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Construction is a breeze

Agilia™, Lafarge’s self compacting concrete allows for pouring without difficulty, providing excellent quality concretes with superior surface finishes. Agilia gives flexibility on worksites at all levels, for all types of applications (foundations, horizontal and vertical structures). Advantages of Agilia™:

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I AM FOLLOWING with great interest the murmurings on the nationalisation of mines, the national land reform program and the drive to force-change policies within the ANC. I have instigated discussions on the matter with several colleagues and friends to test whether the critical issues were generally understood. Most comments I managed to solicit were reticent and guarded; often it centred mainly on the vessel that is making the most noise and the utter disdain for it. Others found it to be of pure entertainment value. Probing further, I found that most people were simply stirred into race concerns rather than addressing the real issue. But, while I hope to cajole our readership to gather insight on the matter, my real intention is to juxtapose South African leadership pre- and post-1994.

Looking back on the dawn of 27 April 1994, when our rainbow nation took its first breath of life, I marvel at the harmony and with equal opportunity. They are remembered for their sense of pride and nobility in South African citizenship. They are remembered for their other South African greats, evoked a deep sense of pride and nobility in South African citizenship. They are remembered for their culture of integrity, respect and principled servant leadership while in public service, displaying a profound hunger for education and knowledge, and through immense personal sacrifice, endeavouring for the greater good of our people.

Just six days before his death, Asmal called for the controversial Information Bill (also known as the “Secrecy Bill”) to be scrapped.

Albertina Sisulu and Kader Asmal, and other South African greats, evoked a deep sense of pride and nobility in South African citizenship. They are remembered for their culture of integrity, respect and principled servant leadership while in public service, displaying a profound hunger for education and knowledge, and through immense personal sacrifice, endeavouring for the greater good of our people.

The death of Albertina Sisulu and Kader Asmal invites a poignant moment of reflection for South Africa. Where do we stand in the greater scheme of the new South Africa – are our leaders focused on building a new nation in the same spirit and legacy of our legendary leaders? I am bound to echo the question that Michelle Obama raised at her historic speech in the Regina Mundi Church in Soweto recently, “What are we going to do with this inheritance?”

FROM THE CEO’S DESK

Kader leadership

Kingdoms, countries, businesses, institutions, marriages – all rise and fall at their levels of leadership (Bishop TD Jakes)

Tributes confirmed that the erudite Asmal was an education-hungry statesman who devoured literature – newspapers, classic literary works and human rights material. He enjoyed the contestation of progressive ideas and positive debate, and was known to fearlessly speak his mind. Asmal resigned from parliament in 2008 in protest against the ANC’s disbanding of the elite Scorpions anti-crime unit. He felt it was a poor decision, and that it was improper that politicians who had been investigated and found to be engaged in corruption by the Scorpions, then took part in the vote to disband the organisation.

In a different life path, Kader Asmal grew up in Stanger, and as a boy met Albert Luthuli, who inspired him to follow his eventual calling of being a fierce fighter for human rights. He was a school teacher and furthered his education in London and Dublin, attaining professorship status in law, specialising in human rights, labour and international law. While Kader Asmal served as Minister of Water Affairs and Forestry, he was the first politician to compile a worldwide study on dams and their water supply capacities. He was convinced that the wars mankind would engage in next would be over scarce water resources.
Tip Walls for Africa

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FOR MANY STUDENTS at universities of technology, formerly known as technikons, a major part of their course involves finding in-service training positions to enable them to comply with the requirements for completing their P1 and P2. For the lucky few students who have bursaries supplied by engineering firms, the jump into the “world of work” is an easy one. For the other students who do not have bursaries though, time, effort and a proactive mindset are a necessity to secure their training positions.

The issue on whether the SAICE YMP (Young Members Panel) could act as a link between industry and students looking for in-service training formed the theme of a recent email-based discussion held amongst members of the SAICE YMP. Yes, it would be great if finding a job was as easy as going onto a website, leaving your details on a database and waiting for the next company to hire you, but that would not do justice to the engineering profession where a code of ethics is held in the highest regard. We as students cannot expect to be spoon-fed into careers. We need to actively go out there and engage with companies in order to secure the positions on our own.

During this discussion, current chairman of the YMP, Andrew McKune, said: “Students need to go out and manage their careers. What you put in, is what you get out! Students who are willing to put themselves out there will be very visible to industry.” A lack of passion is probably one of the reasons for corruption. People are only willing to corrupt things they do not care about or do not hold close to their hearts. If you lack passion for the career path you have chosen, chances are you will not put as much enthusiasm into securing a job. Even when you ultimately secure a position, it will then probably not be enjoyable and will show in your work. It is hard doing something you do not like for 40 years.

So, as a student, what might be the best way to secure a position with a company? Networking!

Networking is probably one of the best ways of getting yourself out there. A CV might do the trick, but nothing shows more drive, passion and enthusiasm than going out there and mingling with others in your chosen profession. One way to do this as a student is through SAICE student chapters. Most universities have student chapters and their sole purpose is to cater to the needs of the student. They facilitate talks and discussions with engineering companies and professionals, thereby empowering students with knowledge and furnishing them with contacts in an effort to make them aware of what is out there.

Being properly informed is the first step in taking action. Join your student chapter if you have not already done so. The more exposure you get in dealing with people from different backgrounds and engineering disciplines, the more likely you are to make the right decisions on what areas of civil engineering you want to go into – be it transportation, geotechnical, structural, water, railways, coastal, environmental, municipal, project management, or whatever other sub-discipline of civil engineering – or even to determine whether engineering is for you at all.

Other ways would be to look for companies on the websites of CESA (Consulting Engineers South Africa) and SAFCEC (South African Federation of Civil Engineering Contractors) where you could search for firms in your area.

In his presentation at a recent road-show for Civil Engineering Professionals of the Future, hosted by the SAICE YMP at the Cape Peninsula University of Technology, the CEO of SAICE, Manglin Pillay, spoke about the relevance of company size for students. We as students would all like to work for major firms and earn a lot of money, but the opportunity for growth could in fact be very limited in big companies. Manglin explained that, in a small company, an intern would not only be able to deal with the technical aspects, but would also be exposed to the business side of running an engineering firm. Being involved in both sides as an intern would make you highly sought after in time to come.

Essentially, there is a shortage of engineers worldwide. But the shortage is not of any engineer; it is a shortage of good engineers. South Africa needs people who will spend three to five years completing a degree or diploma in civil engineering because they have passion, drive and a love for a career which they could possibly immerse themselves in for the next 40 years of their lives.

That same passion must show in everything we do and touch!
What is an economy *REALLY*?

THE WORD ECONOMY is frequently used and frequently abused.

Having been exposed to a basic understanding of economics in the 1980s, I have from time to time pondered the question, “What is this thing we call an economy?” This article seeks to answer that question based on my observations over many years.

The following headlines seem to me to be the most relevant subject areas in determining the success or failure of an economy, with particular reference to the economy of South Africa at present.

**SUCCEED BY ENGINEERING AGAINST FAILURE**

In considering the points that follow there is a fundamental principle applied by engineers, which is "succeed by engineering against failure". This principle requires that we identify the things that cause failure and manage them out of the project or environment in order to achieve successful outcomes.

Thus, when the points below address negative issues, this is done from a perspective of addressing factors that cause failure in order that we may design failure out of the economic system.

**AN ECONOMY IS A SYMBIOTIC COLLECTION OF HUMAN BEINGS**

Over the last few years, as I have become increasingly aware of the importance of early childhood experience, and as outlined in my two Opinions last year [Civil Engineering, July & August 2010, Ed], I have concluded that an economy is a collection of people who harness knowledge and experience symbiotically to create a financial dispensation that is better than that which existed previously.

And so we see a close correlation between symbiotic increases in knowledge and experience and the growth of an economy and, by extension, loss of knowledge and experience leading to a contraction of an economy, which is the threat facing South Africa today.

Symbiosis refers to the productive coexistence of organisms in nature or to the productive coexistence of people in an economy.

One person identifies a need in society and starts a business in order to service that need. In order for that business to run effectively, other knowledge and experience, and other products are required, and so the operation of that business symbiotically creates the need for other businesses or enterprises, and so the economy grows.

If the vision of those who are starting businesses and other enterprises is ambitious, the resulting economy will stretch limits and push boundaries. If the vision of those people is constrained, as in a survival economy, the resulting economy will be constrained.

It is the attitude and vision of people that determine the scale and success, or otherwise, of an economy. Thus we see that in some nations there is much greater prosperity than in others.

**ONLY TWO PERCENT OF THE POPULATION DEFINE THE ECONOMY**

It has been said that 2% of a population know how to create wealth, and that these people define the level of prosperity of the society; that 12% know how to mobilise talent and resources to assist the 2% to create wealth; and that the remaining 86% are oblivious to the workings of the economy and think that wealth happens by magic or favouritism or some sort of behind-the-scenes connivance directed at depriving the majority of that something which is actually theirs.

The lack of awareness of this statistic is a major problem in most economies, and in particular in South Africa today. Where politics and other actions alienate those who know how to create wealth and those who know how to assist them to create wealth such that those people leave, as has been happening in South Africa for some time now, the economy starts to decline. The decline may not be visible to those who are not aware of the finer details of how an economy works, but they are visible nonetheless.

If South Africa is to provide wealth for all its people, it needs to attract and retain those who know how to create wealth and those who know how to assist them to create wealth.

**AN ECONOMY IS NOT SOMETHING THAT CAN BE REDISTRIBUTED**

Inherent in the previous points is a realisation that an economy cannot be created by redistribution.
If the people who are not wealthy knew how to create wealth they would be wealthy. Theoretically there is nothing preventing them from becoming wealthy.

Commercial farmers operate large farms not because they were given the farms as some sort of hand-out, but because they have proven their ability to mobilise resources of capital, machines, people, etc to conduct agricultural endeavours on previously undeveloped land in a manner that allows them to draw a moderate income and still have money left over to buy seed, fertiliser and other inputs, as well as pay workers.

Those workers who have grasped the fundamentals of how to do this have moved on already.

**ENGINEERING, TECHNOLOGY AND METHODOLOGY ARE CENTRAL**

Technology and technical aptitude are central to the success of an economy.

A society that carefully applies technology, and maintains and nurtures that technology, is one that will prosper. A society that drains finance away from maintenance of infrastructure and construction of new infrastructure such that existing infrastructure decays and becomes derelict, as is increasingly happening in South Africa, will eventually sink into poverty and so-called third-world status.

**ATTITUDE, MORALE AND WORDS MAKE OR BREAK AN ECONOMY**

People with a positive attitude and work ethic, and positive morale, build up other people, and the resulting synergies raise the level of emotional energy in the community, and this in turn creates wealth-creating activities.

Negative and destructive words destroy morale and break down the fabric of society. Constantly complaining that the bulk of the economy is “dominated” by white males, when white males have contributed greatly to creating the economy in question, is destroying morale and creating a situation where those who are deemed to be offenders because of their gender and skin colour are increasingly incentivised to seek other countries which recognise their skills and abilities.

The same discrimination, previously, in the reverse direction, was equally destructive, but taking unacceptable behaviour and turning it around in the opposite direction does not make it any more palatable or effective.

**LEAN AND FACILITATIVE GOVERNMENT STIMULATES AN ECONOMY**

Around the world we see that governments which limit their direct involvement in the economy stimulate growth far more effectively than those that get actively involved in the economy and try to manipulate and control it.

An economy is a consequence of the collaborative and cooperative efforts of human beings who know how to create wealth; it is NOT the outcome of bureaucratic interference in the economy by people who clearly do not know how to create wealth – otherwise they would be independently wealthy in their own right.

**EARLY CHILDHOOD EXPERIENCE CREATES THE FOUNDATION FOR AN ECONOMY (AND FOR EDUCATION TO BUILD ON)**

I continue to see how the performance of adults is framed by their experience in the first seven years from conception.

Personality, work ethic, career interest, behaviour in relationships, and many other characteristics of human endeavour are informed and dramatically shaped by early childhood experience.

If we desire to see wealth distributed more widely, we need to distribute the knowledge and experience in early life that will enable the majority of the population to eventually contribute more directly and more dynamically in growing the economy. In the absence of such stimulation, and in the presence of badly planned and badly executed experiments, such as Outcomes Based Education which affected an entire generation, we will see a degradation in the economy twenty to fifty years later.

While having a lesser impact, primary, secondary and tertiary education must naturally all be of a high standard if the economy is to thrive.

**ALL THE REST**

There are many other factors that inform the viability of an economy, but I believe that those listed above are the principal factors. If these factors are addressed there is a reasonable prospect that an economy will prosper. If they are ignored, or worse still, countered, the economy will degrade, although it could take up to fifty years to become visible.
The elusive concept of project success: introducing the Endeavour Success Matrix

MEASURING PROJECT SUCCESS
Measuring project success is a key aspect of project management. If a project is delivered on schedule, within budget and satisfying all stakeholders, then it should be getting a bright green light. If a project is delivered late and over budget, with all the stakeholders dissatisfied with the outcome, then clearly it should be getting a flashing red light. However, it is not always as simple as that because there is a grey area between these green or red examples.

We also need to consider from whose perspective we are viewing the project success. Stakeholders such as the buyer/customer or seller/contractor could have differing opinions. For example, a cost-pluss percentage fee-type of project that went 200% over budget could be a financial disaster from the buyer/customer perspective, but could be very lucrative from the seller/contractor perspective. In project management we usually take the buyer/customer perspective in judging overall project success.

One of the challenges with projects is that they cover a wide range of endeavours from, for example, a student studying to pass an examination (on the simple side of the spectrum), to a huge team of professionals planning and implementing an eight-year programme to stage the Olympic Games (on the complex side of the spectrum). Can we use similar definitions and success criteria (such as the traditional: on time, on budget, and meeting requirements) for both?

This article proposes that:
■ We consider the “endeavour” as comprising a “project” producing an “outcome”.
■ An endeavour’s success should measure the performance of the project management separately from the outcome.
■ An endeavour’s success should be measured against a set of customised and weighted success criteria.
■ Project management success and outcome success should be expressed as a percentage, rather than on a “yes” or “no” basis.

SUCCESS OR FAILURE?
A contentious issue is – do we measure the success of a project against the original approved baselines or the final approved baselines? If a project encounters force majeure situations or the customer changes the scope, it would be unfair on the project management team to use the original baseline. However, if the project management team was incompetent in defining the scope in the first instance, then subsequent “corrective” scope changes should detract from the success of the project. Scope creep is another insidious problem. Scope creep is when features and functionality are added (increasing project scope) without addressing the effects on time, costs and resources, or without customer approval.

Let’s consider the success of the following four projects, firstly in terms of just the baselines, then in the light of additional criteria. Figure 1 shows the results of four projects (A, B, C and D) with a primary statement (in
Which projects are successful?

A low-cost housing scheme probably would not be considered a failure if it was handed over one day late, provided the cost and quality baselines were achieved. However, if the opening ceremony of the Olympic Games was a day late it would have enormous repercussions, and would certainly be considered a project management failure. If the final actual cost of a project exceeds the final approved budget by one dollar, it is theoretically a cost management failure, but practically we would consider it on budget and successful. So where does one draw the over-budget line, $100, $1,000, $100,000?

ENDEAVOUR SUCCESS

It may be more meaningful if we viewed the success of the project life cycle separately from the operations life cycle.

Typically, the Product Life Cycle comprises a Project Life Cycle followed by an Operations Life Cycle. The Project Life Cycle comprises phases, for example: Concept, Development, Implementation, Close-out. Each phase produces deliverables, culminating in a project product, which is handed over to the end-users to realise benefits over the duration of the Operations Life Cycle (which could be anything from performing a theatrical production for a few days, to operating a nuclear power station over many decades).

But not all projects produce a tangible product – some culminate in a service or a result. So it could be misleading to talk of a Product Life Cycle. A more appropriate term would be the Endeavour Life Cycle. In defining a project, both the Project Management Institute (PMI)* and Association for Project Management (APM) use the word “endeavour” so this should be an acceptable term.

Sometimes we are dealing with a program, which is a group of related projects managed in a coordinated way to obtain outcomes or benefits and control not available from managing them individually. The word “endeavour” is applicable to both project and program. The Endevour Life Cycle (ELC) spans the Project Life Cycle (PLC) and the Operations Life Cycle (OLC) as shown in Figure 2.


The PLC should be preceded by a Business Case to justify the effort of undertaking the project.

An endeavour can only be considered a complete success if the project management...
of the PLC’s outputs meets all the project’s scope, time, cost and quality baselines AND the client / end-users were satisfied with the project outcomes during the OLC. We should attempt to measure the endeavour’s success in terms of:

■ Output success. Did the project management team achieve the time, cost and quality requirements (project efficiency)?

■ Outcome success. How successful was the outcome in terms of achieving the expected benefits (endeavour effectiveness)?

TRADITIONAL SUCCESS METRICS

It is not always correct to say that the project has failed if the final cost, schedule or scope exceeds the original baseline. There could have been value-adding scope changes which make the project’s product more valuable. Force majeure situations, which are always beyond the control of the project manager, may also require baseline adjustments. Even if these aspects are taken into account, a simple “yes” or “no” answer to the question, “If a project exceeds its final approved baselines, is it a failure?” is not always sufficient.

It will be useful to separate the judgement of the success of the project management effort from the success of the product in the operations life cycle. The success equation would be as follows:

Endeavour Success =

Project Management Success (efficiency)

+ Operations Success (effectiveness)

Did the outputs / outcomes satisfy the end-user and customer needs? Was the return on investment acceptable?

It is suggested that we move away from the “yes” or “no” judgement, and rather use a success percentage based on success criteria which have been rated and weighted in an Endeavour Success Matrix as shown in the next section.

ENDEAVOUR SUCCESS MATRIX

In the Endeavour Success Matrix approach the project management performance is separated from the product performance (outcome) in the operational life cycle. The “yes” or “no” judgement of success is avoided.

Success criteria are identified for the specific project, and then each criterion is rated according to how successful its performance is assessed by the key stakeholders. Table 1 suggests an approach to rate the budget, schedule performance or stakeholder satisfaction (this could be shown using three separate tables).

Table 2 suggests an approach to rating the scope and quality aspects. The Project Management Office can adopt standard tables for all projects, or adapt them depending on the nature and size of the specific project type.
“I used to live in a tin shack. My new house made of concrete blocks and roof tiles is strong and provides protection from the elements.”

- Thuli Majola
Table 4 Comparison of Traditional Success Criteria vs Endeavour Success Matrix

**Endeavour A**  
Low-cost residential housing complex (subsidised) with 12-month project duration  
Significantly exceeds its final approved baselines but all the stakeholders are satisfied with the outcome

<table>
<thead>
<tr>
<th>Success Criteria</th>
<th>Result:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Residents must be satisfied with the housing</td>
<td>1. Significant scope changes/creep</td>
</tr>
<tr>
<td>2. House selling price should not exceed 10% of target price</td>
<td>2. Over budget by 15%</td>
</tr>
<tr>
<td>3. One month behind schedule</td>
<td></td>
</tr>
<tr>
<td>4. Serious problems with concrete strength</td>
<td></td>
</tr>
</tbody>
</table>

**Traditional verdict on success: Project failed**  
(Reasons: Over budget and late)

<table>
<thead>
<tr>
<th>Success criteria</th>
<th>Rating</th>
<th>Weight</th>
<th>Score</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project Management</td>
<td>Table 1/2</td>
<td>Table 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Scope</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>25% scope creep and corrective changes</td>
</tr>
<tr>
<td>1.2 Schedule</td>
<td>7</td>
<td>3</td>
<td>21</td>
<td>Handed over one month late</td>
</tr>
<tr>
<td>1.3 Budget</td>
<td>6</td>
<td>3</td>
<td>18</td>
<td>15% over final approved budget</td>
</tr>
<tr>
<td>1.4 Quality</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>Rework due to concrete failing tests</td>
</tr>
<tr>
<td>Total for project management</td>
<td></td>
<td></td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Project management success</td>
<td></td>
<td></td>
<td>55%</td>
<td></td>
</tr>
</tbody>
</table>

| Outcomes (End Product) | Table 1/2 | Table 3 | | |
|------------------------|--------|--------|----------|
| 2.1 Client stakeholder satisfaction | 3 | 2 | 6 | Top management somewhat dissatisfied |
| 2.2 Other stakeholder satisfaction | 8 | 4 | 32 | End-user (home owner) mostly satisfied |
| 2.3 Product quality | 8 | 3 | 24 | House owners satisfied after hand-over |
| 2.4 Return on investment | 6 | 1 | 6 | BCR = 1.0 in financial terms |
| Total for outcome | | | 68 | |
| Outcome success | | | 68% | |

**Endeavour C**  
Budget battery-powered motor vehicle  
Performed better than all its final approved baselines, but all the stakeholders are very dissatisfied with the outcome because the Business Case was flawed

<table>
<thead>
<tr>
<th>Key Success Factors</th>
<th>Result:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Budget important to be met</td>
<td>1. Minimal scope creep</td>
</tr>
<tr>
<td>2. End-user must be satisfied</td>
<td>2. Under budget</td>
</tr>
<tr>
<td>3. Specifications must be met</td>
<td>3. Ahead of schedule</td>
</tr>
<tr>
<td>5. Sales far below expectations</td>
<td></td>
</tr>
</tbody>
</table>

**Traditional success verdict: Project succeeded**  
(Reasons: Within budget and ahead of schedule)

<table>
<thead>
<tr>
<th>Success criteria</th>
<th>Rating</th>
<th>Weight</th>
<th>Score</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Project Management</td>
<td>Table 1/2</td>
<td>Table 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Scope</td>
<td>9</td>
<td>2</td>
<td>18</td>
<td>Vehicle delivered with &lt;5% scope creep</td>
</tr>
<tr>
<td>1.2 Schedule</td>
<td>10</td>
<td>2</td>
<td>20</td>
<td>Handed over on time</td>
</tr>
<tr>
<td>1.3 Budget</td>
<td>10</td>
<td>3</td>
<td>30</td>
<td>Within final approved budget with CPI = 1.05</td>
</tr>
<tr>
<td>1.4 Quality</td>
<td>7</td>
<td>3</td>
<td>21</td>
<td>Generally met the specifications first time</td>
</tr>
<tr>
<td>Total for project management</td>
<td></td>
<td></td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>Project management success</td>
<td></td>
<td></td>
<td>89%</td>
<td></td>
</tr>
</tbody>
</table>

| Outcomes (End Product) | Table 1/2 | Table 3 | | |
|------------------------|--------|--------|----------|
| 2.1 Client stakeholder satisfaction | 1 | 2 | 2 | Client totally dissatisfied |
| 2.2 Other stakeholder satisfaction | 1 | 4 | 4 | End-user totally dissatisfied |
| 2.3 Product quality | 7 | 2 | 14 | Specs met, but users complain |
| 2.4 Return on investment | 1 | 2 | 2 | BCR = 0.7 |
| Total for outcome | | | 22 | |
| Outcome success | | | 22% | |
The Engineering and Construction Project Management (ECPM) course is a 3-day intermediate level course covering the principles, processes, tools and techniques of project management in the built environment.

This course is based on the internationally recognised Project Management Body Of Knowledge (PMBOK® Guide) and its Construction Extension published by the Project Management Institute (PMI®). It has been adapted to the South African built environment and covers all the project life cycle phases from the Initial Briefing, Concept, Design, Procurement, Construction and Close-out.

The ECPM course is validated by the South African Institute of Civil Engineers (SAICEproj10/00756/13) and contributes 3 credits towards Continuing Professional Development (CPD) as required by the Engineering Council of South Africa (ECSA) for engineers to retain their professional registration status.

It will establish a solid framework for consistently managing successful projects by drawing up a comprehensive Project Management Plan covering the following management aspects:

- Scope Management
- Time Management
- Cost Management
- Financial Management
- Quality Management
- Human Resource Management
- Risk Management
- Procurement Management
- Integration Management
- Claims Management and Contract Law
- Health & Safety Management
- Environmental Management
- Communication Management


The author believes that the Endeavour Success Matrix approach gives a better insight into the performance of the management of the endeavour during the project life cycle, for which the project manager is accountable, and the successful outcome of the endeavour in the operations life cycle for which the customer, sponsor, or others may be accountable.

BIBLIOGRAPHY
2. Association for Project Management (APM) – Body of Knowledge (BoK) 5th Edition. www.apm.co.uk

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The project management team on Endeavour A had a mediocre performance. The project manager is accountable for this. However, the outcome was quite acceptable.

The project management team on Endeavour C performed well, but the outcome was decidedly unacceptable. The project sponsor is primarily accountable for the latter.

CONCLUSION
The traditional metrics for classifying projects as successful or not are unsatisfactory. Using a yes / no approach can be misleading. The Endeavour Success Matrix permits drilling down to find out what the success criteria for an endeavour were, to what extent they were achieved, and read a brief comment on each.

The author believes that the Endeavour Success Matrix approach gives a better insight into the performance of the management of the endeavour during the project life cycle, for which the project manager is accountable, and the successful outcome of the endeavour in the operations life cycle for which the customer, sponsor, or others may be accountable.

Each criterion is weighted according to how important its contribution is towards achieving endeavour success as suggested in Table 3. The ratings and weightings are then multiplied and summed for project management and outcomes respectively. A percentage success can be reported for each aspect. Worked examples using this approach for projects A and C used previously are shown in Table 4. Unlike a football scoreboard, Table 4 does have a comments column.

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Table 5 Summary of Endeavours A and C

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Build relationships, not bid packages

BACKGROUND
Marketing for consultancies is almost 99% relationship-building, and virtually any other resource you try will only work if that is at the root.

You are going to need to build your business from your relationships; and if you do not have them, you will need to connect the dots and find a way to be near the people you want to do business with.

It is a brave new world in the construction industry that is not going to return to its former self. It is time to stop chasing projects and start building relationships. It is time to differentiate and get back to the roots of how your business was founded. It is time to pay attention to track records – yours and your competitors’. It is time to get smart. This article offers a few suggestions on how to do that.

THE RELATIONSHIP ‘MARKETING MUSTS’
The easiest and most important ‘marketing must’ is to create trusting relationships with your top customers who make you most of your money and pay your bills. Start by making a list of your top 20 to 100 customers. Look at every job you have completed or bid for in the last five years. Who was the customer, architect, engineer, real estate broker, project manager, purchasing manager, or any other person who might have influenced the decision to hire your company? List all of your customers, potential customers and referring parties on a spread sheet, as follows:

■ Loyal customers: customers who use your company only
■ Repeat customers: customers who use you if you are a low bidder
■ Potential customers: customers you want to pursue in your market
■ New target customers: customers in different project types or areas
■ Referring parties: people who can or do refer work to your company

Then rank and sort them by the following important factors:

■ Profit potential
■ Ease of doing business with
■ Desire to do new business with
■ Ease of getting on their bid list
■ Competitive factors or competition
■ Ease of negotiating work with
■ Potential to become a repeat customer
■ Ability to convert from repeat to loyal customer

Now that you have a customer target list to begin your marketing program with, start thinking where you should invest the most time and money.
In the construction business, the biggest marketing bang for your buck is creating customer relationships with your top customers, most desired potential customers and quality referring parties who refer substantial amounts of work to your company. For most small construction companies, focusing on 10 to 20 customers is all it takes to make the most money. Pick the top 10 to 20 customers you want to create a deep relationship with, and plan a marketing strategy to convert customers from potential to repeat to loyal customers.

How often would you have to see them to remain close?

Think about your best friends. To maintain close, loyal and trusting relationships, you must spend quality time with them at least once every two to three months. Quality time includes face-to-face time at dinner, lunch, breakfast, ball games, community events, golfing, hunting, fishing, or industry events together. It does not include job meetings, bids, phone calls, e-mails or negotiating change orders! If you see two customers every week you will see all 20 on your list every 10 weeks, and in so doing you will maintain quality customer relationships with them. If you never take them out, all you can hope for is to stay on their bid list by doing good work for them.

The following ‘marketing musts’ are simple to implement, and will allow you to build a better business with better clients. If you do not introduce some or all of them, your company will stay at the same level and continue fighting for the cheap work and leftovers that most contractors scrape to find.

Have realistic expectations

Do not expect that any day now the market is going to turn around and you will not have all these pressures and challenges any longer. If you lost the last 35 jobs for which you had ‘bid blind’, don’t expect the 36th to be the one. Do not expect to make four phone calls and have somebody throw a job in your lap. Do not expect a call back from somebody you gave no good reason to call you back (i.e. you left a message saying, “This is Joe from Joe’s Drywall; call me with some drywall jobs if you have any.”) Don’t expect a current partner to keep throwing work your way if you are not nurturing the relationship (if you are not courting your customer regularly, guess who is?). Do not expect it to get better – we need to get better at it.

Measure results

If you have not won a bid in your last 40, you need to know that. Too many companies are unaware of their own and their competitors’ recent track record in a particular market sector (what happened three years ago doesn’t matter any longer). The need has never been greater to research your win/loss ratio and see what prices your competitors have been bidding lately. If you have not won something in a particular sector in ages, if you cannot compete in a price range based on what you have seen competitors win similar work at, and you do not have a relationship that would support your bid – why bid at all?

Build relationships, not bid packages

Do not bid for the sake of bidding. Go out there and shake some hands and kiss some babies instead of doing another take-off today on a project where you have no relationship in place to accompany your bid. When you call potential sources of business, know what they are winning, losing and bidding. Then speak about how you can help across the entire scope of their activity, not just on one project. Learn about them, their business, and their challenges. Identify people you want to work with, not projects you want to work on. Pick up the phone and introduce yourself; do not call asking for a set of plans. Build a relationship with them, not just a bid package.

Be the POSITIVE one

There is negativity when we turn on the news. There is negativity when we talk to co-workers, business partners, neighbours, friends and family. There is negativity in trade publications and at networking events. There is negativity in the grocery store and at the movies. It is everywhere. The supply of negativity is high, but the demand for it is low and getting lower. Be the positive one. You will be in high demand as one of a small group supplying hope and smiles.

Take action EVERY day

There is knowing what must be done, and then there is doing it. Your success will be in direct proportion to your commitment to action. Do not give up at the first sign of a challenge or trouble. Stay focused on the important business at hand. Set aside time and energy each day for new business development. Dedicate yourself to doing what it takes to achieve the results you desire. There will be plenty of reasons why not if you are looking for them, so do not accept excuses from yourself or others. Stay positive. Work hard and smart each and every day. “It’s hard to beat a person who never gives up.” (Babe Ruth)

Eyeball-to-eyeball handshake

Even in this electronic age, nothing takes the place of the eyeball-to-eyeball handshake. The initial contact might be through e-mail, Facebook or LinkedIn, for example, but this should never take the place of a real face-to-face meeting. Even in this computer age people still want to deal with people. Therefore, meet with potential customers face to face throughout the whole process; do not wait to meet them only when they sign the contract.

Constant Customer Contact

To stay in touch with your entire customer list, you should send everyone on your list something at least every two to three
months. This will keep you at the top of their minds when they have a need to call. Ongoing customer contacts should accomplish one of the following strategies:

Make customers aware of your company
■ Send out brochures, flyers or photos showing your company’s expertise and accomplishments.
■ Participate at industry meetings/events.

Create a perception of your company’s value
■ Show how you had accomplished major tasks.
■ Speak at industry events.
■ Share charts and graphs that show your value-added services.

Reinforce your relationships
■ Entertain customers by taking them to lunch, or to an event or a meeting.
■ Send them personal handwritten notes.
■ Send them job site photos of project progress.
■ Send them thank you cards/notes after contacts.

Show customers you care about their success
■ Send magazine articles or books that might help them.
■ Send tips or guidelines on how to do things better.

Invite your three best clients for lunch (or coffee) to ‘pick brain’ and share ideas
Such an occasion could be really informal, but would help you understand their interests, trends in their businesses, groupings or associations they value most, the media they follow, and so forth – all vital to planning your future marketing strategies.

Referral program
When visiting your top 10 to 20 customers, ask for referrals. Make it a priority to ask each customer at least once every year for referrals. This will insure a quality target list to expand your customer base. Remember, if you do not ask, you will not get! After they have given you a referral, send them a thank you gift of some value as appreciation for their help.

CONCLUSIONS
These ‘marketing musts’ will hopefully make you lots of money! To get started, begin first with the number one ‘must do’, i.e. relationship marketing. The cost of nurturing customer relationships (e.g. taking them out to lunch) is small compared to making another R50 000 to R100 000 on your bottom-line by building for loyal and repeat customers versus attracting all your work by being the low bidder.

Next, implement number two on the ‘must do’ list, namely constant customer contact. The returns on a four-times-a-year mail marketing drive will definitely outweigh your capital investment in such an initiative.

And then, decide which next ‘must do’ will give you the greatest return. Some companies will need a professional website, others will need a company brochure, while others will be able to get lots of referrals. Choose what will work best for you and make it happen! Remember, any marketing plan in place is better than a perfect plan never executed.

See you at the bank!
IN NOVEMBER 2008, the SACPCMP (South African Council for the Project and Construction Management Professions) published and implemented a registration system for Professional Construction Mentors. They have since identified a need to extend and refine the admission requirements to broaden the application of Construction Mentorship, owing to the very few Professional Construction Mentors applying successfully for registration. It was determined that the requirements for a new category of Construction Mentor should be drawn up in order to draw on experienced and skilled people in the industry, who may not be already professionally registered.

The SACPCMP reported that the number of people applying to the Council for registration as Professional Construction Mentor was significantly smaller than expected. In August 2010, there were only six people registered as Professional Construction Mentors, while another five applications were pending.

The National Department of Public Works approached the SACPCMP with a request to address this shortage of registered persons, as they require greater numbers of Professional Construction Mentors to support their development objectives under different programmes, especially under the Expanded Public Works Programme.

The National Department of Public Works approached the SACPCMP with a request to address this shortage of registered persons, as they require greater numbers of Professional Construction Mentors to support their development objectives under different programmes, especially under the Expanded Public Works Programme. They identified the problem to be the requirement for an NQF level 7 academic qualification, as well as the requirement that the person had to be registered with a Built Environment Council in a professional category.

Most experienced practitioners in construction are very capable of acting as effective mentors, but few have degrees, and even fewer are registered with a Built Environment Council, as there is no statutory requirement for them to do so. The Department of Public Works also requires a Construction Mentor who operates at a much lower level, in support of contractors registered in the lower CIDB Construction Grading Designations (Grades 2-4); someone therefore who is more involved in getting the technical techniques of construction right for a single project, rather than someone who operates at a strategic multi-project level.

In August 2010 the SACPCMP reconvened the committee that prepared the original registration criteria for Professional Construction Mentors from 2004 to 2008, and tasked them to investigate options available for expanding the registration to other categories of Construction Mentor.

The new category would benefit not only the National Department of Public Works, but also several other organisations that currently have an interest in Construction Mentors. The CIDB Status Quo Report on South African Contractor Development Programmes (March 2009) interrogated several contractor development programmes. Common amongst these contractor development programmes, to a larger or smaller degree, was the use of mentorship to ensure the practical implementation of theoretical classroom training to entrench the skills learned.

The Contractor Development Programmes that were reviewed in this report were:

- National Department of Public Works Incubator Programme
- Department of Public Works Eastern Cape Contractor Incubator Programme
- DPW KZN Masakhe Emerging Contractor Development Programme
- DPW Western Cape Contractor Development Programme
- KZN eThekwini Vuk’upile Learnership Contractor Development Programme
- KZN eThekwini Large Contractor Model
- ECDC IECDM
- ESKOM Construction Academy

These programmes have evolved and developed since the CIDB Status Quo Report in 2009, and others have been established by different client and development bodies. The trend throughout these programmes has been to include the use of a coach or mentor to ensure that a contractor achieves his/her potential. It has been established that mentorship is an integral part of contractor development, and that the proper deployment of mentors in the workplace will result in improved success. The quality of mentorship that is provided impacts greatly on the effectiveness of the contractor development programme, and those programmes where there is a formal selection process for mentors also show better results.

The CIDB Status Quo Report concluded that:

- Access to theoretical and practical training supported by mentoring
is core to any Contractor Development Programme.

- Evidence suggests that the quality of mentoring and training provided to contractors within Contractor Development Programmes is variable.
- The quality of training provided by some SAQA accredited trainers is also often not acceptable, as is the quality of mentorship in some Contractor Development Programmes.
- Accreditation of mentors has been established under the mentorship programme managed by the University of the Free State, and more recently registration rules for construction mentors have been established by the SACPCMP.
- The CIDB Report also recommended that Contractor Development Programmes should:
  - Align their formal training provided with the contractor competence model of the CIDB Best Practice Contractor Recognition Scheme (currently being developed)
  - Implement systems to ensure the quality of training provided by training providers – possibly through a “Training and Mentorship Section” within the Contractor Development Programme or Works Department to continually monitor and evaluate the training and mentoring processes, and
  - Use only mentors registered with the SACPCMP.
- Subsequent to the research, the SACPCMP Mentorship Committee prepared proposals for the SACPCMP Council on the registration criteria. These criteria were adjusted, and finally promulgated in November 2010, as a new category for registration with the SACPCMP, namely Construction Mentor, with abbreviation CMentor.
- The new category has been constituted using the following criteria:
  - NQF Level 6 academic qualifications (Matric plus a National Diploma or equivalent)
  - Minimum of ten years relevant experience in the construction industry
  - Minimum of five years relevant experience in the construction industry at supervisory level (Foreman or General Forman Level at least)
  - Be able to demonstrate knowledge, skills and experience in technical and commercial competencies in an examination set by the SACPCMP
  - Be assessed by the SACPCMP as able to act suitably as a mentor following a psychometric examination
  - Be certified as competent in the transfer of skills and knowledge.
- The following restrictions are placed on the Construction Mentor:
  - This new category of Construction Mentor will be permitted to provide mentorship support to contractors up to CIDB Grade 5.
  - The Construction Mentor must sign and commit to the SACPCMP Code of Conduct.
- A clear career path is to be provided to enable a Construction Mentor to become a Professional Construction Mentor, following being registered in this category. This is to also form part of the SACPCMP’s Recognition of Prior Learning (RPL) programme, whereby a formal qualification is not required, and the candidate’s experience and expertise are assessed through a demonstration of his/her ability in the workplace. The SACPCMP RPL programme is still new, and will be tested thoroughly through the implementation of the new Construction Mentor registration process.
- Applications are now open through the SACPCMP for the new category. The process involves the completion of the application forms (available from the SACPCMP), a demonstration of the person’s technical, business and skills transfer ability through essays (as part of the application), sitting through a professional interview with the SACPCMP registrar, and a psychometric examination.
- A voluntary association is being established to cater specifically for the Construction Mentorship profession. Any person wishing to be part of this association should feel free to contact Alain Jacquet (ajacquet@ssinc.co.za) or the SACPCMP offices.
- The creation of the new category of Construction Mentor means that there will now be a possibility for clients, finance houses, and contractors to easily identify persons who have the technical and business skills to effectively develop a fledgling contractor into a successful construction business. The formalisation of the Construction Mentorship Profession will support the CIDB’s National Contractor Development Programme, and ensure that the capacity of the construction industry is bolstered in a more structured manner.
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Collin Ramukhubathi
Area Quarry Manager
Western Cape Aggregates Division

Growth from diversification
NMMU upgrade meets expectations

BACKGROUND
The Nelson Mandela Metropolitan University (NMMU) prides itself as being one of the top universities in South Africa and therefore needs to adjust to the ever changing environment and student expectations. To achieve this, the NMMU has over the past four years embarked on a multimillion-rand program for the upgrading of existing infrastructure, and the construction of new infrastructure. Many new and exciting projects were initiated and completed as part of the Capital Infrastructure Program. This has, in many ways, positively impacted on the daily activities on the various NMMU campuses.

The program budget made allowance for fifty-five infrastructure projects varying in size from as little as R130 000 to over R45 000 000, with an accumulated grand total of R535 000 000. Funding allocated to the Capital Infrastructure Program was made available from internal NMMU sources and by the Department of Higher Education and Training. The Program team comprised twenty-nine individual consulting firms and thirty-one contracting companies.

The NMMU appointed Aurecon in 2007 as Program Managers to assist in the successful management and execution of the overall Capital Infrastructure Program. Aurecon’s responsibilities included:

■ Program financial management and reporting
■ Communication management
■ Time and progress management and reporting
■ Support in the procurement and management of consultants
■ Managing and monitoring program administrative documentation
■ Compilation of individual project plans
■ Acting as the NMMU’s agent (centralised point of communication)
■ Assistance with funding applications
Guidance on construction contract agreement issues. On defined projects, Aurecon was also appointed as the Project Managers and acted as Principle Agent during the construction stage. On these projects the responsibilities included all the duties as laid down by the SACPCMP (South African Council for the Project and Construction Management Professions) during all six stages of a typical project roll-out process.

Two of the main factors for the Program initiation were:

- **Upgrading of existing facilities and infrastructure**
  As part of the management actions of the NMMU it allocates internal Council funding annually to attend to Capital Maintenance works. The Capital Maintenance works arise as a result of necessary maintenance type work which is too large to place under the Operational Maintenance budgets. Due to funding constraints over the past years and a lack of human resource capacity to implement the maintenance works, the Deferred Maintenance Projects value has grown substantially. It was thus necessary to inject a large amount of funding to attend to some of the most necessary deferred maintenance works.

- **New facilities and infrastructure**
  Due to current and expected future student number growth at the NMMU, the demand for new facilities on all campuses was identified and funded as part of the NMMU Capital Infrastructure Program. From the client’s perspective in a post-merger consolidation phase (previously University of Port Elizabeth, Port Elizabeth Technikon and Vista Campus respectively), it was also crucial to promote academic coherence on the various campuses to ensure that similar disciplines and academic programmes that had previously operated on different campuses would be physically located on the same campus.
Program Management Tools and Reporting

Tools used by Aurecon to ensure successful management of the Program are the following:

- Compilation of a Project Management Plan to standardise on procedures, forms and reporting requirements
- Program Cash-Flow Report
- Program Progress Report
- Construction project procurement scorecard
- Standardised service agreements for consultants
- Compilation of project plans for individual projects
- Standardised fee account format
- One-page construction progress summary sheet

Due to the complexity and size of the Program, Aurecon compiled a comprehensive Project Management Plan. The purpose of this Project Management Plan was to create conformity and to regulate the administrative and financial control of the planning, construction and defects liability phase of the NMMU Capital Infrastructure Program projects. In particular, the Plan dealt with the role of various consultants involved in the Program and their areas of responsibility. The aim of the Project Management Plan was to record and implement standard policies and procedures applicable to all projects undertaken in the Capital Infrastructure Program.

The format of the Project Management Plan was based on the nine project management knowledge areas, contained in the Project Management Body of Knowledge, namely:

- Integration management
- Human resources management
- Scope management
- Communications management
- Time management
- Risk management
- Cost management
- Procurement management
- Quality management.

Reporting on Program level was done in two major reports which were submitted to the NMMU on request or on a quarterly basis. The first report, the Cash-Flow Report, included all relevant financial information, reflecting the financial position of the whole Program and for the whole duration, with specific reporting on the following:

- Actual versus projected expenditure
- Actual funding received from sources
- Allocation of received funds
- Internal and external approval of funds
- Overall cash-flow
- Revised cash-flow
- Variances on previous cash-flow projections
- Overall effects of variations/additions/interest earned (summaries).

The second major report, namely the Program Progress Report, recorded progress over the spectrum of projects in relation to the project management knowledge areas. This report summarised the progress made on individual projects in respect of the overall Program.

Taking the NMMU procurement policies into consideration, a tender construction project procurement scorecard was created with broader input from relevant consultants who were appointed on...
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projects within the Program. The scorecard included items which the NMMU deemed necessary for their relevant committees to make a confident/informed decision regarding the appointment approval of contractors.

In consultation with the NMMU Legal Department, and using the service agreement from the Department of Public Works (used with their permission) as a basis, a standard service agreement which suited all professional consultant appointments and with which the NMMU was entirely comfortable, was developed. It has to date been used with very good effect and protects the client against the risk of not being confident and fluent with every service agreement used in the market, and also made the previously lengthy and time-consuming consultant appointment approval process much quicker.

Project plans were created for all projects to define the initial scope, budget, timelines and user department requirements. These plans were used during the internal NMMU funding request process and, following approval of funds, formed the bases for project briefs to consultants.

Standard fee account formats were created and used by all the consultants appointed on the Program. Standard forms and procedures expedited the verification process for both the relevant project/program manager and the relevant NMMU department.

A one-page construction progress summary sheet was developed for the larger construction projects, which indicated to any reader the vital progress and financial parameters of the project. These sheets accompanied each contractor’s payment certificate to the NMMU.

NELSON MANDELA METROPOLITAN UNIVERSITY PROJECTS

As noted above, Aurecon was also appointed as Project Manager on specific projects where the NMMU felt the need,
or lacked the capacity, to ensure that the end product satisfied its requirements. Noted below is a short description of the various projects where Aurecon acted as the Project Manager and Principle Agent.

**New Lecture Hall Complex, South Campus**
This vibrant Lecture Hall Complex provides three new state-of-the-art lecture venues which accommodate 500, 250 and 200 seats respectively. Provision was also made to be able to host conferences in these facilities. This new building strengthens the NMMU’s commitment to providing world-class facilities for its students, signalling the commencement of a new era of major development on the main campus (the first in a number of years), setting the standard for all future developments. (R45 m)

**New HRTEM Research Building, South Campus**
This project required a unique and ground-breaking building to house the first High Resolution Transmission Electron Microscope (HRTEM) in Africa. The new building includes two sections – one to house the extremely sensitive microscope equipment and the other to accommodate the preparation laboratories and support staff offices. Bulk service connections, parking, stormwater provision and an enclosed link corridor to the existing Physics building were included in the project. (R30,5 m construction value, R90 m microscope value)

**New Human Movement Sciences (HMS) Building, South Campus**
Due to the successful growth of student numbers in the HMS and Teacher Education Departments, the need to create dedicated HMS facilities was identified. The identification of a suitable new site and relocation of the Department of HMS would allow for the expansion and consolidation of Initial Teacher Education in such a way to create a coherent teacher education ‘precinct’ on the campus, while creating a new HMS building which would meet international standards, for use by professional sportsmen and students alike. (R40,9 m)

**Health Sciences Department Alterations, South Campus**
A revamp of the Department’s out-dated laboratories and support spaces would include group work areas, computer workspaces, interactive white boards, ceiling-mounted data projectors, a dedicated resource centre, computer-aided learning programmes, a mock pharmacy and a general IT upgrade. All these additions would facilitate and enhance pharmacology practicals for undergraduate students. (R17 m)

**Fire Damage to Building 13, South Campus**
Due to extensive fire damage to the laboratories and general areas in the Physics and Chemistry Building on the South Campus, the NMMU required Aurecon to manage a team of consultants to investigate the extent of the damage and report on estimated repair cost, and to investigate and design repair options and implement repairs in accordance with current standards and legislation. (R7,5 m)

**New Engineering Building, North Campus**
The new building, which was scheduled to go out to tender at the end of May, will reflect an iconic look and project one of the new faces of the university’s North Campus. The new 4 876 m² building will incorporate engineering workshops, tutorial rooms, offices, computer and design laboratories, interactive learning spaces and a 200-seat lecture hall. The Project brief included identifying a suitable site for the building in relation to existing infrastructure. The Project includes the provision of all internal services associated with academic engineering and lecturing facilities, and all external works, bulk services and parking. (R47,6 m)

**New Library, Missionvale Campus**
This project included the provision of a multimillion-rand, state-of-the-art and eco-friendly library at the NMMU Missionvale Campus. The library provides for approximately 65 000 books, and is strategically positioned to facilitate access to and from the surrounding community for staff and students. (R30,4 m)

**Accessibility Solutions, Missionvale Campus**
This work included the construction of walkways and wheelchair ramps externally and internally to buildings. The Missionvale Campus is built on a site with 12 m slopes, and with buildings ranging from single to three storeys, located on various platforms. Initially no lifts or wheelchair hoists were available, and although some ramps existed in various localities, these did not meet NMMU policy or legal requirements. Analysis was done to assess the needs, reports were compiled and approved, and finally implemented across the campus to ensure that all areas and buildings on the campus are accessible to physically disabled persons. A combination of mechanical installations, such as lifts and paraplegic hoists, were strategically installed where required. (R8,4 m)

**Conversion of existing library into a Student Centre, Missionvale Campus**
The existing library was converted into a much needed centralised modern Student Life Centre and Cafeteria. The Student Life Centre consists of two components—a cafeteria (with a new service road for deliveries to the rear of the cafeteria) and a study centre. The latter incorporates new computer laboratories, a writing centre and an IT training laboratory. (R14,5 m)

**CONCLUSION**
The program roll-out over the past few years has seen many successful projects completed. This can be attributed to a number of positive inputs from both the NMMU and Aurecon. The main benefits to the client of having appointed Program and Project Managers can be summarised as follows:

- Program Managers have the responsibility to ensure that the Capital Infrastructure Program is well managed and that projects are delivered on time and within budget.
- Uniformity of contract documentation, service agreements and consultant/contractor payment certificates, all of which cover a large range of projects, is ensured.
- Financial control, which is paramount when working with numerous projects all at various stages, is ensured.
- A well-managed Capital Infrastructure Program reassures the funders and the organisation management that funds are being spent wisely and in accordance with their expectations and requirements.

Having one consultant responsible for the program and for the defined projects enhances the interface between client departments and the project team. Due to the relationship that evolves and the ongoing flow of lessons being learnt from one project to the next, the effectiveness of the consultant teams, and the turnaround time on project implementation, are greatly increased.
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I AM AFRISAM
INTRODUCTION

Menlyn Maine is located in the Menlyn development node to the east of Pretoria where the developer, Menlyn Maine Investment Holdings (Pty) Ltd, bought out 103 residential dwellings for redevelopment. It is a mixed-use precinct development with total development rights exceeding 300 000 m². This 11.4 ha development, comprising 16 land parcels, include the development of offices, showrooms, shops, restaurants, banks, residential units and an hotel.

WorleyParsons was appointed as the developer’s consulting engineers for all the infrastructural components relating to the project. The main WorleyParsons disciplines involved in the project are civil, electrical, transport and management services. The first phase of the project included the upgrading and construction of roads, as well as the installation of all the normal services associated with a township development, i.e. stormwater, water, sewer, electrical and telecommunication networks.

The uniqueness of the project lies in its ambitions of being an innovative, world-class, environmentally sensitive lifestyle development focusing on sustainability. The project was selected as one of only 16 international projects to be endorsed by the Clinton Foundation as a model project in sustainable development. This requires a purposeful focus on all levels of design detail. At a total development budget of R 6 bn – R 7 bn this project is truly an endorsement of the private sector’s confidence in the sustainability of infrastructure related investments in South Africa.

QUALITY OF ENGINEERING DESIGN

The engineering design for the precinct and bulk infrastructure included the following disciplines:

- Civil (water supply, sewer networks, stormwater networks, streets)
- Roads/Transport
- Electrical
- Telecommunication
- Structural
- Hydrological

All designs conformed to the relevant SABS and Tshwane Municipality standards, as prescribed. Where such design standards were insufficient, designs were based on first principles and engineering experience. Design is one of the three pillars that the development was founded on – this resulted in additional scrutiny and focus on quality from the developer and his independent advisors. WorleyParsons was not only accountable to the developer, but also to their appointed external financial and technical advisors. This system of high accountability throughout the design and execution phases was welcomed, and even encouraged by WorleyParsons. The result was a quality end product of superior design.

INGENUITY, ORIGINALITY AND INNOVATION, COUPLED WITH ENVIRONMENTAL, SOCIAL AND ECONOMIC SUSTAINABILITY

Although most of the precinct infrastructure resembles standard infrastructure components, the application thereof was quite unique. The following are a few examples from an engineering, environmental and social perspective:

- Rainwater catchment bio swale on the centre road median
  A specially designed depression provides for maximum natural on-site attenuation and capture of rainwater runoff.
- Construction materials re-use
  From the demolition of 103 houses spoil materials were sorted, crushed, graded and stockpiled on site for use in selected sub-grade and fill layers during road construction, as well as for platform fill materials.
■ Energy efficient lighting
Specially manufactured street light fittings were applied for maximum energy efficiency and LED technology was applied on all traffic signals.

■ Cutting-edge traffic signal controllers
Traffic cameras instead of conventional electromagnetic loops were employed to improve traffic flow control.

■ Integrated 132 kV Breaker/Isolator
Upgrade of the existing bulk substation (as opposed to constructing a new substation) was made possible by introducing a compact integrated 132 kV Breaker/Isolator unit very rarely used in South Africa.

■ Unique Developer Supply Authority Agreement
For the upgrading of the bulk supply infrastructure, a unique contracting model was developed by WorleyParsons and the developer, whereby risks were shared between the developer and the supply authority. This model enabled the upgrade of the supply authority bulk infrastructure without the internal municipal budgeting and financing constraints.

■ IT infrastructure
In order to enable the development to take full advantage of possible future developments in high-speed fibre-optic data network, a very unconventional, comprehensive cableway network was installed to cater for not one (as per the convention), but three full service provider networks. This would enable a full-fibre last-mile-link installation to be implemented in the future.

■ Special aids for the visually impaired
Special audio signal generators were incorporated in the traffic signal designs for improved pedestrian navigation (this application is a first for Tshwane). In addition the precinct was designed with provision for special warning and directional pavement tactile inserts to guide visually impaired pedestrians.
The services of a disability specialist were engaged to align the pavement designs to the guidelines promoted by the SA National Council for the Blind.

**On-site nursery**

An on-site nursery was established to preserve and re-establish all the indigenous and endemic trees that were growing in the precinct prior to re-development.

**MANAGEMENT OF PLANNING AND TECHNICAL DESIGN**

WorleyParsons employed production line and management services divisions for the design development and execution phases of the project. The conventional model of having the lead design engineer also taking responsibility for the planning and coordination of the design team was replaced by the WorleyParsons Lead Technical Project Manager model. Although this requires additional highly skilled resources to be deployed to the project, it results in a more effective allocation of work and an improved integrated planning and design function. A senior WorleyParsons Technical Project Director (PD) took the responsibility of ensuring that the design and planning phase was conducted within time, budget and to the appropriate quality specification. The technical design leaders were therefore freed up to focus on the technical aspects of their design with the PD having the opportunity to introduce a seamless value engineering process throughout the design phase.

**AESTHETICS**

Very close attention was paid to landscaping and paving to achieve a harmonious identity throughout the development.

**BUDGETARY COMPLIANCE**

The engineering services budget of R88,16 m (including contingencies, VAT and fees) was set upfront at the time of procurement, prior to commencement of the project. This budget was maintained.
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with monthly monitoring and reporting to the client’s quantity surveyor. Despite several risk events materialising, such as groundwater seepage, existing services variations and supply authority specification variations, the project was completed within the original budget.

UNUSUAL CONSTRUCTION METHODS

The following is an example of how unusual construction methods were applied to enhance the long-term sustainability of the development: A portion of the median island in Aramist Street was constructed as a swale to attenuate stormwater. The invert of the swale is lower than the adjacent road surface, and covered with vegetation. Surface runoff from the street is diverted into the swale via openings in the kerb line every two metres. The velocity of the water is reduced by the vegetation, causing the water to infiltrate the soil. A subsurface drain along the length of the swale drains away excess water into the piped stormwater system, to ensure that the soil does not become saturated. The swale has the same gradient as the street. It is connected to the conventional stormwater pipe system by means of a grid inlet structure at its lowest point. Should the inflow rate exceed the infiltration rate, the swale will fill up and eventually overflow into the stormwater pipe system via the grid inlet.

INFLUENCE OF CONSULTING ENGINEER ON CONCEPTUAL DESIGN

For the Menlyn Maine project, the developer had the foresight to involve WorleyParsons from the conceptual development stage when the precinct was being conceived. This allowed WorleyParsons to significantly influence the layout from a technical point of view. During this process a regional master plan was developed not only for the development, but also for the Menlyn development node. This allowed for increased efficiencies in terms of the total infrastructure footprint, both in terms of sustainability and functionality. The integration of the engineering infrastructure designs with the development precinct objectives resulted in an improved ultimate product. A good example of this co-planning and design is the on-site stormwater attenuation pond that also serves as a landscaping feature and groundwater sink.

COMPLEXITY AND SOPHISTICATION

The overall precinct development posed few challenges in terms of engineering design, excluding the numerous innovative elements introduced into the project. The execution of the project, however, turned out to be more complex. Re-development of an entire township within a highly developed metropolitan area posed its own challenges. These included relocation of existing functioning services, traffic flow, service interruptions, noise and dust...
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control, pedestrian and spectator control, environmental sensitivity, inclusion of the future service needs of adjacent properties, area-wide infrastructure master planning, and related challenges. The solutions to these challenges required ingenuity not normally associated with this type of project.

RESPONSIBILITY CARRIED BY CONSULTING ENGINEER (RISK)

WorleyParsons was appointed under a Procsa Professional Services Agreement, in terms of which WorleyParsons took on all normal design and supervision risks associated with an infrastructure project. In addition, the company also took on the risk of a fixed fee for both the design and site supervision as per the planned program. Due to the externally induced delays experienced by the project, the company had to fund the significant supervision costs associated with the substantial extension of time. During this period the complete full-time WorleyParsons supervision service was maintained on site, despite reduced construction activity, and at no additional cost to the client.

RESPONSIVENESS TO NEEDS OF CLIENT AND COMMUNITY

In order to respond to the needs of the client and community WorleyParsons endeavored at all times to respond to a service request within 24 hours. This was made possible by placement of a permanent WorleyParsons presence on site, and through weekly visits by the company PD to the precinct. Issues such as dust and noise control, traffic flow control, pedestrian access, engineering services interruptions, and the like were very closely monitored. There was even a temporary road constructed on behalf of an adjacent school to alleviate traffic congestion and improve pedestrian safety during peak periods in an area outside the development precinct. This was done at the developer’s cost.

MEETING THE CLIENT’S DEADLINES FOR READINESS

Very ambitious time lines were set for completion of this complex project. The first phase demanded WorleyParsons to develop and produce the designs, specifications and bills of quantities in a record time. This was done by delaying certain detail design components and local authority approvals until after the official procurement stage. This resulted in construction commencing on time as planned. The contracting regime employed for the project then transferred the responsibility of managing the program during the construction stage to a single main contractor. The contractor was given training and support by WorleyParsons to enable him to detail the construction progress on a project management software program. This was the first project where the contractor employed such electronic aids to assist with managing a project construction program. Ultimately the contractor was awarded extension of time, due to external delays in the approval processes. All parties – the client, WorleyParsons and the contractor – worked hard as a team to minimise the external delays experienced at the end.

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Sandile Thusi (Argyle) Road
stormwater sea outfall extension

BACKGROUND
Argyle Road outfall is located on Durban’s Battery Beach, overlooked by the Blue Waters Hotel and flanked by the Sun Coast Casino and Somtseu Road outfall (Snake Park Pier). The original beach outfall was upgraded to a sea outfall in 1990. The distinctive shotgun culvert stretched 50 m from the original brick outfall to the ocean. Localised beach accretion between Bay of Plenty and Battery Beach, causing blockages at the outlet, necessitated a further extension of Argyle outfall by 60 m. The project commenced in September 2009 and was undertaken by the eThekwini Municipality’s Coastal, Stormwater and Catchment Management Department with Esor Africa as the contractor.

Accretion of the beaches, combined with low stormwater discharge, resulted in the blocking of the outfall at the outlet. During low flows contaminants were washed down from the urban catchment. The plug of sand acted as a filter trapping all the pollutants. Following a rainfall event the sand was breached and high concentration of contaminants escaped into the ocean, adversely affecting the water quality.

The project consists of a temporary jetty and cofferdam stretching into the ocean. The culvert is made up of twelve elliptical mass concrete panels, each consisting of 100 m³ of concrete supported on a total of 72 piles, each 13 m deep.

1 Argyle Road outfall extension
under construction, April 2011
AIMS AND OBJECTIVES
As mentioned above, the main aim of the project was to improve the outlet conditions and water quality of the adjacent beaches. Mardon and Stretch (2004) showed that the Battery Beach area has a serious water quality problem, and it was stated that a reduction of the median pollution levels of Argyle stormwater discharge was required to improve the bathing water quality at Battery Beach and adjacent beaches (Mardon 2003). Although the extension will not remove the problem entirely, it will certainly contribute to a reduction.

The central piers (Bay of Plenty, North Beach and Dairy Beach) have historically accommodated the general public, surfers and/or fishermen. The construction of Argyle outfall presented an opportunity to provide fishermen with a purpose-built platform for angling. The scope of the project was extended to include the construction of a fishing platform with lighting, bait tables and washbasins.

THE TEMPORARY WORKS
A temporary jetty was constructed with hollow steel tube sections and steel I beams. The sheet pile cofferdam was then constructed with 12 m long and 10 mm thick steel sheet piles.

The first sheet piles were installed in November 2009 and by the end of November 2010 they had lost between 5% and 15% of their thickness due to corrosion. The cofferdam performed well on the landward end, but as the project proceeded seawards it was evident that the cofferdam was not as watertight as had been anticipated and progress was hindered by the ingress of sand and water through the sheet pile clutches.

Franki Africa designed and installed the cofferdam and temporary jetty. The cofferdam was designed for an extreme wave height elevation of 5 m. Although the design meant the cofferdam would not fail under fairly extreme conditions, it was still vulnerable to overtopping and this had to be carefully monitored. Based on a wave refraction study it was estimated that the cofferdam would be

\[ \text{The Argyle Road sea outfall in (a) 1991 and (b) 2008} \]
\[ \text{Casting the first section of the Argyle outfall fishing platform, May 2011} \]
\[ \text{Overtopping of the cofferdam on 7 September 2010} \]
VACANCIES

CHIEF CIVIL ENGINEER

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The above vacancy exists in the Procurement and Infrastructure Cluster, Engineering Unit.

Essential qualifications: Bachelor of Science degree in the relevant field obtained through an accredited Further Education and Training Institute. Registration with the Engineering Council of South Africa as a Professional Engineer (Pr Eng). Valid motor driver’s licence (Code B or EB).

Essential experience: 5 years’ post registration experience.

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THE CULVERT

The original shotgun culvert was cast on a shaped blinding profile. The new extension, however, required a class 3a concrete finish on all surfaces as the underside of the culvert is expected to be exposed at some stage. This made the new shuttering significantly more complicated than previously, as it had to be supported off the piles. Esor Africa engineered an elegant steel shutter solution (Figure 5) to comply with the specification. A two-week turn-round time between concrete pours was obtained.

The 100 m² culvert panels were each poured in approximately seven hours. The culvert is a mass concrete structure, so 40 MPa strength after 56 days was specified. The cement was extended with ground granulated blast furnace slag, and a slow hydrating cement (CEM III A) was used to minimise the heat of hydration. The slow strength gain of the concrete was required to prevent cracking in the absence of steel reinforcing.

Since each pour was approximately 240 tons, some movement of the shutter was expected. The movements were

over topped at least once a year during any event exceeding a wave height of 3.5 m, recorded at the Port of Durban’s wave recording buoy. This was the case on 7 September 2010. Exceedance probabilities were used to gauge this risk and it was estimated that one construction week per year would be lost as a result of overtopping, which is currently the case.
carefully monitored and it was found that the shutter rotated about the previous pour by as much as 40 mm. The shutter was therefore set up to compensate for the expected movement.

THE FISHING PLATFORM
The creation of a fishing platform had a few minor challenges. It firstly had to be light; it had to be high enough to avoid most of the wave loading, as well as minimise splashing of the users; it also needed to accommodate paraplegic users. The platform incorporated a polystyrene void to limit its mass and was raised off the culvert level from 4 m chart datum (CD) to 5 m CD, an elevation similar to the central piers. The change in elevation was achieved by a 1:15 grade ramp. A beach access ramp was also provided.

PROJECT STATUS
The project was due to be completed by April 2011, but inclusion of the additional works extended completion to the end of July 2011.

CONCLUSION
The Argyle Road stormwater extension promises to improve the hydraulic efficiency of the outfall, the water quality of adjacent beaches, as well as provide a dedicated fishing pier.

REFERENCES
Mardon, D W, Stretch, D 2004. Comparative assessment of water quality at Durban beaches according to local and international guidelines. Water SA, 30(3).

Specially fabricated C-hook removing internal shuttering
An aerial view of the Argyle outfall temporary sheet pile cofferdam, June 2010

PROJECT TEAM
Randeer Kasserchun Deputy Head of Coastal Stormwater and Catchment Management
Godfrey Vella Manager of Coastal Stormwater and Catchment Management
Richard Martin Area Project Engineer
Peter Fenton Manager of Structures
Stefano Corbella Resident Engineer
Dave Williams Clerk of Works
Arthur Field Director of Esor Africa
Paul Pearce Esor Africa Contracts Managers
Siva Govindasamy Esor Africa Site Agent
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BACKGROUND
The development of ports in southern Africa has historically taken place in sheltered bays and river mouths, as these provided a degree of natural protection to early seafarers wanting to make landfall. Coastal cities and transport infrastructure have developed subsequently, connecting these natural harbours to the resources and cities of the hinterland. However, the growing demand for mineral resources has, in the past decade, led to the development of remote ore deposits at locations with poor overland transport infrastructure and at great distances from sheltered natural harbours. This has resulted in the construction of dedicated ore export facilities on exposed coastlines in developing countries. At such terminals, ore is typically loaded into vessels via a conveyor and ship-loader mounted on a steel jetty which terminates at water depths suitable for small bulk carriers. Alternatively, ore is transported to the bulk carriers by shallow-draught barges and transshipped in deeper water.

MOMA MINERAL SANDS
In 2006 Kenmare Resources developed the Moma Mineral Sands Mine in Nampula Province, northern Mozambique. The mine exports its mineral products via a jetty and a barge. Firstly, an overland conveyor transports minerals to the coast, and feeds a second conveyor on the jetty, which loads the barge at a shallow water loading berth near the coast. The barge

Upgrading of export jetty at Moma Mineral Sands Mine, Mozambique

The upgrading, by Group 5 and Subtech Group, of the export jetty at the Moma Mineral Sands Mine is an unusually challenging marine construction project currently under way in northern Mozambique. Due to its remote location on an open coastline and with restricted access, the work requires careful planning in its design and during construction, with particular attention to construction methodology and temporary works. The work is being undertaken entirely off floating plant, which requires exceptional planning and preparedness, as much of the work can only progress during short weather windows, due to the exposed nature of the site.
Group 5 was awarded a design-and-construct contract in late 2010 to undertake the repair, and chose Subtech Group as their marine support provider. The detailed design was undertaken by WSP under the guidance of the contractors, and was strongly influenced by constructability considerations. All the steel fabrications were designed to be pre-fabricated in South Africa with virtually no site welding being required.

The jetty consists of an elevated access and conveyor trestle, and an independent low-level berthing structure. The berthing structure suffered significant damage due to impact from the barge, and is currently being upgraded. The entire low-level berthing structure is being replaced according to a new design which provides a second berth on the south side of the structure. The new design incorporates horizontal bracing members, which ensure that the berthing loads are carried by several piles acting together, whereas in the original design the piles acted independently.

The jetty structure was originally built using hand-over-hand construction methods, with a piling crane driving on the completed part of the structure, while advancing the construction work ahead of itself over the water. This method was largely independent of sea conditions and required no marine plant or specialist marine skills.

The functioning of the conveyor and ship loader is essential for the mine to export its minerals, and it needs to remain operational throughout the repair period. The conveyor was built after the completion of the jetty, and now limits access to the berth to a narrow walkway. Equipment can therefore only be carried onto the jetty by hand or on a small trolley, and large piling plant can only access the site from the water, requiring a highly specialised marine solution.

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The pre-fabricated components, as well as all the plant and temporary equipment, were loaded onto two barges in Durban and towed to site. Due to the remoteness of the site and the difficulty in transferring any substantial loads from land onto the jetty, the mobilisation needed to be extremely well planned, as any additional items would need to be brought in by sea, with major time and cost implications. The mobilisation was done in two trips using a 2200 Hp tug to tow the first barge loaded with the construction equipment and piles, and returning to collect...
the second barge with the headstocks, walkways, bracing and fenders. The barges serve as a floating lay-down area, as all the materials need to be stored on the barge until they are installed. It was therefore essential to plan the storage in such a way that the modules could be unpacked in the correct order, while maintaining the stability of the barge at all times. Fastening the large bulky items to the barge for the voyage also required extensive temporary support work and planning.

Finally the first barge set off and made good progress against the current. However, since there had recently been acts of piracy to the south of Beira, the tug had to take armed guards on board in Maputo to protect the crews during the journey to Moma.

On arrival in Moma the barge was moored using an anchor spread with which it was able to manoeuvre close up to the jetty to enable the 270 ton lattice boom crane on board to place the pile
guide onto the jetty and start piling. The barge is typically kept away from the jetty and repositioned each time a lift is performed. In bad weather conditions the anchor spread is lifted and the barge towed to the shelter of the island offshore. Since the works started in the cyclone season, weather forecasting was critical, as the barges would need to shelter in an estuary about 35 nautical miles from the site during bad weather.

It is equally important to have regular and accurate forecasting of calm weather, as much of the work can only be undertaken during calm conditions when the movement of the crane hook is within acceptable limits. Even so, all the lifts need to be prepared with positioning guides fixed either to the load or the landing sites, in order to control the horizontal motions of the load and guide it into place. In addition, the skill of the crane operator is critical in ensuring a gentle landing for the loads.
Piling is done with the help of a hanging pile guide, which is supported on the jetty. The pile guide is lifted onto the jetty in calm conditions and secured in position in order to restrain the pile. Twelve open-ended steel piles, each 28 m long, 1.2 m in diameter and weighing 17 tons are to be installed. The piles are pitched on the deck of the barge and lifted into the pile guide, which has hydraulically operated gates to restrain the movement of the pile and hold it in position while the vibrator is attached. Landing the hammer is perhaps the most difficult job as the seven-ton hammer needs to be controlled and guided into the pile frame and attached to the pile with the crane moving by up to 1 m with every passing wave. Again the preparation work is critical, as all hydraulic hoses need to be protected and the hammer needs to be fitted with a guide to assist with aligning it to the pile. Obviously, piles can only be pitched and driven when the sea conditions are favourable, and it is critical that progress is maximised on these days by ensuring all preparations had been made on the marginal weather days when only light work was possible. Planning and preparation are indeed key to the success of this project.

CONCLUSION
At the time of writing this article, seven piles and four walkway beams had been installed, and the damaged end of the jetty had been cut away and removed. In addition, the jetty deck was temporarily being supported by cantilever beams in way of the damaged end pile.

The project is unique to the southern African civil marine construction industry, as it is the first project of this magnitude to be done entirely off floating platforms in open sea conditions. In addition, the remote-ness of the site requires an unusual degree of preparedness, which is achieved through detailed planning of the works from the design stage, through the mobilisation in port, and on to the daily activities on site.

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BACKGROUND

The first harbour basin in Cape Town was the Alfred basin, excavated out of the rock behind the shoreline between 1860 and 1870, under the direction of the British engineer Sir John Coode. Excavation of a second basin landwards of the Alfred started in 1877 and the rock was used to create the breakwaters for what was to become the outer Victoria Basin. However, by the time that the excavations were complete, ships had increased in size significantly and the second basin was considered to be too constrained and was therefore not flooded. It became an oil storage tank farm until the start of the Waterfront development, and was then decommissioned and rehabilitated by the oil companies.

Development of Cape Town’s Victoria & Alfred Waterfront (V&W) started in 1988, and from the beginning the concept of a new marina basin and a canal in the disused oil storage...
and harbour entrance areas was identified in the Master Plan. The basin and canal would provide attractive central nodes around which residential precincts could be developed. In addition the canal would establish a water link between the city and the harbour.

Prestedge Retief Dresner Wijnberg (PRDW) was commissioned by the Victoria & Alfred Waterfront company to investigate the marine engineering infrastructure that would be required to realise the Master Plan. A feasibility study was completed in May 1992. This included the scope of works that would be required to convert Sir John Coode’s second basin into a tidal basin suitable for pleasure craft, and the construction of the canal. It was determined that a tidal canal would be costly and difficult to integrate into the surrounding precincts, due to the depth needed to provide sufficient water below low-tide level and the terracing that would be required for the adjacent landside developments. A perched canal was therefore decided on with a water level set at 600 mm below the typical surrounding ground levels.

It was envisaged that water taxis would be operated along the canal and that residents would be able to moor their private boats on the canal in front of their apartments. A means for the boats to be able to transfer between the tidal basin and the canal was therefore required and it was decided that a traditional boat lock would be the best method. The chosen location for the lock was at the northernmost end of the canal at the boundary of the residential precinct.

The first major component of the V&A basin and canal marine infrastructure was the construction of a section of the canal in 1992 at the Waterfront entrance to enable building of the adjacent City Lodge Hotel. This was an isolated water body that was not connected to the sea and therefore not navigable.

The next project was construction and flooding of the tidal Marina Basin. Fortunately it was possible to construct most of the works in the dry, which included the entrance structure for the future boat lock. Sufficient lock entrance was constructed to contain the recesses for the stoplogs so that a watertight barrier could be formed when the remainder of the lock would be constructed in the future. At that stage the design of the lock barrel and gates had not been undertaken.

Canal construction carried on through a number of phases until completion in 2009. The northern canal section in the Waterfront residential marina was constructed and flooded in phases to match construction and occupation of the adjacent apartments and the One & Only Hotel.

**LOCK DESIGN**

Design of the lock commenced in 2002. A review of current lock designs around the world was undertaken and it was found that contemporary small boat locks in the United Kingdom had curved sector gates rather than the more traditional flat mitre
gates. Unlike mitre gates, sector gates are able to move when the hydrostatic load is acting on them, and in a lock the gates themselves are used as sluices to fill and empty the lock barrel by cracking them open slightly in order to allow the water to flow past the seals. A sector gate lock was therefore selected for the Waterfront, and it is indeed a unique structure in South Africa. Figure 1 shows the configuration of the Waterfront lock, and Figure 2 illustrates the way in which a sector gate lock operates.

The lock and lower reaches of the canal are designed to take yachts with a maximum length of 15 metres and draught of 2.5 metres. Either one 15 metre yacht or a number of smaller size boats can be transferred by the lock at one time, and the lift between the basin and the canal is 3.5 metres on the mean tide. The canal has a fixed water depth of 3.0 metres. The lock barrel caters for the variable tide levels and therefore has a minimum of 3.0 metres water depth at the lowest astronomical tide. It is equipped with floating fenders that rise up and down with the water level and onto which boats tie up so that they do not have to adjust their mooring ropes during the change in level.

In order to verify the filling and emptying times for the lock the sluicing operation was tested with a 1:10 scale hydraulic model at the University of Stellenbosch laboratories. The sector gates at the canal end of the lock are half the height of the marina side gates, and the sluicing flow rate available for the filling operation is consequently less than the emptying rate. The obvious result of this is that the lock barrel takes longer to fill up than to empty. After some experimentation this was mitigated by reducing the radius of the canal gates so that there would be a wider gap for the water to flow through when sluicing.

When the gates at the canal end are sluiced to flood the lock barrel, the incoming water is captured into a pair of culverts that direct the flow transversely into the barrel from each side in opposing flows that dissipate the energy and minimise the water turbulence and the effect on the boats.

Each gate is fabricated from steel plate and hot-rolled sections, and comprises a curved hull plate strengthened with horizontal and vertical plate stiffeners. Each hull plate has three vertical spine beams that are strutted back to the hinges at the top and bottom of the gate. A vertical torque tube and additional bracing is provided to transmit and spread the drive loads to the full height of the gate. All steelwork, including the stainless steel components, are protected by sacrificial anodes.

Rubber music note seals are mounted along the vertical and lower edges of each gate and they bear onto stainless steel plates grouted into the lock barrel walls and base slab. Each length of seal is bolted onto a fabricated stainless steel channel that is adjustable so that the seal position can be fine-tuned to obtain the optimum pressure against the seal plate. All hydrostatic loads on the gate go directly to the hinges and there is no load transmitted through the seals. Sealing takes place by the water pressure on the leg of the music note seal itself, which deflects it and pushes it up against the steel plate.

Mounted on top of each sector gate is a pedestrian walkway to provide public access across the lock.

**CONSTRUCTION**

The lock design was first advanced sufficiently to enable construction of the concrete barrel and gate recesses. This was
undertaken in 2003 and 2004 by WBHO as part of a canal wall contract. Construction of the lock barrel and gate recesses took place with steel stoplogs in position in the entrance to hold back the waters of the tidal Marina Basin, and required working down to 5 metres below sea level for completion of the excavation and construction of the base slab (see Figures 3 and 4).

Fortunately the entire lock structure is founded on unweathered greywacke rock which, although highly jointed, restricted water ingress to manageable flows. The 39 metre long concrete structure was constructed in four panels and the contraction joints between the panels were sealed with hydrophilic rubber waterstops that swell and seal the gap. Once complete the lock barrel was opened up to the sea and allowed to flood until it became necessary to dewater it for the lock gate installation (see Figure 5).

In 2007 the design of the lock gates was completed and a tender issued for the construction of the steel sector gates. The canal gate contract had contractor designed components to it and used the FIDIC Conditions of Contract for Plant and Design-Build. PRDW was responsible for the design of all gate steelwork and the contractor was responsible for the design of all the mechanical, hydraulic, electrical and control components required to move and operate the gates. It was anticipated that the gates would be driven by hydraulic cylinders, but this was not prescribed in the tender documentation, as it was expected that electrical drive systems could also be offered.
Petrel Engineering was the successful tenderer and the contract was awarded in March 2008. They elected to use a hydraulic cylinder drive system and during the initial part of the contract PRDW worked closely with them to finalise the aspects of the gates affected by the drive system. This included the steelwork required to transmit the drive loads into the gates and the support plinths for the cylinders. Figure 6 shows one of the lock gates being assembled by Petrel on its side inside the lock barrel.

The power pack for the gate drive hydraulics is located in an underground plant room located beneath the control cabin at the side of the lock, and hydraulic fluid is pumped to each cylinder via steel pipelines located in ducts that run along the side of the barrel.

The lock is operated from the control cabin which is perched to give a view down into the barrel. All operations are automated and actioned by push-button controls. The sluicing sequence for each gate was set up and fixed during commissioning and there is an electronic interlock to prevent both gates being open at the same time. Feeding into the operating system are proximity detectors which verify the position of the gate and water level sensors located in the canal, lock barrel and downstream in the tidal area. The proximity detectors sense when the gate is at each pause or stop position during the opening or closing sequences and the signal from them triggers the operating system to stop the gate. On the other hand the water level sensors operate during the sluicing phase and detect when the difference in water levels across the gate is low enough to initiate the next phase of the opening.

Despite the reduction in gate radius that was implemented as a result of the model testing, it was felt during commissioning that the lock filling period could be reduced further. This was done by adding in a second sluice position to the canal gates, halfway through the filling cycle, in which the gates are opened further in order to increase the in-flow.

A 28-day trial period was stipulated as part of the lock commissioning and for this the contractor had to operate the lock every half-hour for eleven hours each day. This trial period verified the robustness of the lock structure, drive and control systems and highlighted those items that needed to be improved or modified. The lock was handed over to the client in May 2009 and has become a feature and attraction in its own right at the country’s premier tourist destination.

ACKNOWLEDGEMENT
Prestedge Retief Dresner Wijnberg would like to acknowledge the V&A Waterfront for supporting this article.

PROJECT TEAM
Client Victoria & Alfred Waterfront (Pty) Ltd
Design Consultants Prestedge Retief Dresner Wijnberg (Pty) Ltd
Contractor (concrete works) WBHO Construction (Pty) Ltd
Contractor (sector gates) Petrel Engineering (Pty) Ltd
Contractor (floating fenders) Jarr Marine CC

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THE NEW CONSOL NIGEL N1 factory is rapidly taking shape and nearing completion. The factory is a flagship facility which will produce approximately 400 t of glass bottles per day. Earthworks began on 18 April 2010, and the factory will be in full production by 1 September 2011. With the civil and structural work virtually complete, mechanical and electrical engineers are now working round the clock to complete the installation of the furnace, power supplies, raw material supply systems and other associated works.

THE PROJECT IN BRIEF
BSM Baker Consulting Civil and Structural Engineers designed all structures and civil works for the project. Tight deadlines, difficult ground conditions, numerous changes, as well as the complex mechanical and electrical systems which have to be housed in these structures, made the design and construction of this new facility particularly challenging, but thanks to the company’s extensive experience in serving the glass and heavy industrial sector, a facility of an exceptionally high standard is nearing completion. The use of the latest 3D structural engineering software also assisted in addressing the three-dimensional nature of this facility during the design process (Figures 2 and 6).

THE STRUCTURES OF NIGEL
The main furnace building contains a gas-fired 400 t per day furnace. Roof trusses span 50 - 60 m to provide large open areas for machinery, while carrying under-slung gantry cranes, platforms...
and numerous services (Figure 1). Floors were designed to carry the very high loads experienced during furnace rebuilds.

Sophisticated bottle testing equipment occupies a 70 m length of the structure, where bottles are thoroughly inspected for flaws and other defects to ensure quality. Reject bottles are passed into the basement where a conveyor system recycles them. This means that there are numerous penetrations through floors, beams and walls which made structural design and draughting a process requiring meticulous attention to detail.

The batch plant has four large concrete silos for sand and soda ash, each with a capacity of 1 200 m$^3$ (Figure 3). Additional steel silos contain a variety of ingredients and crushed glass. Mixers, bucket elevators, fans, kilometres of cabling and conveyors criss-cross this state-of-the-art raw material storage and mixing structure. It is equipped with cullet processing facilities for the recycling of glass, in line with Consol’s environmental policies.

A 20 000 m$^2$ warehouse provides a storage facility for all the packaged crates of bottles. An extensive marshalling yard has been constructed to allow for the streamlined loading and unloading of trucks as bottles are transported around the country. Administration buildings, compressor houses, substations and various storage facilities are dotted around the site, with numerous services gantries connecting them.

A hardpan ferricrete layer across the entire site in Nigel has created a perched water table. Water and earthworks have thus been a challenge throughout the project. Numerous drains had to be cut to allow the soil to drain during bulk earthworks (Figure 4). Sump pumps have been in operation continually. Also, the 500 mm of rain which fell across the 2010 Christmas holiday period flooded many areas and caused extremely muddy conditions.

**AND WHAT DO THE PEOPLE GET?**

The new factory will employ roughly 180 permanent workers, with some being sourced from current operations. In addition, for most of the outsourced services on site local people could be employed. The economy of Nigel is receiving a boost through
local involvement and investment. The council of Ekurhuleni has strongly supported the entire process, through the EIA application, energy supply application and other processes. Generally, their support provided the foundation for the construction process to proceed smoothly.

WHAT NEXT?
This, the first phase of the Nigel factory, is nearing completion. Design of the N2 production line will begin soon and be in operation in the near future. These two furnaces together will increase production for Africa’s largest glass manufacturer by 220 000 t per year. The site has a capacity to accommodate three times the capacity of the current N1 furnace.

CONSL NIGEL N1: CONSTRUCTION STATISTICS AND INTERESTING FACTS

<table>
<thead>
<tr>
<th>Construction period</th>
<th>18 April 2010 (earthworks) 1 September 2011 (fully operational)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget</td>
<td>R1,3 billion for Phase 1</td>
</tr>
<tr>
<td>Structures constructed</td>
<td>Batch plant, production building, 20 000 m² warehouse, compressor house, substations, numerous administration buildings, services gantries, weigh-bridge, marshalling yards, and numerous service or supply structures</td>
</tr>
<tr>
<td>Construction materials</td>
<td>3 000 t of steel</td>
</tr>
<tr>
<td></td>
<td>27 000 m³ of concrete</td>
</tr>
<tr>
<td></td>
<td>200 000 m³ of bulk earthworks</td>
</tr>
<tr>
<td></td>
<td>2 000 000 bricks</td>
</tr>
<tr>
<td>Furnace size</td>
<td>400 tons per day</td>
</tr>
</tbody>
</table>

PROJECT TEAM

Civil and structural engineers BSM Baker
Project management Meprotech
Industrial architecture and ancillary project management Capex Projects
Bulk earthworks contractor Roadline / Akhane JV
Civil contractors Abbeydale / Akhane JV, JT Son Construction
Steelwork contractors Churchyard & Umpleby, Omnistruct Nikosi
Mechanical engineers Washtech, EME, Makeway
Electrical engineers Marcus Kneen (Pty) Ltd

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- Minimum 5 years’ experience in Waste Management (particularly Solid Waste Disposal site design)
- Minimum 10 years’ experience in design & construction of waste transfer sections; solid waste sites; Buy Back Centres (BBC) and Material Recovery Centres (MRF).

Resident Engineer: Housing (Fixed Term Contract) – Durban
Overseeing earthworks & paving works on housing project.
- BSc (Civil Eng) / BTech Civil & Pr Eng
- Minimum 10 years experience in design & construction of civil engineering services involving significant earthwork embankments

Sheq Manager (Fixed Term Contract) – Ingula Pumped Storage Scheme (Lady-Smith)
- Degree/HND in SHEQ Management or other recognized qualification in SHEQ Management and audits
- Certification with an accredited body
- 7-10 years experience in the civil engineering/construction industry in SHEQ procedures and audits, of which at least 5 years experience in a related management position
- Knowledge of OH&S Act 85 of 1993, OH&SAS 18001, IS 14001 & ISO 9001 essential

Senior Water Engineer/Senior Associate – Sunninghill
Manage projects and assist with the development of the water and sanitation business.
- B.Eng/BSc Civil Engineering and PHEng
- 10-15 years experience in the design of water-and wastewater utilities and associated technologies (e.g. water distribution, pump stations, pipelines) at senior management level
- Experience working in a commercial environment and successfully preparing financial proposals

Business Development Manager (Mining & Metallurgy) - Sunninghill
Provide effective leadership on Mining & Metallurgy Sector from a business development perspective.
- A relevant first degree in the Engineering or Sciences field from an approved university
- At least 10 years post qualification experience in the Mining & Metallurgy sector (and associated technologies), both operationally and in a senior consulting role
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Closing date: 31 July 2011
The strength increase of concrete beams with different reinforcing bars

INTRODUCTION

The 2011 “Reinforced Concrete and Masonry Design III” class (National Diploma in Civil Engineering at the University of Johannesburg) embarked on a research project to demonstrate the increased strength of similar-sized concrete beams due to the increased cross-sectional area of reinforcing bars. The theoretical bending moment resistance of the beams was compared to the experimentally tested bending moment endured by the beam.

The following variables were used in this research project:

- Increased cross-sectional area of reinforcing bars
- Different load applications:
  - Mid span line loaded beams (MSLL)
  - Third span line loaded beams to simulate uniformly distributed loads (TSLL)

EXPERIMENTAL PROCEDURE

The class was divided into ten groups, and each group had to construct their own reinforced concrete beams (4,5 m long, 250 mm wide and 450 mm deep) by assembling steel shutters, fixing the reinforcement and casting their respective beams with ready-mixed concrete. The beams were then simply supported on a load frame and tested until failure.

THEORY BEHIND THE EXPERIMENT

The theoretical maximum bending moments for the beam were determined using the formula obtained from the South African Standard Code of Practice (“The Structural use of Concrete Part 1: Design” SANS 10100-1:2000). Please note that the partial safety material factors for concrete (1.5) and steel reinforcement (1.15) have been omitted in the formulas used below in order to obtain an unfactored theoretically calculated bending moment to correlate with the experimentally tested bending moment.
The maximum compressive stress in the concrete beam ($\sigma_c$) is obtained by multiplying the 28 day concrete cube crushing stress ($f_{cu}$) with a factor of 0.67 which changes the cube stress into bending stress.

Compressive Stress of Concrete ($\sigma_c$) = $0.67 f_{cu}$

Compression Force of Concrete ($C_c$) = Concrete Stress ($\sigma_c$) x Compression Block Area
= $(0.67 f_{cu}) (b \times 0.9 \times x)$
= $0.603 f_{cu} b \times x$

Compression Yield Stress of Concrete ($f_{yc}$) = $700 - 1400 \frac{d'}{d}$ not exceeding 196.1 kPa for mild steel

Compression Force of Reinforcement ($C_r$) = Area of Reinf
= $f_{yc} A_s$

Tensile Yield Stress of the Reinforcement = $f_y$

Tensile Force of Reinforcement ($T$) = Yield Stress Reinf ($f_y$) x Area of Reinf ($A_s$)
= $f_y A_s$

Equilibrium of Forces: $C_c + C_r = T$
= $0.603 f_{cu} b x + f_{yc} A_s = f_y A_s$

Therefore $x = \frac{(f_y A_s - f_{yc} A_s)}{(0.603 f_{cu} b)}$

Theoretical Max Moment Resist (Concrete) = $C_r Z_r + C_c Z_c$
= $\frac{f_{yc} A_s Z_r}{0.603 f_{cu} b} + f_{yc} A_s Z_c$

But $Z_r = d - d'$
and $Z_c = d - 0.45 x$

Theoretical Max Moment Resist due to Concrete
= $\frac{f_{yc} A_s (d - d')}{0.603 f_{cu} b} + 0.603 f_{cu} b x (d - 0.45 x)$

Table 1 Beam specification and loading system for each group

<table>
<thead>
<tr>
<th>Group</th>
<th>Beam Dimensions</th>
<th>Reinforcement</th>
<th>Applied Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4500 250 450</td>
<td>2 Y 10</td>
<td>2 Y 8</td>
</tr>
<tr>
<td>3</td>
<td>4500 250 450</td>
<td>2 Y 10</td>
<td>2 Y 8</td>
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<tr>
<td>4</td>
<td>4500 250 450</td>
<td>2 Y 12</td>
<td>2 Y 8</td>
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<tr>
<td>5</td>
<td>4500 250 450</td>
<td>2 Y 12</td>
<td>2 Y 8</td>
</tr>
<tr>
<td>6</td>
<td>4500 250 450</td>
<td>2 Y 16</td>
<td>2 Y 8</td>
</tr>
<tr>
<td>7</td>
<td>4500 250 450</td>
<td>2 Y 16</td>
<td>2 Y 8</td>
</tr>
<tr>
<td>8</td>
<td>4500 250 450</td>
<td>2 Y 20</td>
<td>2 Y 8</td>
</tr>
<tr>
<td>9</td>
<td>4500 250 450</td>
<td>2 Y 20</td>
<td>2 Y 8</td>
</tr>
<tr>
<td>10</td>
<td>4500 250 450</td>
<td>2 Y 25</td>
<td>2 Y 8</td>
</tr>
<tr>
<td>11</td>
<td>4500 250 450</td>
<td>2 Y 25</td>
<td>2 Y 8</td>
</tr>
</tbody>
</table>
Theoretical Max Moment Resist due to Steel

\[ = T Z_c + C_r (Z_r - Z_c) \]

\[ = f_y A_s (d - 0.45 x) + f_{yc} A_s' (0.45 x - d') \]

The maximum experimental moment of the reinforced concrete beam is made up of the following three moments induced by:
- Beam own weight
- Load spreader weight
- Applied load

Experimental Max Moment (UDL)

\[ = \frac{(w l^2)}{8} + \frac{(P_{ls} l)}{6} + \frac{(P_{al} l)}{6} \]

Experimental Max Moment (Point Load)

\[ = \frac{(w l^2)}{8} + \frac{(P_{ls} l)}{4} + \frac{(P_{al} l)}{4} \]

**DISCUSSION OF RESULTS**

Table 2 indicates the results for all groups of students. Note that the theoretically calculated bending moment correlates very well with the experimentally tested bending moment resistance. The difference between the calculated and experimentally tested bending moment resistance is all within 7%.

Figures 4 and 5 summarise the load deflection graphs for each individual group. Note how well the theoretically calculated value compares with the yield point of each beam. From...
these graphs it is evident that more reinforcement leads to higher load bearing capacity.

From Table 3 it is evident that the percentage increase in the reinforcement cross-sectional area is not equal to the percentage moment increase.

Table 2 Comparison between theoretically calculated and laboratory measured bending moment

<table>
<thead>
<tr>
<th>Group</th>
<th>Load Application</th>
<th>x (mm)</th>
<th>Theoret Mr (kNm)</th>
<th>Theoret Lr (kN)</th>
<th>Experim Lappl (kN)</th>
<th>Experim Mappl (kNm)</th>
<th>Ratio Mr/Mappl</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>MSLL</td>
<td>13.5</td>
<td>34.13</td>
<td>23.51</td>
<td>25.00</td>
<td>35.80</td>
<td>0.95</td>
</tr>
<tr>
<td>3</td>
<td>TSLL</td>
<td>13.5</td>
<td>34.13</td>
<td>33.27</td>
<td>35.00</td>
<td>35.43</td>
<td>0.96</td>
</tr>
<tr>
<td>4</td>
<td>MSLL</td>
<td>23.3</td>
<td>48.90</td>
<td>36.64</td>
<td>37.00</td>
<td>49.30</td>
<td>0.99</td>
</tr>
<tr>
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<td>TSLL</td>
<td>23.3</td>
<td>48.90</td>
<td>52.96</td>
<td>47.00</td>
<td>44.43</td>
<td>1.10</td>
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<tr>
<td>6</td>
<td>MSLL</td>
<td>48.3</td>
<td>84.81</td>
<td>68.56</td>
<td>70.00</td>
<td>86.43</td>
<td>0.98</td>
</tr>
<tr>
<td>7</td>
<td>TSLL</td>
<td>48.3</td>
<td>84.81</td>
<td>100.84</td>
<td>105.00</td>
<td>87.93</td>
<td>0.96</td>
</tr>
<tr>
<td>8</td>
<td>MSLL</td>
<td>80.3</td>
<td>127.52</td>
<td>106.52</td>
<td>115.00</td>
<td>137.05</td>
<td>0.93</td>
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<tr>
<td>9</td>
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<td>80.3</td>
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<td>157.78</td>
<td>157.00</td>
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<td>1.00</td>
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<td>MSLL</td>
<td>130.4</td>
<td>186.64</td>
<td>159.07</td>
<td>160.00</td>
<td>187.68</td>
<td>0.99</td>
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<td>130.4</td>
<td>186.64</td>
<td>236.61</td>
<td>220.00</td>
<td>174.18</td>
<td>1.07</td>
</tr>
</tbody>
</table>

Table 3 Comparison between the reinforcement increase vs the moment increase of the beams

<table>
<thead>
<tr>
<th>Group</th>
<th>Reinforcement</th>
<th>Bottom (kNm)</th>
<th>Theoret Mr (kNm)</th>
<th>Experim Lappl (kNm)</th>
<th>Strength Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theoret Mr</td>
<td>Experim Mappl</td>
<td>Reinforcement Increase %</td>
</tr>
<tr>
<td>2</td>
<td>2 Y</td>
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<td>34.13</td>
<td>35.80</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>2 Y</td>
<td>10</td>
<td>34.13</td>
<td>35.43</td>
<td>0.00</td>
</tr>
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<td>87.93</td>
<td>60.96</td>
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<td>137.05</td>
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<td>174.18</td>
<td>84.01</td>
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</table>

Figures 4 and 5 summarise the load deflection graphs for each individual group. Note how well the theoretically calculated value compares with the yield point of each beam.
The 2011 Fulton Awards

THE WINNERS OF the 2011 Fulton Awards were announced at a gala event at the Champagne Sports Resort in the Drakensberg on 4 June. These prestigious awards, for excellence in the application of concrete, are made every two years by the Concrete Society of Southern Africa (CSSA) with the Cement & Concrete Institute (C&CI) as anchor sponsor. Thirty-one major projects competed in the following six categories: Civil Engineering, Building, Concrete in Architecture, Unique Design Aspects, Construction Techniques, and Innovative Technologies. This article summarises the winners per category.

The judges for the 2011 Fulton Awards were the President of the South African Institution of Civil Engineering (Seetella Makhetha), the President of the South African Institute of Architects (Fanuel Motsepe), and the CEO of CSSA, John Sheath.

CIVIL ENGINEERING CATEGORY

Blackburn Pedestrian Bridge near Umhlanga
Submitted by SSI Engineers & Environmental Consultants

This remarkable structure provides the local people of Blackburn, Durban, with a new, safe route to work, as well as lifestyle opportunities in the nearby Umhlanga New Town Centre. The bridge is one of the longest cable-stayed pedestrian bridges in Africa, and the judges were impressed by the careful attention to design and detail which was necessary due to the uniquely-shaped pylon. The highest quality of finish was achieved from the exposed ‘durability’ class concrete which results in the minimum of maintenance being required during its life-cycle. Concrete was also chosen as the construction material for the two kilometres of associated walkway between Blackburn Village and Umhlanga. According to the judges, “The towering pylon and fanning stays of the bridge now highlight the capabilities of civil engineering and construction in South Africa.”

BUILDING CATEGORY

Ubuntu Education Centre in Zwide Township, Port Elizabeth
Submitted by John Blair Architects in association with Nongonyama Okpanume Hewitt-Coleman Architects

In this category the judges were very impressed with the use of off-shutter concrete as main element of the building, which provided a continuity of finish and form that met the design intent.

CONCRETE IN ARCHITECTURE CATEGORY

Ubuntu Education Centre in Zwide Township, Port Elizabeth
Submitted by John Blair Architects in association with Nongonyama Okpanume Hewitt-Coleman Architects

In this category the judges were impressed by the careful attention to design and detail which was necessary due to the uniquely-shaped pylon. The highest quality of finish was achieved from the exposed ‘durability’ class concrete which results in the minimum of maintenance being required during its life-cycle. Concrete was also chosen as the construction material for the two kilometres of associated walkway between Blackburn Village and Umhlanga. According to the judges, “The towering pylon and fanning stays of the bridge now highlight the capabilities of civil engineering and construction in South Africa.”
Reinforced concrete had been used as the principle building material for walls, floors and roofs. A smooth off-shutter finish to the concrete had been used aesthetically for all external faces, and this finish was carried through with good effect to the main interior walls. The concrete structure provides a sense of permanence and durability.

**UNIQUE DESIGN ASPECTS CATEGORY**

*Mountain House Roofs*

Submitted by architects Hulme & Associates Consulting Structural & Civil Engineers

The judges felt that the roofs of this residential property at the foot of Table Mountain showcased concrete in a very special and unique way. According to them, “The organic shapes chosen for the roofs aid the house to blend harmoniously into the mountain backdrop. These also allow unique views of the mountain, when seen from the inside, to be ‘framed’ with raised sections of the roofs – a very well thought-out concept. The choice of concrete for the roofs shows perfectly its versatility, structural capacity, durability and aesthetic qualities.

**CONSTRUCTION TECHNIQUES CATEGORY**

*Hospital Bend Preselection Traffic Scheme*

Submitted by BKS (Pty) Ltd

This project involved the construction of new overpass bridges for traffic flowing into Cape Town from Rhodes Drive and Settlers Way. The judges were impressed with the use of the suspended formwork system which utilised purpose-made structural steel lattice overhead girders with steel support structures, the design of which required extensive integration of the various design and construction elements. The Anzio Road Overpass was particularly challenging, as the sharply curved bridge deck had to accommodate a vertical, as well as a horizontal transitional curve, leading into a circular curve with a variable superelevation. Impressive also, was the attention given to the concrete mixes, incorporating supplementary cementitious materials to not only improve resistance to marine conditions, but also reduce carbon emissions.
Concrete technology played a large part in bringing its various benefits directly to bear on the correct elements in this project. The externally visible architectural form, or silhouette, of the building is that of two towers whose north and south faces are defined by irregular curves, resulting in a canyon-like atrium space between the two towers. This atrium space is about six metres wide at its lowest point, and eleven metres wide at its widest. The dramatic vertical space that results is enlivened by a series of precast concrete link bridges that have a fan-shaped arrangement in plan and spiral upwards in this tight space.
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MARKET CONTRIBUTION

Three-dimensional data capturing
an overview

INTRODUCTION
Project managers, engineers, architects, asset managers, town planners, GIS practitioners and everybody else in the construction industry all need reliable and accurate spatial information for decision-making, design, analysis and construction purposes. Traditionally as-built information was acquired by aerial or ground survey methods. In recent years LIDAR established itself as a fast and efficient methodology to acquire three-dimensional data. This article serves as a brief overview of the methodology and to give the reader a general feel for what it is all about and what can be expected.

3D LIDAR
Definition of LIDAR (Light Detection And Ranging)
LIDAR is a three-dimensional laser scan and each pixel that is scanned is assigned an x,y,z value which allows for accurate 3D mapping.

Buzz words
It can be confusing but the following terms all refer to LIDAR or products that use LIDAR equipment as part of the data capturing process: LIDAR, scanning, laser imaging, 3D mobile scanning, airborne lidar and terrestrial scanning.

Characteristics
3D laser imaging (LIDAR) is a proven technology used by the construction industry worldwide to obtain fast, accurate and efficient 3D digital data. The system is a highly integrated package with digital image capturing and sophisticated software tools.

Difference between scanning and survey
With conventional surveying methods the instrument is pointed at the object to be captured (single point), while with scanning everything is captured (point cloud) and the required data is extracted from the point cloud.
**Advantages of 3D laser scanning**
- Safe – surveyors are not exposed to dangerous terrain
- Fast and efficient data collection – the client now receives all the data of a project and can choose which to use
- Data is available in two formats:
  - 3D – Autocad, Microstation and soon ArcInfo
  - 2D – Any industry standard CAD package

**DIFFERENT SCANNING METHODOLOGIES**
The following is a short summary of the two ground-based methodologies:

**Terrestrial laser scanning:**
This is the use of a single instrument set up on a tripod or other base. In general these can scan 270 degrees vertical and 360 degrees horizontal with a small footprint underneath the instrument that cannot be reached. The various models capture data in many different ways from single points, points in a specific grid or everything in view (point cloud). The effective range can vary from as little as one metre to a kilometre or more, and the accuracy can be from 1 mm – 100 mm, depending on distance and type of equipment.

*Typical applications*
Any existing objects, such as as-built surveys of existing plant and buildings, whether inside or outside buildings, structures, open pit mines, volumetric surveys, inaccessible or dangerous areas, deformation surveys, etc.

*Advantages*
It is possible to obtain accuracies and reach areas where mobile and airborne scanners are not effective.

**3D mobile scanning**
A three-dimensional mobile scanning unit comprises laser sensors, GPS, navigation sensor (IMU) and high resolution cameras, and can be mounted on any moving vehicle, boat or trolley. The effective range varies from 30 m – 200 m and accuracies from 1 cm – 10 cm.

*Typical applications*
Construction sites, open pit mines, route corridors, as-built plant, bridges, municipal assets, volumes.

*Advantages*
- Survey grade accuracy under very challenging conditions.
- Extremely fast – if the vehicle or boat can reach the area it can be mapped at speeds of up to 70 kph.

**GOLDEN RULES FOR TENDER SPECIFICATIONS**
- Quality assurance is an essential part of any project, especially independent check surveys to confirm that the model generated is accurately geo-referenced to the ground profile.
- No two scanners are the same and accuracy to be achieved need to be specified – relative (between points) and absolute (relative to the ground).
- Ask the tenderer to disclose the accuracies of the scanner, IMU and GPS, because each of the instruments has an inherent accuracy margin and the effect is a cumulative error.
- Specify that the survey must be connected to a benchmark system on the site and not to the nearest trigonometrical beacon. If engineering design accuracies are needed it is not unreasonable to have a benchmark every 3 – 5 km. The height accuracy of ground control must be 300% better than the mapping accuracy required, e.g. 10 cm mapping requires 3 – 4 cm height accuracy on the benchmarks.
- Rigorous ground control is the single most important part of any of these methods. This includes visible targets or pre-marks that can be check-surveyed. Ensure that the consultant can supply the client with data in a format that is palatable and suitable for the expertise in his/her office.

**CONCLUSION**
There is no single data capturing methodology that is superior to other, and each must be regarded as another tool to get the work done as fast and efficiently as possible. There are a myriad of scanners and software on the market, but at the end of the day the survey consultant must use the method which is the most effective for the specific circumstances, even if it is conventional ground survey.

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A modular construction approach for mechanically stabilised earth structures

A SYSTEM FOR mechanically stabilised earth (MSE) structures is defined as a complete supplied package that includes design, specifications and all prefabricated construction materials necessary for the complete construction of a soil-reinforced structure. This package may also include technical assistance during the planning and construction phase. Each system can be separated into modules that are self-sufficient to manage and execute.

MSE structures can be described by the reinforcement geometry, stress

1. Marikana: Terramesh tip wall at a platinum mine in South Africa – total height 23 m
2. Optimum: Combination Terramesh/Macforce tip wall at a coal mine in Mpumalanga – total height 17 m
3. Klipspruit: Macforce tip wall at a coal mine in Mpumalanga – total height 22 m
4. Iduapriem: Terramesh tip wall at a gold mine in Ghana – total height 29 m
5. Etoile: Macforce tip wall at a cobalt mine in southern DRC – total height 14 m
transfer mechanism, reinforcement material, extensibility of the reinforcement material, and the type of facing and connections.

The mining and materials handling sectors are known to support and prefer discrete systems and modular concepts that offer predictability, composite and preferably low-maintenance systems. Infrastructure requirements at a mining site often require robust if not harsh durability specifications of the materials to be used. The remote nature of their location, the need for speedy construction and the high cost or loss of down-time preclude infrastructure systems that are difficult or take long to install.

MSE satisfies such requirements because it consists of essentially three major components, namely the cladding on the wall facing, the soil reinforcement and soil. The delivery of the first two items is relatively easy, thanks to their dimensions and capacity for shipping by container.

The preparation and installation of these materials are easily taught and, to achieve adequate competence, the learning time is short. MSE systems are flexible and as such can accommodate poorer soil conditions without decreasing its structural integrity, compared to more rigid reinforced concrete systems.

MSE favours a low-skill labour component, and as such is popular when creating simple work skills and employment in poor rural areas. When socio-economic pressures on contracts need to be considered, MSE systems are favourable, as they support a basic entry level, but are sufficiently user-friendly for repeated work on other projects.

Maccaferri SA and other geotechnical companies have a range of these MSE systems that qualify for these advantages. The rider to MSE systems is the certification of design, materials, technical assistance and professional assurance. Certification is highly recommended to ensure the package – from design and supply to handover of the structure to the client.

The structures in the accompanying photographs are but a few Maccaferri examples of how clients’ requirements were adequately met with regard to speed of installation, dealing with poor foundation conditions, labour/employment/skills development, cost-effectiveness and safe construction. These are all mining sector projects that perform as expected and designed.

The civil and mining industries are advised to be meticulous when confirming that solutions comply with certified design, materials and installation guidelines as suggested by engineering institutions that are recognised and approved.

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IN BRIEF

PRECAST CONCRETE AIDS
FAST-TRACK BUILDING
OF NEW CROCODILE
RIVER BRIDGE

THE USE OF PRECAST concrete played a major role in the fast-track erection of the Kruger Park’s new Crocodile River Bridge, which gives access from Komatipoort to the Crocodile Bridge Rest Camp and the southeastern section of the Kruger National Park.

Opened in December 2010, the new bridge replaces the old crossing, which had silted up. With its hydraulic capacity drastically reduced, any substantial flooding of the Crocodile River led to the old structure being overtopped and closed to traffic. In addition, during bridge inspections in 2006, it was found that some deck slabs showed structural failure due to shear and bending. A load restriction was subsequently imposed.

SANParks appointed Aurecon for consultancy services on the project. Luuk Hepkema, Aurecon engineer, says the old crossing consisted of a vented low-water concrete bridge with 35 openings, each roughly 4.7 m long with a one-metre clearance above the rockbed level. The crossing was 3.7 m wide and allowed only single lane traffic.

Originally the structure was 91.8 m long with 20 openings. When the floods of 2 000 washed away the approaches, the structure was extended with 15 openings. The same flood damaged a small dam 300 m downstream, which was reconstructed with a small increase in height.

Hepkema says a hydrological study showed that the number of vehicles crossing the bridge did not justify a high-level bridge. SANParks accepted Aurecon’s proposal to raise the road level by 1.9 m to a height where overtopping would roughly occur only every five years.

Aurecon furthermore recommended removing the existing deck slabs and erecting reinforced concrete portals, utilising the existing piers. By having a portal at alternative

1. Erection of concrete portals for the elevated Crocodile River Bridge (Photo: Des Gamble)
2. Anchoring of precast panels on top of existing pier
3. The new Crocodile River Bridge was opened to traffic in December 2010
spans, the remaining openings needed only an infill slab. A system of prefabricated concrete units was adopted to ensure fast construction.

A temporary bypass was required during construction to accommodate the daily traffic. Only during the winter months – with limited rainfall and low water levels – would the gravel bypass with large drainage openings have been practical.

The existing piers were anchored into the rock bed and, to save costs, it was decided to use the old piers as a base for the new portals. The bottom portion of the portal leg was fixed into the existing piers.

Furthermore, each span was divided in four precast units. “The four units were connected to each other with a tie beam at the top. Dividing the precast units resulted in ease of transport and the erection of the units with light equipment. All the precast units were manufactured in Meyerton and transported by road to the site. The length of the slabs varied, but the portals had fixed dimensions,” Hepkema explains.

“The approaches were also raised. An in-situ cast small reinforced concrete wall contained the approach fills. For the new sections, a concrete pavement was proposed. The short construction period available before the summer rains was the main reason for using as many precast units as possible.”

Tsitemba Brand Construction handled the R7.3 million project which has drastically improved access to the southeastern part of the Kruger National Park.

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FAILED RETAINING WALLS – ARE YOU COVERED?

A GROWING BAND of South African property owners is learning some hard lessons about failed retaining walls. They have discovered that, although their walls are insured together with the rest of their fixed properties, when they fail, as some of them inevitably do, their claims for the repair work are often not met.

There are several legitimate reasons why insurance companies do not simply pay up when presented with claims – inadequate wall designs, poor workmanship and defective materials being some of the contributing factors. However, by far the most common escape clause relates to the fact that 95% of the walls which fail were not designed by structural engineers.

In order for insurance claims to have any chance of success, property owners must be able to submit approved structural engineering designs on walls higher than 1.5 m. This is one of the basic conditions stipulated in a typical home or property owner’s insurance policy.

President of the Concrete Manufacturers Association (CMA), and vice-president of its Concrete Retaining Block (CRB) Division, Silvio Ferraris, says the abnormally high rainfall pattern earlier this year has seen a rise in retaining wall failures.

“Most of the failures have occurred on walls built either with stone or bricks, whereas the incidence on concrete retaining block (CRB) and in-situ concrete walls has been relatively low.

“Many of the walls which have failed were built between 30 to 60 years ago and most of the failures were caused by a rise in the underground water pressure. However, no matter how old the walls, providing property owners
can produce a set of engineering drawings, their claims will usually be regarded in a positive light. That said, there are many instances in which the structural drawings have either disappeared during change of ownership, or simply did not exist in the first place.

"Insurance policies cover subsidence and landslip, but exclude damage caused by excavations and defective workmanship. Other typical exclusions include normal settlement, shrinkage, expansion or inadequate compaction. However, defective workmanship and inadequate compaction are very difficult to prove, especially if the project was supervised by an engineer, and more especially if photographs were taken during construction as supporting evidence.

"People buying a house on steeply sloping ground should establish whether the retaining walls on the property were designed by a structural engineer and should ask for the certification to prove it. If no documentation can be produced the new owner should either factor this into the purchase price or get the existing owner to have the wall properly assessed by a structural engineer. This can involve considerable expense, as the engineer may well recommend some improvements, such as proper drainage.

"Of course it goes without saying that anyone wanting a new retaining wall built higher than 1,5 m must get a structural engineer involved, not only in the design of the wall, but also to ensure that the contractor follows the design to the letter. Once the wall is built a copy of the drawing and design certificate should be lodged with the local council, and the original should be kept by the owner as record," concludes Ferraris.

The Trekkopje Joint Venture (JV), comprising Concor Roads & Earthworks as lead partner, together with Grinaker-LTA and Basil Read, reports that it has been consistently achieving its present productivity targets on what is a complicated project that requires precision planning and programme scheduling.

Upon completion the leach pad will be 4 km long and 1 km wide – the biggest of its kind in southern Africa and the second largest in the world. The sheer volume of material required is unprecedented for a project of this nature, according to Concor project manager Clive Meyer.

"For instance, 2,5 km of piping is being laid every day, while 3,8 million tons of material will be crushed for the overliner over a period of 17 months, with 2,5 million m² of 2 mm HDPE (High Density Polyethylene) plastic liner being imported from the USA," he says. "A total of 3,7 million m³ of earth will be moved, involving the blasting of 600 000 m³ of rock. Uranium will be leached from the pad into almost 900 km of piping, with diameters varying between 100 and 700 mm."

At the current contract peak there are more than 800 people on site, comprising the JV’s own staff and locally sourced personnel.

The cut and fill of the individual cells involves 1,8 million m³ of cut and fill. Total gypcrete usage will be 320 000 m³, with 180 000 m³ of dispersive material sourced from a borrow pit.

"The stone crushing process is slower than we had envisaged at the time of tender," Meyer comments. "We have increased the number of crushers on site to eight. The crushing rate has also been slower than we anticipated, owing to the massive volume of overliner. We need to crush at a rate of 11 000 tons per day to maintain the programme schedule."

A centre corridor running down the middle of the two rows of heap leach pads has a southern turning circle which required 334 000 m³ of fill and a northern turning circle which required 265 000 m³ of fill.

Ancillary works involve a total volume of 140 000 m³ of earthworks and the construction of 14 platforms to provide a solid base on which to build the necessary foundations for the crushing and screening plants.

This is a plant-intensive project, with more than 260 items of large plant on site, including dozers, excavators, loaders, rigid frame and articulated dump trucks.

The project is scheduled for completion by December 2012.
ADMIXTURES PLAY VITAL ROLE IN SELF-COMPACTING CONCRETE

SELF-COMPACTING CONCRETE (SCC) – a technology that has been available in South Africa for roughly ten years – has the amazing ability to flow into complex shapes and penetrate inaccessible spots while achieving high strengths and superior surface finishes.

These characteristics would be nearly impossible to achieve without the addition of admixtures in the concrete mix, particularly “new generation” super-plasticisers.

Construction chemical materials company, Chryso, has been supplying admixtures to the construction industry globally for over 65 years and has two different ranges of super-plasticisers for SCC.

Eddie Correia, General Manager: Technical Services at Chryso, says: “Chryso’s Premia range of products is geared towards SCC within the precast industry, while the Optima range of products is used by the ready-mix industry to produce SCC.

*Using SCC in the precast industry, one basically looks at aesthetics and noise reduction. SCC does not require mechanical vibration for placing and compaction, thus reducing noise levels. This helps in meeting occupational health and safety requirements, while allowing construction in built-up residential areas during the night.

Admixtures supplied by Chryso SA played an important role in the SCC used for the construction of the Nelson Mandela Bridge in Johannesburg

“Another big positive for SCC in the precast industry is the high-quality finish – reducing blemishes and the need for concrete repairs.

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SCC also aids in a fast placement rate and improves the mould turnaround time.

“The molecules in the Premia range are very effective water reducers and offer workability retention between 30 and 45 minutes. These features are particularly appropriate for the production constraints within the precast industry, achieving high early strengths,” adds Correia.

Chryso’s Optima range is designed through a unique patented phosphonate technology that allows the ready-mix industry to produce cohesive, low-viscous concrete.

“Chryso has the ability to match super-plasticisers with cement chemistry. We look at the soluble alkalis and soluble sulphates in the cement and then choose a suitable super-plasticiser, thus optimising the dosage of super-plasticisers for cost purposes. Chryso also helps find the best possible admixture/cement compatibility. This is why there are so many products within the Optima range,” says Correia.

One such product is Optima 100 – a super-plasticiser that extends slump retentions of concrete and is compatible with the majority of cement types. “Optima 100 is a unique product in that it is not water sensitive. Some other super-plasticisers become very sensitive should too much water be added to the mix, but Optima 100 is a robust admixture with regard to water control and allows for the production of SCC that is not too water sensitive. The aim with SCC is to produce robust, non-sensitive mix designs that can be easily implemented,” explains Correia.

A significant challenge with regard to SCC lies in the fact that South Africa typically uses dry batch plants. This provides little room for error, as the mix design has to be correct the first time around. Therefore it is very important to receive the correct technical advice.

Brenton Brouard, Chryso’s Concrete Laboratory Manager, says Chryso can provide all required technical support. “Chryso looks at a customer’s raw materials, picks the appropriate admixtures, and creates a mixed design that meets all requirements.

“Due to the sophisticated nature of SCC, there has to be strict control of mix design technology. In order to make SCC with consistent accuracy and acceptable quality, a homogenous mix has to be created. The same cement from the same supplier, from the same factory, should be used. The size and shape of aggregate can affect the cost effectiveness of SCC and, should the size and shape vary, adjustments may have to be made to the mix design,” he adds.

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WHY USE EXTENDED RATHER THAN PURE CEMENTS?

NEGATIVE PERCEPTIONS ABOUT the durability and performance of extended cements, combined with tradition and a conservative approach to new technology, have caused resistance to their use, a situation which is gradually changing, according to experts from AfriSam.
“Extended cements are being used increasingly in major projects such as Gautrain, the SANRAL Gauteng Freeway Improvement Project, Melrose Arch and the Koeberg interchange upgrade in Cape Town,” Mike McDonald, Afrisam product manager (cement), points out.

“For years,” adds Amit Dawneerangen, technical manager (product support), “Afrisam has been conducting exhaustive tests on different blended materials in aggressive conditions, monitoring performance year on year to test for durability and performance. Using this data, the company works closely with engineers in designing concrete mixes and the amount of cover concrete required for structures in different areas of exposure.

“There are several main elements that cause deleterious effects in concrete,” he continues. “These include carbon dioxide, chloride ingress, sulphates, alkali silica reaction, a reaction between the aggregate and the alkalis in cement, and abrasion. On-going research and testing have demonstrated conclusively that blended cements perform better than pure cement in providing impermeability, workability and durability.”

Afrisam uses the three durability index tests – the oxygen permeability index, the water sorptivity index and the chloride conductivity index, developed in South Africa by the University of Cape Town – to test the performance of extended cements.

“We have one of the few laboratories in the country with the equipment, competence and expertise to do this,” McDonald says.
Fly ash and slag, both industrial by-products which would normally be consigned to landfills, are used in extended cements, thus providing an immediate environmental benefit. “Fly ash has a fine particle size, which improves the workability of concrete considerably, creating a dense concrete matrix and enhancing impermeability,” Dawneerangen explains. “The correct mix design and the use of appropriate chemicals accelerate the strength development process which otherwise would be longer for extended cement. The percentage of fly ash could be varied according to the aggressiveness of the application.”

Slag also provides a dense concrete matrix, improving workability and is also known to capture chloride ions, protecting concrete from chloride ingress and prolonging the lifecycle of the concrete. A combination of slag and fly ash provides both chloride-capturing ability and a dense concrete matrix. This combination was used in the Gautrain project where aggressive soil conditions prevailed.

Limestone is also used to extend cement to provide a more cohesive concrete mix, which favours excellent finishing with application of proper concrete technology.

Using extended cements, McDonald and Dawneerangen stress, results in improved durability, permeability and workability, while benefiting the environment by reducing the carbon footprint without jeopardising strength, quality and durability.

“The slower gain in early strength development that is normally associated with extended cements can be countered by using appropriate water reducing and activating chemicals. Non-renewable resources such as coal and limestone, which are consumed in the cement manufacturing process, can be used more responsibly while still complying with specifications and user requirements, and producing structures that last the required lifetime,” McDonald states.

“Fortunately, the more enlightened consulting engineers and construction companies are increasingly appreciating the significant benefits which accrue from using extended cements, and I am confident that perceptions and traditions will inevitably give way to the concrete proof.”

JOHNSON CRANE HIRE PURCHASES 100TH CRANE FROM LIEBHERR

JOHNSON CRANE HIRE (JCH), the biggest crane hire company in Africa and the second biggest in the southern hemisphere, recently purchased its 100th Liebherr crane. This milestone was commemorated with a celebration at Liebherr’s East Rand premises attended by representatives from Liebherr’s German and South African operations, including Christoph Kleiner, managing director of Mobile Cranes Liebherr-Werk Ehingen GmbH, and Jan Liebherr, the oldest grandson of the company’s late founder, Dr Ing Hans Liebherr, who officially handed over the unit to JCH.

JCH has subsequently purchased four more Liebherr cranes. Martin Bekker, managing director at JCH, praised Liebherr’s innovative approach to crane technology, as well as its world-class after-sales service.

“From JCH’s earliest days, Liebherr has shown immense support and loyalty,” Bekker said. “They have partnered us on many levels, even to the extent of representing our interests – and, in fact, the interests of all other South African crane companies – by recently inviting representatives of the Department of Transport and the CSIR to a workshop in Germany to discuss the appropriate application of abnormal load regulations for cranes using our national roads.

“Our company has grown from strength to strength over the years and, despite the effects of the global economic crisis, we are today running at about 80% crane utilisation. Liebherr has made a significant contribution to this success and we are very positive about the future.”

JCH, Liebherr’s biggest client in Africa, bought its first Liebherr crane in 1995 and has added 103 more units to its fleet over the past 16 years. During his visit to South Africa, Christoph Kleiner described Liebherr’s relationship with JCH as “more than unique, it is actually remarkable”.

“JCH is an outstanding company reflecting all the characteristics we most value in a partnership such as this,” Kleiner said. “In selecting cranes, JCH is not solely driven by price, but
has shown itself committed to purchasing cranes which are fit for purpose and which will offer its clients the most efficient service.

"JCH and Liebherr are both family businesses and have almost become family to one another since 1995. We have established a valuable partnership founded on open doors and honest consultation. We work side by side with Martin Bekker to ensure JCH meets the local industry's increasing safety, health and productivity requirements. We have also helped guide the company as its services have extended beyond traditional customer sectors to serve other areas of industry in South Africa.

"JCH has also consulted with us regularly on specific jobs and we have been able to assist with customisation of certain attachments not only for a particular job, but also to ensure the company achieves optimum usage in return for their investment in each crane. These modifications are carried out by Liebherr Africa.

“We are committed to ensuring that JCH remains the top crane hire company in South Africa,” Kleiner concluded. “And we are going to do this by maintaining and deepening our well established relationship with the company. We are well acquainted with the JCH fleet and in an ideal position to advise the company on current and future trends in crane hire.”

JCH’s fleet of hydraulic and crawler cranes is the largest in Africa. The company operates throughout southern Africa, through 13 local branches and a subsidiary in Botswana. Crane services are available 24 hours a day, seven days a week.
DYNAMITE COMES IN SMALL PACKAGES
PILOT CRUSHTEC, South Africa’s leading supplier of mobile and semi-mobile crushing, screening and material handling solutions, is experiencing a surge of interest in its small impact crushers, of which the Pilot Modular TM0605 impact crusher (see photo) is an example. Relatively low in cost and scoring very high marks in versatility, these crushers process such diverse materials as building rubble, glass, concrete, limestone, iron ore and coal with ease, and at a fraction of the cost of using larger-scale equipment.

“The growing popularity of our mobile Pilot Modular TM0605 and semi-mobile Pilot Modular BR0605 impact crushers is due to the increasing awareness of their proven ability to handle a wide range of applications, and importantly, at a relatively low capital cost to our customers,” says regional sales manager Nicolan Govender. Pilot Crushtec’s small impact crushers are backed by a comprehensive package of excellent after-sales service and support, and have won many friends in South Africa, while proving their worth overseas as well, especially in India.

INFO
Nicolan Govender
Regional Sales Manager: Pilot Crushtec
011 842 5600
nicolang@pilotcrushtec.com

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Cementitious Patching

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- Epoxy Grouting Paste
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- Chemical Spin-in Capsules & Bars

Cementitious grouts have a wide application ranging from aesthetic finishes to lending corrosion resistance on projects!

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Aesthetic, practical, lasting! Cementitious Patching can be done on small or expansive areas on concrete projects!

Perfected to patch concrete columns, beams, decks, walls and floors!
“THE SCIENCE AND technology sectors hold great promise for government’s development ambitions and need to be given far more attention and support than they currently receive,” says Minister Naledi Pandor.

Speaking in her budget debate on Tuesday 24 May, she argued for increased resource and policy support to strengthen excellence. This should be particularly in disciplines and sectors that have the potential to make a contribution to improving the country’s development status, expanding economic growth and changing the quality of life of individuals and communities.

“The funding of science and technology must be improved if we are to realise our ambitious national goal of building a knowledge-based economy. One of the areas that must be addressed is increased support for post-graduate study and for senior researchers, plus a more stable funding model for all our research-performing institutions,” she said.

The department was allocated R4,1 billion in the adjusted estimates of 2010/2011 and has spent 98% of its budget. “Our biggest hurdle is vacancies, due to the lack of appropriate skills. We will give this challenge more attention. In this financial year our allocation is R4,4 billion.”

The following allocations have been made for this year:

- Over R200 million will be spent on expanding access to SANReN (South African National Research Network) in order to ensure that all universities in South Africa are connected by December 2011.
- Sixty-two new research chairs will be established, thereby increasing the number of chairs to 154, with a total investment in research chairs of R914 million by 2013.
- An additional 25 post-doctoral fellowships, each worth R 180 000 per annum for three years, will be created.
- R433 million to the TIA (Technology Innovation Agency), R1,089 billion to the NRF (National Research Foundation), R687 million to the CSIR (Council for Scientific and Industrial Research), R206 million to the HSRC (Human Sciences Research Council), R93 million to the South African National Space Agency, R32 million to the Africa Institute of South Africa and R11 million to the Academy of Science of South Africa (ASSAf).

Minister Pandor revealed that her department intends creating an institutional and policy framework that advances and sustains a coordinated and responsive National System of Innovation. “The Technology Innovation Agency (TIA) is our key agency in this regard. Now fully operational, it has begun to add value to several investment opportunities.”

So far 26 investments have been identified. Eleven have a very strong likelihood of enhancing job creation and socio-economic development. Eleven others have proceeded beyond proof-of-concept stage, and four are ready for commercialisation. Over R400 million will be committed to this successful investment portfolio.

She continued, “Recent research reports from our universities and science councils point to robust and growing research activity in a wide range of disciplines. We are committed to ensuring that we build on this wealth of intellectual activity, and intend to support our institutions and researchers much more vigorously. “Our allocation of R1,089 billion for 2011/12 to the National Research Foundation (NRF) is a positive investment in our researchers and our national facilities.”

Addressing centres of excellence, the Minister said, “We have also expanded the number of institutions that support researchers and our human resource development programme”.

These attract high-level research and development skills, through providing substantial funding for equipment, for post-graduate research opportunity, and places for focused research development and innovation. R50 million has been allocated to the first eight centres of excellence, and more centres are on the cards. Minister Pandor emphasised that her department welcomes support efforts by scientists and universities to establish centres of research excellence, and confirmed that her department’s support for a range of university-based research centres would continue. “We will also continue to provide support to the excellent African Institute for Mathematical Studies,” she added.

“The President has supported my proposal that there should be a National Committee on Science Technology and Innovation (including relevant ministers and stakeholders), to ensure sustained political commitment and oversight of national Research and Development support,” she revealed. The department’s executive is drafting the proposed terms of reference and composition of the committee.

“We also believe serious consideration should be given to locating the budgets of science councils within the Science and Technology budget in order to ensure assured and improved resourcing of all our science councils. Sector departments would still have the right to direct policy, but we would ensure resourcing and full attention to research, technology development and innovation,” she explained.

NOTE

During her inspiring keynote address at the NSTF-BHP Billiton Awards gala evening two days after her budget debate, Minister Pandor reassured the science, engineering and technology fraternity of her department’s continued support, saying to them that “the good times for researchers are here”. [See Civil Engineering, June 2011, page 79]
Summary of SAICE membership status
as on 31 May 2011

Please note:

a) Members who would like to see any other specific statistics are invited to contact the chairman of the SAICE Membership Committee,
Athol Schwarz:
082 777 1961
aschwarz@hatch.co.za

b) For membership queries please contact SAICE’s membership officer,
Norma Koekemoer:
011 805 5947
norma@saice.org.za

### MEMBERSHIP BY CATEGORY

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Francois Paul van der Merwe

PAUL VAN DER MERWE was born and also grew up in Stellenbosch. From standard two (now grade 4) he was a boarder at St George’s Grammar School in Cape Town. He studied at the University of Cape Town from 1953 and became a land surveyor. As the family grew, however, he realised that his career would often take him away for long periods of time. He then decided to return to the University of Cape Town in 1961 to study civil engineering.

After graduating, Paul joined VKE in Cape Town, working as designer on motorways and as an engineer on site. In 1971 the family moved to Johannesburg where Paul joined Jones & Wagener. He soon became a partner in the firm.

At Jones & Wagener Paul started on the Main Reef Road design for the Johannesburg City Council. As time progressed he worked on steelworks for Iscor, power stations for Eskom, gold mines and collieries. He always started with the infrastructure, and then got involved in all kinds of detail as the work developed. Some of his most exciting projects were the designing of walkways for draglines from one colliery to the next. These machines weigh up to 4 500 tons, and the walkways are up to 40 m wide and 30 km long, crossing roads, railway lines, Eskom power lines and rivers.

Thanks to his surveying background, Paul was a meticulous engineer. He did not jump to conclusions, but looked at a problem in detail from all angles before putting pen to paper.

Paul passed away suddenly on Christmas Day last year while on holiday at Betty’s Bay. He had been ill for a few months and was receiving treatment.

Peter Day from Jones & Wagener was asked to say a few words at Paul’s memorial service at the Andrew Murray congregation in Johannesburg. In preparation for this, he and I sat together and recalled so many of the moments we had shared with Paul. Peter concentrated on the professional side of Paul’s life, taking us through his role in the company over the years. The following is part of what Peter had to say:

Paul had a big drawing table in his office. He would invariably stand and work at this table. There were those meticulous handwritten notes and calculations, always in pencil and always on lined paper. No matter how busy Paul was, he would always be prepared to drop his own work to assist others. This was a philosophy that he carried over into his personal life, as reflected by his work as a volunteer fire-fighter, frequent blood donor and a pillar of the church.

Paul spent a lot of time in the field, doing survey work, planning projects and checking up on the work done by contractors. Alex Johnston, also still with Jones & Wagner, was Paul’s draughtsman and right-hand man, and accompanied him on many of his field trips. Alex used to say, “Paul is so slim, hy kan selfs die kontore op die grond sien.”

Paul was so willing to assist and had such a wealth of knowledge at his fingertips that, in later years, we had to caution the younger engineers in the office about running to Paul with every problem. We were concerned that they would simply rely on his knowledge rather than getting to grips with the problem by themselves.

After retiring from Jones & Wagener, Paul and I decided to start all over again. One of the people he came into contact with during this time was Tony A’Bear, an engineering geologist. In a note to us, Tony summed up Paul better than we will ever be able to: “I did not know him well, but really enjoyed the few brief moments we had together working on the Gautrain Project. He impressed me as a gentle, thoughtful person who had a wealth of knowledge and experience, which he was always willing to share.”

Paul was a very special person to have been called away at 12 o’clock on Christmas Day. I was his partner for 40 years, and at the moment his desk in our office is still as he left it before going on holiday. I will find it difficult to clear, as the neatly stacked files and calculations epitomise everything I have always valued in Paul.

Dr Fritz Wagener
Consulting Geotechnical and Civil Engineer
wagenerf@telkomsa.net
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<td>Business Finances for Built Environment Professionals</td>
<td>Wolf Weideman</td>
<td>Dawn Hermanus <a href="mailto:dawn@saice.org.za">dawn@saice.org.za</a></td>
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<td>13-14 October Cape Town</td>
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