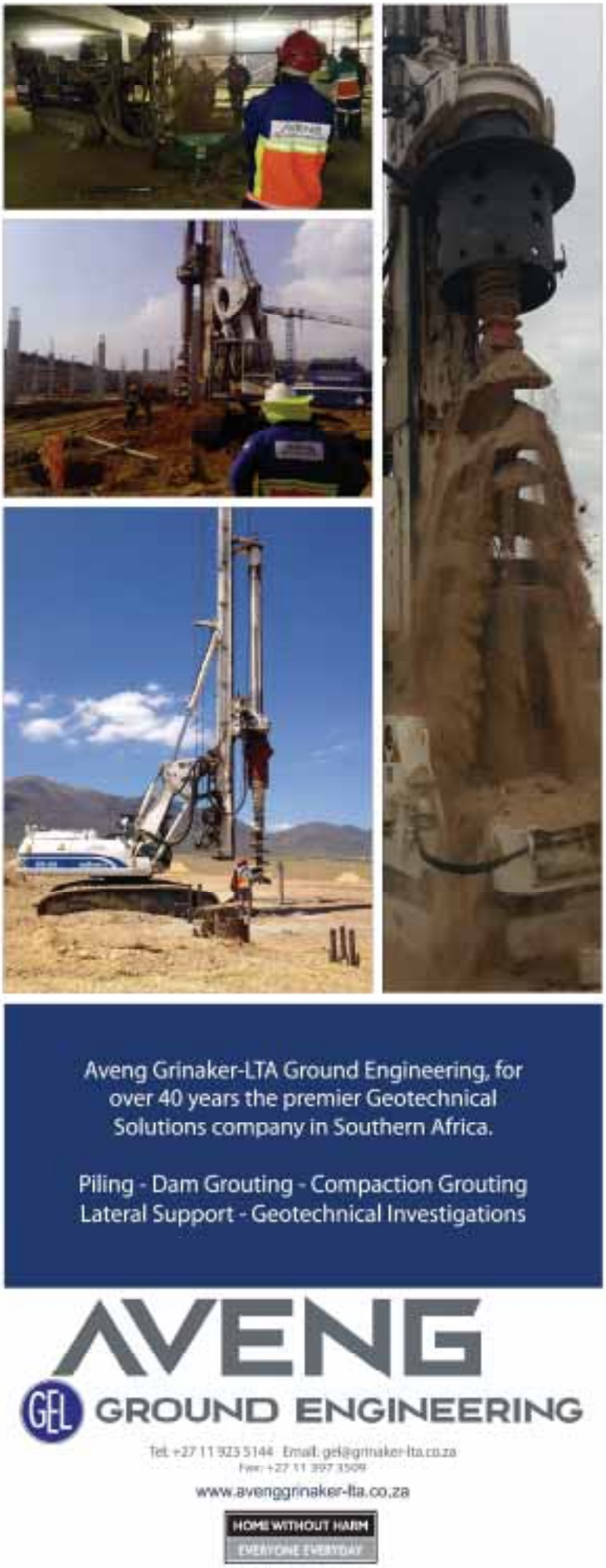
The National Roads Act levied a tax of three pence a gallon on imported petrol for road works, and took over-all responsibility for the most important 5 000 miles of main through-roads, as well as taking over all the provinces' road debts. This relieved the provinces of their most embarrassing roads, gave them an example of what could be done without prohibitive expense by bold policy, and inspired them to attempt to show that they could do better than the National Road Board.

The Board realised early that it was impossible to cope with corrugations under heavy traffic, except by protective surfacing. It founded a laboratory and encouraged full-scale trial of overseas ideas. It was soon discovered that properly compacted bases of natural or blended sand-clay or gravel were just as effective as water-bound macadam costing three times as much, and that light surface treatment (chip-and-spray) is just as good as premix surfacing costing three or four times as much for the heaviest traffic on rural roads.

Unfortunately, good gravel was rather scarce, but this difficulty was largely overcome by the discovery in the early 1940s that the addition of from 2% to 5% of cement (or in some cases of even smaller amounts of lime) modified a rather unsatisfactory soil or gravel so that it made a perfectly satisfactory base. A little experimenting had been done with soil-cement in the States before this but the successful use of such extremely small quantities of cement or lime was a South African innovation, and in this period it is believed that South Africa led the world in modified soil-cement pavement layers.

There existed large areas of particularly poor soils, the so called "black turfs" in particular, where ordinary methods of construction failed badly. The solution to this problem was provided in the middle 1940s by the adoption of the California Bearing Ratio test, which showed that there is a far greater range of soil strengths than was then supposed, and supplied a means of designing a road bed of successively better layers until the surface is reached in such a way that no layer is thicker or more expensive or more heavily compacted than it needs to be.

Although the original ideal of a surfaced road which is so cheap that its overall cost is less than that of building and maintaining a gravel road was never attained, these tools and techniques made it economically possible to provide a bituminous surface on any road carrying 3 000 or so vehicles a day, below which point the lack of kneading action by traffic allowed the bitumen to harden and crack. Ordinary maintenance of gravel



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roads could cope with traffic of up to 300 vehicles per day, so that the rural road problem appeared to be solved except for the solid slog of doing and paying for the work.

The Second World War and its aftermath delayed this goal, as it disorganised the roads departments by denuding them of men and plant, and raised the price of plant and imported materials to about three and a half times what it had been, and of everything else to about two and a half times. In addition to this the war was followed by a virtual revolution in motor transport in which the tremendous increase in the number of vehicles created a clear justification for an increased construction programme.

DECIDING ON SPECIFIC ROUTES

The Board settled on fourteen specific routes for recommendation to the government. The density of population, volume of traffic and the existing road assets and vested interests motivated the choice of these routes. It also took into account the need for progressive improvement of capacity and standards. Finally, routes were selected which would best serve the existing and future requirements of through traffic – taking into account local feeder traffic – between the main urban centres in the Union, traffic to and from adjoining territories, seasonal traffic to coastal holiday resorts and national centres of scenic interest such as the Kruger National Park and the Cango Caves, overseas tourist traffic, and national defence.

The Board was particularly proud of the specifications prepared for the system of national roads. These provided for an all-weather traffic speed of 60 mph (96 km/h), which was considered high in those days. On two-lane roads, the width of the gravelled section would be 18 ft (5.4 m) or 20 ft (16 m) when the intention was to provide an asphalt surface. The formation width would be 32 ft (9.7 m) and the distance between the fences at least 100 ft (30.4 m).

Initially the intention was to provide both single- and double-traffic way bridges, but the Board subsequently decided that all bridges should be double-lane structures.

When the National Road Act of 1935 was passed, the majority of roads in South Africa were still relics of the days of the ox wagon. Paths followed by the indigenous population had become wagon tracks and then earth roads, and in time the earth roads were gravelled. However, the general attitude of the National Roads Board was that, while many of the physical elements of the new national roads would wear out or be damaged or destroyed, their location would forever remain a monument to competent engineering rather than a reminder of poor alignment.

The National Road Scheme of 1935 was an enormous undertaking, the extent of which was not properly appreciated at the time, and by 1938 the five-year programme was well behind schedule. Trouble was being experienced with vested local interests in respect of route location, and added to this, the Board's engineers were confronted with extremely complex road building problems for that time on several routes, notably Route 2 from Cape Town to Durban where really difficult topographical conditions were experienced. Some of the rivers and gorges to be crossed required the most spectacular bridges ever to be built in South Africa.

Nevertheless there was hope that by 1942 all the earthworks, excepting some heavy construction in mountain passes,

would be complete. Unfortunately the outbreak of the Second World War eliminated any possibility that the road programme would be adhered to.

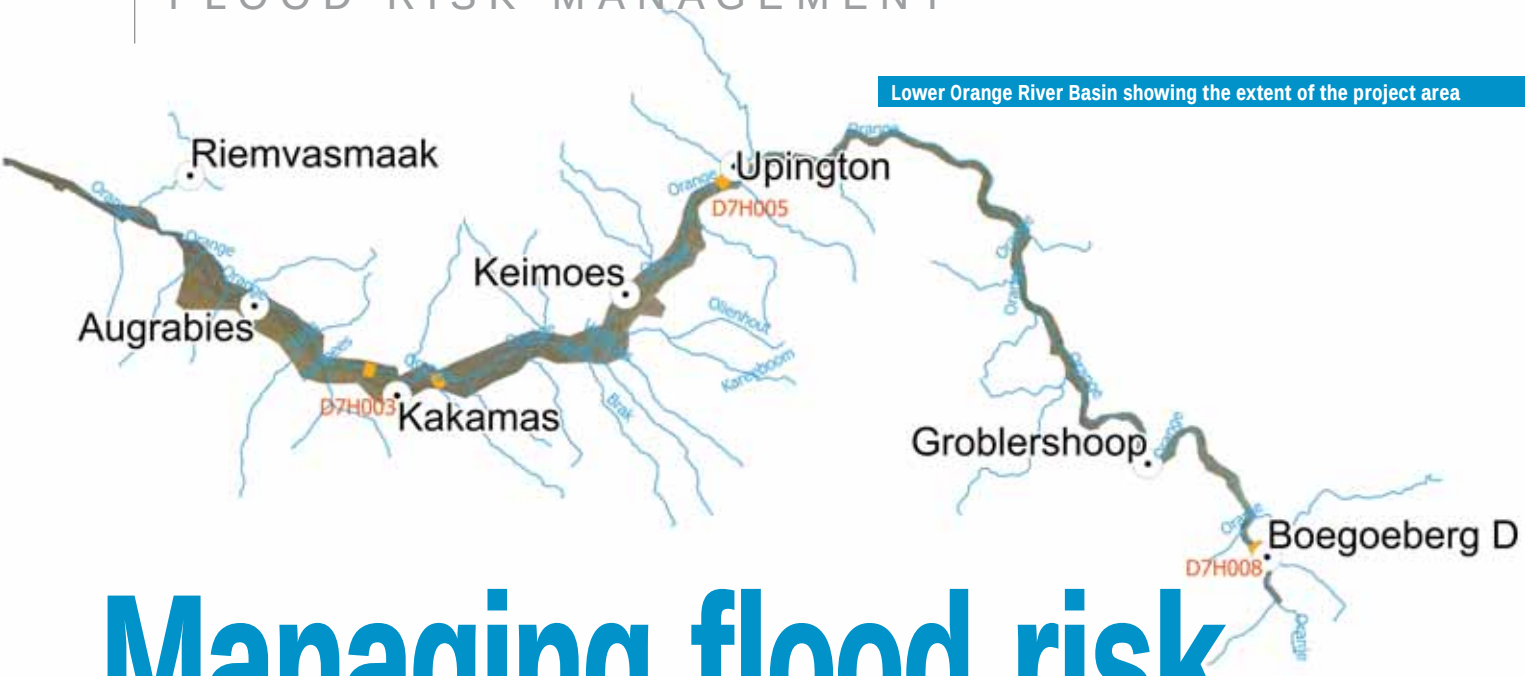
During the war the national road programme had to be largely suspended because of the war effort, in which the entire organisation was placed at the disposal of the government for purposes of war.

SETTING THE STAGE FOR "MODERN" ROADS

Following the war, the National Roads Board was established in 1948 and its function entrusted to the National Transport Commission. The national road programme of 1935 was well behind schedule, and in March 1950, 2 379 miles of bituminous surfaced roads had been completed (out of 5 173 miles on the original scheme) and earthworks had been completed over 3 681 miles. At this stage investment in rural roads and bridges in the Union was less than 60% that for railways. The total length of rural roads in South Africa at the time was of the order of 85 000 miles, the majority being provincial roads. The scene was now set for the newly constituted National Transport Commission, together with the four provinces and the municipalities, to move into the "modern" era of road infrastructure development.

In the words of Colonel F E Vincent, then head of the road engineering staff of the National Roads Board, "The goal which seemed so remote in 1919 – getting the traffic out of the mud and joining all places in the (then) Union with good, safe, all-weather roads – has been virtually achieved, but the traffic problem seems as far from a complete solution as ever. Traffic congestion is such that the towns which we set out to join together have become obstacles to free passage, just as difficult to negotiate as the original roads (or lack of them) and far more dangerous. Bypasses will assure free-flow of traffic not desiring to visit the cities, and expressways and throughways, while sounding very promising, must be seen in the light that even the best of them cannot continue to accept traffic at one end any faster than it can get rid of it at the other. This means that the amount of traffic any road can carry into a city is limited by the amount of parking available in the city for this traffic. While there is every hope of solving the problem it is obvious that the authorities concerned will have to do a lot of very bold, hard and clear thinking; a considerably greater share of road user taxation will have to be devoted to urban road problems and vested interests will have to accept the inevitable changes in the pattern of urban life which the modern revolution in motor transport is bringing about. Finally, the individual citizen will have to realise that, in spite of all that engineering can do, his own restraint, co-operation and self-discipline are essential if he – or she – is to enjoy the full benefits that motor transport can bring."

The stage was now set for the advent of "modern roads", a development which commenced in the 1950s, and was largely based on North American practice and design criteria, as the required expertise was not generally available in South Africa at the time. ◻



Lower Orange River Basin showing the extent of the project area

Managing flood risk on the Orange River

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A group of international water experts have teamed up to investigate flood management options for the Orange River. Fourth Element Consulting and ILISO Consulting in South Africa, together with UK-based HR Wallingford, are providing hydraulic modelling and flood management solutions for the Lower Orange River. The project includes the hydraulic modelling of over 350 km of river, covering vineyards and wheat fields from the Boegoeberg Dam (near Groblershoop) to Onseepkans. Over R1 billion has been allocated to the rehabilitation works.

BACKGROUND

The Orange River is the largest river in South Africa. Its catchment area of almost 900 000 km^2 reaches into Lesotho, Namibia and Botswana and yields over 20% of South Africa's fresh water. Rainfall varies dramatically from over 1 000 mm per annum in the eastern highlands in Lesotho to less than 100 mm per annum along the Atlantic seaboard. As a result, over 90% of the catchment's mean annual runoff is derived from its upper areas, including the Vaal River which is a major tributary of the Orange River.

This yield has provided an important water source to an otherwise arid area along the lower reaches of the Orange River, and since the late 1800s an important agricultural economy has developed along the river. Vineyards produce table grapes, sultanas and wine. Other high-value crops such as citrus, pistachios, pecans and vegetables are grown, as well as cereal crops. Most of the agricultural lands are in the alluvial floodplains and islands along the river, irrigated by an extensive system of canals and weirs.

BOEGOEBERG DAM

The first of the weirs to be constructed was the Boegoeberg Dam, 150 km up-


Boegoeberg Dam

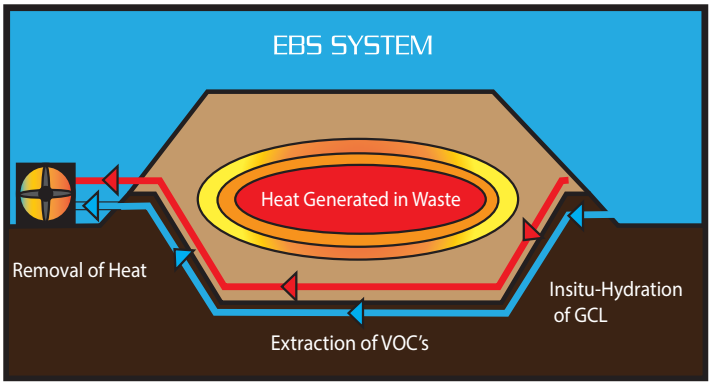

Agricultural lands near Keimoes

stream of Upington. Plans for the dam and associated canals were first conceived in the 1870s, but the full benefit of the scheme could not quite match its cost. This was reviewed on a number of occasions with varying areas of irrigated lands to be served, but it was not until the Great Depression in the late 1920s that the feasibility of the scheme was realised. Used as a job-creation initiative, the 9 m high Boegoeberg Dam was completed in 1932 and irrigated 7 700 ha. Since then, another eight government irrigation schemes have been established downstream, with over 400 km of canals irrigating more than 20 000 ha.

FLOOD LEVEES

Flooding would have been part of the agricultural life cycle on these lands, and flood levees were a likely method of flood control. Early records in the archives of the Department of Water Affairs report on damage to flood levees after a flood event in 1957. However, it was only after a particularly large flood in 1974 that there was a concerted effort by the Department of Water Affairs and various local municipalities to develop a network of flood levees. At that time, the design level for the levees was referenced to recorded flood levels during a smaller event in 1976, but did not take into account other flood conditions that could occur. Subsequent events have shown that this has had variable success, with smaller floods resulting in higher flood levels in some locations. In addition, poor design and construction have resulted in slippage and failure of some of the levees.

After widespread damage during a flood in 2011, the Department of

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APPROVED INSTALLATION AIC CONTRACTOR IAGI

Agriculture, Land Reform and Rural Development (DALRRD) undertook to address the problem. ILISO Consulting was appointed to undertake the hydraulic analysis, master planning and concept design of a large area of the irrigation system in the Lower Orange River, and to coordinate a programme of design and construction.

ADDRESSING THE PROBLEM

The study area includes approximately 350 km of the Orange River from the Boegoeberg Dam to the Augrabies Falls, and a smaller 20 km section further downstream at Onseepkans on the border with Namibia. The DALRRD required a two-dimensional (2D) hydraulic model to be developed for the study, and ILISO Consulting appointed Fourth Element Consulting to undertake the 2D modelling work, while HR Wallingford was called upon as specialist advisors for both the modelling and flood management.

A 2D model was selected rather than the more familiar one-dimensional (1D) model, because of the complexity of the

Vineyards on Renosterkop Island

The Orange River at Blouputs

river system and the requirement to realistically model flood spreading across the floodplains caused by breaching and overtopping of defences at any location. Parts of the river system have a complex network of braided river channels, with islands between the channels, some of which are irrigated and have levees.

The area to be modelled is just over 1 000 km^2, and a flood hydrograph in the Lower Orange system is typically a double-peaked event of 30 to 45 days' duration. A modelling strategy had to be developed to simulate the passing of a flood hydrograph along the length of the river in a sensible run time, whilst maintaining sufficient detail in the model.

The InfoWorks ICM software has been selected for the study. It has proved better able to handle the large terrain data sets, hence it has been possible to mesh large areas. The river has been divided into six models. The last one is a stand-alone model for the Onseepkans area, while the first five flow from one to the other from Boegoeberg to Augrabies Falls. The largest model surface area is over 200 km^2 and the detail is aimed at master planning rather than detailed design. This still requires that the flood levees are represented in sufficient detail to ensure that their effect on the passing flood hydrograph is adequately simulated.

One of the concerns of the DALRRD is that, in the past, the construction of levees was overseen by different organisations, including the farmers themselves, and the standards of design and construction were variable. In many cases the levees were constructed from the sediment deposited on the lands during a previous flood, and are therefore prone to slippage and collapse. Most of the levees were constructed right on the river bank (to maximise crop coverage), resulting in stability problems, as well as being prone to erosion. In the 2011 flood it is understood that many of the levees failed before they were overtopped.

Data collected for the study included a LiDAR survey of the flood risk areas. There is no formal record of the flood levees, so the LiDAR survey data has been used to identify them as far as possible – there are over 800 km of levees. Formally constructed and maintained levees are relatively easily identified from the LiDAR data, but this has not been the case everywhere, and in some cases there were gaps in the flood levee data. The way in which these gaps are filled will depend on the impact that they have on the model results obtained during the calibration process.

Whilst there will be uncertainties in terrain and flood levee conditions prior to the calibration events, the study will benefit from a comprehensive set of flood records for one of the largest flood events in recent memory. The flood of 1988 caused widespread damage, not only in the Lower Orange River area, but also further upstream where there was widespread inundation, riverside towns flooded, croplands destroyed and even two dam failures. Having one of the best flood warning systems in South Africa, residents and farmers in the Lower Orange area were able to evacuate to higher ground.

The flood flow varied along the river depending on the impact of the floodplains, but was of the order of 8 000 m^3/s in the modelled reaches. It is regarded as being close to a 50-year return period event. The Department of Water Affairs at the time commissioned the establishment of a series of flood beacons along both banks of the river and the data for these are being used in the calibration of the models.

The primary purpose of the calibrated models will be to support the development of a masterplan for flood management along the river, with a specific focus on agricultural lands. A range of return period floods will be run to determine design levels for flood levees. The outcome will be linked to a GIS such that the design teams and the DALRRD themselves can plan for levee design at specific locations.

The master plan will also highlight vulnerable areas – those that are not currently protected by levees and those that could experience worsening flood risk and flood damage if upstream and surrounding levees are raised. The study is also starting to raise questions about how the design return period is going to be selected. Scheme cost versus flood benefit is not yet being considered. However, farmers and stakeholders in the areas are already asking questions about this, some believing that a lower level of flood protection would be more manageable. One of the challenges of the project will therefore be to achieve an equitable solution for a long length of river where the levees and floodplain inundation have a significant impact on flood flows and water levels further downstream.

The question of drainage of the floodplains following inundation will also need to be addressed, as this affects the duration of flooding and the impact on crops. There are currently relatively few flood gates in the system. They typically consist of hinged flap gates, but these are viewed as having variable success because of the possibility of failure during flood events. Manually operated sluice gates are also in operation at some points. Elsewhere farmers will break sections of the levees to release retained flood waters after the flood hydrograph has passed.

A MODEL WITH POTENTIAL

No doubt additional questions will arise as the master plan develops and it is expected that this will highlight the value of the asset that will be the 2D hydraulic model, not only for the present study, but also for the future management of the system. It is also expected that the model will become relatively quick to run as the understanding of the system improves and computer systems become more powerful. The model is possibly the largest of its kind in southern Africa and, as the benefits become apparent, may lead to similar modelling approaches for other major rivers in Africa. ◻

The construction of levees by different bodies has, over the years, resulted in varying standards of design

On working as a Resident Engineer in South Africa

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In this article Philip Wyatt shares some amusing anecdotes of his time spent working as an RE on various South African projects.

My reasons for coming to South Africa in the late 60s are now a little fuzzy. I do recall being shown photographs by another Masters student, who had worked for Murray & Roberts for a year, of thatched 'huts' with a foot of snow on the roof and cranes against a cloudless blue sky. At that stage the best job that could be wished for in the UK was to work on survey on the motorway projects, and the prospect was not particularly attractive. I therefore responded to an advertisement in a Sunday newspaper to work for the National Institute for Road Research at the CSIR in Pretoria. I was sent a first-class rail ticket to the interview in London. Nobody travelled first class, and certainly not struggling students, which I discovered when I sat alone in my compartment for the first hour or so, after which I happily joined the normal people in second class.

For twenty or so years I worked on designing bridges and roads, and in the early 90s was made a director of Geustyn Forsyth and Joubert in Durban. Subsequently I felt a change was needed, and in 1995 accepted a job with Africon in Malaysia. They had a skills transfer arrangement with a Malaysian company and more than 20 engineers, some with and some without their families, travelled to Kuala Lumpur. This was a somewhat over-the-top method of complying with my restraint of trade requirements to not work within 100 km of Durban. Subsequently I was recruited by an Australian consulting practice to work as the design manager for a team designing the infrastructure for the Olympic Games in Sydney. When this had been completed, my wife and I returned to South Africa towards the end of 1997. With no clear idea of what to do, I accepted a short-term contract as a Resident Engineer on a SANRAL contract for the rehabilitation of the N3 between Mooi River and Estcourt in


New interchange at the old Durban International Airport

KwaZulu-Natal. Thus began a new career path as a Resident Engineer, which has had some lighter moments that I would like to share with you.

MOOI RIVER TO ESTCOURT

The rehabilitation procedure was to mill out the visibly distressed sections of asphalt surfacing and replace it on the same day with new asphalt. Every morning at dawn I walked in front of the milling machine and marked out the areas to be removed. Because of the patterns I created on the road I was known as Picasso by the milling machine operator. One morning I was creating my work of art on a section of the northbound carriageway near Mooi River when I heard a squeal of tyres and several large bangs. On peering over the hedge I saw a car on its roof about 30 m from the road. I scrambled through the hedge and ran towards the vehicle, but halfway there I met a younger man heading in the same direction. He handed me his phone and told me he was a paramedic and gave me an emergency number to phone. What a relief that I was not going to be faced with whatever had transpired to the occupants of the car. Not only that, but the occupants could be thankful that a paramedic was on his way to assist, and that they had me with my intimate knowledge of the freeway marker boards who was able to summon help and accurately describe the position of the accident to the rescue services. I duly rang the number and after what felt like a long time I heard "Hello". I blurted out, "There has been an accident on the N3 southbound carriageway at kilometre whatever whatever." Again "Hello". I breathlessly repeated my message. "Please hold," came the response, followed by a soothing piece of music. I stared in disbelief at the phone. My heroics had been in vain and by this stage the three occupants of the car had been assisted out of the vehicle with little more than a few scratches and bruises. I hung up.

DURBAN INTERNATIONAL AIRPORT INTERCHANGE

On completion of this contract, I moved to the site for the new interchange at the old Durban International Airport. There were few amusing incidents here, as the contingent of armed guards necessary to protect those working on the site failed to prevent me from being mugged and shot at, and a worker being robbed at gunpoint for his sardine sandwiches. We had a very strong supervisory team on this site and on completion of the contract one of the directors of the consulting practice said that he wanted this 'A' team to supervise the upgrading of a section of the N2 through the Kei cuttings in the eastern Transkei. Mention of the 'A' team and I was sold, as were apparently the rest of the team. It is noteworthy that this is a worthwhile tactic if you want people to move to inhospitable places and only travel home for a weekend every two or three weeks.

KEI CUTTINGS

Our site offices were next to the Kei River and the contractor had provided a small garden in front of the office buildings. A little bush began to grow next to my office door. It grew quite rapidly and when members of the SAPS visited me they would point at the bush and laugh amongst themselves. There were numerous people housed in the camp, but the bush was allowed to flourish. It was perhaps thought that it was there for the recreational use of the Resident Engineer and was therefore to be revered. It was

Work in progress on the Kei cuttings

Rehabilitation of the Town Hill section of the N3 outside Pietermaritzburg

an attractive bush and reached a height of more than a metre. At this point the temptation obviously became too great – one morning I arrived at my office to find it had gone and the soil neatly replaced. It was as if it had never been there. Perhaps I had been hallucinating.

The surveyor and his two assistants were travelling through one of the Stop/Go restrictions on site when a truck travelling in the opposite direction failed to stop at the Stop sign and careered head-on into his bakkie. One of the truck's wheels ended up close to the driver's head, but all escaped without injury. The bakkie was written off and several cars in the queue at the Stop sign were damaged as he bounced off them. The local traffic officers questioned the driver of the truck and he informed them that his brakes had failed on the steep downhill section before the Stop sign. After due consideration of the situation, they decided that it was not necessary to charge the driver with any offence and that it was alright to allow the truck to continue on his journey. And away he went. When I heard what had happened I was angry and approached the commanding officer of the local Road Traffic Inspectorate for an explanation. He must have thought that this was a potential threat to his job as he brought several members of the SAPS to the next site meeting to defend him. They informed the meeting that they would only become involved if somebody had been killed, and since nobody had died there was nothing they could do. The irony of allowing a truck with brake failure to continue was lost on those that counted.

Accommodation of traffic through the site was interesting to say the least. Restricting the traffic to a single lane using traffic lights was considered dangerous for motorists stopping at night and therefore two-way traffic had to be maintained outside working hours. Traffic was accommodated on a 6 m wide gravel wearing course and with 50 m radius curves. The road was slippery when wet and dusty when dry, and despite the high traffic volumes, including car transporters and inter-city buses, there were no serious incidents. During the day the road was completely closed with locked gates between 10:00 and 14:00 to allow the contractor unrestricted access for blasting and other activities. The situation was advertised widely to advise motorists of the closure, but naturally some arrived at the gates shortly after 10:00 and had to wait for four hours. I was frequently confronted by irate motorists demanding special dispensation to travel through the cuttings. The closures were in place for almost a year, and despite the good intention of allowing the contractor unrestricted access, the time taken for the route to clear after closing the gates,

During the day the road was completely closed with locked gates between 10:00 and 14:00 to allow the contractor unrestricted access for blasting and other activities. The situation was advertised widely to advise motorists of the closure, but naturally some arrived at the gates shortly after 10:00 and had to wait for four hours.

Civillain by Jonah Ptak

and the traffic congestion caused when the gates were opened, proved counter-productive. It also took an inordinate amount of time for the supervisory staff to travel the 15 km to the other end of the site, and a request for an inspection after 3 pm was met with a lack of enthusiasm. At the end of this contract the 'A' team dispersed. After dabbling in some consulting work, I moved to work on the rehabilitation of the Town Hill section of the N3 outside Pietermaritzburg.

TOWN HILL

The contract was mainly to mill out the existing asphalt and replace with a continuously reinforced concrete in the slow shoulder, the slow lane and the middle lane. The outer lane was to be milled and replaced with stone mastic asphalt. The Road Traffic Inspectorate (RTI) naturally insisted that two lanes in each direction had to be available at all times on this exceptionally heavily trafficked section of road. Precast concrete New Jersey Barriers were used to separate the traffic from the working area, and on occasion they had to be perched on the edge of the excavation to provide sufficient width for the two lanes. Articulated trucks tracking around the tight curves on the hill would frequently clip the barriers, which were connected with steel plates, and many metres of barrier would then fall over like dominoes. A fork-lift truck was available at all times to replace the recumbent barriers.

A short section of the eastbound, downhill carriageway was too narrow to rehabilitate *and* maintain two lanes of traffic. The RTI agreed that we could separate the trucks from the cars at the top of the hill, bring the trucks down the hill in a single lane and provide two lanes in each direction for cars in contra-flow on the westbound carriageway. Concrete barriers were placed in the centre of the carriageway to provide a physical separation. This worked well for the required duration, with only the occasional holidaymaker taking a wrong decision and then crawling down the hill sandwiched between the trucks. The motorists who used the system correctly were rewarded with magnificent views over Pietermaritzburg from the elevated eastbound carriageway and the added bonus of not having to interact with any trucks. This was so popular that I was asked on several occasions if this situation could remain indefinitely.

KING SHAKA AIRPORT INTERCHANGE

With the 2010 FIFA World Cup tournament looming and the new airport construction well underway, I began a 24-month contract to construct the airport interchange on the N2 at La Mercy. This involved the construction of two major bridges, four interchange ramps and a toll plaza. The contract went smoothly, except that details of the toll plaza were only finalised about six months from the scheduled completion date. The client would not open the road without the toll plaza being operational, and the airport couldn't open without the access road. It was touch and go and we were still painting the lines in the plaza area when the first cars came through, but we made it.

A GOOD JOURNEY

There have been many incidents over the years, some amusing and some not so amusing, but by and large it has all been worthwhile and enjoyable. ◻

Maccaferri SA (Pty) Ltd changes its trading name to Maccaferri Africa

Maccaferri SA (Pty) Ltd, manufacturer of double-twist mesh used in the production of gabions, mattresses, geosynthetics, rockfall mitigation, MSEW solutions and other engineering products, has changed its name and is now trading as Maccaferri Africa (since January 2014).

After 56 years of providing quality engineering services, products and solutions for their clients, Maccaferri Africa positions itself to serve the increasing demand for its products and services on the African continent.

The African market has observed remarkable growth, thanks not only to internal development, but also to external finance from international organisations such as the World Bank, the African Development Bank and other donor funds. The development of the continent, fostered by a more stable political situation, resulted in South Africa's inclusion in the Brazil, Russia, India, China and South Africa (BRICS) summit in 2010.

The name change to Maccaferri Africa is a definite sign of the continuous expansion of the company and its will to invest, penetrate and stabilise its presence in the African markets.

The new structure of Maccaferri in Africa looks as follows:

- Maccaferri Africa, with its head office in Durban, South Africa, will manage more than 30 countries – from the northeast down to southern Africa and areas in West Africa, from Egypt to Mozambique on the east coast, and the Democratic Republic of the Congo and Namibia on the west side, plus the English and Portuguese speaking states in West Africa. The continent's manufacturing facilities are in Tongaat, Durban, South Africa.
- The Indian Ocean islands fall within Maccaferri Africa's areas of responsibility.
- Maccaferri Maghreb, managed by Maccaferri France, will cover the Maghreb region and the French speaking countries.
- Maccaferri Nigeria Ltd will manage Nigeria with their technical and sales office in Port Harcourt.
- Maccaferri Italy will maintain its presence in Libya whilst the political situation is neutralising.

Maccaferri Africa represents the response of the company to the transformation and growth of the African market, thereby consolidating its presence under a focused entity: Maccaferri Africa.

▶ INFO

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Engineering 25 years of innovation

A SOLID FOUNDATION FROM THE START

Prokon Software Consultants was founded in 1989 by structural engineers Karl Eschberger and Jacques Pienaar. Leading up to this time, they realised that structural analysis and design software had the potential to change the structural engineering sector.

At the time desktop computers were still a novelty and the duo focused their energy on writing programmes for DOS-based personal computers. Their work was extremely well received and before long most of their colleagues started incorporating their software into their daily work routines.

ADVENT OF THE PERSONAL COMPUTER – THE CATALYST FOR GROWTH

In the 1980s, desktop computers were becoming widely used, and soon most engineers were migrating from mainframe computers to PCs. It was a natural progression for Karl and Jacques as well. Their first DOS-based programmes were well received and a few months later they decided to establish their own venture. Thus, Prokon was born.

The company grew in popularity in its native South Africa, but they knew that their software had the potential to be a global success. In 1992 they brought Brian Zeederberg on board to establish a United Kingdom office. This was a defining moment for Prokon and their global reputation started spreading like wildfire shortly thereafter.

The popularity of Windows 95 placed a PC on the desk of virtually every engineer. This provided Prokon with a new market opportunity, which they pursued, and they soon expanded their solutions to fit.

In 2003 a Canadian office was opened and the company now had a platform from which they could further expand their activities around the globe.

Today Prokon software is used and trusted by structural engineers in roughly 80 countries. Prokon software is not only developed for engineers, but is developed by engineers. Prokon employs a dedicated staff complement of structural engineers and other competent staff, and is supported by a well-trained sales force and a skilled technical team.

SIMPLICITY, FORM, FUNCTION – A WINNING RECIPE

Prokon software can be used in the design of simple, single-beam structures, and yet it is powerful enough to complete full structural analyses and designs of substantial high-rise projects with ease. Advanced analyses, such as second-order, non-linear and dynamic analyses can be performed.

FLEXIBLE LICENSING FEES

In monetary terms, Prokon provides the most reliable and cost-effective software applications for structural engineering consultants, contractors, students, academics, and even large engineering firms with thousands of staff.

The Prokon suite's scalable pricing model makes it a viable solution for any size project. Whether the budget and requirements call for one or fifty programmes, Prokon can deliver a reliable cost-effective solution.

In addition, Prokon also offers an annual rental licence option that allows one to access software without the need for an up front capital investment of purchasing software licences outright.

AUTODESK® ACCREDITATION

The South African branch of Prokon Software Consultants became an Autodesk® Gold Partner for the southern Africa region in 2001. This status has since expanded to Autodesk® Authorised Training Centre (Southern Africa), and Autodesk® Authorised Developer (worldwide). Today Prokon Software Consultants is one of the largest Autodesk® resellers in South Africa.

INDUSTRY RECOGNITION

There is no doubt that since its inception in 1989, Prokon has had a major influence in the South African structural engineering sector. This contribution was recognised in 2009 when Karl Eschberger was selected as a finalist for the National Science and Technology Forum Awards, which honour outstanding contributions to science, engineering, technology and innovation (SETI), with annual awards in a number of categories.

INTO THE FUTURE

As a market leader, Prokon recognises the importance of innovation in an ever changing environment. The newly released Sumo Structural Modeller, a 3D finite element analysis application, builds on previous analysis modules. It integrates with and extends Autodesk's world-leading AutoCAD® Revit® Structure and AutoCAD®. It simultaneously addresses the growing need for Building Information Modelling (BIM). The exceptional level of integration between Prokon modules continues to improve, and extends automatically to Autodesk® products. Celebrating a quarter of a century as a leader in providing structural engineering software solutions, Prokon is set for even greater heights in the future.

CONTACT DETAILS

Please see advertisement on the next page. ◻

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Sika solves bridge-widening problem

SIKA'S CARBON FIBRE PLATES became a feasible option when the R43 route between Worcester and Wolseley, in the Western Cape, was recently upgraded and widened. The contract necessitated the widening of the existing bridges, which includes the Jan du Toit River Bridge. The bridge consists of three 9.8 m spans and required widening of about three metres on either side of the deck.

Since the carrying capacity of the original bridge does not comply with the requirements of the TMH7 Bridge Loading Code, structural strengthening of the original deck was required. Design engineers from Aurecon originally specified steel plates, 150 mm wide and 5 mm thick, with a bolt and epoxy fastening method, as additional reinforcement to the existing deck soffit. However, it was soon realised that, since the bridge is spanning water, the heavy steel plating system becomes cumbersome and difficult to handle and install, and it would require rust-removing maintenance and monitoring of the system in the long term. A further problem was that the steel would be prone to possible theft for sale as scrap metal.

With these factors in mind, specialised civil contracting company, DSC-Zendon, suggested the use of carbon fibre plates instead of steel. In liaison with the client (Western Cape Provincial Government) and the designers, the contractor then decided to use internationally


Application of SikaDur


Preparation with CarboDur-Colma cleaner

approved Sika CarboDur S512 plates (50 mm x 1.2 mm thick) for the bridge strengthening.

These pultruded carbon fibre reinforced polymer (CFRP) laminates are designed for structural strengthening of concrete, timber and masonry, and are bonded to the structure using Sikadur-30, a thixotropic, structural, two-part adhesive based on a combination of epoxy resins and special filler.

Sika CarboDur plates are exceptionally strong, and provide excellent durability and fatigue resistance. Importantly, for this project, these non-corrosive plates are easy to install, especially overhead. Supplied in rolls, they are lightweight and easy to transport, while their unlimited lengths eliminate the need for joints. This versatile product is suitable for use in a wide variety of strengthening and reinforcing applications.

High-strength Sikadur-30 (46 kits used), is easy to mix and apply, hardens without shrinkage and provides high initial and ultimate mechanical resistance. Due to the ease of installing 513 metres of the Sika CarboDur system, DSC-Zendon was able to complete the project in just one month. This drastic reduction of the installation period enabled substantial time saving, which contributed to the project costing the same as a steel-plating installation.


Placement of CarboDur plate

With Sika CarboDurplates being used worldwide to rectify earthquake-damaged structures, the R43 Bridge is guaranteed to stand the test of time.

▶ INFO

www.sika.co.za

IN BRIEF

ATLAS COPCO TO LAUNCH MOBILE EQUIPMENT FOR 'OPENING HOLES' IN MINES

Atlas Copco is to launch a new mobile rig for boring so-called opening holes in mines. The new rig, called Easer, can perform both box hole boring and down-reaming with a hole diameter of 750 mm, as well as conventional raiseboring with a hole diameter of up to 1 200 mm.

Since its introduction in the mid-1960s, the raiseboring technique has been considered the safest and most productive way of excavating raises in most mining applications. In block caving, and in most types of sublevel mining, a vast amount of short raises act as openings for the rock to expand into when blasting.

Traditional raiseboring machines typically require a concrete platform and tie-down bolts to keep the machine stable during operation. In the total turnover time for such short raises the actual boring time is often below 50%.

The increased demand for a highly mobile and versatile rig specifically designed to create these opening holes safely and efficiently, has led to the development of the Easer. The rig can produce opening holes with a maximum diameter of 750 mm and a hole depth of up to 60 m. It uses standard 200 mm (8 in) boring rods with a 228 mm (39 in) pilot drill bit.

All the necessary operating equipment is part of the carrier, with the exception of the rods, and the setup procedure does not require any site preparation.

"Our mission in developing the Easer has been to speed up the operation," says Johnny Lyly, Product Manager at Atlas Copco.

The Atlas Copco Easer, which will be launched during 2014

"The timeframe for drilling a 40 metre opening hole, from setup to take down, is less than 30 hours, and set up/take down is done in less than one hour."

The Easer offers the same drilling modes as traditional raiseboring rigs: box hole boring, down-reaming and conventional raiseboring. To switch from box hole boring to down-reaming, the gearbox is rotated 180 degrees – a simple operation that can be carried out in an underground workshop. In raiseboring mode, the Easer can drill up to 1 200 mm.

The name Easer is derived from the expression "ease off", meaning to take off or release pressure, which is used in reference to the blast hole into which rock expands during blasting.

The Easer is scheduled for launch during 2014.

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DPI TRADING 'MUSSELS' IN ON SUSTAINABLE AQUA FARMING

An environmentally-friendly floating raft mussel culture farm has been expanded in Saldanha Bay using high-density polyethylene (HDPE) pipes supplied by leading fluid conveyance products and solutions expert DPI Trading.

The Cape Agency for Sustainable Integrated Development in Rural Areas (CASIDRA), which is a project implementation agent for the Department of Agriculture, contracted DPI Trading to supply R1.2 million's worth of 800 mm HDPE pipes to the black empowered Imbaza mussel farm project.

The pipes are being used to form the base for flotation rafts that are used to cultivate the mussels. CASIDRA project coordinator Clovis Bhiya reveals that the HDPE material serves as a far more robust alternative to industry standard wooden beams.

"Wood is prone to rotting during prolonged exposure to saltwater conditions, and is also easily damaged during strong winds and heavy storms. HDPE pipe is highly durable, and able to withstand these elements without experiencing any damage, and its UV-resistant properties ensure that prolonged exposure to the sun will not result in brittleness and cracking," he explains.

Bhiya adds that mussel culture on floating rafts provides the advantage of growing a large amount of mussels in a small area, thereby reducing competition with other users of coastal resources, while ensuring that the mussels are protected from seagulls by using nets. "The HDPE rafts also create favourable hydrodynamics for mussel feeding."

According to Bhiya, mussel raft culture is environmentally sustainable, as the mussels feed on natural phytoplankton in

Floating raft under construction – here the timber has been secured to the HDPE pipes by means of nylon straps and threaded bolts

Completed floating raft for mussel culture farm

monitored and approved shellfish growing areas. "The rafts and mussel cultures act as artificial reefs that attract dozens of species of invertebrates, fish and birds."

DPI Trading Western Cape external sales representative Charlene Curlewis points out that a total of 384 m of pipe, produced by leading southern African extruded pipe manufacturer Sangio, was supplied to the Imbaza project in 12 m lengths to form the base of four new rafts. Sangio recently invested in the large-bore extruder used to manufacture the pipes for this project, and is now capable of manufacturing HDPE pipe in diameters ranging from 16 mm to 1 000 mm.

DPI Trading's scope of the project was successfully completed within four weeks in September 2013, according to specified budgets and deadlines.

With the implementation of the four new HDPE rafts, the Imbaza mussel farm project aims to increase its annual mussel production from 600 tons to 1 200 tons in the short term. "In addition to improved food security and sustainable job creation, the Imbaza project will also benefit the broader mussel industry by incorporating farm and factory workers into two workers' trusts, thereby ensuring benefit from the project's broad-based empowerment objectives," Bhiya concludes.

▶ INFO

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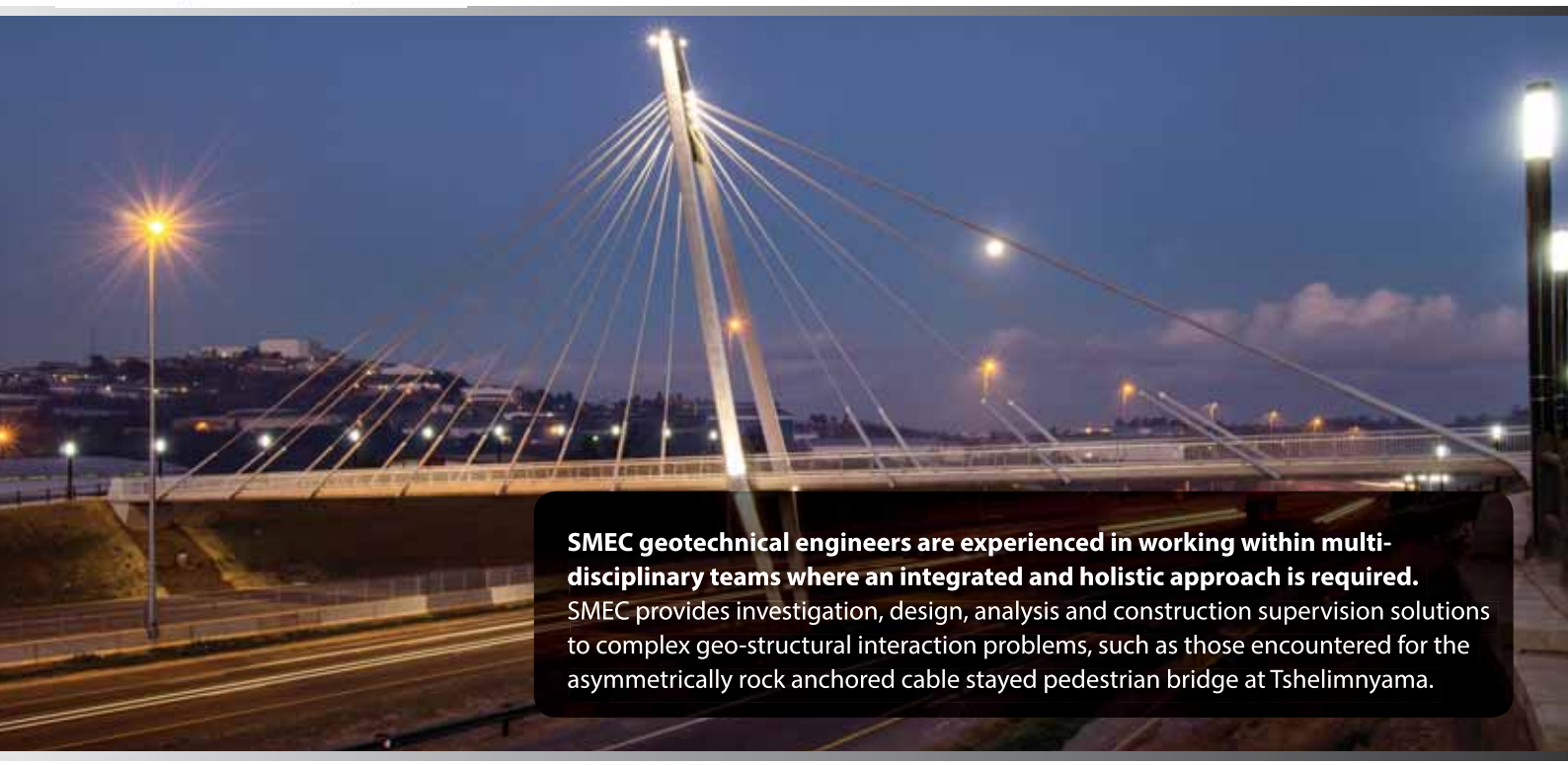

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FIBERITE LAUNCHES AFRICA'S FIRST COMPOSITE MANHOLE COVERS

Fiberite Products ('Fiberite'), a Pretoria-based manufacturing company, is starting to make inroads into the local utilities, civil engineering and telecommunications sector with its new innovative composite manhole covers and frames. "Fiberite became the first company in Africa to design and manufacture composite manhole covers and frames for these sectors," says founder and CEO Corné Visser. Visser feels that cast iron, steel and polymer concrete manhole covers are no longer fit-for-purpose.

Metal products used in infrastructure applications are disappearing all over the world, in what is becoming a metal theft epidemic. Cast iron and steel manhole covers are easy pickings for thieves, who then sell them as scrap metal. The weight of cast iron and steel manhole covers, once thought to be a theft deterrent, has now become one of the principle attracting factors. Visser says that steel manhole covers get stolen all the time, sometimes even on the very same day that they had been replaced.

Fiberite composite manhole cover

The theft of manhole covers causes huge problems for municipalities – it interferes with service delivery; open manholes are a public danger; exposed infrastructure is vulnerable to damage; and it is costly to replace.

The composite manhole covers, on the other hand, have no scrap or resale value, making them unattractive to thieves.

Fiberite composite manhole covers are certified by the South African Bureau of Standards (SABS) under the international standard EN 124/SANS50124 – the first South African owned company to do so.

The composite manhole covers are manufactured locally using a technologically advanced composite manufacturing process to create a highly engineered, incredibly strong composite product. The composite covers are available in a range of sizes and load ratings.

Key benefits offered by Fiberite composite manhole covers over their steel and concrete counterparts include higher quality, improved safety, greater longevity, lower life cycle costs (LCC) and a greatly reduced risk of theft. Due to the light weight of the composite covers there is no need for cranes and other heavy-lifting equipment.

Unlike cast iron and steel manhole covers, the composite covers are non-corrosive and non-conductive. The composite covers have a unique skid resistant surface and will not spinout, making it safe for road use purposes – indeed a 'fit and forget' product for civil engineering applications.

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WORLD-CLASS WATERPROOFING SOLUTIONS FROM MAPEI

With its comprehensive range of waterproofing products, Mapei South Africa has well-proven solutions for all waterproofing challenges. For the past five years, the company's technical service team has been introducing the local construction industry and DIY home owner to the benefits of their advanced building technology additives, sealants, adhesives and concrete performance chemicals. Offering market-leading performance and handling advantages, Mapei's 1 400 products are recognised throughout Europe, America and the Far East.

For waterproofing a typical flat roof, balcony or terrace, curved roof, guttering and downpipes, Mapei offers conveni-

Aquaflex Roof HR is a ready-to-use waterproofing product with high solar reflectance

Quick and simple application of Mapeband SA – particularly useful in those awkward-to-seal areas

ence in a 20 kg drum in the form of Aquaflex Roof, a ready-to-use flexible liquid membrane containing fibres, for continuous waterproofing layers on exposed external surfaces. The versatile, easy-to-use product may be applied to concrete, ceramic and stone coatings, cementitious screeds, asbestos cement, bitumen sheaths, wood, and even galvanised sheet, copper, aluminium and iron after applying Mapei Eco Prim T primer.

Once dry, Aquaflex Roof is tough enough to withstand occasional light foot traffic, and flexible enough to cope with normal temperature variation expansion and contraction stresses. The product is resistant to all atmospheric conditions and UV radiation, and provides long-lasting protection for the substrate.

Where there is a focus on the sustainable thermal efficiency of a building, the solution is Aquaflex Roof HR, a ready-to-use, fibre-filled liquid membrane with a high solar reflectance index (SRI) of 105. The white-coloured product lowers the surface temperature of the roof by more than 50% compared with a dark-coloured covering.

For any successful waterproofing job, 90% of the attention needs to be paid to 10% of the area – the corners, the joints, the cracks and the fillets between horizontal and vertical surfaces. Mapei's research and development into elastic waterproofing systems has produced Mapeband SA, a user-friendly, long-lasting

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AES Consulting was founded in 2009 as a close-corporation. Our mission is to be a consulting engineering firm small enough to afford personal involvement from directors and associates, not only on all our projects, but also to maintain direct personal contact with clients.

AES firmly believes that this will enable the firm to deliver a dynamic service to clients, with the added assurance that our interests are well looked after by the stakeholders of the company.

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solution for these awkward-to-seal areas. Mapeband SA is a self-adhesive butyl rubber tape with alkali-resistant non-woven fabric bonded on the outer surface to provide excellent adhesion for the waterproofing membrane that will be applied over it.

Mapeband SA has excellent adhesion to virtually any type of absorbent and non-absorbent substrate and gives immediate protection against heavy rain. Typical applications include waterproofing corners and fillets between walls and floors on terraces, balconies and in bathrooms and showers; sealing the joins between different types of material such as bitumen membranes, metal, ceramic and cementitious screeds; and those hard-to-reach fillets between windows and door fittings, ledges and substrates. The ideal solution for flexibly sealing and waterproofing expansion joints and any cracks that are subject to movement is Mapeband TPE.

"Mapei's excellent research and development produce user- and eco-friendly products that enable us to offer our South African customers world-class solutions for any waterproofing needs," says Paul Nieuwoudt, Mapei South Africa's Product Manager for Building Systems. "We can provide an optimum solution for a wide range of structural and environmental conditions, resulting in a long service life."

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THE ROLE OF SYNTHETIC FIBRES IN CONCRETE

Bryan Perrie
MD of The Concrete Institute

"Deficiency in tension in both plastic and hardened concrete made with Portland cement can be overcome by the use of conventional rod reinforcement and the inclusion of a sufficient volume of certain fibres. While synthetic fibres can be used to improve the strength of hardened concrete, it is primarily used for crack control in plastic and semi-hardened concrete," explains Bryan Perrie, Managing Director of The Concrete Institute. He continues:

"Various types of synthetic fibres are being used to improve the performance of concrete. This brief article summarises the use of synthetic fibres in the concrete mix.

"Synthetic fibres are man-made fibres resulting from research and development in the petrochemical and textile industries. There are two different physical fibre forms – monofilament fibres, and fibres produced from fibrillated tape.

Concrete, whether used on the ground or raised by charging hopper for loftier applications, can be improved by the use of fibres, says The Concrete Institute

"Currently there are two different synthetic fibre volumes used, namely low-volume percentage (0.1% to 0.3% by volume) and high-volume percentage (0.4% to 0.8% by volume). Most synthetic fibre applications are at the 0.1% level at which the strength of hardened concrete is unaffected and their use is restricted to crack control.

"Synthetic fibre types that have been tried in cement concrete matrices include acrylic, aramid, carbon, nylon, polyester, polyethylene and polypropylene.

Acrylic: Acrylic fibres have been used to replace asbestos fibre in many fibre-reinforced concrete products. In this process, fibres are initially dispersed in a diluted water and cement mixture.

Aramid: Aramid fibres are 2.5 times as strong as glass fibres and five times as strong as steel fibres, per unit mass. Due to the relatively high cost of these fibres, aramid-fibre-reinforced concrete has been primarily used as an asbestos cement replacement in certain high-strength applications.

Carbon: Carbon fibre is very strong and substantially more expensive than others, and therefore its commercial use has been limited.

Nylon: Currently only two types of nylon fibre are marketed for concrete. Nylon is heat stable, hydrophilic, relatively inert and resistant to a wide variety of materials. It is particularly effective in imparting impact resistance and flexural toughness, and sustaining and increasing the load-carrying capacity of concrete following first crack.

Polyester: Polyester fibres are available in monofilament form and belong to the thermoplastic polyester group. They are temperature-sensitive, and above normal service temperatures their properties may be altered.

Polyethylene: Concrete reinforced with polyethylene fibres at contents between 2% and 4% by volume exhibits a linear flexural load deflection behaviour up to first crack, followed by an apparent transfer of load to the fibres permitting an increase in load until the fibres break.

Polypropylene: Polypropylene fibres are hydrophobic and therefore have the disadvantages of poor bond characteristics with cement matrix, a low melting point, high combustibility and a relatively low modulus of elasticity. Polypropylene fibres are tough, but have low tensile strength and modulus of elasticity; they have a plastic stress-strain characteristic.

Fabric and composite fibre reinforcement: South African manufacturers have been extremely innovative in developing versions of fibre for use with concrete. To overcome the bond and elastic modulus problem of polypropylene fibres, one development has been that of a composite of a core fibre (which can be polypropylene or a stiffer material such as acrylic, Kevlar, glass or carbon fibres) around which is spun a fluffy coating of polypropylene or cellulose. The coating can be bonded to the core at intervals to enhance the composite behaviour. These composite strands can be woven into a textile, or cut into appropriate lengths for a range of applications."

▶ INFO

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(to download leaflet *Fibre-reinforced Concrete*)

POLYUREA COMES TO THE FORE IN SA CONSTRUCTION INDUSTRY

Reflecting an international trend, polyurea is coming to the fore in South Africa as an innovative solution for repairing concrete buildings and structures.

"Polyurea has an extremely long service life, with high puncture and impact resistance and a completely seamless waterproofing barrier," Hein Pretorius, contracts manager at Murray & Roberts Concrete Repair, says. "Originally designed as a waterproofing product, it can also withstand harsh industrial chemicals, including acids, is fully UV-resistant and is available in a large range of different colours, opening up a spectrum of potential applications.

"Although its use is relatively new to South Africa, it has been tried and tested in the USA for more than a decade. Its heat- and impact-resistant properties add up to a long lifespan and, depending on the application, the product can be guaranteed for up to 15 years.

"Polyurea can be applied to any type of substrate and it is also extremely flexible – up to 400 times its nominal thickness. This characteristic lends itself to the sealing of construction joints as an alternative to the traditionally used hypalon bandages."

Polyurea can be applied over torched-on waterproofing products, eliminating the costly exercise of removing a previous product before the treatment can be applied. As an industrial coating, it demonstrates excellent chemical resistance to hydrocarbons and hydrogen sulphide gas, and has properties that enable its use in submerged sewage applications. It is also ideal for sealing potable water retaining structures, as steel corrosion protection and for the internal lining of steel chutes.

"Since polyurea is a spray-on application, it is possible to cover up to 800 square metres of surface area in one day," Pretorius says. "Only two people are needed to operate the application equipment, so it is also not a labour-intensive process, and the area becomes fully trafficable only two minutes after application."

The Murray & Roberts Concrete Repair team used polyurea for repair work on the ABSA Towers in central Pretoria, where the scope of work called for the application of 32 000 square metres of 1.5 mm thick polyurea to the external façade of the 34-storey building. Existing mosaic tiles had begun peeling and would have impacted the aesthetics of the building, and possibly the safety of pedestrians in the area. Applying the polyurea to the outside face of the existing cladding effectively restrained the mosaics and allowed the building renovators to install a new façade, secure in the knowledge that the substrate will not peel or come away.

"This is an historic building and it was important that the repair work did not damage the building façade in any way," Pretorius explains. "Using polyurea technology, we were able to give the client a guarantee in this regard. It was also a highly cost-effective option, because the mosaic tiling did not have to be removed to allow for repairs."

Polyurea was also used at Standard Bank's Johannesburg headquarters to restrain marble tiles applied to marble-clad arches. The marble slabs were pulling away from the cladding

structure and needed to be reattached, as this also posed a safety hazard to pedestrians. In this instance, the cladding comprised large marble slabs 50 mm thick, measuring 1.6 metres by 0.9 metres. By the end of the project, a total area of 1 800 square metres had been restrained.

"What made this project unique was that the polyurea was applied to the internal face, between the tile back and the structure itself," Pretorius adds. "This in itself presented challenges, as access to the back of the façades was limited. Where access was severely restricted, we re-engineered the stringer attachment system to ensure the structural integrity of the façade."

At Middelburg Ferrochrome, Murray & Roberts Concrete Repair used polyurea as waterproofing, applying it to numerous concrete roof slabs to make them watertight. Its benefit in this type of application is that the waterproofing can be guaranteed for ten years with no maintenance agreement – essentially supplying the customer with a labour-free solution for the next ten years.

External view of marble arches at Standard Bank's Johannesburg headquarters, sprayed with polyurea on the inside

▶ INFO

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View of ABSA Towers during the application of polyuria, and drilling and dowelling to anchor new façades to this historic building

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Bentley Sustaining Infrastructure

MINISTERS COMMISSION TWO MAJOR INVESTOR PROJECTS AT COEGA

On 10 March two Coega investor projects, with a combined investment value of R700 million, were commissioned by the Minister of Trade and Industry, Dr Rob Davies, and the Minister of Energy, Dikobe Ben Martins.

The Agni Steels and DCD Wind Towers commissioning comes ahead of the start of major production at both facilities and the promulgation of new legislation on Special Economic Zones (SEZ).

"Amendments to the SEZ Bill were passed through the National Council of Provinces last week and the bill is currently awaiting President Jacob Zuma's signature," Davies said.

During their visit to the Coega Industrial Development Zone (IDZ), both ministers welcomed the advances in the energy and metals sectors.

Minister Davies said he was pleased to note the significant progress at the Coega IDZ. "Attracting companies like Agni Steels and DCD Wind Towers that will generate inputs into renewable energy and local metals beneficiation is a welcome development in terms of this particular IDZ. We look forward to these projects achieving success, as well as those coming on stream in the near future."

He explained that the combined Port of Ngqura and Coega IDZ public investment amounted to R6.19 billion, and that Coega had realised a return on investment of R2.2 billion. He said he was confident that the investment would be recovered, as Coega has already signed on 23 investors with an investment value of R11.3 billion.

Energy Minister Martins lauded the work of the Eastern Cape in helping to build the nationwide energy imperatives. "The Coega IDZ has built the requisite momentum to sustain the projects initiated – projects which span the value chain and constitute a generation project in the realisation of the National Integrated Resource Plan." Martins highlighted the Dedisa Peaking Power Plant, DCD Wind Towers and the new Coega investor, Powerway, who are photo-voltaic manufacturers.

DCD Wind Towers has now started with their initial process qualifications at their 23 000 m² wind tower manufacturing facility in Zone 3 of the Coega IDZ. The facility is expected to create close to 200 jobs, and produce between 110 and 120 wind towers per year. DCD created over 250 jobs during the construction phase, with more than 90% of the workers coming from the Nelson Mandela Bay region.

DCD Marketing Manager for Energy, Henk Schoeman, said that 65% of wind turbine parts could either be manufactured or assembled in South Africa, and that the DCD Group had initially invested R85 million in exploring the renewable energy market feasibility – an investment which resulted in the R300 million Coega plant.

"The tower is the first part of this business. We have shown we can do this, now we are looking forward to growing business within a winning environment in South Africa," said Schoeman, confirming that DCD has already signed contracts with Vestas and Nordex for Round 2 of the Renewable Energy Independent Power Producer Procurement Programme (REIPPP), and also has contracts lined up for Round 3.

Agni Steels SA will start operating this month and has invested R400 million in this first-of-its-kind steel mill in the

Agni Steels' Hassan Khan (left), Minister of Trade and Industry Dr Rob Davies and Minister of Energy Dikobe Ben Martins push the button to unveil a plaque commemorating the commissioning of the facility in the Coega IDZ

Winds of change: DCD Wind Towers is almost ready to start producing wind tower parts in Zone 3 of the Coega IDZ

Fired up: Agni Steels, in the Coega IDZ, will shortly start production of steel billets

Engineering & The Built Environment

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Eastern Cape. The company has completed pilots and test runs with success, ahead of plans to fire up the furnaces on a permanent basis. Once on, the plant will run 24 hours a day, seven days a week in three shifts, and will employ 300 people.

The project will benefit from the Minerals Beneficiation Bill of 2011, which incentivises local beneficiation of scrap metal in particular. Davies said there is a shortage of specialised steel products that were formerly produced in South Africa, but are now imported, and that Agni Steels would contribute to reversing this trend.

The high-tech smelting facility will produce mild steel billets from scrap metal. During the first phase of the project the plant will produce steel billets for export to India and other African countries, thereby enhancing local beneficiation.

Second and third phases are also planned, with the second phase set to double production, according to Dhiroshan Moodley, co-owner of the local operation. “We will create 300 jobs in the first phase and this will build up to 800 in the third phase, when we will incorporate a fully automated rolling mill to further beneficiate the mild steel billets by producing various steel end products.”

Ayanda Vilakazi, Head of Marketing and Communication for the Coega Development Corporation, said the fact that two ministers took time out of their schedules to mark the commissioning of two catalytic projects indicates the national commitment to the Coega IDZ and its role as a driver of economic growth in the province.

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VACUUM CLEANING AT TUTUKA POWER STATION

Rope access specialist company, Skyriders, is in the process of completing industrial vacuum cleaning at the Tutuka power station in Mpumalanga on hard-to-reach structures that are inaccessible to standard methods such as scaffolding.

As fly ash debris can have negative effects on the environment and on the efficiency of a power station, Eskom appointed Skyriders in November 2013 to undertake the challenging process of removing this debris along all the inaccessible structures of the power station, including the boiler house, turbine hall, ash handling plant, structural beams, side walls and cable trays.

Fly ash is a residue produced from the combustion of coal, and is damaging to power station infrastructure, as it causes blockages. Skyriders marketing manager Mike Zinn says that a large team of rope-access specialists is currently on site at Tutuka in order to remove this harmful debris.

"The 3 654 MW Tutuka facility is an important link in the 765 kV extra-high-voltage transmission system linking Mpumalanga with the Western Cape and KwaZulu-Natal, and the risk of any unforeseen downtime is immense. The sheer volumes of fly ash is a major challenge, but Skyriders has in-depth experience on similar Eskom projects, and our rope-access technicians are proficient in utilising industrial-grade vacuum cleaners at height to remove the debris," he explains.

Although scaffolding has proved to be the tried-and-trusted method for access to work-at-height applications, Zinn says that rope is a far more efficient means of gaining access to high-elevation structures, particularly in the power generation sector. "Rope access is considerably faster and cheaper, while technicians are provided with more flexibility and safety."

Zinn notes that the project has been successful to date, and should be completed by June this year.

“With a zero-fatality record spanning more than 16 years, Skyriders has developed a reputation of being the leading provider of rope-access-aided inspection, non-destructive testing and maintenance-related services to the South African power generation industry,” he concludes.

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▶ INFO

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Working at height, vacuuming hard-to-reach structures at the Tutuka power station

OSH SPECIALISTS UNDER ONE ROOF AT OSH EXPO AFRICA

With many building and construction projects being of a fast-track nature, the emphasis on personnel safety is escalating. Occupational health and safety/risk managers are often inundated with responding to and reporting on incidents.

Commonly reported OHS incidents on site include trips, slips and falls. These accidents can occur in a number of scenarios, including working at height, operating or being in the vicinity of earth moving equipment, or when lifting or erecting building materials, structures or equipment. Adherence to stringent Department of Labour (DoL) regulations can only be achieved by buy-in from construction and building company management and their employees.

In all instances, the use of appropriate safety equipment, coupled with the incorporation of an inclusive risk assessment and management plan, is essential. In order to provide OHS/risk managers with access to a comprehensive range of health and safety equipment in one common venue, UBM Montgomery will be hosting the fourth OSH EXPO Africa exhibition at the Gallagher Convention Centre in Midrand, Johannesburg, from **13 to 15 May**.

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SAICE FELLOW APPOINTED AS NEW MD OF BOSCH STEMELE

Danai Magugumela, new MD of Bosch Stemele, and Fellow of SAICE

Multi-disciplinary infrastructure engineering company, Bosch Stemele, is delighted to announce the appointment of Danai Magugumela (who is well known in SAICE circles) as its new managing director.

Considering her engineering pedigree and extensive exposure within the industry's top level management spheres, it is no surprise Danai was chosen as successor to outgoing MD and company namesake, Max Stemele.

Danai needs no introduction to the industry, having proved her mettle with an exceptional track record spanning nearly 20 years with both a multi-national engineering company, and before that with highly regarded South African consulting firms. She is a former board member of the South African National Roads Agency, sits on the Council of the University of Pretoria, and is a member of the advisory Council of the Faculty of Engineering, Built Environment and IT at the same institution. She holds an MSc in Civil Engineering from Texas A&M University in the US, is a registered professional engineer, and is also a Fellow of both the South African Academy of Engineering and the South African Institution of Civil Engineering.

Retiring Managing Director, Max Stemele, who has steered the company successfully since 1998, says Danai is the perfect candidate to lead the company to successfully achieving its goals. "I am confident that Danai and her team will continue to build on the legacy of the 'Bosch Way' while progressing Bosch Stemele's empowerment and transformation initiatives." (The company currently holds a Level 2 BBBEE status.) Max will continue as a director until 31 August 2014, and thereafter as a non-executive director of both Bosch Stemele and Bosch Holdings.

Danai intends building on Bosch Stemele's track record as a proudly South African company. "In this era of local firms becoming part of large multinationals, I believe there is a window of opportunity for locally owned firms to take the lead on local projects," she says. "I look forward to growing the presence of the firm in Gauteng and increasing the number of infrastructure projects that we deliver to Gauteng-based clients, such as national government departments, parastatals, merchant banks, and large corporates."

Excited about meeting new people and discovering the 'Bosch Way' in her first weeks, she says,"Bosch Stemele has a high percentage of youthful employees, which is energising, because the organisation will be challenged to be dynamic and competitive."

Asked what advice she has for other female engineers, Danai responded as follows: "Firstly, hard work not only pays off, it achieves results and earns respect. Secondly, I have learnt that no woman should expect to make it without help. So, create a support structure that will allow you to make things work in all aspects of your life. Finally, be an advocate for speaking out rather than simply fitting in. Women leaders should be more assertive about what they require from their workplace. An example would be creating a flexible timetable that suits your work and home life, and sticking to working flexibly whilst being productive. By doing this, women leaders who are influential enough can make huge changes for other women in the working world."

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Alternatively e-mail a detailed CV to gary@edm.co.za

SAICE'S Golden Oldies

It is remarkable how age does not deter civil engineers from remaining active in, or associated with, their profession far beyond 'normal' retirement. On page 19 of this edition we profiled an inspiring geotechnical engineer who will be turning 90 this year, and on these following pages (pp 70–73) we introduce a few more of our 'golden oldies'.

CORALIE SQUIRES – A CIVIL ENGINEER WHO ALMOST WASN'T

In Salisbury (now Harare), just before she headed to the University of Cape Town (UCT) where she had been accepted to do a BSc in 1951, Irene Coralie Squires was introduced to a lady structural engineer who had qualified overseas. This encounter settled in her that civil engineering was really what she wanted to do.

On arrival at the university she had to go and see the dean of the engineering faculty and ask permission to change to engineering. After a faculty discussion, and the dean (Dean Menzies) learning that he knew her father, this was granted. However, they warned her, if they found this unsuitable for her, she would be asked to revert back to a BSc.

Her father, upon discovering that he, too, knew the dean, wrote to ask him to dissuade her from engineering. By the time her father's letter reached the dean, he had already given her permission and had to stand by that decision. Sadly, Coralie's father passed away before she had qualified.

Possibly one of the first female civil engineers to qualify at UCT (under her maiden name Hopley), she was the only girl in the class, except for mathematics, where there was a fellow girl – bliss!

UCT was also where she met her husband, Hilary, and besides her other duties, has been by his side for 57 years during his time as advocate, politician, member of parliament, minister in the government, and judge.

In a recent interview, this busy grandmother, wife, gardener, sewer and problem solver, shared with us some of her story.

If you hadn't become a civil engineer, what might you have become?
I probably would have ended up teaching.

I wanted to be a land surveyor like my father, but he said this would be unfair, as I would have to be given the town work, because, as a female, it would not be feasible for me to go out into the bush camping for months on end. This would mean that the men would have to do a disproportionate amount of bush work while I performed the town work!

My parents always told my three sisters and me that we were at liberty to choose what career we liked (provided it was not land surveying), but that if we chose to be a street sweeper we should strive to be the best street sweeper, so that when the next slump came we would be retained as we had shown we could work hard and perform well.

Please tell us about some of the work you've done.
In 1955 I began my career with FE Kanthack and Partners who were consulting engineers with a branch office in Salisbury. David Piesold, who was the partner there, was someone who influenced my work ethic greatly.

His insistence on checking work, on putting dates on documents and letters, and recording instructions have stayed with me all this time and have stood me in great stead on several occasions. His work ethic had a positive effect on his whole office. I will never forget an occasion when I asked if I might have

a Friday afternoon off as I had been offered a lift to Bulawayo where my fiancé was to be for the weekend (those were the days when we worked on Saturdays). Permission granted I had a good weekend and on Monday asked him how he would like me to make up the time I had been given off. He looked puzzled and said, "Oh, I am sure you will just make it up very easily." Well, I have been making it up ever since and know that the other staff members also made up far more time than they ever took off. New staff from overseas sometimes had a little difficulty understanding the give and take, but most saw how well the environment of trust worked and joined a band of very happy employees.

After getting married in 1956, we moved to Bulawayo where I was employed by the Bulawayo Municipality in their Roads and then Water Departments.

The only 'discrimination' I ever encountered was here where, after I had been working there for a while, salaries were restructured and my income was increased. I was, however, at a loss in finding where I was on the salary scale and I thought they may be overpaying me! I queried this to discover I had been put on a scale applicable to me only. Why? Because it had been decided by the municipal council that women in any profession should be paid less than an equivalent man!

On another occasion I went out to inspect and advise on a farm dam, and it was obvious to me that the client had no faith in what I had to say. So, on my return to the office I suggested that one of the men should take over and go out on the next site visit. He returned to say that he had had exactly the same reception and that he would rather I persevered with the project!

In 1961 our daughter was born and until 1966 I was fully employed by my husband and two children. In 1966 we returned to Salisbury, where I was approached by Watermeyer, Legge, Piesold and Uhlman (formally FE Kanthack and Partners) to again work for their consultancy. Having two small children, it was arranged that I work mornings only, but this soon became flexi-time and I gradually became a full-time employee. Here I was again very lucky, as my mother helped enormously with minding the children.

One of the many interesting projects I was involved with during this period was the design of the Shire River Bridge in Malawi.

When designing a bridge one tries to take into account all types of loading that may be experienced, but when we went to Malawi to attend the official opening of the structure and saw the President and his entourage walking over the bridge followed by all the guests and hoards of bystanders all chanting and doing their tribal dancing in unison, we immediately thought of the resulting resonance and amplitude – a loading which we realised we had not allowed for!

In 1984 we immigrated to South Africa. We came to live in Durban and at that time WLPU had just opened an office in Pietermaritzburg. When they were in need of help I would commute from Durban to assist. Eventually WLPU opened an office in Durban which became my base until my retirement in 1994.

Towards the end of this period I was running the office, and thank goodness for spell checks, as I had to write and vet all the correspondence. I keep telling my grandchildren that it doesn't matter what you do in life you will, at some stage, need to have a good grasp of English!

Coralie Squires (middle) seen here with her family a few years ago

What did you find most difficult or challenging?

The most challenging thing in my life was trying to fit into a day all I needed to do and trying to balance my responsibilities as a mother and wife with my work commitments, and I really do not think it is possible to do full justice to it all at once. I was exceptionally lucky in the flexi-time I had when my children were small, but I soon discovered that people, and especially children, like to tell you their problems or stories *when they come home* and not when you suddenly find you have some time to listen to them – working mothers are not perfect for children!

What has been some of the more important things that you have learnt during your working life?

A skill I quickly put into practice when dealing with bureaucracy and poor service was "to go to the top" and how to do it. This I learned from a business friend who headed up a successful organisation, and how invaluable that advice was and still is. He always maintained that the busier and more important a person is the easier he is to contact and the better his organisation is run.

What are some of your thoughts on the future of civil engineering?

I think the civil engineering profession has changed so much over my lifetime and will no doubt change more in the future.

One problem there seems to be is the remuneration offered engineers. Whereas it is enough to live on comfortably, the young tell me it does not give them the disposable income to enable them to have the luxurious skiing trips, etc, which are enjoyed by other professionals. I am not sure how true this is, but I have known engineers looking for new pastures for the above reason.

I do also think that, with all the computer-generated designs and other such aids, it is most important to have a mentor or supervisor who has hands-on experience to try and pass on that knowledge to newly qualified engineers. I wish Allyson Lawless's appeal to retired engineers to do this very thing will continue to be carried out in all parts of the country.

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LIONEL BEINART – WHO KNEW HOW TO FUND HIS STUDIES!

Lionel Beinart, who is 92 years old and who has been a member of SAICE since May 1950, wanted to become a civil engineer when he was still a pupil at Malmesbury Boys High School.

At the age of 16 he and a school friend attended the 1937 Rosebank Show. He had half a crown (two shillings and six pence, or later in decimal coinage about 25 cents) to spend.

Upon entering the showgrounds, Lionel noticed a competition to win a new Chevrolet four-door sedan (the first time a new car had been offered as the prize). The challenge was to guess the number of grapes that were in a wire mesh enclosure filled with bunches of grapes.

Leaving the friend to go his way, Lionel applied himself to the task of counting the number of bunches and estimating the number of berries on each bunch before entering his estimation of 11 156 grapes.

Each day for the next week he doggedly checked the daily newspaper for the competition results. On that Saturday he bought the weekend *Argus* and saw in the stop press that he was the one who had estimated closest to the correct number of grapes and had been confirmed as the winner. Dressed in his new suit, he accompanied his father to collect the car at a formal ceremony in Cape Town.

Unfortunately he was too young to hold a driver's licence, so when he was asked what he would do with the car, he said he intended selling it and using the proceeds to help fund studies in civil engineering. Many (many) years later when the family were trying to track down newspaper reports of 1937, the curator of the Malmesbury Museum asked what Lionel had actually done with the car, and they were able to say that he had sold the car for £275, which he then put towards his studies in civil engineering at the University of Cape Town, from where he graduated in 1940.

Lionel, who was head of road maintenance (trunk and national) in the Cape Province for many years, still enjoys reading *Civil Engineering* every month, as well as the SAICE newsletter, so we hope the facts are right, otherwise he'll be calling us to take us to task!

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Lionel Beinart (middle row second from left) surrounded by colleagues at the Cape Provincial Roads Department (from a group photograph of 1964)

DR BARNETT BERGMAN – ACKNOWLEDGED IN INTERNATIONAL DIRECTORY

Dr Bergman, who has just turned 90 and who currently resides in Los Angeles, has also, like Lionel Beinart, been a member of SAICE since May 1950.

He started his career in 1946 in South Africa as a municipal engineer designing sewerage systems. In 1951 he moved to America temporarily where he studied soil mechanics at MIT. Upon his return to South Africa he joined Dr JE Hamlin, who at the time was considered the foremost consultant in the sewage treatment field.

In 1953 Dr Bergman became a member of the Institute of Sewage Purification, which was a predecessor of the current Chartered Institution of Water and Environmental Management (CIWEM). Here he served on the committee that drafted design criteria for sewage treatment in South Africa. During his career he designed more than 50 wastewater treatment works in South Africa and other African countries.

After more than 40 years of serving the cause of raising water quality standards, he retired (in 1989) from BS Bergman & Partners, the company that he had established in 1957 and that he had built up to a multidisciplinary firm of 300 professionals.

Although retired, he still remains active in his field of interest, and was honoured for his services in the 2005 International Directory of the CIWEM.

▶ INFO

Compiled from information provided by the SAICE Membership Committee

Dr Barnett Bergman, who has just turned 90

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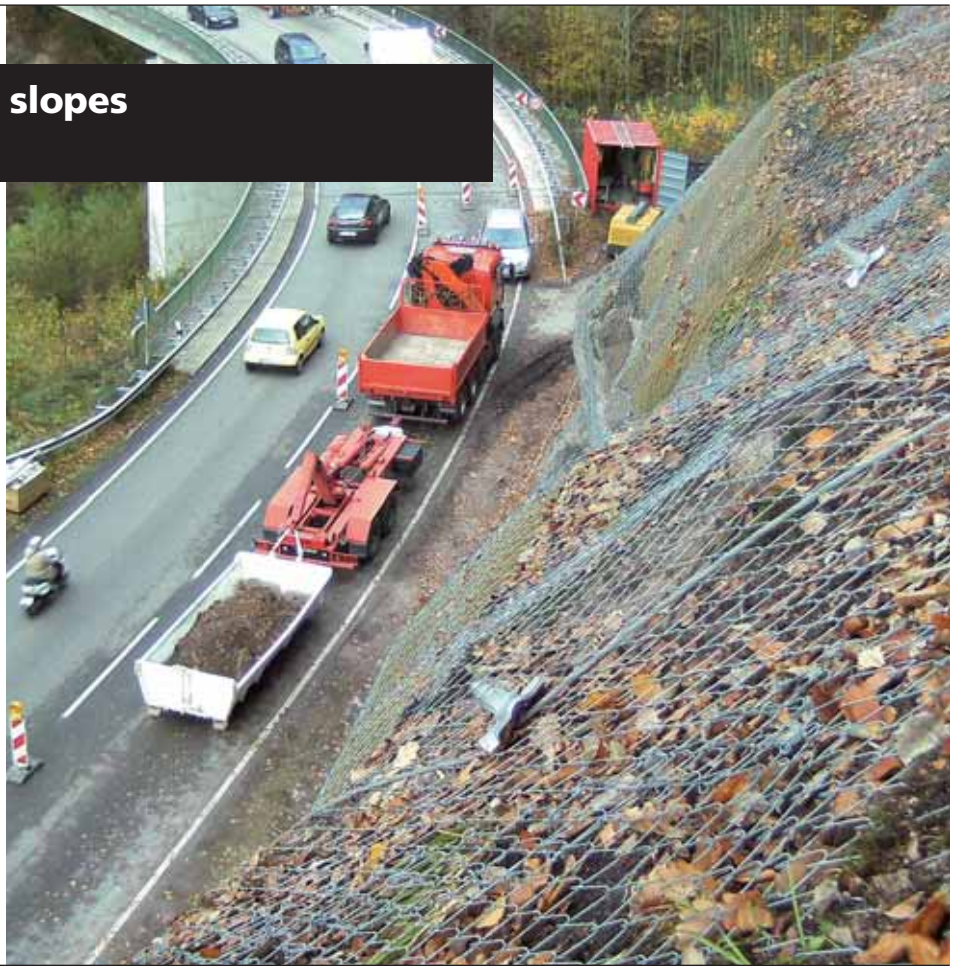

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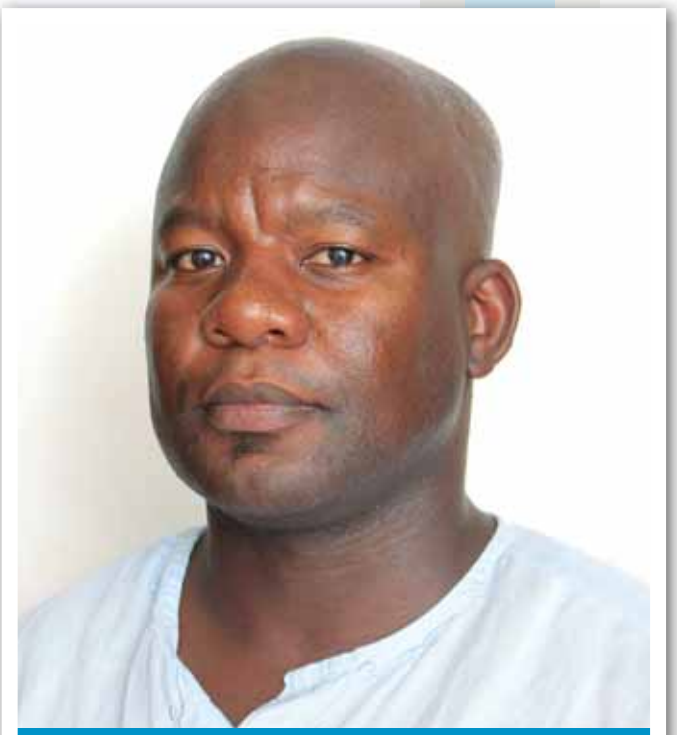
Thank you SAICE! Thank you SPEBS!

For many young SAICE members their first experience of SAICE was when they were awarded a SPEBS bursary. In most cases that bursary made the difference between becoming a qualified person with usable skills, or never achieving that dream. And in many instances that bursary served as a launch pad into a lifetime of learning.



Sizwe Sifo Pr Tech Eng, ex-SPEBS bursar

SPEBS, which stands for 'SAICE Patrons Engineering Bursary Scheme', is a financial assistance scheme administered by the Institution to assist financially needy and academically deserving students who study towards the National Diploma or the Degree in Civil Engineering at a South African tertiary institution. The scheme was started in the early nineties and was, for many years, funded by donations from civil engineering companies and individuals, and SAICE Branches and Divisions (the 'patrons').

Over the years the method of administering the scheme has undergone changes, but to this day SPEBS remains a vehicle that is making a substantial difference in young people's lives. In 2013 alone, for example, SAICE awarded a total of R282 000 in SPEBS bursaries to 35 students who were studying at 14 different tertiary institutions across the country.

The impact that such a bursary has on the lives of financially needy students and their immediate relatives is often so astounding that it moves one to tears. Every now and again an ex-SPEBS bursar comes to the fore, sharing his/her story with us, and it is only then that one realises what sacrifices still had to be made to attain that dream, despite the partial financial assistance provided by the SPEBS bursary.

An ex-SPEBS bursar who recently shared his story with us is **Sizwe Sifo**, who now lives in Port Shepstone with his wife, Putuma, and their two daughters. Here, in his own words, is how SPEBS launched his career.

My story starts in a rural village

I was born and raised in the rural village of Mthatha. When I was young I used to visit my cousins who were staying in town at the time. Their living conditions were far better than what I was accustomed to, because they had running water and flushing toilets. I was intrigued by how tap water gets purified and transported for human use, and I was eager to understand the concept of a waterborne sewerage system. I guess I could not understand why we, as people living in rural areas, could not have the same basic amenities as people living in developed areas. It was at that stage that I decided to make a difference in my village by pur-

suing studies in a field that deals with clean drinking water and acceptable sanitation standards.

After completing Grade 12 in 1996 at Mqikela Senior Secondary School, I registered at the Port Elizabeth Technikon for a Diploma in Civil Engineering. My parents managed to pay tuition and residence fees for the first year, i.e. for S1 and S2. When I was about to start my second year, in 1998, it became clear to me that my parents would not be able to pay all my study fees. As a result I had to look at alternative ways of obtaining the extra money needed for my studies. I managed to get a part-time job as a peer-helper, teaching extra classes to first-year students, but the money I earned was too little to salvage the situation. It was while I was walking through the corridors of the Civil Engineering Department at the Port Elizabeth Technikon that I noticed an advert by SAICE, which was pinned on a notice board, calling for under-privileged learners to apply for a SPEBS study bursary. I applied, and was accepted immediately. The SPEBS bursary helped me to pay my fees from the second year up to when I obtained the National Diploma in Civil Engineering.

I then joined Stewart Scott International (now Royal HaskoningDHV) as a technician, where I enjoyed the exposure to the practical side of civil engineering, and where I was involved in various projects as a project technician. After two years of working as a technician I was still interested in knowing more about water engineering and I felt that the theoretical knowledge I had then was not enough. I then registered for a B Tech Degree in Water Engineering at the Port Elizabeth Technikon (now the Nelson Mandela Metropolitan University), and this study was paid in full by Stewart Scott. In 2004 I completed my B.Tech degree with five distinctions out of eight subjects.

In 2005 I started my own company, offering project management services in water and wastewater engineering to various clients.

Current company involvement

I am a managing member of Tibaa Consulting Engineers and Project Managers, which is a civil and structural engineering consulting firm. The firm has two offices – in Port Shepstone and Mthatha – and has nine staff members. I am also a director of Nassao Lab, which is a civil engineering laboratory.

Studying further

Currently I am doing a BSc (Hon) (Applied Science) (Water Resources) at the University of Pretoria. I expect to complete the course in 2015, and would then like to follow it up with a Masters in Civil Engineering to enhance my knowledge of water engineering in general, and pump stations and reservoir design in particular, as well as structural engineering.

Professional membership and related registration

I am registered with ECSA as a Professional Engineering Technologist, and as a competent engineer with the NHBRC, and I am a member of both SAICE and IPET.

Acknowledgements

First and foremost, I would like to thank SAICE for the study bursary that I received so many years ago, which helped me to complete my National Diploma in Civil Engineering. Had it not been for that SPEBS bursary I doubt very much if I would have been where I am today. I also want to thank Mr Johan de Koker (SPEBS registrar at that time), who fully understood the plight of under-privileged students. As a token of appreciation I want to pledge a yearly contribution to SPEBS towards the education of less privileged students. This will start during the course of 2014.

Lastly, but not least, I want to thank Mr Hennie Erwee, who was my mentor while I was working for Stewart Scott. There were times when I thought that I would not make it in the civil engineering industry, but he kept on encouraging me to never give up. He gave me great exposure, not only to the technical aspects of civil engineering, but also with regard to business development and marketing. I am my own boss today because of his teachings. Ndibambangazozozibinimhlekazi u-Erwee (a handshake with both hands, Mr Erwee). ◻

FOR MORE INFORMATION ABOUT SPEBS

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SAICE National Office
011 805 5947
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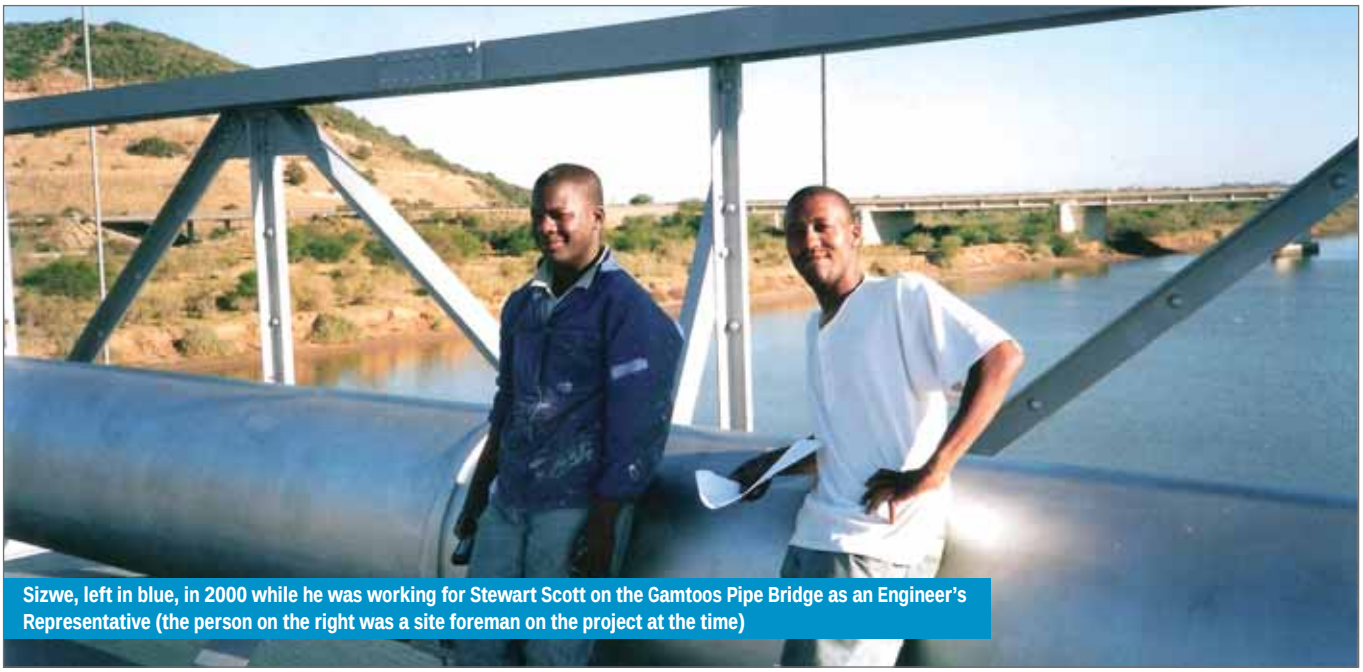

Sizwe, left in blue, in 2000 while he was working for Stewart Scott on the Gamtoos Pipe Bridge as an Engineer's Representative (the person on the right was a site foreman on the project at the time)

YOUNG MEMBERS' PAGES

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DID YOU KNOW?

Langeled Pipeline

Claiming the title of the world's longest underwater gas pipeline, Langeled was developed to pipe Norway's natural gas to a power-hungry British market. It runs for 1 166 km and can pump a maximum of 25.5 billion m^3 of gas a year. The pipeline was opened in two stages, the first in October 2006, and the second a year later in 2007.
http://www.constructionweekonline.com/article-8024-the-10-greatest-engineering-feats-of-the-decade/5/#.UtwuhxD8LIU

Big Brutus

Big Brutus is the second largest electric shovel in the world. In May 1963, Big Brutus came alive. After taking more than 150 railroad cars and over a year to build, Big Brutus was in operation. Engineers designed the 15 000 horsepower shovel to revitalise the strip-mining industry. It is 16 storeys (48 metres) tall and has a boom 46 metres long. At 4 900 000 kg, Big Brutus's bucket can lift up to 150 tons of coal – enough to fill three railroad cars. It ran 24 hours a day at a maximum speed of 0.35 kilometres per hour. It used as much electricity in one day as a town of 15 000 people. In 1974, Big Brutus had to be shut down because its cost of operation was twice that of the value of coal it recovered. Big Brutus was dedicated as "a Museum and Memorial Dedicated to the Rich Coal Mining History in Southeast Kansas" in July 1985, and in September 1987 the American Society of Mechanical Engineers (ASME) designated Big Brutus a Regional Historic Mechanical Engineering Landmark.
http://www.engineergirl.org/what_engineers_do/FunFacts/BigBrutus.aspx

Hangzhou Bay Bridge

Currently the record holder as the world's largest sea bridge, this structure was completed in 2007 and chopped 120 km off the drive between Ningbo and Shanghai. The bridge was engineered to deal with the massive tides, plus the seasonal storms that can rip through the area. The possibility of a ship colliding with the bridge also had to be accounted for in the design. The bridge has six express lanes in two directions and an orthotropic steel deck is used on its main spans and five ramp bridges, and was paved with 50 millimetres of epoxy asphalt concrete.
http://www.constructionweekonline.com/article-8024-the-10-greatest-engineering-feats-of-the-decade/8/#.UtwvuRD8LIU

Bobsleigh Runs

There are less than 20 bobsleigh tracks in the entire world approved by the sport's international governing organisation. The 2002 Olympic track in Park City, Utah, is the southernmost track in the world and is designed for bobsleigh, luge and skeleton (a fast winter sliding sport) events. Engineers faced several challenges during construction of the $25 million venue. To build the smoothly curved walls, engineers used shotcrete, a form of concrete that is sprayed onto a reinforced steel structure containing a refrigeration tube. To create the ice surface, the concrete is cooled to -11º C and water is sprayed on until a 2-inch layer of ice is formed. The $25 million cost includes 297 000 watts of track lighting, 62 hydrants, 24 cameras and eight scoreboards.
http://www.engineergirl.org/what_engineers_do/FunFacts/BobsleighRuns.aspx

ELEGANT SOLUTION

Back in the 60s, a jet manufacturer was trying to build a jet that would go Mach 4 (four times the speed of sound for you non-aeronautical types). Finally after many years of designing, the jet was finished. A test pilot took it out for its maiden flight. Everyone gathered around ... and the plane went to Mach 1 ... Mach 2 ... Mach 3 ... Mach 3.5 ... and the wings ripped off, the plane hit the ground and killed the test pilot.

The engineers went back to the design and spent months revamping it. They came out with a new and improved second version, but when they tested it, it had the same disastrous results – the plane's wings ripped off and the pilot was killed in the crash. The engineers went through seven iterations, until finally they were about to give up.

They decided to contact Bob, a retired engineer with the reputation of being able to fix all problems.

Bob comes in, asks to see all the design figures, charts and drawings, and takes them home to study them. He calls the next day and says he has discovered a solution to the problem – holes must be drilled vertically through the wings at the exact spot where they attach to the body. At first everyone argues that the wings are ripping off, so why drill holes through them? But Bob insists that it will work. So eventually, they give in and do it.

The jet is tested later that day and not only does it reach Mach 4, but it goes to Mach 5.3 before the test is declared over and successful. All the engineers rush to Bob and congratulate him on his uncanny ability to discover the solution.

"How did you know?" asks one of the engineers. "Well, I'll tell you. I was on the toilet, and it occurred to me – toilet paper never tears on the perforations."

Enlighten App– interesting new technology

Avinash Menon
SAICE Young Members Panel
avinash@itse.co.za

GREEN DRIVER

When you are stopped at a traffic light, you might be wondering how long it is going to take until the signal turns green. Will you have enough time to read a text message that you got (although illegal), or will you have enough time to take a sip of your drink? Well, the Enlighten App, developed by Green Driver Inc, does just that. The app predicts when the signal is going to turn green. Then, a few seconds before it turns green, the app chimes to notify the driver that the light is about to change.

AVAILABLE CITIES

Unfortunately, this app is only available in Eugene and Portland, Oregon, in the United States of America. It is currently being tested and will soon be rolled out in various cities in Texas and California. You might be wondering when it is going to be available in South African cities. To figure that out, we need to understand a bit more about the technology behind the app.

TECHNOLOGY

Green Driver has the technology to extract information regarding signal timing from the city's traffic management system. A traffic management system/centre is a central control room where information regarding the existing signal timing, phasing, time of day plans, etc, is stored. From this centre one is able to observe the current traffic flow conditions and also, by using cameras, view an intersection real-time. A system like this enables the officials to make real-time decisions, such as redirecting traffic in case of an accident, thereby reducing delays and congestion. The City of Tshwane is currently in the process of implementing such a system.

The GPS on the phone enables the app to locate the user on the road network and the direction of travel. By being able to interface with the city's traffic management system, it is able to extract information regarding the signal timing plan at a particular intersection. Using the timing plan, the app is able to warn the driver before the signal turns green.

IMPLICATION FOR SOUTH AFRICA

The traffic management system, or urban traffic control, is currently being pursued in various cities in South Africa – Cape Town, Johannesburg, eThekwini (Durban), Tshwane and parts of Ekurhuleni. Such a system aims at advising, warning and guiding road users, thereby reducing congestion and greenhouse gas emissions. It will not be long before all the major cities in South Africa have an urban traffic control. Whether the city will be willing to share the signal timing information with a developer such as Green Driver, is yet to be seen.

The next stage of an 'Intelligent Transportation System' would be Dedicated Short Range Communication (DSRC), which is a one-way or two-way short- to medium-range wireless communication channel, usually between the transport infrastructure and the vehicle. Using this technology, the traffic signals will be able to communicate with the cars and determine how many vehicles have their right-turn indicator on, thereby optimising the signals based on real-time traffic demand. Car manufactures and telecommunication firms are heavily investing in such technologies to make our travelling safer and more efficient. ◻

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SAICE Training Calendar 2014

Course Name	Course Dates	Location	CPD Accreditation Number	Course Presenter	Contact
GCC 2010	12–13 May 2014	Cape Town	SAICEcon13/01359/16	Neville Gurry	cheryl-lee@saice.org.za
	28–29 August 2014	Midrand			
	4–5 September 2014	Bloemfontein			
	13–14 October 2014	Midrand			
	27–28 October 2014	Port Elizabeth			
Bridge Maintenance	2 June 2014	Midrand	SAICErail12/01156/15	Ed Elton	dawn@saice.org.za
	15 September 2014	Pietermaritzburg			
	10 November 2014	Midrand			
Basics of Track Engineering	3–4 June 2014	Midrand	SAICErail12/01155/15	Ed Elton	dawn@saice.org.za
	16–17 September 2014	Pietermaritzburg			
	11–12 November 2014	Midrand			
Railway Transport	5–6 June 2014	Midrand	SAICErail11/00887/14	Ed Elton	dawn@saice.org.za
	18–19 September 2014	Pietermaritzburg			
	13–14 November 2014	Midrand			
Technical Report Writing	26–27 May 2014	Durban	SAICEbus12/01067/15	Les Wiggill	cheryl-lee@saice.org.za
	13–14 August 2014	Midrand			
	1–2 September 2014	Cape Town			
	30–31 October 2014	Midrand			
	3–4 November 2014	Port Elizabeth			
Practical Geometric Design	8–12 December 2014	Midrand	SAICEtr13/01418/16	Tom McKune	dawn@saice.org.za
Reinforced Concrete Design to SANS 10100-1:2000	14 May 2014	Durban	SAICEstr12/01066/15	Greg Parrott	cheryl-lee@saice.org.za
	19 June 2014	Midrand			
	16 July 2014	Cape Town			
	20 August 2014	East London			
	29 October 2014	Midrand			
	26 November 2014	Port Elizabeth			
Structural Steel Design Code to SANS 10162: 1-2005	6 May 2014	Durban	SAICEstr12/01158/15	Greg Parrott	cheryl-lee@saice.org.za
	18 June 2014	Midrand			
	15 July 2014	Cape Town			
	19 August 2014	East London			
	28 October 2014	Midrand			
	25 November 2014	Port Elizabeth			
Business Finances for Built Environment Professionals	8–9 May 2014	Cape Town	SAICEfin12/01021/15	Wolf Weidemann	dawn@saice.org.za
	7–8 August 2014	Durban			
	20–21 August 2014	Polokwane			
	6–7 November 2014	Midrand			
Handling Projects in a Consulting Engineer's Practice	5–6 May 2014	Cape Town	SAICEproj12/01022/15	Wolf Weidemann	dawn@saice.org.za
	4–5 August 2014	Durban			
	3–4 November 2014	Midrand			
Leadership and Management Principles & Practice in Engineering	21–22 May 2014	Midrand	SAIMechE-0543-02/15	David Ramsay	dawn@saice.org.za
	13–14 August 2014	Cape Town			
	20–21 August 2014	Midrand			
	10–11 September 2014	Durban			
	8–9 October 2014	Bloemfontein			

Concrete Pavement Slabs	21 May 2014	Cape Town	IPET2010/03	Bruce Raath	cheryl-lee@saice.org.za
	3 July 2014	Durban			
	9 July 2014	Port Elizabeth			
	20 August 2014	Bloemfontein			
	23 October 2014	Midrand			
Water Law	28–29 May 2014	Port Elizabeth	SAICEwat13/01308/16	Hubert Thompson	dawn@saice.org.za
	25–26 June 2014	Midrand			
	27–28 August 2014	Cape Town			
	10–11 September 2014	Durban			
The Different Legal Procedures to Resolve Constructional Disputes	15–16 May 2014	Midrand	SAICEcon13/01368/16	Hubert Thompson	dawn@saice.org.za
	11–12 June 2014	Cape Town			
	18–19 June 2014	Bloemfontein			
	30–31 July 2014	Port Elizabeth			
	6–7 August 2014	Durban			
Earthmoving Equipment, Technology and Management for Civil Engineering and Infrastructure Projects	2–4 July 2014	Midrand	SAICEcon12/01177/15	Prof Zvi Borowitsh	dawn@saice.org.za
	7–9 July 2014	Durban			

In-house courses are available. To arrange, please contact:
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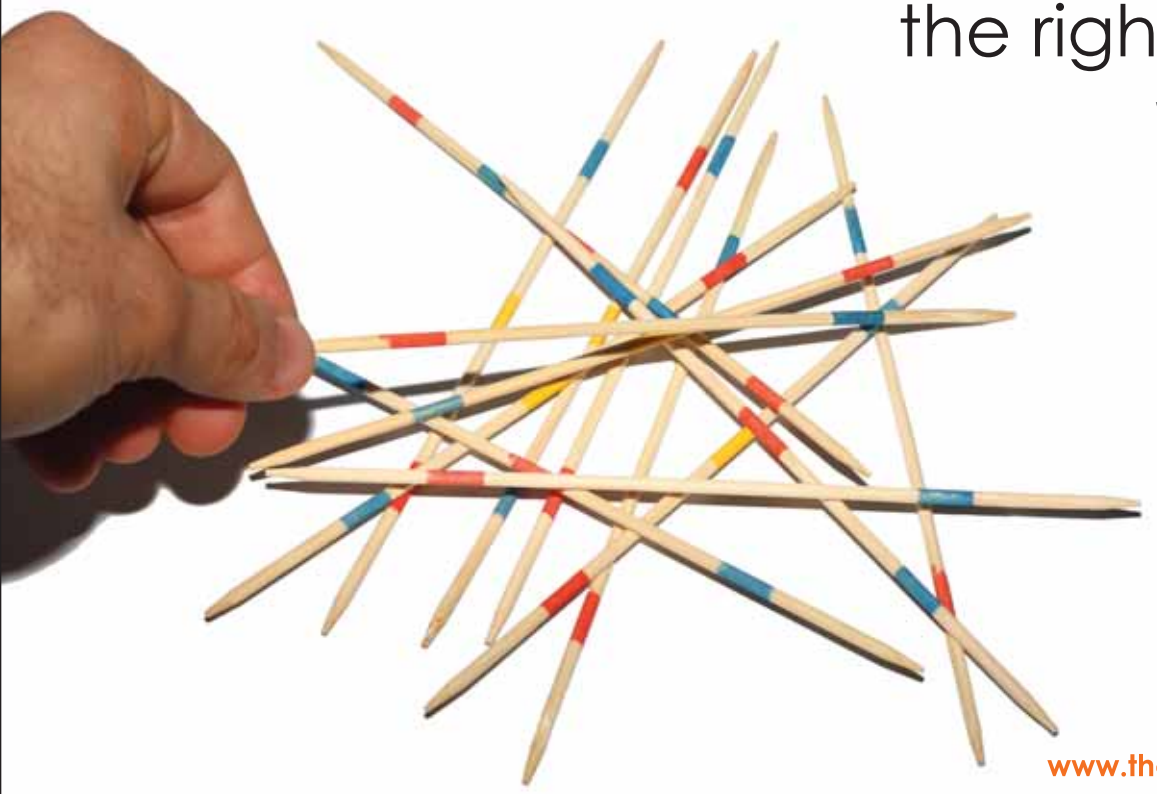

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SAFCEC changes its name

SAFCEC, which was founded in 1939 as the South African Federation of Civil Engineering Contractors to support established and emerging contractors, has changed its name to the South African Forum of Civil Engineering Contractors, still under the acronym SAFCEC.

Times have changed, and over the years SAFCEC has grown by leaps and bounds to where they find themselves today. The word "Forum" now better describes their way of business – they present a united voice on issues affecting the civil engineering contracting industry.

This name change could not have come at a better time. In 2013 SAFCEC was presented with a great opportunity to strengthen the organisation through restructuring, thereby ensuring that they are well placed to improve service delivery to their members and to enhance transformation efforts internally, as well as in the civil engineering contracting industry.

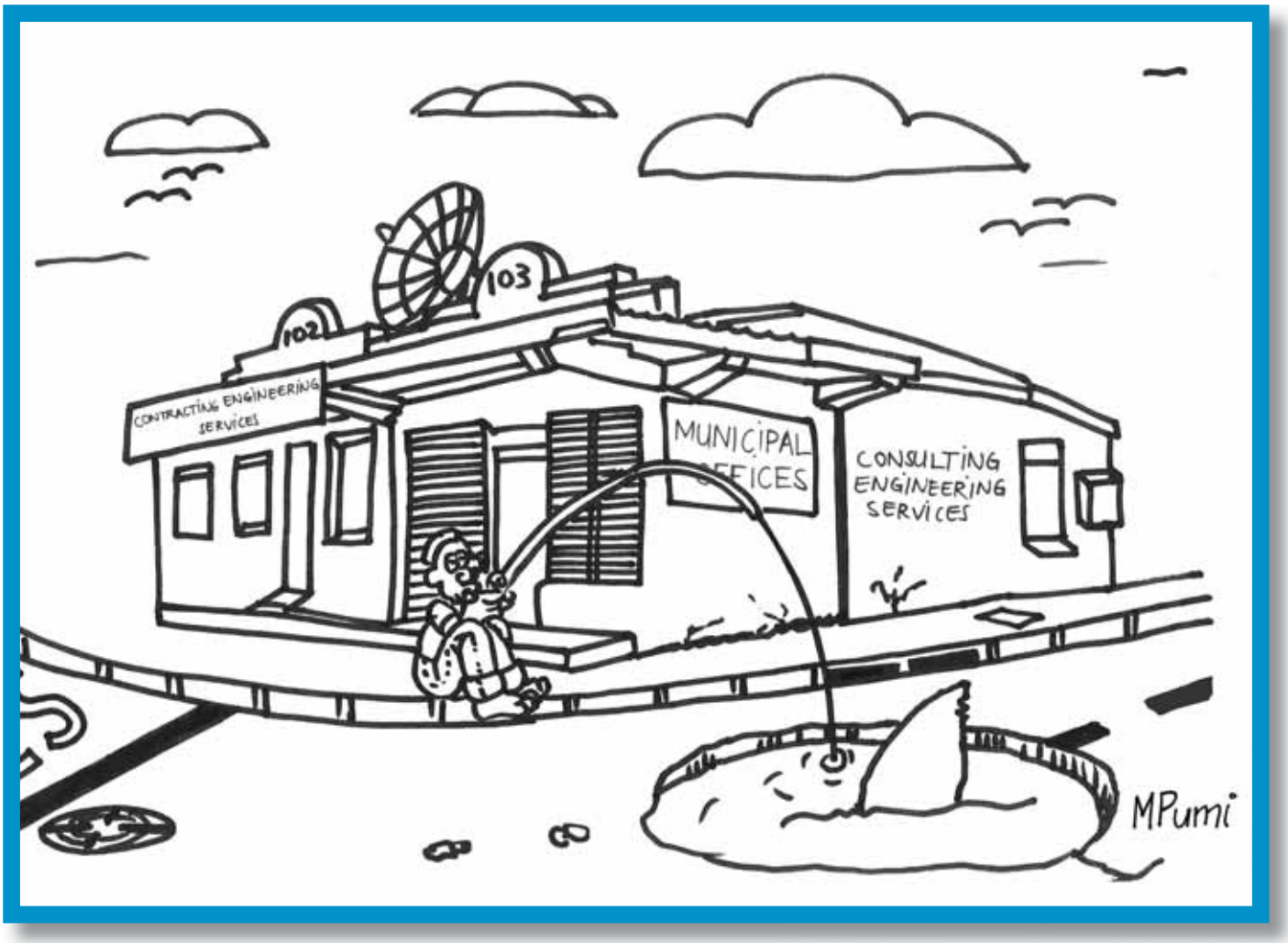
SAFCEC considers their name change as a significant symbol that illustrates all their changes and achievements to date, as they celebrate their 75th anniversary this year.

SAFCEC intends continuing its resolute focus on its members, and remains committed to service excellence when meeting its members' needs regarding Human Resources and Labour Relations, Training, Transformation and Development, Health and Safety, and Contractual and Economic advice, so that they can stay informed and operative in an ever changing and demanding environment.

SAFCEC contact

Annemie Cowley
SAFCEC Manager Communications
T: +27 11 409 0904
E: annemie@safcec.org.za

MPumi's cartoon of the month



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