TRANSPORTATION ENGINEERING

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IN A FRAYED black-and-white photograph of the Standard 3 Class of 1960, of the rustic Umdhloti State Aided Indian Primary School, there are 33 pairs of hopeful fledgling eyes staring out of the picture. At a closer examination of the frame, a handsome face arrests my attention – the face of one named Cram, a countenance of innocence and deep contemplation, beyond his years. The child stands in the front row, in uninterrupted sight of the camera, wearing a short-sleeved white shirt, grey short pants and his feet bare.

A gift.

The community of Verulam, on Friday 7 September 2012, celebrated the life of the town’s last mayor (1991–1996), the Honourable Mr Cram Rambarun. At the funeral, the preacher proclaimed Cram Rambarun an Abner – ‘God’s light and warrior’ – saying that he epitomised illumination and presence, and that he was an erudite scholar, who used his politics to defend the rights of the poor, and who dined with ease and comfort in humble homes and mansions alike. The thousands of diverse people in attendance bore testimony to the eulogy.

I learned that the great man, in his early days, conceptualised a potable water supply project, raised the funds, sought the expertise of engineers, and provided a supply of borehole water to the poorest in the town. He did this on a voluntary basis. During his years as mayor, and being a son of the community, he quietly refused the stipend offered to him as councillor. He redirected the emolument into a fund that was used to build a world-class market that still serves Verulam today, some 20 years later.

SAICE is home to some 10 000 civil engineering practitioners, from all avenues of the built environment. Our membership includes heads of departments and lecturers of all universities and universities of technology that offer civil engineering. Our members work in the private sector, mainly in consulting and construction, and in parastatals including Eskom, Transnet, SANRAL, PRASA and others. Our members also emanate from the finance sector – banking, investment and insurance. Even though engineering and technical resources are in short supply in government, many of our members are from the public sector, from all tiers of government.

Herein lies an opportunity – a dominant and prevailing platform to influence the direction of a nation and to positively effect change where it is needed most. Have you considered this opportunity and your role as a civil engineer to leave a legacy? When was the last time you engaged with your local SAICE branch?

But, in keeping with the spirit of my salutation, I wish to direct my thoughts to the need for engineers at local government level, at the municipalities where service delivery meets the people, where corruption and malpractice is perceived to be at its most fierce. I have travelled across the length and breadth of South Africa talking to civil engineering practitioners, and I have heard the anthems of grievances our engineers have raised – poor procurement practices, anti-competitive behaviour, unprofessionalism in the municipality, and the lack of mentoring and training for young engineers in local government.

In place of complaining, and my sympathising with the squalid state of affairs, I propose we immerse ourselves in the solution and not the morass. Because engineering practitioners solve problems – like soldiers are trained for battle, civil engineers are trained to solve problems.

May I offer an alternative approach – how about the SAICE local branch, with the might of its membership behind the committee, together with the senior office bearers of SAICE, approaches local political leaders with a view to align our technical resources to assist the municipality solve its challenges. I have been approached by professionally registered SAICE members, keen to assist in making improvements at municipalities as full-time employees. They have offered to install their names on a database – we are contemplating such a database for the imminent future.

Engineers appear to have lost all recognition at government level – intellectuals reduced to scraping through scraps of unethical politics and debilitating bureaucracy. But doing nothing is not an option. If we wish to change the story of South Africa, and achieve plan 2030, your municipality and your community needs you.

Civil engineers are a gift to society – make yourself available to be unwrapped by your local community. Start etching your mark on society, the same etching that will be proclaimed at your eulogy when the trumpet sounds.

A gift

“I expect to pass through this world but once. Any good thing, therefore, that I can do or any kindness I can show to any fellow human being, let me do it now. Let me not defer nor neglect it, for I shall not pass this way again.”

Stephen Grellet
(Quaker Minister) 1773-1855
ON THE COVER
A typical 120 to 140 ton per hour COMAR batch plant. COMAR has been a leader in the design and manufacturing of asphalt plant and related equipment for the past 25 years. Having just been bought by B&E International, all bodes well for the next 25 years.
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ON 31 AUGUST 2012 COMAR Plant Design and Manufacturing celebrated its 25th birthday. This milestone was achieved after the vision that Fernando Correia had all those years ago when deciding to apply his vast experience to build his own business. Through all the years, up until his death in November 2009, he was ably supported by his wife Maria, and together they built a brand that has become well known and respected, not only in South and southern Africa, but almost across the entire continent. So strong was the company they had built that it could continue after his passing, and to this day COMAR not only designs and manufactures complete batch and continuous asphalt plants, but also any of the components that clients may require individually or otherwise. These include cold feed bins and systems, recycling facilities, emission control systems and hot storage facilities, any of which can be adapted for use in mobile or fixed facilities.

Outside of the plant and appurtenant equipment range COMAR also builds ancillary equipment, such as bitumen storage tanks, bitumen drum heating and decanting facilities, base course mixers, brooms, tank sprayers (distributors) and chip spreaders.

National Asphalt, one of COMAR’s biggest and oldest customers, recently approached the company to enquire about the possibilities of introducing up to 50% reclaimed asphalt (RA) using a mobile plant. This followed on the company’s extensive involvement with the Warm Mix trials in eThekwini, where up to 50% RA is introduced using COMAR technology on a fixed plant, and with indications that this would be happening further afield on a more regular basis. The result was that with COMAR’s current design capability and input from overseas experts, and National Asphalt’s in-house expertise, a conceptual design was produced which was then converted into a final design. National Asphalt then committed to a firm order for a 120 ton per hour mobile plant, capable of doing a minimum of 40% reclaimed asphalt. Shortly thereafter the need to upgrade their Vanderbijlpark plant to similar
specifications arose, this time, however, looking only at the heating and mixing drums, together with the 50% RA system.

According to Chris Stander, Director at National Asphalt, they are very excited and look forward to receiving the mobile plant sometime early next year, and the Vanderbijlpark upgrade perhaps even sooner than that. Stander explains: “The mobile plants that we have, serve us well and it was a relatively easy decision to go with COMAR after again looking at the main names out there in some detail. Our first mobile plant by COMAR was the result of us touring the USA and Europe many years ago and then asking Fernando to put together all the bits and pieces that we liked from the various manufacturers, but adapted to be suitable to our local conditions.” While Stander believes that the very high cost of the imported plants is the main drawback, he is also of the opinion that the extremely sophisticated technology used in the control systems is not always suited for our local conditions, and when that goes wrong one could be delayed seriously. He goes on to say that, with COMAR being “just around the corner”, spares and wearing parts are readily available and easily obtainable.

Maria Correia recently retired from COMAR, and at the same time sold the business to B&E International. Ownership of COMAR in fact changed on the very day of the company’s 25th anniversary celebrations. COMAR staff believe that the new owners will bring in new knowledge and support that would ensure that COMAR remains the leading designers and manufacturers of asphalt plants and ancillary equipment in southern Africa and the rest of the continent. According to Ken Basson, director responsible for the Plant & Engineering Division of B&E International, huge emphasis is being placed on research and development in general, but also on improving the environmental aspects of the COMAR plant designs to ensure absolute compliance with legislation. “What we have in COMAR is very exciting and we look forward to building and improving an already great company that will continue to deliver top quality asphalt equipment into the African market.”
THE ARTICLE “You can but you may not” in the feature “From the CEO’s Desk” (Civil Engineering, July 2012) is misleading and ill-informed in its references to the Engineering Council of South Africa (ECSA) and the registration of engineering practitioners. The response below by ECSA seeks to place the matter in its true perspective.

This article, reduced to its essentials, is about two issues: first, the conduct of persons who are registered with ECSA; and second, protecting the public interest against unregistered practitioners, described in the article as “fly-by-night practitioners”, implying that they are neither competent nor accountable for their work.

Regarding the first, there are two issues for already-registered persons: obligations relating to the Code of Conduct and “who may do what”. Regarding the CEO’s assertion that the ECSA Code of Conduct is not widely known or practised, and is a guideline and therefore not enforceable, the position is as follows: all applicants for registration sign a sworn undertaking to abide by all the provisions of the Engineering Profession Act, its Rules and, in particular, the Code of Professional Conduct. The Act is clear: failure to comply with the Code of Conduct is improper conduct. The not insignificant number of registered persons who face ECSA disciplinary investigation and tribunals for misconduct are always charged in terms of the Code. Two points are worthy of note: the Code is enforceable and ignorance of the Code is no defence. Each engineering practitioner should therefore internalise the Code of Conduct – a very accessible document.

Regarding “who may do what”, the first and most essential level of regulation is section 3(1)(b) of the Code: Registered Persons may not undertake or offer to undertake work of a nature for which their education, training and experience have not rendered them competent to perform. The education and professional competence at the level of registration are defined for each professional category. These standards differentiate the categories largely by the levels of underpinning knowledge, problem-solving and engineering activity. These competencies, for example, place the Professional Technologist in the middle ground as the applier of established technology to families of problems amenable to the technology. The Professional Engineer, by contrast is expected to be able to address problems and requirements that may be ill-defined, unfamiliar, require original analysis and not lie within standards and codes. On the other side, the Professional Technician’s competency is to apply established procedures, usually in support of wider engineering activity.

The CEO’s personal assertion that, as a civil engineer with experience in mining and municipal waste disposal, he is able to practise as an electrical engineer is erroneous belief. Such practice, without significant further education, training and experience in electrical engineering, is clearly actionable under the Code of Conduct. Similarly, a registered person signing off the work of an unregistered person without detailed insight and checking and assuming the responsibility for the work is clearly misconduct, and such cases have been effectively actioned.

The logical conclusion of the article is somewhat veiled. It suggests that we “rely on the codes of conduct ..., to keep the baddies at bay” without being clear on whether
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Vela VKE is a leading consultant in the African Transport sector, with a proven track record in delivering award-winning projects. Vela VKE works closely with clients to deliver innovative and sustainable projects, on time and within budget. Vela VKE’s services range from feasibility studies and detailed design to public private partnerships and construction supervision.

this is considered good or bad. It goes on to hint that more detailed regulation of those already registered, for example by requiring multiple registrations and further examinations, are needed. As the Code only applies to those already registered, so would the additional regulation. Evidence from ECSA’s disciplinary cases does not indicate that there is a significant problem with practitioners working outside their areas of competence, either discipline-wise or across categories. Rather, the majority of disciplinary cases reflect less than competent work in the person’s professed field. The disciplinary process is capable of handling a complaint about a registered person working in an area requiring greater competence. The question naturally arises: given that the disciplinary process is effective in the cases in which it has been invoked, what is the benefit of increased regulation of those who are already in the registration net? No such need has been demonstrated.

Consensus in the profession is that the greater problem is that of unregistered persons, who may not be adequately competent and who are not accountable for their actions in a way that a registered person would be. Where the “baddies” are those not registered, the intent of the Act, which was to make registration in any category a licence to practice at the category level, has not yet been achieved, despite the existence of a simple, proven method to determine whether a given piece of work must, in the interests of the public, be performed in a responsible capacity by someone registered with ECSA in a particular category.

The test is whether the work requires the competence of a registered person for technically and economically acceptable outcomes that are safe, healthy and environmentally sound. Inherent in this question is the risk associated with the work and its solution. The test comes down to the following questions: What are the risks associated with the work and the delivered product? What level of competence is required for effective mitigation of the risks? Is the determined level of competence at or above the level defined for any category of registration?

The test above is analogous to one that a registered person should always apply in contemplating taking on a particular assignment: What are the risks? Am I competent to produce a solution with the risks mitigated to an acceptable level?

Reverting to the Code of Conduct and the way the CEO’s article seeks to diminish it, engineering is a profession that requires significant technical and organisational ability, coupled with the attitudes and skills to ensure that the work brings benefits and minimises harm. This requires a truly professional approach, starting with self-regulation by every professional. The Code of Conduct supports this first level of regulation. This is backed up by a process for complaints, investigation and tribunals.

As engineering practitioners we take pride in our problem-solving ability. The first step is to solve the right problem, namely, to achieve compulsory registration for all work where the risks to the public require the competence of a registered engineering professional.

The CEO is correct that engineers must engage in a process to map the future. Such a process exists and is ongoing. It just needs clear engineering professional thinking.
IDENTITY CRISIS

Needless to say, civil engineering has been an aspect of life since the beginning of human existence. The earliest practice of civil engineering may have commenced between 4000 and 2000 BC when humans started to abandon their nomadic lifestyles, creating a need for the construction of shelter. For a long time there was no clear distinction between civil engineers, scientists, mathematicians, businessmen or even farmers. Still today the civil engineering industry extends its reach so broadly that we, as civil engineers, often find ourselves to be in an ‘identity crisis’. For me, this particular experience sparked as early as the years of studentship. I believe I speak for many when I describe the first ever-so-quaint enquiry from my campus roommate: “So you study civil engineering. What is that … like architecture?”

Architecture! Little did I know that I would eventually come to shudder at that question as a civil engineer one day! So I would nonchalantly continue to explain to my roommate how we are basically responsible for everything you see in the built environment. This would lead my roommate to start enquiring about roads and rails, and I would eventually find myself explaining about harbours and dams and water treatment and transit systems and so on and so forth. Just then my roommate’s face would start cringing in cynicism – probably to hide his confusion and doubt. “You seriously do all that?” he would ask suspiciously. “You tar roads and build dams …. hmm?”

The conversation would continue until I somehow found myself wondering the same thing as my roommate, a similar sensation as when one repeats the same word aloud so many times that it loses its meaning. I don’t blame my roommate, because in fact I was myself confused as to what it really meant to be a civil engineer. This raised a fundamental question in my mind – if I didn’t know what it meant to be a civil engineer, how could I have geared my mind during the early stages of professional development to align with what I would be doing eventually?

The civil engineering industry is immense and encompasses an expansive spectrum of skills and occupations. It extends its reach over each and every artisan, brick layer and skilled technician, through to every designer and contractor and all the managers during a project, all the way up to the top management level of some of the biggest enterprises in the world. Every one of them would be custodians of the legacy of civil engineering, each respectively in his/her own way. How then does one, as a young student (or even graduate), find and assert one’s niche within such a diverse environment?

STICKS AND STONES

Perhaps one can seek comfort by looking into the sticks and stones of definition itself – words – the fabric of meaning. Let’s regard the name ‘civil engineer’ and take it apart piece by piece. The word ‘engineer’ derives from a Latin word *ingenium* meaning ‘talent’ or ‘clever device’. This is indeed comforting, as it would imply a civil engineer to be probably somewhat intelligent or even ‘talented’ as etymology suggests! The realisation that this applies to all engineers would lead me to explore deeper into the origins of the name. The word ‘civil’ is a Latin derivative of the adjective *civilis* or the noun *civis* meaning ‘citizen’ or ‘people of the public’. Here, even with the least amount of information one can find some sense as to what it means to be a civil engineer, only regarding the simple sticks and stones, namely to be the ‘talent of the people’, an ‘engineer of the people’ – the so-called ‘People’s Engineer’.

Perhaps this may even provide a fundamental guideline to how we as civil engineers should perceive our environment, for one’s perception of the world dictates one’s actions towards the world. Civil engineers embody great power, figuratively and literally. We embody the potential to move mountains, to create access where there are obstacles, engage development where there is ruin, improve health where there is disease. Conversely, engineering activities are also able to cause the same or greater extent of harm as our very potential to relieve harm. Irrespective of the intentions, these activities can manifest themselves in so many forms, often completely inadvertently. To be the ‘People’s Engineer’ is the bond to humanity for the civil engineering profession, and
at the same time can prove to be the greatest trial for a civil engineer’s career.

As it goes: “Sticks and stones may break bones, but words will never hurt”, though I beg to differ from this age-old saying when it comes to civil engineering. Typically civil engineers are very mindful of the technical constitution – the ‘sticks and stones’ of our profession – but we often forget the significance of our human constitution – our ‘words’ – in a figurative sense. Despite the substantial technical power that civil engineers exemplify, one must never forget the soft side, the social side of civil engineering. Words can do just as much damage as the sticks and stones, because words can modify our perception of our environment, thus affecting the way we choose to act towards it. On the other hand, words can also be a source of great impetus. There is probably some truth in the saying: “The pen is mightier than the sword”, and this goes both for the positive and the negative sense. Being a ‘People’s Engineer’ transcends that of technical requirements and compels involvement on the social and ethical levels. As we have so often heard, the days are over where the civil engineer sits in a corner, in a back office somewhere, and makes theoretical calculations in segregation. The nature of our modern profession requires a high degree of involvement, engagement and social awareness. To be the ‘People’s Engineer’ not only means to be a front runner of the ‘sticks and stones’, but also to have directive command of the ‘words’.

**BUREAUCRATIC BS (BACK STAGE)**

We know too well how bureaucracy has a hand in the undertakings of civil engineering. Still, it is a substantial basis of empowerment to the industry. Political policies and initiatives often result in the difference between a first-world and a third-world environment. Civil engineers must often operate within the bureaucratic BS, having to work intimately before a political backdrop. Political drama may arguably be the most influential aspect driving civil engineering activities, potentially promoting the development of the nation and improving the lifestyles of the people. Considering the civil engineer’s close relationship with bureaucracy, all the more do we need to maintain sound public awareness within our profession. However, this attribute must be ever so cautiously handled. In the world of politics, more often than not, winning arguments takes priority over actually solving the problems at hand. Having one foot in politics, one can so easily slip into the realm of disillusionment, where winning arguments equals solving problems. This in itself is an important aspect to contemplate.

One must be cautious and understand that winning the argument does not always solve the problem. This trend is all too familiar; we have seen this being repeated over and over again on so many levels of governmental administration. As civil engineers, we are required to be good communicators, to be eloquent and even persuasive at times, but perhaps we should also put our hearts where they originally belonged, to be pure problem-solvers at the core.

**A CIVIL ATTITUDE**

Being a ‘People’s Engineer’ probably means many different things to different people, though I think most would agree that being this kind of engineer is easier said than done. However, it shouldn’t dampen our spirits to strive for such a pure ideal. Our industry expects us to be sound designers, efficient managers, competent contractors and finally experienced capable engineering professionals, along with a keen sense of people dynamics. This already seems a tall order, considering the prevalent skills shortage in our sectors, not to mention trying to do so amidst a potentially shark-infested industry, where only the strongest has the right of survival. This appears almost overwhelming, so in order to survive, many assume the position of the soldier in battle, rather than the benevolent and caring civilian. Nevertheless, as simplistic as it may sound, let us as civil engineers always strive to maintain a ‘civil’ attitude. Perhaps the journey to realizing the epitome of the ‘People’s Engineer’ can start with simply being civil to the people around us, that is, loving our neighbours. It is after all the civil and courteous sentiments that have kept the world going through all the ages of adversity; and there is no better embodiment of these sentiments than the Civil Engineer – the People’s Engineer.
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Facts and fiction about e-tolling

TOLLING HISTORY
Toll roads are at least 2 700 years old, as tolls had to be paid by travellers using the Susa–Babylon highway under the regime of Ashurbanipal, who reigned in the seventh century BC (Gilliet 1990). A 14th century example (though not for a road) is Castle Loevestein in the Netherlands, which was built at a strategic point where two rivers meet, and where tolls were charged on boats sailing along the river.

Many modern European roads were originally constructed as toll roads, in order to recoup the costs of construction. In 14th century England some of the most heavily used roads were repaired with money raised from tolls by ‘pavage’ grants.

In the 20th century, road tolls were introduced in Europe to finance the construction of motorway networks and specific road infrastructure such as bridges and tunnels. Italy was the first European country to apply the use of motorway tolls on a 50 km motorway section near Milan in 1924. Greece followed by making users pay for the network of motorways around and between its cities in 1927. Later, in the 1950s and 1960s, France, Spain and Portugal also started to build motorways, largely with the aid of concessions, allowing rapid development of this infrastructure without massive state debts. Since then, road tolls have been introduced in the majority of the European Union member states (Jordi 2008).

South Africa’s history of toll roads goes as far back as the 1700s, when the governor of the Cape Colony collected tolls to effect repairs to roads. Tolls were also levied on roads in the former provinces of Natal and the Orange Free State, up to the end of the 19th century. The modern toll road (with toll booths) was first established in 1983 in the Tsitsikamma (www.arrivealive.co.za).

The aim of a toll road, as described above, was the generation of (earmarked) funds to pay off and/or maintain the road. The idea is that the user pays. This is also the idea in the South African case, as was confirmed by the Treasury Director General, Lungisa Fuzile, at the Economist of the Year function earlier this year: “The principle of user pays had been upheld in relation to the SA National Roads Agency Limited.” (BusinessLIVE 13 April 2012)

MODERN TOLLING SYSTEMS
During the past two to three decades, tolling ideas have changed. On the one hand, governments and researchers are exploring ways to collect (earmarked) road building and maintenance funding in different ways. The collection of fuel levies is the most obvious choice for this. However, this is not possible in the South African context, and earmarking of these funds is not possible under the current status quo.

On the other hand, investigations are looking into the possibility of reducing congestion, vehicle kilometres, fuel consumption and air pollution through tolling or other fee systems. Systems, such as e-tolling and kilometre charges that vary in space and time are explored.

Internationally, there are two e-tolling systems that have been implemented successfully, i.e. the Congestion Charge Zone (CCZ) and the electronic pay lanes – often High Occupancy and Toll (HOT) lanes – applied to a broader network.
Examples of successful application of the CCZ are currently limited to a small number of cities and urban roads, and the notable schemes include the electronic road pricing in Singapore, the London congestion charge, the Stockholm congestion tax, and the Milan Area C (Small & Verhoeof 2007; Corriere della Sera Milano 2012).

Regarding network-wide applications, Jansen & Vanderschuren (1994) concluded that pay lanes or HOT lanes are more efficient than when a toll is applied to all lanes. The improvement of traffic flows needs to be the driver for the implementation of these systems. Network-wide systems that charge all lanes will not have a positive effect on traffic flows and are, therefore, not efficient. If the aim of these systems is to generate earmarked funds, then other tax schemes, such as a fuel levy, are deemed more efficient, as processes to collect these taxes are already in place in most countries around the world, and the implementation and maintenance of the road-based toll collection infrastructure is therefore an unnecessary cost.

Implementing pay lanes will provide the improved level of service required by paying customers, while non-paying customers will have an alternative on the congested lanes. The year 1995 marked the launch of the first actually implemented HOT lanes facility – the SR91 Express in Los Angeles. The project’s success garnered the attention of the US Congress and the Federal Highway Administration, which endorsed the concept of HOT lanes when it introduced the Value Pricing Pilot Program in 1998 under the Transportation Equity Act for the 21st Century. In 2006, the federal government reinforced its support for HOT lanes through the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), which has references specific to HOT lanes. Today, states across the US are implementing HOT lanes to help ease congestion and deliver affordable infrastructure (http://www.495expresslanes.com).

Besides e-tolling systems, such as the ones described, the introduction of a kilometre fee, using intelligent in-vehicle systems that track time and space, is the other option that is explored. During the peak periods, people would have to pay a higher fee than during the off-peak. The implementation of these systems is being explored, mainly in Europe.

**IMPLEMENTATION CHALLENGES**

Congestion charging in London was introduced on 17 February 2003 and is applied in the Central Business District (CBD) between 07:00 and 18:00 (Monday–Friday only). On the first day 190,000 vehicles moved into or within the zone during charging hours – a decrease of around 25% on normal traffic levels, partly due to it also being the half-term school holiday (BBC 2003a). Traffic levels rose again by 5% at the beginning of the second week, following the return to schools. Further reports indicated that, over the first month or so of operation, traffic was consistently down by at least 15% on pre-charge levels (BBC 2003b).

Although congestion levels decreased in the London CBD, extensions of the system have seen a less successful implementation. The Western Extension of the area has received a lot of (negative) attention in government debates and the press. After the introduction, the discussion continued, leading to the official removal of the Western Extension from the charging zone on 4 January 2011, while charging on the Western Extension effectively ended on 24 December 2010 (http://www.tfl.gov.uk/).

The Netherlands tried to introduce network-wide e-tolling systems on more than one occasion. In the mid-1990s, extensive research proved that none of the service providers were able to meet the government’s requirements. This, and the public pressure against the project, pushed the government into scrapping the initiative. More recently, plans to introduce an intelligent kilometre charge system were also abandoned. Belgium is planning to introduce a kilometre fee in 2013, first for freight vehicles and later for all other motorised traffic. Time will tell whether this will be successful, as the debates, discussion and mostly negative views about the congestion and kilometre charging in Belgium can currently still be witnessed in the press (the last article online was published three days before writing this article).

**SUCCESS STORIES**

As indicated, London, Stockholm, Milan and Singapore have implemented successful systems that have a CCZ approach. The US Department of Transport’s Research and Innovative Technology Administration (RITA) has concluded, based on European and Asian case studies, that simplicity in programme goals and strong championing of the programme by the government and, in particular by executive and legislative leadership, are critical to the successful implementation of road pricing initiatives (http://www.itsbenefits.its.dot.gov).

To guarantee successful implementation of road pricing, RITA has concluded that congestion pricing and public transportation convey mutual benefits – road pricing benefits public transportation by improving transit speeds and the reliability of transit service, increasing transit ridership, lowering costs for transit providers, and expanding the source of revenue that may be used for transit, while public transportation benefits road pricing by absorbing commuters who shift their travel from automobile to bus or rail (Federal Register 2006).

The above clearly indicates that there has been a shift in objectives related to toll roads – from the generation of earmarked funds for road building, upgrading and maintenance, to combating congestion.

Examples of the achievements made possible by managing these lanes, include:

- Reduction of the frequency of collisions caused when motorists encounter congested conditions, work zones, or incidents.
- Improved throughput and/or reduced emissions by achieving more uniform and stable traffic flow as demand approaches capacity. This uses the freeway more efficiently and retards or prevents the onset of congestion.
- Improved reliability of travel times for certain classes of travellers.
- Distribution of total delay in a more equitable manner, preserving some capacity for downstream segments.
- Increased efficiency of operation under reduced capacity conditions caused by incidents or maintenance operations.
- Diversion of some freeway traffic to alternative routes, or alternative departure times to better use corridor capacity, which reduces peak-period traffic demand on the freeway.
- Provision of a travel time incentive to high-occupancy vehicles.
- Extension of pavement life.
Furthermore, from a user’s perspective it appears that:
(http://www.495expresslanes.com)
■ Only 25% of toll-paying customers on SR-91 in Southern California are in the top income bracket.
■ Some 78% of lower-income motorists in San Diego support local HOT lanes.
■ Most HOT lane users on the SR-91 pay to use the lanes a few times a week when they need faster/more reliable travel time.

WHAT DOES THIS MEAN FOR SOUTH AFRICA?

Within South Africa the arguments for e-tolling have included the ‘user pays principle’ and earmarking funds for the repayment of capital investment in road building and maintenance, as well as the possible reduction of congestion and an improved level of service on the highways. As indicated in this article, these are two aims that require different systems.

The collection of earmarked funds is best done through existing tax schemes, such as a fuel levy. At this moment, Treasury does not allow earmarked collection of funds. The question is, does a view like this warrant the implementation of an expensive toll collection system that might worsen traffic conditions?

As investment in e-tolling has happened in Gauteng; the question is: can the system be amended to a tolling system that benefits traffic conditions? Based on the literature, it can be concluded that a pay lane or HOT lane approach, generally, provides better results, and that the system needs to be supported by a convenient and affordable public transport system. Rethinking the application of the e-tolling system, as well as the improvement and integration of public transport systems in the area, is in the view of the author a step towards more sustainable transport in the Gauteng province.

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To guarantee successful implementation of road pricing, RITA has concluded that congestion pricing and public transportation convey mutual benefits – road pricing benefits public transportation by improving transit speeds and the reliability of transit service, increasing transit ridership, lowering costs for transit providers, and expanding the source of revenue that may be used for transit, while public transportation benefits road pricing by absorbing commuters who shift their travel from automobile to bus or rail.
Imagine a city without cars. Imagine traffic-free precincts where people can move about freely and in complete safety without vehicles, noise or smells to disturb them. Is such a city possible? Yes – and here’s how.

**THE CURRENT PROBLEM**

Virtually every city in the world today has a major problem with congestion caused by the ever increasing volume of cars on the road. Congestion results in delay, cost, unpredictability, frustration, road rage, crashes and the need to build more roads. Cars, mostly carrying one person, weigh tons more than, and take up many times the space required by, their cargo.

In addition, massive volumes of fuel are consumed by cars which results in the further problems of air pollution, noise, environmental degradation, carbon gases contributing to global warming, consumption of dwindling oil resources and balance of payment costs.

For years and years the only alternative to private cars that has been hopelessly proposed is public transport, but even the most avid supporters of this option realise that it is not a complete solution, has many of the same problems as the above, has numerous limitations and will never entirely replace the car. For decades public transport has been prioritised, but the shift to private cars has continued unabated. Individual transport is demanded, public transport is supplied – this cannot ever solve the problem.

**THE SOLUTION**

The solution, however, is not to try to ban cars, but to eliminate the need for them. This can only be done if a viable alternative is available. That alternative is the pod.

A pod is an individual person mover – a covered chair on wheels that can be driven. The proposed pod will be small, light, quiet, slow, safe, fuel efficient and fun to drive.

For pods, along with pedestrians, cyclists and other slow-moving traffic to operate safely, precincts protected from all vehicles capable of exceeding 25 km/h would need to be created. These precincts are the residential, shopping and office suburbs that exist today. Within the precincts cars, trucks, buses and motorcycles would be banned and walkers, children and the elderly, cyclists and pods would freely roam the streets.

**WHAT IS A POD?**

A pod is transport on a human scale; small enough to fit through a doorway, drive into a lift or do a U-turn in a parking bay; light enough to travel all day on a car battery; slow enough to not endanger pedestrians and cyclists; safe enough that a child and the infirm can drive one; and cheap enough that anyone who can afford a monthly bus fare can buy one.

Pods can have all the comforts and convenience of a modern car – comfortable seats, protection from the elements, heating, air-conditioning, radio, music, GPS, sun roofs, glove-boxes, cold-drink holders and storage space for suitcases or groceries.

Pods will be able to be linked in trains, one behind the other, or in groups of any number, with the lead vehicle taking control when they are joined. They can be modified with flat beds to carry freight. They can be driven conventionally or by remote control from outside the vehicle.

Pods will also have communication, via built-in cell phones or by dedicated links to other pods in the train, so people can carry on a conversation while traveling, or parents can hear what children are getting up to.
Pods can be made of light materials such as fibre-glass or plastics, as the protection of a steel cocoon is not required. Pods will also be able to negotiate steep slopes (like golf carts). They could even be designed to climb stairs and ride on escalators.

The most likely form of propulsion will be electric motors. Pods will be extremely efficient on power, being light and slow. There will be no need for gears; golf cart technology (electric or liquid fuel) will enable quick acceleration and automatic braking. They could even be pedalled. Dependence on fossil fuels for personal transport will all but disappear, making pods amazingly environmentally friendly.

Electric pods can be recharged at night when electricity is available and cheap. Pods docked at charging points can negotiate special rates during night hours with power companies pleased to have consumers for their excess off-peak supply. This is an environmentally ideal solution, as power is generated 24 hours daily, and burnt off as heat when power demand is low. Power taken during peak periods can be charged at a premium, but there will be little need for pods to use peak power, as these electric vehicles will be able to be used almost continuously for up to eight hours without recharging, and will have an estimated range of around 50 km per charge.

**HOW WILL IT WORK?**

Pod precincts or protected zones would need to be identified. These will be existing residential, shopping, office and/or mixed suburbs defined by an outer perimeter of existing rail lines, freeways or major arterial roads. These precincts will typically be 1.5 to 4.0 km long and wide, which is the spacing of major arterial routes in most cities. Initially, gated communities or retirement villages would make ideal pod precincts.

Within the precinct, any vehicle capable of doing more than 25 km/h will eventually be banned. During the transition, cars, motor cycles, buses or heavy vehicles entering the precinct will have to be escorted by a pod, a bicycle or a pedestrian to ensure that they do not endanger pod and NMT (non-motorised transport) street users. This restriction could be accompanied by an increasing penalty charge for vehicle use to encourage precinct residents to convert. While the zones can be declared immediately, it is envisaged that a transition period to 100% pods and NMT of around ten years will be needed, which is the approximate life of a private car.

At the limited number of access points to each precinct, pod stations will need to be constructed. At the pod station, people and pods can cross to adjacent precincts or will load onto public transport, i.e. pod carriers which will carry them the longer distances between precincts. Pod carriers can be road or rail-based. Effectively, a pod carrier is a modified bus or train where you bring your own seat or use the seats provided.

At each pod station, there will be pod hire points for those users without their own pod transport.

Pod stations will have level loading platforms, as for bus rapid and rail transport, where the pods can be driven on and off the carrier with minimal delay. The pod carriers will also offer seating for pedestrians, cyclists and for pod users who do not wish to remain in their vehicle.

Pod carriers will have dedicated routes and can run at high speeds between stations. As cars disappear, there will be more than adequate road space for this. The stations will be at one to four kilometre intervals, depending on precinct access points.

For intercity travel, pod carriers can also be provided, but initially cars will continue to be allowed. Cars can be stored in parking lots at city boundaries, or escorted to and from precincts as described earlier. Intercity travel will, however, primarily be provided by pod carriers, or by buses, trains or aeroplanes, with pods hired at destinations.

**CONCLUSION**

There is indeed a solution to urban congestion and environmental pollution, which is practical, simple and cheap. Protected precincts for NMT and pods will revolutionise cities, making them clean, safe and desirable. The dependence on fossil fuels for individual transport and the major environmental problems caused by private cars will be eliminated. Private pods, safe cycling and walking, combined with public carriers for longer distances, will meet the growing demand of users for personal door to door transportation. Finally, the amount of land and tarmac required for transport will dramatically reduce.

Join the car-free revolution today!

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For years and the only alternative to private cars that has been hopefully proposed is public transport, but even the most avid supporters of this option realise that it is not a complete solution, has many of the same problems as private cars, has numerous limitations and will never entirely replace the car. For decades public transport has been prioritised, but the shift to private cars has continued unabated. Individual transport is demanded, public transport is supplied - this cannot ever solve the problem. The solution, however, is not to try to ban cars, but to eliminate the need for them. This can only be done if a viable alternative is available. That alternative is the pod
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Variable demand traffic modelling: introducing realities

BACKGROUND
In most urban areas the demand for road space has increased to a point where the traffic demand during peak periods far exceeds the available road capacity, or supply, resulting in congestion. The higher the levels of congestion, the longer it takes to reach one’s destination. This gets to the point where road users make certain decisions regarding their travel plans, such as to start their trips earlier or later to miss the peak periods, which results in peak spreading. Prior to the upgrading of the Gauteng freeways it was recorded that the peak period (this being the period where the freeways were running at their maximum capacity) was extending by 15 minutes every year.

Traffic and transport modelling in South Africa generally continues to use the standard trip assignment algorithms, and modellers attempt to mitigate the effects of congestion in their base models by modelling the ‘supply’ conditions through factoring the input trip generation rates or adjusting the trip matrices to ‘supply’ traffic counts. As a result the latent traffic demands are excluded from the base traffic models.

AIMS AND OBJECTIVES
The aim of this article is to examine the use of variable demand traffic modelling techniques with the objective of demonstrating how this approach can be used to introduce another element of reality into traffic modelling outputs. This is achieved by retaining the traffic demand in the model, with the outputs reflecting the effects of congestion and producing results that the road network can accommodate.

Based upon this examination, an approach to traffic modelling is proposed which, if approved by planning authorities, could lead the way to providing more comprehensive and reliable outputs for transport and infrastructure planning.

BACKGROUND ISSUES
Transport and traffic modelling is a tool used for the planning of roads and public transport systems, as it is used to predict traffic volumes and traffic patterns based on ‘what if’ scenarios. Models are developed at different levels of complexity, from macro-models, where one models traffic over relatively large areas, to micro-simulation models that animate traffic movements through a smaller part of the road network. They reflect a specific time of the day, usually an hour during the peak period.

Transport modelling has been used extensively in South Africa to test various road planning and development schemes. In undertaking the modelling, the generally accepted four-step model process is adopted, this being:
Trip generation – where land use data and trip generation data, e.g. that contained in the South African Trip Generation Rate Manual (SATGRM), is used to determine the quantum of trips generated by, and attracted to various development types.

Trip distribution – this being derived usually from information obtained from surveys and thereafter through the calibration of a trip distribution function.

Modal split – this being derived from undertaking generalised cost comparisons between private and public trip making, the availability of public transport supply and car ownership levels.

Trip assignment – determined through the model assignment algorithms, which ultimately assign the public transport passengers and private vehicles onto the modelled networks. During the development of the base year model, the assigned flows on the network are normally calibrated to reflect measured traffic volumes, thus ensuring that the base year model ‘robustly’ reflects current traffic flows during the modelled hour.

The problem with the above calibration process is that on congested road networks one is not modelling the actual traffic demand, but rather only the ‘supply’ demand which the road network can supply/accommodate. The difference between the actual and ‘supply’ demands is often referred to as the latent demand. The fact that the latent demand is ‘calibrated out’ of base year models is obviously problematic, since the modelled demands are being underestimated. This problem gets carried forward, in that models predicting the traffic demands in future years will inherit this shortcoming. The implications of excluding the latent demand can be extensive, say in under-estimating future urban freeway requirements.

### VARIABLE DEMAND MODELS

As congestion levels increase, trips take longer and the perceived ‘generalised’ cost of the trip increases. Standard models assign trip matrices onto the road network irrespective of these individual changes in travel cost. The variable demand model utilises the principle that there is an elasticity between travel cost during the modelled period and travel demand, i.e. as the perceived cost of a trip during the modelled
hour increases, individuals change their trip-making patterns, for example, by:
■ Travelling at an alternative time, outside the peak hour (modelled hour)
■ Embarking in ride-sharing schemes
■ Using an alternative mode of transport, i.e. using public transport

The elastic demand function can take a variety of forms, and different functions and function parameters would be different for various trip types (trip purpose) and vehicle types. It is not within the scope of this article to determine which function would be most applicable to South African conditions; however, these functions include the following:
■ Logit (incremental form)
■ Power law or constant elasticity
■ Exponential
■ Elastic exponential
■ Nested logit
■ Shared logit

The use of variable demand models is a requirement of the Highway Agency of the Department of Transport (UK). This was introduced in 2006 through the issuing of the Transport Analysis Guidance (TAG).

MODEL EVALUATION DESCRIPTION
To demonstrate the issues around current transport model assignment techniques, and in order to compare these results with those obtained from using variable demand assignments, a simple hypothetical situation was modelled. This network comprised a heavily trafficked arterial road, representing a congested road network, along which commercial developments take place. The results from this model, in terms of the volume/capacity (V/C) ratios and trip generation rates, demonstrate the different outputs attained from the two traffic modelling approaches.

Four scenarios are examined where traffic travels from the west on an arterial, either through to the east or to office parks on the eastern end of the road. Figure 1 depicts these scenarios. The demand trips to the office park are assumed to be based on the SATGRM, assuming a trip generation rate of 2.2 trips per 100 m² of Gross Leasable Area (GLA). The scenarios in more detail are as follows:
■ Scenario 1: A single carriageway two-lane road with a capacity of 1 800 vehicles per hour (in one direction), with a demand of 1 000 through trips and 1 000 trips to Office Park 1 during the peak hour.
■ Scenario 2: Scenario 1 but adding Office Park 2 with a peak hour demand of 500 trips.
■ Scenario 3: Scenario 2 but with Office Park 2 having a peak hour demand of 2 000 trips.
■ Scenario 4: Scenario 3 but with an improved road with a one-way capacity of 3 600 vehicles per hour.

The standard models assume current modelling practices and the variable demand models use the power law form of the variable demand function, which takes the form:

\[ T_i = T_{ij}(c/c_0)^p \]

Where:
\[ T = \text{the number of trips travelling between an origin } i \text{ and destination } j \]
\[ T_{ij} = \text{the number of demand trips assuming demand conditions} \]
\[ c = \text{the perceived cost of travel assuming free-flow conditions} \]
\[ c_0 = \text{the perceived cost of travel} \]
\[ p = \text{a user defined constant} \]

In order to determine \( p \), it was assumed that, should the perceived cost of travel between the origin \( i \) and destination \( j \) increase by 50%, actual demand would reduce by 20% during the modelled hour, i.e. as a result of a change in the time of travel or a suppression of trips by way of ride-sharing or a change in mode.

Using the power law formula, the relationship between the increase in perceived travel cost and the reduction in the trip demand during the modelled period is shown in Figure 2.

TABLE 1 Model results

<table>
<thead>
<tr>
<th>Model type</th>
<th>Scenario</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>2000</td>
<td>2500</td>
<td>4000</td>
<td>4000</td>
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<td></td>
<td>V/C ratio</td>
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<td>1.39</td>
<td>2.22</td>
<td>1.11</td>
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<td></td>
<td>Trips past the office developments</td>
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<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>Trips to Office Park 1</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>Trips to Office Park 2</td>
<td>500</td>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trip generation rate to Office Park 1</td>
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<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
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<tr>
<td></td>
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<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
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<td>Trips assigned</td>
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<td>2004</td>
<td>2880</td>
<td>3443</td>
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<tr>
<td></td>
<td>V/C ratio</td>
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<td>1.11</td>
<td>1.60</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
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<td>720</td>
<td>866</td>
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<tr>
<td></td>
<td>Trips to Office Park 1</td>
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<tr>
<td></td>
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<td>402</td>
<td>1438</td>
<td>1713</td>
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<tr>
<td></td>
<td>Trip generation rate to Office Park 1</td>
<td>1.89</td>
<td>1.76</td>
<td>1.59</td>
<td>1.90</td>
</tr>
<tr>
<td></td>
<td>Trip generation rate to Office Park 2</td>
<td>1.77</td>
<td>1.58</td>
<td></td>
<td>1.88</td>
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</tbody>
</table>

DISCUSSION OF RESULTS
The demand model results are as one would expect, in that the traffic that is assigned to the road network ‘manages’ to arrive at their destinations during the modelled hour. In the case of Scenarios 2 and 3, this results in V/C
The variable demand model results provide an indication of the demand for alternative modes of transport during the modelled hour.

The upgrading of the road reduces the V/C ratio of the road to the same level as Scenario 1, as expected. The variable demand model results provide a more realistic outcome in terms of predicted traffic volumes. These results highlight the following:

- The maximum V/C ratio in Scenario 3 reduces from 2.22 to 1.60, which still provides the indication that the road requires upgrading.
- Traffic to the three destinations (the end of the road and the office parks) must share the available road space and hence the ‘supply’ traffic flows for each destination reduce.
- The variable demand trip generation rates to the office parks reduce due to the need to share the available road capacity.
- Increasing the road capacity allows more traffic to access the office parks during the modelled hour, hence the trip generation rate increases.

Further to the above, the difference between the trips assigned in the standard model and the variable demand model provides an indication of the demand for alternative modes of transport during the modelled period.

The variable demand model results negate the trend whereby modellers use observed entry/exit traffic counts at similar developments in the area as the trip generation rates for their traffic impact studies. This practice means that the input trip generation rates for proposed developments are reduced to the ‘supply’ trip generation rates based on the limited capacity of the surrounding road network. Adding this to a model that has been calibrated to ‘supply’ traffic counts removes any latent demand from the model. As a result no reasonable results would be obtained by increasing road capacity in the area which, as demonstrated using the variable demand model, would increase trip generation rates and the amount of traffic travelling through the modelled area.

**CONCLUSIONS**

The comparison of fixed demand versus variable demand traffic modelling, albeit using a simple example, and noting the problems associated with trying to produce a supply model using a fixed demand model, reveals a number of issues, these being:

- True demand models will overestimate traffic flows on the road network.
- Calibrating a fixed demand model to ‘supply’ traffic counts and using measured trip generation rates from developments with congested access roads completely remove any latent demand from the traffic model. As a result, the traffic projections on any major road upgrades will be underestimated.
- Using variable demand assignment algorithms enables the modeller to use SATGRM rates for the proposed development and retain latent demand from congested upstream conditions. Such latent traffic demand would be ‘released’ onto the road network in the event of road network capacity.
- The model used for this demonstration is simplistic, but the theory demonstrated does apply to much larger models, including models comprising large congested networks.
- The demonstration model used one of the available variable demand functions calibrated to an assumed relationship between the increase in cost and reduction in demand. This function may not necessarily be the most appropriate for local (South African) conditions and hence further research in this regard is required.
- Using the variable demand modelling process, and results from these models, the design of accesses to developments would be more appropriate as they would be in line with the traffic volumes that can physically get to them as opposed to being over-designed.
- The properties of variable demand models can be used to provide a compromise between authorities and developers in the determination of trip generation rates for proposed developments.
- The results presented here show the benefits of variable demand models in that they assign actual demand trip matrices and produce assignments that are closer to the supply capacity of the road network. On-going research is being undertaken to determine the most appropriate variable demand function that should be adopted to represent South African conditions.

**RECOMMENDATIONS**

Variable demand models retain latent traffic demand in the input trip matrices and are able to assign this latent demand in the evaluation of road improvement schemes. Road schemes that improve traffic distribution, as opposed to merely shifting traffic problems or providing road capacity that cannot be accessed, will be highlighted. It is therefore recommended that planning authorities pursue the use of variable demand model algorithms in the prioritisation of road infrastructure schemes.

Due to the potential benefits of using variable demand modelling techniques, it is recommended that the South African transport authorities consider specifying the use of variable demand models in large traffic impact assessments where proposed developments generate over say 1 000 vehicle trips per hour. In regard to the debate between developers and authorities with respect to trip generation rates and road construction requirements, it is suggested that:

- Developers pay bulk contributions based on the number of trips calculated using the SATGM for the future upgrading of the road network.
- Development access upgrades are based on supply traffic volumes, preventing the need to build unnecessary infrastructure that traffic would not fully utilise due to congested upstream conditions.
- Bulk contributions be used for road upgrades, which include the upgrading of intersections when sufficient funding has been collected.

In order to promote the use of variable demand modelling, it is recommended that South African authorities promote further research into the use of variable demand modelling algorithms, the appropriate functions that should be used and the calibrating of these to local conditions.

**REFERENCES**

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INTRODUCTION
Independent of the physical infrastructure and vehicle type, the provision of information has been identified as an important element that provides, or improves, customer satisfaction (Mitretek Systems 2001). Internationally, the trend is to provide real-time information through the implementation of Advanced Traveller Information Systems (ATIS). This article provides a summary of the ATIS system for the Jammie Shuttle service at the University of Cape Town (UCT). The idea behind the implementation of this system is to act as a demonstration project for other public transport systems in South Africa and beyond.

BACKGROUND
Mobility patterns of South African inhabitants are dependent on the level of income. While most of the urban rich are car owners, the urban poor depend on public transport. Moreover, a fair share of the population cannot afford any type of transport (Vanderschuren 2006).

The National Household Travel Survey 2003 (NHTS: DoT 2005), indicates that 40% of work trips are by public transport, while 23% of work trips are on foot. Given that the car only accounts for 32% of work trips, it is clear that public transport plays a very important role in the South African context.

The NHTS (DoT 2005) indicates that 47% of the population live within 15 minutes’ walking distance from a bus stop, while close to 37.7% claim to have no access to a bus stop in their vicinity. However, less than 6% of the population use buses to
gain access to facilities, such as shops, welfare services, medical services, post offices, etc. This is in contrast to minibus-taxis, which are the second most commonly used mode of transport to access facilities.

For more than a decade now South African transport policy documents have been focused on providing mobility for all. The White Paper on National Transport Policy (NDOT 1996) indicates in its vision statement to ‘provide safe, reliable, effective, efficient, and fully integrated transport operations and infrastructure, which will best meet the needs of freight and passenger customers at improved levels of service’. Government has also identified that the provision of public transport plays a crucial role in working towards this vision.

Besides the improvement of the physical infrastructure and vehicles, the provision of information has been identified as an important element that provides, or improves, customer satisfaction (Mitretex Systems 2001). Internationally the trend is to provide electronically displayed and up-to-the-minute public transport vehicle arrival information, i.e. real-time information, through the implementation of Advanced Traveller Information Systems (ATIS). The level of public transport related information provision in Africa is low, to say the least. In order to change the image of public transport, operators could start to provide real-time information. The system implemented on the Jammie Shuttle (the public transport system of the University of Cape Town), demonstrates the real-time traveller information system opportunities in the hope that other South African public transport providers will follow.

**IMPROVING CUSTOMER SATISFACTION**

Satisfaction measures obtained from citizens are frequently used in performance-based contracts, due to their presumed link with company performance. However, few studies have actually examined the link between traveller satisfaction measures and objective performance measures in public transport (Friman & Fellesson 2009). The ones that have, have found that an increase in supply (qualitatively or quantitatively) will not automatically lead to a corresponding increase in demand and satisfaction (Fujii & Kitamura 2003, Mackett & Edwards 1998).

The European Committee for Standardisation (2002) has adopted a comprehensive framework for analysing both functional and technical quality determinants in urban public transport. This framework also serves as a common European reference to identify quality elements in public transport. In this framework, urban public transport attributes have been classified into eight categories, i.e. availability, accessibility, information, time, customer care, comfort, security and environment (CEN 2002). The provision of accurate information, at various points before and during the trip, appears to be of the essence.

Transit agencies of all sizes, and even smaller agencies, are utilising real-time traveller information to increase overall customer satisfaction. In 2007, 94 transit agencies responded to a questionnaire carried out by the US DOT Research and Innovative Technology Administration (RITA). It appeared that, at the time, 61% of all fixed-route buses were equipped with Automated Vehicle Location (AVL) systems and that 27% provided real-time information. For all other transit modes the penetration was less, i.e. heavy or rapid rail has 19% of its vehicles equipped with AVL and provides real-time information in only 4% of the cases; light rail has 34% AVL and 20% real-time information; almost 50% of demand-responsive vehicles have AVL, while real-time information is only provided in 2% of the cases; 29% of commuter rail vehicles have AVL and in only 8% of the cases real-time information is provided; and, last but not least, 63% of ferry boats use AVL and no real-time information is provided by these operators (FHWA 2010).

**ADVANCED TRAVELLER INFORMATION SYSTEM**

International experience (FHWA 2010) clearly indicates that the provision of real-time passenger information plays an essential role in improvement of customer satisfaction. Travellers can be provided with real-time information by a web-based platform (terminals-internet information), via a Variable Message Sign (VMS) or TV, and via SMS services. However, the real-time information service needs to be aligned to traveller needs in order to increase the passenger demand and/or satisfaction. Moreover, only if the quality of the information is (very) good, will customer satisfaction, and possible passenger demand, increase.

The OneBusAway (OBA) transit traveller information system has existed as a service for transit riders since the summer of 2008 (http://onebusaway.org). The current primary use of OneBusAway is to provide real-time next bus countdown information for riders of King County Metro (KCM) in greater Seattle (Ferris et al 2009). The results of an evaluation study by Watkins (Watkins et al 2011) indicate that OBA users show increased satisfaction with public transportation, as well as having a perception of decreased waiting time. It was not found to significantly increase trip frequency of travellers, nor was it found to reduce waiting anxiety or the perception of on-time performance. However, an overall transit ridership increase was witnessed, which can be translated to improved customer satisfaction.

OneBusAway uses the underlying data feed from KCM’s AVL system and the prediction algorithms developed by Dailey and his team from the Electrical Engineering Department at the University of Washington (Maclean & Dailey 2002). The Jammie Shuttle traveller real-time information system also uses AVL, and an algorithm that was developed locally.

**ATIS IMPLEMENTATION ON THE JAMMIE SHUTTLE SERVICE**

The Jammie Shuttle system was the first recapitalised public transport system in South Africa. Before 2005, although there was a contract with a service provider, minibus-taxi type services were provided on the campus of the University of Cape Town, and the drivers behaved in the same way as the para-transit vehicles do in the rest of the country. The vehicles were often overloaded, unsafe and there was a general disregard for the law.

Since 2005, the services have become more formalised, permits were issued, drivers wear uniforms, the vehicles have a standardised colour and timetables were introduced. The daily trip rate during the semesters has increased from 16 000 person trips in 2005 to over 42 000 person trips in 2011.
Together with the improved services on the ground, the development of an Advanced Management Systems (AMS) started to improve the system management and monitoring possibilities. The AMS includes vehicle tracking, vehicle maintenance, scheduling, reporting, driver feedback and an ATIS system.

The implementation of an improved Jammie Shuttle service came with a steep price tag. It was, therefore, of utmost importance to monitor that the expenses were warranted. The service provider, as stipulated in the contract, was required to provide up-to-date monitoring information regarding the vehicles, driver behaviour and the passenger numbers. However, it quickly became clear that the service provider was not able to provide the required detail. That was when the development of an improved management system started. Further development and improvements have happened ever since. The rollout of the ATIS finally commenced in 2011 and is still under development.

The focus of this article is the ATIS system. This system has a couple of facets which each has its own function and provides an important element to the success of the ATIS system. The facets are the following:

- Each vehicle operator is issued an Identification-Key (iButton) for each driver.
- The vehicle tracker is a device fitted with GPS.
- GPS and iButton information is communicated via GSM network to the server.
- The server stores and calculates information.
- The server provides information to various systems:
  - Web information system
  - Mobile phone information system (request via stop + route number)
  - Stop information system
  - TV information system
- The future aim is to include all public transport services on the web and mobile phone services.

Figure 1 provides an overview of the components of the system. In 2011 one shuttle stop was equipped with two VMSs, providing real-time traveller information from every approach to the stop. Moreover, six TVs were mounted in various buildings on the upper campus, while one TV will be tested outside, under an overhang of a building.

In 2012 the plan is to mount a TV in a local shopping centre to expose the general public to the Jammie Shuttle ATIS. One large VMS is also planned for Tugwell, the busiest Jammie Shuttle stop.

PRELIMINARY FINDINGS

Public transport systems in South Africa, generally, have a bad reputation. South Africa is currently working on the implementation of new, improved public transport systems (Bus Rapid Transport). The implementation of ATIS systems could be one of the building blocks of improved public transport.

During the pre-survey that was conducted on the UCT campus, students, staff and third parties (service providers) were interviewed. Besides the collection of valuable data needed for the design of the main survey, the opinions of users were gathered regarding the implementation of a Jammie Shuttle ATIS system. It appeared that Jammie Shuttle users are very positive and excited about the planned system.
Based on the literature review and the fact that ATIS systems are not available for bus services in South Africa yet, it was concluded that a survey is needed. As mentioned, the pre-survey was carried out in 2011. The author hopes to be able to report back on the full results of the research in 2013.

ACKNOWLEDGEMENTS
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CONSTRUCTION TECHNOLOGY
INNOVATION

The elements of the construction process have been done before on other projects executed by Murray & Roberts Construction and Concor Civils. However, the combination of construction technologies chosen for this project is unique.

The structure in its final form is an underpass having a total length of 52.5 m. The width is 12.0 m, sufficient for two road lanes of 3.7 m and two sidewalks of 2.3 m. The structure was constructed in two halves — one 28.0 m in length and the other 24.5 m. The difference was necessitated by the 2% site slope and the requirement that the two structures meet on the centre line of the railway. The Price Street side is the longer of the two. Figure 1 shows an aerial view of the project.

The first site construction activity was the construction of the lateral support which was made in two box cuts, one on either side of the embankment. This was constructed as close to the railway platforms as possible in order to reduce the jacking length of the structures. Vertical micro-piles were placed on the line of the excavation to keep the vertical displacement of the railway lines to a minimum. The lateral support was constructed from the top down in the normal manner, with soil nails being placed to provide the required lateral support. This work was undertaken by Esorfranki Geotechnical.

Within the box cut formed by the lateral support, the reinforced concrete strip foundations were cast. These foundations had a steel sliding surface on top and steel side guides to keep the structure on track during the jacking operation. The top surface of the steel sliding surfaces was placed within ± 0.5 mm by using a specially designed adjustable support and grouting system. These foundations formed a portion of the permanent works and had the necessary cover and strength required of the permanent works.

The vertical side walls were constructed next. These side walls have a corresponding sliding steel shoe on the bottom edge. This makes the wall, once the formwork is removed, unstable under lateral loading. A novel method, using welded steel angle sections at the base of the wall, was employed to keep the wall stable while the reinforced concrete deck was constructed. AfriSam supplied all the concrete for the project, as well as technical advice for the more difficult concreting operations.

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Figure 1: Aerial view of project; Hoy Street is the near side and Price Street the far side

Concor Civils completes innovative Newclare road-under-rail underpass
The drum-deck was constructed next. This activity used high-load capacity frames supplied by Doka. The top surface was power-floated in order to make the top surface as smooth as possible, and bentonite and HDPE sheets were used to keep the jacking friction coefficient as low as possible.

A special requirement of this project was the reported nature of the embankment material. The material was thought to be mine sand from the nearby mines. This necessitated special cutting edges which would keep the excavation beneath the railway lines stable at all times. As it turned out, the embankment material was found to be well compacted fill with a large clay content and rocks up to 500 mm in size. However, the cutting edges were strong enough to support this material and to keep the embankment stable. Figure 3 shows the top cutting edge on the Hoy Street side.

Jacking commenced on the Hoy Street side. Esorfranki Geotechnical undertook the jacking operation, as well as the removal of material during the jacking operation. The Hoy Street structure weighed 1 100 tons and required a jacking force of 1 200 tons compared with a theoretical jacking force of 1 080 tons.

The Price Street side weighed 1 140 tons and required a jacking force in excess of 1 000 tons. The jacking arrangement is best seen in Figure 2. Both walls were jacked simultaneously, often with differing pressures in an effort to maintain the desired directional heading.
A large volume of very hard quartzite was encountered in the embankment – an unexpected occurrence at a critical time during the construction. This delayed the jacking by close to six months. Drilling and blasting were required to remove the rock, as can be seen in Figure 6.

The two structures met exactly as expected on the centre line of the project (see Figure 5). This short-lived relief was, however, totally eclipsed by the unexpected additional volume of quartzite to be blasted and removed for the construction of the triangular in-fill walls – clearly shown in Figure 6. The excavation process for these walls involved working from the top, shotcreting and anchoring the gunited surface to form a stable surface against which the in-fill walls were cast.

The in-fill walls were then constructed. This was done using a single-sided shuttering system, as well as employing rock anchor ties to restrain the formwork.

The structure was completed by the addition of the galvanised steel gutter placed under the junction of the two structures and linked to a drainage system within the walls to take any leakage to the road level below.

The construction of the road works and drainage completed the project.

CORPORATE SOCIAL INVESTMENT

During the 18-month contract period, 30 local labourers were employed and trained in basic construction activities. Small to medium enterprises were employed for managing the traffic on the roads adjacent to the site, as well as the paving of the sidewalks. Special training was conducted for the workforce who had to work close to the existing railway. Railway flagmen and scaffolding erectors were also trained.

DESIGN INNOVATION

The new Newclare underpass was designed in such a way that the Newclare to Westbury rail traffic remained operational at all times. The Murray & Roberts Construction/Concor Civils solution was chosen as the most cost-effective and reliable solution for this difficult crossing.

The adoption of two semi-complete structures for the crossing is considered innovative. Originally it was intended that both structures would be jacked simultaneously in order to maintain a stable embankment. But after the installation of the lateral...
support it was clear that the embankment was sufficiently stable to have the jacking operations undertaken sequentially.

While the soffits for both structures line up, as well as the inside surfaces of the walls, the design required the Hoy Street structure to have a deck of 100 mm thicker than the Price Street structure, and to have walls that are 100 mm thicker as well. This was required to ensure that the Hoy Street deck cutting edges overlapped the Price Street cutting edges as the two structures met in the centre. Figure 3 shows the Hoy Street cutting edge.

As the structures closed, the pipe sections were cut away to allow the Price Street cutting edge to pass below the inverted railway embankment for the last 1 500 mm of the closure. The Price Street cutting edge was of a different design and was unbolted and removed in sections as the two structures closed. The final gap of 150 mm was partially sealed using gunite.

The side cutting edges were bolted in place using threaded bar cast into the concrete. Once the cutting edges were removed, reinforcing couplers were screwed over the stubs and continuity rebar screwed to the couplers to be part of the wall rebar. The stubs are just visible in Figure 6.

About 5.0 m from the final jacked position, both structures are unstable due to the large soil and rail loading. In order to maintain stability over this crucial construction stage, it was necessary to anchor the back of the structures. The installation of one set of anchors can be seen in Figure 2.

The last 5.0 m of all four walls were constructed parallel with the sliding surfaces. This can also be seen in Figure 2. The concept was to anchor the back of the structures during the last 5.0 m of jacking by placing rock anchors on either side of all four walls and constructing a steel cross-head over the top of each wall, and anchoring the structure down. Double steel sliding plates were built into the top of each wing wall, as can be seen in the photographs.

Teflon pads were placed below the steel cross-heads. As the structures were jacked forward, the initially vertical tendons simply displaced to an angle of 2.3 degrees, representing the friction angle of Teflon to steel. This was a pleasant surprise, since we anticipated jacking the cross-head backwards as the structures moved forward.

Figure 6 shows an overlap of the sliding structure over the cast foundation of about 1.0 m. Since it was not advisable to construct sliding foundations for the structures once they were moving, an angle of the front cutting edge was chosen as 37 degrees (flatter than the normal 45 degrees), and a 1.0 m overlap over the end of the cast sliding foundation was allowed. This allowed the two structures to meet without having to construct additional sliding surfaces beyond the extent of the lateral support.

ENVIRONMENT IMPACT CONSIDERATIONS

The project was constructed in a built-up environment, so due care and attention had to be given to construction noise levels. Compressors were specially silenced, and noise and vibration from blasting was managed by using small-charge-delayed blasting.

The material excavated from the underpass was placed and compacted to reinforce the toe of the adjacent railway embankment, thereby obviating the necessity for hauling this material over the already busy streets. This was seen as a safety consideration, since the local community use the streets for recreation activities.

HEALTH AND SAFETY

The normal health and safety standards applicable to all Murray & Roberts Construction/Concor Civils projects were applied to this project. All persons for technical expertise and unmatched experience, contact ROCLA now on Tel: (011) 670-7600 or Fax: (011) 472-2141 Web: www.roclaproducts.co.za

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Rainwater Harvesting Systems that last ...
required to work close to the operating railway were given special training to ensure knowledge of the specific and invisible hazards. All sub-contractors were inducted into the Murray & Roberts Construction/Concor Civils safety standards and were expected to conform to the requirements, as well as to produce Risk Assessments and Method Statements for all activities.

**Quantifiable Time, Cost and Quality**

The project took 18 months to complete with a final completion value of R29.5 m. The quality was managed according to the Murray & Roberts Construction Quality System. Special attention was paid to the accuracy of the sliding surfaces to ensure the lowest possible friction force, as well as the accuracy of the final junction between the two precast structures.

**Risk Management**

There were numerous risks associated with this project.

The major risk was the interruption of the PRASA (Passenger Rail Agency of South Africa) rail service. This was mitigated by the strapping of the rail tracks by driving mini-piles as vertical support behind the gunited lateral support and by bracing the embankment using a lateral tie system through the embankment from one face to the other, as can be seen on the right in Figure 3. The vertical and horizontal movements of the track were monitored on a regular basis during jacking to ensure that the track alignment was not compromised. The railway lines nevertheless needed to be realigned and packed out a few times during the jacking. An interesting aspect was that the rail displacements did not always follow a predictable pattern, and various complex theories were proposed to account for the various movements.

The actual jacking force applied to the structures was a risk. The jacking force depended on numerous factors, such as the friction between the two steel sliding surfaces at the base of the walls, the friction of the side walls and the actual lateral pressures, the friction of the top deck and the friction between the foundation directional guide system. The final jacking forces were significantly more than calculated, probably due to the variation in the embankment material.

The two structures had to line up in the lateral direction. This risk was mitigated by placing up-stands on either side of the sliding foundations to steer the vertical walls. The out-of-position was then limited to 50 mm.

The stability of the jacked structures was a significant risk. This was obviated by the tie-down system, 600 ton on the Hoy Street side and 400 ton on the Price Street side. While the tie-down force was constant, the lever arm changed as the structure was jacked forward, thereby increasing the restraining moment as the structure was jacked forward to counteract the increasing over-turning moment.

**Project Team**

Client  Johannesburg Development Agency  
Consulting engineer  Vela VKE  
Structural design  Murray & Roberts Construction/Concor Civils  
Lateral support design  Jones & Wagener  
Lateral support construction  Esorfranki Geotechnical  
Concrete construction  Concor Civils  
Jacking of structures  Esorfranki Pipejacking  
Concrete supply  AfriSam

*Figure 8: The completed underpass*
NEW VARIOKIT Engineering Construction Kit
for balanced cantilever construction method

About PERI
In 2011, the PERI Group successfully negotiated the takeover of Wiehahn Formwork and scaffolding. Wiehahn has been one of the market leaders in the South African formwork and scaffolding industry for over 40 years and the sole PERI distributor for more than 10 years. PERI is a global, family owned and operated business based in Germany and one of the leading brands in formwork worldwide. PERI Southern Africa is a global player with a strong local track record.

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System solutions with standardised, rentable PERI system components and construction-compliant connecting.

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Motorway bridge A4, Tarnow, Poland
THE South African National Roads Agency SOC Limited (SANRAL) recognised the need to reduce the potential for accidents on a section of the N2 near Mtubatuba which passes through the township of KwaMsane. Goba (Pty) Ltd were appointed by SANRAL as the consulting engineers for the design and construction supervision of the KwaMsane Community Access Roads and Pedestrian Facilities, Phase 2. The project lies within the Mtubatuba Local Municipality and is situated adjacent to National Route 2, Section 30, near Mtubatuba in Northern KwaZulu-Natal.

This community project includes the upgrading of three community access roads, namely the Western Collector, the Eastern Collector and the N2 Underpass (which connects the Western and Eastern Collectors) from an existing heavily fatigued (potholed), surfaced road to a continuously reinforced concrete (CRC) pavement. The existing badly potholed roads within the township resulted in pedestrians and taxis using this portion of the N2 as a collection and drop-off area, as the roads were almost impassable, particularly during the wet season. The local municipality were unable to effectively maintain the roads due to the high recurrence of potholes caused by a weak pavement structure and weak in-situ subgrades.

In addition to the 2.8 km long upgrade of the roads, additional pedestrian facilities were constructed along the Eastern Collector and N2 Underpass to ensure safe passage for the local scholars from two nearby schools.

CONCEPTUAL DESIGN AND CONSTRUCTION METHODS

The project was undertaken as a community upliftment project. SANRAL and Goba identified the need for a road system that was safe, provided pedestrian facilities and required minimal future maintenance.
Of the various pavement options considered, a CRC pavement was selected based on the high volumes of heavy vehicles from a nearby quarry and poor quality highly weathered basalt subgrades. By stipulating that construction had to be carried out by labour intensive means, the CRC pavement option provided an ideal opportunity to train and employ local labour.

In order to minimise future maintenance of the road, the concept of a perpetual pavement was introduced and a 150 mm thick CRC pavement, with an unsealed, tied and keyed longitudinal centre line joint was designed and constructed. The CRC pavement thickness was modelled using, amongst others, the design traffic loading obtained from data from the quarry located on the eastern side of the N2. The Cement and Concrete Institute’s (C&CI) cncPave software was used to optimise the steel diameter and steel spacing required. The side drains were also tied to the concrete pavement to eliminate the need for a sealed joint there.

Upgrading of the Western Collector included the construction of the new pavement between the existing concrete-lined side drains, constructed under Phase 1 of the project. A survey of the existing road edge was carried out and a new
longitudinal alignment was developed to take the existing varying cross fall and road crown into consideration.

Due to the nature of the topography and the alignment of the existing road infrastructure in the area, drainage on the Eastern Collector was identified as a crucial element in the design. Existing stormwater outlets were located on steep grades in certain areas and, due to the high concentration of stormwater, severe erosion and damage to properties occurred. This necessitated the design and construction of gabion storm water attenuating structures to curb existing erosion in these areas and to control future stormwater runoff into affected properties.

In order to maximise the benefits to the community on this project (local labour usage) it was a contractual requirement that the concrete be batched on site by means of mechanical mixers and hand placed.

Mazcon Civil and Building Contractors (Mazcon) were awarded the contract for the sum of R17 m and construction commenced in late June 2010. Mazcon is a black-owned construction company established in 2001 with a 7CEPE CIDB rating, and is a level 6 BEE contributor.

COMMUNITY AND ENVIRONMENTAL INVOLVEMENT
To ensure maximisation of community participation in the project, two requirements were stipulated in the contract documentation. These were that a minimum of 8% of the total contract value should be spent on local labour and that at least 35% of the total project expenditure should be retained within the community and within the bounds of the Umkhanyakude District Municipality.

As part of the community upliftment programme, funds were allocated for training within KwaMsane. The C&CI was approached by Goba to conduct an engineering training course for forty local labourers on the batching of concrete and the construction of a CRC pavement. The training course involved lectures on concrete theory and its applications, and a two-day practical workshop on the construction of a CRC pavement. The labourers who were trained were subsequently hired by the main contractor for the duration of the project and took immense pride in constructing their own roads.

To facilitate the training, Goba contacted a local school for the use of their premises during lectures presented by the C&CI. To increase the delegates’ skills, Goba, together with Mazcon, facilitated training on steel fixing, formwork erection and concrete batching within the site camp before construction of a mandatory trial section to assess the skills knowledge gained.
Thirty local community members were also trained in home-based care as part of a generic training programme. Goba contracted Tholowethu Trading Enterprise to conduct a three-day training course in international home-based care, held at the Mtubatuba Town Hall.

The delegates were taught various methods of communication, community empowerment, community mobilisation and basic nursing care with specific reference to rural, elderly and HIV positive people. The knowledge gained was then taken out and used within the community.

As part of the entrepreneurial training, Goba recommended that Mazcon be assisted in attaining a recognised quality management system. Wynleigh International (Pty) Limited was contracted to assist Mazcon in compiling an in-house quality assurance plan. This would enable Mazcon to become more competitive in the market place and secure its position as an emerging contractor. Furthermore, a local construction company, Amajika General Trading 2, established under Phase 1 of the project, was appointed as a sub-contractor for the project. This company was utilised throughout the project for concrete batching, v-drain construction and pothole repairs amounting to nearly R600 000, and is envisaged to carry out maintenance on other surfaced roads in the township.

Two students received in-service training under Goba and Mascon’s supervision during the construction phase. A total of nearly R400 000 was spent on training as part of this contract.

Within the project, SANRAL had allocated funds for the construction of community facilities. Four projects were thus identified within the KwaMsane community.
The first project was to procure and install eight refuse bins around the KwaMsane community to reduce the amount of visible litter. This project was undertaken with the assistance of the Mtubatuba Municipality to ensure that refuse was removed and correctly disposed of.

The second project was to design and construct three bus shelters for the bus lay-bys along the new roadway. Two bus lay-bys and shelters were constructed at identified locations along the Western Collector and one was constructed along the Eastern Collector.

The third project involved the re-grading of an internal access road within the community. The existing road had insufficient drainage, which was compounded by inconsistent town planning resulting in stormwater outlets at critical areas being blocked by local residents as the runoff was damaging their properties. Various alternate drainage options were considered, with the selected option to regrade the existing road and construct proper drainage facilities along the road being implemented.

The fourth project involved the planting of fruit trees within the properties of local residents. Various local fruit-bearing trees were planted in selected areas to enhance the aesthetics of KwaMsane and provide a means of an alternative food source for local inhabitants. The expenditure for these community projects amounted to R780 000.

CONCLUSION

The project, which will be completed within the allocated budget, is in the final stages of completion, with only minor auxiliary works requiring attention. The aim of reducing the number of pedestrians and vehicles on the N2 has largely been achieved, as there is a significant increase in commuter traffic, in particular taxis, along the upgraded local routes. Future planned phases will reduce the N2 traffic even further.

A total of nearly R5.3 million has been spent within the Umkhanyakude District, of which R2.1 million was spent on local labour, and a further R1.4 million within the local community. Based on the requirements stipulated, the project was a tremendous success, with all aspects regarding the community facilities, expenditure and training being met. In addition to the benefits for the community, the final product is aesthetically pleasing and was constructed to a high standard by the community themselves.
Fixing the High Water Mark Part 1 of 4:
The fatal flaw in the South African legal definition

PREAMBLE
The seashore marks a phase change in the nature of the surface of the earth from solid to liquid. Since the liquid phase, the surface of the sea, is in a constant state of agitation, the physical boundary is in constant motion, but it does so within a defined fuzzy zone. There are two independent drivers: tidal waves (equinoctial spring tides in the extreme) which are deterministic, and wind waves (storm waves in the extreme) that are probabilistic. The magnitude of each varies enormously, from negligible to extreme in different parts of the world, and does so each independently of the other, although there is some tendency for coastal morphology to induce inverse correlation. It becomes a matter of policy, within the constraints of the natural physical processes, how to assess, select from and combine these two to demarcate a seashore boundary.

SOURCES
The concept of the high water mark (HWM) in the Anglo Saxon world generally has two sources:

Lord Chief Justice Matthew Hale in *De Jure Maris* (1666) gave a clear description of the basic parameters of the tides:

a) The high spring tides, which are the fluxes of the sea at those tides that happen at the two equinoctials.
b) The spring tides, which happen twice every month at full and change of the moon.
c) Ordinary tides or neap tides, which happen between the full and change of the moon (new moon).

The British Isles lie in a region of mega-tides, a condition often amplified to extreme tides in the estuaries that account for a significant portion of the coastline. Under these conditions, there is a wide variation in the tides between neaps and springs. Hale held that for most of the time land that was only flooded by exceptional tides could be and was used as any other land and should be judged to be above the high water mark. Hence, he held that Crown land extended landward only so far as it could be covered by the ordinary flux of the sea. Although his intent was clear, there has been some dissension over whether he meant neap high water or average high water, averaged across the neaps between two successive spring tides.

To the extent that nothing much of principle turns on this, it can be easily clarified in legislation. More notable, is that it reflects the normal condition of deep estuaries that are completely protected from oceanic waves. Hale’s approach is explicitly limited to the tides and completely excludes any form of wave action.

The Institutes of Justinian (533 AD) is the other source. The relevant section is Book II, Title 1, Clause 3 – Of the Different Kinds of Things. The primary intent of this section is a catalogue of the various classes of ownership of things. In other words, the important issue is ownership, not the precise physical nature of the object or, in this case, the location of a boundary.

ASSESSMENT
The key sentence in the Institutes of Justinian reads: “*Est autem litus maris, quatenus hibernus fluxus maximus excurrit*.”
I have translated this as: “The seashore, however, is as far as the greatest run-up of the winter waves.”

The two key words are:

**Excurrit**: This generally means to dash out or sally. I have chosen to convert the original Latin from a verb to a noun and translate it as the modern term of “run-up”. I have avoided the term “swash” since this describes the manner of the terminal excursion of the waves on the seashore, not the extent of that excursion which is covered by “run-up”. Both words are terms recently adopted by oceanography and coastal engineering. They cover the explicit meanings of these two aspects of the maximum landwards excursion of the sea due to wave action.

**Fluctus**: Normally this means “waves” and I have translated it as such. As in its English derivative, “fluctuate”, the verb form has the meaning of “undulate” and derives from “fluere” (to flow). As a result, *fluctus* is sometimes used in the meaning of “flood”.

The key phrase is the one I have translated as “is as far as the greatest run-up of the winter waves”.

Other translations, generally by leading English jurists over the last 200 years, are the following:

1. T Cooper 1812 (USA): over which the greatest winter flood extends itself
2. W Grapel 1855 (UK): over which the highest winter’s tide extends itself
3. J Abdy 1876 (UK): the line reached by the highest winter-tide
4. J Moyle 1913 (UK): the limit of the highest tide in time of storm or winter
5. J Thomas 1975 (UK): as far as the winter tide reaches its furthest extent
6. Wikipedia 2011: as far as the greatest winter flood runs up

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**Figure 1**: Tide parameters on the South African coast, a typical open, oceanic, high-energy, micro-tidal shore.
This is staggering! Every one of them is incorrect!

Justinian is straightforward and clear, yet numbers 2 to 5 all persist in translating "fluctus" as "tide". There may have been some sort of collaboration in the sense that one copied from another. Cooper does state that his rendering is based on that of a prior translation by a Dr Harris, and Thomas claims to have followed Moyle.

This substitution of "tide" for "wave" may owe something to a cross contamination, with the basis of the approach of Hale strengthened by the process of copying. The most likely explanation, however, is that all are focused on the main subject of the work and not on an apparently minor detail of physical exactitude. They have allowed themselves to drop into a common, albeit normally poetic, English usage – to refer to the "sea" as "tide".

The straightforward nature of Justinian's definition conforms exceptionally well with the typical Mediterranean shore, particularly the North African and Levantine coasts – open high-energy shores with a micro (virtually zero) tide. I once had the experience of walking along the seashore at Tel Aviv in the company of two professors of coastal engineering. The Australian, in typically brash Australian manner, remarked dismissively that, of course, the wave regime on that coast was all fetch limited. The Israeli, very politely for an Israeli, replied that actually it was duration limited. Even in the great oceans of the world where fetch is virtually unlimited, duration is the usual constraint on oceanic swell. Much of the shoreline of the Mediterranean can be exposed to very severe waves with large shoreward excursions of the waters of the sea.

Hence, the use of "tide" in translating Justinian is completely inappropriate.

The other two translations, numbers 1 and 6 are also defective in the use of "flood" instead of "waves". This could have arisen by translating "fluctus" in its minor meaning of "flood". But this is only persuasive as a subliminal influence on the translator. The context suggests strongly that it is just a variation of the use of "tides" – an abbreviation of "tide". The primary meaning of the terms "flood" and "ebb" refer to the rising and falling of the tide, but it would be quite natural to associate high water with the rising tide and low water with the falling tide. The Oxford English Dictionary does list two usages: "top-of-the-flood" and "flood-mark" that bear out this supposition. It follows then that "flood" could simply be loose usage for high water and this is the intended meaning of "flood" in translations numbers 1 and 6, which, through "flood tide", is cognate with "tide" in translations 2 to 5.

Hence, the use of "flood" in translating Justinian is also completely inappropriate.

Both errors introduce into the translation an idea that is not present in the original. To summarise:

- Hale treats tides without any concern for waves.
- Justinian treats waves without any concern for tides.

Each definition is qualified.

Hale is quite explicit. He requires that the boundary of the seashore, the high water mark, be delineated by the water line of a pre-specified tide and that this tide should be less than the highest...
tides on that shore. Also, by his exposition of the characteristics of the tides, he makes it clear that he intends only the astronomic tides and, by default, by making no mention of them, explicitly excludes all other tsunami-like fluctuations of the sea surface level.

Justinian, too, is explicit in his qualification: “the greatest run-up of the winter waves”. By and large, the greatest run-up will be caused by the greatest waves, and these in turn will be the storm waves. In the Mediterranean and in effect the temperate and high latitude regions, these storms are extra-tropical cyclones. Although they can occur at all times of the year, the greatest energy transferred to the sea surface occurs during the winter, and winter characterises these storms and the great waves they generate – as prescribed by Justinian.

Tropical cyclones, also known as “hurricanes” or “typhoons”, have very different characteristics to the temperate, extra-tropical cyclones. Where the temperate cyclone tends to be widespread and diffuse, the tropical is commonly localised and intense. Whereas a particular temperate shore will experience the full impact of many storms each year, the full impact of a tropical cyclone on a particular piece of tropical shore will be very infrequent. They are extreme events to be treated as such. Since they are typically a summer phenomenon, they are by default excluded from Justinian. To this Hale would be sympathetic.

While these two opinions of Hale and Justinian are independent of each other, they are valid representations of reality and are capable of superposition, i.e. they can be applied together as appropriate to local circumstances. In other words, on coasts where both tides and waves are significant, a definition of the high water mark based on a combination of the two by addition of the two excursions, one riding on the other, would be fully appropriate and in keeping with the intent of each taken independently. Viewed this way, these opinions are beautifully cognisant, as far as they go, of the modern understanding of the sea and the seashore.

SOUTH AFRICAN USAGE

However, the net result of these errors in translation of Justinian in the South African context, with Hale lurking in the background, has been definitions of the high water mark in two pieces of legislation that are both garble.

The Seashore Act of 1935 gives a definition of the high water mark based on case law: “high water mark” means the highest line reached by the water of the sea during ordinary storms occurring during the most stormy period of the year, excluding exceptional or abnormal floods. Here the problem is the use of the word “floods” – the error described in translations numbers 1 and 6 above. In the English mega-tidal estuaries, the use of the terms “flood” and “ebb” serve to describe the very real fast-flowing currents of the rising and falling tides. On the open, high-energy, micro-tidal South African coasts a vestige of these tidal flows does exist in some of the estuaries, but are relatively insignificant and, in practice, the terms are not used on this coast. Hence, the use of the term “flood” only leads to confusion, and sometimes becomes confused with riverine floods that occasionally pass through an estuary. Here it should be kept in mind that these riverine floods have no effect whatsoever on sea level. The only residual effect will be the backwater curve from the sea.

On open, high-energy, micro-tidal shores the sea shore is generally quite steep and the difference in altitude between HAT (Highest Astronomical Tide) and Mean High Water Springs is quite small. Hence the difference in landward excursion between these two tides is generally too small to be significant. In fact, compared to the wave effects, it is probably not measureable.

On open, high-energy, oceanic shores the maximum excursion of the sea onto land is dominated by wave effects. It will be the maximum run-up of the swash of the sea that depends both on the weather and the breaking of the waves. Both have the effect of raising the sea level at the shoreline. Under storm conditions, it is the breaking of the waves that has the dominant effect, and the final altitude of the run-up can be many times the incident wave height. This in turn is very dependent on the nature of the shore and can vary widely on different shores. Overall, the contribution of storm attack will be much greater than that of the tides. In practice, there is no need to specify a cut-off to the tides, as in Hale; on the South African coast, Justinian alone would be appropriate.

The Integrated Coastal Zone Management Act of 2008 now replaces the 1935 definition as follows:

“high water mark” means the highest line reached by coastal waters, but excluding any line reached as a result of

a) exceptional or abnormal floods or storms that occur no more than once in ten years or
b) an estuary being closed to the sea.

The opening statement is reasonable. The problem is in the exceptions. Exception (a) includes the false term “floods” which has been discussed above. It also introduces the idea of a limiting return period of “once in ten years” without any further explanation or definition. Given the complexity of the subject touched upon above, in its present form, it is probably unworkable.

Exception (b), in its present form, is also probably unworkable. Many, if not most of the small estuaries are commonly closed but open on occasion. The wording gives no guidelines as to when an estuary is to be deemed to be closed.

CONCLUSION

Both Justinian and Hale, when translated into plain modern language, amount to straightforward common sense. Both exclude the extremes of events with a low frequency of occurrence.

In tide-dominated macro-tidal estuaries or other protected waters, use a deterministically predetermined sub-extreme tide level to delineate the HWM. On open oceanic, micro-tidal shores where there is an insignificant difference between HAT and Mean High Water Springs, ignore the tides. In effect, use HAT.

On wave-dominated oceanic shores, use the extreme wave run-up of the winter storms generated by extra tropical cyclones. Ignore the wave run-up generated by tropical cyclones (also known as hurricanes or typhoons).

Hence, in practice, the only way to identify the HWM on a micro-tidal, high-energy shore is to walk along the coast and observe the signs, the swash line, the line of flotsam, and equally, the edge of terrestrial vegetation.

Estuaries that are sometimes closed, do occasionally open to the sea and present two different water levels. When they are open, even on micro-tidal shores, they are effectively tide-dominated. Hence use Hale to delineate the HWM, using HAT in the case of micro-tidal shores. When they are closed, they can be flooded in the rainy season well above the equivalent HWM until the barrier dune overtops and breaches. This is not an HWM in the usual sense, but can be used to delineate a safe
building or development line. It falls into the same category as flood-lines of predetermined return period or flood magnitude shown on zoning plans, although in the case of these estuaries the line is determined by the altitude of the barrier, not the magnitude of the flood.

NOTE
This monograph is limited to a re-examination of the sources of the South African legislation on the definition of the high water mark and to the interpretation of the nature of waves and tides relevant to the issues. The matter, however, is not conclusive without parallel analyses of:

a) The geometry of coastlines, in particular fractal geometry and fuzzy zones.
b) The behaviour of unstable, mobile coastlines, in particular sandy shores.
c) A survey of current usage and development on the seashore, and current legislation and legal interpretations thereof.

These three will be undertaken as and when time permits, and will form follow-up articles to the one presented here.

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Figure 2: Extreme (in this case a clear weather) storm swash reaching to the HWM
Innovations arising from a MacForce

A NUMBER OF innovations were introduced by Maccaferri Southern Africa during the construction of mechanically stabilised earth walls (MSEW) at a multi-level road intersection near Richards Bay in KwaZulu-Natal. Following a presentation on MacForce, an enquiry was received from the consultants regarding its possible use on this project. MacForce is a T-shaped concrete panel system with polymeric geosynthetic strip reinforcement which obeys friction criteria to develop a mechanically stabilised earth structure. It results in a continuous homogeneous block. Successful mining-related applications have been completed over the last five years in Africa. This application in January 2010 was Maccaferri’s entry into the transport sector and the first major one outside the mining industry. The project gave rise to innovations in component design and construction, costing and billing methods, and logistical and procedural matters.

John Ross Parkway and the West Central Arterial road cross each other about 10 km outside Richards Bay. The project involved five walls, two of which were installed back-to-back, and comprised an area in excess of 4 000 m² with a maximum height of 12 m, making it the largest combined total area of a MacForce wall in Africa.

Preliminary design was undertaken by Maccaferri’s World Design Centre in India. Detailed design was completed locally, and incorporated both existing and future services for the project. Several culverts, including some which contain gas mains, run through the embankment. A few of them are not perpendicular to a wall and hence presented an additional challenge. Special ‘lips’ were incorporated which acted as wedges to improve the sliding resistance of the walls.

Future widening of the onramp onto the West Central Arterial road was envisaged by the client. The design of one of the walls therefore had to accommodate this. It meant that founding to the same depth as the foundation of the bridge abutment was required. Here, too, specifically designed lips were incorporated into the bridge abutment for aesthetic and technical reasons, and the joint between the walls and the abutment was also covered.

The impact barrier on the top of a wall had to integrate with the wall in such a way as to limit the transfer of loads onto the wall. It was decided that the coping would be separate from the barrier. This involved further innovation, as the coping detail that was provided by Maccaferri had not previously been utilised in a project in South Africa.

MacForce concrete panels were designed with the ability to withstand:
• the construction process – lifting and placement into the vertical position, and
• the force generated on each of the reinforcements.

Upon completion of the design, a full schedule of panels and quantities was established.

Scribante Construction was awarded the civil works on the project, along with joint venture partners Steffanutti Stocks who were the structural contractors. The bridge designers were Stewart Scott & Associates, while the civil works were designed by Iliso Consulting.

Previous MacForce projects had not involved the preparation of tender documents. In this case, itemised bills of quantity were generated to meet the consultant’s requirements, arising from their choice of COLTO for this purpose. This format of the bills of quantity has since become a standard within Maccaferri, with COLTO currently under review to change Section 7200 to read “Mechanically Stabilised Earth Walls”.

The MacForce system comprises a number of different components, including...
toggles, loops, half rounds, PVC sleeves, locating pins, buffer pads, moulds, geo-synthetic reinforcement and geotextile. Components are sourced from a number of places, and this presented a logistical challenge. Maccaferri was able to provide assistance to ensure timely deliveries and accurate invoicing.

The contractor had planned to utilise their ready-mix batch plant as the pre-casting yard. Maccaferri’s offer of assistance at the start of the project for site supervision during panel pre-casting and the initial construction phase was accepted by the contractor. This activity gave rise to the identification of an improvement in the design of the moulds used for casting the MacForce panels which are now in their fourth generation. In addition, a cost-saving innovation was identified in the construction of a panel, but this is proprietary in nature.

Further procedural matters were addressed with the contractor to improve overall workflow and cost minimisation. These covered the areas of quality control, work process cycling through the casting yard, panel damage limitation and component loss. Arising from this work, procedures were developed for ensuring that the correct length of reinforcement is utilised. In turn, this led to rationalisation of the types of reinforcement to be made available for future projects.

The quantity of materials supplied to site, including consumables and reinforcement, was recorded on pro-forma invoices for Materials-On-Site (MOS) payments. This was another first for Maccaferri, as such items are normally built into the cost of the project. A purpose-designed spreadsheet of costs and mark-ups was developed to produce a costing sheet for use in making an MOS claim. These were processed by the contractor for issue to clients.

Maccaferri’s involvement in this project provided the client with a cost-effective solution for the construction of the MSEW. It also was mutually beneficial for the contractor and Maccaferri insofar as a number of innovations and improvements were identified and implemented. The work on this project demonstrated Maccaferri’s ability and willingness to meet the challenges of maintaining quality within constrained financial circumstances in a new environment.

INFO
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MARKET CONTRIBUTION

Results of the 2012 Infrastructure Sector Research Survey
carried out by executive search firm Landelahni Business Leaders Amrop SA

ACCORDING TO LANDELAHNI CEO Sandra Burmeister, crucial infrastructure schemes across the world are competing for a dwindling skills pool amid fears that the skills shortage could delay projects in major markets. Driven largely by China and India, construction is expected to grow globally by 67% over the next eight years.

Major construction companies in South Africa are meanwhile looking northwards to win a share of the huge infrastructure projects being rolled out across the African continent. However, Burmeister warns that it is essential to develop and retain key technical skills if South Africa is to meet the challenge of building massive new infrastructure, while at the same time upgrading existing services.

The 2012 Landelahni Infrastructure Sector Survey researched 75 companies with just over 300 000 permanent employees in the following sectors:
- Infrastructure
  - Main participants in electricity, water, waste, roads, rail and ports
- Construction
  - Major participants based on the Construction Industry Development Board (CIDB) list of companies able to deliver projects of more than R30 million
  - Large JSE-listed construction companies
  - Consulting engineering firms
  - Large suppliers to construction industry, e.g. cement producers.

GLOBAL INFRASTRUCTURE GROWTH

“The demand for infrastructure is driven by rising populations and rapid urbanisation, and is causing a shift for all players in the sector,” says Burmeister. “Internationally, recovery is slow, but the outlook is extremely positive between now and 2020.”

Construction is expected to grow from $7.2 trillion to $12 trillion in 2020, driven largely by emerging markets. An Oxford Economics survey estimates that construction will account for 13.2% of global GDP by 2020.

Asian markets will continue to develop rapidly, with China and India driving growth. Stimulus spending across both developed and developing economies will continue to boost the industry, as will increasing demand for traditional and alternative energy sources.


“So far, around 25% of these are being financed and implemented. This means a R250 billion spend per year – about R100 billion more than the average spent over the past five years, including the FIFA World Cup.”

Growth in sub-Saharan Africa is expected to be about 14% higher than that in South Africa. On the African continent $20 billion in infrastructure projects are already under way.
According to the 2012 KPMG Global Construction Survey, “new infrastructure projects are expected to be on a huge scale, so size and global reach will matter. With scale comes complexity as global players navigate tough political, commercial, regulatory and governance environments.”

“This calls for advanced leadership skills,” continues Burmeister. “Winning new contracts is increasingly about having the right expertise. We need to develop enough skills to ensure proper maintenance and timeous upgrades of existing infrastructure, and to avoid further deterioration of essential services across the country.”

SA INFRASTRUCTURE SUPPLY CONSTRAINTS

Public sector capacity

In government, engineering skills have reached a new low, with a recent Consulting Engineers South Africa (CESA) report estimating that there are only 1 800 engineers across government (excluding state-owned entities) and more than 1 000 engineering posts are vacant.

The National Treasury reports that in 2010/11 government spent only 68% of its total capital budget. “Ramping up government capacity to implement R3.2 trillion of mega-projects is an enormous challenge and is likely to result in an increase of public-private partnerships,” according to Burmeister.

“We are already relying on international partners to bring expertise not available locally – as we see with Gautrain, the building of new coal-fired power stations, nuclear energy initiatives and the drive for alternative energy.”

Skills shortages

“Skills shortages are rated the major risk of doing business in emerging economies. The battle for skilled resources is likely to intensify – globally and locally.”

Total employment in the local infrastructure sector grew from 634 000 in 2001 to 1.2 million in 2007, dropping to 1.1 million in 2010.

While the slump in South African construction activity alleviated the skills shortage to some extent, research shows that 74% of companies are still struggling to fill engineering vacancies. The current order book of SA-listed construction companies is over R430 billion.

“We simply do not have the right kinds of skills to meet the specific demands of huge new infrastructure projects,” says Burmeister. “We continue to face the dichotomy of high unemployment among the unskilled and semi-skilled, and high vacancy rates for the highly skilled.

“It is critical that companies spend time and money on developing a leadership and graduate pipeline, as well as a supply of professional and skilled workers, including artisans.”

SA LABOUR MARKET SUPPLY

Artisans

In 2006 South Africa produced a total of 3 222 artisans across all trades. In 2010 this number rose dramatically to 11 778.

“This is testimony to what government and business can accomplish by working together with a focused outcome,” says Burmeister.

“The National Programme for Artisan Development (NAD) aims for another 50 000 artisans by 2015. Based on current figures, this is a high target.

“We must guard against a focus on quantity of certifications over quality. The pass rate needs to go well beyond its current level of 45%. Moreover, the focus needs to be on four-year, rather than one-year certifications. Only then will we make a significant impact in securing our artisan skills base for the future.”

Engineering graduates

Of the 600 000 candidates who wrote school-leaving examinations in 2009, only 22% passed maths higher grade and only 7% passed physical science higher grade. In the same year, only 28% of students in public higher education institutions were enrolled for programmes in science, engineering and technology.

Total graduations (degrees and diplomas) across all engineering disciplines between 1998 and 2010 numbered 70 475, at a 13.8% pass rate. Of this total, 29 280 engineers graduated with degrees from universities, an average of 2 252 per year.

“There was an upward trend for black and female engineering graduates, which is positive,” says Burmeister.

“However, the average university pass rate is 16%, far below the international average of 25%.”

These figures compare with 1.9 million engineering graduates in China in 2010, 763 635 in India and 10 765 in the United Kingdom.

Infrastructure-specific graduates

In the case of infrastructure-specific studies, in 2010 electrical engineering university graduates numbered 899, followed by civil engineering at 847, and mechanical engineering at 766.
The slow pace of economic growth, along with government delays in awarding tenders continue to limit the recovery of the local infrastructure and construction sector. The downturn may have given some respite to the scarce skills shortage. However, South Africa is not training enough engineers, artisans and technicians to deliver the long-awaited R845 billion government infrastructure projects in the pipeline.

Professional engineers
ECSA data shows that, in 2010, there was a limited pool of 14 700 professional engineers registered across all disciplines, with many of these aging out of the market. “Gender remains an issue,” says Burmeister, “with less than 3% female professional engineers.”

The number of candidate engineers is relatively robust at 5 600. However, according to ECSA, the conversion rate to professional engineers is low, because lean organisations are not committing resources to the required three to four years of on-the-job mentoring.

Training
The infrastructure sector has continued to invest in skills training despite the economic downturn, and has made a significant investment particularly at executive level.

The industry has increased expenditure on the training of artisans and technicians. However, bursary spend in 2011 was around only 0,2% of payroll.

Burmeister believes the skills challenge is exacerbated by the presence of 35 000 small and medium contractors who have little capacity to train and develop staff. “Training will continue to be carried out by large contractors, listed construction companies and parastatals.”

Planning for infrastructure growth and sustainability
“There is growing global demand for specialist engineering skills to deliver on new mega-projects,” says Burmeister. “With this comes increased demand for professionals in risk management, information technology professionals able to support business and systems efficiencies, and executives capable of leading across multiple geographies and cultures.

Investing in the right kind of skills
Alongside the Presidential Infrastructure Coordinating Commission (PICC) 20-year infrastructure plan, Burmeister believes we need a roadmap of the skills we need to invest in today. “First, we must align our educational systems to meet these requirements,” she says. “Only in this way can we ensure that we have skills to support not just the build, but the maintenance and upgrade of infrastructure now and in the future.

Further investment and spend in skills development is not just a scorecard measure. It’s an economic imperative for a sustainable infrastructure industry.”

Filling the talent pipeline
A multi-pronged approach is needed for filling the talent pipeline.

“This includes increasing bursary spend in core scarce skills areas of business, increasing graduate hiring and training programmes, and extending retirement dates or calling back early retirees,” says Burmeister.

“Companies can use smart strategies like cross-functional project teams and offshore assignments for exposure and accelerated development.”

Increase in outsourcing and partnerships
Burmeister argues that government will need to increase its capacity to manage outsourced projects and public-private partnerships. “This means an increase in commercial, technical and risk management skills,” she says.

“Business – and its institutional investors – will need to learn to balance short-term profits against overall economic imperatives such as job creation and skills development.

“The proportion of contractors who are paid for expertise on a project-by-project basis will continue to increase significantly. Our legislation will need to support work permits and visas where external resources are required.

Remuneration
“Remuneration packages will continue to spiral for those with specialised skills demanded by the market. Skills premiums for certain core business activities will continue to rise.

“A significant increase in investment in the development of graduates, young professionals and mid-tier professionals will help to balance supply and demand, and in the long run will be more cost effective.

“That means executive incentives should be aligned to increasing skills across the business, and not only to boosting bottom-line profits.”

Global resourcing strategies
“Global resourcing strategies are essential to enable delivery of infrastructure investment in the face of increased mobility of scarce skills,” continues Burmeister.

“Leaders of the future must be able to manage large businesses, projects and stakeholders across multiple geographies and cultures. Businesses will need to be able to offer both the breadth and depth of services – designing, building, financing and operating.

“The sector must become a leader in sustainability. As the 2012 KPMG Global Construction Survey states: ‘Sustainability

In a nutshell
- The slow pace of economic growth, along with government delays in awarding tenders continue to limit the recovery of the local infrastructure and construction sector.
- The downturn may have given some respite to the scarce skills shortage. However, South Africa is not training enough engineers, artisans and technicians to deliver the long-awaited R845 billion government infrastructure projects in the pipeline.
begins and ends with construction, the materials used, the waste produced and the final built environment.”

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INFO

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IN BRIEF

A CAMERA FOR THE CATWALK

NIKON RECENTLY launched the COOLPIX S01, a striking microcam that marks the most fashionable addition to date for the COOLPIX range. Even though it has a body smaller than a credit card, its stand-out style makes sure it is noticed. In glossy red, mirror, white, black, or pink, with a 3x optical zoom NIKKOR lens, 6.2 cm touchscreen, 10.1 MP CCD image sensor, 7.3 GB internal memory and 720 p movie, it is a camera that can be used anytime, anywhere.

Romi Jacobs, Chief Marketing Officer for Nikon in South Africa, comments: “The COOLPIX S01 is irresistible. With its ultra-compact body and feather-like weight, it is unbelievably cute, and yet it packages up enough top-end technology to ensure great photos every time. When it’s tucked away in a bag or purse, you probably won’t even know you are carrying it, but when you do whip it out, the 3x optical zoom lens and the 10.1 megapixel image sensor will not fail to impress. Its easy-to-use touch screen makes it fun to shoot movies with special effects, or apply creative filters to photos you have taken.”

With an in-built battery and 7.3 GB internal memory, the super-sleek and ultra-streamlined COOLPIX S01 can store up to 3 000 images at full resolution or three hours of video in VGA quality in the camera, with no need for memory cards or external charging units.

Meanwhile, the intuitive touchscreen operation encourages you to get hands on, to shoot beautiful images and movies using the 10.1-MP CCD image sensor. From a movie filmed with a nostalgic sepia effect, to the retro feel of photos given a Toy Camera filter, there are plenty of creative effects to add a unique touch. Large menu icons on the touchscreen make navigation easy. The home screen can be customised to suit your preferences or you can use one of your own photos as the background image.

The suggested price is R1 599.

Other key features

NIKKOR 3x optical zoom lens (29–87 mm): Enjoy the benefits of Nikon’s precise lens technology. From group shots to portraits, this lens offers superior photos and movies on the go.

HD movie (720 p): Record life in high-definition motion with ease. A simple touch of the screen in Movie Mode is all it takes to start recording your movie.

Motion Blur Detection: This function reduces the effect of camera shake to compensate for camera and subject movement. High ISO (up to 1600) light sensitivity reduces the risk of blurred images with fast-moving subjects or in low-light.

Easy Auto mode with Scene Auto selector: The camera automatically chooses the optimum scene mode for stunning results every time.

EXPEED C2: Nikon’s advanced image processing system optimises all camera technologies for quick response, superior performance and maximum image quality.

USB and AC charging: Can be charged from your computer with the USB cable included.

INFO

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CORDLESS INSPECTION CAMERA FROM BOSCH LOOKS INTO HARD-TO-REACH PLACES

THE GOS 10, 8 V-LI Professional cordless inspection camera from Bosch now enables you to quickly look inside tight spaces, pipes, drains or shafts. Professional tradesmen can use it to quickly and easily conduct a problem analysis when making repairs. The camera excels due to its particularly good image quality. Thanks to the resolution of 320 x 240 pixels and the realistic colour rendering, even details are easy to identify on the 2.7-inch LCD display. Little dirt gets stuck in front of the lens on the smooth surface of the camera head, so good visibility is enabled even in dusty environments.

The large depth of field from 3.8 centimetres to infinity offers an optimum view of the object. The Power LED on the camera head illuminates dark areas consistently and intensively. There are nine brightness settings to ensure that the appropriate light intensity is provided for every situation.

Flexible in use

The GOS 10, 8 V-LI Professional offers a versatile range of applications for plumbers, HVAC fitters and repairmen. For example, professional tradesmen use this tool to inspect ventilation shafts or to view cavity walls, thanks to the 122 cm camera cable.
and the short camera head with a diameter of 17 mm. Both the cable and the camera head are waterproof, enabling virtually unlimited use in wet and dirty environments. The tool comes complete with accessories – mirror, magnet and hook – which increase the range of applications. While the hook and magnet can be used to pull smaller objects closer, the mirror enables you to look around corners. If required, the images can be transferred to larger monitors during inspection by using the supplied cinch cable to connect the monitor to the integrated video-out interface.

**Premium lithium-ion battery with long lifetime**

The long lifetime of the Bosch Premium batteries is thanks to the Electronic Cell Protection (ECP) from Bosch. It reliably protects the battery against overload, overheating and deep discharge. There is also no memory effect and the batteries are fully ready for use, even if they have not been used for months. The batteries offer a run-time of seven to fifteen hours depending on the light intensity used on the camera. The charge level indicator indicates the remaining battery run-time.

The GOS 10,8 V-LI Professional cordless inspection camera is available at specialist retail outlets at the recommended price of R2 999 (including VAT).

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**NEW DIRECTORY PUBLISHED BY THE GMBA**

THE Gauteng Master Builders Association (GMBA) has published a new directory of members and services. According to James Tubb, Executive Director of the GMBA, the directory, available in a handy and compact A5 size, is aimed at the general public, and current and prospective new members. “We felt that there was a need in the marketplace for a printed directory to augment the membership listing already available on our website. The directory will be updated on an annual basis,” he adds.

The 80-page booklet contains details of office bearers, benefits of membership, and alphabetic as well as category listing of members. It also contains supplier listings and comprehensive advice on

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**CUTTING-EDGE TECHNOLOGY AND RELIABILITY WITH VOITH’S ECO-FRIENDLY WATER-OPERATED TURBO COUPLINGS**

VOITH TURBO MEETS the challenges of manufacturing safe, environmentally friendly products, hence Voith water-operated turbo couplings comply with ISO 140001 environmental specifications to meet international demands for environmental protection and safety in mining and industrial operations.

According to Hans Voshol, Voith Product Manager: Start-up Components, the company is a world leader in hydrodynamic coupling technology, and Voith water couplings present customers with all the advantages of oil-filled couplings and more. The ISO compliance, combined with some ingenious design features, means that Voith water couplings ensure substantially improved energy efficiency.

Hans explains, “Voith water couplings can deliver higher output because the density of water is higher than that of other fluids. Because water’s specific heat capacity is double that of oil, water-operated couplings allow more stop-starts, and the couplings’ lower slip reduces temperatures. Another advantage is the environmentally friendly and convenient use of drinking water, which is generally freely available at any plant and easier to transport (eco-friendly) as an operating medium. Hans also points to the added benefits offered by eliminating the stocking of oil, thereby removing the risks of oil spills and using the incorrect grade of oil.

Advantages unique to the hydrodynamic couplings include:

- Smooth acceleration of heavy masses
- Use of standard asynchronous motors
- Motor-over dimensioning is not necessary
- Torque limitation during start-up
- Effective damping of shocks and vibrations
- Overload protection for motor and driven machine
- Load compensation for multi-motor drives
- Relieved motor start and run-up
- Hydrodynamic couplings are used mainly in belt conveyors, armoured face conveyors (AFCs), fans, centrifuges, wood chippers, mills and pumps, etc. “Water-operated couplings have been operating specifically on underground AFC drives for many years. Operating at the coal face, these drives demand intrinsic safety – a criterion that Voith water-operated turbo couplings always meet with confidence,” comments Hans.

Hans also says that one of South Africa’s leading coal mines has standardised on Voith hydrodynamic water couplings, thanks to successful, efficient and failure-free operation over many years. The water couplings can be retrofitted to any existing application or installation, since sizes are the same as those of oil couplings. The numerous advantages offered by Voith water-operated turbo couplings far outweigh the initial purchase costs.

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NEW CATEGORY FORMAT FOR CMA AWARDS TAKES OFF

THE NEW CATEGORY format for the 2012 Awards for Excellence Competition of the CMA (Concrete Manufacturers Association) has had a flying start. A total of 74 competition entries were received, reflecting the strength and diversity of the precast concrete industry.

Besides the introduction of new awards categories announced earlier this year (see p 71 of Civil Engineering, May 2012), this is the first time that the awards entry book, which showcases entry pictures and lists the professional teams involved, has been published electronically (www.cma.org.za).

The competition takes on additional significance this year with the CMA celebrating its 40th anniversary, an achievement which will be celebrated jointly with the Awards for Excellence presentation ceremony on 3 November. Like many of its peers, the CMA has humble beginnings as a masonry association in 1972, a paving division having been added shortly thereafter.

As anticipated, the ‘Aesthetics’ category captured the lion’s share of the new entry format, with 28 submissions, followed by ‘Innovation’ (15), ‘Technical Excellence’ (13), ‘Sustainability’ (7) and five each for ‘Community Involvement’ and ‘Vintage’. Some entries were entered for two or more categories.

Judging of the Awards took place on 8 August. As in previous competitions, a trophy will be presented to the overall winner of each of six entry categories. However, the regional and national awards of former competitions have been dropped. Instead, three commendation awards per category will be made, providing the entries are of a sufficiently high standard to merit an award.

The CMA’s acting director, Taco Voogt, says that since they were first staged in 1985, the Awards have become the undoubtedly highlighted of the precast concrete industry’s calendar.

“They provide an excellent vehicle for southern African designers and project developers to establish themselves as trendsetters across several disciplines, and in doing so to gain national recognition. The CMA is justifiably proud of the superior attributes of precast concrete evident in this year’s competition – attributes which are certainly on a par with those of our global compatriots.”

Sponsors for this year’s awards include: cement producers, Afrisam and PPC; cement and building materials supplier, Lafarge; and concrete mould manufacturer, Kobra.

A civil engineering project entered into the ‘Innovation’ and ‘Technical Excellence’ categories was the Precast concrete elements for the Ingula pumped storage scheme.

The project required the construction of a concrete framework to support a 400 ton gantry crane in the generator hall of the main underground works. Access to the chamber via a blasted tunnel was limited, and an innovative solution was provided by the deployment of permanent precast concrete shutters manufactured by Rocla.

The project required a total of 552 concrete columns, beams and corbel elements in 38 product variants which were assembled and filled with reinforced concrete on site. Weighing up to eight tons apiece, they varied between 1.5 m and 11 m in length. Extremely tight tolerances of ±3 mm for linear dimensions and ±2 mm for vertical alignment were met through stringent quality control measures at Rocla’s factory.

Limited access to the underground works meant that the project’s engineers, CMC di Revenna, opted for concrete shuttering as opposed to its conventional equivalent. The latter would have required an additional work team in an already crowded work area.

The concrete shutter design called for male joints to be cast into the upper ends of each column and female joints into the bottom ends. This was accomplished by casting all the columns upside down, a process which entailed the design of a special handling system. Handling complexity was compounded by the unique centre of gravity of each column and this meant designing for all possible scenarios.
ESORFRANKI GEOTECHNICAL BEGINS CONTINUOUS JACKING PROJECT

ESORFRANKI Geotechnical has begun a three month long continuous jacking operation in KwaZulu-Natal as part of an intricate new stormwater drainage system being implemented to address land slippages caused by excess rainwater on Durban’s Bluff. The project requires the Esorfranki team to jack an inclined tunnel 130 m long into loose sand.

The Department of Public Works gave the go-ahead in 2011 for a permanent stormwater drainage system to replace a temporary system installed at the local military base 12 years ago. Excess stormwater from the 8.01 ha site will be channelled via a 2 km network of underground piping into a 60 m vertical shaft connected via the 130 m long inclined tunnel to a sea outfall.

The overall design of the stormwater system has been undertaken by Sookan and Associates, with detailed design of the vertical shaft and the angled jacked tunnel executed by Esorfranki Geotechnical. Moore Spence J ones were appointed as the responsible geotechnical engineers.

“The contract for the new stormwater drainage system was awarded to us in November last year and includes the rehabilitation of a 1 000 m³, 30 m deep slip caused by water from a burst stormwater pipe on the western side of the Bluff,” Byron Field, Esorfranki Geotechnical contracts manager, explains. “Water from the burst pipe caused a cascade of about 2 000 m³ of loose material to move down the harbour-facing slope, covering railway lines serving the nearby bulk coal terminal.

“The tunnelling portion of the project presents an interesting challenge, owing to the loose running sand through which the tunnel is being jacked, as well as the length of the jack. This has meant that the jacking operation must run continuously from start-up in August, right through to December, when the tunnel will intersect with the vertical shaft.

As part of the project scope, Esorfranki Geotechnical will demolish the existing sea outfall on the beach and construct a new outfall structure which will be piled and socketed into rock. The installation of 2 km of stormwater reticulation, with some pipes going as deep as 4 m, has been subcontracted to sister company, Esorfranki Pipelines.

The reticulation element of the contract started in February 2012 and is on schedule for completion at project handover in June next year.

As a separate element of the same contract, Esorfranki Geotechnical is rehabilitating a slippage on the western slope that occurred in 2009. This involves the installation of a series of geosteps comprising soil encased in geotextile, and is being carried out at the lower levels.

Field says safety is a top priority on the project, and to this end Esorfranki Geotechnical has implemented a new, internationally recognised safety system in terms of the OSHA 18001 regulation. And, in terms of environmental impact, the project is proving a challenging work site that requires the Esorfranki team to limit its impact on the natural vegetation as far as possible. After project completion, all working areas will be fully rehabilitated.

INFO

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AMERICAN ACCOLADE FOR UCT TRIO

PROF MARK ALEXANDER, chairman of the Cement & Concrete Institute (C&C1), and two of his colleagues at the University of Cape Town’s Department of Civil Engineering, have received the
American Concrete Institute’s prestigious Wason Medal for Materials Research. The three men are all members of the UCT Concrete Materials & Structural Integrity Research Unit (CoMSIRU), and are also well known in SAICE circles.

The Wason Medal for Materials Research was introduced in 1917 by Leonard C Wason, past president of ACI. It is awarded to a member or members of the Institute reporting, in a peer-reviewed paper published by the Institute, original research work on concrete materials and their use, or a discovery that advances the state of knowledge of materials used in the construction industry.

Prof Alexander, Mike Otieno (PhD student) and Dr Hans Beushausen won the accolade for the paper they produced on “Sustainability of various measurement techniques for assessing corrosion in cracked concrete”, published in the ACI Materials Journal in 2010.

“The award of the Wason Medal reflects the high quality output of the CoMSIRU research group, and of Mike Otieno’s work on this paper in particular,” said Prof Alexander.

INFO
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CoMSIRU’s Prof Mark Alexander (left), Mike Otieno (centre) and Dr Hans Beushausen (all well known in SAICE circles) have received the ACI’s Wason Medal for Materials Research.

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An update on the standard system of measurement for civil engineering quantities in southern Africa (CESMM3)

THE TRADITIONAL approach to civil engineering contracts is set out in the following documents (which were published during the 1970s and early 1980s):

■ South African Association of Consulting Model Form 1 All Disciplines, Articles and Conditions of Agreement
■ Civil Engineering Quantities (third edition) (CEQ73)
■ SABS 1200, Standardised specification for civil engineering construction
■ SABS 0120, Code of practice for use with standardised specifications for civil engineering and contract documents

SAICE developed all of the documents with the exception of the Consulting Model Form. The specifications (SABS 1200) and code of practice (SABS 0120) were handed over to the South African Bureau of Standards (SABS) to publish and maintain.

A methodology for measuring civil engineering quantities was provided in Clause 8 of each part of SABS 1200. This clause, however, needed to be read together with the SAICE Civil Engineering Quantities (CEQ73). CEQ was updated in 1990, whereas most of the parts of SABS 1200 have not been updated since the 1980s. In 2000, the SABS Technical Committee for Construction Standards took the decision to withdraw the SABS 1200 series of specifications and the code of practice SABS 0120 once:

■ a new series of standardised specification for Construction Works is published, and

SAICE has put in place a standard system of measurement for civil engineering works. SANS 10403 (formatting and compilation of construction procurement documents) was published in 2003 and the six parts of SANS 1921 (construction and management requirements for works contracts) were published in 2004. All the parts of SANS 2001 (construction works) relating to structural materials (timber, masonry, steel and concrete) were published by 2007, while final drafts for all the standards relating to pipelines were available by the end of 2008. SAICE commenced with the development of a standalone standard system of measurement for civil engineering quantities in 2007, but put the project on hold due to the slowdown in SABS’s throughput of the SANS 2001 standards.

In 2010 the Department of Public Works raised an issue with SABS regarding measurement and payment, as the foreword to SANS 2001-CC1 (structural concrete) stated that parts of SABS 1200 relating to concrete were withdrawn. Their concerns focused on the need for a complete system of measurement and they had difficulty with the piecemeal withdrawal of parts of SABS 1200. The SABS secretariat, however, on their own initiative decided in January 2011 to conduct a straw poll without contextualising the issues – “SABS is now proposing that we continue to support, develop and maintain the SANS 1200 series of standards. These would be developed in parallel with the SANS 2001 docs, so that end users have a choice of which to use.” Their findings were that “the overwhelming response (±75%) to the survey was in favour of retaining the SANS 1200 documents”. SABS thereafter proposed...
that SABS 1200 be updated, and where a part of SABS 1200 and SANS 2001 covered the same scope, the two be amalgamated into one document.

ICE-SA, a joint division of SAICE and the Institution of Civil Engineers (ICE) (London), published in the first half of 2011 the Southern African Edition of the Civil Engineering Standard Method of Measurement (third edition) (CESMM3). CESMM3, which was developed by ICE, became a logical choice as a base document for the successor to the current system of measurement embedded in the SABS 1200 Standardised Specifications, as it is a document founded on the same thinking and philosophy as the system that has evolved in South Africa. It is widely used in Africa and is well understood by the international community. It is a well tried and tested document that is adequately supported by a range of comprehensive handbooks and texts.

The Southern African Edition of CESMM3 was finalised with South African industry inputs and public comments. The modifications to CESMM3 in the Southern African Edition may be summarised as follows:

■ No reference is made to any standard form of contract, as the terms and text are aligned with standard forms of contract commonly used in the region.

■ The terminology is aligned with the provisions of the CIDB’s Standard for Uniformity in Construction Procurement, and international standards.

■ Reference is made, where appropriate, to South African national standards.

■ The items and terminology reflect southern African practices.

■ Requirements have been introduced for the fabrication of structural metalwork items to be supported by separate bills of quantities developed in accordance with the Southern African Institute of Steel Construction’s system of measurement.

■ Classes EA (additional earthworks) and RA (additional road works) have been introduced to provide flexibility to accommodate regional earthworks practices, i.e. to enable interim operations to be measured.

ICE has recently updated the CESMM3 and has very recently published a fourth edition. CESMM4 has adopted the same approach that was followed in the Southern African Edition of CESMM3. CESMM4 is ‘contract neutral’, i.e. it does not depend on any form of contract which accommodates a measure and value approach. It is also now generally ‘national standard neutral’. It does not, however, address the South African practices that were specifically requested by industry to be included in the Southern African Edition of CESMM3, and as such should not be used in southern Africa. There is also no need to revise the Southern African Edition of CESMM3 to align with CESMM4.

The SABS proposal to revise SABS 1200 was rejected by the Technical Committee at their meeting in June 2011. The committee called upon the SABS secretariat to convene a meeting for its members to discuss the issue. SABS, however, decided to hold an open-forum discussion on 24 July 2012 to debate the future direction of the SABS 1200 and SANS 2001 standards in the belief that there was a high level of support for the continuation of the SABS 1200 documents.

Three industry presentations were made at that meeting. The first presentation made on behalf of SAICE, ICE-SA, the Joint Structural Division, Consulting Engineers South Africa, the South African Federation of Civil Engineering Contractors, and the Cement and Concrete Institute recommended that SABS 1200, together with SABS 0120, be withdrawn as soon as the corresponding parts of SANS 2001 are published. Telkom made a presentation on one of the parts of SANS 1200 and SANS 2001, and highlighted that both these standards need to be updated to reflect current requirements. The Southern African Institute of Steel Construction noted an industry resistance to changing from SABS 1200 to SANS 2001 and recommended that the SANS 2001 / SANS 1921 approach be adopted and professional people be appointed to work with the SABS committees to complete the outstanding work. No support for the continuation of SABS 1200 was expressed by any of the participants of the workshop. Industry now stands challenged to convert the earthworks specifications into parts of SANS 2001.

The Southern African Edition of CESMM3 is suitable for use with international, national, organisational and bespoke standards using most forms of contract. It costs R500 including VAT, but excluding postage, and may be obtained from the Association of South African Quantity Surveyors (Tel: +27 11 315 4140), Consulting Engineers South Africa (Tel: +27 11 463 2022), Engineering Contract Strategies (Tel: +27 11 803 3008), the South African Federation of Civil Engineering Contractors (Tel: +27 11 409 0900) and the South African Institution of Civil Engineering (Tel: +27 11 805 5947).
THE FINALS OF AQUALIBRIUM, the exciting SAICE-WRC Schools Water Competition 2012, were held at the Sci-Bono Discovery Centre in Newtown, Johannesburg, on Friday 27 July 2012. The competition never fails to excite and intrigue the teams, spectators and everybody involved!

Winners of the regional competitions came to Johannesburg from as far as Bloemfontein, Cape Town, East London, Pietermaritzburg, Richards Bay, Port Elizabeth, and Middelburg in Mpumulanga to battle the local winners for top honours. Learners were flown to Johannesburg and accommodated in a good hotel – an experience that these young people and some of the educators will never forget! For most this was their first experience of the ‘big city’.

Without the generous sponsorship of the WRC (Water Research Commission, our naming-rights sponsor), as well as VelA VE, FIBERPIPE, Marley Pipe Systems, WISA (Water Institute of Southern Africa), SSI Engineers & Environmental Consultants, ILISO Consulting, and Rand Water, this event would of course not have been possible.

The 2012 champions, with 160 penalty points conceded, were the all-girls team from the Domino Servite Secondary School in Pietermaritzburg (they were in the second place in 2011). The
team members were Zama Nyende, Nntenga Memela and Bianca Coetzee. In the second place was the Steelcrest High School from Middelburg, Mpumalanga, with 180 penalty points. The team members were Hoteb Nkadimeng, Trinity Nkosi and Nokphiwa Mokoena. In the third spot was the Hoërskool Grens from East London with 315 penalty points achieved by Niel Verwoerd, Justin Vorster and Tommie Terblanche. The three winning teams shared the prize-money of just more than R17 000.

BACKGROUND
Both the South African Institution of Civil Engineering and Rand Water celebrated a hundred years of existence in 2003 and, as part of their centenary celebrations, they launched this joint competition for high school learners devised by Professor Kobus van Zyl and students from the University of Johannesburg (Prof Van Zyl has since relocated to the University of Cape Town). Since then the competition has been streamlined and has gained momentum in application.

HOW THE COMPETITION WORKS
Water distribution systems are important to supply safe and clean drinking water to people. The teams are tasked to design a model water distribution network to distribute three litres of water equally between three points on the grid, using two different diameter pipes and connection pieces. They are then judged on how well they execute the task – working on a penalty points system. The teams have a period of about an hour in which to design, build and operate their network.

This competition exposes learners to the practical application of processes that influence their daily lives, in this instance how water gets to their homes. They are made aware of the intricacies
involved in the design of water distribution networks and the actual water delivery to households.

As part of the competition the water cycle is explained to the learners. Issues such as why we have to pay for water, the building of dams, and the distribution of water through water boards to municipalities and then to users, as well as the conservation of our water resources are discussed.

The grid used for the water distribution network is on a background that depicts the entire water cycle. It intrigues learners, as well as educators, who find it a very helpful educational tool. The educational value of this project will be highlighted internationally by Prof Van Zyl this month when he delivers a paper in Australia on the value of a physical water network competition for outreach and teaching purposes, using the SAICE experience as example.

The competition creates awareness regarding the issues surrounding water in South Africa and spreads the message that water is a precious commodity, which should be recycled, reused, respected and conserved. Through this competition SAICE and the WRC, the current major sponsor, help to spread the word that water should be used wisely, that infrastructure should be maintained and that new infrastructure should be created to provide potable water to those without water.

This competition also supports government’s initiatives aimed at encouraging learners to take mathematics and science at school and to follow a career as a science or civil engineering professional. Only in this way can we assure that the quality of life of all South Africans will be better in future. In fact, as a direct result of this competition there are presently three students studying civil engineering, all from the Phomolong Secondary School in Tembisa – two at the University of the Witwatersrand (second and third year respectively), and one at the University of Cape Town (second year). These young people from disadvantaged backgrounds are determined to go MAD, i.e. to Make A Difference in their communities!

For more information on the annual Aqualibrium Schools Water Competition, please contact Marie Ashpole at SAICE National Office (011 805 5947 / marie@saice.org.za).
This competition exposes learners to the practical application of processes that influence their daily lives, in this instance how water gets to their homes. They are made aware of the intricacies involved in the design of water distribution networks.
Winners: Domino Servite Secondary School, Pietermaritzburg
The winning team with, from left, Manglin Pillay (CEO of SAICE), Dr Heidi Snyman (WRC, naming-rights sponsor) and Dr Martin van Veelen (SAICE President)

Second: Steelcrest High School, Middelburg, Mpumalanga

Third: Hoërskool Grens, East London
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RAY FONE, an Honorary Fellow and a dedicated stalwart member of the Institution since 1946, passed away last year at the age of 95. Due to unforeseen circumstances, this obituary is being published now, after the anniversary of his death.

He was born in England and immigrated to South Africa with his parents in 1922. Matriculating from SACS, he graduated with a civil engineering degree from the University of Cape Town in 1935.

He worked for the Department of Irrigation (now Water Affairs) for a short period, and then joined the Department of Public Works. For Public Works, at the time responsible for all interprovincial and international bridges, he designed the road bridge over the Limpopo River at Groblers Bridge (or Martins Drift), a popular border crossing for access to Botswana.

Ray saw active service in the South African Engineering Corps during the Second World War in Ethiopia, North Africa and Italy with the final rank of captain.

On his return to South Africa, he joined the Roodepoort Municipality. Later he moved to Vereeniging Municipality where he rose to Town Engineer, a position he held for 21 years prior to his retirement in 1980.

As a Town Engineer, Ray was a member of the Transvaal Association of Town and City Engineers, which was chaired by the City Engineer of Johannesburg, and he was the vice-chairman for some ten years.

Following his retirement, he was appointed as the Director of Works of the University of Bophuthatswana from 1980 to 1982.

Ray was active in the then SAICE Division of Urban and Rural Development for many years. When it was still called the Municipal Engineering Division he served as their Council representative for 15 years and later became its chairman. In 1999 he received a Special Award from the Division of Urban and Rural Development for meritorious service.

Ray was elected a Fellow of the Institution in 1974 and was awarded Honorary Fellowship in 2002.

He was also a Fellow of the Institute of Municipal Engineering of Southern Africa and a member of the Institution of Structural Engineers.

Two professional activities within the Institution stand apart from his other contributions.

The first is the subject of building regulations. Ray was the Institution’s representative on the National Building Regulations Evaluation Committee, a member of the NBR’s Technical Advisory Committee, and was active on committees of the Institution and the Engineering Council dealing with the regulations for many years. In 1985 he received the very first SAICE President’s Award from Ron Heydenrych for his work related to the National Building Regulations.

The second was the task of going through Government Gazettes from 1983 to 2000, a job he meticulously carried out with diligence. Not only did he draw attention to legislation and regulation changes that were of interest to the profession, but he also generally prepared the comment that would be submitted by the Institution to the Government Department concerned or to Parliament.

This information was also disseminated to the various SAICE Technical Divisions for information and for possible action. He reviewed over 14 000 Gazettes! Some record!

Sadly, deteriorating eyesight forced him to cease making this contribution, and the Institution has yet to find a willing and able person to continue this work. Dawie Botha, SAICE Executive Director at the time, recalls that Ray was always phoning him to make sure that he had received his copious notes, and was apologising towards the end of his stint as advisor about his handwriting and his inability to continue. Dawie says: “For me he will remain the ideal VOLUNTEER and I cherish the fact that I came to know him so well.”

Ray’s wife, Patricia, passed away ten years ago. He is survived by his son, Keith (in Australia), daughter, Felicity, and several grandchildren. His eldest son, John, unfortunately predeceased him.

Alec Hay
SAICE President 1996
alechay@myisp.co.za

With input from Dawie Botha and Dr Kevin Wall
The SAICE Chronicles!

I have good and bad news for the membership of our beloved Institution: the Chronicles are back! Good news for those colleagues in SAICE who have been chipping away at my conscience for the last several years; bad news for the compiler/author who is now beginning to remember the escalating workload inherent in their production! But it is too late for reconsideration – die koeël is deur die kerk. It will be done (DV) and, to be expected in our profession, there is a defined timeline. The format will be different: instead of a piecework series like previously (see picture), the Chronicles will be published as a complete volume – one of the earlier problems that I foresaw was that, as the Institution grew, so would the size of each decade’s report, as did the need for special, one-off report items such as the parallel history of SAICET prior to its absorption into the Institution.

I must re-utter my earlier appeals for help/assistance/input/suggestions. I intend to stick very closely to the format used previously: i.e. Political Setting/Members/Membership/Presidents/Administration/Finances/Hallmarks/Summary of Projects. Equally, I need to identify a theme for each decade: the first four have already been done – Railways, Irrigation, Sanitation and Roads, respectively. For simplicity in dealing with copyright issues, I shall be drawing principally but not exclusively on SAICE publications, so am particularly open to suggestions and/or tip-offs regarding interesting or unusual material.

Finally, I have suggested to our magazine editor that a small corner be devoted to the Chronicles from time to time, not only to provide a progress monitor, but to air a specific request for information etc. There is an enormous amount of personal civil engineering history buried in our collective memories out there – please give a thought to making it available to all!

Contact: either Francis Legge at +27 82 886 2808 (legge@iafrica.com) or Verelene de Koker at +27 11 805 5947 (verelene@saice.org.za).

Francis Legge
Author/Compiler: SAICE Chronicles

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<td>Pietermaritzburg</td>
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<td>Reinforced Concrete Design to SANS 10100-1:2000</td>
<td>23 October 2012</td>
<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>Business Finances for Built Environment Professionals</td>
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<td>Handling Projects in a Consulting Engineer’s Practice</td>
<td>8-9 October 2012</td>
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<td>Sanitary Drainage Systems for Buildings</td>
<td>23 October 2012</td>
<td>Durban</td>
<td>SAICEwat12/01103/15</td>
<td>Vollie Brink</td>
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<td>Earthmoving Equipment, Technology and Management for Civil Engineering &amp; Infrastructure Projects</td>
<td>17-19 October 2012</td>
<td>Midrand</td>
<td>SAICEcon12/01177/15</td>
<td>Prof Zvi Borowitsh</td>
<td><a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
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<td>Concrete on Site</td>
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<td>IPET 2010/02</td>
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<td>Durability, Deterioration and Repair of Concrete</td>
<td>18 October 2012</td>
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<td>IPET 2012/02</td>
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<td><a href="mailto:cheryl-lee@saice.org.za">cheryl-lee@saice.org.za</a></td>
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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
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