Opinions

- hydraulic fracturing
- water and politics
- e-tolling

Focus on Water Engineering

Nazir Alli
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Give that man a Bells

THE E-TOLL SITUATION remains a dwang – because engineers have entrusted the issue to faulty politicians and a lawgiver. A judge, parading his legal prowess in the intricacies of the law – 'thou shalt not kill,' 'thou shalt not covet another man's cattle' – has adjudicated a technical matter, closely related to transport planning and economics, based on public opinion. The lawgiver strolled down his mountain, waving his tablet (i-Pad) and spurted out an emotional decision – the eleventh commandment: 'thou shalt not e-toll'.

Before I chirp:

It's about time SAFA does something right and appoints Gordon Igesund as head coach of our national football team – it's long overdue. SA football has an indigenous rhythm and psychology that he understands. Igesund's trophy cabinet is bursting with evidence of mastering winning recipes. Igesund was overlooked for the top job despite guiding four PSL clubs to titles – Manning Rangers during the inaugural 1996/7 season, Orlando Pirates in 2000/1, Santos in 2001/2 and Mamelodi Sundowns in 2006/7. At Moroka Swallows, he took a bunch of rejects and turned them into a gutsy unit, saving them from relegation in 2010/11, and almost winning the title this season. I say, "Give that man a Bells."

I have to take a poke at The Spear – that illustrious masterpiece that seems to have left the moral dignity of our president hanging. If there is something to be said about tolerance for polygamy and unprotected sex outside of polygamous marriage, surely the same tolerance should be exercised for freedom of expression. Or is that not part of our culture? The matter climaxed in parliament recently where Mr President expressed his concern about the moral demise of sleepy parliamentarians, and the lack of respect for his dignity – never mind the ailing infrastructure, e-tolls, unemployment, lack of service delivery and other pressing issues. No Bells for him.

The e-tolling saga has affirmed two points that we have been raving about. The first being, politicians should go where the cameras are and resist interfering with the work of technocrats. Let the technocrats and consultants get on with the job of infrastructure development and management. Secondly, it is pivotal to have appropriately qualified, dynamic, technical people installed in government, fully armed with decision-making powers. Dynamic engineers are capable of abstract thinking, solve macro level problems using scientific knowledge, thrive in teams, work well across international borders, have strong interpersonal skills and are capable of leading innovation. In loose MBA terms these are 'movers and shakers' in the industry.

On the matter of movers and shakers, and e-toll, I want to share my thoughts on e-toll personified – Nazir Alli, the outgoing and incoming CEO of SANRAL.

Regarding his resignation and reinstatement, our politicians have definitely come out looking like world-class entertainers. The board of SANRAL clearly "...accepted the resignation of chief executive officer Nazir Alli...." The audacious Tembakazi Mnyaka, the board's chairperson, who squeezed through the crowds to get to the front, announced, "...we accepted his resignation.... (we) are working on appointing a (new) CEO...." The Minister himself, the satisfied, right honourable Comrade Sibusiso Ndebele, "...wished Alli well in his future...." This by the way, is the same minister that made us dizzy with it's on – it's off – it's on – it's off and finally announced in parliament, "...e-toll is beyond the point of no return....", meaning that the public will have to pay. For these theatrics, the right honourable Comrade Sibusiso Ndebele, "...wished Alli well in his future...." This is my opinion on the PR around e-tolling is that it was shoddy. I have heard that Nazir is brusque and direct. From the little engagement I have had with him, he is bold, controversial and speaks his mind. I was recently at an event where he challenged white-owned consultants to JV with BBBEE outfits to improve transfer of skills and transformation in engineering. He even challenged the organisation that had invited him to be original and creative with their 2012/13 slogan line. But this is what movers and shakers do. They contest the status quo. They get things done. You don't become the top dog of a leading parastatal in the forefront of service delivery by being a conformist – one needs mettle to be a high-flier.

I like how the uninformed public pointed fingers in Nazir's direction: "He took the loans." Come now, let us reason together – do you really think that Nazir Alli took a mortgage on his house to embark on the GFIP? When funding from government was not quite forthcoming, the alternative was to do nothing or take action. He took action, unlike what our other comrades do – get what you can, can what you get and sit on your can. In the entire GFIP scenario Nazir Alli is a leader that is actually doing his job despite political interferences and administration challenges. I say, "Give that man a Bells."

See page 73 of this edition for more on Nazir Alli.
ON THE COVER
Golder Associates’ role in the Moatize project in Mozambique involved the detailed design and site supervision of the tailings storage facility (TSF) and waste storage facility. During the design of the TSF, Golder encouraged Vale to incorporate a penstock system into the TSF, as opposed to a barge system.

ON THE COVER
Incorporating a penstock system into the TSF at its Moatize mine is a first for diversified miner Vale.

Golder provides specialist services to Moatize

FROM THE CEO’S DESK
Give that man a Bells

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Considering e-tolling soberly

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The involvement of ground engineering and environmental services firm Golder Associates in the detailed design of a water supply system, tailings storage facility and waste storage facility for diversified miner Vale’s Moatize Coal Mine in the Tete Province of Mozambique saw Golder carry out a sophisticated project that balanced the needs of the client with the region’s environmental sensitivities.
By placing a series of wellpoints and low lift pumps in an alluvial aquifer on the banks of the Revubwe River, Golder conceptualised a design that had the ability to provide Moatize with a water supply of more than 600 ℓ/s.

A 23 km above-the-ground steel pipeline also formed part of the water supply contract. Golder’s Water Infrastructure Division team had to come up with an above-the-ground pipeline design that would accommodate peaks and troughs in the topography. The pipeline was designed to be installed on the toe of the lower side of the main access road to the mine. Pipe supports of up to 3 m high carry the pipeline above ground level, and the pipe is able to shift on a skid plate with two 32 mm diameter round guide bars. Anchor blocks were designed to accommodate the length and the forces in the pipeline, and special expansion joints had to be installed to allow for thermal expansion during extreme temperature changes – 15°C in winter and 65°C in summer.

The role of Golder’s Mine Infrastructure and Waste Division in the project involved the detailed design and site supervision of the TSF and waste storage facility. During the design of the TSF, Golder encouraged Vale to incorporate a penstock system into the TSF, as opposed to a barge.
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system. This is the first time that Vale has made use of a penstock system in a TSF on any of their mining operations across the globe.

Golder installed a return water system that runs through the bottom of the southern embankment wall, all the way through the length of the TSF, with a final inlet on the northern smaller wall. The slurry gets discharged from the main embankment wall and forms a ‘beach’. The water runs into the nearest penstock until it reaches the next penstock – the penstocks are closed in sequence until the water reaches the far end of the wall. The water then collects into a system that runs along the side of the wall with a slatted inlet that can be raised as the TSF, water and silt raise the facility. The water runs into the overflow and back underneath the TSF under the main wall and then to the return water dam.

The penstock design is a sophisticated one that allows the pumps to continue operating when the facility builds up. Golder placed pressure control valves downstream of these pumps to ensure that they always run at the same pressure – allowing the pumps to cope with both dry and wet periods.

The project also took into account certain environmental sensitivities, one being the protection of baobab trees along the route of the 23 km return water pipeline. Golder routed the pipeline around these trees, thereby avoiding disturbance of any flora.

Despite working in a Portuguese-speaking African country, while dealing with a Brazilian client, the Golder team, which comprised a complement of South African and Australian engineers and scientists, pulled off a successful project – proving that Golder, time and again, is able to deliver complex projects that are executed from a global skills base on a local level.

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WATCHING THE LATE morning sun finally appear over the crest of the flat-topped mountains brings welcome warmth that starkly contrasts the crisp coolness of the desert nights in the Karoo. I can still smell the clove on my hands that was used to spice the springbuck and fat-tail sheep sausage we made the day before. The rich green colour of the lucerne crop seems almost out of place in the middle of such an expanse of dusty tan earth filled with volcanic rocks and small bushes that somehow manage to thrive in such a dry environment.

In the background I hear the plunger of the windmill pump bobbing up and down, and the squeak reminds me that the vitality of the lucerne, the animals, and the farmers I’m staying with depends on a vast network of aquifers deep beneath the earth’s surface. Undoubtedly, the farmers who originally battled against the harsh weather, remoteness and difficult terrain of the Karoo to settle here would never have suspected that the livelihood of their descendants would be so influenced by the activities of oil and gas corporations. Little did they know about the enormous reservoirs of natural gas buried even deeper than the aquifers, or the economic trends that would put these resources and the farmers themselves at the centre of one of the biggest debates of contemporary significance.

Certainly, anyone who has experienced the hospitality of the farmers in the Karoo, or watched the colour of the Swartberg Mountains change as the sun sets, or marvelled at the explosive power of a kudu jumping over a two-metre fence would cringe at the thought of jeopardising the fragile source of life that these underground networks of water represent, but the economic demand for clean domestic energy and job creation has brought us to the point of considering this risk. Getting to the natural gas buried deep in the Karoo is risky because it requires an aggressive mining technique called hydraulic fracturing (fracking). The process involves pumping water, at high pressure, into a geological formation in order to create a system of cracks that allows more hydrocarbons to be extracted than otherwise would have been possible from a pristine reservoir. Initially, this method was considered a last resort to increase production (due to the cost and effort required), but given the state of energy resource availability and changes in the economic climate, this process has gained tremendous momentum.

The arguments for and against fracking have been laid out clearly by both sides. Those for fracking point to the potential for economic growth. Those against fear the environmental liabilities. On the pro side, formations like the Karoo gas shale are estimated to contain enough natural gas to provide the equivalent of four hundred years of energy use in South Africa. In addition, according to a spokesperson for Econometrix, the process of harvesting natural gas, and associated activities like distribution, will increase South Africa’s GDP by R80 – R200 billion and employ 700 000 people a year for 25 years.
In terms of clean energy, natural gas gives off 50-70% less carbon dioxide than coal when used to produce electricity. However, sceptics raise concerns about the chemicals used in the process to enable water to better penetrate the reservoir rock. These chemicals can potentially leach into underground aquifers, permanently contaminating them. Not only is this compelling, due to the scarcity of fresh water supplies (particularly in Africa), but exposure to these chemicals has been linked to an extensive list of infirmities, including cancer, birth defects, and reproductive disease. In addition, the process of fracking a well requires tremendous amounts of water to be pumped into the reservoir (tens of millions of litres per frack, per well), most of which is not reusable due to the presence of chemical additives. These concerns seem to resonate with people already uncomfortable with the potential for unexpected disasters associated with harvesting energy resources, fearing a fracking equivalent of the Deepwater Horizon incident, which caused extensive ecological damage in the Gulf of Mexico. Very little progress has been made in this debate due to the truly compelling nature of the arguments on both sides. No reasonable person can defend their position on this issue without simultaneously acknowledging the considerable cost (economic or environmental) associated with choosing one side over the other.

This predicament suggests that we should focus our collective energy in a new direction. Often the best strategy for settling an unwinnable argument is to creatively brainstorm an alternative that, in the end, gives both sides what they want. In the case of hydraulic fracturing, is it possible to frack in such a way that we realise the economic advantages, while avoiding the environmental dangers? The lack of understanding regarding this question itself suggests that not only are we wasting a lot of energy and resources battling over an argument that cannot be won, but that our arguments have been largely devoid of the most rational tool at our disposal - scientific research.
repeated. This philosophy should also extend to South Africa’s policy decisions to ensure that the economic benefit for the oil companies does indeed benefit South Africa as a nation.

Anytime I meet someone unwilling to even consider the opposing position regarding the fracking debate I wonder if we truly realise what is at stake? Aren’t the losses either way convincing enough to motivate us to work together to come up with a solution? If we are not proactive we stand the risk of being taken advantage of – missing out on tremendous potential for prosperity, and corrupting critical natural resources that will be damaged forever. Rather than ignore the reasoning of our opponents, let’s dedicate ourselves instead to creative problem solving. The key to preventing an imbalance between those with enough money and power to do almost anything, and those genuinely concerned for the wellbeing of farmers in the Karoo, is scientific knowledge brought forth through objective research. We need to be fanatical about making sure that the body of scientific research is complete enough to develop standards for hydraulic fracturing, and about policy that ensures the economic outcomes directly benefit South Africa. Without these regulations in place ahead of time, preventing catastrophe or recouping benefits will be largely impossible.

Engineers and researchers have an important role in this debate: the responsibility to provide a scientific perspective on an argument that has heretofore been only heuristically or anecdotally debated. We need to do our best to shift the focus on this issue from whether or not to frack, to consider instead if it is possible to frack safely and responsibly. If indeed it can be done safely, those for and against fracking can once again live in harmony and South Africa as a nation will reap a tremendous benefit.

Whether you support protecting the environment or stimulating South Africa’s economy, you can make a substantial contribution simply by advocating more funding for studying the process of hydraulic fracturing (and related physical processes) in an objective manner. In the end, it may indeed not be possible to take advantage of this enormous energy resource without compromising the livelihood of the farmers in the Karoo, and we should be willing to accept that and stop there, but if we can, and good policy is put into practice, not only will we all benefit from the development of this industry, but the farmers themselves will see improved roads, better schools, and additional income to offset the boom and bust nature of their profession.

In many ways the Karoo represents a good example of duality – hot days with cold nights, plants and animals thriving in a harsh environment, people living in such unpopulated areas. It seems strange to imagine farmers with a positive viewpoint on hydraulic fracturing, but if we, as engineers and scientists, do a good job of problem solving, this could actually become a reality and another example of coexisting contrasts. It’s up to us to find a way to take advantage of the benefits that hydraulic fracturing has to offer without compromising any of the multitude of wonderful things that make the Karoo so special. This could be the most significant contribution this generation of engineers can make, and is why we should fully support the development of programmes that provide resources for research in this area. Even incremental progress in this field will add tremendous value to our perspective, regardless of what side of the debate we are on, and finally enable us to come to resolution over the debate without giving in.
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Water and politics must mix

There were three water engineers, an Australian, a South African and a Brazilian, standing in the rain trying to work out what had gone wrong.

The Australian had spent fifteen years improving the management of the country’s main artery, the Murray-Darling River, trying to maintain the river’s health and ensure that its waters were wisely used. All had been going well when he retired, but then politics had got in the way. Under pressure from environmentalists, plans were amended to take more water from farmers for the environment. So, when they were finally presented, one group of farmers simply collected the reports in a big pile and burnt them. At that point the government, whose slim majority depended on rural voters, took fright and scrapped the proposals.

The Brazilian had a similar story. As head of the country’s national water agency, he had led a plan to take water to the drought-prone northeast of the country, one of the poorest areas of that country. All was going well until a Catholic priest went on hunger strike claiming, with little hard evidence, that the plan would put the area where the water was coming from at risk during drought. Again, the government took fright and the plan was put on hold.

As we talked, just a few months ago, the rain was pouring down outside, mocking the British water managers who had just...
declared a drought in the catchment of the river Thames and much of England. The managers were upset, because the British government had been dithering for years over plans to transport water from surplus areas, or build new storage. Instead, the politicians’ current priority is to build a huge (and hugely expensive) new sewerage tunnel under the Thames to prevent the occasional spillage of stormwater containing raw sewage into the estuary. They are doing this not because of community complaints or any significant harm, but because of the threat of action by the European Court of Justice for not complying with European environmental regulations.

As the South African participant, I was rather relieved by all these sad stories. We are, correctly, not particularly cheerful about the state of our water and its management, but it is clear that we are not alone. Here we have what is regularly referred to internationally as one of the best sets of water law in the world. It is now increasingly referred to as one more example of a good law which, unfortunately, has not been implemented. So, except in a few isolated corners of the country, water users are not officially part of the management of their local resource. Companies (and municipalities) that discharge wastewater into rivers are not being asked to pay the costs of managing the mess they create, and indeed in many cases are not even being prosecuted for flagrant breaches of their discharge permits.

Although there are rivers in the country where water use exceeds the water available, the provisions of the law that allow for a reallocation between users, which would also make it possible to allocate water to new users, has only been applied in three minor sub-catchments. And the list could go on. So, South Africa shares the problems of the other countries.

Yet, water managers cannot complain that no-one is concerned about water. On the contrary, across the world there has been a surge of interest in the challenges posed by water and its management that goes well beyond the usual suspects. So the business leaders who meet annually at Davos were told this year that, amongst the risks facing the world, water supply shortages came second only to systemic financial failure. Meanwhile, a report that represents the collective wisdom (?) of the USA’s Intelligence Agencies concluded that, within the next ten years, many countries “will experience water problems – shortages, poor water quality or drought – that will risk instability and state failure, increase regional tensions and (one suspects most seriously) distract them from working with the United States on important US policy objectives.”

That report was cited to us by a retired General from the United States Army Corps of Engineers, which is responsible for the construction and management of things like the flood protection levees around New Orleans. He thought it was an important development because it meant that the President of the USA would now take personal oversight of strategic responses to the water challenges. That did not comfort us. We remembered when a colonel came from the White House’s National Security Council to the Kyoto World Water Forum to suggest that the world’s water supply problems would be solved if poor people used new household disinfection products, which happened to have been developed by US companies (recent research has demonstrated convincingly that household-based treatment does not improve family health).

As we talked, it became clear that there was a fundamental disconnect between the people like us, who tried to manage water, and the politicians and the communities they represented, who made the final decisions. The only place where this is not the case was China where most of the ministers were engineers, many with decades of hands-on experience. One result has been a proliferation of major water projects across that country. But even in China, water managers spend as much time on social and environmental issues as on water engineering.

Pondering the problem, we concluded that our initial gut reaction – to keep politicians out of water management – was wrong. Nor should we expect that any democracy would elect a cabinet full of engineers any time soon. We had to recognise that in most societies politicians were elected to take decisions on behalf of society, and we needed to understand and respond to their concerns. Rather than keep the politicians out of water management, we had to work with them so that we would become part of their political decisions and they would become part of water management.

Australia provides a case study of what can go wrong if you don’t take that approach. There, in the early 2000s, the politicians felt that they had to be seen to listen to the loud voices of their city constituents who wanted to protect the riverine environment even if it was a thousand miles away. To demonstrate this, they committed themselves to conservation and more efficient use to meet urban needs, and hence built no new water storage.

Predictably though, when the country was hit by a ten-year mega-drought, they had to respond to citizens’ demands to be allowed to take showers. So they invested hugely in desalination plants – over AUS$50 billion (ZAR400 billion). Predictably, by the time the plants were finished, the drought had broken and the challenge was to deal with the floods and the high cost of mothballing plants that would not be needed for at least five years, at a cost of over ZAR500 million annually, for Sydney alone. The problem was that while the politicians operated on the short time-scales of elections and public opinion, the long-term business of developing and implementing a balanced and resilient strategy was ignored.

Australia’s water dramas put South Africa’s small problems – such as dealing with a few tens of litres per second of acid decant from old gold mines – in a useful perspective. A bit of dithering while longer-term strategic issues are considered – in this case, who should pay and where should the treated water go – is probably a good thing. Indeed, one of our challenges at the National Planning Commission is to find ways to ensure that long-term issues like water resource management are factored into short-term decisions about annual budget priorities. So, while we should continue to urge politicians to ensure that the next phase of the Lesotho Highlands Water Project is built on time (it will enhance dilution capacity as well as supply), we must also focus peoples’ attention on the need for better water management by municipalities, industries and households to bridge the gap between the long-term project and our short-term needs. And we should always be talking about the need to plan for the next big drought, which is well overdue.

The lesson from bitter experience in many countries is that engineers and other water managers need to understand and inform the concerns of their society, understand how democratic preferences are formed, and engage with them. Successful water management strategies will emerge because of public and political support, not despite it.
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Considering e-tolling soberly

FIRST OF ALL, I should state that this is my personal opinion and does not reflect the position of my employer.

It is unfortunate that a series of events conspired to place the e-toll system before the North Gauteng High Court. I do not blame the court for the current e-toll impasse. I am of the opinion that it was unfair to expect the court to rule on such a complicated transport economic matter. Clem Sunter supported tolling on News 24, but very few comments were received from transportation engineers, hence my appreciation that SAICE’s CEO invited me to share my opinion.

If we assume that the user-pay principle is currently a best practice transport economic instrument, what went wrong? Insufficient engagement? Not sure, as I remember numerous debates over recent years. Inability to convince civil society? Apparently so, but will it ever be possible? There are many reasons why we are where we are, but let us face some serious facts:

■ Mobility is a prerequisite for economic development and prosperity.
■ More and improved roads attract additional traffic, and in particular use of private cars.
■ Public transport, as alternative to the use of private cars on the freeways currently, cannot be taken seriously.
■ Congestion is largely symptomatic of unbalanced modal use, and spatial imbalances inherited and left uncontrolled, will eventually choke arterials to a standstill.
■ Trucks are, and will increasingly be the victims of growing congestion, with spiralling logistics costs of distributing consumer goods in urban areas.
■ Tolling is well-researched and globally accepted as a transport economic instrument to not only change driver behaviour and source funding (especially for rural or interregional roads), but also to serve as traffic management tool (especially for urban or intraregional roads) such as the London congestion charging scheme.

It is my opinion that we have to look at the traffic system as a whole and understand that the improved freeways, the Gautrain and other forms of public transport should be managed as an integrated solution to provide and ensure mobility. Citizens are currently subsidising Bombela from personal taxes because of insufficient passenger volumes. This could have been prevented if the users of the roads were asked to pay for the use, and incentivised to use the Gautrain, because the trade-off between road and rail costs would change behaviour. The argument is correct that we need more public transport with better coverage than the Gautrain, but then that should be addressed and not prevent tolling. Let us identify the real problem and address that, while at the same time utilising best practice transport economic instruments to change behaviour.

The benefits of tolling include the following: users pay for what they use, funding of capital investment, travel demand management (such as smoothing peak hour demand with differentiated tariffs), support of public transport and change of behaviour. The benefits of time saving, reduced congestion and lower operational costs clearly outweigh the costs of the toll. There are indeed other transport economic instruments for funding, such as fuel levies, annual licence fees and subsidies, but none are as effective as tolling for traffic management. Tolling is probably the most effective instrument to encourage private vehicle users to switch mode from their cars to the Gautrain or to other forms of public transport.

And if other suitable forms of public transport do not exist? Let us then address that problem and get entrepreneurs to operate regular bus and taxi services between origins and destinations that make sense. Passengers do not and should not pay toll, because public transport should be encouraged, in accordance with the vision of the National Development Plan.

Maybe the way forward should be to:
■ Start with reasonable variable toll tariffs (if not already reasonable), implementing for the majority as the rule (private vehicles constitute by far the majority of users).
■ Exclude all public transport and emergency services unconditionally.
■ Identify justified other exemptions and manage accordingly (surely it won’t be a deal breaker to exclude rental cars).
■ Increase ridership on the Gautrain with a differential tariff structure.
■ Put more buses and taxis on the toll roads, as they do not and should not have to pay toll.
■ Introduce high occupancy vehicle (HOV) lanes with differential tariff structures.

We cannot afford any more delays to the implementation of this well-designed traffic management system, not to even mention the complete waste of the world-class portals and other system infrastructure ready for use. Let us do the right thing for the right reason and address concerns where they belong.
As a general rule, steel strips are used as reinforcing material in the design of REINFORCED EARTH® structures. Polymeric reinforcements are used with appropriate connections in the event of special conditions.

Road and Rail Applications
- Retaining Walls
- Approach Ramps to Bridges
- Bridge Abutments – True and Mixed
- Widening of Cuttings

As a general rule, steel strips are used as reinforcing material in the design of REINFORCED EARTH® structures. Polymeric reinforcements are used with appropriate connections in the event of special conditions.
Tapping untapped renewable energy

IN WATER DISTRIBUTION networks in South Africa, water is often fed under gravity from a higher reservoir to another reservoir at a lower level. The high pressure head at the receiving reservoir is then dissipated through the control valves (altitude valves), or in some cases, orifice plates. The benefit of this hydropower generating application is that minimal civil works need to be done as the control valves are normally inside a control room/valve chamber. No negative environmental or social effects require mitigation and the anticipated lead times should be short.

There are basically four areas where energy generation can occur in the water supply and distribution system, as shown in Figure 1 (Briggeman 2011):

- **Dam releases** – conventional hydropower
- **At water treatment works (raw water)** – the bulk pipeline from the water source can be tapped
- **Potable water** – at inlets to service reservoirs or in the distribution network itself where excess energy is dissipated (typically with pressure reducing valves (PRV))
- **Treated effluent** – cases where the treated effluent has potential energy based on its elevation above the discharge point.

The University of Pretoria, supported by the Water Research Commission (WRC) and collaborating organisations such as the University of Pretoria, Dept Civil Engineering, marco.vandijk@up.ac.za; Prof Fanie van Vuuren, Dept Civil Engineering, University of Pretoria, fvuuren@eng.up.ac.za; Jay Bhagwan, Water Research Commission, jayb@wrc.org.za; Adriaan Kurtz, City of Tshwane Metropolitan Municipality, adriaank@tshwane.gov.za.
City of Tshwane is engaged in a research project to investigate the potential of extracting the available energy from existing and newly installed water supply and distribution systems. The project aims to enable the owners and administrators of the bulk water supply and distribution systems to install small-scale hydropower systems to generate hydroelectricity for on-site use, and in some cases to supply energy to isolated electricity demand clusters, or even to the national electricity grid, depending on the location, type and size of installation.

To distinguish the type of hydropower that will be generated it is called “conduit hydropower” (NHA 2011), as shown in Figure 1 at locations 2, 3 and 4.

Hydropower has the following advantages over other forms of energy production in terms of economics, social and environmental impacts (ESHA 2004, USBR 2008):

- **Clean renewable and sustainable energy**, as it makes use of the energy in water due to flow and available head. It does not emit any atmospheric pollutants such as carbon dioxide, sulphurous oxides, nitrous oxides or particulates such as ash.
- **Hydropower schemes often have very long lifetimes and high efficiency levels**, and operation costs per annum can be as low as 1% of the initial investment costs.
- **Hydroelectric energy has no fuel cost and low operating and maintenance costs**, and thus it is essentially inflation proof.
- **Hydroelectric energy technology is a proven technology** that offers high efficiencies, as well as reliable and flexible operation.

**Conduit hydropower requires a small capital investment** and has a short return on investment period since existing infrastructure is utilised.

**FREQUENTLY ASKED QUESTIONS**

**What is conduit hydropower?**

Conduit hydropower is when excess energy available in pressurised conduits (pumping or gravity) is transformed into clean, renewable hydroelectric energy by means of a turbine (see Figure 2).

**How does conduit hydropower work?**

Due to demand patterns and component size determination, the water entering the reservoir still has excess energy which is normally dissipated by means of pressure control valves. By installing a parallel system, a turbine, the flow and head are used to generate hydroelectric power.

**When is a site feasible?**

Feasibility studies aim to objectively and rationally uncover the strengths and weaknesses of the venture, opportunities and threats as presented by the environment; the resources required to carry through; and ultimately the prospects for success. In its simplest term, the two criteria to judge feasibility are cost required and value to be attained. In conduit hydropower projects some may have a monetary value providing a fast payback period, whilst others have additional value, servicing remote sites with subsequent benefits.

**Where can we install conduit hydropower?**

An initial scoping investigation (van Vuuren 2010) highlighted the potential hydropower generation at the inlets to storage reservoirs. In South Africa there are 284 municipalities and several water supply utilities all owning and operating gravity water supply distribution systems which have some type of pressure dissipating system at the downstream end of the supply pipe.

New types of inline turbines such as the LucidPipe™ Power System from Lucid Energy is a new, water-to-wire energy recovery solution that enables water-intensive industrial, municipal and agricultural facilities to produce clean, reliable, low-cost electricity from their gravity-fed water pipelines (Figure 3) (Kanagy 2011).
How is the electricity generated by the plant used?
The electricity generated by a plant can be used on site for the lighting, telemetry system, alarm system and electric fence. Larger systems (higher kW output) could be connected to the electrical grid thus reducing the demand from ESKOM. In some cases electricity can be sold directly to ESKOM.

How are conduit hydropower plants financed?
The feasibility studies conducted thus far indicated that these types of hydropower installations have a relatively short payback period. The reason for this is the minimum amount of civil works required compared to conventional hydropower projects. Due to the very low profile of small-scale hydropower development in South Africa during the last two decades there are no defined approaches and methods for the financing of hydroelectric installations. Currently the municipalities or water boards would utilise their own budgets to finance such projects. Larger-type installation could, however, require other funding mechanisms (DBSA, commercial banks etc).

POTENTIAL IN THE CITY OF TSHWANE WATER DISTRIBUTION SYSTEM
The City of Tshwane (now including Metsweding) receives bulk water from Rand Water, Magalies Water and its own sources which include boreholes, water purifications plants...
and fountains. Water is then distributed through a large water system that includes 160 reservoirs, 42 water towers, 10 677 km of pipes and more than 260 pressure reducing installations (PRVs) which operate at pressures up to 250 m. Geographically speaking, the City of Tshwane has a lower elevation than the bulk service reservoirs of Rand Water (the main water supply), resulting in high pressures still available in Tshwane.

In a desktop study the ten reservoirs with the highest potential in the City of Tshwane were identified (Figure 4). The use of the potential energy stored in the pressurised closed-conduit water systems in Tshwane is, however, not limited to these sites. These ten sites have a potential to generate 10 000 000 kWh/annum.

CASE STUDY: PIERRE VAN RYNEVELD CONDUIT HYDROPOWER PLANT (PVRCHP)

The first closed-conduit hydropower pilot plant in South Africa was constructed at the Pierre van Ryneveld Reservoir situated in the Country Lane Estate south of Pretoria. It is a ±15 kW installation utilising a cross-flow turbine discharging through the roof into the reservoir (Figure 5). A controlled flow is supplied to the turbine from the main supply line into the reservoir (Figure 6).
PAYBACK PERIOD
The preliminary cost for the pilot plant totalled R550 000. This was for the turbine and generator, electrical work, pipework, valve chamber, enclosure/plant housing, monitoring system, and data logging and communication system. Annual income would be in the order of R78 000 for electricity generated, based on 60 c/kwh. Assuming a discount rate of 10% and a very optimistic energy escalation rate of only 8% would result in a payback period of ±9 years (IRR = 23% for 20 year design life)

The plan is to utilise the generated power on site for lighting, alarms, communication etc. The members of the home owners association of the Country Lane Estate have also indicated that they would like to utilise the power for street lighting. Annually ±131 000 kWh could be generated with this unit, enough to supply ten households from this pilot plant. As long as people use water, electricity can be generated!

The pilot plant installation has a favourable payback period and up-scaling of the plant would result in an even faster payback period.

ACKNOWLEDGEMENT
The research project is funded by the Water Research Commission. The Commission’s support is acknowledged with gratitude.

REFERENCES
A DECISION BY the South African government about ten years ago not to proceed at that time with the scheduled coal-fired power station construction has come as a blessing in disguise for a disused Blake hydraulic ram pump (HRP) manufactured way back in 1962.

To be able to use environmentally friendly civil and hydraulic engineering technology, the Wits End Guest Resort near Champagne Castle in KwaZulu-Natal has purchased and installed the shelved hydraulic ram pump, still in perfect working order, thereby reducing dependency on rising ESKOM costs. No electrical energy is required for the HRP, which generates the required pumping head purely by hydraulic means, creating and then harnessing water hammer overpressures. Water hammer is generated by a change in velocity of the water flowing in a pipeline and is quite common in plumbing systems, characterised by a ‘knock’ when a tap is closed.

Nestled at the foot of the Little Berg and fed by a tributary of the Sterkspruit, the Wits End picturesque earthen embankment dam also services a number of developments in the vicinity with fresh water. The dam, which is fully approved by the Department of Water Affairs, is home to a wide and bio-diverse variety of fish, bird, plant and animal life coexisting with a growing tourist industry in this beautiful valley.

**Technological (Electricity-Free) Pumping Data:**

<table>
<thead>
<tr>
<th>Supply Pipeline (Steel) data:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Available kinetic energy head for the HRP</td>
<td>4 m</td>
</tr>
<tr>
<td>Length of steel supply pipe</td>
<td>36 m</td>
</tr>
<tr>
<td>Nominal diameter of the steel supply pipe</td>
<td>100 mm</td>
</tr>
<tr>
<td>Flow rate of steel supply pipe</td>
<td>333 ℓ/minute</td>
</tr>
<tr>
<td>Velocity (pulsing)</td>
<td>0-0.71 m/s</td>
</tr>
<tr>
<td>Maximum number of pulses per minute</td>
<td>120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rising Main (HDPE pipe) data:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrostatic head for the HRP delivery</td>
<td>50 m</td>
</tr>
<tr>
<td>Length of HDPE delivery pipe</td>
<td>500 m</td>
</tr>
<tr>
<td>Nominal diameter of HDPE delivery pipe</td>
<td>40 mm</td>
</tr>
<tr>
<td>Flow rate of HDPE delivery pipe</td>
<td>50 ℓ/minute</td>
</tr>
<tr>
<td>Velocity (steady state from mounted pressure vessel)</td>
<td>0.66 m/s</td>
</tr>
</tbody>
</table>

**Overall % flow efficiency (by in-built pump design):** 15%

The overall apparent ‘inefficiency’ of 100-15 = 85% is of no consequence, as the ‘lost’ water comes from surplus flow, which needed to be released from the dam anyhow towards satisfying normal river flow requirements downstream.
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Made In South Africa by South Africans since 1924

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- 219 mm - 610 mm diameter range
- Wall thickness: 4,5 mm - 12,7 mm

Spiral Welded Pipe
- Submerged arc-welding (SAW) process
- 610 mm - 2540 mm diameter range
- Wall thickness: 4,5 mm - 19,00 mm

Quality
- API 5L & 5CT
- ISO 9001:2008
- SANS 719

Coatings and Linings
To international specifications
- 3 Layer Polyethylene (3LPE) Coating
- Fusion Bonded Polyethylene : Sintakote®
- Modified Bitumen : Bituguard®
- Hot applied Tape Wrap
- Cement Mortar Lining
- Solvent Free Epoxy Lining

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uThukela Water taking the first step towards proactive pipeline integrity management

uThukela Water (Pty) Ltd recently completed a series of investigations as part of a programme to assess the condition of two critical raw water supply pipelines.

THE NTSHINGWAYO DAM (previously known as the Chelmsford Dam) was completed in 1961 to supply the town of Newcastle in KwaZulu-Natal, as well as the Eskom thermal power station and surrounding industries and farms. Two gravity pipelines were built from the dam. The then Department of Water Affairs and Forestry constructed a pre-stressed concrete pipeline (PCP) to supply the Ngagane Water Treatment Works (WTW) that supply potable water to Newcastle and its surrounding communities. A second steel pipeline was built by Eskom to supply water to the Ingagane Power Station, which was mothballed in 1990 and subsequently decommissioned. A fibre-cement (FC) pipeline was built between the power station and the Ngagane WTW to augment the capacity of the pre-stressed concrete pipeline and to utilise the existing steel pipeline after decommissioning of the power station to increase capacity and provide redundancy.

Both raw water pipelines have been in service for almost 50 years. The two pipelines are strategically important in that they supply the largest portion of raw water to the Ngagane works for treatment. The raw water supply system experienced significant water losses, raising concerns about the condition and structural integrity of the pipelines. Water requirements are such that neither pipeline can be taken out of service for extended periods.

In-service inspection technologies were therefore required. The investigations, which involved a number of survey techniques and technologies, were performed by SSIS Sahara (Pty) Ltd.

SSIS implemented a phased approach to assess the integrity of the pipelines. Apart from being more appealing when budgets are limited, this approach also ensures that the outcome of each inspection builds on the previous results and is scrutinised before implementing further investigations simply to drive revenue. The following investigations were performed as part of this appointment:

- Site survey and desktop study
- Tethered non-disruptive in-line leak detection survey using the Sahara® system
- Transient pressure monitoring
- Coating integrity and corrosion potential survey on the steel pipeline.

INVESTIGATION FINDINGS

Site survey and desktop study

Very little design and construction records of the pipelines still exist. SSIS was therefore reliant on field surveys to confirm the route and the design details of the pipelines. The site investigation found that the majority of pipeline components (air valves, isolating valves and scour valves) were in a poor condition (see Figure 1). This is unfortunately a common observation on many bulk water supply pipelines in South Africa and is certainly not unique to uThukela Water.

Leak detection survey

A combined pipe length of almost 38 km was successfully inspected on the pre-stressed concrete, steel and fibre-cement pipelines using the Sahara® inspection system. Sahara® is a proven system that is used worldwide to accurately pinpoint the location, and to estimate the magnitude of leaks in water pipelines of any material type. Because leaks in pipelines are directly associated with the structural integrity of the pipe wall and the joints or steel welds, Sahara® is an ideal non-destructive, real-time pipeline condition assessment tool. It is deployed while the pipeline remains in service, allowing for uninterrupted water service delivery to customers while inspections are performed.

Six leaks were found on the PCP, while five leaks were detected on the Steel/FC pipeline. Interestingly, eight of the leaks were found at pipeline components like air valves, scour valves and isolating valves, with only one and two leaks detected on the main pipe barrels of the PCP and the Steel/FC pipelines respectively, which is indicative of the condition of the main pipe barrels.

Large volumes of moving or stationary air were also detected in both pipelines. Excessive air entrainment could increase internal corrosion or adversely affect the hydraulic capacity of a pipeline.

Transient pressure monitoring

Transient pressure surges can result in severe damage or even failure of pipelines.
Aged pipelines are especially susceptible to surge-related damage. Remote Transient Pressure Monitoring (RTPM) on both pipelines found that end-line valve closures result in pressure surges (see Figure 2). Although not excessive, mitigating measures were recommended to reduce pressure surges even more.

The hydraulic modelling of both pipelines yielded interesting results. Whereas the hydraulic performance of the Steel/FC pipeline was as expected, the hydraulic analysis of the PCP produced results that were not representative of the expected condition of the main pipe barrel. Entrapped air, the presence of some large leaks along the pipeline and an isolating valve that was stuck in an almost closed position (see Figure 3) are the most likely causes of the anomalous hydraulic behaviour of the pipeline.

The hydraulic assessment confirmed the theoretical hydraulic capacity of both pipelines, which is important from a master planning point of view.

External coating integrity survey
The external corrosion potential and coating integrity surveys confirmed that more than half of the steel pipeline is located in areas characterised by corrosive soils, while significant stray current interference is experienced due to the location of the pipelines near high-voltage transmission mains and a major railway crossing. The cathodic protection system was not providing adequate corrosion protection, and some coating defects were detected that would require further investigation and repair.

Recommendations
Based on the findings of the surveys performed on the PCP and Steel/FC pipelines, and given the relatively low operating pressures that the pipelines are exposed to, it is believed that rehabilitation or selective repair methods could be a cost-effective alternative to overall pipeline replacement. This was confirmed when sections of the PCP were removed to install a by-pass connection, offering the opportunity to inspect the internal condition of the pipeline and finding it to be in better than expected condition after almost fifty years of service (see Figure 4).

Additional investigations were recommended to inform the decision-making process going forward and build on the information gathered to date. A number of the recommended actions are currently being implemented.

PRO-ACTIVE PIPELINE INTEGRITY MANAGEMENT
Water utilities simply do not have sufficient capital funding to indiscriminately replace bulk pipelines any longer. The alternative solution is to either do nothing...
(and then react to failures through costly and inefficient emergency repairs) or to better understand the condition of the existing infrastructure and perform proactive maintenance, thereby managing the integrity of the infrastructure.

Based on extensive international experience, only a small portion of a pipeline typically requires repair or replacement, while the rest of the pipeline may still be in a good condition. Pro-active pipeline integrity management, based on appropriate condition assessment inspections and targeted repairs, typically costs between 5% and 15% of the capital replacement value, giving utilities the reliability of a new pipeline in terms of performance and safety at a fraction of the cost of capital replacement.

**CONCLUDING REMARKS**

This project highlights the value of implementing a comprehensive and proactive pipeline condition assessment programme. uThukela Water originally faced the prospect of full infrastructure replacement at significant capital cost, based on pipe age and water loss as its only indicators. The investigations performed to date, however, indicate that rehabilitation or selective repair methods could be a cost-effective alternative to pipe replacement. Further investigations will be required, but with the baseline now set, uThukela Water can continue to implement a proactive approach to the management of its bulk infrastructure, setting an example for other utilities faced with similar challenges in South Africa.

**FACT BOX**

<table>
<thead>
<tr>
<th>Client</th>
<th>uThukela Water (Pty) Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Integrity survey of two raw water mains from Ntshingwayo Dam to the Ngagane Water Treatment Plant</td>
</tr>
<tr>
<td>Region</td>
<td>KwaZulu-Natal</td>
</tr>
<tr>
<td>Inspection distance</td>
<td>38 km</td>
</tr>
<tr>
<td>Project duration</td>
<td>January to December 2011</td>
</tr>
<tr>
<td>Pipeline description</td>
<td>Steel, fibre-cement and pre-stressed concrete pipelines of 600 and 700 mm ND</td>
</tr>
</tbody>
</table>

**Key project outcomes**

- Discovered 11 leaks of varying sizes
- Assessed and documented the condition of pipeline components, such as air valves, scour valves and isolating valves
- Assessed the hydraulic performance of both pipelines
- Performed external corrosion potential and coating integrity surveys
- Established a baseline for the condition of the pipelines, against which future inspections can be measured to assess trends and decisions can be made on the most appropriate way forward
- Improved understanding of the condition and operation of the system enabling pro-active management and more focused maintenance interventions

**Pipeline Toolbox**

- Live Leak Detection
- Live CCTV Inspection
- Pre-Stressed Concrete Pipe (PCP):
  - Condition Assessment
  - Risk Analysis
  - Monitoring
- Metal Pipe Wall Loss
- Rehabilitation & Repair
- Structural Design & Optimisation
- Hydraulic Analysis & Verification
- Forensic Investigation
Practices of discharging high COD (Chemical Oxygen Demand) wastewater into municipal and other water sources, and the sustained high CO₂ emissions into the atmosphere, are in discord with the drive to reduce our carbon footprint. Anaerobic wastewater treatment is an effective method of generating energy (methane) from high COD wastewater. This can significantly reduce the carbon footprint of industrial, food processing and chemical plants in two ways. Firstly by partly substituting external energy inputs, and secondly by reducing the energy consumption of the treatment process itself, since anaerobic treatment is far less energy intensive than the equivalent aerobic treatment.

**INTRODUCTION**

Concerns over dwindling crude oil reserves and the need to curb the levels of greenhouse gas emissions have promoted the development of alternative fuels. Anaerobic wastewater treatments are an excellent source of alternative energy (bio-methane). Methane (CH₄) is a greenhouse gas that is 25 times more damaging to the atmosphere than CO₂. ‘Carbon credits’ are awarded in proportion to the emission reduction of greenhouse gases, and can be claimed under the Clean Development Mechanism programme promoted by the Kyoto Protocol. Recovery of energy from methane combustion can be used to reduce the energy expenditure of a process plant.

**ANAEROBIC WASTEWATER TREATMENT**

Strong organic wastewaters (BOD > 500 mg/l) are typically produced from agricultural, food, distillery, brewery, beverage, textile, paper and pulp industries (BOD: Biological Oxygen Demand). These wastewaters usually contain highly biodegradable organic matter,
When It Counts........... “Size & Strength Does Matter”

With “TEKFLO” You Get What You Pay For!!!
and when aerobic processes are employed to treat such wastes the processes are beset by problems such as:
- difficulty in maintaining aerobic conditions especially with high concentration of TSS (Total Suspended Solids)
- sludge bulking
- inability to process high BOD or COD loadings
- high operational and energy costs
- high production of biomass and subsequent high disposal costs of the waste sludge.

Anaerobic processes have been shown to be effective in the treatment of strong organic wastewaters. Despite the ability of anaerobic processes in treating high BOD, COD and TSS wastes, complete stabilisation of organic matter is not possible by anaerobic treatment only. Therefore aerobic treatment usually follows anaerobic treatment (Grady et al 1999).

Anaerobic wastewater treatment is a multistep process involving symbiotic relationships between a consortium of microbes. Figure 1 depicts the microbial, biochemical and symbiotic complexity inherent in anaerobic treatment systems (Grady et al 1999, Anderson et al 2003).

The microbial kinetics of anaerobic wastewater treatments are frequently developed from anaerobic digestion of pure substrates. The composition of wastewater from the aforementioned industries is complex and cannot be similar to pure substrates. Depending on the composition of COD, different micro-organisms in the consortium will actively participate in converting COD to the end product, \( \text{CH}_4 \).

It is therefore imperative that consortium performance be determined for the particular wastewater; this would allow for proper reactor design.

**WASTE TO ENERGY CASE STUDY**

**Anaerobic and aerobic wastewater treatment process**

The anaerobic and aerobic treatment plant (Figure 2) was designed to treat food industry wastewater.

**Table 1 UASB reactor design specifications and projected performance**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UASB influent COD</td>
<td>26 000 mg/l</td>
</tr>
<tr>
<td>Design HRT</td>
<td>25 h</td>
</tr>
<tr>
<td>UASB volume</td>
<td>37.50 m³</td>
</tr>
<tr>
<td>Organic loading rate</td>
<td>25 kg COD/m³.d</td>
</tr>
<tr>
<td>Biomass Generation</td>
<td>2 200 mg VSS/t</td>
</tr>
<tr>
<td>SRT</td>
<td>4.3 d</td>
</tr>
<tr>
<td>Sludge production</td>
<td>79.6 kg/d</td>
</tr>
<tr>
<td><strong>Biogas</strong></td>
<td></td>
</tr>
<tr>
<td>Composition</td>
<td>( \text{CH}_4 (60%)), ( \text{CO}_2 (40%))</td>
</tr>
<tr>
<td>Flow rate</td>
<td>21 Nm³/h</td>
</tr>
<tr>
<td>COD removal efficiency</td>
<td>85%</td>
</tr>
<tr>
<td><strong>UASB Effluent COD</strong></td>
<td>3 900 mg/l</td>
</tr>
</tbody>
</table>

It is therefore imperative that consortium performance be determined for the particular wastewater; this would allow for proper reactor design.

**Figure 2: Anaerobic and aerobic treatment for food industry wastewater**

**Figure 3: Aerobic treatment for food industry wastewater**
CONNS MANUFACTURING Co (Pty) Ltd, a privately owned water filtration company in Cape Town, specialises in primary sand and disc filtration for agriculture and industry. From the required flow rate (m³/hr), CONNS will design, manufacture, assemble and ship skid-mounted modular plug and play filterbank units. CONNS supplies single Simplex Standalone units, Duplex units or Multible Modular Filterbanks according to customer’s filtration requirements. Using the CONN 500 ton hydraulic press, domes of various sizes in mild steel, are deep drawn and pressed out to form tank bodies for a wide range of CONNS products:

- CONNS Sandfilters, CONNS Activated Carbon Tanks and CONNS Fertilizer Application Tanks.
- Also manufactured are a range of CONNS Discfilters and Meshfilters.

CONNS Filters are widely used throughout Southern Africa as primary filtration for:

1. Agriculture on Drip, Microjet, and Sprinkler Irrigation Systems.
2. Factory / Mine Water Filtration – Direct or Side Stream.
3. Drinking Water Filtration for Farms, Households, Small Towns and Municipalities.

For over 45 years years, CONNS has supplied the Southern African market with basic robust water filtration equipment and has built up a good name for quality, service and reliability.
Table 3 Strictly aerobic reactor design specifications and projected performance

<table>
<thead>
<tr>
<th>Aerated reactor influent COD</th>
<th>26 000 mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design HRT</td>
<td>160 h</td>
</tr>
<tr>
<td>Aerator volume</td>
<td>240 m³</td>
</tr>
<tr>
<td>Organic loading rate</td>
<td>3.9 kg COD/m³ d</td>
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<tr>
<td>Biomass generation</td>
<td>3 600 mg VSS/t</td>
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<tr>
<td>SRT</td>
<td>5 d</td>
</tr>
<tr>
<td>Sludge production</td>
<td>430 kg/d</td>
</tr>
<tr>
<td>Oxygenation requirement</td>
<td>19.7 kg O₂/h</td>
</tr>
<tr>
<td>COD removal efficiency</td>
<td>93%</td>
</tr>
<tr>
<td>Aerated reactor effluent COD</td>
<td>260 mg/l</td>
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</tbody>
</table>

Table 4 Comparison of anaerobic vs aerobic treatment processes

<table>
<thead>
<tr>
<th>Case 1 - Methane Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaerobic</td>
</tr>
<tr>
<td>Item</td>
</tr>
<tr>
<td>Power</td>
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the anaerobic wastewater treatment can be a source of income to cater for plant operation costs.

The energy input required for the operation of the aerobic reactor is significantly higher compared to that required for anaerobic operation. This high energy requirement makes the use of strictly aerobic treatment processes unfeasible for treating high COD wastewater.

Analysis of waste sludge generation from the two processes shows that waste sludge generated from anaerobic and aerobic processes was approximately 61 kg/d compared to the strictly anaerobic process which was expected to generate 430 kg/d of waste sludge. Reduction in waste sludge is therefore an added benefit of using anaerobic treatments.

CONCLUSIONS

Anaerobic wastewater treatment has been shown to be effective in generating an alternative energy source. Use of methane in processes that require combustion can replace resources such as coal. Furthermore, the carbon credit gained by the use of methane can be traded to provide an alternative income stream. These benefits highlight the potential energy savings and revenue that can be generated from a small wastewater treatment plant (36 m³/day), and are expected to be more substantial when anaerobic treatment is applied in high-volume high-COD wastewaters.

BIBLIOGRAPHY


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The use of gabions in hydraulic applications

HISTORY OF GABIONS
Using a basket containing manageable small stones, instead of a single heavy, large stone which is difficult to move, is an old concept that has been well known to mankind for a long time. First records of the use of this system go back more than 2,000 years, when the Egyptians used cylindrical willow baskets filled with small stones to protect the banks of the River Nile from erosion.

Those characteristics were maintained until the nineteenth century, when willow was replaced by gabions made of wire netting. The word “gabion” has its origins from the Italian word “gabbione”, which means “big cage”.

Officine Maccaferri was the first to undertake industrial production of gabions in 1894. The first major work using factory-made gabions was in fact in that same year in the River Reno. Gabions remain in use up to this day.

Over the years, and as technology developed, improvements to gabions have been on-going to meet the increasing demands from customers. As an illustration of such evolution, the original square, simple-twist mesh was replaced by a hexagonal double-twist mesh. The wire was also being protected by an increasingly thicker zinc layer, and also by the introduction of PVC coating.

DEFINITIONS
A flexible gabion structure is a combination of wire netting and stone fill. To fill the gabion, all types of durable stone can be used, preferably those with a high specific weight and good resistance to the atmospheric agents (water, wind, ice, etc).

The ideal size of stone varies between one and two times the smaller dimension of the mesh opening (see “b” in the figure alongside). The gabion void index is defined as being the percentage between the stone fill volume and the total capacity of the gabion. The use of regular dimension stones, possibly between 1 and 2b, gives a minimum void ratio, thus providing a better distribution of the existing strains, and maximum support capability of the structure. The average specific weight for a gabion, when considering a void content between 30% and 40%, is approximately 1,700 kg/m³.
TECHNICAL AND FUNCTIONAL CHARACTERISTICS

The acceptance of gabions in various types of work for more than a hundred years is due to the following characteristics, which give gabions an enormous advantages over other possible solutions:

Monolithicity
A gabion structure is made by various elements linked through continuous fastening. The latter ensures mesh continuity and allows regular distribution of the imposed forces among the three dimensions (width, height and depth), as well as ensuring that the whole weight of a structure is equal to the sum of the weights of each element.

The settling of soil, transported by water, in the voids between stones, and the eventual appearance of vegetation, increase monolithicity, improving the static characteristics of the structure over time. Gabion works can therefore be considered as single, homogeneous and monolithic structures.

Flexibility
The constituent materials of gabions give high flexibility to the structure when compared to other types of solutions. The wire netting assures resistance to tension on the structure, which therefore may absorb loadings not predicted at the time of design. This is one of the most important characteristics of gabions – the structure deforms, but its resistance is not decreased, because while following land movements the structure maintains the same loadings on the soil.

Flexibility is particularly necessary where the work is done over unstable land or where, as in the case of rivers, there is the possibility of settlement due to erosion, or where phenomena such as swallow holes may occur.

Another advantage of flexibility is that any eventual collapse of gabion structures does not happen suddenly as in the case of rigid structures, but does so gradually and can be seen clearly, allowing for decisions to be made in good time in most cases.

Flexibility, within technically acceptable limits, therefore gives gabion structures the capability of deforming while maintaining its function, whereas rigid or near rigid structures would collapse in similar situations.

Permeability
Empty spaces between stone fill-in gabions allow fluid movement through them. For this reason gabion works are not generally affected by hydraulic pressure and therefore work much more efficiently under such circumstances. As for hydraulic works, like in canal and river bank support, gabions allow water flow in both directions, i.e. river-land and land-river, without forming an impermeable barrier.

The fact that the installation of a gabion structure does not change the usual fluid movements at the site or the physical characteristics of the adjoining soil, is of great value.

Simplicity and economy
Being simple, Maccaferri gabions do not require a skilled labour force or special equipment. Ordinary tools are usually needed, such as pliers, tweezers, crowbars and other easily available tools. Rapid construction, resulting in immediate use of the completed gabion structures, is possible, together with the possibility to easily change or enlarge the structure. It is therefore also possible to be built in stages.

Because of the standardisation of gabions it is possible to produce effective structures with only a few technical instructions. Stone fill for the work is usually easily found near the site.

Gabions also do not require special foundations, only simple levelling of the foundation, which has considerable cost saving advantages.

In some cases the only materials that need to be transported to the site are the gabions and the fastening wire, therefore reducing transport costs, especially at difficult-to-reach sites.

Versatility
Gabion structures match local needs and conditions perfectly. While they can be built using mechanical means, they are also very suited to labour intensive projects.

Theses structures can be built in any climate – low or high temperatures, drought or rainy season, and under different environmental conditions, such as in the presence of water, at remote sites, and on poor soils with low bearing capability.

If stone is not available, gabions can be filled with bags of sand or a sand-cement mix, or with concrete blocks, bricks, and so forth, and if a smooth surface is needed, the final face can be covered with mortar.

Should there be a need for a rapid integration with the local natural environment, seeds can be scattered inside the gabions.
Environmental integration

Gabion structures are the least damaging to the environment, as they are built with stone. The structure integrates with the environment over time as empty spaces between stones become filled with soil and seeds, and as vegetation grows, harmoniously covering the structure and eventually re-creating the pre-existing environment. Gabion structures therefore do not significantly change the ecosystems in which they are erected. They do not stop the natural flow of water nor the flourishing of native plant species. As a consequence they do not create any harm to biological communities, whether these be in rivers (from plankton to fish), or on land (from decomposing micro-organisms to local animals).

Social characteristics

As has already been said, because of the simplicity of the gabion method, it allows recruitment of an unqualified work force, usually hired on site, which is sometimes a far more important social benefit than the final work itself.

Durability

- Dry walls (stone walls) prove that gabion works may last for hundreds of years, even after the wire netting rusts away.
- It is important to note that, in the case of a break in any single wire, the double-twist prevents the unravelling of the mesh and movement of stones out of the gabion.
- Heavy zinc coating, or GalFan, of wires assures that eventual deterioration of the netting by rusting happens very slowly under normal conditions.
- Under severe chemical conditions or in a maritime environment, where corrosion is a more severe process, it is possible to extend wire life considerably by making use of PVC coating.
- The life of a gabion structure is not measured by wire netting durability. Experience has proved that gabions are simply receptacles for stones, necessary only to guarantee the shape of the whole structure. It is well known that after some time void spaces are filled and cemented with soil and plant roots, thus creating a uniform solid structure.
- With the passage of time gabion structures provide a natural balance with the environment so that subsequently the structure carries lighter pressures than experienced at the time of construction.
- It is possible then to say that gabion structures could be considered as permanent installations.

EXAMPLES OF GABION STRUCTURES

Gabion structures may be divided as follows:
- Support structures
- Lining structures
- Mixed structures
- Other

Support structures: These are structures which have to support loads (thrusts) either by means of their own weight or by the action of the mesh tension together with the soil reinforcement (Terramesh), or even both.

Lining structures: These are made of thin elements to cover large surface areas, for example to create a lining that would protect stable land from possible erosion. As in the case of water courses, for instance, lining structures prevent soil from the river bed from being eroded away by the force of the water. The thickness and geometric shape of the lining are calculated according to water velocity and soil characteristics. Stability and resistance in highly inclined edges and slopes are assured by anchoring the lining to the soil using stakes, thus preventing eventual slipping.

Mixed structures: These are structures in which both characteristics (support and lining) act together.

CONCLUSION

Maccaferri River Analysis (MAC.R.A.) software has been developed to provide engineers with a rapid and efficient tool with which to conduct the stability analysis of watercourse cross-sections with respect to both water flow and wave motion. A supplementary programme, GAWAC, enables the engineer to analyse the stability of the structure as a retaining wall. Additional technical information on design and applications is also available in the Maccaferri Digital library.

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The South African National Committee on Large Dams (SANCOLD) has been very active both locally and internationally. Some of SANCOLD’s major initiatives are highlighted in this article.

The International Commission on Large Dams (ICOLD) is a non-governmental organisation that provides a forum for exchange of knowledge and experience in dam engineering, construction and operation at international level. The organisation leads the profession in ensuring that dams are built safely, efficiently, economically and without detrimental effects for the environment. ICOLD was founded in 1928 and has National Committees in 95 countries (in 2011) with more than 10 000 individual members who are practicing engineers, geologists and scientists from governmental and private organisations, consulting firms, universities and construction companies. ICOLD holds its Annual Meeting in a different country each year where business (managerial and technical) is discussed. Every third year the Annual Meeting is combined with a Congress where a greater number of participants attend the technical sessions. The latest Congress (2012) took place early in June in Kyoto, Japan. Further information about the organisation is available on the ICOLD website (www.icold-cigb.net).

SANCOLD was formed in 1965 and represents South Africa as a National Committee member on ICOLD. SAICE has a reserved position on the SANCOLD Management Committee – the current representative is Tente Tente, with Dr Eduard Vorster as the alternate.

SANCOLD has an ambitious and exciting programme for 2012, with the following main activities:

■ Preparations for the development of a guideline on floods
■ Preparations for the development of a guideline on risk analysis
■ Preparations for the development of the publication, Your Dam, which will focus on the operation and maintenance of small dams, written for the owners of such dams
■ Development of a guideline for the application of geofabrics in embankment dams
■ SANCOLD short course on Dam Design, Construction and Environmental Aspects. The course will be held from 1 to 3 August 2012 in Hilton, KwaZulu-Natal, and will include a site visit to the roller-compacted concrete Spring Grove Dam currently under construction.
SANCOLD has been very active within ICOLD during the last year, and the future promises to be equally so! The main highlights are given below and many of these offer many opportunities to our members for interesting, career-building international activities and networking.

South Africa is represented on a number of ICOLD Technical Committees. We have a system of SANCOLD Working Groups for each of the Committees and interested members may apply for participation. The ICOLD Committees where we have representation are presented in Table 1.

South Africa played a leading role in the revisions of the ICOLD Constitution and Bylaws, which were approved in 2011. The revisions were aimed at improved governance of the organisation. We have a document before the forthcoming General Assembly to effect a small amendment in the Bylaws.

ICOLD is divided into various zones and has a Vice-President for each one. Prof Gerrit Basson of the University of Stellenbosch is the only candidate for this important position and will be elected at the ICOLD General Assembly in Kyoto in June 2012.

For the forthcoming ICOLD Congress in Kyoto, South Africa has twelve papers that have been accepted for publication. Only a limited number of authors are selected for oral presentations, and so far three of our authors will be speaking at the Congress.

South Africa hosted ICOLD events in 1978 (Cape Town, Annual Meeting) and 1994 (Durban, Annual Meeting and Congress). The SANCOLD Management Committee has decided to bid for the hosting of the 2016 ICOLD Annual Meeting. The vote on this will take place during the 2013 ICOLD Annual Meeting. If we are successful, it will be a wonderful opportunity for persons in South Africa and southern Africa to interact with the international dam community. Many commercial opportunities will arise from this event. Typically some 600 to 1 000 delegates attend the Annual Meeting, plus 200 to 300 accompanying persons. The second phase of the Lesotho Highlands Water Project will be under way at the time and should attract a lot of interest from the international attendees. The Annual Meeting will be held in Johannesburg during May 2016. SANCOLD is already far advanced with the planning for the event, including various study tours in South Africa and neighbouring countries.

ICOLD has changed its policy in respect of its large range of publications. Members of National Committees such as SANCOLD can now download these publications free of charge from the password-protected portion of the ICOLD website. The password is provided to SANCOLD members via the SANCOLD secretary upon request.

For further details on SANCOLD and the forthcoming course, please visit the SANCOLD website (www.sancold.org.za), or contact the SANCOLD secretary (secretary@sancold.org.za).

<table>
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<tr>
<th>Committee Name</th>
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<tr>
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<td>2009-2013</td>
<td>Dawid van Wyk</td>
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<tr>
<td>Committee on Concrete Dams</td>
<td>2012-2015</td>
<td>Q Shaw</td>
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<tr>
<td>Committee on Embankment Dams</td>
<td>2010-2014</td>
<td>D Badenhorst</td>
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<td>Committee on Engineering Activities Associated with the Planning Process for Water Resources Projects</td>
<td>2011-2014</td>
<td>S Mabuda</td>
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<tr>
<td>Committee on Dam Surveillance</td>
<td>2012-2016</td>
<td>Dr C Oosthuizen (chairman)</td>
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<td>Committee on Dam Safety</td>
<td>2012-2016</td>
<td>I Segers</td>
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<td>Committee on Tailings Dams</td>
<td>2011-2014</td>
<td>Duncan Grant-Stuart</td>
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<td>PD Pyke</td>
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<tr>
<td>Committee on the Register of Dams &amp; Documentation</td>
<td>2011-2014</td>
<td>Bertrand Collet</td>
</tr>
<tr>
<td>Committee on Dams for Hydroelectric Energy</td>
<td>2007-2012</td>
<td>L Furstenburg</td>
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Activities of the SAICE Water Engineering Division

WORKSHOP
The SAICE Water Engineering Division, together with the University of Pretoria and the Water Research Commission, held a successful two-day workshop on Small Scale Hydroelectric Power on 29 and 30 May 2012 in Pretoria. The workshop, which included site visits on the second day, was attended by more than 80 people. The first conduit hydropower plant in South Africa at the Pierre van Ryneveld Reservoir was visited, as well as the decommissioned Hartbeespoort Dam hydropower plant (there are plans to revive this site). Workshop course material is available on: www.microhydropower.net

SAICE WATER ENGINEERING DIVISION CHAIRMAN’S AWARDS
The Water Engineering Division is pleased to announce the following awards for best paper in the SAICE journal and best article in the SAICE magazine:

The Water Engineering Division
Best Paper Award 2010 (journal)
Jan Nortje for his paper in Vol 52 (2) 2010: Estimation of extreme flood peaks by selective statistical analyses of relevant flood peak data within similar hydrological regions.

The Water Engineering Division
Best Article Award 2010 (magazine)
Chris Seddon for his article in the July 2010 edition: The cause of failure of the Massingir Dam Bottom Outlet Works – lessons to be learned for designers of reinforced concrete pressure conduits or penstocks.

OTHER ACTIVITIES PLANNED FOR 2012 INCLUDE THE FOLLOWING:
Site visit to the De Hoop Dam
Date: 13 July 2012
Contact: Stefan Malan (stefanm@goba.co.za)
The De Hoop Dam forms part of the Olifants River Water Resources Development Project (Phase 2A) and is located on the Steelpoort River, near Roossenekal in the Steelpoort district of the Limpopo Province. The Category III Dam is a roller-compacted concrete gravity dam with uncontrolled stepped central ogee, 88 m high and 1 015 m overall wall length, with a capacity of 347 Mm³ – the 13th largest dam in South Africa. It is expected that impoundment will commence on 1 August 2012.

Breakfast lecture
Date: 14 November 2012
Contact: Anca Burger (anca.burger@angloamerican.com)
Speaker: Prof Roland Schulze
Topic: Climate Change and South Africa’s Water

SAICE WATER DIVISION CALENDAR
The Water Division Calendar (courses, site visits, activities, contact details, etc) is available in electronic format on the SAICE website for importing directly into your Outlook Calendar, or in PDF format (www.saice.org.za/divisions/water.html).
Kelly Long from Grahamstown was the recipient of the SAICE Water Engineering Division’s gold medal for her excellent project on Polymers at ESKOM’s EXPO for Young Scientists. The Division has an annual award for projects that they source at the EXPO. The gold medal, however, had not been awarded for a few years as projects did not meet the exacting standards. The dam on Kelly’s father’s farm was losing water through leaking, so she started doing research and discovered a polymer with suitable properties. She applied her newly acquired knowledge and was able to seal the dam effectively. Kelly is excited about her research, as many farmers with similar problems could benefit from her research.

THE THREE BLUE spheres represent the relative amounts of water on planet Earth in comparison to its size.

The largest sphere represents all the water on the planet, i.e. the oceans, ice caps, lakes, rivers, groundwater, atmospheric water, and the water in human beings, plants and animals. Its diameter is about 1 384 km, which is the distance from the SAICE National Office in Midrand to Stellenbosch, and its volume would be around 1 386 000 000 km$^3$.

The smaller sphere represents the world’s liquid fresh water, i.e. groundwater, lakes, swamp water and rivers. Its diameter is about 272.8 km, and its volume is approximately 10 633 450 km$^3$, of which 99% is groundwater, much of which is not accessible to humans.

The tiny sphere (pinpoint) is representative of all the fresh water in lakes and rivers. Most of the water for life on Earth comes from these surface-water sources. The diameter of this sphere is only 56.2 km, and its volume is only about 93 113 km$^3$.


Water is precious!
WITH THE COP17 Conference on Climate Change still fresh in our minds, the KwaZulu-Natal Department of Transport is stepping up a gear and playing its part in reducing its carbon footprint. On a recently completed project on the North Coast, the reclaimed asphalt (RA) from one 5 km section of road was imported to create a foamed bitumen stabilised material (BSM) base course on an adjacent 5 km section, at massively reduced heat generation and distances travelled, and at a third of the cost of a conventional black base. In addition, its own asphalt surfacing was recycled in situ to generate a foamed bitumen-stabilised sub-base layer below, thus adding even more to the savings being achieved.

The heart of the process is the state-of-the-art Wirtgen KMA 220 cold recycling mobile mixing plant, which the contractor recently imported from Germany. The compact unit, with its own power plant, is towed to the site, where it is opened out and connected to a cement silo and water and bitumen tankers. A temporary ramp is constructed up to the hopper section, where the RA is tipped in and fed via a conveyor belt to the pug mill. A nominal amount of cement is added before the foaming process takes place. This is achieved by injecting a small amount of water into hot bitumen, causing it to expand by up to 20 times. The pug mill continually throws the RA into the air, allowing the foam to be sprayed into it to ‘spot-weld’ the particles together. The mixed BSM is fed directly up a conveyor belt into the waiting trucks and onto the road.

The various contractors involved in the two separate contracts did sterling work, ensuring the success of the project. For maximum efficiency, the different operations were all coordinated – from milling out the RA on the one contract and delivering it to the power screen, checking for consistency before processing it in the recycler and then hauling it to the road to the conventional asphalt paver to be compacted. If there was a breakdown of one operation, the others had to slow down accordingly. Training of every member of both the consulting and contracting
staff was vital, as was the drawing up of method statements and agreeing on roles, responsibilities and lines of communication. Heavy reliance was placed on the Asphalt Academy’s TG2 (2009) guidelines and reporting schedules. This project has indeed been highlighted as a model for future BSM applications.

The parties involved are enthusiastic about this technology where old asphalt, which was often of just nuisance value, can now be put to good use. With proven cost savings and significant reductions in greenhouse emissions, the Department is very keen on repeating the exercise.
Strategies to address the skills shortage in the delivery and maintenance of infrastructure in South Africa: a civil engineering perspective

INTRODUCTION

The engineering profession plays a critical role in the delivery and maintenance of infrastructure. It is involved in:

- the detailed planning, design, construction and optimisation or condition assessment of infrastructure
- the development of short-, medium- and long-term infrastructure plans at both a portfolio and project level, and the administration of works contracts for the acquisition, refurbishment, rehabilitation and maintenance of infrastructure
- the strategic planning and management of the operation and maintenance of infrastructure, and
- specific duties relating to health, safety and environmental aspects of infrastructure as provided for in legislation.

The civil engineering discipline currently accounts for just less than half the number of professional engineers and professional engineering technologists registered with the Engineering Council of South Africa (ECSA). A major portion of the work undertaken by civil engineers involves public infrastructure.

The perceived shortage of engineers in South Africa has been a topic of conversation as far back as 1971 when the South

<table>
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<th>Table 1</th>
<th>Interventions recommended by Lawless in 2005</th>
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<tr>
<td>Time frame</td>
<td>Intervention</td>
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<tr>
<td>Short-term</td>
<td>Retain senior professionals and appoint retired professionals to supervise and train young graduates and initiate and manage projects</td>
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<td>Review conditions of employment including remuneration, qualifications, grading, responsibility, authority and employment equity targets</td>
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<td>Attract people back into the industry</td>
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<td>Re-introduce structured workplace training through the industry</td>
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<td>Medium-term</td>
<td>Increase the number of technologists</td>
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<td>Improve the employability of national diploma graduates</td>
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<td>Implement comprehensive succession planning and associated training</td>
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<td>Long-term</td>
<td>Increase the number of graduate civil engineers</td>
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to secure sustainable work for in-service training, as well as post-graduation employment” (Venter 2012). Lawless (2011) reported that between 45% and 99% of students at eleven higher learning institutions were unable to graduate due to no or insufficient experiential training.

The time has come to review some of the thinking around the shortage of civil engineering skills in South Africa and the strategies to overcome such shortages.

A CRITICAL REVIEW OF THE PERCEIVED SHORTAGE OF ENGINEERS IN SOUTH AFRICA

The population to engineer indicator

Lawless (2005) tabulated the numbers of registered engineers in various countries, based on an extensive desktop survey and the contacting of various institutions and registering bodies that provided data of varying reliability, detail and dates for data sets (see Table 3). Lawless did caution that some registration bodies similar to ECSA provided figures for professional engineers only whilst others provided figures for all engineers, whether registered or not. In particular, she singled out China and India as possibly representing all engineers and not just registered engineers. Lawless nevertheless used these figures to calculate population per engineer and, where data was available, provided comparative figures for population per doctor (see Table 3.)

Lawless, in interpreting her indicator “population per engineer”, made the observation that “although South Africa is perceived to be technologically stronger than many countries it is desconcerting that South Africa’s ratio of population to engineer is not significantly better than Zimbabwe, Namibia and Tanzania and other less developed countries.”

Extracts from Lawless’s tabulation of population per engineer and population per doctor have been analysed and reported on in several reports, papers and publications. For example, the Engineering Professions Association of Namibia (EPAN) notified its members that “this shows clearly that the number of our engineers is not enough for the population quoted” (EPAN 2005).

Nxumalo and Nordengen (2010) stated that “Our ratio of engineers to population is a major challenge as we are behind even developing countries like India ….the ratio of population to engineers is significantly lower than various other countries. A comparison with other developing and developed countries suggests that South Africa is far behind. Western Europe and North America have an average of between 150 and 300 people per engineer. It is disconcerting to note that both China and India are also in that company. South Africa has only one tenth of the engineers of those nations; therefore our needs are far greater than we can imagine.”

ECSA has asserted that “the international benchmark of an average population per engineer shows that South Africa lags behind other developing countries. In South Africa, one engineer services 3 166, compared to Brazil’s 227 and Malaysia’s 543 per engineer. The discrepancy in the benchmark points to one thing: South Africa is severely under-engineered.” (ECSA 2010b)

It is easy to understand the indicator “population per doctor”, as it is driven by the health of the people (disease burden, age profile, etc) and the funding / affordability of the available health care system. The distinction between doctors and other members of the health care team is well understood, as well as the patient—doctor relationship. This is not the case when considering the indicator “population per engineer”, for the following reasons:

1) Registration can mean one of two things in different jurisdictions — recognition of demonstrated achievement of a defined standard of competency or a licence to practise. Accordingly registration can be voluntary or mandatory. As a result, the incentive or requirement to register varies (UNESCO 2010).

2) The registration culture varies from country to country. Some countries register three tracks equating to ECSA’s categories of engineer, technologist and technician (UNESCO 2010). In some countries only the engineer, or the engineer and technologist, tracks are registered. The equivalency of the different tracks in different jurisdictions is not clear.

3) There is an inconsistent reporting of engineering graduation data. According to Duke University (2005), articles have typically “stated that in 2004 the United States graduated roughly 70,000 undergraduate engineers, while China graduated 600,000 and India 350,000. Our study has determined that these are inappropriate comparisons. These massive numbers of Indian and Chinese engineering graduates include not only four-year degrees, but also three-year training programs and diploma holders.”

An alternative indicator

Engineering works (e.g. civil and structural works, building services, works for the harnessing of energy, the treatment of substances, mining operations, transportation and mechanical and electrical power, and electronic and process systems) is driven by finance and not numbers of people alone. No matter how many people live in a geographical area, finance is required to undertake engineering works. A more understandable or rational metric is accordingly “GDP to engineer”, as indicated in Table 3. The data in Table 3 paints a very different picture. Although South Africa has a population to engineer ratio of 3166:1 compared to a developed country average of 295:1, it has

| Table 2 Percentage of firms wanting to increase staff but struggling to find suitable candidates (CESA 2012) |
|---------------------------------|-----------------|----------------|-----------------|-----------------|-----------------|
| December 2007 | Engineer | 94.5 | Technologist | 90.6 | Technician | 89.4 | Other Technical Staff | 52.1 | Support Staff | 28.7 |
| June 2008 | 67.4 | 61.7 | 43.0 | 40.6 | 18.5 |
| December 2008 | 33.2 | 11.3 | 9.3 | 2.5 | 2.3 |
| June 2009 | 26.4 | 12.8 | 12.5 | 3.8 | 1.9 |
| December 2009 | 26.1 | 73.6 | 25.5 | 14.9 | 14.0 |
| June 2010 | 16.6 | 11.9 | 1.7 | 11.9 | 0.4 |
| December 2010 | 81.5 | 18.3 | 18.3 | 10.1 | 5.8 |
| June 2011 | 66.0 | 51.8 | 52.8 | 8.3 | 6.6 |
| December 2011 | 74.0 | 36.0 | 22.0 | 4.8 | 6.9 |
a GDP to engineer ratio of US$16.4m:1 compared to US$11.5m:1 for developed countries. Accordingly, the shortage of engineers, based on the ratio GDP to engineer, suggests an order of magnitude lower shortfall, which aligns with other indicators such as those produced by CESA and current anecdotal observations.

What is immediately apparent in Table 3 is the variability of the data. For example, the ratio GDP to engineer in developed countries ranges from US$5.1 to 16.2 m per engineer, possibly due to inconsistencies in the reporting of the number of engineers. According to a recent UNESCO Report (2010), the lack of a clear-cut definition as to “what is covered under the concept of engineering” and “who in the workforce is really an engineer” has frustrated international comparisons. A better benchmark is to perhaps compare South Africa against the average for the English-speaking developed countries who are signatories to the Engineers Mobility Forum, i.e. Australia, Canada, Ireland, UK and the USA, who have an average GDP to engineer ratio of US$14.0m:1 and an average population to engineer ratio of 348:1. South Africa’s GDP-based statistic of US$16.4m:1 is not more than 20% higher than this average, whereas the population-based statistic of 3 166:1 is 9.1 times higher.

The anomaly in the two statistics is in part explained by the findings of Hall, a scenario planner who studied commercial activities in South Africa many years ago. According to Lawless (2005), Hall concluded that the “numbers employed to serve the white population matched those of the Western World, hence the impressive first world infrastructure serving mainly the white population to engineer”

Engineering works (e.g. civil and structural works, building services, works for the harnessing of energy, the treatment of substances, mining operations, transportation and mechanical and electrical power, and electronic and process systems) is driven by finance and not numbers of people alone. No matter how many people live in a geographical area, finance is required to undertake engineering works. A more understandable or rational metric is accordingly “GDP to engineer”

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communities concentrated in the main cities. He concluded that if the country were to tackle service delivery in all forms ... the number of professional staff would have to increase dramatically to address the needs of the whole population." When Hall made these conclusions, the economy was almost exclusively in the hands of the white South Africans who enjoyed a very much higher per capita income than black South Africans. Clearly, if the level of services provided to the majority (black) population increased, more engineers would be required. It goes without saying that GDP would have to increase through the productivity impact brought about by such infrastructure, or budgets would have to be reprioritised to finance this expansion. Finance is required to deliver and maintain such infrastructure.

South Africa's per capita income in 2005 was US$5192 whereas the comparative figure for Australia, Canada, Ireland, UK and USA was US$40282, i.e. 7.8 times higher. This figure is a similar order of magnitude to the difference in the population to engineer ratio of 9.1, being only 17% lower. Accordingly, the population to engineer ratio alone yields misleading and grossly exaggerated conclusions, as it ignores per capita income, which is a measure of the money available in the private and public sector to support engineering works.

Any comparison between countries based on GDP per engineer also needs to be viewed with caution. Apart from the aforementioned anomalies in the reporting on the number of engineers, what makes up the economy and the demand for infrastructure also need to be considered, as well as what types of engineers are required, e.g. discipline (civil, electronic,

| Table 3 Population per engineer and GDP per engineer in various countries |
|---------------------------------|-----------------|----------------|-----------------|-----------------|-----------------|
| **Country**                     | **Population**  | **Number of registered engineers** | **Population per engineer** | **Population per doctor** | **GDP per capita (IBRD World Bank 2008)** |
| **Western Europe**              |                 |                               |                              |                              |                                   |
| Denmark*                        | 5 520 295       | 30 926                         | 179                          | 273                          | 16                             | 47 793 | 8.6 |
| Finland*                        | 5 357 934       | 39 537                         | 136                          | 304                          | 22                             | 37 262 | 5.1 |
| France*                         | 60 656 178      | 220 000                        | 276                          | 297                          | 24                             | 34 008 | 9.4 |
| Germany*                        | 82 443 000      | 380 000                        | 217                          | 291                          | 21                             | 33 849 | 7.3 |
| Greece*                         | 15 000 000      | 87 337                         | 172                          | 199                          | 29                             | 22 285 | 3.8 |
| Iceland*                        | 270 603         | 1 019                          | 266                          | 283                          | 11                             | 54 975 | 14.6 |
| Ireland*                        | 3 917 203       | 14 000                         | 280                          | 362                          | 8                              | 48 405 | 13.6 |
| Norway*                         | 4 600 246       | 37 685                         | 122                          | 308                          | 3                              | 65 267 | 8.0 |
| Sweden*                         | 9 254 613       | 44 352                         | 209                          | 291                          | 19                             | 39 621 | 8.3 |
| UK*                             | 58 821 000      | 189 406                        | 311                          | 492                          | 20                             | 37 266 | 11.6 |
| **Eastern Europe**              |                 |                               |                              |                              |                                   |
| Hungary                         | 10 661 747      | 4 815                          | 2 214                        | 437                          | 40                             | 10 962 | 24.3 |
| Romania                         | 23 434 194      | 8 056                          | 2 909                        | 523                          | 60                             | 4 575  | 13.3 |
| **North America**               |                 |                               |                              |                              |                                   |
| Canada*                         | 30 337 000      | 169 512                        | 179                          | 475                          | 13                             | 35 133 | 6.3 |
| USA*                            | 296 771 226     | 762 000                        | 389                          | 361                          | 6                              | 41 674 | 16.2 |
| **South America**               |                 |                               |                              |                              |                                   |
| Argentina                       | 36 260 130      | 80 000                         | 453                          | 354                          | 55                             | 4 836  | 2.2 |
| Brazil                          | 184 203 744     | 811 483                        | 227                          | 379                          | 65                             | 4 791  | 1.1 |
| Chile                           | 14 973 843      | 22 000                         | 681                          | 2 025                        | 48                             | 7 305  | 5.0 |
| **Australia**                   |                 |                               |                              |                              |                                   |
| Australia*                      | 20 372 452      | 44 767                         | 455                          | 414                          | 17                             | 34 774 | 15.8 |
| **Asia**                        |                 |                               |                              |                              |                                   |
| China                           | 1 300 000 000   | 10 000 000                     | 130                          | 593                          | 86                             | 1 721  | 0.2 |
| Hong Kong                       | 5 000 000       | 10 798                         | 463                          | 617                          | 10                             | 26 094 | 12.1 |
| India                           | 1 020 000 000   | 6 500 000                      | 157                          | 2 320                        | 108                            | 707    | 0.1 |
| Japan*                          | 121 000 000     | 400 000                        | 303                          | 476                          | 23                             | 35 604 | 10.8 |
| Korea                           | 45 985 289      | 21 534                         | 2 335                        | 585                          | 34                             | 16 441 | 35.1 |
| Malaysia                        | 25 500 000      | 47 000                         | 543                          | 1 436                        | 53                             | 5 250  | 2.9 |
| Singapore                       | 4 240 000       | 3 161                          | 1 341                        | 318                          | 7                              | 26 879 | 36.0 |
| Sri Lanka                       | 18 732 255      | 3 348                          | 5 595                        | -                            | 97                             | 1 218  | 4.1 |
| **Africa**                      |                 |                               |                              |                              |                                   |
| Ghana                           | 21 029 853      | 1 644                          | 12 792                       | 2 500                        | 125                            | 502    | 6.4 |
| Namibia                         | 2 030 692       | 320                            | 6 346                        | 4 545                        | 82                             | 3 049  | 19.3 |
| South Africa                    | 46 888 200      | 14 806                         | 3 166                        | 1 493                        | 67                             | 5 192  | 16.4 |
| Swaziland                       | 979 000         | 80                             | 12 238                       | 9 100                        | 83                             | 2 270  | 27.8 |
| Tanzania                        | 36 766 356      | 6 200                          | 5 930                        | -                            | 131                            | 360    | 2.1 |
| Zambia                          | 11 261 795      | 881                            | 12 783                       | 11 100                       | 126                            | 636    | 8.1 |

* Developed country according to the UN’s Trade and Development Index
mechanical, etc) and specialisations within a discipline (maintenance, construction, design, etc).

Irrespective of the projections for numbers of engineers based on the various indicators, an increase in the number of engineers will be required in South Africa to:

■ address various aspects of sustainable development, e.g. the development of renewable energy sources, advancements in technology, solutions for sustaining the environment and improving healthcare; and to
■ deliver and maintain infrastructure that is needed to produce socio-economic growth.

THE NATURE OF THE CIVIL ENGINEERING SKILLS SHORTAGE IN SOUTH AFRICA

Understanding where the shortages occur

The Lawless (2005) survey found that there was a shortage of mid-career civil engineers, i.e. suitably qualified, registered and experienced engineers. CESA’s statistics shown in Table 2 suggest that a shortage for such personnel still exists, despite an underutilisation of the current capacity of the consulting industry. This can in part be explained by the age profiles of the members of SAICE and the Institution of Structural Engineers (IStructE), a London-based international organisation, as shown in Figure 1 (Watermeyer 2006). The average age in 2005 of a SAICE member was 52 and of a Fellow 58 (senior member of the profession). By way of comparison the Terblanche (1971) survey indicated a median age of 39.1 years for economically active civil engineers. It also indicated that 21.6,
29.6, 29.9, 13.6 and 5.3% of such engineers fell into the age groups <30, 30-39, 40-49, 50-59 and >60 respectively (see Figure 1).

The sharp drop in mid-career engineers in the 2005 statistics from the 1967 industry profile is prevalent in both SAICE’s and IStructE’s membership, probably caused by the introduction of computers in the 1970s, which reduced the demand for civil engineers and opened up an alternative career path for those wishing to pursue a career in computer engineering and related fields. The steeper drop in the case of SAICE can be attributed to emigration in the wake of the dismantling of apartheid and economic globalisation.

The Construction Industry Development Board (CIDB) published in 2007 a discussion document to portray the state of skills in the industry, identify the skills provisioning challenges and mobilise the industry to contribute to skills development in response to government’s large infrastructure spending programme in 2005. The CIDB in order to interpret the additional demand for skills, and to place the skills challenge in context, differentiated between:

- “scarce skills”, i.e. those skills which are in short supply but which can be obtained through short-term targeted training, and
- “critical skills”, i.e. particular high-level skills within certain occupations.

The CIDB concluded from case studies that the largest demand for skills is in the scarce skills categories, which can be met through short-term targeted training. Critical skills, on the other hand, are required in much fewer numbers, but require up to 10 to 20 years of experience. The CIDB did pinpoint that the shortages in the public sector were reflected particularly at the point of delivery in local government and in the private sector where the lack of experienced site managers was seen to undermine delivery in terms of expected time, cost and quality requirements. They also drew attention to the issue of client delivery capacity. They pointed out that while there may be sufficient numbers employed, many of the individuals in the sector lack the critical skills, knowledge and experience to effectively manage and ensure the delivery of infrastructure in terms of requisite standards of cost, quality and time. In this regard, this discussion paper pointed out that almost 40% of the senior officials and managers in the public sector have five years or less experience.

Researchers at the Duke University (2005) see two main tracks for engineering graduates, namely dynamic engineers and transactional engineers, as opposed to the current categorisation of many countries, including South Africa, into “professional engineer,” “professional engineering technologist” and “professional engineering technician”. Dynamic engineers are those “who are capable of abstract thinking, solving high level problems using scientific knowledge, thrive in teams, work well across international borders, have strong interpersonal skills and are capable of leading innovation.” On the other hand, transactional engineers, although they may possess engineering fundamentals, are not seen to have the experience or expertise to apply this knowledge to complex problems. They are viewed as being largely responsible for “rote and repetitive tasks in the workforce”. Quality of education is seen to be a major factor in the breeding of dynamic
engineers. Accordingly, not all professional engineers are dy-
namic engineers. However, dynamic engineers are more likely to
be found in this grouping of engineers.

The Duke University’s categorisation may be likened to that
of the CIDB, i.e. transactional engineers equate to the scarce
skills category and dynamic engineers to the critical skills cate-
gory. Where the two approaches to defining the skills sets differ,
is that 10 to 20 years of experience will not convert transactional
engineers into dynamic engineers. It can, however, improve the
quality and quantity of transactional outputs. In practice there
will also be a number of engineers that fall somewhere between
these two basic types of engineers.

The distribution of skills shortages
The National Planning Commission (NPC 2011) has recently
pointed out that “transformation in the post-apartheid state
required that the racial monopoly over skill be challenged and dis-
mantled.” Their analysis of the current state of play within govern-
ment on the outcome of this imperative is that “the result has been
a reduction in the number of professionals available to the state,
and a looming crisis in the generational reproduction of professional
expertise as the ageing cohorts continue to leave the system.” The
NPC also recognises that “this skills deficit has an adverse impact
not only on frontline service delivery,... but also on the ability of
government to engage in long-term planning, coordination across
institutions, run efficient operations, ensure adequate maintenance
of infrastructure, establish organisational systems and routines, and
manage personnel and industrial relations.”

Table 4 presents a rough comparison of the distribution of
engineers and technologists in South Africa in 1967 and 2005
by comparing the figures published by Terblanche (1971) and
Lawless (2005). What is clearly evident from Table 4 is that there
has been a major flow of engineers from the public sector to the
consulting sector over time.

The NPC (2011) also makes the observation that “many
short-term responses to skills shortages do little to address
long-term capacity constraints. Consultants can be brought
in to design and build infrastructure, but without in-house
technical expertise provincial and local governments lack the
capacity to ensure the work is done to an adequate standard
or to maintain the infrastructure once the work has been
completed.” The NPC proposes to rewrite the story of South
Africa by addressing nine key development goals. Five of
these goals relate directly to infrastructure development,
namely job creation, improving infrastructure, transforming
urban and rural spaces, anti-corruption and transitioning
into a green economy. Such a plan, however, is only credible
if its delivery mechanism is viable. While government can
easily outsource transactional engineering work, it cannot
outsource its planning responsibilities and its overall tech-
nical management of the delivery and maintenance of its in-
frastucture. Dynamic engineers are required within govern-
ment to oversee this and make the necessary judgement calls.
These skills are, however, always in demand in all sectors.

STRATEGIES TO ADDRESS
THE CIVIL ENGINEERING SKILLS SHORTAGE

Strategies to increase the supply of critical skills
The 1971 and 2005 strategies to address the shortages of engineers
focused on increasing the number of civil engineers, i.e. the supply.
More recent strategies have, however, focused on developing the skills and experience of graduate engineers through structured programmes, to enter the profession by becoming registered with ECSA. These strategies need to be continued. However, the number of graduates required at an entry level to the profession needs to be reconsidered, as the supply appears to be outstripping the demand. South Africa does not require a tenfold increase in its number of engineers, as has been suggested in recent years.

The 2011 age profile of registered engineers of all disciplines in the three categories of engineers registered by ECSA is as shown in Figure 2 (Franks 2011). Table 2 indicates the fluctuating demand for the various categories of registered engineers. Critical questions need to be asked regarding the numbers required in each of the three streams. The demand for professional engineers amongst consulting engineering firms appears to be higher than for the other two categories. Given the findings of the Duke University regarding the linkage between education and dynamic engineers, priority should be given to developing more professional engineers who have greater potential to become dynamic engineers in preference to the other two streams.

Reducing the demand through more efficient practices

With the notable exception of the 2007 CIDB report, what has not been explored is making civil engineering practice more efficient as a measure to reduce the perceived demand. The CIDB 2007 report suggested in this regard:

- the packaging of public sector projects into large multi-year contracts which require fewer skilled and experienced people within government to procure, manage and administer; and reducing the professional inputs in the design and supervision of the works, as well as the on-site management of the works through economies of scale; and

- standardisation of procurement documentation, designs, specifications, procurement, pricing, contracting and targeting strategies within particular infrastructure programmes, which would significantly reduce the internal and external professional inputs required to deliver projects.

Evidence in the health sector in South Africa has, for example, indicated that quality healthcare can be delivered in the face of severe staff shortages and in resource-limited contexts. Organisational routines and protocols which encourage coordinated efficiency and enable staff to understand their respective roles and responsibilities within an established system when underpinned by teamwork, job satisfaction, commitment to the job and a focus on communication and relationships have overcome such constraints (Watermeyer 2012). There is no reason why similar strategies cannot likewise enable the delivery of engineering works in the public sector in the face of staff shortages and other resource constraints.

Public sector strategies, in addition to those already identified by the CIDB, which have the potential to improve efficiencies and reduce the demand for professional inputs include:

1) Enter into long-term collaborative relationships, e.g. by entering into target cost or management framework contracts (Watermeyer and Thumbiran 2009; Watermeyer 2010).

2) Integrate design and construction in projects by either assigning more design responsibilities to contractors or engaging contractors earlier in projects (when not more than 25% of the design is complete) (Watermeyer 2010).

3) Adopt a comprehensive, uniform and systematic system for the delivery and scheduled maintenance of public infrastructure, such as that embodied in the CIDB and National Treasury IDM Toolkit (2010) (Infrastructure Delivery Management System) which:

   a) is capable of being documented and implemented in accordance with the requirements of ISO 9001 Quality management systems – requirements, and

   b) instil what Greenhalgh (2008) describes as routine (a repetitive, recognisable pattern of independent actions, involving multiple actors) which reduces uncertainty.

Accelerating the development of critical skills

A key question that needs to be asked, is how the current experience gap can be narrowed, i.e. what is the quickest way to convert scarce skills into critical skills, particularly in the public sector. The starting point is to identify what role government wishes to play in the delivery and maintenance of infrastructure. The NPC (2011) has indicated that government needs to assume responsibility for planning, and the management of the delivery and maintenance of infrastructure – it cannot outsource these responsibilities.

There is a dearth of documented civil planning practices and related technical literature that is aligned to the South African environment. Government has documented their Infrastructure Delivery Management System (CIDB and National Treasury 2011) and has only started to develop comprehensive guidance on the implementation of a range of alternative contracting strategies. The basic standards of materials and workmanship, SANS 1200 standardised specifications for civil engineering works, are geared for the traditional approaches to delivery and have in the main not been updated since the 1980s (Watermeyer et al 2012).

Government as client has in the past led the development of standards to serve their infrastructure needs. With the erosion of its technical capabilities, such standards have either not been updated for several years or have simply disappeared or are not included in procurement documentation. There is a particular need to document uniform standards for municipal services, preferably in the form of national standards in order to satisfy international trade obligations.

The South African Bureau of Standards (SABS) is, according to the Standards Act 2008, the peak organisation for standardisation. SABS currently has neither the technical leadership nor technical capabilities to update and develop the volume and nature of the standards that are required. The Act does, however, make provision for SABS to appoint Standards Development Organisations to develop South African national standards in accordance with specified criteria. Learned societies and industry associations need to become Standards Development Organisations, or to participate in these, in order to provide the necessary technical leadership and expertise to develop the much needed national standards.

ECSA currently registers engineers at the point of entry into the profession, based on academic qualifications and not on post-graduate qualifications. It does not register or recognise basic specialisations, such as geotechnical engineering, structural engineering and transportation engineering, let alone specialist skills relating to practice areas such as construction procurement, public sector delivery management, planning, etc. Learned societies and industry associations need to fill this vacuum and publish specialist lists, i.e. non-statutory voluntary listing of professionals who...
have met a defined standard of competence in a specialist area, typically administered by a professional or trade body. Such bodies will also need to train, mentor and develop their members’ skills to reach the required standard of competencies.

Strategies that need to be considered by learned societies and industry associations to accelerate the development of critical skills include the following:

- Produce civil engineering standards and tools to support practice, including South African national standards.
- Develop planning skills, tools, techniques, etc, which are capable of integrating with and being understood by other disciplines and decision-makers.
- Accredit and recognise specialist civil engineering skills, including those relating to planning, procurement and delivery management.
- Publish in communications with their constituents (e.g. in monthly magazines and newsletters and on websites) articles on professional guidance and technical aspects which would provide information on everyday matters affecting civil engineering practice.

CONCLUSIONS

The civil engineering profession plays a major role in the growth and development of a country’s economy. It is experiencing a shortage of engineering skills, the quantum of which is not known or well understood. There is no simple answer to the question of how many civil engineers are required to meet present and future demands. There are a number of factors which need to be considered when attempting to answer this question, including current levels of utilisation, the type and quality of engineering professionals that are required, the state of the economy, the demand for infrastructure, procurement strategies that are used to deliver infrastructure and the infrastructure delivery management system that is used by government to deliver and maintain infrastructure.

There is a need to broaden the range of strategies that have been employed to date to address the current shortage, particularly in the public sector. Demand-side strategies aimed at reducing the demand on the services of civil engineers also need to be considered, alongside those aimed at increasing the number of entrants to the profession (critical skills) and the retention of existing skills. Strategies also need to be put in place to accelerate the gain in experience in order to address the need for critical skills, to in turn address the mid-career deficit in skills.

REFERENCES


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Vela VKE Board: left to right: Viwe Qegu, Arthur Taute, Mathews Phosa, Dave Gertzen, Tom Marshall, George Munyai, Job Molongo, Motupi Malaka

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INTRODUCTION

In a skills- and knowledge-hungry world, where a veritable army of enthusiastic graduates and middle managers, all armed with a myopic focus on rapid promotion at the speed of thought, and who are jostling with increasing restlessness for position, whilst waiting impatiently beneath the wings of the remaining baby-boomer technical experts, Intentional Storytelling offers one of the most time-tested and effective means of sharing and transferring knowledge, experience and wisdom, while at the same time being a lot of fun for both the storyteller and the listeners (refer to Part 2 of this Knowledge Transfer series where we talked about the importance of fun being used to embed the learning process in our long-term memory). [See note at end of article. Ed]

Since the early development of written language by the more advanced cultures of our early human evolution, the ability, techniques and privilege of writing were usually bestowed only upon the spiritual leaders and royalty of the various nations, and almost everybody else had to rely on the ability to tell stories, or participate in various forms of either individual or participative narrative communication forums.

Indeed, whilst we are biologically referred to as Homo Sapiens as a species, we are sociologically referred to as Homo Narans – or storytelling people. Most indigenous cultures on the continent of Africa relied solely on this form of effective communication for several millennia, until written language was introduced by the various settlers from Europe. African cultures, however, remain rich in stories and there is a lot to be learnt from this tried and trusted form of passing on one’s cultural heritage to the next generation – instead of today’s unrealistic and failed reliance on technology systems and autocratic management practices only.

Storytelling provides us with the essential context and other important environmental or sociological conditions at the time, which are often lost in the stark and emotionless world of the written word.

So where does storytelling fit into the complex, technical world of civil engineering, and just what is Intentional Storytelling?

If we accept the simple definitions of “Knowledge is information in context” and “Wisdom is the key output of a significant event, where critical experience is gained for the first time, just after the moment that you actually first needed it,” then Intentional Storytelling is about an expert, or equally experienced technical person, engaging with a group of less experienced staff, in a structured narrative communication, with a view to transferring critical information in context, and thus ensuring the transfer of key knowledge and wisdom – the wisdom component being successfully introduced, as the listeners are now ‘armed’ to identify and avoid the recurrence of similar events and outcomes, due to being either ‘prepared for the early signals’ or empowered to know the appropriate evasive action to take – forewarned is forearmed in the high risk and complex world of civil engineering.

The following Intentional Storytelling methodology has been researched, developed and honed over nearly ten years of practical implementation by Mentoring 4 Success™, in order to provide mentors and experts with the ability to participate meaningfully in the preparation of our next generation of engineering leaders and technical managers.

INTENTIONAL STORYTELLING - THE METHODOLOGY

The key ingredients for effective Intentional Storytelling are:

■ Focus on the critical central message and don’t get side-tracked.
■ Keep to between seven and ten minutes – any longer and you are probably introducing various other messages – and keep focused.
■ Prepare well and use a checklist or model as below to ensure maximum effectiveness.
Use a central message – the main purpose and point of the story

Intentional Storytelling is not bed-time storytelling – it must not put people to sleep. Stories should be short, sharp and inspirational, with a very clearly articulated central message. Do not dilute the impact or effectiveness of the story by having multiple messages, and keep true to the message by avoiding wandering off or getting side-tracked.

Consider multiple learning styles – appeal to auditory, visual, sensory and kinaesthetic styles

The 100 billion neurons in our brains are all wired in different ways, and developmental psychologists have identified four primary learning styles, with many of us using a combination of styles, depending on how we have learned to adapt our own basic style, in order to cope with how we have been taught in the past. So, by combining some storytelling (auditory) with good pictures or graphics (visual) with some emotions (sensory) with some props or physical examples (kinaesthetic) will ensure that we engage with all the learning styles for maximum ‘brain-story’ wiring and retention.

Plan a logical story structure – use a well-planned start, middle and end

Keep your Intentional Storytelling impactful by planning a compelling opening message, followed by a well-structured and engaging middle content element and then a powerful closing, or ‘call to action’. Ideally, the start and end components should comprise 25% of the whole story and 75% should be reserved for the more detailed content in the middle.

Use metaphors and analogies – comparisons, strong associations and figures of speech

Anybody with a reasonable education will have been endowed with a plethora of metaphors, analogies, sayings, proverbs, allegories, parables and figures of speech over time and these are very powerful ‘learning hooks’ onto which we can hang new experiential learning. The brain has already developed a level of comfort and understanding with the associated imaginary symbolism created in our brains with these connections, and if we can make strong, tangible, cognitive connections to these metaphors and analogies, the brain can process the embedment and recall functions for any newly acquired knowledge with ease.

Ensure a connection to your listeners – engagement through constant involvement

In order to ensure a successful connection to your listeners, place subtle pressure on them to participate by regularly asking random individuals for their opinion, own experiences or some input. This keeps everyone engaged and ready to answer questions and thereby improves the embedding and learning process – listeners almost sub-consciously prepare themselves to answer your next question.

**Introduce a strong emotional connection – use personal style, tone, variable pitch, facial expression, targeted emphasis, body language and strategic silence to invoke the listeners’ emotions**

Long-term memories and effective memory recall are all functions of the brain which are enabled by the limbic system, or emotional brain. Therefore, the more emotional connections we can help the listener make during the Intentional Storytelling process, the stronger their memory of the story and their ability to recall the salient points and lessons from the story will be, long after the story has been told.

**Test your influence on the listeners’ thinking – regularly identify and magnify key ‘learnings’ through observation and questioning**

Intentional Storytelling is designed to significantly improve and influence your listeners’ thinking and quality of future decision-making. It is therefore essential to randomly select one or two listeners from time to time and ask them thought-provoking questions, such as, “What could or should we have done differently?” or “What can you start doing differently in future as a result of this story?” The storyteller must look for tangible shifts in behaviour and the way things will be done or improved in future, in order to validate that their story was successful.

In fact, this is one of the best ways to do a self-assessment to check your personal effectiveness and ability to share and transfer knowledge and wisdom as a new Intentional Storyteller.
The model discussed here will help you focus on the areas you need to improve.

**Focus on leading to action – get commitment from the listeners that appropriate action is required and will be taken**

Effective *Intentional Storytelling* by experts should always lead to some form of appropriate action, if only to undertake to record the story in the organisation’s knowledge repository for future accessibility, with the recording activities to be done by the listeners to improve embodiment.

There are various ways of recording and storing expert stories and knowledge, such as *Tacit Knowledge Discovery and Capture and Retrospective Analysis* (these will be covered in a future article). However, for the purpose of this article, the key to effectively gathering, packaging and storing knowledge and wisdom through stories, is to use a simple story-capturing model which combines purpose, text, visuals and summarised lessons, with key words and tags for searching and recovery purposes – and to avoid long, verbose policy and procedural amendments.

**Unpack the relative value concept – expose the ‘not so obvious’ consequences of the story for improved quality of strategic and critical thinking**

Most stories have a strong ‘cause and effect’ correlation or sequence, which can be played out by the experienced storyteller and which may not have been so obvious to the less experienced listeners. This may include potential financial loss, reputational risk, staff flight, competitor response or legal consequence to name a few, and it is a good idea to highlight these other considerations in order to build the strategic and critical thinking capability of your listeners.

**Key lessons learned – summarising the key lessons and knowledge gained from the story**

The *Intentional Storytelling* session should end with a powerfully facilitated review and consensus-based agreement on the ‘key lessons learned’ from the story. Ideally, the storyteller facilitates and guides the listeners to summarise between three and five key lessons learned from the story and to consolidate these lessons in some form of knowledge asset, which will be either communicated or captured and become accessible to ‘appropriate others’, via some form of organisational or functional knowledge repository.

**CONCLUSION**

*Intentional Storytelling* is at the core of strategic sustainability and competitive advantage, as it is a simple, but formalised and structured way for experts and experienced engineers to share and transfer critical knowledge and wisdom to less experienced staff, in such a way that they have the maximum capability of recalling the ‘key lessons required’ before the acid invoice of life’s expensive lessons is issued yet again.

**NOTE 1**

Intentional Storytelling is a registered process and copyright of Mentoring 4 Success™ (Pty) Ltd and forms part of the unique 12-part Mentors Toolkit™

**NOTE 2**


BMK Engineering Consultants, a multi-disciplinary civil engineering consulting company providing engineering solutions which stem from the advanced management and technical skills offered by each and every staff member. BMK is known for their service excellence and quality of work which is due to the continued communication between staff and client on every stage of the project cycle, to achieve optimal work success. BMK Engineering Consultants currently a Level 1 BBBEE company, and is proudly ISO 9001:2008 certified.

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www.bmkconsulting.co.za
King Shaka gets flood protection

A recently constructed concrete channel, lined with specially engineered Technicrete Armorflex erosion-protection blocks, is protecting KZN’s King Shaka International Airport from seasonal flooding by diverting stormwater away from the airport’s vulnerable eastern boundary.

ENGINEERING CHALLENGE

The engineering solution to the recurring flooding problem, which involved the construction of a 100 m long artificial watercourse, has also had a major environmental beneficial spin-off in that the nearby sand dunes are being protected from erosion by stormwater run-off, and vegetation growth is already beginning to hide the concrete floor of the channel.

Experts from Goba Civil Engineering Consultants, who were called in to study the flooding problem, had discovered that stormwater flowing from the catchment area of a rehabilitated borrow pit nearby was severely scouring and disfiguring the slope of a large sand dune.

“The plan was to create an integral structure of Armorflex blocks, tied together with steel wire and secured with steel anchor bars hammered into the dune face, and fixed at the top and bottom of the slope using concrete ground beams,” says the designer, Steve Pearse, associate director of Goba. “The channel would have to accommodate the flow of stormwater without slipping down the face of the dune.”

Varying between 6 m and 10 m in width, the channel is lined with two types of Armorflex concrete blocks, widely favoured as an environmentally sound solution to the most difficult erosion problems.

From the start, solving the problem proved a major engineering and logistical challenge. “The scoured-out dune channel was over 5.5 m deep in places, with steep slopes of over 50 degrees, which regularly threatened to collapse,” says WBHO (main contractor) site engineer Sandile Ndaba. “Uprooted trees had to be cleared away before building work could begin. Access to the site was possible only through cane fields, so large vehicles could not reach it, and all building materials had to be hauled over 1 km by small front-end loaders.”

FROM THE BOTTOM UP

“The final design called for a maximum side slope of 45 degrees and a maximum longitudinal slope of 40 degrees, which meant that building the Armorflex channel had to start from the lower end and move upwards,” says Pearse.

Concrete anchor ground beams were secured at both ends of the
channel construction. At the steepest sections of the channel, the Manta anchors were hydraulically hammered into the ground up to a depth of 6 m, and blocks locked into place. Spaced out at specific intervals on the channel surface, dissipation blocks were positioned to slow the velocity of the stormwater.

Solid Armorflex 205 concrete blocks form the base of the channel, absorbing the heaviest force of the stormwater run-off. The sloping ‘walls’ on each side of the channel are lined with lighter 180R blocks, which have slotted openings to encourage natural growth of plants and grasses. Eventually the channel will vanish under a carpet of natural green growth.

Frank Stahlhut, WBHO contracts manager on the project, reported, “It was the first time I had worked with Armorflex. In my view it’s a much better option than concrete or gabions in highly erodable material such as sand dunes, and it is already proving itself.”

In early March, not long after the completion of the channel, the area was hit by a cyclone, with more than 200 mm of rain falling in a few days. “The channel worked extremely well – just as it was designed to,” says Stahlhut.
Roofing and SANS 10400-XA:2011 pitching for greater energy-efficiency

AS FROM November this year roofing on South African buildings will have to be considerably more energy-efficient.

Building regulations have recently undergone major revision, the aim being to introduce much greater energy-efficiency into all construction materials and processes. It was an initiative driven by the Department of Trade and Industry (DTI) through the NRCS (National Regulator for Compulsory Specifications).

Roofing materials and systems constitute one of the areas covered by new energy-efficient regulations, SANS 10400-XA:2011, which are largely based on the voluntary energy-efficiency standard SANS 204:2011. Published by SABS in November last year, SANS 10400-XA:2011 becomes mandatory in November 2012.

The Concrete Manufacturers Association (CMA) says that at this stage the regulations apply to new buildings only, although this may change.

“It is not clear whether SANS 10400-XA:2011 will be applicable to subsidised housing as well, and we are waiting for the Minister of Human Settlements to make a statement to that effect. However, one thing is for certain and that is roofing is an area which offers great potential for substantial energy savings.”

SANS 10400-XA:2011 requires that, irrespective of material composition, roofs must be built to maintain thermal resistance (R) values of between 2,7 and 3,7 depending on the climatic region in which they are located. Thermal resistance is the measurement which determines how various materials, in this instance roofing materials, prevent internal temperatures from rising too fast and becoming excessively hot, or from dropping too quickly and becoming uncomfortably cold.

Roofs and roofing structures form just one element of a building’s total thermal resistance capacity. Others include masonry, flooring, windows/curtains and doors.

“What the new regulations mean for the construction industry and property developers is that most forms of roofing are going to need much better thermal resistance and this is likely to be achieved through the addition of various types of insulation material,” according to the CMA.

Table F.3 of SANS 204:2011 lists various materials and elements which make up the total thermal resistance of a roofing system. Thermal resistance is measured in m².k/w and is described as an R value.

“The CMA is concerned that the R value for concrete roof tiles quoted in SANS 204:2011 was only 0,02 compared to 0,00 for metal cladding. Although we assumed metal cladding had no thermal resistance, logic told us that the R value for concrete roof tiles must be greater than 0,02.”

In an attempt to prove this, the CMA commissioned the AAAMSA Group to compare the thermal performance of a metal-cladding roofing system to its concrete roof tile equivalent, using South Africa’s first ‘hot box’ apparatus, operated by TTL in Pretoria.

The tests were based on ‘Cathedral Ceiling’ roofing systems using 8 mm gypsum board. Temperature movement was upwards and outside wind velocity was 5,5 m/s.

The surface-to-surface R values yielded from the hot box tests were 0,2 for the metal cladding and 0,32 for the concrete roof tile. To get the actual R value of the roofing material, the 0,05 R value of the 8 mm gypsum and the 0,16 R value of the air space should be subtracted.
R value metal cladding
= 0.20 – 0.21 ≈ 0.00
R value concrete roof tile
= 0.32 – 0.21 ≈ 0.11
(5.5 times higher than the quoted 0.02)

Figure 1 isolates the various contributions to the thermal resistance in a basic metal-cladded roof on wooden beams with no ceiling (typical of government subsidy houses a few years back).

Just by adding a ceiling one achieves an increase in thermal efficiency, not only from the ceiling itself, but more importantly, from the air space between the metal cladding and the ceiling (see Figure 2).

The CMA has always stated that a ceiling is very important. Besides its aesthetic dimension, it improves thermal efficiency by a considerable margin. Adding concrete roof tiles simply makes the system that much better (see Figure 3).

According to the CMA it is the addition of a ceiling which enhances the thermal resistance of both materials considerably, i.e. from 0.24 to 0.34 depending on the direction of the temperature movement.

However, the CMA points out that when one goes to the expense of assembling additional rafters

---

**Figure 1: Metal cladding on beams - no ceiling**

<table>
<thead>
<tr>
<th>Component</th>
<th>Up</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor air film (7 m/s)</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Metal cladding</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Indoor air film (still air/horizontal)</td>
<td>0.11</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Total R value</strong></td>
<td>0.14</td>
<td>0.19</td>
</tr>
</tbody>
</table>

**Figure 2: Metal cladding on trusses with ceiling**

<table>
<thead>
<tr>
<th>Component</th>
<th>Up</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor air film (7 m/s)</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Metal cladding</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Roof air space (non-reflective)</td>
<td>0.18</td>
<td>0.28</td>
</tr>
<tr>
<td>Plasterboard (10 mm)</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Indoor air film (still air/horizontal)</td>
<td>0.11</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Total R value</strong></td>
<td>0.38</td>
<td>0.53</td>
</tr>
<tr>
<td><strong>Increase</strong></td>
<td>171%</td>
<td>179%</td>
</tr>
</tbody>
</table>

**Figure 3: Concrete roof tiles on trusses with ceiling**

<table>
<thead>
<tr>
<th>Component</th>
<th>Up</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor air film (7 m/s)</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Concrete roof tiles</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>Roof air space (non-reflective)</td>
<td>0.18</td>
<td>0.28</td>
</tr>
<tr>
<td>Plasterboard (10 mm)</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Indoor air film (still air/horizontal)</td>
<td>0.11</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Total R value</strong></td>
<td>0.49</td>
<td>0.64</td>
</tr>
<tr>
<td><strong>Increase</strong></td>
<td>250%</td>
<td>237%</td>
</tr>
<tr>
<td><strong>Additional increase</strong></td>
<td>29%</td>
<td>21%</td>
</tr>
</tbody>
</table>
for the inclusion of a ceiling, it makes sense to use concrete roof tiles rather than metal cladding.

“Concrete tiles cost no more than metal sheeting. Where metal roofs can save on capital outlay is in a lower roof-frame requirement when no ceiling is included. However, living under a metal roof with no ceiling is not much better than occupying an oven or a freezer, depending on external ambient temperatures.

“Besides providing greater thermal resistance than metal, concrete roof tiles offer other benefits, such as a very low maintenance requirement and better aesthetic properties. Furthermore, what SANS 204 and SANS 10400-XA have not taken into account at this stage is thermal mass, namely the capacity to store heat much like a battery stores power.

“The CMA is continuing its research in this area with the aim of proving that roof systems incorporating heavy roof claddings, such as concrete roof tiles, might require a lower total R value compared to lighter materials. A similar theory is used to differentiate between masonry walls and lightweight construction methods. Research is also being conducted as to what degree thermal mass adds to overall thermal efficiency, and once completed, is likely to prove that it makes a substantial contribution.”
The ecoLine_b unit separates the oil / petrochemical waste from the water which then accumulates on top of and in direct contact with the water awaiting removal by an oil recycler. This unit has a shut-off valve which will close the exit pipe if the separated oil in the tank reaches a specified maximum level. EcoLine_b has a residual contamination of free petroleum content of less than 5 mg/l.

All the basic elements of the ecoLine_b system can be accessed from ground level, which minimises confined requirements for routine cleaning and maintenance. The annual cost savings range from 30% to 50% lower than conventional separator systems.

ecoLine_b for light liquids

ecoLine_b is the most cost effective unit that is designed to separate non-emulsified light liquids or low-water soluble fluids with a specific gravity below 0.95, which includes gasoline, diesel, heating oils and other mineral oils from effluent discharge. The filter works on a two-step separation process, including gravity separation and coalescing media elements.

ecoSorp for oil adsorption
ecoSorp is a hydrocarbon adsorbing system designed to remove small amounts of light liquids from the effluent. This is the last element of a purification chain consisting of a grit chamber and ecoSep oil and water separator. ecoSorp removes small amounts of free, physically emulsified and dissolved oil by adsorption. The purified water can be directly discharged, as residual hydrocarbon concentrations are below 0.1 ppm.

ecoStop for petroleum spill control
ecoStop is a petroleum spill control system designed for any facility or site where the potential for a petroleum spill exists (gasoline and other fueling facilities, electrical transformers, generators, oil storage areas and transportation fueling systems). This system is installed in-line and downstream from any segregated petroleum containment drainage area. The ecoSep system comes standard with an ecoStop unit included.

ecoStop provides the safest, most cost-effective method to control spills, as it detects spills automatically, therefore eliminating human error, which is the most common failure in traditional spill control systems.

Today’s environmental legislation is very difficult to comply with, but according to Jennifer Webb, Operations Manager at Alltrap Engineering, “By using the ecoTechnic® range of products for specific applications, organisations will be able to save on costs and meet tomorrow’s standards today. The goal is to protect our clean water supply and get high efficiency oil and petrol/water separation that is also cost effective.”

Gravity grease separators for effluent

In addition to the oil and petrochemical separators, Rocla has also developed a full range of Gravity Grease Separators. Grease, part of the effluent from restaurant kitchens, is generally made up of larger, more buoyant particles than oil and petrol and can therefore be quite successfully separated using efficient Gravity Separation.

“Rocla is offering a full range of concrete tanks to suit every application,” says Justin Kretzmar, Rocla Sales Engineer. “Our Grease Separator is placed outside, below the ground where it is easily accessible for cleaning. Utilising the longer length of the circumference of a circle to increase inlet flow path distance, the Rocla separator offers superior separation to normal square or rectangular type products. Inlet and outlet components have been specifically designed to reduce flow velocities within the tank.”
SAPPMA AND IFPA DONATE BEND TESTING MACHINE FOR TRAINING

THE INSTALLATION and Fabrication Plastics Pipe Association (IFPA), and its parent body, the Southern African Plastic Pipe Manufacturers Association (SAPPMA), have recently made a bend testing machine available for training and testing purposes at the Plastics SA Head Office in Midrand.

Developed in Germany, bend testing is a quick and very effective way of determining the quality of fusion of butt welds. According to Jan Venter, CEO of SAPPMA, the bend testing machine is used for quality assurance of butt welds done by contractors, as well as those done during training sessions hosted by Plastics SA.

“We have identified that a huge need exists for experienced butt welders in the plastics industry,” Venter says, explaining that a well-engineered pipe system is dependent on good design, high pipe quality and minimum standards at the downstream end, which includes looking at the quality of fabricated fittings and pipeline installation. “SAPPMA realised what tremendous benefit it would unlock for the plastic pipe industry if we were to make a bend tester available that could practically test and judge the quality of butt welding on pipes manufactured from HDPE and PVC. Not only does Plastics SA offer practical, hands-on training on the bend tester for their students, but they also make an operator available should any of our members wish to perform their own tests,” Venter says.

The concept of a bend test for welds is simple: A narrow strip is cut from the welded joint, longitudinally with the pipe. This strip of material is prepared to a determined shape and finish. The finished sample is inserted in the machine and bent at a specified rate into a U-shape. No cracks should appear at the weld area during the process. The purpose is to make sure the plastic material of the two pipes are properly fused, and that the weld and the heat affected zone (HAZ) have appropriate mechanical properties. Usually, bend tests are designed so that the outer surface of the specimen is stretched to a ductility level that approximates the minimum percentage elongation required in a tensile test. When defects exist in materials strained to these limits, the material tears locally. When tearing exceeds a specific limit, the specimen fails.

“The plastic piping business is a strategic industry and hardware needs to be reliable for extended periods of time. Long-term product and installation quality is therefore fundamental. By making this investment into the future of the plastic pipe industry, we are confident that we will...
see a marked improvement in the quality of butt welds and therefore in pipe installations in general in the months to come.

DRIVING INNOVATION FOR THE MINING AND TAILINGS INDUSTRY

MARLEY INFRASTRUCTURE, who is dedicated to heading up the industry with quality pipe solutions, recently collaborated with Mocke Pipeline Construction to complete the longest known tailing pipeline for gold slurry in South Africa from the Ergo plant in Springs to Crown, passing through the Johannesburg area. This immense project, commissioned by Fraser Alexander and mining giant DRD Gold SA, involved the lining of a 500 mm diameter pipe, 50 km long, using Mocke’s revolutionary Sureline™ Technology – a first for Africa.

The complex Sureline™ Technology is a cost-effective and durable polyethylene (HDPE) internal lining process that folds the fully dimensional liner pipe into a C-shape by using a tucking device on site, which enables the liner pipe to be pulled through the steel pipe in lengths of up to 2 km per piece and sizes up to 1 200 mm in diameter. After the lining has been pulled through, the liner is reformatted to its original shape with air, forming a tight-fit liner to match the internal diameter of the host pipeline.

In Africa, Mocke’s Sureline is one of only two plastic liner technology companies that exist in the rehabilitation market. Sureline saves up to 50% on replacement costs of existing old pipelines and up to 90% on eliminating flanges on newly constructed pipelines.

For this project, Marley supplied superior, highly corrosion resistant HDPE lining worth R23 million. The company also provided daily interactive on-site support to help address unforeseen challenges, which was greatly appreciated by Mocke Construction, as voiced by Hein Mocke himself. This commitment to excellence enabled the two companies to complete the project in ten months, two months ahead of schedule, extending the lifespan of the pipeline in excess of 34 years, thereby surpassing the preferred lining solutions of the past.

This massive and ground-breaking project paved the way for the future of pumping slurries and rehabilitating underground pipelines in the mining industry.

INDUSTRY PRACTITIONERS JOIN FORCES TO FOSTER A SAFE WORKING ENVIRONMENT

BUILDSAFE SOUTH AFRICA, a home-grown safety initiative founded by Aveng Grinaker-LTA, Fluor, Sasol Technology, Murray & Roberts and Foster Wheeler, is making progress in its bid to improve safety in the construction industry through collaboration. The initiative, launched on 19 January 2012, has increased its signatory member companies to 33, while individuals registered with the website have risen to well over 500.

Speaking about the progress that has been made in entrenching a culture of safety, inaugural chairman Grahame McCaig says: “The response so far has been phenomenal and the diversity of our membership, which is representative of the industry as a whole, is most encouraging. Companies and individuals alike are beginning to recognise that sharing information aimed at improving safety on construction projects, is a social responsibility that should be embraced. Registering with the BuildSafe website is free and provides access to an invaluable HSE information portal.”

Through its website (www.buildsafe.co.za) the organisation provides a broad spectrum of material to its members, who are predominantly industry
managers and HSE professionals, as well as to general visitors to increase health, safety and welfare (HS&W) awareness and to promote incident and injury-free workplaces. BuildSafe has a simple mechanism – members submit HS&W information which, after checking to ensure technical compliance and alignment to industry best practice, is then uploaded to the BuildSafe website for general use, but also shared with those registered with the website through e-mail and social media channels. The benefit of registering with the website is regular access to safety information that can be used to highlight and prevent incidents from occurring, in addition to access to useful information for continuous learning and for the development of material for toolbox talks, awareness lectures and on-site training.

The not-for-profit organisation encourages its members to be proactive about safety and invites them to send in information (including pictures and documents), to ask questions and to send alerts to its e-mail address (info@buildsafe.co.za). Through such knowledge sharing, the industry will be enabled to reduce the number of incidents and positively influence awareness, thereby building a safety culture.

McCaig concludes that, “Safety is not only ethically ‘the right thing to do’. Businesswise it is ‘the smart thing to do’. Although there is no competitive advantage to be gained through safety, we must work together to raise the benchmark and ensure a safer, more productive work place. Safety is an investment – the returns will be delivered through improved bottom-line performance.”

OFF-THE-SHELF PRECAST CRCP SYSTEM DEVELOPED IN SA

THE SKYLINE GROUP has developed an innovative precast concrete road system based on proven Continuously Reinforced Concrete Pavement (CRCP) techniques. Benoni-based Skyline’s new Postten system, for which a patent is pending, involves an off-the-shelf cost-saving solution for concrete pavement construction, in which Postten slabs are transported to site and laid on a dry sub-base to form bi-directional ‘continuous’ roads.

Michael Kretzmann, managing director of Skyline, says Postten slab dimensions are within the standard guide for concrete floors – with the length not greater than 30 times the thickness, and the width less than 1.5 times the length – which prevents drying shrinkage. “To allow for transport to site with conventional transport vehicles, the slab length is set at 2.5 m and the width at the road lane width of 3.5 m. Some self-supporting reinforcing is provided to add rigidity and prevent cracks or fissures during transport.”

According to Kretzmann, Postten slabs with a 180 mm thickness should effectively provide 60 to 80 years of operational life. “Postten is a long-life system and will exceed the life expectancy of standard CRCP pavements, therefore all reinforcing and reinforcing mesh has a minimum of 50 mm concrete cover,” he adds.

The slabs feature hollow tubes and cones to accommodate torque rods, which are fastened and tightened together on site. The rods are not loaded into the slabs before placement to prevent the rods being bent in transport.

To enable adjacent slabs to butt up against each other and ‘pass’ the torque rods from slab to slab in both directions, female cones are cast in on all sides of the slab during precasting at the Skyline plant. The fastened torque rod connection provides a continuous and unbroken length of rebar in the longitudinal direction of the Postten CRCP. “This concealed locking of the reinforcing torque bars, and the post-tensioning into one continuous reinforced slab in both longitudinal and transverse directions, sets the Postten slab apart from other systems that are currently available. The concept also provides resistance to transverse cracks. Any number of parallel lanes can be added, using the
same securing system," Kretzmann says. "To accommodate road curves, only the length dimension of the Postten slabs would require alteration."

Colloidal cement grout is pumped under pressure in and around the torque rods and nuts to provide an effective imitation of on-site casting.

The moulds for Postten slabs are made from profile-cut 6 mm steel sides, resting on a 40 mm granite base to prevent warping and mechanical damage. The solid steel frame platform for the granite base and concrete can be mounted on a wheel chassis or lifted by fork lift after casting to a curing area. The concrete mix for the slabs was designed by Skyline according to W30 specifications.

Kretzmann says the Postten system provides the solution for current concrete road building problems, such as shrinkage, long on-site construction periods, and logistic limitations for laying down pavements in more than one location at a time. It also eliminates the need for specialised paving machine operation, duplication of effort to align both rebar and then the paver, specialised transport to move the pavers, and the joining of precast or in-situ slabs using dowels.

"There is also no need to control temperature and other site conditions during casting and curing; and the performance – as well as costs and overheads – can be predicted. With sufficient moulds, up to 150 m of pavement can be placed in an eight-hour shift. The slabs can also be overlaid with asphalt for high-traffic national roads.

"A Postten system with thinner slabs of say 150 mm would be ideal for factory or warehouse floors. For airport runways, hard-standing and parking areas, the thickness could be increased to 320 or 400 mm. Future development could include adding walls and service ducts to the slabs for human settlement housing – and such housing could even be moved."

Skyline intends making the Postten system available for national use through the allocation of manufacturing licences.

The development of the system is not Skyline’s first involvement in concrete roads. The Group manufactured over 55 000 concrete barriers for SANRAL’S Gauteng Freeway Improvement Project, as well as bridge parapets of various sizes, toll gantry blocks and special manholes for all the junction cables on the medians. Wing walls, light masts and 30 m high list mast bases (with all the ducting running through the centre of the base) were also provided.

KAYTECH CELEBRATES 40 YEARS IN BUSINESS - 27 OF THEM GREEN!

EVER WONDER WHAT happens to those plastic cool drink bottles you throw away in your rubbish bags? The answer is most likely to be right under your feet!

Kaytech has been providing bidim® (geotextiles) and other geosynthetic solutions to the southern African civil engineering industry since 1972. Initially importing the finished bidim product, the company began producing bidim locally in 1978 and within six years they introduced recycled PET (polyethylene terephthalate). In 2000 Kaytech announced that full production of bidim would be 100% recycled PET. So, the tonnage of recycled bidim produced over the last 27 years calculates to 672 million 2-litre cool drink bottles!

Kaytech converts ‘green’ PET pellets and flake into extruded fibre via a continuous-filament spun-bonding process, followed by needle-punching which gives the finished geotextile its structural integrity. Bidim is the only continuous-filament, spun-bonded, needle-punched geotextile on the market – and the only continuous filament geotextile to use recycled plastics in its manufacture, according to Kaytech production director, Chris Els.

Because Kaytech simply melts down the granulated bottles, crystallises the polymer and spins it directly into filaments, the good properties built into the raw materials are retained and the resultant filaments possess the strength and durability demanded by
Civil engineers. Over the past eleven years, Kaytech’s ISO 9001 registered production facility in Atlantis has extracted more than 18 million kg of high-grade polyester from discarded plastic cool drink bottles (equivalent to around 300 million 2-litre bottles). Converting this 100% recycled material into an eco-friendly polyester geotextile, makes A-grade bidim the natural choice for specialist base fabrics in technical textiles. It also meets the most stringent civil engineering and industrial specifications.

As market leaders in geosynthetic solutions and pioneers in geotextiles for 40 years, Kaytech is understandably proud of their ability to engineer innovative solutions that meet specific requirements. All the more so for finding increasing success in curbing production costs through recycling – for the greater benefit of Mother Earth!

NEW FREE PUBLICATIONS FROM THE C&CI

Concrete Roads: a sustainable solution
This new 26-page full-colour publication by the Cement & Concrete Institute (C&CI) is the third in a series of publications on the sustainable use of concrete.

Authored by Bryan Perrie, C&CI Managing Director and globally-respected authority on concrete pavements, the free publication covers the environmental, economic and social aspects of concrete pavements and draws on international experience to demonstrate that concrete pavements are a sustainable solution for South Africa.

Perrie says in the introduction: “Sustainable pavements make efficient use of natural resources and respect the environment during their entire life cycle: they improve transport facilities for the entire community, provide services to society in terms of mobility, safety and comfort by means of judicious choices regarding design, construction, maintenance and demolition.”

He believes that concrete pavements offer substantial benefits over the long term and, in economic terms, are often the most favourable solution when life-cycle costs are taken into account. “This is even more so when user costs are taken into account, as concrete requires minimal maintenance and results in less disruption to road users.”

Concrete pavements, furthermore, provide benefits such as reduced fuel consumption, pollution reduction, stormwater attenuation, local availability, recyclability, reduced heat island effect, reduction in street lighting requirements, labour-intensive construction, and improved skid resistance.

“Concrete pavements have a crucial role to play in the provision of new infrastructure in South Africa, as well as for the upgrading of existing pavement infrastructure. Concrete overlays and inlays provide an ideal solution for the upgrading of existing asphalt and un-surfaced pavements for all categories of traffic. The development of ultra-thin concrete pavements has added to the various types of concrete available to the road design engineer,” Perrie states.

Farm reservoirs
This publication is an updated, revised version of one of its most popular and durable publications.

First produced in 1984, the publication is a manual dealing with the use of concrete for water-retaining structures for irrigation, watering stock, farm dams, swimming pools, and household use. It has in the past 28 years been widely used as reference book by thousands of members of the rural community and owners of smallholdings in urban areas, as it enabled owners to build structures that would be serviceable for many years.

The 52-page A4-size publication deals with the construction of circular reservoirs with reinforced concrete walls, as well as those with walls of fired clay bricks, concrete masonry, and corrugated galvanised steel. Guidelines for reservoirs built with travelling moulds are included. Rectangular reservoirs and swimming pools, elliptical swimming pools, and drinking troughs are the topics of other chapters, while data for estimating the quantities of materials required is also provided.

Obtain free copies of both publications
011 315 0300
publications@cnci.org.za
info@cnci.org.za
www.cnci.org.za

DEADLINE APPROACHES FOR 2013 FULTON AWARDS NOMINATIONS

The Concrete Society of Southern Africa (CSSA) would like to remind interested parties of the deadline for nominations for the CSSA 2013 Fulton Awards – 31 August 2012.
These highly prestigious awards are presented every two years by the CSSA to honour excellence and innovation in the design and use of concrete. The Cement & Concrete Institute (C&CI) will again be the anchor sponsor of the awards, for which any project completed during 2011 - or substantially completed in 2012 - is eligible. John Sheath, CEO of CSSA, says there will be six categories for the 2013 Awards instead of the five that applied in 2011, and the categories have also been altered to include two new ones, namely Sustainable Concrete and Community Structure. The other four categories are as before – Civil Engineering Structure, Building Structure, Architectural Concrete and Innovative Construction.

The new Sustainable Concrete category covers projects that demonstrate the innovative application of concrete through the implementation of sustainable strategies during the design, construction and use phase. Community Structures are ones that have made a significant contribution to the formation of socially viable environments and the values of communities, with a high participation of stakeholders such as client, users, local communities, local authorities, non-governmental organisations and others.

Sheath says the 2011 Fulton Awards attracted a near record number of entries and the CSSA is hoping to equal, or improve on, the 31 submissions that competed for the top awards last year. Judging will be done by the presidents of the CSSA, the South African Institute of Architects (SAIA), and SAICE. “The judges’ questions have all been reviewed and amended to suit the slight changes in categories,” he stated.

The Blackburn Pedestrian Bridge across the N2 at Umhlanga near Durban - winner in the Civil Engineering category in the 2011 Fulton Awards

The 2013 Fulton Awards will be presented at a gala function at the Champagne Sports resort in the Drakensberg on Saturday 8 June 2013.

Nomination forms obtainable from:
CSSA Administrator
012 348 5305
admin@concretesociety.co.za
www.concretesociety.co.za

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For more information contact the TAL Technical Advice Centre on 0860 000 TAL(825), or email taltech@norcrossa.com

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Everything is negotiable except our quality and service!
Insist on Vitagrid products for your safety!
ON PAGE 8 of the September 2008 edition of Civil Engineering we published the following introduction to an article on the launch of the Gauteng Freeway Improvement Project (GFIP), a project of the South African National Roads Agency (SANRAL):

“Very visible, and extensive in its scope and scale, the GFIP is an exciting project that, once completed, should immediately and positively affect the lives of most people living and working in Johannesburg and Pretoria. Whereas other huge, award-winning projects often benefit only a few thousand people on a regular basis, the GFIP promises to contribute substantially to easing the daily lives of hundreds of thousands of motorists and passengers who currently spend many precious hours stuck in traffic. The official launch of the first phase of the GFIP happened on 24 June 2008 during a sod-turning ceremony at the Gilloolys Interchange, one of Gauteng’s busiest interchanges. Work had started before the launch already, but has since taken off in all earnest. Motorists have become used to lane restrictions, concrete barriers and mounds of soil along their various routes to work and back, and are watching with interest the activities of the many tipper trucks, graders, back-actors, water trucks and other construction vehicles at the side of the road or on the central reservation. ‘This is indeed the stuff that little boys (who become civil engineers!) dream of.’

Now, four years later we who live and work in Gauteng are driving on these 120 kilometres of vastly improved freeways – getting to work and back home in less time than was possible four years ago; and feeling decidedly safer on wider, well-lit roads. The successful completion of this massive project was made possible by the excellent work of a dedicated SANRAL team under the able leadership of CEO Nazir Alli.

Since its establishment in 1998, SANRAL has inherited approximately 16 000 km of road nationally. Under Nazir’s leadership this road network was expanded, operated and maintained to the highest standards. The SAICE Infrastructure Report Card for South Africa 2011 allocated a B grading (‘Fit for the Future’) for national roads. This grading places our national road network on par with the world’s best. The successes attributed to this network are testimony to Nazir’s strong leadership, technical competency and excellent business acumen.

It can be said that he is a visionary leader who propelled the transportation industry into the 21st century, while working in a complex environment. SANRAL is consequently recognised as a world leader in roads engineering, and has been mandated to provide a platform for foreign direct investment, primarily through concession contracts. It is also a known fact that many professional engineers have been trained and developed through Nazir and SANRAL.

SANRAL’s performance was acknowledged by government when the Roads Agency was requested to take ownership of a number of provincial roads, nationally. The intervention was required because SANRAL was seen as the only organisation that could successfully upgrade and maintain these roads.

SAICE lamented the recent (temporary) departure of such a dedicated and competent leader, who is also a Fellow of the Institution and a previous recipient of the SAICE Transportation Division Chairman’s Award for outstanding service to the transportation engineering profession.

We are greatly relieved that Nazir’s resignation has been withdrawn, as engineering-related organisations and infrastructure need to be managed by experienced engineering professionals. Nazir Alli is such a person. His comeback will ensure that the necessary continuity is retained at SANRAL at a very critical stage for roads projects throughout South Africa.
SAICE attends the FAEO General Assembly in Nairobi

INTRODUCTION AND BACKGROUND
SAICE, being the secretariat of the Africa Engineers Forum (AEF), was invited by the secretariat of the Federation of African Organisations of Engineers (FAOE) to their General Assembly (GA) in Nairobi, Kenya, which took place from 8 to 10 May 2012.

SAICE CEO, Manglin Pillay, and the chairperson of the SAICE International Panel, Kribbs Moodley, attended the GA as AEF and SAICE representatives respectively. The event offered them the opportunity to authenticate the activities of the AEF to the rest of Africa and other local and international organisations, and to present South Africa and the AEF’s interest in uniting African engineering organisations.

Historically, the FАОE represented Africa at the World Federation of Engineering Organisations (WFEO) with full voting rights. However, their member countries were limited to countries predominantly from West and East Africa. The AEF, whose signatory countries include predominantly countries in the Southern African Development Community (SADC), represented the southern African countries at the WFEO, but possessed “observer status” only. Therefore, unlike the FАОE, the AEF does not have voting powers at the WFEO.

The main focus of the GA in Nairobi was to establish a single body to represent African engineering organisations at the WFEO, the African Union (AU), and other relevant local and international bodies.

ATTENDEES
The GA was attended by presidents and executives from engineering organisations from various countries: Benin, Burkina Faso, Cameroon, Chad, Gambia, Ghana, Kenya, Nigeria, Malawi, South Africa, Senegal, Sierra Leone, Tanzania, Togo, Uganda and Zambia.

UNITED ENGINEERING BODY FOR AFRICA ESTABLISHED
During the GA the Constitution of the hitherto Federation of African Organisations of Engineers (FAOE) was amended. In full recognition of the legacy and good work of the FАОE and the Africa Engineers Forum (AEF), the GA unanimously agreed to establish a central united home for African engineering organisations, in solidarity and under the name Federation of African Engineering Organisations (FAEO).

CONSTITUTION FOR THE FAEO
The FAEO Constitution was discussed, debated and unanimously accepted and adopted in final draft format, and took effect from 8 May 2012. The accepted Constitution was the basis for conducting elections for representation in the Executive Committee of the FAEO.

CONCLUSIONS
The following conclusions were drawn from SAICE’s participation in the GA:
- SAICE’s participation was pivotal in the success of achieving a united engineering body. SAICE accepted that the AEF will now be known as the SAFEO. Similarly the other four regions have also adopted new names. The new name of the united body is the FAEO.
- The role of SAICE as secretariat to the AEF/SAFEO was officially accepted by the FAEO.
- The relationship between South Africa and other African countries was entrenched with a view to collaborate on mutually beneficial projects via individual countries, SAFEO, the other four regional bodies, or the FAEO.

Theo Jacobs
SAICE International Liaison Officer
theo@saice.org.za

ACCEPTANCE OF FIVE REGIONAL ENGINEERING BODIES
The new constitution recognises five regional bodies to work under the FAEO, representing Africa at the WFEO, the AU, and any other appropriate local or international organisation. The five regional bodies are:
- Central African Federation of Engineering Organisations (CAFEO)
- Eastern African Federation of Engineering Organisations (EAFEO)
- North African Federation of Engineering Organisations (NAFEO)
- Southern African Federation of Engineering Organisations (SAFEO)
- West African Federation of Engineering Organisations (WAFEO)
SAAE elects Executive Committee for 2012-2014 term

The South African Academy of Engineering (SAAE) recently elected the following ten members to its Executive Committee for the period 2012 to 2014:

- Mr Dawie Botha
- Dr Liesbeth Botha
- Mr Simphiwe Duma
- Mr Trueman Goba
- Prof Stephan Heyns
- Dr James Maina
- Mr Dempsey Naidoo
- Prof Cyril O’Connor
- Mr Bob Pullen
- Dr Mike Shand

From the Executive Committee the following people were chosen as President and Vice-Presidents for the 2012-2014 term:

- Bob Pullen: President
- Trueman Goba: Vice-President
- Dempsey Naidoo: Vice-President
- Dr Mike Shand: Vice-President

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General Manager - Projects/Heavy Lift Division

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SAICE Construction Award for 2012

The conditions for this award are as follows:

1. The SAICE Construction Award supersedes the Basil Read Award. The Award is for peer recognition and may consist of a Gold Medal and/or up to two Bronze Medals, which are presented annually to a member of the Institution who is employed in or associated with Civil Engineering Construction and who, in the opinion of the South African Institution of Civil Engineering (SAICE), Project Management and Construction Division (PMCD), has made an outstanding contribution or rendered significant service to Civil Engineering Construction, normally within the previous two years.

2. Nominations and motivations are invited annually from individual members, Branches or Divisions and are to be submitted in the first instance to the SAICE Project Management and Construction Division, which will pass its recommendation to the SAICE Executive Board for approval.

3. The PMCD will take into account the achievement of a candidate/s in one or more of the following fields when considering its recommendations:
   a. Direct control of an engineering construction unit which achieves an exceptionally high production, coupled with a concomitant reduction in cost.
   b. Development of engineering techniques which have made a major contribution to the efficiency of a significant part of the construction process, or engineering or management techniques which will significantly impact the construction process, e.g. reduction in cost, saving in time, improved ergonomics.
   c. Overcoming extreme physical obstacles encountered in the execution of construction work.
   d. Solving unexpected and difficult problems encountered on a construction project, including the development and implementation of imaginative and practical design solutions.
   e. Methods leading to significant simplification or improvement of construction organisation and planning.
   f. Contributions resulting in a significant improvement of the image of construction.
   g. Leadership or innovation in the implementation of socio-economic development, environmental applications or occupational health and safety regulations.
   h. Entrepreneurial leadership and/or management in the development of a construction unit or organisation.

This list of considerations is not exclusive and motivation for the Award need not be confined to these fields of endeavour.

4. In the event of no suitable candidate being proposed, the PMCD may withhold its recommendations in any one year. Bronze medals may be awarded in a year in which no Award for the Gold Medal is made.

SAICE Young Constructor’s Award for 2012

The conditions for this award are as follows:

1. The SAICE Young Constructor’s Award runs in parallel with the SAICE PMCD Construction Award. The Award, in the form of a commendation and prize, is presented annually to a young member/s (under 35 years) of the Institution who is employed in or associated with Civil Engineering Construction and who, in the opinion of the South African Institution of Civil Engineering (SAICE), Project Management and Construction Division (PMCD), has made a significant contribution or rendered innovative service to Civil Engineering Construction normally within the previous two years.

2. Nominations and motivations are invited annually from individual members, Branches or Divisions and are to be submitted in the first instance to the SAICE Project Management and Construction Division which will pass its recommendation to the SAICE Executive Board for approval.

3. The PMCD will take into account the achievement of a candidate/s in one or more of the following fields when considering its recommendations:
   a. Individual leadership/management of an engineering construction unit which achieves high production coupled with a concomitant reduction in cost.
   b. Innovation in the development and implementation of engineering techniques which have made a significant contribution to the efficiency of part of the construction process or engineering or management techniques.
   c. Overcoming physical obstacles or solving difficult problems encountered in the planning and execution of construction work.
   d. Contributions resulting in a significant improvement of the image of construction.
   e. Leadership or innovation in the implementation of socio-economic development, environmental applications or occupational health and safety regulations.
   f. Personal contribution towards the safety of co-workers.
   g. Significant contribution to the development of individuals or the organisation.
   h. Achieving peer-recognition internally or externally to their contribution in construction.

This list of considerations is not exclusive and motivation for the Award need not be confined to these fields of endeavour.

4. In the event of no suitable candidate being proposed, the PMCD may withhold its recommendations in any one year.

Submission Details for both Awards

Deadline 30 July 2012

Number Nominations need not be limited to one submission

Address Chairman, SAICE PMCD Division
Private Bag X200
Halfway House, 1685

E-Mail secretary@saicepmd.co.za
GOBA ENGINEERING

GOBA is an independent, progressive South African Consulting Engineering firm, which offers multidisciplinary services packaged to meet each client's project requirements. The organisation provides expertise in the fields of Transportation, Mining, Structures and Water.

At GOBA, we commit ourselves to working closely with clients, creating cost-effective and sustainable solutions and enabling the acquisition of new quality assets. The firm's track record in this regard is best reflected through awards that have been received over the years for technical and business excellence.

We believe in the pursuit of excellence in client service, employee welfare and career enhancement.

CREATING SUSTAINABLE SOLUTIONS  TOUCHING EVERYDAY LIVES
Clause 3.1.1 of the By-Laws reads as follows:

“Every candidate for election to the Council shall be a Corporate Member and shall be proposed by a Corporate Member and seconded by another Corporate Member.”

Nominees accepting nomination are required to sign opposite their names in the last column of the nomination form. Nomination for election to Council must be accompanied by a Curriculum Vitae of the nominee not exceeding 75 words. The CV will accompany the ballot form, and the format of the CV is described in Sections A and B. According to a 2004 Council resolution, candidates are requested to also submit a focus statement. Please see Section C in this regard.

Section A: Information concerning the nominee’s contribution to the Institution.
Section B: Information concerning nominee’s career, with special reference to civil engineering positions held, etc.
Section C: A brief statement of what the nominee intends to promote / achieve / stand for / introduce / contribute, or preferred area of interest.

Please Note: Nominations received without an attached CV will not be considered.

Closing date: 31 July 2012. Acceptable transmission formats - email, fax and ordinary mail. All nominations are treated with due respect of confidentiality.

If more than 10 nominees from Corporate Members are received, a ballot will have to be held. If a ballot is to be held, the closing date for the ballot will be 31 August 2012. Notice of the ballot will be sent out using two formats, i.e.
1. By e-mail to those Corporate Members whose electronic address appears on the SAICE database, and
2. By normal surface mail to those members who have not informed SAICE of an e-mail address.

In accordance with Clause 3.3 of the Constitution, the Council has elected Office Bearers for the Institution for 2013 as follows:

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
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<tbody>
<tr>
<td>President</td>
<td>Mr P Kleynhans</td>
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<tr>
<td>President-Elect</td>
<td>Mr S Mkhacane</td>
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<tr>
<td>Vice-President</td>
<td>Mr M Pautz</td>
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<tr>
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<td>Mr S Naicker</td>
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<tr>
<td>Vice-President</td>
<td>Mr T McKune</td>
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<tr>
<td>Vice-President</td>
<td>Dr C Herold</td>
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In terms of Clause 3.3.4 of the Constitution, the following are ipso facto members of the Council for the year 2013:

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
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<tbody>
<tr>
<td>The immediate Past President</td>
<td>Dr M van Veelen</td>
</tr>
<tr>
<td>The two most recent Past Presidents</td>
<td>Mr SN Makhetha, Mr AM Naidu</td>
</tr>
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</table>
### NOMINATION FORM 2013

#### 10 Corporate Members

<table>
<thead>
<tr>
<th>SURNAME</th>
<th>FIRST NAMES</th>
<th>PROPOSER</th>
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#### Under 36 Members

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Please fax, e-mail or post this form, plus the CV of the nominee, to SAICE National Office, for attention Memory Scheepers, by 31 July 2012

Fax: 011 805 5971 | e-Mail: memory@saice.org.za | Postal address: Private Bag X200, Halfway House, 1685
<table>
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<tr>
<th>Course Name</th>
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<th>Course Presenter</th>
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<td>GCC</td>
<td>2-3 August 2012</td>
<td>Midrand</td>
<td>SAICEcon10/00706/13</td>
<td>Theuns Eloff</td>
<td><a href="mailto:cheryl-lee@saice.org.za">cheryl-lee@saice.org.za</a></td>
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<td>Bridge Maintenance</td>
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<td>Pietermaritzburg</td>
<td>SAICErail09/00495/12</td>
<td>Ed Elton</td>
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<td><a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
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<td>Midrand</td>
<td>SAICEstr12/01066/15</td>
<td>Greg Parrott</td>
<td><a href="mailto:cheryl-lee@saice.org.za">cheryl-lee@saice.org.za</a></td>
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<td>Leadership and Management Principles &amp; Practice in Engineering</td>
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<td>Durban</td>
<td>SAIMechE-0543-02/15</td>
<td>David Ramsay</td>
<td><a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
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<td>29-30 August 2012</td>
<td>Midrand</td>
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Gerard Carè, an expert in finite element analysis and the principal developer of the Strand7 finite element program, will be visiting South Africa from 17 to 26 July to share his knowledge and experience, and to deliver training. With his background in computer science, pure mathematics and aeronautical engineering, Gerard has been the driving force behind the Strand7 software for almost 25 years. Gerard’s obsession with making engineering software easy and fun to use has been significant in the continuing success of Strand7.

Gerard will be discussing trends in finite element modelling and will be presenting the latest developments in Strand7 at the Plastics Federation Conference Centre on **17 July 2012** at 9h30 for 10h00. The presentation will include live modelling and analysis examples, background theory, and a discussion on some of the upcoming features in Strand7. **Anyone interested is welcome to attend.**

He will also be delivering a Strand7 training course from 18 to 26 July. The course will cover a range of modules from basic modelling and meshing and linear analysis, through to more complex topics such as nonlinear static and dynamic analysis, and specific processes for structural engineering modelling. The training will be hands-on, with a high-spec computer per participant. As there will be plenty of opportunity to ask questions and gain a better understanding of the underlying principles and theory of Finite Element Analysis, the course will be suitable for prospective users wishing to enter the field, and for existing users to expand their understanding and usage of the system.

For more details of the various events that Gerard will be addressing, contact Allyson Lawless: 011 476 4100 or allyson@ally.co.za
It’s confirmed

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