



**ENGINEERING A BETTER FUTURE**  
Prof Elsabé Kearsley

Presidential Address 2009

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## About Elsabé Kearsley

Professor Elsabé Kearsley is a specialist in the field of concrete materials. The research in which she is involved, aims at reducing the environmental impact of the concrete and cement industry by using materials more effectively and efficiently. The research includes studying foamed concrete, very high strength concrete, fibre reinforcing and the inclusion of waste materials, such as coal ash from power stations, recycled concrete, glass, etc. The ultimate dream is to provide high strength, affordable lightweight concrete for ease of application in major structures, which would have an economic impact on construction in South Africa.

"A current focal point of my research into this technology is its application in the design and production of building materials for affordable housing. The thermal isolation properties of the product are also investigated in view of South Africa's energy problems. The use of foamed concrete in buildings could, for instance, obviate the use of air-conditioning equipment," she says.

She passionately believes that one has to be the change agent, otherwise nothing will ever change. She is also adamant that, "As an industry we have to take responsibility for ourselves, and part of that is to plough back. You cannot be too busy to volunteer your time for SAICE or ECSA or any other professional organisation; it is not an option."

Elsabé's philosophy is to grab every opportunity and run with it as hard as she can, which is what she intends doing on SAICE's behalf during her presidential year.

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## Prologue

It is an honour to be the 107th elected president of the South African Institution of Civil Engineering (SAICE), and indeed being part of this great profession. Reading through the addresses of past presidents, I became acutely aware of how much the environment that we live and operate in has changed over the decades. In my address, I intend to highlight some of these changes and give an indication of what I believe we need to do to ensure that SAICE retains the leading role that it has been fulfilling for more than a century. In recent years SAICE has reached a higher profile than ever before – an achievement that brought with it new challenges and responsibilities.

## Setting the scene

We live in a rapidly changing world, and working at a university, I am constantly reminded of the fact that the youth of today – the engineering professionals of the future – have a frame of reference that is completely different from that of previous generations.

I worked on a construction site in the 1980s with only a landline telephone on site and we often had to go to the post office to send telex messages to head office, as that was the only way to communicate complicated concepts. Today it is unthinkable that the Resident Engineer would not have constant access to a cellphone and a notebook computer with a 3G card, and few people even remember what a telex machine looked like!

The development of computers and the telecommunication industry are good indicators to highlight the extent of changes that have taken place in the world of civil engineering.

A brief look at major milestones along the 70 year long road of the development of computers:

- David Packard and Bill Hewlett founded the Hewlett-Packard company in a garage in 1939. Their first big order was from Walt Disney Pictures for eight model 200B computers to generate the sound effects of the 1940 movie "Fantasia".
- By 1944 IBM designed and built the Harvard Mark I which was a room-sized, relay-based calculator with a fifty foot long camshaft that synchronized the thousands of component parts.
- In 1960 the precursor to the minicomputer, DEC's PDP-1, sold for \$120 000. Fifty of these computers were built and they included a cathodic ray tube graphic display and required only one operator.
- In 1967 Hewlett-Packard entered the general purpose computer market with its HP-2115 for computation, offering computational power formerly only found in much larger computers. This computer supported a variety of languages such as BASIC and FORTRAN.
- By 1977 the first personal computers were released.
- In 1981 IBM introduced its PC using Microsoft's DOS operating system.
- IBM introduced a PS/2 machine in 1987, which made a 3 ½-inch floppy disk drive, video graphics and the use of a mouse with a PC, standard for the first time.
- With the evolution of the Internet, personal computers are becoming as common as the television and the telephone in the household.

The development of mobile telephones shows a similar timeline:

- In 1876 Alexander Graham Bell made the first telephone call.
- The first commercial telephone calls in the UK were made in 1912.



- 1985 saw the development of shoulder phones which operated with more than 20 kg worth of batteries.
- The first Global Standard for Mobile (GSM) all-digital network was launched in 1993.
- The first text message was sent in 1992 and the Short Message Service (SMS) was launched in 1994.
- In 1998 more mobile phones were sold worldwide than cars and PCs combined.
- On New Years day 2004 a record number of 111 million text messages were sent.
- Today we have picture phones, multimedia messages and 3G handsets.

These dates prove that today there are still many mature engineers in the workplace who studied and started their careers using log-tables and slide rules. These engineers now have to act as mentors for young people who grew up in a completely different society where PCs and mobile phones have become an undisputed part of our lives.

Information is available instantly and constantly. With internet access it is possible to find almost any information from anywhere in the world with the click of a button. The disadvantage of the modern age is "information overload" and it is becoming increasingly difficult to distinguish between good references, valid information and blatantly false marketing on the internet.

I believe that a large part of the changing environment around us, as civil engineering professionals, has to do with increased access to information and how to deal with it in a professional manner. The fact that you can download information from the internet does not mean that you are capable of designing civil engineering Infrastructure!

The dramatic changes and improvements, brought about by the development of modern telecommunications and computer technology, is a direct result of significant investment in research and development over an extended period of time. It is interesting to note that, for both computers and mobile phones, years of research were required between the initial development of the idea and the large scale market acceptance of the concept.

South African engineers are highly rated internationally and many problems have been solved through the creativity of locally trained experts. South Africa undertakes about 0,5% of global research. The National Research and Development Strategy, published in 2002, aims at strengthening our connectedness to global research networks and to ensure that we develop networks and centres of excellence in the SADC (Southern African Development Community) and across the continent. In addition, we need to ensure that we properly protect our intellectual property and indigenous knowledge. This will require new partnerships and new commitments from the science, engineering and technology community. To date the civil engineering community has been very slow at investing in research and the time is ripe for the industry as a whole to develop a collective approach to support research and development.

## Profile of civil engineering - the human touch

*"Engineering is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to a plan on paper. Then it moves to realisation in stone or metal or energy. Then it brings homes to men or women. Then it elevates the standard of living and adds to the comforts of life. This is the engineer's high privilege." — Herbert Clark Hoover, Engineer & President of the US from 1929-1932*

It is impossible for a modern civilization to exist without civil engineering, yet we as professionals in the field have problems in convincing the society we work in of the importance of employing engineering professionals to execute technical functions.

Every decision-maker should be aware of the fact that clean water and sanitation, which is a fundamental requirement for healthy communities, can only be delivered as a result of the efforts of civil engineering professionals. In fact, it has been stated by prominent Professor of Medicine, Prof Harry Seftel, that: *"During the first half of the 20th century the life span doubled in the Western world. The doubling had little to do with the efforts of the medical profession. The striking increase was mostly due to engineers whose technology produced a vast improvement in environmental and social hygiene."*

Likewise, structural engineering makes it possible to erect safe, durable and strong shelters, and transportation engineering is required to move people and products. Thabo Mbeki, in his State of the Nation address in February 2008, stated that improving the quality of life of all South Africans is the centre of the economic programmes of the government. These programmes include the massive investment in infrastructure that we are currently experiencing. We as civil engineering professionals have to ensure that investment in infrastructure remains a priority. Constant political changes and regular elections mean that the political decision-makers also change, and we should not underestimate the importance of constant communication with decision-makers.

If I think back to why I studied civil engineering, my main motivation was that I was good at mathematics and science and I did not want to work with people. This is still today to a large extent the thinking of pupils that are considering a career in civil engineering.

However, the daily work of a person working in the civil engineering field is most certainly for people and it should always be about people. Should we not be marketing civil engineering as being about people, saving lives and improving the quality of life of communities by providing suitable infrastructure? Mathematics and science are the tools required to do the work, but you will never hear any other professionals referring to their work by mentioning the tools they use. Can you imagine the doctor telling you that he or she became a doctor because they were interested in human sciences? All of us want our doctors to be interested in

improving quality of life or reducing human suffering. Is it not time for us to think about civil engineering in the same way?

The American Society of Civil Engineers' publication "Civil Engineering Body of Knowledge for the 21st Century - Preparing the civil engineer for the future" (2nd edition) identifies 24 professional outcomes needed for civil engineers. These outcomes encompass a lot more than just the technical skills formerly seen as sufficient for engineers and also address the issue of engineers working for "the people".

The outcomes, as listed below, are statements that describe what individuals are expected to know and be able to do by the time of entry into the practice of civil engineering at the professional level in the 21st century. Note the "people emphasis" in outcomes 16 - 24. As civil engineering professionals we should see it as our privilege to use the knowledge we acquired through tertiary education to serve society. We are the custodians of modern civilization and it is our responsibility to look after and maintain society.

#### **Foundational Outcomes:**

- Outcome 1: Mathematics
- Outcome 2: Natural Sciences
- Outcome 3: Humanities
- Outcome 4: Social Sciences

#### **Technical Outcomes:**

- Outcome 5: Materials Science
- Outcome 6: Mechanics
- Outcome 7: Experiments
- Outcome 8: Problem recognition and solving
- Outcome 9: Design
- Outcome 10: Sustainability
- Outcome 11: Contemporary issues and historical perspectives
- Outcome 12: Risk and uncertainty
- Outcome 13: Project management
- Outcome 14: Breadth in civil engineering areas
- Outcome 15: Technical specialisation

#### **Professional Outcomes:**

- Outcome 16: Communication
- Outcome 17: Public policy
- Outcome 18: Business and public administration
- Outcome 19: Globalisation
- Outcome 20: Leadership
- Outcome 21: Teamwork
- Outcome 22: Attitudes
- Outcome 23: Lifelong learning
- Outcome 24: Professional and ethical responsibility



## Guiding the engineering professionals of our future

It is with growing frustration that I see how the future options of today's youth are limited, not by their own lack of ability or effort, but by a complete lack of appropriate and informed career guidance. Parents trust school teachers to give advice that would be in the best interest of the pupils, yet schools are trying to improve their pass rates by advising learners to avoid taking so-called difficult subjects such as mathematics and science.

When I had to choose a career, my career guidance teacher told me that civil engineers fix watches, but luckily my parents were better informed and I had a good idea of what civil engineering entailed. Thirty years later the level of career guidance is no better and in many schools learners have nobody to even give them some form of advice. Fortunately many SAICE initiatives like the bridge building competition facilitate better understanding.

The first group of students produced through the outcomes-based education system is starting tertiary education this year and only time will tell whether the level of knowledge learners obtained through this system has sufficiently prepared them for university education.

To me it is a matter of great concern that the Department of Education announced in 2008 that the third Mathematics paper (covering geometry and trigonometry that one would need for an engineering education) was not compulsory for the final country-wide school exam at the end of 2008. As this paper also happened to be the last on the exam timetable, the majority of Grade 12 pupils decided not to write this paper. Many schools did not even cover this work and pupils were instructed to find private tutoring if they wanted to write the paper.

Urgent intervention is required and we as engineering professionals are the only people who can speak up to ensure that our school system does not make it impossible to train the engineering professionals this country needs for the future.

SAICE has around 8000 members and if all of us get involved with the schools in the communities that we come from, work or live in, we can make a difference. I am convinced that dedicated teachers would encourage learners to study Mathematics and Science if they were informed enough regarding the consequences of their actions.

SAICE members can get involved with participating in or even initiating career guidance events at schools, and we have several excellent tools at our disposal. For instance, if each of us takes the Civil Engineering Career DVD, "The road to your future", that was produced by SAFCEC (South African Federation of Civil Engineering Contractors) and SAICE, to our local schools we can already make a significant difference.

## A look at SAICE history

To know where you are going, you often need to look at where you come from. On 14 January 1903, the Cape Society of Civil Engineers was established. The name of the society was changed to the South African Society of Civil Engineers in 1910 and in 1948 to the South African Institution of Civil Engineers. When the Institution merged with the South African Institute of Civil Engineering Technicians and Technologists in 1994, the name changed to the South African Institution of Civil Engineering. The merger brought together the different members of the civil engineering professional team, clearly stating that engineers, technologists and technicians are not in competition with one another, but are all members of, and have specific roles to play, in a professional team.

In his presidential address, Dr Bingle Kruger (SAICE President of 1995) stated that as civil engineering professionals we must "*adopt the role of leaders in both technical and non-technical fields, determining top-level policy and actively managing the course of the future in full co-operation with all the relevant individuals and groups that constitute our society*". He stated that "*leadership is the art of influencing people to do the right thing*". I believe that the role of SAICE in 2009 is to influence not only individuals, but also government structures, to ensure that the best solutions to improve the quality of life for all South Africans are found.

In 2000 a strategic plan titled "Supporting Development in South Africa" was published by SAICE. At that stage SAICE's mission was to advance professional knowledge and improve the practice of civil engineering by:

- Being a learned society for all those associated with civil engineering;
- Enabling members, through consultation and accountability, to provide the community with environmentally and economically sustainable infrastructure;
- Catering for the interest and needs of our members by creating an effective communication channel in a strong, dynamic and stable organization;
- Providing our members with continued education in technical, managerial and communication skills;
- Advancing and upholding the professional ethics of the civil engineering profession;
- Enhancing the recognition of civil engineering as a highly respected profession and a desirable career;
- Encouraging our members to strive for excellence in civil engineering.

Five strategic goals were identified:

- **Technical leadership** - support the attainment of excellence in civil engineering by encouraging innovation in civil engineering and facilitating the development and transfer of information, best practice and standards relating to civil engineering.

- **Professional development** – enhance and maintain a culture of life-long learning and of high professional competence of SAICE members.
- **Growth and participation** – grow the membership base and active participation of members within SAICE.
- **Relevance and recognition** – enhance the value, contribution and visibility of SAICE to members, the profession and society.
- **Organizational excellence** – enhance the organizational excellence of SAICE, ensuring the optimal use of resources and member participation.

The mission and the goals are still valid in 2009 and SAICE should continue striving to achieve these goals to ensure that our organisation remains relevant.

## Engineering our future

Trueman Goba, in his presidential address of 2002, made a plea for increased volunteerism in SAICE. As a voluntary association, our future depends on the members contributing their time and expertise. In 2009 we will yet again have to challenge all members to start taking part in SAICE activities as volunteers. An additional challenge is that many of our members who are willing to volunteer simply cannot find enough time while coping with day to day pressures.

SAICE is successfully transforming in its membership profile, as can be seen in the graphs. There is a significant growth in young and student members. The numbers for female and black members still need to increase significantly, but the upward trend is visible already. The challenge faced by SAICE, however, is getting these members involved. We will have to determine whether the current branch and division structure is sufficient for communicating with young members. We firstly have to establish the aspirations, perceptions and needs of younger members by asking them what they need from their professional society, and then address these to positively experience the benefits of SAICE membership.

It is encouraging that students are now again becoming involved in SAICE activities and a number of Student Chapters have been re-established recently. SAICE needs a plan to ensure that these Chapters are sustainable in view of varied student member involvement annually.

Our rapidly changing environment necessitates engineering professionals to remain abreast of new developments. The Engineering Council of South Africa (ECSA) requires compulsory periodic renewal of registration every five years for which regular attendance of Continuing Professional Development (CPD) courses is a prerequisite. SAICE has been actively involved with offering of CPD courses, at a beneficial rate for SAICE members.

## Young members

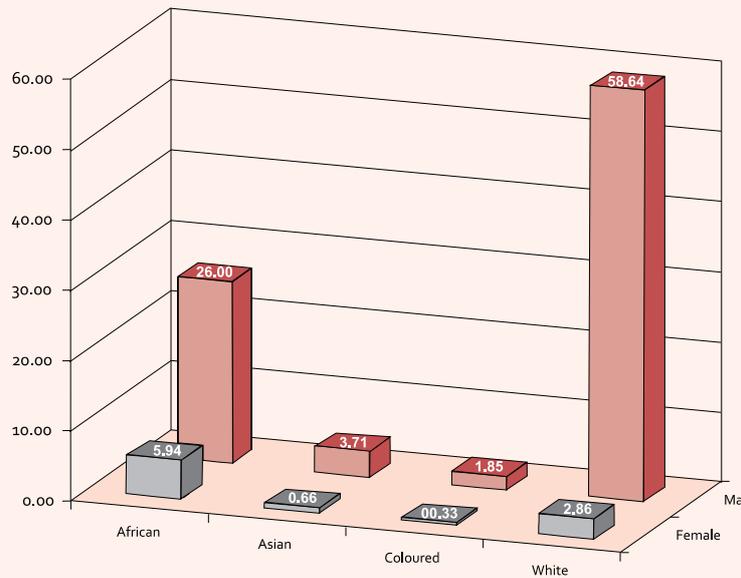
In her president's address of 2007, Sarah Buck of IStructE (Institution of Structural Engineers) stated that it is necessary to attract, support and enthuse people to ensure that they remain members of an institution. I believe that this is also true for keeping people in a profession.

Civil engineering is currently experiencing a boom as we have not seen before in South African history. We have been able to attract record numbers of young people into the profession. To keep the young people interested in civil engineering, we as experienced professionals must support them in their careers. The first step in supporting a young person in a career is proper mentorship. Many young graduates have been frustrated by the lack of training

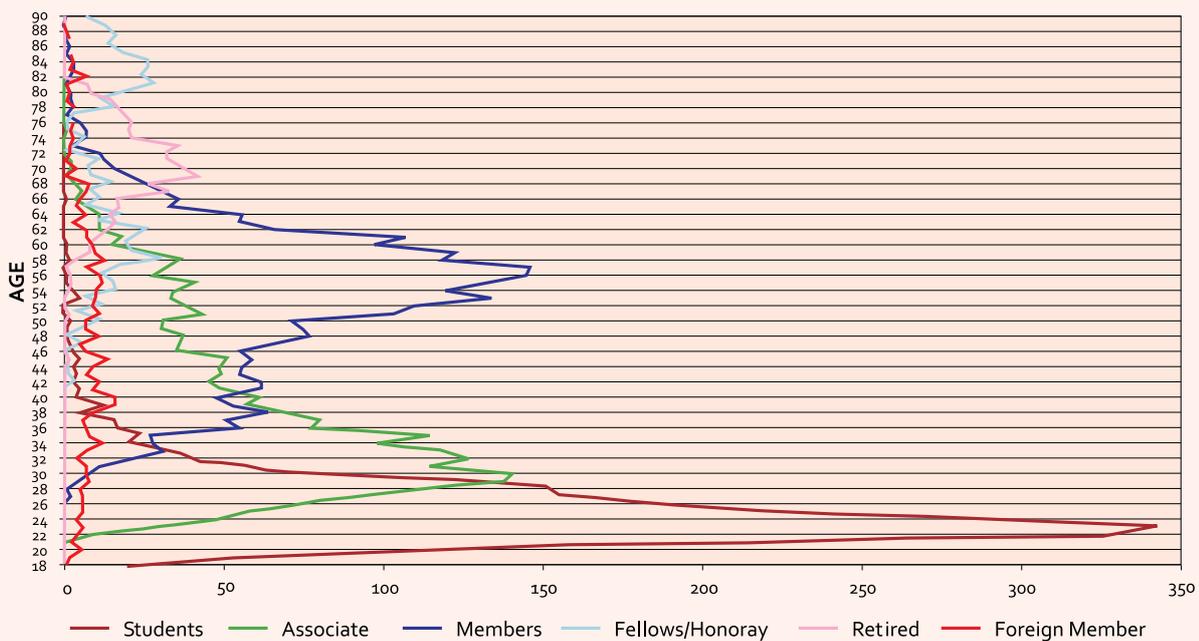


opportunities during their studies and immediately after graduating.

The majority of experienced civil engineering professionals are in their late fifties and older, and SAICE is currently harnessing their expertise to transfer skills to the younger generation while these older professionals are still actively involved in civil engineering, through the SAICE Section 21 company called Civils Masakheni. We must also keep the young graduates enthused. If they are enthusiastic, they will transfer their enthusiasm to others, thus ensuring that we maintain a steady stream of young bright professionals starting exciting careers in civil engineering.



SAICE membership by race and gender - Oct 2008



SAICE membership by age - Oct 2008



## The Millennium Development Goals



## The role of voluntary associations

During 2008 there were many heated discussions about the proposed legislation that would mandate the Council for the Built Environment to handle the professional registration of all built environment professionals. At this stage the Minister of Public Works has stated that further consultation will take place before the legislation is tabled again. During this process the SAICE membership involvement reached an all time high. It was very exciting to see how passionate civil engineering professionals are about our professional status, and about how it is achieved and maintained. It was clear that the members of SAICE were prepared to stand up for what we believe in, and many people were prepared to volunteer resources to ensure that the long-term interests of our profession are served.

We as the Institution need to evaluate the current situation and decide where we want to go. As a voluntary association, SAICE has always supported ECSA by nominating people to partake in its committee structure that has been evolving during the last 40 years. Many good processes and procedures have been developed over time and it would be catastrophic to just discontinue the current process of professional registration.

It is, however, essential to critically evaluate the current procedures to ensure that the shortfalls and problems in the system are addressed and that the system is improved to ensure that all professionals working in the built environment are appropriately trained and experienced to execute the work that they are employed to do, without putting public health and safety at risk. It is time that the engineering industry stands up and works together to ensure that we have an inclusive registration system without unnecessary barriers to entry. It is only by engaging all role players that we will be able to move forward.

It is our duty as civil engineering professionals to be passionate about what we do. Many of us were badly affected by the economic hardship the industry experienced in the recent past and the fight for survival has dampened the enthusiasm of some. The culture of chasing work for money developed as a result and many negative aspects of this practice is still with us. Generally, most of us did not choose civil engineering for the monetary rewards, but currently almost everybody working in the civil engineering field earns decent salaries and has sufficient work, yet as a profession we have not moved on to face the new challenges.

### What are these new challenges?

#### *Poverty alleviation*

While addressing the World Economic Forum (WEF) in Davos, Switzerland, well-known celebrity Bono challenged, "We'll be remembered for three things right now: the internet, the war against terror, and what we did or didn't do about the glorious continent of Africa and its travails. And I think we can be the generation that ends extreme poverty."

Regina Clewlow, of Engineers for a Sustainable World (ESW), agrees with Bono. "Our goal is to engage engineers to address global poverty and sustainable development issues," she says.

Poverty alleviation is more than an economic challenge, though, and without the serious attention of scientific and engineering minds, it is unlikely that any of the Millennium Development Goals (MDGs) will be met. Presently, more than one billion people in the world live on less than one dollar per day, and many of

these same people lack access to safe drinking water and proper sanitation. Embedded within the MDGs is the desire to reduce by half the number of people who lack access to safe drinking water by the year 2015.

The sheer magnitude of this problem is daunting, but Clewlow emphasized that engineers had to focus on solutions that were relevant to the environment they are working in. For example, advanced water purification technologies, like those found in the United States, are not always appropriate in remote parts of the world. This embodies an important lesson: engineering is often best when it relies heavily on local materials and labour, along with the adaptation of known technology to fit local circumstances.

Almost all of the MDGs require the skills of some type of engineering, for example, access to modern energy resources is considered an essential prerequisite for improving the life of communities and individuals. At present nearly two billion people in mostly rural areas lack access to modern energy services.

### *Carbon footprint*

Internationally engineers have been talking for years about reducing their carbon footprint, sustainability and the greening of engineering – what are we doing in South Africa?

### *Corruption*

Corruption in the global engineering and construction industry robs communities of the funds needed to build schools, roads, hospitals and water projects. The annual cost is estimated at approximately \$500 billion. Corruption often begins with poor decisions made by individuals and it is time that we acknowledge that in South Africa we need to educate our professionals, who work in the engineering and construction industry, to promote ethical decision-making. What are we doing to eliminate corruption in civil engineering?

### *Climate change*

Climate change could have a significant effect on civil engineering by for example affecting the availability of water and the intensity of storms. Are we pro-actively taking actions to deal with the consequences of climate change? Do we mitigate only, or are we designing right the first time?

### *Modern materials*

Modern materials for use in the construction industry are increasingly being promoted by international companies. How should we as engineering professionals in a developing country deal with these materials and trends? Where does sustainability fit in?

### *Research and development*

Should the civil engineering industry not be investing more in Research and Development to ensure that we find the best solutions for the problems the industry faces?

### *Globalisation*

Globalisation is affecting all of us and as civil engineering professionals on the southern tip of Africa we have to use the benefits this international network can bring. Our interaction and inputs in the World Federation of Engineering Organisations, and UNESCO (United Nations Educational, Scientific and Cultural Organisation), together with our part in the establishment of the Africa Engineers Forum, have proved to be very important. Many of our African colleagues are looking to and depending on us for leadership in world forums.

With the above challenges in mind, and to ensure that our Institution remains relevant, the SAICE executive, under the leadership of Ali Naidu, the elected president for 2010, is currently looking at a vision for 2020.

Looking at the age profile of our members, SAICE will have to find ways to actively engage our young members – **they are the future**. The pool of people currently volunteering their time is just not big enough for SAICE to make the impact it is capable of making. Recent interventions proved that it is possible to change our future by speaking up as a group and there is no better vehicle available than SAICE!

With approximately 8000 members, SAICE is financially viable and we are no longer in the fight for survival experienced by many smaller voluntary organizations, both locally and in the rest of Africa. Is it not time for us to set up a network where we can assist groups such as the civil engineering institutions in the rest of Africa in providing a professional service to their members?

### *Conclusion*

In conclusion I agree with Allyson Lawless, SAICE president of 2000, that we CAN make a difference and every one of us has to ensure that our profession obtains and retains the status it deserves. As civil engineering practitioners we need to promote our profession by ensuring that all decision-makers know exactly what the extent of the contribution of civil engineering is in any modern civilisation.

The interests of all civil engineering professionals in South Africa can best be served if we encourage every civil engineer, technologist and technician to become actively involved in SAICE to ensure that SAICE speaks on behalf of all civil engineering professionals in South Africa. We as civil engineering professionals have to engineer a better future, not only for ourselves, but for everybody living in our beautiful country now and in the future!

## Space-age feats of engineering



Malaysia: The Paradigm PJ is a futuristic beauty of steel and glass



Ambitious futuristic project: AZ Island – an artificial island capable of movement similar to a luxury ocean liner



Star Wars inspiration: Facility at Sea, a sustainable marine research platform and feat of offshore building engineering



In October 2009, BMW will inaugurate its new, original and futuristic centre 'BMW Welt' in Munich, entirely realized out of steel and glass



Abu Dhabi's Rose Tower: The tallest furnished hotel in the world

## A struggle for basic survival



*A struggle for water in Apac, Northern Uganda*



*Slum above an open drain in Indonesia*



*Atrocious road conditions in Gorongosa, Mozambique*



*Water has become a very scarce commodity in Buea, Cameroon. Even in July, in the heart of the rainy season, it is hard to find a tap flowing uninterruptedly in the average home for up to six hours at any given time*



*A common scene in Kibera, Nairobi - water vending*



*Ghana is the land of small business, and it is a very religious country. Put the two together and you will see some interesting business names – example: "Hands of God Engineering" (auto repair)*

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