Civil Engineering

Siviele Ingenieurswese

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SAISI SAICE

ON THE COVER

Chapman's Peak Drive

State-of-the-art engineering solutions were found to address the rockfall problems besetting this spectacular route in the Western Cape, including many firsts for engineering in South Africa, if not in the African continent

SAISI SAICE

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FORUM

SOUL-SEARCHING ...

I WOULD LIKE TO TAKE this opportunity to support Dawie Botha's point of view in his recent Opinion pieces and ask more questions about the profession we find ourselves in.

As a young engineer pre-registration I am quickly finding out how tough the world can be. I chose to be a civil engineer as I felt that it best suited my talents and gave me an opportunity to make the world a better place for all. But I find myself in an industry where the client is king, and time and cost far outweigh safety and economy. Where we as professionals have to bend our rules and codes to the will of the client to get the work, we are still liable for the results of their poor judgement and they claim back their losses from our Professional Indemnity.

I recently attended the KZN launch of the YPF (Young Professionals Forum) at which we as young engineers were asked to market civil engineering to other young people to increase the numbers of engineers to cope with the ever-expanding workload of our growing economy. This is all well and good, but why should they? All the engineers that I have met, both long practising and new, have one trait in common – they are civil engineers because they wanted to be civil engineers and nothing else. This common trait is both our greatest strength and our greatest weakness. It is our greatest strength, because it makes us passionate about our work, keeps us going long into the night to solve that problem and gives us our greatest reward in our work: finding the correct solution to the problem. But it is our greatest weakness in that it allows others to prey on our desire to solve problems at the cost of our financial security and personal time. This has to change if we are to attract more engineers to our profession. I'm sure that many brilliant people find themselves trapped in the financial world or in lawyers' offices who could be some of the best engineers of our time but who chose a work with a more suitable salary over one with greater job satisfaction. I always feel guilty when I think of wanting more money to do the job that I choose to do. Hell, I would pay to do some of the things I have had the opportunity to do, but with the social responsibility that we carry as professional engineers, why shouldn't we be better rewarded?

Any young person whose matriculation results allow him or her to study civil engineering at university could in reality study towards almost any profession of choice. If we want to make civil engineering more attractive to people such as these, we need to have a look at our competition. Other engineering fields are just as challenging but are more financially rewarding and involve less responsibility and liability for the work. Lawyers and accountants are highly regarded in society and well paid for their services. Our clients pay their lawyers' and accountants' bills on time and in full, yet seem to take forever to get around to paying for our services. Advertising and marketing agents charge well for their services, and clients are happy to fork out for their schemes and ideas, but when it comes to paying a few more fees for a resident engineer to oversee the works on site that we as the consultants are responsible for, they complain that we are being too materialistic and money grabbing. I could go on ...

We need to stand up for ourselves and our profession and charge the correct fees, take the correct time to do the work, and take more control of the work for wich we are ultimately responsible. Once we have done this we can expect more young people to want to become engineers.

James Melvill

ON MOUNTAIN PASSES

HAVING RECENTLY RETIRED to the south-western Cape I am getting to know Cape mountain passes better. Topping all the impressions I have gained is profound admiration and respect for the genius of Thomas Bain – truly the 'Colossus of Roads'.

Bain's Swartberg Pass was a high priority for closer inspection. The spectacular ascent from the Oudtshoorn side reveals his skill in combining sound engineering with sensitive treatment of the environment – practically a century before the concept of ecological preservation entered our profession as a priority. The minimal disturbance of the natural rock strata was of course also influenced by the difficulty of rock excavation in his day. His astute understanding of rock and slope stability is apparent. Opened to traffic in 1887, today his road functions perfectly with its drystone retaining walls, reasonable gradients and adequate stormwater drainage – nearly 120 years later!

The 32 km long access road extending westwards from the top of the Swartberg Pass to the head of the Gamkaskloof Valley (die Hel) is a sad modern contrast. Why do we build 'roads' like this? Does it start with a meagre budget and a political instruction to the roads department to 'get those tourists to the Hel as fast as possible and no arguments'? In carrying out this instruction to the letter the D9 (or equivalent) bulldozer is sent in and proceeds to devastate the environment by mercilessly gouging out the upper side and pushing the material over the lower side, thus creating a shelf devoid of compaction, and making no provision for stability and stormwater drainage. 'Ah well, it doesn't rain that often there … does it?'

And then there is the Huisrivier Pass, which was built in the 1970s. Situated between Ladismith and Calitzdorp, it is a very pleasant drive with generous carriageway widths and gentle gradients. Cuts were made into the quartzitic sandstone to create the roadway – only one difficulty: the rock formation is layered and fractured, slopes at about 60 degrees up from the road and has a strike parallel to the road centreline. This rock is cut back to a slope of about 80 to 90 degrees. Stability? No problem! Build reinforced concrete catchwalls along the base of the cut. Thirty years later and some of these walls have filled up with slipped slabs of rock. In one or two places a large rock even peeps menacingly over the top! Where will the next one-tonner come to rest?

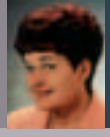
Was this the right design approach? Would Thomas Bain have looked for trouble with this dicey uncompromising rock formation? What alternatives were there? Perhaps cut and cover or the Bain wall-and-fill platform? More costly, no doubt, but what do we say when the next big one lands on a car?

What's to be done? My suggestion is, first, don't try to empty the storage areas behind the walls – too hazardous. What about using the existing wall as one side support for a roof slab over the road? We will have to do something really soon. Chapman's Peak has made the public aware that falling rocks can kill. It is hoped that the relevant department has a plan in place. We don't need a serious accident at Huisrivier to damage our professional image.

While I have singled out a couple of perceived problems, I firmly remain – as a water and sewerage man myself – proud of the achievements of my roads colleagues when I travel over the many kilometres of well-designed and well-built roads and passes.

George J Malan gmalan@telkomsa.net
Fellow (retired)

AWARDS SECTION **Compiled by**
Sarie Moolman Editor *Civil Engineering*
From submissions by SAICE branches



Rehabilitation of Chapman's Peak Drive
a triumph for South African engineering

The re-opening of Chapman's Peak Drive has been heralded as a great success, enabling tourists and locals to once again experience the exquisite beauty and engineering magnificence of the drive. The coupling of 21st-century cutting-edge design and construction processes with the courage and determination of the engineers of the early 1920s who built the original drive has resulted in this project showcasing the outstanding talents of South African engineering. Prestigious international events such as the Argus Cycle Tour and the Two Oceans Marathon have rightfully returned to their original routes with very positive feedback from cyclists, runners and supporters alike

CHAPMAN'S PEAK DRIVE, which opened in 1922, is certainly the most spectacular section of the scenic drive around the Cape Peninsula. Not only does it have historical and touristic significance, but it remains a significant commuter route. Some 4 km of the 11 km pass is cut into the near-vertical cliffs that form the coastline between Hout Bay and Noordhoek.

Despite its spectacular views and extraordinary beauty, the drive is not without danger, as rockfalls and mudslides have always been a hazard for motorists – particularly during storms in winter. Four deaths and several serious injuries resulted from rockfall incidents between 1998 and its closure as a public road in January 2000 after the last fatal occurrence.

In order to re-open the road to the public, the hazard from rocks and debris landing on the road had to be substantially reduced and the associated risk and liability of injury or death to road users minimised. At the same time, the touristic, historical, aesthetic, environmental and traffic implications of road widening and other substantial construction works had to be considered. All of these had to be carried out in a very short time and within a limited budget.

This was the task that faced Entilini Concessions in 2002 when it was awarded a 30-year concession for the rehabilitation and operation of Chapman's Peak Drive as a toll road.

ROCK FALL PROTECTION MEASURES

The scale of the design and construction of the Works was formidable, with many of the activities required being 'first-offs' in South Africa. The design of rockfall protection measures involved sophisticated three-dimensional computer modelling of the topography and a geological assessment of the mountain and location of boulders on the slopes and cliffs above the road to predict the associated rockfall patterns. This modelling predicted, on a statistical basis, the location, trajectory, frequency, bounce height and energy of falling rocks along the route. These predictions formed the basis for determining the optimum size and shape positions of the rockfall protection structures and for their design.

CATCH FENCES

The primary rockfall protection measure that was chosen was the installation above the road of approximately 1 600 m of flexible high-energy-absorbing catch fences manufactured by Geobrugg of Switzerland. These fences have capacities ranging from 500 to 3 500 kJ and vary in height from 4 m to 6 m. They are positioned at various locations and elevations above the road to suit the local topography and rockfall trajectories. The installation of these catch fences was a first for South Africa and is one of the largest of such installations in the world.

CHAPMAN'S PEAK UPDATE

AWARDS

- Winner of the SAACE National Award for Engineering Excellence (2004)
- Winner of the SAFCEC National President's Award (2004)
- Winner of the Bentley Systems prestigious international award (Civil Design) for the 3D and 2D rockfall hazard analysis and design using the Microstation suite of geospatial software packages (2004)
- Runner-up in SAICE's National Award for Excellence in Civil Engineering (2004)

After an intensive 14-month design and construction period, Chapman's Peak Drive was re-opened to traffic as a toll road on 20 December 2003.

Feedback from the business and tourist industry confirms that Chapman's Peak Drive has made a welcome return as an international 'tourist destination', complementing other tourist destinations in the Western Cape.

But it was not long before the rockfall protection measures were put to the test. Shortly after the road was re-opened, two large boulders (11 m^3 and 7 m^3) fell onto the cantilevered concrete counterfort structure. No damage to the structure was recorded and – more importantly – the boulders did not reach the trafficked road, which would have been the case had the structure not been in place.

Following two successive relatively mild winters, with no real heavy rainstorms, it seemed that the winter of 2004 would follow a similar pattern. This was not to be, and during the months of July and August 2004, three rainfall incidents occurred that were of short duration but extremely high intensity. A total of 395 mm of rain was recorded at the Hout Bay Plaza over this period, which may be compared with the mean annual precipitation for the area of 740 mm.

Built into the new traffic management system are road closure alarms that are activated at specified levels of wind velocity and rainfall intensity/duration. The intensity of the above rainfalls activated the alarms in the central control room and the road was closed to traffic.

Shortly afterwards, several debris slides and discrete rockfall incidents occurred that impacted the catch fences. While most of these incidents

CONCRETE IMPACT PROTECTION CANOPIES

At two locations where the sandstone cliffs extend to more than 400 m above the road, the capacity of even the largest catch fence was inadequate for the very high frequency of and energy predicted from rockfalls and debris flows. Concrete impact protection canopies were used instead, as they require less maintenance and are better able to accommodate the near-vertical rockfall trajectories, the local rock profile and the debris- and washout-associated natural stormwater flows. These structures arch over the road and protect it by either intercepting rockfall and debris or deflecting the material over the road and into the sea below.

Both structures have canopies consisting of grids of deep beam ribs covered with planted backfill that are designed to catch debris and cushion the structure against the high rockfall impact forces. However, the two structures are very different in concept and design, as they are located in areas with very different geology and road alignment conditions.

CANTILEVER CANOPY

The first structure is located on a tight bend at the confluence of three gullies. It is a 40 m long curved cantilever canopy, which arches over both lanes, leaving an unobstructed view of the sea below. It is tied back into the cliff face at either end by a number of 100 t rock anchors and is supported in the middle by 11 large pre-stressed counterfort ribs.

The structure spans a fault, and is founded in hard granite on the north side and fairly soft sandstone on the southern end, with rock of varying strength in between. The granite varied between partially decomposed soft rock and hard rock that was split into blocks by a series of near-vertical fracture planes, which resulted in stability concerns and the need for particularly long rock anchors.

THE PORTAL CANOPY

The second portal structure is located where the road is cut back from the edge of the cliff to be aligned with the start of a 180 m length of 'half tunnel'. This point coincides with the highest predicted rockfall energies. This structure is free of the cliff face behind where it is supported by tapered columns while a row of circular sloping columns give support to the front edge.

Access was a particular challenge, with 70 % of the construction concentrated in a 3 km section. Access for more than 450 people and equipment for seven different construction activities had to be co-ordinated each day under conditions similar to that of working in a tunnel.

Chapman's Peak: a magnificent construction site and a once-in-a-lifetime experience for everyone involved. □

were safely intercepted by the catch fences, activating some of the friction break-rings in the fence anchoring cables and partly filling behind the netting as per the design, four fences that were located in gullies were damaged by large debris flows (in excess of 200 m^3) and had to be replaced. These incidents resulted in the temporary closure of the road while it was cleared of debris and the four fences were replaced.

The catch fences performed exceptionally well under the circumstances and met the terms of the rockfall hazard parameters anticipated in the design. In this period literally thousands of rocks, including several large blocks of up to 0,5 m^3, were intercepted, which would otherwise have reached the road. Only one rock of significant proportions reached the road where there was no catch fence.

Client

Western Cape Provincial Administration (WCPA), in partnership with Entilini Concession (Pty) Ltd

Professional Team

Chapman's Peak Engineering Group (CPEG), comprising Vela VKE Consulting Engineers, Melis & Du Plessis Geotechnical Engineers, Stewart Scott International, Zietsman Lloyd Hemsted

Main Contractor

Chapman's Peak Construction Joint Venture (CPC JV), comprising Concor Holdings, Haw & Inglis, Jolinde Construction, JPK Construction

Madiba's bridge graces the Johannesburg skyline

Nelson Mandela Bridge – a 284 m long asymmetrical dual-pylon cable-stayed bridge – reaches out from the slopes of Braamfontein, across 42 railway lines, to link up with the cultural precinct of Newtown, contributing to the much-needed rejuvenation plan of the Johannesburg Development Agency. This functional and aesthetically pleasing landmark of international note is not only a fitting tribute to a great statesman, but last year also took the honours as the winner of SAICE's national award in the category of technical excellence (2003).

TECHNICAL CHALLENGES

The founding conditions were poor, as the bridge would cross the Johannesburg graben, which is a highly weathered zone of Ventersdorp lava. The depth of highly weathered material varies between some 50 m at the centre of the graben to 30 m at the south end and 20 m at the north end.

The geometry of the bridge concept was determined mainly by the road geometry, which links Bertha Street in the north with West Street in the south. Between these two fixed ends, the location of possible founding positions between the rail lines resulted in a bridge span configuration of a 176 m main span, 42 m south backspan, and 66 m north backspan. A cable-stayed bridge was found to be the most suitable bridge type, but the unequal backspan lengths resulted in pylons of unequal height, the north pylon being 48 m high above deck level and the south pylon 35 m.

The asymmetrical design of the bridge is unique and resulted in a landmark structure that is already widely associated with Johannesburg.

The main span of the bridge consists of a composite deck with two structural steel box girders, connected by transverse plate girders and a reinforced concrete deck slab. The composite design provides a relatively light deck structure. In the backspans, the box girders are replaced by reinforced concrete edge beams and the transverse plate girders are replaced by reinforced concrete beams, thus providing the counterweight to balance the long main span.

The pylons consist of two circular concrete-filled columns with tubular cross bracing. The pylons are fixed into the box girders on both sides of the deck and are supported on the substructure by large pot bearings. The pylon substructure consists of large and robust cone-shaped piers designed to resist derailment collisions.

Stay cables comprise bundles of high-tensile steel strands, each galvanised and sheathed in high-density polyethylene. Each cable is contained in a polyethylene sleeve for additional protection and aesthetics.

Innovative design and an uncompromising attitude to safety, coupled with grassroots commitment from all involved, ensured that the many difficult and varied challenges posed by the project were successfully met and overcome.

Client
Blue IQ Project and Johannesburg Development Agency

Project Funders
Blue IQ Project, Johannesburg Metro through the JDA, South African Roads Agency, Department of Transport

Implementing Agent
South African National Roads Agency

Consulting Engineer to the Client
Goba Moahloli Keeve Steyn

Main Contractor
LBA Consortium:
A consortium between Grinaker-LTA – BCW JV (comprising Grinaker-LTA Limited and Bafokeng Civil Works (Pty) Ltd) and the Nelson Mandela Bridge Consultants Consortium (comprising BKS (Pty) Ltd and ARQ (Pty) Ltd with subconsultants COWI, Dissing+Weitling and P D Naidoo and Associates)

Images

Nelson Mandela Bridge

Commendation for unconventional pedestrian bridge

The Moretele Gardens Pedestrian Bridge over the N1 at Hammanskraal is a unique structure resulting from the fusion of engineering innovation, accommodation of environmental constraints, and community requirements. Since its completion, the bridge has become a landmark because of its pleasing yet unusual shape. No similar structural system had previously been used in a bridge. Comments have been received that a more suitable location should have been selected for such a unique bridge, but it is appropriate that this bold statement of design and fabrication should serve the community of Hammanskraal, where technology and imagination can serve to initiate and enhance community-driven projects. The bridge received a commendation in the category of technical excellence (2003).

THE MORETELE GARDENS BRIDGE links the townships of Mandela Village, Morokolong and Kekana Gardens adjacent to the N1 between the Hammanskraal interchange and the Carousel Casino border, north of Pretoria.

The bridge forms part of a larger project, the Hammanskraal Pedestrian Safety Project. This project was aimed at reducing the abnormally high rate of pedestrian deaths caused by people traversing the highway and included the construction of 3 m high brick walls along the sides of the highway (see p 13).

The increasing theft of aluminium handrailing called for a solution where the intrinsic value of the material would be less than the demand, and durability and function would meet the designer's long-term demands. The pre-manufactured concrete railing met this requirement. Aesthetically pleasing shadow lines cast by the railing are enhanced by the circular external tubular reinforcing with its mesh grid. The internal reinforcing with tubular pipe is unconventional and unique, allowing a thin walkway slab in concrete.

DESIGN ASPECTS

The design includes a curved, thin section slab with concrete handrailing supported on shaped piers. The long span of the walkway slab is supported from pier to pier by external corkscrew spiral reinforcing in the form of heavy-walled steel piping. The steel piping is covered with mesh.

The unusual geometric shape of the helix symbolises linear movement along the axis. Similar physical phenomena are found in electrical coil, where forces are generated along the centre of the helical shape by current flow in the helix. The right-handed rule in vector algebra illustrates this relationship between circular and linear geometry. On this structure, the linear movement is that of pedestrians through the bridge.

The load transfer is complex, and at first glance apparently inefficient when compared to a lattice truss. In fact, the premium paid for this unusual shape, which could only have been constructed in steel, is relatively small.

COMMUNITY INVOLVEMENT

The project development utilised all aspects of community participation and created numerous employment and training opportunities.

Client
Tshwane Metropolitan Municipality, Metsweding Metropolitan Municipality, South African National Roads Agency

Consulting Engineers and Project Managers
LTE Consulting (Pty) Ltd

Main Contractor
Stefanutti & Bressan

Structural Engineer
Dekker & Gelderblom / RTBA Design Services

Steelwork Fabricator
Boksan Projects

Images

Moretele Bridge

Amangwe/Loskop wins Community-based Award

Before the construction of the Amangwe/Loskop Bulk Water Supply Scheme, most of the 43 000 people in the Amangwe tribal area near Estcourt in the foothills of the Drakensberg had no assured supply of water and relied on springs, boreholes and streams for their water supply. The gravity-fed water system which was designed and constructed to supply water to the inhabitants won SAICE's national award for community-based projects. This is the second award that BCP Engineers have won in a two-month period. Their rotary interchange at the Liberty Midlands Mall has recently won the 2004 SAICE regional award for technical excellence.

THE SCHEME IS THE CULMINATION of a seven-year project which has greatly improved the quality of life in the area and is already providing opportunities for growth and development in the region.

In 1996 BCP Engineers were approached by community representatives and requested to assist in accessing funds to provide the area with a reliable water supply. At the time the community were reliant on isolated groundwater sources and protected springs for water, and certain areas of Loskop were served by an under-capacity river abstraction scheme.

Many areas lacked a reliable supply in close proximity to residents. The primary economic activity in the region is subsistence agriculture, and development of this activity and the promotion of sustainability in the region is not possible without a reliable supply of water. A project steering committee was established with representatives from all traditional sub-regions, as well as uThukela District Municipality, the Department of Water Affairs and Forestry (DWAF) and Sukuma Development Services.

A feasibility study recommended the implementation of two schemes, allowing for phased implementation as funds became available. However, on confirmation of the exact dam site elevation during preliminary design investigations, it became apparent that the schemes could be combined and the entire project area could effectively be supplied by a single source.

Some tricky problems had to be faced during the construction process. For example, the remoteness of the project area and the extent of the network invariably resulted in supply delays, problem reporting delays, etc, and required greater supervision to ensure standards were adhered to.

'The success of the project was the result of the joint efforts of numerous individuals and organisations who have worked together to make the scheme possible. Community representatives unselfishly gave of their time and set aside political differences for the good of their people. Government departments co-operated in all aspects to assist delivery. Contractors worked together and with the community structures to ensure largely harmonious relations during construction; and the people themselves gave their full support as both employees and public representatives. 'A success story all around,' in the words of André Strauss of BCP Engineers.

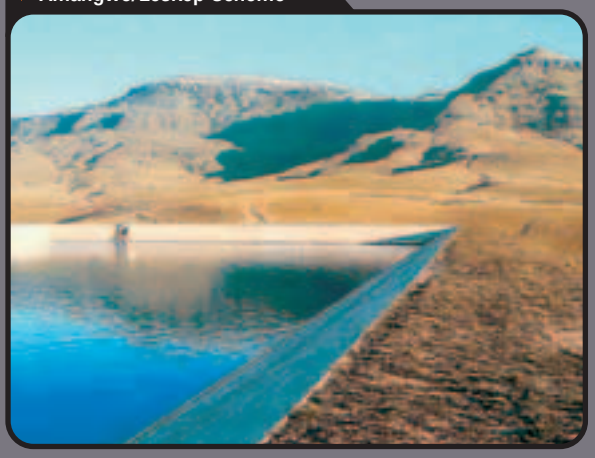
Client
uThukela District Municipality

Professional Team
BCP Engineers, Sukuma Development Services

Main Contractors
Aquamanzi/WBHO, E-Quality Construction

Images

Amangwe/Loskop Scheme



Mohale Dam
among highest CFRDs in the world

Mohale Dam in Lesotho – a component of Phase 1B of the Lesotho Highlands Water Project – has been designed to store the waters of the Senqunyane River, which are then fed through the reservoir of Katse Dam via the transfer tunnel to increase the yield of Phase 1A of the Project. At 145 m high, Mohale Dam is the highest concrete-faced rockfill dam (CFRD) in Africa and among the highest CFRDs in the world. The dam was built of 7,7 million m³ of basalt rock. At full supply level, the reservoir storage is 947 million m³. The project won SAICE's international award.

ENGINEERING EXCELLENCE

State-of-the-art techniques developed worldwide for CFRDs were used in the construction of Mohale Dam.

- A new and innovative kerb system was developed. Once this kerb achieved initial set and minimum strength, filter-transition layers were placed behind it. These were compacted with a smooth drum vibrating roller. The kerb concrete provided a much stronger surface to erect the face slab forms and reinforcement mats.
- The face slab was slip formed in two parts with the lower section being slipped once the height of the rockfill had reached about 100 m. As this part of the slab was being placed, rockfill placement above this level continued on the downstream side of the dam wall. Once the rockfill had reached full height, the upper portion of the concrete slab was slid from the top of the previous slabs up to the base level of the parapet wall.
- The concept applied to the river diversion works was fairly unique. As the upstream main dam embankment had to be raised to EL 1 997 m (1:500 flood) by the end of the first dry season, the purpose of the upstream cofferdam was redefined to protect the works during the first dry season only, for construction of plinth up to EL 1 967 m (1:5 year flood) and later for upstream clay protection.
- A bypass canal around the cofferdam was introduced to avoid damage, as the risk of overtopping the upstream cofferdam was then increased.

LOCAL BENEFITS

Local benefits include:

- provision of new access roads to formerly remote areas
- training of local people in construction and construction-related enterprises
- improved education and health facilities
- injection of outside income into the formerly remote rural economy
- a programme of training of professionals, which was implemented in Lesotho

Client
Lesotho Highlands Development Authority

Consulting Engineers
Stewart Scott (Pty) Ltd, BKS (Pty) Ltd, Melis & Du Plessis (Pty) Ltd, Snowy Mountains Engineering Corporation (Australia), Harza Engineering Co (now MWH) (USA), Nippon Koei Co (Japan), SM Consulting (Lesotho)

Main Contractors
Mohale Dam Contractors

Images

Mohale Dam

Nandi Drive Interchange

Construction of the Nandi Drive interchange on the N2 outside Durban between the Umgeni and KwaMashu interchanges forms the first phase of a much larger project that will link North Coast Road in Briardene with Malandela Road in KwaMashu.

The interchange is a semi-diamond, clover-type interchange. Particular constraints included achieving acceptable sight distances and merge lengths with the southbound on-ramp having three different merge points. As there was no precedent in South Africa for handling these types of traffic conflict, the USA's Highway Capacity Manual was used and the ramp was designed from first principles. At the request of the eventual owner of the interchange, SANRAL, the CSIR was asked to independently review the design for suitability. A compact and efficient layout, with high design standards, was achieved. The project received the Durban Branch award in the category of technical excellence in 2004.

Client
eThekwini Municipality – Roads Department

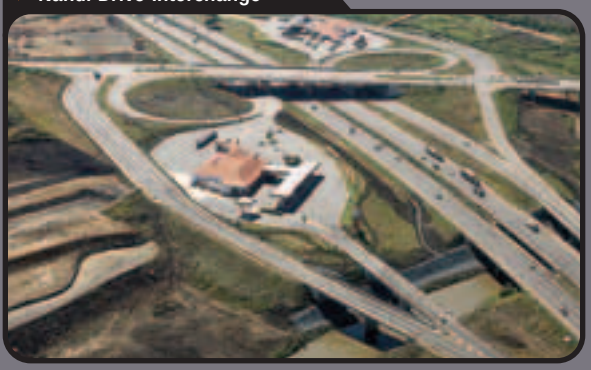
Consulting Engineers
Goba Moahloli Keeve Steyn / Letsunyane Associates JV

Main Contractors
Grinaker-LTA / Sivukile JV

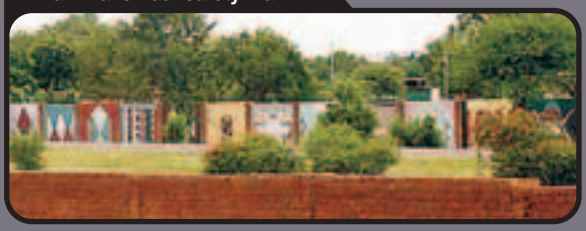
Subcontractors
Stefanutti & Bressan; Scribante Construction

Images

Nandi Drive Interchange



Hammanskraal safety wall



Villagers involved in solution

The villages of Mandela Village, Morokolong and Kekana Gardens lie adjacent to the N1 between the Hammanskraal Interchange and the Carousel Casino border. There were numerous fatal accidents on this stretch of road involving pedestrians attempting to cross the freeway. To solve the problem, it was decided to design a physical barrier in the form of a double brick wall on the road reserve boundaries, as well as an overpass bridge (see page 9).

Although the pedestrian bridge was constructed by conventional methods, it was a prerequisite of the contract that the remaining components of the project be constructed using employment-intensive methods. Only contractors from the villages were considered and 528 jobs were created. The wall panels, decorated with Ndebele art work, involved volunteers from the community who were given the opportunity to demonstrate their skills.

Client
SANRAL, Gauteng Provincial Government, Tshwane Metropolitan Municipality, Metsweding District Municipality

Engineer and Project Manager
BKS (Pty) Ltd

Design Team
BKD (Pty) Ltd and Glen Mills Architects

Training
PAM Training Providers

Community awareness and roads safety training
CSIR Transportek

Relocation

THE AREAS SURROUNDING the Luvuvhu River require additional water mainly for domestic use. Many years of investigation, planning and preparatory work culminated in the construction of Nandoni Dam. The site is rich in evidence of Early Iron Age settlements – hence the name Nandoni, which means 'place of the iron smelters'.

Construction of the dam inevitably had a significant impact on local communities. Of particular concern was the need to

Client

Department of Water Affairs and Forestry

Relocation Manager

BKS

Technical Team

BKS (municipal infrastructure), Elias Mahapa (town planner), Osglo Louis Trichardt (architect), B A Hassim (quantity surveyor), Anthropology Private Practice, Pretoria University, Faculty of Medicine (relocation of graves), J van Schalkwyk (archaeology), Eddie Mashau and A N J Bester (ethnology and sociology), Motopos Project Services (electrical engineering)

Social Development

Mothopo Technologies and Sego-Dolo Development JV, Vincent Nemadodzi (community liaison), WOMIWU (agricultural consultant)

Images

Nandoni

action plan at Nandoni Dam

The Nandoni Dam relocation action plan (RAP) focused on mitigating negative impacts on communities and the environment surrounding the Nandoni Dam in the Luvuvhu River southeast of Thohoyandou in Limpopo Province. The main objective of the RAP was to leave communities and individuals no worse off than they were before the dam was constructed. Implementation of the plan is a prime example of how engineering can better the lives of South African communities and how engineers can work in partnership with local authorities, government departments, the private sector and communities. The partnership at institutional and grassroots level ensured that all stakeholders participated meaningfully in decision-making and proved that communication is a two-way process.

relocate people whose houses are within the dam basin. Also, many graves scattered in and around the dam basin had to be relocated to cemeteries in the villages.

BKS compiled the RAP as part of the project preparation activities and the company was then appointed to implement the RAP before and during the dam construction phase.

The RAP comprised four main modules:

- construction of 465 new houses and community buildings
- relocation of 1 000 graves
- obtaining 3 193 ha of tribal land for the project
- documenting archaeological sites, mainly from the Early Iron Age

The implementation of the RAP at Nandoni Dam is a good example of the way in which the impact of engineering development on communities can be mitigated with sustainable positive outcomes for the people affected by the project.

Ingenious solution to access problem

The Tsomo River Bridge on road DR08389 (Nqamakwe district) is located in a remote area some 20 km from the confluence of the Tsomo and Kei rivers in the Nqamakwe district of the Mnquma (Butterworth) local municipality in the Eastern Cape. The project was to provide secure access to the villages at Endulini and involved the construction of a new bridge over the Tsomo River to replace an old bridge. This bridge provides the only access to Endulini. During heavy rains the river regularly overtopped the old bridge and washed away the approaches, isolating the villages during the flooding and while the damage was repaired. The project was entered by Amatole Branch.

REQUIREMENTS

The client's requirements were for an environmentally compliant, low-maintenance, safe bridge in a 1:15 flood with uninterrupted passage over the river during construction.

OPTIONS

Several options were considered:

- Retain the old bridge and reinforce approaches against erosion.
- Extend the old bridge, add extra spans and reinforce approaches.
- Build a new bridge adjacent to the existing bridge.
- Build a new bridge directly on top of the old bridge.
- Build a new bridge alongside the old bridge.

SOLUTION

It was decided to use the old bridge as the platform for scaffolding, create a 'tunnel' through the scaffolding for access, and incorporate parts of the old bridge in the new structure.

The main challenge facing the designers was to accommodate the new bridge support work and simultaneously provide continuous access for the public on the old bridge.

END RESULT

Construction challenges were overcome by designing the bridge to fit standard scaffolding and shuttering and making maximum use of the old bridge.

The final product is functionally efficient, economic, and aesthetically pleasing, and has improved the quality of life of the people of Endulini.

Client

Department of Roads and Public Works, Eastern Cape

Consulting Engineers

Lukhozi Consulting Engineers (Pty) Ltd

Main Contractors

Roberts Bros / Phambili Construction JV

Images

Tsomo River Bridge

Kogmanskloof a tribute to 'padmakers'

Kogmanskloof Pass is situated on an important tourist route – the R62 – linking Ashton with Montagu in the Western Cape. In March 2003, damage estimated at R60 million was caused after torrential rains in the Langeberg Mountain region when a devastating flood washed away seven approaches at five bridges between Ashton and Montagu, as well as a 200 m section of the road in Kogmanskloof Pass. An extended period of disruption, isolation and inconvenience was feared, but a team of experienced 'padmakers' combined their expertise and resources, and within two weeks the road was reopened to traffic – a feat termed 'a miracle' by the local press. The project was entered in the technical excellence category.

THE PROJECT SERVES AS AN EXCELLENT EXAMPLE of the ability and willingness of our industry to combine forces on all levels when faced with the daunting task of overcoming obstacles and bringing relief to a community in distress. The provincial government's Road Infrastructure Branch, district municipal authorities, private contractors, consulting engineers, plant and material suppliers, and property owners worked together to complete the task in record time.

The procurement period for contracts was reduced from the usual three months to 36 hours. The selected contractors were willing to react and provide their best resources at short notice, while plant supply companies made plant – especially trucks – available at short notice.

The project was completed at a cost of R3 million and in an extraordinary short period – proof that a team of 'padmakers' with a common goal and mutual trust can make the impossible possible!

Client
Western Cape Provincial Administration: Roads Infrastructure Branch

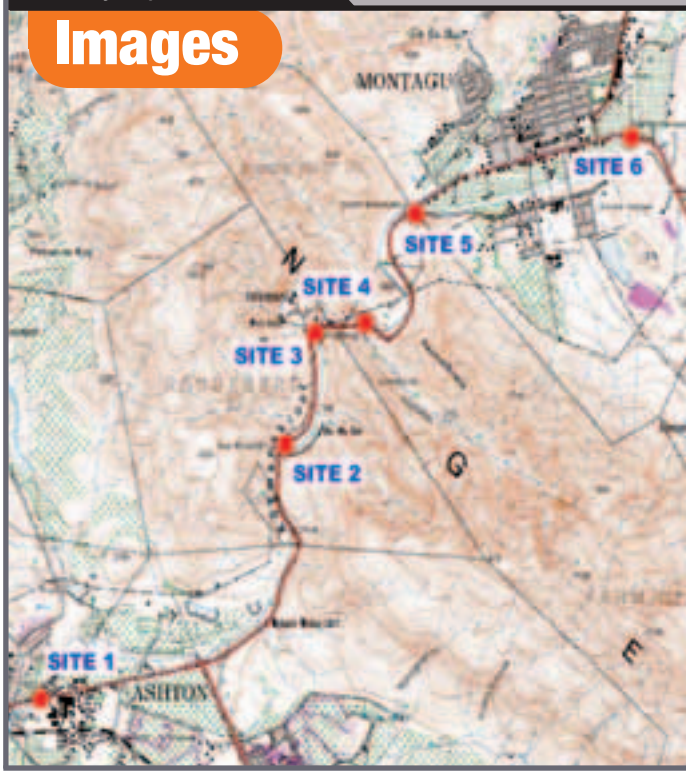
Professional Team
BKS Engineering and Management

Main Contractors
Boland District Municipality, District Roads Engineer, Haw & Inglis (Pty) Ltd, Alpha Civil (Pty) Ltd, Vusela Construction (Pty) Ltd

Major Subcontractor
Prima Klipbrekers (Pty) Ltd

Locality Map

Images



A dam good plan

The Mooi-Mgeni River Transfer Scheme (Phase 1 – MMTS-1) in the Midlands of KwaZulu-Natal is an outstanding example of the ability of the civil engineering profession to meet major challenges in innovative ways, in this case the increasing demand of the Durban and Pietermaritzburg metropolitan areas. The project's main civil engineering components are the new Mearns Weir providing water to the Mearns pumping station, water conveyance along the receiving streams, and raising Midmar Dam. Innovative techniques used in designing and constructing the civil components, as well as the effectiveness of public participation programmes, warranted the nomination of the scheme for the SAICE award in the category of technical excellence.

PLANNING STUDIES PERFORMED IN the previous decade indicated that the assurance of supply to the Durban-Pietermaritzburg areas reached alarmingly low levels, requiring immediate attention to prevent water shortages. A solution had to be found in order to prevent large economic losses to the region.

The objective of the solution eventually decided on – MMTS-1 – was to increase the yield and assurance of supply of the Midmar Dam by diverting additional water from the Mooi River to the Mgeni River catchment.

DESIGN AND FEATURES

Mearns Weir, a 12 m high concrete gravity structure with a full supply capacity of 5,1 million m³, spans 311 m across the width of the Mooi River. The outlet works enables the diversion of 4,3 m³/s of water to the Mearns pumping station.

From the discharge point, water flows along the 26 km meandering stretch of the receiving streams into Midmar Dam. Midmar Dam was originally constructed in the mid-1960s. Provision for raising was included in the original design, but this option became a serious consideration only in the late 1990s as part of the MMTS-1. By this time, much had changed in respect of dam design and safety issues, as well as flood hydrology. With some innovation, however, a solution with a cost saving of around 50 % over the original raising design was identified and implemented.

For a raising height of 3,5 m, which increases full supply storage from 175 million m³ to 235 million m³, a fixed reinforced concrete labyrinth spillway crest was demonstrated to represent the optimal solution capable of safely accommodating the range of floods applicable at the site. This option represented by far the lowest cost solution, and obviated the need for an auxiliary spillway with fusegate/plug systems that could result in loss of storage and/or significant damage downstream after a major flood. The labyrinth spillway also minimised the impact of raising on discharge flows during floods.

Exceptional ingenuity and skill were manifested by engineers in achieving this major project within budget and on time – a tribute to all who were involved in planning and implementing A Dam Good Plan!

Client
Department of Water Affairs and Forestry

Professional Team
DWAF Civil Design

Main Contractor
DWAF Construction

Subcontractor
J&T Demolition (Pty) Ltd

Images

Phase 1

Midmar Dam

Millennium flair

The innovative design of the new port control and VTS centre (the Millennium Tower) in Durban not only embodies the core of marine operations in the Port of Durban, but also makes the most of its prominent siting on the Bluff to visually communicate the prevailing environmental condition – wind and tide, so symbolic of maritime endeavour – to the public. The design of the tower embodies every aspect of engineering – structural, civil, mechanical, electrical and electronic – orchestrated in symphony to create a structure that interactively responds to the environment. The project was entered by Durban Branch in the technical excellence category.

THE NATIONAL PORTS AUTHORITY OF SOUTH AFRICA has embarked upon a programme to install vessel tracking systems (VTS) in its ports to improve navigation safety. In the Port of Durban this created a requirement for new facilities to accommodate the system operators – however, it was also seen as an opportunity to consolidate the port's entire vessel traffic management in one purpose-built building.

The port control function used to be located on the top floor of the Durmarine building on the T-Jetty, built in the 1950s. Since that time, urban developments around the port have gradually diminished the outlook from the control room, to the extent that visibility seaward was severely compromised.

The establishment of the port was probably most influenced by the 80 m high Bluff promontory on the southeastern side of the bay, which provided shelter from the prevailing winds to the early sailing vessels. It was to this promontory, with its ready elevation and magnificent views over the port, city and sea approaches, that the Port of Durban looked to provide its vessel traffic management control tower.

Because of its prominent siting on the Bluff skyline, it was felt that the building eventually erected should not be merely functional, but should make a statement to symbolise the role and importance of the port to the city and perhaps to become an icon for both port and city. Consequently a design comepetition was held for architects, assisted by engineers, to come up with a design for the building. Fairly rigid design criteria, including cost, were specified for what in effect was a tower structure.

Following an exhaustive evaluation by an expert panel comprising port and city officials, professional and academic bodies, a local firm of architects, Soundspacedesign, was appointed to design what was to become known as the 'Millennium Tower'.

The tower is conceived as a politically neutral abstraction of organic forms, affected by forces of nature in real time. Deriving inspiration from the land (a budding sugar-cane shoot), the sea (shells and fish) and nautical imagery (sails, masts, cranes and funnels) it synthesised these forms into a functional, forward-looking structural expression for the Port of Durban. The tower communicates fluctuations of sun, wind and tide while symbolising the growth and transformation of the city into the third millennium.

Client
National Ports Authority

Architects
Soundspacedesign

Engineers
STRUCTURAL ENGINEERS
Vawda Thornton

ELECTRICAL ENGINEERS
Ramble Malone

MECHANICAL ENGINEERS
PLP Consulting

ELECTRONIC ENGINEERS
Berriman & Associates

Quantity Surveyors
Scott & Schou

Main Contractors
Protekon Construction

Major Subcontractors and Suppliers
Afri Structures; Alpul Aluminium; Amakhaza Moia Air Conditioning; Kone Elevators; Edison Power; Alpha Stone and Readymix

Images

Millennium Tower

uShaka a world-class facility

Construction commenced in August 2002 on the R750 million uShaka Marine World in Durban. The development consists of an oceanarium, dolphinarium, water park, and retail area. Construction and commissioning were completed at the end of April 2004, within time and budget. This massive development is an outstanding example of a complex multi-disciplinary engineering design and fast-track construction project that culminated in a successful project.

THE USHAKA OCEANARIUM and dolphinarium with an exhibit volume of 17 500 m^3 replaced the old Sea World and is the seventh largest aquarium in the world. The vision for uShaka was to create a world-class facility that would be within the top ten in terms of water volume and would be non-conventional in terms of appearance.

uShaka Marine World with a total seawater volume of 21 800 m^3 consists of

- seven open ocean tanks
- a dolphinarium show pool
- dolphin interactive, holding, maternity and training pools
- seal and penguin pools
- 27 aquarium exhibits in the hold of a ship wreck
- a quarantine and fish hospital facility
- a rehabilitation facility for mammals

NEWS FLASH

uShaka Marine World has received a special award for creative design and theme from the Themed Entertainment Association in Los Angeles. The uShaka award fell under the category of marine parks.

The Thea awards are regarded as the Oscars of the theme park industry and receiving this award puts the venue in the premier league of international attractions.

Client
Project Director: Moreland

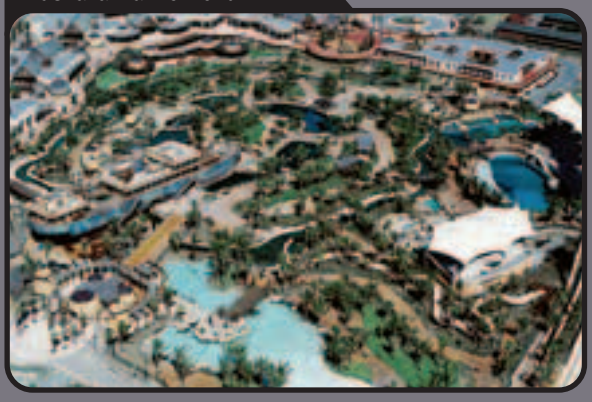
Professional Team
Campbell, Bernstein & Irving / Siyabonga JV, Arup

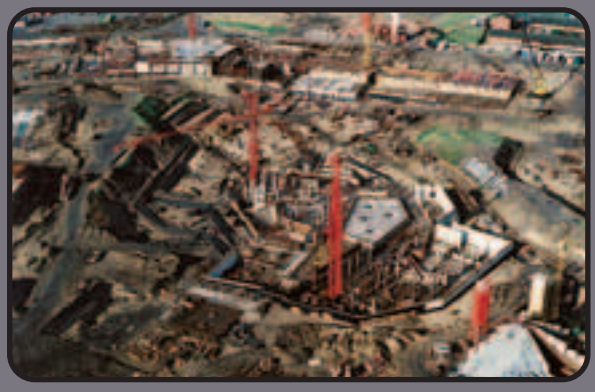
Main Contractors
MJV, Esor

Subcontractors
Subcontractors: Same Water

Images

uShaka Marine World





Compiled by Sarie Moolman
Editor *Civil Engineering* smoolman@netactive.co.za

EVIDENCE INDICATES BIGGEST EXTINCTION WASN'T CAUSED BY ASTEROID OR COMET

FOR THE LAST THREE YEARS evidence has been building that the impact of a comet or asteroid triggered the biggest mass extinction in Earth history, but new research from a team headed by a University of Washington (UW) scientist disputes that notion.

In a paper published recently by Science Express, the online version of the journal *Science*, the researchers say they have found no evidence for an impact at the time of 'the Great Dying' 250 million years ago. Instead, their research indicates the culprit might have been atmospheric warming because of greenhouse gases triggered by erupting volcanoes.

The extinction occurred at the boundary between the Permian and Triassic periods at a time when all land was concentrated in a supercontinent called Pangea. The Great Dying is considered the biggest catastrophe in the history of life on Earth, with 90 % of all marine life and nearly three-quarters of land-based plant and animal life going extinct.

'The marine extinction and the land extinction appear to be simultaneous, based on the geochemical evidence we found,' said UW paleontologist Peter Ward, lead author of the paper. 'Animals and plants both on land and in the sea were dying at the same time, and apparently from the same causes – too much heat and too little oxygen.'

Co-authors of the paper are Roger Buick and Geoffrey Garrison of the UW; Jennifer Botha and Roger Smith of the South African Museum; Joseph Kirschvink of the California Institute of Technology; Michael de Kock of Rand Afrikaans University (University of Johannesburg); and Douglas Erwin of the Smithsonian Institution.

The Karoo Basin of South Africa has provided the most intensively studied record of Permian-Triassic vertebrate fossils. In their work, the researchers were able to use chemical, biological and magnetic evidence to correlate sedimentary layers in the Karoo to similar layers in China that previous research has tied to the marine extinction at the end of the Permian period.

Evidence from the marine extinction is 'eerily similar' to what the researchers found in the Karoo Basin, Ward said. Over seven years, they collected 126 reptile or amphibian skulls from a nearly 1 000 foot thick section of exposed Karoo sediment deposits from the time of the extinction. They found two patterns, one showing gradual extinction over about 10 million years leading up to the boundary between the Permian and Triassic periods, and the other for a sharp increase in extinction rate at the boundary that then lasted another 5 million years.

The scientists said they found nothing in the Karoo that would indicate a body such as an asteroid hit around the time of the extinction, though they looked specifically for impact clays or material ejected from a crater left by such an impact.

They contend that if there was a comet or asteroid impact, it was a minor element of the Permian extinction. Evidence from the Karoo, they said, is consistent with a mass extinction resulting from catastrophic ecosystem changes over a long time scale, not sudden changes associated with an impact.

The work, funded by the National Aeronautics and Space Administration's Astrobiology Institute, the National Science Foundation and the National Research Foundation of South Africa, provides a glimpse of what can happen with long-term climate warming, Ward said.

In this case, there is ample evidence that the world got much warmer over a long period because of continuous volcanic eruptions in an area known as the Siberian Traps. As volcanism warmed the planet, large stores of methane gas frozen on the ocean floor might have been

released to trigger runaway greenhouse warming, Ward said. But evidence suggests that species began dying out gradually as the planet warmed until conditions reached a critical threshold beyond which most species could not survive.

'It appears that atmospheric oxygen levels were dropping at this point also,' he said. 'If that's true, then high and intermediate elevations would have become uninhabitable. More than half the world would have been unliveable, life could only exist at the lowest elevations.'

He noted that the normal atmospheric oxygen level is around 21 %, but evidence indicates that at the time of the Great Dying it dropped to about 16 % – the equivalent of trying to breathe at the top of a 14 000 foot mountain.

'I think temperatures rose to a critical point. It got hotter and hotter until it reached a critical point and everything died,' Ward said. 'It was a double-whammy of warmer temperatures and low oxygen, and most life couldn't deal with it.'

Newswise

AT LEAST ONE DEVASTATING ATTACK ON NET IN NEXT DECADE

A WIDE-RANGING SURVEY of technology leaders, scholars, industry officials, and analysts finds that most internet experts expect attacks on the network infrastructure in the coming decade as the Internet becomes more embedded in everyday and commercial life.

Some 66 % of the experts responding to a survey by the Pew Internet & American Life Project and Elon University agreed with the prediction that at least one devastating attack will occur in the next ten years on the networked information infrastructure or the US's power grid.

In addition, there was notable agreement among the 1 286 experts in the survey that in the next ten years the Internet will be more deeply integrated in our physical environments and high-speed connections will proliferate – with mixed results. They believe the dawning of the blog era will bring radical change to the news and publishing industry and they think the internet will have the least impact on religious institutions.

Some other predictions with which a majority of respondents agreed:

- 59 % agreed with a prediction that more government and business surveillance will occur as computing devices proliferate and become embedded in appliances, cars, phones, and even clothes.
- 57 % agreed that virtual classes will become more widespread in formal education and that students might at least occasionally be grouped with others who share their interests and skills, rather than by age.
- 56 % agreed that as telecommuting and home-schooling expand, the boundary between work and leisure will diminish and family dynamics will change because of that.
- 50% believe that anonymous, free, music file-sharing on peer-to-peer networks will still be easy to perform a decade from now.

At the same time, there were stark disagreements among experts about whether Internet use would foment a rise in religious and political extremist groups, whether Internet use would usher in more participation in civic organisations, and whether the widespread adoption of technology in the health system would ameliorate the most knotty problems in the system such as rising costs and medical errors.

'Nobody knows for sure what lies ahead – and the history of the Internet has taught us to expect the unexpected – but this group of experts provides the perspective of long experience. Half were online before the advent of the Web,' said Susannah Fox, associate director of the Pew Internet Project and lead author of the report. 'Institutions that resist change, like education and health care, come in for the sharpest criticism among these information revolutionaries.'

The experts were relatively unconvinced about two suggested impacts of the Internet related to democratic politics and processes:

- Just 32 % agreed that people would use the Internet to support their political biases and filter out information that disagrees with their views. Half the respondents disagreed with or disputed that prediction.
- Only 32 % agreed with a prediction that online voting would be secure and widespread by 2014. Half of the respondents disagreed or disputed that idea.

The survey was conducted online survey in September last year. It grew out of an effort by the Pew Internet Project and the Elon University School of Communications to look at predictions made about the impact of the Internet in the period between 1990 and 1995.

The Pew-Elon survey asked the experts to describe what dimensions of online life in the past decade have caught them by surprise. Similarly, they were asked about the changes they thought would occur in the last decade, but have not really materialised. Their answers:

PLEASANT SURPRISES: These experts are in awe of the development of the Web and the explosion of information sources on top of the basic internet backbone. They also said they were amazed at the improvements in online search technology, the spread of peer-to-peer networks, and the rise of blogs.

UNPLEASANT SURPRISES: They are startled that educational institutions have changed so little, despite widespread expectation a decade ago that schools would be quick to embrace change. They are unhappy that gaps exist in Internet access for many groups – those with low income, those with lower levels of educational attainment, and those in rural areas. And they still think there is a long way to go before political institutions will benefit from the Internet.

The full report can be read and/or downloaded in PDF format from www.pewinternet.org/report_display.asp?r=145

NATURAL DISASTERS THREAT TO BIG CITIES

NATURAL DISASTERS CAN be a threat to the growing expansion of big cities underground, the United Nations says. It says developers often burrow beneath the surface without knowing enough of the risks and with inadequate plans to lessen the effects of any disaster.

The warning came from experts at the United Nations University (UNU) before a conference on how to reduce disasters in the Japanese city of Kobe, from 18 to 22 January.

Forgotten dangers

The UNU experts say growing urban land pressure is making it increasingly attractive to find new subterranean space for subways, shopping malls, car parks and other needs.

But Dr Srikantha Herath of the UNU says studies of potential natural disaster risks are often neglected. 'The concentration of people and wealth in such underground spaces is expanding and merits careful examination. Such facilities in many areas have not been used sufficiently long to be exposed to various types of extreme hazard events of low frequencies. Modelling a variety of catastrophic events is essential for building contingencies into underground infrastructure designs, including evacuations and the emergency containment and transport of flood waters, for example.'

The university says water can travel long distances underground from a flood source. But often there are no sub-surface maps, because underground space is usually mapped in relation to a building overhead.

Answers to hand

Dr Janos Bogardi, director of UNU's new Institute for Environment and Human Security, in the German city of Bonn, said: 'Underground spaces should be designed to withstand multi-hazards. For example, fire risks require planners to also include the ability to seal off and compartmentalise underground space quickly.'

Dr Bogardi said many infrastructure solutions existed to reduce the magnitude of hazards. Breakwaters, for example, spared the Indian port of Chennai (formerly Madras) from the worst effects of the Asian tsunami.

BBC News

Vincent Bester
Managing director, Knowledge Base

Knowledge Base responds to tsunami call for civil engineering aid

THE TSUNAMI CRISIS on 26 December 2004 caused large-scale destruction never seen in the history of natural disasters. Many countries in the North Indian Oceans were affected, leaving hundreds of thousands of families without food, shelter and clothing. Towns and villages they called home were erased from the map.

After liaising with the tsunami Global Relief co-ordinators in Johannesburg, Knowledge Base Software have made a special offer that will lend assistance to the South African engineers who have volunteered their services and expertise in the infrastructural rehabilitation and redevelopment of affected countries.

'We have targeted over a million rands worth of support that we would like to contribute to Tsunami Relief. After years of developing Civil Designer and AllyCAD, both world-class packages used by thousands of long-standing clients around the globe, we are very pleased to be offering our software at no charge to assist with the reconstruction process,' says Vincent Bester, managing director of Knowledge Base Software.

'Our involvement to supply completely integrated civil engineering software will be backed by our support centre who will assist the tsunami relief project engineers to resolve software related queries and also assist in technical problem solving. In this way our qualified and highly skilled professionals will work alongside the tsunami engineering team to resolve critical issues, but will operate from our offices in South Africa,' notes Bester.

Vincent Bester has met with Dawie Botha, SAICE's executive director, on 13 January 2004 to formalise the arrangement.

Yolanda Desai, tel 021-701-1850
or yolanda@knowbase.co.za

Kaytech plays its part at uShaka Marine World

THE USHAKA ISLAND Marine Theme Park – which opened last year 2004 – has been one of Durban's biggest and most-innovative developments. Rated as a world-leader among marine theme parks, the project has hugely enhanced Durban's reputation as a soughtafter tourist destination and the park has, since its opening, attracted throngs of captivated and delighted visitors – both local and international – to the stunning facilities which it offers.

Caption: Canals under construction at uShaka Marine World

Moreland Developments (Pty) Ltd – Tongaat-Hulett's property development subsidiary – was commissioned by the Durban Metropolitan Council to direct the development of the uShaka Island Marine Theme Park.

Numerous subcontractors and joint ventures were awarded a number of contracts for the various phases of the project, ranging from the early infrastructural development – including subsoil drainage, plumbing and electrical installations – to the later work involving the building of the canals, aquaria, dolphinarium and seal arena.

Kaytech's geosynthetic products were installed in subsoil drainage behind and adjacent to retaining walls and divers structures as well as under canals.

The company's pre-fabricated, 100 mm wide Wickdrains were installed at 45° angles at 2,5 m c/c onto waterproofing protection masonite boards which were installed against the retaining walls and structures. This was done to be more effective in intercepting seepage water.

Along the base, the Wickdrains were overlapped around a 100 mm-diameter Geopipe wrapped in a bidim A2 sock to ensure the intercepted water is rapidly removed.

The maze of concrete-lined canals were cast onto a sand bedding layer which was underlain by a bidim A2 separation layer. Flo-Drain strips, 500 mm wide, were laid at 3 m c/c connecting to a conventional central 300 x 300 mm subsoil drain.

The landscaping contract was extensive and bidim A2 was used as a separator/filter blanket between a stone drainage layer and topsoil on concrete decks as well as beneath the meandering gravel pathways.

Although Kaytech is well known for its geosynthetic products for civil engineering and building applications, it also supplied a large quantity of 110 mm- and 150 mm-diameter Kableflex cable ducts for the electrical installations.

Garth James, tel 031-717-2300, ktechgmj@kaymac.co.za

New version of revolutionary pipe launched in South Africa

A REVOLUTIONARY VERSION of structured wall pipe (SWP), a technologically advanced lightweight and durable high-density polyethylene pipe, has been launched in the South African market.

The spirally wound pipe, which is substantially lighter than its concrete and vitreous clay counterparts, features a unique rectangular profile which is wound over the inner liner of the pipe. This rectangular profile is intimately bound to the inner liner and uses geometric efficiency to offer superior ring stiffness without the sacrifice of excess raw material.

According to Spiro SWP MD Johann van Zyl, high-density polyethylene (PE-HD) is an ideal pipe material because of its outstanding resistance to corrosive and aggressive chemical environments. This characteristic makes it ideally suited for sewer applications because of its inertia to hydrogen sulphide gas as well as scale and sediment build-up, which is often experienced in pipes manufactured from traditional materials.

'PE-HD is about three times more resistant to abrasion than steel which makes it a perfect option for the discharge of chemical effluents in mining applications. The carbon black that is used as a common stabilising material, also acts as a barrier to ultraviolet light. This means that PE-HD pipes can be used for above-ground applications as well, and it can be stored for extensive time periods in exposed conditions without any harm to the pipe's properties,' explains van Zyl.

Spiro SWP ranges in diameter from 450 mm to 3 000 mm. It is available in standard lengths of 6 m and multiples thereof and boasts an unusual yellow inner colour.

'Until now customers had to be content with a black inner surface as the only option with PE-HD pipes. Although it is possible for us to also manufacture a black inner surface, the standard yellow colour which reflects light, is incredibly practical with the laying and inspection of pipe lines during installation and later during inspections with CCTV cameras.'

PE-HD is a unique material and highly viscoelastic in behaviour. This characteristic favourably attributes to a much higher wall strain than rigid materials and the ability to withstand large deformation and deflection without failure.

Johann van Zyl tel 012-377-1670, cell 082-456-7507, johannvanzyl@lantic.net

Young professionals forum launched in Durban

THE KWAZULU-NATAL BRANCH of the South African Association of Consulting Engineers has launched the KZN Young Professionals Forum. The function was attended by Althea Povey (president of SAACE), Clint Koopman (SAACE's Young Engineer of the Year 2004), Neil Macleod (Head Water and Sanitation: Ethekweni Municipality), Clive Swaisland (SAACE KZN Branch Chairman), Ethekweni municipality engineers, KZN consulting engineers, representatives of the South African Roads Federation and young engineers (aged 18–35).

Speaking at the launch, Althea Povey challenged the young professionals to use their energy, creativity and passion to transform the industry and asked their employers to encourage and welcome their innovative thinking.

Clint Koopman gave his experiences of attending the Copenhagen 2004 FIDIC Conference. He highlighted that South African engineers must be proud of being South African. Internationally South African engineers are being held in high regard.

Neil Macleod highlighted the role of the young engineer within the industry. His message to the YPFs was to enhance the ease of technology usage with that of communication skills and to learn from their older colleagues.

Dominic Collett pointed out that 'with a projected shortage of professional engineers, 10 000 additional professional engineers will be required over the next ten years to meet future requirements'.

An appeal from Francis

In the 1950s SAICE published an annual list of members, which was distributed with the magazine. Francis Legge needs copies of these lists to complete his research for the SAICE Chronicles. Company libraries are most likely to have a collection of these lists.

Please contact Francis:
tel 011-489-2149, cell 082-886-2808,
e-mail legge@iafrica.com

OOPS!!! Our printers, Creda Communications, are red faced about the green faces in the January issue. A gremlin switched plates before printing commenced. Unfortunately the magazine was despatched before the error was discovered.

Mike Deeks
President of SAICE

Develop engineers to suit needs of country, says new SAICE president

MIKE DEEKS, SAICE's 102nd president, delivered his inaugural address at the Johannesburg Country Club in Auckland Park on 4 February. The prestigious SAICE coffeetable book *Foundation for the Future – Civil Engineering in South Africa* was launched on the same occasion.

In his address Mike referred to the unfortunate widely reported failing of various structures in recent times. These failings occurred at a time when South Africa had world-class health and safety and construction regulations in place. These were gazetted in 2003 and were supported and endorsed by all roleplayers in the industry.

He pointed out that, generally, poor records regarding fatalities and injuries existed and that up-to-date statistics on incidents were not available. These incidents and a 'blitz' by the Department of Manpower indicated a low level of compliance with the regulations. Only five per cent of sites assessed were fully compliant. Another contributing factor could be the absence of departmental enforcement and the fact that there is no evident prosecution of offenders. Where there has been demonstrable commitment to a policy of 'zero harm' by owners, contractors and other role-players, improved results were evident.

Concerning civil engineering as a career option, Deeks said that school leavers, including possible new entrants into the field, were presented with an attractive choice of other career fields. 'They are likely to perceive construction as dangerous, dirty and an uncaring employment sector,' he said. He commented that this impacted on civil engineering as a career choice at a time when South Africa has a real need for new top-calibre men and women to pursue civil engineering. 'The industry is faced with the prospects of a boom in construction of infrastructure and industrial projects at a time when its skilled resources are reduced to critical levels, and many of its civil engineering professionals are approaching retirement.'

As far as young engineers are concerned, Mike feels that the 'grandfather figures' of civil engineering should play a stronger role in guiding them to professional maturity. To intensify SAICE's efforts to develop engineers who would suit the needs of the country is one of the things Mike would strive for during his presidential year. Commenting on his interaction with young engineers, he said, 'What I find very gratifying is that many of these new engineers are approaching their profession with the right attitude. They have what it takes to deliver the kind of infrastructure that South Africa needs. My personal perception is that, these days, students who go into engineering are likely to do so because they want to improve the lot of their fellow men.'

Mike is a seasoned contracting man and served in various SAICE portfolios for several years. He feels that contractors do not always play the role they should in institutional and professional affairs. He has been with the Murray & Roberts Group for 24 years.

'I believe a mark of winning organisations these days is that their executives are seen to be playing a strong vocational and professional role in the industry that they operate in. It is for that reason that, at Murray & Roberts, we encourage our people to register professionally and to play a role in vocational societies and industry forums,' said Mike.

Mike has been the chairman of the Engineering Council of South Africa's (ECSA) Professional Advisory Committee since 2002, having served on the committee from 1995.

Mike concluded by saying that to bring about real improvement and thus improve the image of construction, what is needed is the adoption of a health and safety culture, as well as personal commitment by all members of the Institution.

The coffeetable book can be ordered from SAICE National Office at R250 (excluding VAT). Contact Angelene on 011-805-5947 or aaylward@saice.org.za

DIARISE THIS!

Event	Date	Venue	Contact
Coastal Engineering & Management Course	1–2 March 3–4 March 7–8 March 10–11 March 17–18 March 2005	Port Elizabeth George Durban Johannesburg Cape Town	Lungelwa Lamani Tel 011-805-5947, Fax 011-805-5971 llamani@saice.org.za
Technical Report Writing	1–2 March 4–5 July 11–12 August	Midrand Cape Town Midrand	Lungelwa Lamani Tel 011-805-5947, Fax 011-805-5971 llamani@saice.org.za
Traffic Calming and Road Safety	10–11 March 2005	Stellenbosch University Bellville Campus, Cape Town	Tel 011-403-5603 Fax 011-403-7736
Business Finances for Built Environment Professionals	23–24 March 2005 9–10 June	Midrand Midrand	Lungelwa Lamani Tel 011-805-5947, Fax 011-805-5971 llamani@saice.org.za
City of Cape Town Symposium **Catchment, Stormwater and River Management**	9 April 2005	University of the Western Cape	Randal Adriaans Tel 021-487-2453, Fax 021-487-2441 Csrm.symposium@capetown.gov.za
Handling Projects in a Consulting Engineer's Practice	14–15 April 2005 4–5 August 2005	Midrand Midrand	Lungelwa Lamani Tel 011-805-5947, Fax 011-805-5971 llamani@saice.org.za
South African Society for Intelligent Transportation Systems SASITS Conference 2005	10–13 May 2005	Cape Town International Convention Centre (CTICC) Cape Town	Carla de Jager Tel 011-805-5947, Fax 011-805-5971 cdejager@saice.org.za
EcoSan 2005 **Third International Conference on Ecological Sanitation**	23–27 May 2005	International Convention Centre (ICC), Durban	Carla de Jager Tel 011-805-5947, Fax 011-805-5971 cdejager@saice.org.za

At the awards evening, October 2004

International Award (2003), Mohale Dam: Erlyn Snell (Mohale Consultants Group, MCG – Stewart Scott), Francis Gibbons (MCG – Stewart Scott), Colin Gratwick (project manager MCG – Snowy Mountains Engineering Corporation), Louis Melis (MCG – Melis & Du Plessis), Danie Badenhorst (MCG – BKS), Hein Grimsehl (MCG – BKS), Ron Watermeyer

Technical Excellence Award (2003), Nelson Mandela Bridge: Llewellyn Pike (Goba Moahloli Keeve Steyn), Willem van der Merwe (SA National Roads Agency), Frans Kromhout (BKS – for Nelson Mandela Bridge Consultants Consortium), Paul Arnott-Job (Johannesburg Development Agency), Ron Watermeyer, Werner Jerling (Grinaker-LTA – for Grinaker-LTA – Bafokeng Civil Works JV)

Moretele Gardens Pedestrian Bridge: Commendation, Technical Excellence Category: Prof Nick Dekker (Dekker en Gelderblom), Councillor D Mthetwa, Hilton Vorster (Roads and Stormwater Division), Dr L Potgieter, Councillor A B Malope, Ron Watermeyer

Peter Beretta (AKI) receiving a certificate from Ron Watermeyer for the best presentation, uShaka Marine World, on behalf of Martin Bright (CBI/Siyabonga) and the rest of the professional team

Community-based (2002): Amangwe/Loskop Bulk Water Supply: Thabo Mabuya, BCP Engineers (on behalf of the team), Ron Watermeyer

Rehabilitation of Chapman's Peak: Commendation, Technical Excellence Category: Louis Melis (Chapman's Peak Engineering Group), Shirwell Kipps (Chapman's Peak Engineering Group), Marcus Minutelli (Chapman's Peak Construction JV), Wynand Dreyer (Entilini Concession), Prudent Katide (Chapman's Peak Engineering Group), Malcolm Watters (Western Cape Provincial Administration), Ron Watermeyer

Looking back on another job well done: David Bapela (Volkswagen conference centre technician), Zina Girald (SAICE communications officer), Helen van der Schyff (Autodesk (sponsor): business development manager for infrastructure platform and legalisation), Dawie Botha (SAICE executive director)

Text Will Alexander
alexwjr@iafrica.com

How can we help you?

Suggestions for those who may be involved in disaster aid programmes

CIVIL ENGINEERING IS one of the most satisfying professions. We plan, design, build and operate structures, which we can proudly show to our children and grandchildren and tell them that we had a hand in their construction. There is one higher level of satisfaction and that is where we deal directly with the people who benefit from our knowledge and expertise.

The call for assistance in the aftermath of the tsunami tragedy is a good example. It provides a unique opportunity to increase the quality of life for thousands of people who have suffered from this disaster. However, in order to do this we have to be fully aware of the many difficulties and complications that could arise. The purpose of these notes is to provide some guidance that will allow those who have undertaken this task to complete it efficiently, safely and with personal satisfaction.

HEALTH PRECAUTIONS

First and foremost you have to look after yourself. You will be of no use if you are a burden on those who accompany you. You have to be reasonably fit and be prepared for any health problems that may arise. It is not only for your own good, it is also a health requirement in some countries where you are required to produce certificates of inoculation against some of the more health-threatening diseases. In most of our cities there are specialist doctors in this field. They will give you pamphlets showing the various health requirements for different parts of the globe and will do the inoculating. There is a special yellow form that the doctor will fill in and you can then staple it to your passport. SAICE should also approach the SA Department of Health for advice.

In general, press reports tend to be unduly alarmist. The problem is not with decaying human bodies, but more related to poor hygiene. Only drink bottled liquids if at all possible. Never eat uncooked food or unpeeled fruit. Keep away from pet dogs. If you are bitten, consult your nearest medic as soon as possible.

You should also carry a small emergency first-aid kit with you. The first and most important item is a packet of Imodium Plus tablets for the inevitable nausea, diarrhoea and stomach cramps that you will pick up early in your trip. The next most important item is a small, non-aerosol spray of Merthiolate for all cuts and scratches. It stops bleeding and is an antiseptic. This is essential because even the smallest scratches can quickly become infected in tropical climates. Thirdly, you will need a small packet of mixed Elastoplast strips to cover these cuts and scratches.

You will also need a stick of insect repellent to apply to your legs where ticks are prevalent, and to all exposed parts of your body from dusk onwards. Note that aerosol sprays are prohibited in aircraft luggage. Also ask for advice on malaria precautions as there is growing resistance to this disease, and different treatments are recommended for different regions. Also inquire from your tropical diseases doctor whether you should take anti-histamine tablets with you for insect stings. I once brushed against a bush full of small gray caterpillars in the Caprivi and had to have some massive injections in my posterior when I returned home. I was told that it was an allergic reaction between the anti-malarial tablets and the caterpillar stings. Take a tube of sunblock cream as well.

If you are on medication take the original pillboxes with you together with the instructions, as the medics will want to know what medication you are on and what allergies you have in the unlikely event where you need medical attention yourself.

The next issue is clothing. You will have to travel lightly so take the minimum of clothing plus some role-on deodorant rather than a lot of clean clothing. You need a pair of waterproof hiking boots and soft headgear. Wide-brimmed hats take up too much space, and caps do not provide sufficient protection. Wear slacks at all times so do not take any shorts. Take one long-sleeved shirt for wearing after dusk.

This is my much-used checklist. It includes the clothes that you are wearing. One robust windcheater with at least one inside pocket. Ask your wife to sew a flap above the inside pocket that you can then button over the pocket to prevent your passport and other documents from falling out when you remove your jacket. Two pairs of slacks, three shirts, two sets of underclothes, pyjamas, three pairs of socks, four handkerchiefs, two belts, one pair of casual shoes, one pair of waterproof hiking boots, one soft hat, one jersey, light raincoat, shaving gear, small first-aid kit, medication, insect repellent, writing material, maps, corkscrew, small immersion heater with set of international plug adapters, one mug, sachets of coffee, powdered milk and sugar, a packet of Ouma's rusks, a bottle of water, plastic eating utensils, soap, detergent, pocket calculator, tape measure, pocket knife, small torch, candle, matches and a small roll of thick string. A yellow, folding carpenter's rule is handy when you want to illustrate sizes in your photos. Enquire whether cellphones can be used in the country that you will visit.

Do not forget your laptop, camera, lots of film, and spare batteries for all battery-operated equipment. A modern GPS with the ability to measure altitude is essential. The latest versions are full of additional information such as the best fishing times in coastal areas. Don't forget the cable required to download this information onto your laptop. Keep your laptop, camera, GPS and cellphone with you at all times, but remember that no sharp objects such as penknives, bottle openers and scissors may be taken in your hand luggage.

INSURANCE

Check your travel and health insurance policies. Some policies do not cover non-commercial flights on single-engined planes or helicopters, for example. They may not provide cover arising from civil unrest, etc.

INTERNATIONAL DRIVER'S LICENCE

Contact your local AA office for advice regarding the requirements of the countries that you will visit. The main AA centres can provide international driver's licences. Take your ID, local driver's licence and two passport photos.

If you do not have any off-road driving experience this will not be the occasion to test your skills. 4X4s are very heavy, and when they get stuck in mud or sand all four wheels rapidly dig themselves in. It can take hours to get the vehicle back on the road. This is one of the reasons why you should always travel in two vehicles plus a long towrope in unknown territory.

PASSPORTS AND VISAS

If you do not have a passport you can apply for a temporary passport. A letter from SAICE on official letterhead explaining the position may help. Visas are best obtained

via your travel agency. Again, a covering letter from SAICE, Foreign Affairs or, better still, from the country that you are visiting will help.

MONEY

US dollar notes are universally accepted. Take a good supply of notes in low denominations ($1, $5 and $10). Additional amounts may be needed in local currencies. The easiest is to take traveller's cheques in US dollars and cash them for local currency at the airport when you land, or at the hotel, or if all else fails at the local bank. I doubt whether there are any operational ATMs in the devastated areas.

Always take more money than you expect to use. I suggest at least $100 ($500 if you can afford it) in $20 denominations in a separate envelope in a different pocket out of sight. Some hotels and others are reluctant to accept $100 notes because of the risk of forgeries.

DOCUMENTATION

SAICE shoulc arrange for get-togethers well before the groups leave for their destinations. Representatives of the departments of Foreign Affairs and Water Affairs should be present at the discussions. The Department of Foreign Affairs (DFA) should be requested to provide individual To Whom It May Concern documents to each one of those who will be going overseas. The certificates should include the person's ID and passport number as well as a list of contact persons at the South African embassies and consulates that both the holder of the document as well as any who require more information may be contacted. This is essential.

Once you have received this documentation, make two sets of photocopies of the full information in your passport, plus the yellow inoculation certificate, the Department of Foreign Affairs certificate and your international driver's licence. Keep the originals on you at all times, take one set with you in your hand baggage, and leave the third set at home.

TRAVEL ARRANGEMENTS

These arrangements should preferably be made for the group via a travel agency rather than electronically. They can advise you on travel insurance and other matters. Also ask them about procedures if you are forced to cancel seats or return earlier than expected. Some airlines (including SAA) are more restrictive than others.

SECURITY

Bear in mind that you will be operating in a disturbed area, including situations of possible unrest. Never move around on your own on foot or alone in a vehicle. Do not move about at night. Beware of pickpockets at all times, especially in a crowd. They often work in pairs. One distracts your attention while the other does the damage.

WHAT TO EXPECT WHEN YOU ARRIVE ON SITE

You can expect a lot of confusion, particularly when agencies from other countries may be on site with the same objective, and competing for attention, particularly when the press are around.

The one most important rule at all times and with discussions at all levels is that your approach should be *How can we help you*? All too often agencies arrive with the attitude that they know what is best. It is essential that you work in close consultation with the responsible authorities. Do not expect to be welcomed with open arms. The local authorities will have a lot on their hands and you will have to prove your capabilities first. There will be many obstacles, irritations and red tape. Work through your liaison officer and let him sort things out rather than get involved personally.

ARRIVAL ON SITE

Much will depend on the location and extent of the damage. There will be a lot of confusion, so be prepared for the worst. The two most difficult problems initially will be accommodation and transport. If funds permit, the best option would be to have these arrangements made though a local safari organisation before you arrive. They will be familiar with local conditions and will be able to provide tent accommodation and 4x4 vehicles with drivers.

RECONNAISSANCE

The purpose of the first visit is a rapid reconnaissance, preferably from the air, followed by a visit to the worst affected area by land. A detailed study is not required at this stage. The team that is being put together back in South Africa require feedback on the magnitude of the work as early as possible so that they can start planning. Draw some thick lines on a map showing the approximate boundaries of the areas that have different degrees of damage. Take lots of photos which people or a yellow carpenter's rule in the photograph to provide scale information. Ask the local people being photographed to indicate the height reached by the water. Note the type of structures that survived major damage. This will provide design information for restoration work. Note the type of water supplies (whether from wells, boreholes or reticulation systems) and get a general idea of the vulnerability of these systems.

The next priority is to speak to the local people (preferably to a group of women in the worst affected area) via an interpreter and with the permission of the local leader. Ask them your standard question *How can we help*? Be prepared for some surprises.

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The third priority is a broad assessment of the availability of local material for repairs and reestablishment of the infrastructure, and the fourth is the level of knowledge and experience available to operate and maintain power generation and water treatment works for example. Another mistake that well-meaning donors often make is to over-estimate the capacity of the local people to operate and maintain even the simplest equipment. The poor communities do not have the funds for fuel, let alone for operation and maintenance. There is a lot of room for ingenuity in the design of cheap, robust equipment. The worst situation will be where South African companies donate inappropriate equipment and expect this to be used in the affected areas.

EARLY WARNING SYSTEMS

This is an obvious requirement but is very difficult to achieve in practice. The major difficulty is in getting the warning through to those at risk. A warning system that does not work properly is far worse than no system at all. Remotely operated sirens are the best solution in densely populated areas. Radio warnings and 'sky shouts' from loudspeakers mounted on low flying aircraft are best in rural areas. This is a separate issue and will require a lot of planning and discussions.

Will Alexander was a member of the United Nations' Scientific and Technical Committee on Natural Disasters and chaired its subcommittee on Early Warning Systems from 1994 to the end of the international decade for natural disaster reduction in 2000. After the Mozambique floods he was invited to participate in an international team established to advise the Mozambique government on the development of a flood disaster mitigation programme. He has been very active in this field in South Africa.