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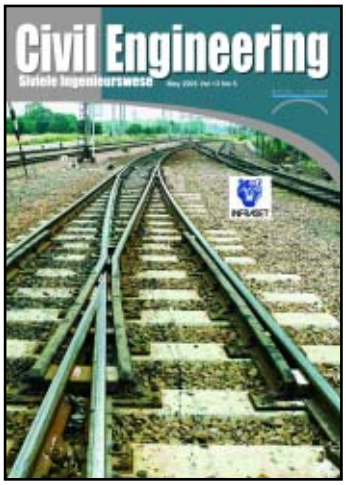
SAISI SAICE



Photograph: David Beer

ON THE COVER

The Capital Park rail junction in Pretoria where a pilot project to test Infraset's Universal Sleeper/Infrabolt concrete sleeper replacement system for turnouts on timber has met with great success. As a result Spoornet and Metrorail have issued three tenders for the initial upgrading of approximately 170 timber turnout sets countrywide

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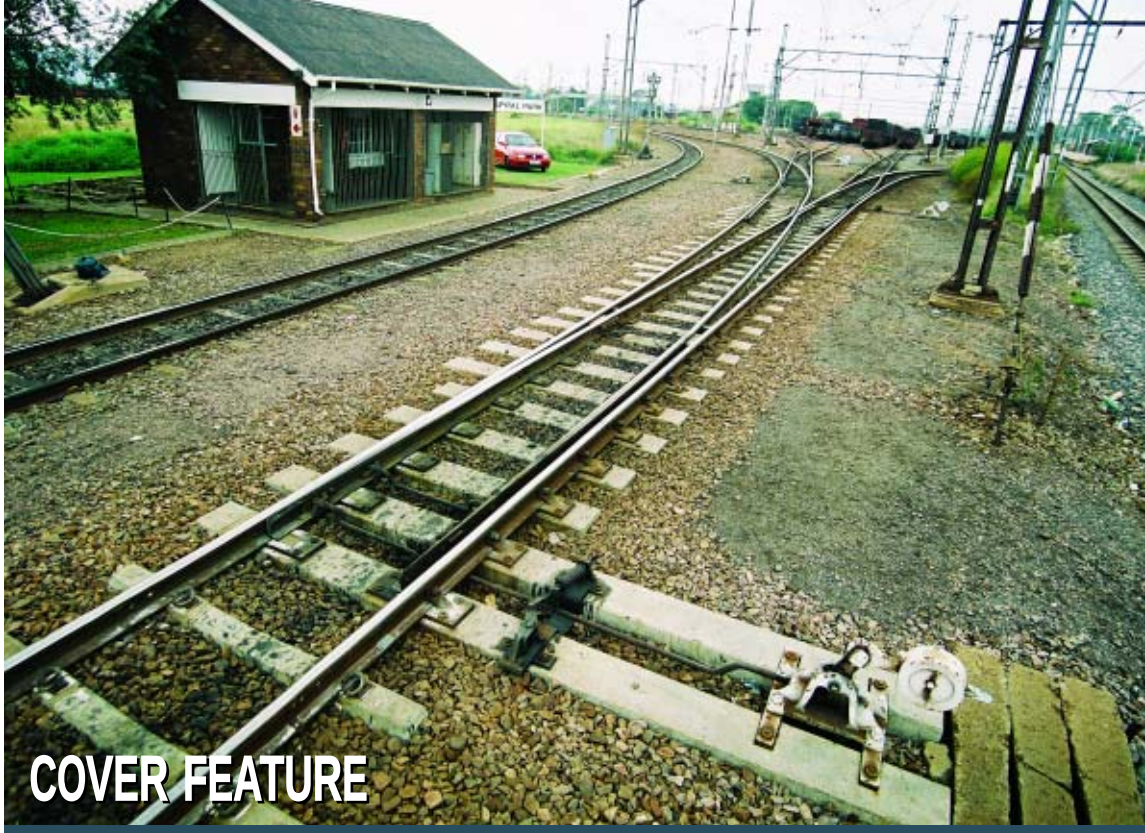
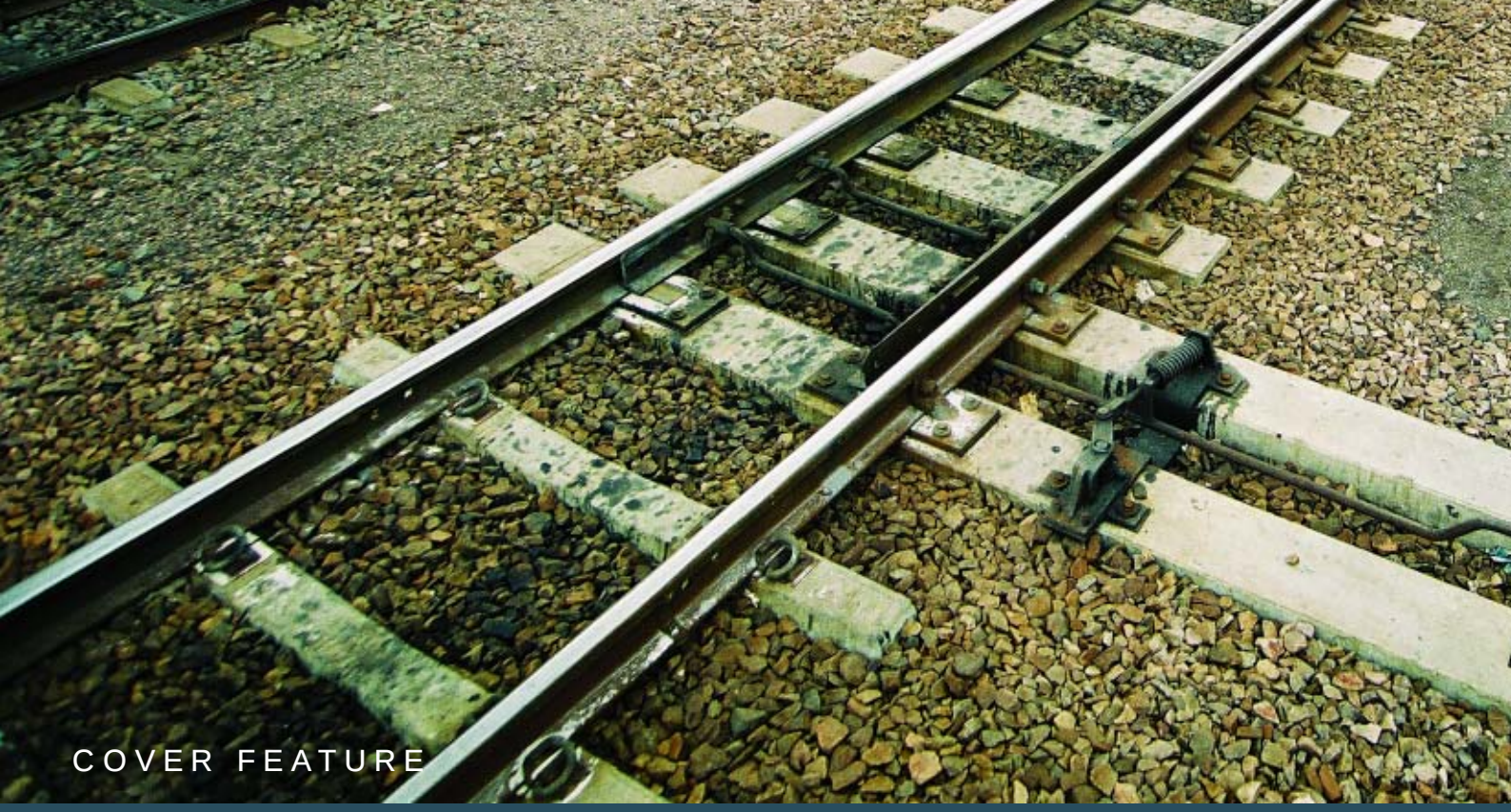


COVER FEATURE

Rail sleeper technology breakthrough from Infraset **5**

RAILWAYS AND HARBOURS



COVER FEATURE

Rail sleeper technology breakthrough from Infraset

INFRASET – INFRASTRUCTURE PRODUCTS has done it again. After its world-first launch last year of a concrete rail sleeper for a one-in-seven double-slip rail turnout, a feat most rail engineers thought was simply not possible, the company has once again confounded the sceptics and developed a viable replacement for some 14 000 timber sleeper turnouts on South Africa's extensive rail network.

Universal Sleeper, as the system is known, was developed in close collaboration with Spoornet and Metrorail. It is a solution that was made possible through the deployment of an innovative fastening system, Infrabolt, which was jointly developed by Infraset and Nedschroef.

A pilot project to test the Universal Sleeper/Infrabolt sleeper system has been completed at Pretoria's Capital Park rail junction. The system has proved to be very stable, and as a result, Spoornet and Metrorail have issued three tenders for the initial refurbishment of approximately 170 timber turnout sets countrywide.

Kobus Burger, marketing executive of Infraset – Infrastructure Products, says the new concrete sleeper system represents a significant point of departure from last year's one-in-seven sleeper system, which also used concrete technology as a replacement for timber sleepers.

'The beauty of the Universal Sleeper/Infrabolt solution is that it uses standard sleepers which can be mass produced. Should spares be required, for instance through a derailment, they can be supplied ex-stock – a major plus factor.

'This flexibility was brought about by the fact that sleeper bolt holes can be drilled on site, as is done with timber sleepers. It also enables timber sleepers to be replaced without disturbing the entire turnout and makes for much faster and simpler upgrades,' adds Burger.

Above: Concrete sleepers supplied by Infraset were used to replace the old timber sleepers at the Capital Park rail junction in Pretoria
Below: A newly installed concrete sleeper which has been secured by Infraset's patented Infrabolt system

Infraset's Infrabolt steel bolts are torqued to 250 Nm at the Capital Park rail turnout test site in Pretoria. Infrabolt is a patented bolting system specifically developed by Infraset for the re-engineering of turnouts on timber sleepers with concrete sleepers

The drilling of bolt holes for Infraset's patented bolting system, Infrabolt, takes place at a rail turnout test site at Capital Park in Pretoria. Clamps keep the rails securely in place while a special Hilti drill is used to drill holes through the reinforced concrete sleeper

The first phase of a turnout upgrade begins with the replacement of four sleepers spaced at even intervals along the full length of the turnout. They secure the turnout and keep it aligned during the rest of the re-engineering process when four or five consecutive sleepers can be replaced at a time. This is done by pulling the old sleepers out from under the rails and sliding in the new ones.

'In developing the system we undertook several experiments, which mainly revolved around finding a suitable bolting solution. We used a plastic dowel, but this proved unsatisfactory. We found that the threads tended to strip when they were not properly aligned or were over-torqued,' observed Burger.

Once again Infraset's ability to think 'outside the box' provided an answer which proved both ingenious and simple.

A threaded steel collar would be inserted into the bolt hole from the bottom of the sleeper; an unorthodox solution, which before it was implemented, raised several eyebrows. However, the execution proved remarkably simple and failsafe. Remove sufficient ballast from under the sleeper to create the room for insertion and replace the ballast once the bolting operation has been completed.

The collar is easily inserted by hand and a drop hammer is used to knock it firmly into position. Once in place the steel bolt can be screwed into the collar and torqued to 250 Nm.

Another innovation offered by the Infrabolt system is that the collar itself is insulated with an HDPE sleeve. This renders the bolt and collar inert and prevents interference with the electrical signalling current which runs through the rails.

A further factor which favoured drilling bolt holes on site was a high-speed drill supplied by Hilti. Once the template is in place and the rails accurately aligned to within a maximum variance of 0,5 mm, the Hilti drill is able to drill through a concrete sleeper in 35 seconds.

Burger concluded by saying that Infraset, Spoornet and Metrorail meet on a regular basis to address the concrete technology needs of both transport agencies and that it was out of these forums that the Universal Sleeper/Infrabolt solution arose.

Both Universal Sleeper and Infrabolt have been patented. In addition to the world-first one-in-seven concrete sleeper system mentioned earlier, Infraset was also the developer of a low-profile concrete sleeper for railway tunnels – another world first. ◻

Message from SAICE Executive Director Dawie Botha

The year 2004 has been my fourteenth with SAICE. It was also the tenth year of the new SA democracy. Our environment is still changing at a pace that is difficult to cope with and rapid change is the norm.

In the late 1980s SAICE leaders already foresaw the fact that our Institution would have to adapt and indeed lead change. We were prepared for this in a certain sense, but we are nevertheless still battling to cope. Our volunteers remain under tremendous pressure and this is impacting on SAICE's efficiency and capacity to deal with the daily challenges.

SAICE is currently enjoying the best recognition it has ever had and this was enhanced by the exposure we sought and achieved during the centenary year of 2003. The challenge is to remain on that level. The activities that SAICE is involved in benefit our members enormously, but it is also clear that unless they stay close to the Institution in terms of participation in the structures, that they do not always appreciate the growth and successes achieved.

This brief report cannot give credit to a year as busy as 2004, but I will highlight a couple of events that for me personally made it another satisfactory and indeed outstanding year:

- Following on our successful participation at the 2002 World Summit event, and the invitation to attend the general assembly of the World Federation of Engineering Organisations (WFEO) in Tunis, I was elected a member of the new Capacity-building Committee of WFEO. I attended the first full-scale meeting in Washington in June and my impression is that our Africa Engineers Forum and its new Protocol is *THE* model to follow. Our input is not only recognised but also highly appreciated by our African colleagues as well as our colleagues from the UK and the USA.
- Our Africa Engineers Forum meeting at Kariba resulted in an enhanced Protocol and Preamble and I am currently the secretariat for this alliance that we established in 1995. My dear friend Eng Sam Kundishora of Zimbabwe is the chairman.
- We were appointed by CETA (Construction SETA) to research and survey the skills environment in civil engineering. This enormous project is nearing completion and is led by Allyson Lawless. I am confident that it will become the premier tool for intervention in terms of capacity.
- We met with the Ministers of Transport and the Minister of Education in 2004. Subsequent follow-up meetings with their departments and close co-operation are a reality.
- The so-called Centenary Coffee Table Book – that took almost two years to complete – was delivered in the last week of December 2004. My personal input was substantial and it is a privilege to be able to now use this publication for the purposes it was intended for: to be a companion and source of learning, guidance and information and orientation. The project was made possible by advertisers and sponsors and the publisher Chris van Rensburg. FOUNDATION FOR THE FUTURE is a worthwhile and wonderful product that represents a milestone without equal.
- SAICE was appointed by the SA Department of Water Affairs and Forestry to continue with the Capacity-building Programme in the field of Water and Sanitation. The Government of Belguim has also now joined this exciting project.

Unfortunately limited space prevents me from mentioning more at this stage, but I can easily fill another book with what we have achieved and were involved in. I thank the SAICE Leadership for their continued support and I my staff for their dedication and team spirit.

Last but not least, I thank my non-SAICE family – my wife, Ria, who has been at my side for 34 years now, and who should indeed be a SAICE honorary member, as well as my children, and now my grandchildren, for being my home foundation.

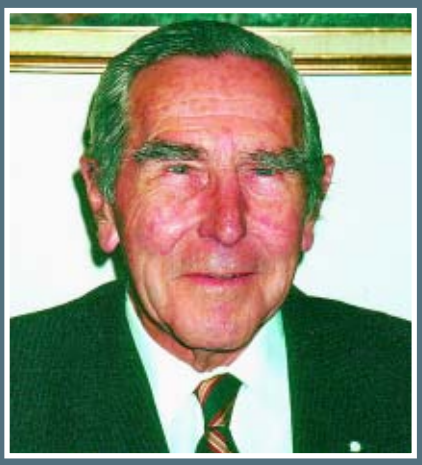
After this fourteen-year trek at SAICE National Office my wife and I will be on a 'short sabbatical' from 2 May until the middle of June 2005.

Text Marie Ashpole

PROFILE

Pieter Hendrik Louw

For the love of rails and people



Pieter Louw is a household name in South African Railways (SAR, now Spoornet) circles. His father, Pieter Johannes Louw, who became president of SAICE in 1953, was a civil engineer on the railways. Born on 25 September 1927 in Sea Point, Cape Town, young Pieter was destined to follow in his father's footsteps

EDUCATION

After various transfers and appointments, the family settled in Ladysmith, KwaZulu-Natal, where Pieter started school at Egerton Primary School.

Pieter frequently accompanied his father on trolley inspections of the rail tracks during the school holidays. The trolley was a converted canvas-hood Morris Oxford car fitted with flanged wheels. The steering wheel was used to operate the brakes mechanically with their cast-iron brake shoes. They lived and slept in a wooden construction caboose. It was a great thrill for Pieter to be handed the heavy train staff used for train control at the stations!

Pieter remembers travelling to Durban by car for the annual holidays. Celluloid side screens were installed in the doors – his mother wearing a dustcoat and scarf and his father a dustcoat, driving gloves and hat. Fuel reached the engine by gravity feed, and therefore very steep hills had to be negotiated in reverse gear to allow fuel to reach the carburettor. Chains were on hand to help negotiate muddy roads.

By Standard 5, Pieter had attended schools in Ladysmith, Cape Town, Durban, East London and Johannesburg. He was then sent to Paarl Boys High as a boarder and matriculated in 1944.

He recollects the 'best' transfer – the one to East London by air in a Junkers JU 54, the Lord Charles Somerset. Fresh air came into the cabin via a flexible tube with a scoop outside and a ball seal at the nozzle end. Air pressure pushed the ball seal into the tube, allowing fresh air to enter. The toilet, at the back of the aircraft, consisted of a pail, in a canvas bag, and cradle.

Among his memories of East London he recalls passengers being taken off the mail boat in a basket, loaded onto a tug and transported to the quayside. Interesting weekend outings included watching the salvaging efforts and breaking up of the *Stuart Star*, and the motor-racing Grand Prix, with ERAs and Auto Unions and drivers such as Lord Howe, Rosemeier and Steve Chapini.

Then World War II (1939–1945) broke out. Staff volunteered for active service in the Railway Division of the South African Engineering Corps. A major achievement of the Railway Division was the building of the line from Haifa in Palestine (now in Israel) through Lebanon to Syria in record time. Many of the volunteers were awarded the MBE and CBE.

Pieter recalls accompanying his father to Grootfontein and Tsumeb when visiting his parents, who were then stationed in Windhoek. The trip was undertaken in a Ford V8 with transverse leaf springs. Mosquito gauze was placed over the front of the radiator to prevent grass and seeds from clogging it and causing the car to overheat. Occasionally the grass had to be removed from the gauze and from around the exhaust to prevent the car being set alight.

At Fort Namutoni in Etosha the railway group were accommodated in police post accommodation. Today, the stables for the camels used by the police for their patrols are luxury rooms.

In 1945 Pieter enrolled at the University of the Witwatersrand, from where he graduated in 1949 with a BSc degree in Civil Engineering.

SAR

On qualifying Pieter was appointed to the SAR's Bridge Design Office, where most bridge designs were done.

Pieter designed and drew the plans for, among others:

- the N1 over the harbour lines in Cape Town
- the level-crossing elimination at Stellenbosch Station, at Isipingo Beach, and on the Greytown line (road-over-rail bridges)
- two rail-over-river bridges in the Hartenbos area
- fixed-end rocker and free-end roller bearings for the new half-through steel spans for the bridge over the Vaal River at Vereeniging

On leaving the Bridge Office, Pieter staked out the line from Cookhouse over Slagtersnek to Klipfontein. The excessive heat in the Fish River Valley meant that everybody had to be up at dawn, have breakfast after 11:00 and restart work at 16:00. Because the evening sky was so clear, the District Engineer attempted to interest Pieter in astronomy.

On completion of this deviation, Pieter went to Commadagga, where he worked on tunnels with Norman Schmidt. (Norman Schmidt and Tony Boniface compiled and edited the publication *Tunnelling in Southern Africa* for the South African National Council on Tunnelling.)

Because tunnelling was done over 24 hours in 12-hour shifts, Pieter was on duty virtually 24 hours a day, snatching sleep whenever he could. Four tunnels were being excavated simultaneously, each constructed and excavated by a different method. Pieter reminisced that he 'found tunnelling exciting and interesting'! For recreation the men played rugby, badminton, hockey, tennis and even went yachting. Dances and movie shows were also held regularly.

After the searing heat of Commadagga, Pieter was transferred to Naauwpoort, of which he said, 'With the wind, sleet, snow and cold I am convinced that Naauwpoort is the coldest town in South Africa.' It was a most enjoyable time, although the weather was miserable. At that time Karoo lamb cost one shilling and six pence a pound (about 15 cents for 500 g)!

In 1953 Pieter was transferred to Reef Construction in Johannesburg to work at New Kazerne on the property of City Deep. He was responsible for building the Transhipment Depot at Kazerne and the arch roof covering over the canalised Natalspruit.

There he had to supervise and give line and level. Few contractors employed engineers and they were dependent on the railway engineers for line and level. Until about 1955 most railway construction work was done departmentally, including the building of houses and stations.

The policy changed after 1955. New capital works had to be put out to tender to

contractors to encourage the growth of the private sector, as the mines and other industries were not able to attract and sustain new investment in South Africa. The railways retained the planning and design function.

Next he moved to Vereeniging. At that time the SAR recruited engineers in Europe because of the shortage of engineers. War service had created a backlog of engineers, and a boom period had increased demand. There was also an exodus of engineers – contractors were employing them, and many others were joining or setting up consultancy practices.

Vaal River Bridge

The steelwork for the Vaal River Bridge was erected on the approach embankment on the Vereeniging side. It was launched while Pieter was in Vereeniging in 1954. The southern approach alignment of the railway line to the bridge was on a curve with the transition curves at the one end starting at 13 ft centres. At the other end the transition curve ended at the width between the centrelines of the bridges, making it rather difficult to stake out, particularly because a road subway had to be accommodated under the curved portion of the railway line.

New Johannesburg station

In July 1954 Pieter returned to Johannesburg for the building of the new station, phase 1 of which had been completed. Everything at the old station that concerned passenger and suburban traffic had to be moved to what eventually became the main line platforms – at a level 14 ft (4,27 m) lower than the old station rail formation.

Reef Construction

The headquarters were in the Raemar Court building, where the rotunda was built. The old Kazerne goods sheds were converted to workshops, stores, rod bending and welding workshops, and a carpenter's shop. The accommodation building for travelling catering staff and the RMT depot sheds, which had a shell roof, had to be founded on Franki Piles because of decomposed Ventersdorp lava.

Reef Construction attempted to replace timber sleepers with concrete sleepers in the passenger and suburban staging yards, because timber sleepers were in short supply and difficult to obtain. Timber sleepers were essential because of colour-light signalling, electrolysis associated with electrified track, and the high concentration of cyanic acid used in the gold-refining process. Acid in the soil and runoff from the waste mine dumps caused rapid deterioration of steel sleepers by electrolytic action. To save on timber sleepers, concrete pot sleepers were used. To keep gauge, every third sleeper was made of timber.

Johannesburg Underground

Pieter had been involved in the proposed extension of the line from Johannesburg Station, which would run under the Fort, emerge at The Wilds, and follow the route of the M1 as it is today; then change direction to pick up Alexandra Township, turn in a westerly direction, pick up the Braamfontein Spruit, Parkview Golf Course, Milpark and go underneath Braamfontein Yard, linking up at Crown Station. No further work followed – apparently the Railway Act did not allow for the provision of a metropolitan transport service. (It is interesting that in his presidential address to the South African Institution of Civil Engineers in 1948, William Marshall Clark, General Manager of the Railways, predicted 'severe road congestion in Johannesburg' and asked that an underground commuter system be considered.)

Maintenance challenge

After another stint in Vereeniging, Pieter was transferred to Johannesburg to the System Manager's Office on maintenance for the Western Transvaal System. He explained: 'At the time I was of the opinion that the System Manager and his senior officers knew their requirements and should do the planning, while the construction department would construct. Soon enough, however, I discovered that there was more to maintenance than I had thought and more than enough to keep busy. Maintenance of the track and permanent way materials is a highly scientific field. Besides accidents and derailments that had to be attended to, as well as accident inquiries and complaints by farmers and railway staff, I found maintenance of the track and structures challenging and interesting.'

Pieter explained that problems of construction are day-to-day, to be solved immediately. Problems of maintenance are solved only after exhaustive investigation and research and results are not immediately apparent – thus possibly less satisfying!

Dewatering of the gold mines on the West Rand caused sinkholes to form in the dolomites close to the main line. Gatsrand Station derived its name from sinkholes. (Subsequently, as there was danger to the main Johannesburg–Cape Town railway line, and to avoid numerous deviations, the Potchefstroom–Fochville line was strengthened, electrified and extended and became the busy Cape Main Line.)

The era of mechanised track maintenance began in 1958. A commission investigated modern methods of railway maintenance in Europe and the United Kingdom and published guidelines. Regulations were also published on the use of on-track maintenance machines. Off-track roads within the railway reserve had to be built for easy access and to maintain firebreaks, clean out culverts and eradicate noxious weeds. A weed-spray train was designed and built on a DZ truck. The extensive programme replacing steam with diesel locomotives and the extension of electrification introduced in the late 1950s also reduced the incidence of veld fires.

A Level Crossing Eliminations Committee drew up a priority list. The various roads departments or local authorities undertook the design and execution of some of the level-crossing elimination schemes. In the late 1950s and 1960s numerous level crossings still existed, even on national roads.

Pieter had to relieve district engineers in other areas when they were on leave or sick leave, especially when the routine annual inspection of the bridges and culverts had to be carried out. It was done by motor trolley, hastily. So that trains would not be delayed, the inspector had to jump in and out of the trolley at every opening under the track or structure over the track. One had to scramble up and down embankments and cuttings – a test of anybody's fitness!

SWA/NAMIBIA

In May 1963 Pieter was promoted to Windhoek as District Engineer (Mechanisation). The South West Africa (SWA) System encompassed all SAR activities, including road motor services and harbours north of De Aar. His work stretched from De Aar to Ondongwa. New works included a large housing programme in Windhoek, the Philip Troskie Hostel and the goods shed at Tsumeb. The family home was almost 1 500 km from the beginning of the SWA System. Going to Upington for work meant being away from home for more than a week.

Pieter was shocked to see what he had to contend with in SWA. The rails were anything from CGR, NGR, KRUPP to SAR rolling with lengths of 10 m and 12 m. Later 36 m rail of mass 30 kg/m were introduced on all relaying work in SWA. Owing to high corrosion there were short sections of 48 kg/m rail along the coast at Lüderitz and Walvis Bay. Sleepers were a mixture of steel and timber. The introduction of mechanised maintenance on the SWA System was a huge challenge against enormous odds.

Track washaways occurred seasonally. Owing to the topography and ground conditions the runoff was virtually 100% and sudden heavy downpours caused flash floods. The critical areas were around Asab, Tses, Wasser, Nuwefontein, Tsumispark and Vogelsang. Another problem was the notorious SWA *koringkrieke*, which swarmed onto the track, causing the wheels of the locomotive to slip. Just one *koringkriek* squashed on the line would attract swarms of cannibalistic others!

BACK IN THE RSA

In January 1968 Pieter was transferred to Pretoria Construction and stationed at Capi-

tal Park. He was allocated the Pretoria and Waterval Boven districts. This encompassed every construction site west of Waterval Boven and north of Pretoria, and from Soekmekaar to Gravelotte in the Eastern Transvaal System.

As District Engineer, Pieter was in charge of building the servicing depot for the new Blue Train. This project included the deviation of a gravity-feed water-supply pipeline from Fountains Valley to the Findlay reservoir on Salvokop, which was built by the Royal Engineers shortly after the end of the Anglo-Boer War.

Pieter Louw with his wife, Helene

The converted Morris Oxford with its canvas hood and fitted flanged wheels in front of the caboose

Then Pieter was transferred to the System Manager's Office, Eastern Transvaal System, in Pretoria. He did trolley inspections and gave talks on safety, as well as motivational talks on materials, machines, manpower, money and minutes (the judicious use of time).

At the end of 1978 he was promoted to the post of Inspecting Engineer Maintenance in the Office of the Chief Civil Engineer in Johannesburg. In the last ten years of his 39 years of service, he was involved mainly in administration and management.

'An alarming development, shortly before my retirement, was the evaluation of engineers with more emphasis placed on engineers' management skills and qualities than their engineering skills, experience and expertise.' He paid tribute to the grand group of chainmen, known as survey boys, with whom he had the pleasure of working in rain, cold, snow and extreme heat in the Fish River Valley and the Western Transvaal.

Today, Pieter finds it disheartening to see the reduction of general traffic on the railways, the increase of heavy-vehicle traffic on the roads, and the vandalising, stealing and uplifting of some of the most scenic branch lines.

CONCLUSION

Pieter and his wife, Helene, epitomise love and service to their fellow human beings. Having served in St Johns Ambulance in the SAR countrywide, they gave of themselves generously and were awarded the Knight in the Order of St John and Dame in the Order of St John respectively, as described in the citation:

For the Faith
For the Service of Humankind

SAICE salutes its own 'Knight and Dame'! ◻

Text A R Wijnberg
Photos Prestedge Retief Dresner Wijnberg

RAILWAYS AND HARBOURS

NGQURA UPDATE

THE NEED FOR THE NEW PORT of Ngqura, near Port Elizabeth, arose from the South African government's macro-economic policy of establishing regional development zones known as spatial development initiatives (SDIs). These zones combine the opportunities offered by low-cost power, existing infrastructure, a large labour market and available land with the need for regional development.

The 15 000 ha Coega Industrial Development Zone (IDZ), about 25 km from Port Elizabeth, represents such an initiative for the Eastern Cape. The existing harbour at Port Elizabeth is constrained by the encroachment of the city around the port with its associated environmental, health and safety limitations. The new port will serve as a bulk and neo-bulk commodity facility for the IDZ and the associated hinterland. The design brief for the port called for the establishment of a new facility for the initial requirements of the development zone and long-term regional and national transportation demands.

The development of the new port should be seen within the context of the existing network of ports and their associated functions. Ports in South Africa are owned by a single national port authority, the National Ports Authority of South Africa (NPA). The NPA seeks to optimise the investment in ports on a national basis. The establishment of development zones with their associated ports needs to consider both the regional and national transportation demands. Ngqura is seen as an opportunity to export commodities from the interior of the country, to import bulk commodities for processing in the IDZ for re-export, and to release land for appropriate development in the existing harbour.

DESIGN CRITERIA

The design requirements for the port included traffic, cargo handling, navigation, engineering, safety and environmental criteria. A range of design vessels was considered resulting, at the end of the first phase of the project, in a port capable of accommodating ships up to 350 m in length with loaded drafts up to 15 m, and beams of up to 50 m.

The navigation requirements related to these design ships directly affected the spatial layout of the port. International codes of practice pertaining to maritime works determined the initial approach and entrance channel and basin configuration, while landside functional requirements, prevailing geology and coastal processes had a major influence on the final layout.

Specific environmental constraints were identified at an early stage of the feasibility study. These included the maintenance of an exclusion zone of 500 m around the islands and the maintenance of littoral transport which required the installation of a permanent sand bypass system. Where relevant, mitigatory measures and contingency plans have been put in place to deal with operational issues such as ballast water management and pollution control. A comprehensive environmental impact assessment (EIA) was carried out and a permit for construction

Main: Dolos being stored on the western reclamation prior to placement
Insert: The eastern breakwater head under construction

OVERVIEW

The new deepwater port of Ngqura, 25 km north-east of Port Elizabeth, represents a major civil engineering project currently under construction. The port has been designed to serve a local, regional and national hinterland within the context of the government's spatial development initiative programme. The initial phase of the project comprises the provision of the base infrastructure such as the breakwaters, approach and entrance channels, the harbour basin, a sand bypass system and five deepwater berths. Subsequent phases allow for the coastwise and inland expansion of the port with a view to accommodating more than 30 berths in future. The project represents the first major port development since the construction of Richards Bay in the 1970s and has a number of interesting technical aspects. These include the largest breakwater structure and the first fixed sand bypass installation in southern Africa. A total of some 25 million m^3 of dredging and dry excavation has been completed over a period of nearly three years, along with the placement of 280 000 m^3 of mass concrete quay walls representing 1,5 km of berthing. When completed, the port will be capable of accommodating ships up to 350 m in length with loaded drafts up to 15 m. This will allow for post panamax container and dry bulk carrier vessels at the facility. The port design and construction has been executed within an overarching environmental management framework aimed at achieving compliance with national coastal management policy.

obtained in June 2002. The EIA addressed biophysical, ecological, socio-economic and cultural aspects and was subject to a full public participation process prior to its submission to the regulatory authorities.

A comprehensive site investigation programme was commissioned in late 1996, during the feasibility stage of the project. This programme was aimed at the characterisation of site conditions for the design process.

The shoreline of interest lies between the Swartkops and Sundays river estuaries. The terrestrial topography is typified by coast parallel dunes up to 30 m high, which give way to uniformly undulating hills up to 50 m high within 3 to 4 km of the coast. The Coega River valley represents the only major incision into the coastal land form. The lower valley is between 400 m and 1 000 m wide, of which a portion has been developed as a commercial salt works. The nearshore bathymetry is uniform, reaching –20 m within 2 km of the shoreline.

The geology of the site is characterised by Quaternary alluvial and estuarine sediments in the river mouth and adjacent dunes, and Tertiary formations in the flanking hills, which overlie Cretaceous mudstones, siltstones and sandstones. To the north of the estuary evidence of quartzitic sandstones has been recorded at depth. Of primary importance to the location of the port is the existence of an asymmetric palaeo-valley, filled with discontinuous layers of gravel which provided the opportunity for soft excavation to the required depths. Site investigations have included onshore and offshore rotary drilling, vibrocore sampling, jet probing, penetrometer tests and well pump testing.

Two wind stations have been established on site, on the adjacent hills and Jahleel island. These short-term records have been supplemented by data from regional weather stations around the bay.

The coastal processes considered relevant to project design are waves (long and short period), tides, currents and sediment transport. Waves and current data have been measured using a sub-surface directional guage in 16,5 m water depth. Sea level information is obtained from the South African Navy tide gauge located in Port Elizabeth harbour. Regular beach profile measurements are taken to confirm baseline beach form conditions.

PORT LAYOUT

The first phase of the project comprises the provision of two container berths and three bulk berths. The critical path for construction was determined by the provision of the first bulk berths. Four berths have been provided with depths of –16,5 m chart datum (CD) and one berth with a depth of –18 m CD. A 300 m wide, 16,0 m deep channel links the berthing area to a 700 m diameter turning basin which has a depth of –18 m CD. A stopping distance of 1 800 m is provided from the end of the breakwater to the centre of the turning circle. The channel bottom width narrows over this length from 600 m to 300 m in the entrance. Seawards of the entrance the approach channel bottom width increases to 500 m through a 2 000 m radius bend towards the south-southeast. The approach channel is dredged to –18,0 m CD.

Extensive work was undertaken during the design phase to ensure that design criteria were met in respect of the port layout. This included numerical and physical modelling of wave penetration and resonance in the harbour basin, induced vessel motions of moored vessels and navigation simulation under critical operating conditions. The latter involved pilots testing the new port using a full bridge simulator for various vessels.

BREAKWATERS

The design of the breakwaters was undertaken using the hydraulic laboratories at the CSIR and University of Stellenbosch. Two two-dimensional models (scale 1:50 and 1:75) were used to design the typical breakwater section. The three-dimensional modelling work was undertaken at a scale of 1/100. All modelling work was carried out using irregular random waves based on those measured to determine armour unit stability and overtopping in the field data collection programme.

Both caisson and rubblemound options were considered for the breakwaters. Preliminary studies indicated that the caisson option was problematic, while the availability of suitable rock within 10 km of the harbour made the rubblemound option economically attractive. Owing to the time constraints placed on the design and construction phases, it was decided to apply a conservative design based on existing prototype breakwaters in the region.

The main breakwater is 2 610 m long, terminating in a water depth of –16,5 m CD. Foundation conditions comprise a relatively thin layer (1–5 m thick) of fine sand overlying bedrock. The breakwater comprises core rock (5 kg to 3 000 kg), armour rock (3–6 t)

The cutter suction and trailer hopper suction dregders working in the basin

The dry excavation prior to flooding of the basin

The western and eastern breakwater head caissons prior to float-out

and dolos concrete armour units (30 t), based on a significant design wave height of 9 m.

The main breakwater can be divided into three sections, the shallow water and surf zone, intermediate zone and the deepwater section. The deepwater section has a final deck level of +7 m CD with a clear width of 9 m. A double layer of 30 t dolos concrete armour units are used on a multiple gradient seaward slope. The 1:4/3 leeward slope is armoured with a single layer of 30 t units to accommodate overtopping. The breakwater head consists of a pre-cast concrete cellular caisson founded on a 1 m thick stone bedding underlain by a 5 m thick graded rock foundation. The reinforced concrete caisson unit is 66,75 m wide, 24,25 m long and 22 m tall (see figure 1).

The secondary breakwater is 1 080 m long and terminates in a water depth of –14,5 m CD. The structure comprises a central rock core, a rock underlayer protected by a double layer of 30 t dolos units at a slope of 1:5/3. The leeward slope is made up of 2–5 t armour rock at a slope of 1:4/3. The breakwater terminates with a 100 m long caisson structure. The 9 m wide mass concrete capping will be at an elevation of +6,5 m CD. The quantity of materials (bulk, in situ) required for the construction of the breakwaters are summarised below:

- Rock 3 254 000 m^3
- Dolos, 30 t 26 000
- Mass concrete 146 000 m^3

The material for the construction of the breakwaters is mined at the existing Coega Kop quarry approximately 10 km from the site. This quarry has previously been used to supply rock to the existing harbour breakwater at Port Elizabeth. The quarry consists of quartzitic sandstones of the Table Mountain Group. The rock is generally very hard, crystalline quartzite.

Quarry production rates of 86 000 t per week of rubble and 16 000 t per week of aggregates have been achieved. Dolos production averaged 50 units per day. A surfaced haul road and site services were constructed before the main contract was awarded to expedite the ramp-up to maximum production. The breakwater caissons were constructed in the dry excavation and floated into position.

QUAY WALLS AND BASIN EXCAVATION

The quay walls provide berthing for shipping and port support vessels. The first phase envisages the construction of 1 520 m of quay wall. A number of different concepts were considered for the quay walls, including solid faced retaining walls constructed from ground level, gravity retaining walls constructed in a dewatered excavation and open piled wharfs. The preferred option was a voided mass concrete gravity wall constructed in a dewatered excavation.

Three separate sections, 620 m, 600 m and 300 m respectively, have been constructed on either side of the 300 m wide basin. Onshore drilling results indicated that the foundation conditions in this area were primarily a cobble matrix or very soft cretaceous bedrock (< 4 MPa). Founding levels are at –17,0 m to –19 m CD.

Cope levels are at +5,0 m CD. Bollard and fender spacing are at 20 m intervals. The mass capping consists of a reinforced coping beam containing a service tunnel with expansion joints at 20 m intervals.

The 1 520 m of quay wall comprises 280 000 m^3 of concrete and required the excavation of approximately 13 million m^3 of material. Excavated spoil has been deposited in an onshore reclamation. The construction of the quay walls commenced simultaneously with the breakwaters. The dry construction required the installation of a 1,5 km slurry cut-off wall and dewatering system in order to lower the ground water level in the

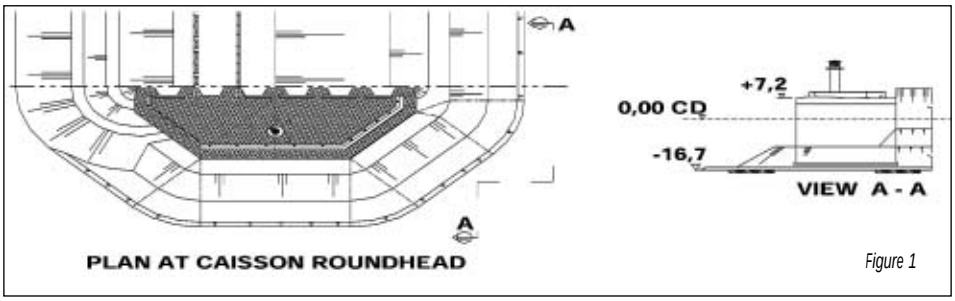


Figure 1

The dolos casting yard during production

The western breakwater viewed from the landside

The sand bypass temporary works under construction

excavation, all protected by a 600 m long rock armoured bund wall. Approximately 7 million m^3 of material was removed from the basin and quay wall excavations. The basin floor at –16 m CD provided an ideal site for the construction of the five breakwater caissons. The flooding of the harbour basin represented one of the most challenging aspects of the construction project as quay wall, earthworks, dredging and caisson construction work needed to meet common milestones without inducing delays or compromising the safety of the works.

DREDGING WORKS

The dredging of the port approaches, basin and berthing areas required the removal of some 12,3 million m3 of material. The dredging work extends from the –18,0 m CD contour offshore to the +5,0 m CD contour onshore. Work was undertaken in exposed and protected waters. Dredge material was deposited in an offshore dump site in a water depth exceeding –30 m CD approximately 7 km from the harbour.

The approach and entrance channels constituted some 2,0 million m^3 and the basin 10,3 million m^3 of dredged material. The nature of the material was predominantly fine sand to coarse gravel interspersed with clay and shell lenses. The river channel yielded cobbles up to 200 mm in size at depths of –13,0 m to –16,0 m CD. Areas of soft mudstone and harder siltstones underlie this material.

The dredging contractor undertook the work using a cutter suction dredge and a trailer hopper suction dredge. The average daily production on site throughout the 45-week operation was 39 000 m^3. Throughout the dredging operation the contractor was required to meet turbidity levels of < 80 mg/l above ambient, 100 m from the islands.

SAND BYPASS SCHEME

The primary function of the sand bypass scheme is to maintain continuity of the natural littoral sand transport along the coast. This was an environmental requirement for the project.

Initial estimates indicate that the net longshore movement of sand is approximately 160 000 m^3 in a north-easterly direction. These estimates correlate well with the observed build-up of sand at Kings Beach, next to the existing harbour at Port Elizabeth. The sand bypass system will remove sand from the root of the secondary breakwater and discharge it north-east of the main breakwater.

Sand will be abstracted using a series of jet pumps mounted on a fixed jetty positioned across the surf zone. Localised sumps will be excavated into the rock to provide sufficient storage. The sand/water slurry will be pumped in pipelines located in a service corridor around the back of port to the main breakwater.

The system is designed to move up to 300 000 m^3 per year of sand with cobbles of up to 150 mm in diameter, in order to accommodate the expected variability in the natural sand transport rate. The sand is predominantly fine grained (150 micron). The sand bypass jetty and sand trap is currently under construction. The contractor has created an excavation protected by sand bags and armour rock within which the jetty piling and sand trap are being built in the dry. Commissioning of the sand bypass system is expected towards the end of 2005.

CONCLUSION

The construction of the new port of Ngqura is nearing completion. The project has brought together NPA's engineers and a number of South African specialist consulting firms in coastal and port engineering, using the CSIR modelling facilities, to plan and design all aspects of the works, thus maintaining and extending expertise for future development in the region. □

The harbour site looking north over the approach channel into the basin

PARTIES INVOLVED IN THE PROJECT

CLIENT
National Ports Authority of South Africa

DESIGNERS
Lead Consultants:
Prestedge Retief Dresner Wijnberg

Breakwaters:
Prestedge Retief Dresner Wijnberg

Quay wall bulk earthworks civil infrastructure:
Protekon

Dredging:
Entech Consultants

Sand bypass:
Prestedge Retief Dresner Wijnberg
Naylor Naylor van Schalkwyk

CONTRACTORS
Breakwaters, quay walls, earthworks:
Ngqura Harbour Contractors JV

Dredging:
Jan de Nul NV

Sand bypass:
Connec JV

Civil Infrastructure:
Protekon

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Designing railway formations for

Figure 1 Formation rehabilitation on the Broodsnyersplaas – Richards Bay coal line

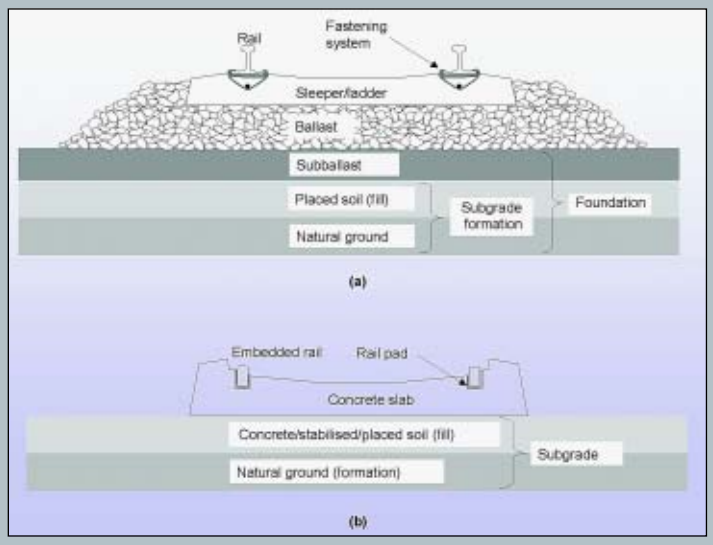

Figure 2 Cross sections of typical track structures: (a) conventional, ballasted track structure (b) non-conventional, ballastless track structure

Why should we be designing railway formations for the future? Not too long ago it was thought that once a railway is built, it would exist forever and there would be no need to consider its future performance. With the birth of the Gautrain Rapid Rail Link and the extensive upgrading and rehabilitation on South Africa's heavy-haul coal export line (COALlink), railway formations have become a focus for consultants, researchers and academics in the civil engineering field in South Africa. The authors address various issues related to the design of railway formations and their performance into the future

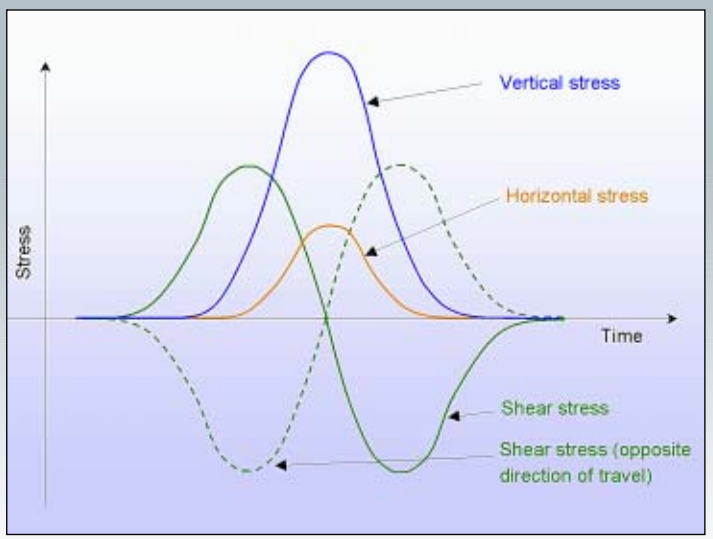

Figure 3 Stresses on a pavement element due to a single moving wheel load (redrawn from Brown 1996)

THE SIGNIFICANCE OF RAILWAY FORMATIONS

Railway formations have not received adequate attention in terms of research and development, despite the substantial effect they can have on the successful operation of a railway. Substructure failure often results in unsatisfactory track geometry and track/vehicle dynamics, which necessitates speed restrictions and track closures. Speed restrictions result in longer journeys, cause unpredictable service to the customer and lead to financial losses to infrastructure owners and operators. The following three aspects highlight the significance of railway formations:

- According to COALlink, earthworks construction comprises more than half of the total track expenditure in the construction or upgrading of railway lines.
- The effect that substructure failure can have on the service levels of a railway is significant and experience has shown that the majority of speed restrictions on a heavy-haul line are related to poor performance or failure of the substructure.
- The regular maintenance of track sections due to formation problems usually escalates with time, and because the actual problem is never solved, maintenance costs accumulate to unsustainable levels, later dictating complete formation rehabilitation.

These facts emphasise the importance of designing and constructing railway track formations with state-of-the-art knowledge and methods.

TRACK FORMATION STRUCTURE

Ballasted and non-ballasted track structures have two main components, namely the superstructure and the substructure. The conventional superstructure consists of the rails, the fastening system and

the future

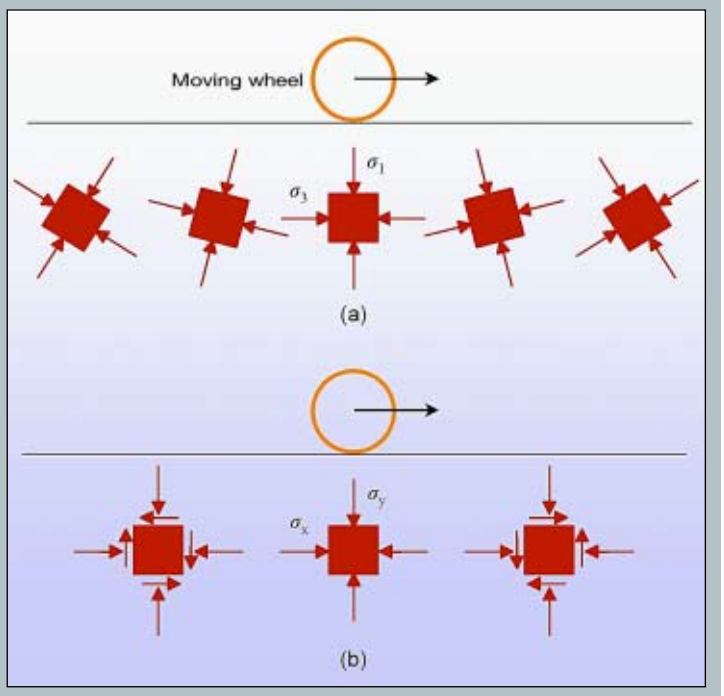

Figure 4 Stresses on a pavement element: (a) principal stresses – element rotates; (b) no rotation – shear stress reversal (redrawn from Brown 1996)

the sleepers. The substructure consists of the ballast, the subballast and the subgrade. The subballast and subgrade are often referred to as the formation, which is the focus of this article (see figure 2). The main functions of the formation are to support the repeated traffic-induced stresses transmitted through ballast without failure or excessive deformation, and to resist various environmental factors while providing a stable platform for the track.

TRACK FORMATION LOADING

Figure 3 shows the stresses as experienced by a fixed soil element in or below a pavement structure as a rolling, single wheel passes. This type of loading is valid for all pavement structures including roads, rail track and airport runways.

Figure 4 displays the associated pattern of principal stresses illustrating the rotation of the principal stress directions that takes place. The figure shows the 180° change (or reversal) of the shear stress acting on a soil particle. The reversal of the shear stress and resulting rotation of principal planes make this type of loading unique. Unfortunately, this stress regime can not be reproduced in the conventional laboratory triaxial test. The results from this test, however, have largely determined the present knowledge of the mechanical properties of granular and fine-grained material. The hollow cylinder apparatus is the only available laboratory apparatus that can be used to continuously rotate the principal stresses as is the case with pavement loading.

TRACK FORMATION DESIGN

Railways across the world base their track formation design on experience and/or semi-empirical methods and design charts. However, state-of-the-art formation design is based on resilient modulus and permanent deformation. Linear elastic, multi-layered system analysis is used to prevent progressive shear failure and plastic deformation. In this design method, permanent deformation is estimated from repeated triaxial tests on selected materials. However, it has been pointed out that triaxial testing can not reproduce the complex stress regime in a pavement structure due to vehicle loading. Principal stress rotation affects the stress-strain behaviour of clays and granular materials, pore pressure generation and shear strength. The current design methods do not take principal stress rotation into account. Research by the authors aims to established a rational design method to improve design life prediction, track maintenance and performance.

HOLLOW CYLINDER TESTING

A hollow cylinder apparatus (HCA) (see figure 5) was developed at the University of Southampton to investigate the behaviour of selected construction materials under the influence of principal stress rotation. Four different materials were selected with clay contents ranging from 7 % to 24 %, representing material as specified for the construction of new formations as well as the material present in existing track formations. Pairs of samples were tested in the HCA to study the effect of principal stress rotation on the behaviour of these materials. Figure 6 shows the loads applied to an HCA soil sample, as well as the displacements that result from this type of loading.

A series of laboratory tests were carried out on the selected materials during which pairs of samples were subjected to cyclic loading corresponding to train loading. The exact magnitudes of the loading were obtained from dynamic finite element analyses of 26 tonne/axle train loading on a complete 3D track model, as demonstrated by Lourens and Maree (1994).

Figure 8 shows a typical result where cyclic loading with and cyclic loading without principal stress rotation (PSR) are compared with each other. The rate of permanent deformation accumulation was greater for loading with PSR than for loading without PSR for all the materials tested. It was found that PSR is responsible for an increase of 60–310 % in the rate of permanent deformation accumulation, depending on the clay content of the material. Furthermore, PSR results in a lower stiffness of the material compared to loading in one direction (triaxial loading). All materials that were tested experienced a reduction in stiffness of 22–26 % as a result of principal stress rotation. During PSR, new load columns and particle contacts are established to accommodate the changing stress conditions. The result is that particles slide relative to one another and cause a reduction in stiffness of the material as well as an increase in permanent deformation.

DESIGN LIFE PREDICTION

A practical implication of the results obtained from the HCA testing is, amongst others, that when design life prediction of railway formations is based on cyclic triaxial testing, the expected life of the formation will be over-estimated and failure will occur much earlier than expected. It is therefore crucial that the role of principal stress rotation is considered in any design that aims to predict the long-term performance of a track formation, or for that matter, any pavement structure.

FIELD MEASUREMENTS

The laboratory results described above have produced a fundamental basis for design life prediction. However, a need exists to supplement these results with actual field measurements. For this reason a test site has been chosen on the coal export line (COALlink) to study resilient as well as permanent deformation behaviour of a newly built track formation under heavy axle loading. Instrumentation at the test site include the following:

- multi-depth deflectometers (MDDs) to measure pavement layer deflections (transient and permanent)
- pressure plates to measure total vertical stresses due to train loading
- strain gauge configurations to determine the vertical and lateral loading on the rails

Figure 5 Hollow cylinder apparatus at the University of Southampton

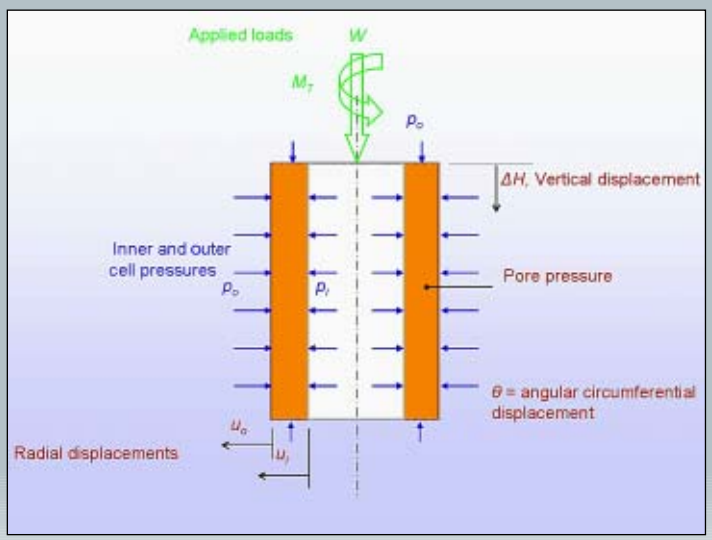

Figure 6 Load application for an HCA soil sample and the resultant displacements

- linear variable differential transformers (LVDTs) to measure sleeper and rail movement, and
- accelerometers to measure rail, sleeper and ballast acceleration

The track will be monitored over a period of several years to determine and model the permanent deformation of the track and ultimately the expected service life of the track formation.

GEOBASE

As part of a large-scale field investigation to determine the formation condition on specific Spoornet lines, GEOBASE (Spoornet Geotechnical Data Management Software) has been developed. GEOBASE comprises a database, condition assessment modules and data presentation functions. The software accommodates sampling of up to five formation layers at every testing location. Data such as plasticity index, liquid limit, grading analysis, layer stiffness, soil description, moisture content, field density, rock depth and description, etc. can be stored in the database. The software can be used to present all data in user-defined graphs and to calculate a formation condition index (FCI) based on the accumulated soil parameters. The FCI values are used to identify problem sections and to prioritise track maintenance as well as formation rehabilitation.

TRACK FORMATION DESIGN FOR THE FUTURE

The design of track formations should be aimed at curtailing the most common causes of formation failure, which include the following:

- lack of competent construction materials and consequent usage of sub-standard materials
- high rainfall patterns and insufficient sub-surface drainage
- insufficient compaction of structural layers
- construction on in-situ material with inadequate support
- subgrade attrition leading to mud pumping
- cracking of the stabilised subballast layer because of an unbalanced design with respect to layer stiffness

A design philosophy has consequently been developed based on the following fundamentals:

- an analytical and structural approach to predict resilient and permanent deformation behaviour, based on laboratory and field measurements
- whole-life costing and design life prediction
- the use of high-quality gravels and imported crushed stone
- compaction to high densities
- an extensive drainage design with fin drains as well as blanket drains
- site-specific designs instead of generic designs
- extensive quality assurance throughout the construction period, specified as part of the design

The flow diagram in figure 7 demonstrates how the laboratory and field testing, the Geobase databasis and other laboratory and field testing data will be used to create a track formation maintenance and management model which will enable accurate design life prediction and estimation of maintenance expenditure.

CONCLUSIONS

- The estimated/predicted design life of railway formations is a key element in the design process and management of such an asset.
- Permanent deformation for a range of track formations materials has been quantified for design life prediction of railway formations. These predictions are based on high-quality laboratory tests and full-scale field instrumentation.

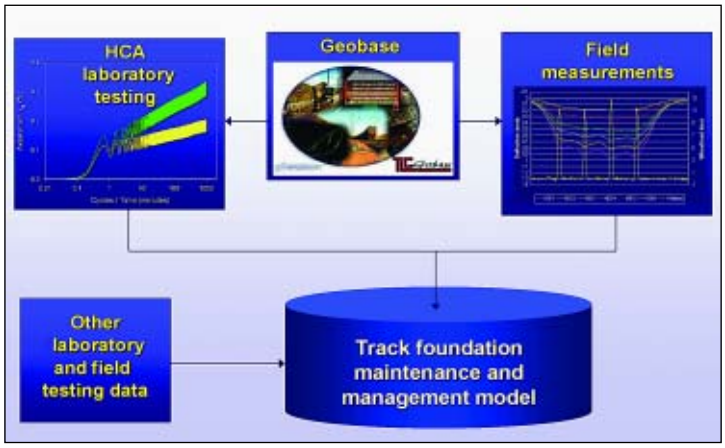

Figure 7 Flow diagram for input into the track formation maintenance and management model

- The design of railway formations for the next 100 years should be based on a rational, structural and scientific approach.

Acknowledgements

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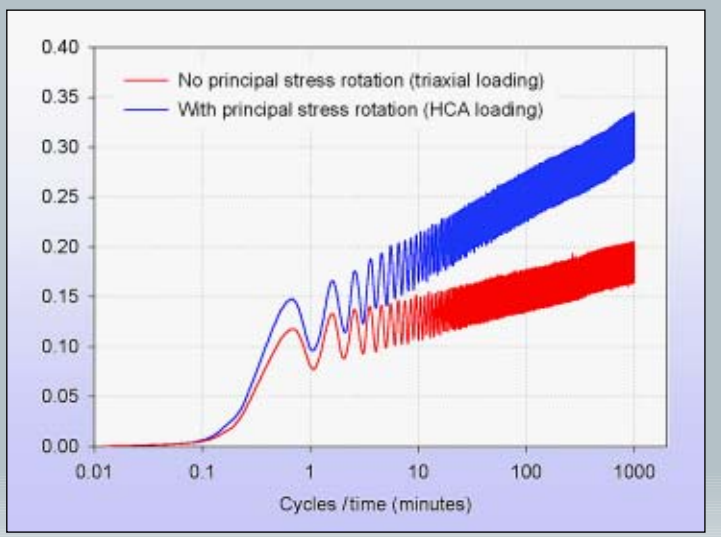

Figure 8 Permanent deformation during cyclic loading (14 % clay sample)

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Compiled by Huibrecht R Kop
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Some problems had to be overcome during the construction of the building ...

PROTEKON RAIL (Project Engineering), a subsidiary of Transnet, has recently completed the second of four underfloor wheel lathe (UFL) projects for Spoornet, the rail transport division of Transnet. Each project included the design and provision of new infrastructure to house the mechanical equipment used for the wheel-cutting process.

As with road-going rubber-wheeled vehicles, railway rolling stock also experience wear on the steel wheels. Instead of replacing the wheel tread, the steel wheels can be cut back to the unique wheel profile that allows trains, with fixed axles, to move around curves.

The first facility was constructed at the Electrical Locomotive depot in Sentrarand (Johannesburg) and the second was completed at the Umbilo Electric Loco Depot (Durban). The infrastructure consisted of a building to house the wheel lathe, as well as a pre-inspection pit area and a departure area. In addition, railway track was provided to allow rolling stock to enter the building.

Other infrastructure that had to be provided included electrical light and power and overhead traction equipment, a 5 t overhead crane, telecommunications, computer links, water, sewer and stormwater reticulation, and a road access system.

The planning and design started with the basic layout of the building and the surrounding transport infrastructure, up to the point that all designs could be completed except for the particular requirements for the founding and placing of the UFL, which depended on the manufacturer of the UFL. After the award of the UFL contract the requirements could be finalised and the designs completed.

Some interesting civil engineering aspects of the infrastructure included having to overcome challenges such as ground water, collapsing sand excavations, heavy rainfall, depot operations, and interested and anxious clients and operators. The Umbilo facility was constructed on a piled-supported foundation slab, constructed in a excavation that was continuously dewatered, due to the founding level being approximately 2 m below the groundwater table.

The underfloor lathe is manufactured and installed such that the wheels can be cut while still located on the locomotive, a process that can vary between 30 and 60 minutes. This operation prevents the time-consuming and costly process of removing

Infrastructure for new underfloor wheel lathes

The new building at Umbilo that houses the under-floor wheel lathe. Site agent Ricky du Plessis is crossing into the new access road

the wheels and axles from the rolling stock and having the machining done on a horizontal bed lathe.

The UFL contract was awarded to a Polish company, Rafamet, who manufactured and installed the first two lathes during a contract period of 13 months.

The UFL is a computer (numerically controlled) operating system, resulting in very few inputs being required by the operator in determining what the minimum cutting depth is to obtain optimum profile. The removal of all excess steel shavings from the building is done by a conveyor system that first crushes all cuttings into smaller pieces underneath he UFL and then conveys all chips to a collection bin located on the outside of the building.

Another new unique feature of these projects was the provision of remote-controlled battery-powered shunting vehicles, which are used to place the rolling stock on the UFL for the cutting process. The remote control panel is placed at the UFL to allow precision placing of the axles above the driving rollers and cutting heads. These shunters were acquired from NITEQ, a Dutch company just north of Amsterdam.

The next two facilities are to be established at Spoonet's Ermelo Locomotive Depot to service all the COALline traffic and at Spoornet's Saldanha Workshops to serve all Iron Export line rolling stock. ◻

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Railway assets

Effective outsourcing the key

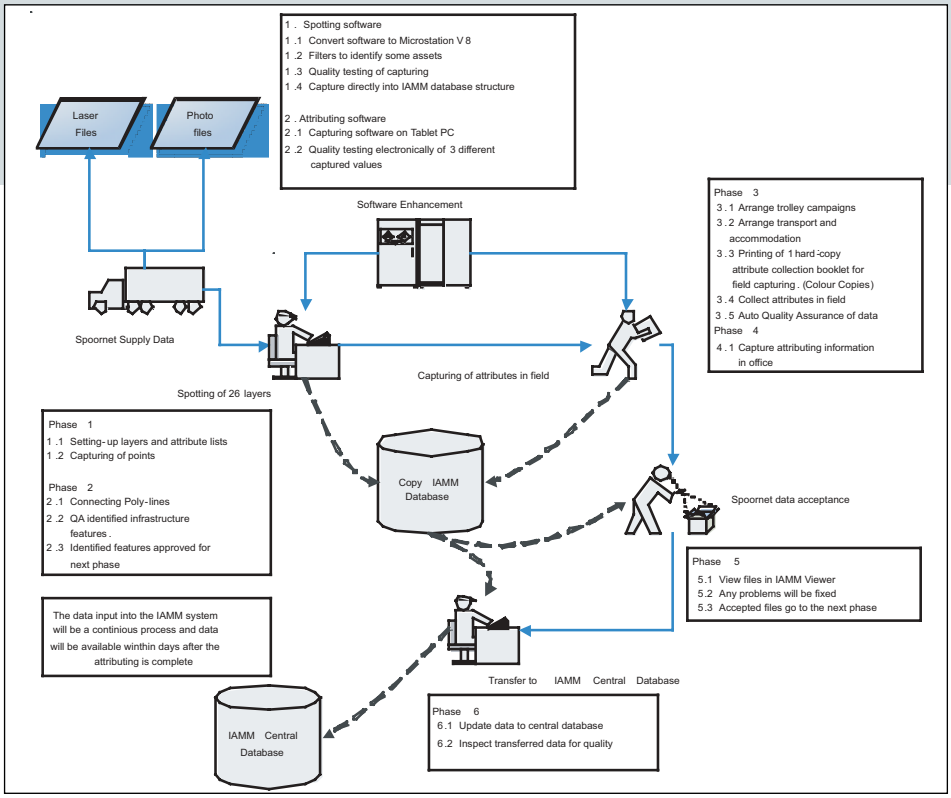

Figure 1 Data collection, classification and database population process

SPOORNET OUTSOURCED a project for the data collection, classification and population of 6 344 km of railway track nation-wide to a partnership consisting of e-Logics and Computer Foundation (a wholly owned subsidiary of Arivia.kom). Here, effective outsourcing requires an understanding of linear infrastructure maintenance management. The integration of resources, processes and technology forms the core of such an extensive project. The output requirements for delivery consists of data that contains points, lines and polygons in GIS format, representing assets with attributes (classifying the assets). This data set is used to populate the asset repository database used in Spoornet's IAMM (Infrastructure Applied Maintenance Management) system, which is built and configured on by e-Logics in partnership with Computer Foundation.

INFRASTRUCTURE MAINTENANCE MANAGEMENT OBJECTS

Spoornet's current IAMM system consists of three high-level business objects defining the maintenance management system used for analysis and decision-making:

- locating the infrastructure assets
- determining the condition of the assets
- compiling records of maintenance activities to keep the line operational

Future business objectives that will be developed and incorporated into the IAMM system include operational characteristics (traffic characteristics of trains operating over the line) and components (inventory) forming part of the assets.

The core component of the IAMM system is the asset repository: a geographically based referencing system that relates all railroad assets and its location to condition, traffic characteristics, and maintenance activities.

The project discussed here focuses on the information collected for populating the asset repository of the IAMM system.

ASSET REPOSITORY

The geographic location of all physical infrastructure assets and the linear referencing system forms the basis of the relational database of the IAMM system.

Obtaining a complete record of all railway assets is the first step in establishing an infrastructure asset repository which is to be utilised in Spoornet's infrastructure maintenance management system. Currently the asset repository contains 27 layers of assets defined by point, line and polygon assets. Examples include signals, track segments, overhead track equipment support structures, train authorisation buildings, and electrical sub-stations. Each of the layers has its own defined attributes (member data). The attributes can be divided into two types, namely generic-required attributes and layer-specific attributes (these are user defined).

Generic-required attributes include asset location referencing information and asset names/numbers for each asset.

Generally, all railways keep up a set of build charts that define all the assets along the right of way. These charts describe the asset and its linear location. Owing to the lack of records and the inaccuracy of asset location information, Spoornet surveyed the right of way using LiDAR technology. LiDAR technology consists of laser-surveyed data and aerial photos. This data enables location-based referencing to be captured for the physical infrastructure owned by Spoornet.

LiDAR TECHNOLOGY

LiDAR (light detecting and ranging) is a laser scanning system operated from a GPS-located helicopter platform collecting geo-referenced surface data points. The outputs of the system include laser points, video material, and/or digital photographs. Spoornet used two companies to survey their right of way, namely Fugro-Inpark FliMAP (from the Netherlands) and Airborne Laser Solutions (South Africa). The data is accessible using proprietary Microsoft Windows-based software programs called Flip7 and ALSRail add-ons utilising MicroStation and TerraScan/TerraPhoto as the underlying technology.

(For additional technical information on LiDAR technology refer to www.flimap.com, www.flimap.nl and www.alsafrica.com.)

ASSET COLLECTION, CLASSIFICATION AND DATABASE POPULATION

To execute an extensive project of this nature one has to understand infrastructure maintenance management and the processes involved in the project. This is particularly the case in view of the multitude of complexities surrounding the project – for example:

- combining client resources with outsourced resources (taking into account that the outsourced partner consists of two different organisations)
- a tight time frame
- processes to ensure the delivery of a quali-

ASSET-IDENTIFICATION PHASES

- *Phase 1:* Set up layers and attributes lists in the Oracle database and capture asset points in the asset-collection application.
- *Phase 2:* Connect polylines (for line and polygon types of assets), quality assure (QA) identified infrastructure features, and identify features approved for the next phase.

FIELD-ATTRIBUTING PHASES

- *Phase 3:* Arrange trolley campaigns; arrange transport and accommodation; print five hard-copy attribute collection booklets for field capturing; collect attributes in the field; quality assure data collected.

Process

Because of time constraints, e-Logics developed a process to ensure that data could be provided in the shortest period and to enable Spoornet to utilise the data as soon as possible (figure 1). This high-level process comprises the steps identified here.

POPULATING ATTRIBUTING INFORMATION

- *Phase 4:* Capture attributing information into the IAMM database.

QUALITY ASSURANCE OF DATA

- *Phase 5:* View files in the IAMM viewer and correct mistakes in data capturing. Accepted files go to the next phase.

UPDATE DATA TO PRODUCTION DATABASE

- *Phase 6:* Update data to central database and inspect transferred data for quality.

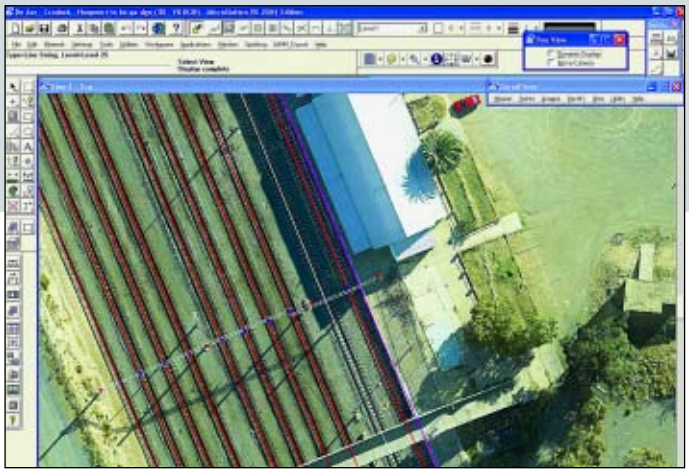

Figure 2 Asset identification software built on MicroStation

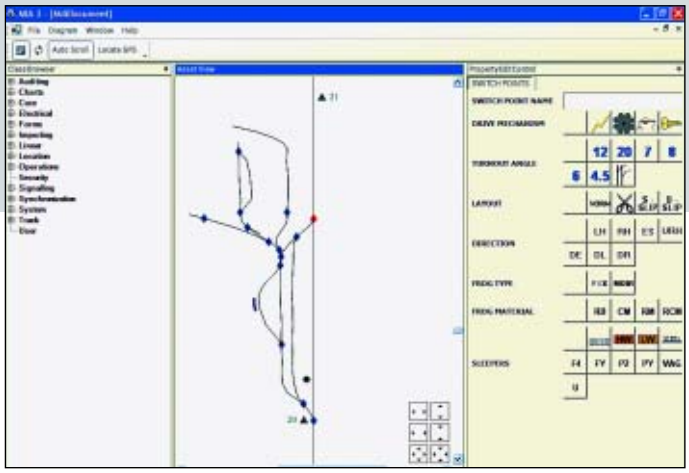

Figure 3 Asset classification software built on the ESI framework

ty product
- logistics and availability of the client resources

Developing a detailed project process reduces the project risks and ensures effective integration between the resources of all parties, processes and technology used to deliver a final product (see box above).

QUALITY ASSURANCE

The quality of the data is of the utmost importance, therefore quality assurance forms part of almost all phases. According to our estimates the critical path is determined by the process of field data capture. Limitations in this phase are that only two teams can work in the field at any given time and that the field data collection time is relatively fixed. With this information at hand, the only phases that could be improved upon was the asset identification phase and the attributing phase after the field data has been gathered. Improving these phases required re-developing the asset identification software (developed by Computer Foundation) and developing enhanced attributing software (developed by e-Logics and built on their MIA system).

ASSET IDENTIFICATION

The primary improvement in this phase derived from direct integration into a copy of the current IAMM asset inventory database. Included into the asset collection phase was the incorporation of business rules for quality assurance of identified assets. Computer Foundation re-developed the capturing application using MicroStation as the basis of the software (see figure 2).

The CAD-type software enables users to draw on the raw laser and aerial photo data to identify assets.

ASSET CLASSIFICATION – FIELD WORK

e-Logics provided the services for classification of assets in the field. At first we envisaged using the attributing software directly on the trolley campaigns. This process was tested on tablet PCs during the first campaign, between Saldanha and Sishen. It soon became evident that although the software enhanced the capability of a user to classify the assets, flexibility would be a constraint during the capturing process, which was performed at speeds of up to 30 km/hour. An alternative method was opted for: capturing the attributes in shorthand on paper maps, a method previously used by Spoornet.

POPULATING CLASSIFICATION INFORMATION

After the field work, the paper maps are put through a quality assurance process before populating the classification information using the attributing software. All map files are compared and reconciled in a single file illuminating discrepancies between files. The reconciled file is used to add and delete the required assets in the asset identification phase. When all assets have been identified, the file is used to classify the assets in the attributing software developed for this phase (see figure 3).

The attributing software brought about a dramatic improvement in productivity. Historical information indicated that this phase could be performed at approximately 20 km/day, but with the newly developed software productivity increased to 100 km/day, on average.

CONCLUSIONS

- In an extensive project of this nature, effective outsourcing requires understanding linear infrastructure maintenance management to ensure successful asset data collection, classification and population of an asset repository.
- A detailed project process reduces the risk of poor quality and project overruns.
- Successful integration of the process, resources and technology is a key to successful delivery.
- Effective communication is critical.

ACKNOWLEDGMENTS

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- e-Logics (Pty) Ltd: A Moolman and N Schoeman
- Computer Foundation: F de Lange

References are available on request

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Railway asset *maintenance and management education initiatives*

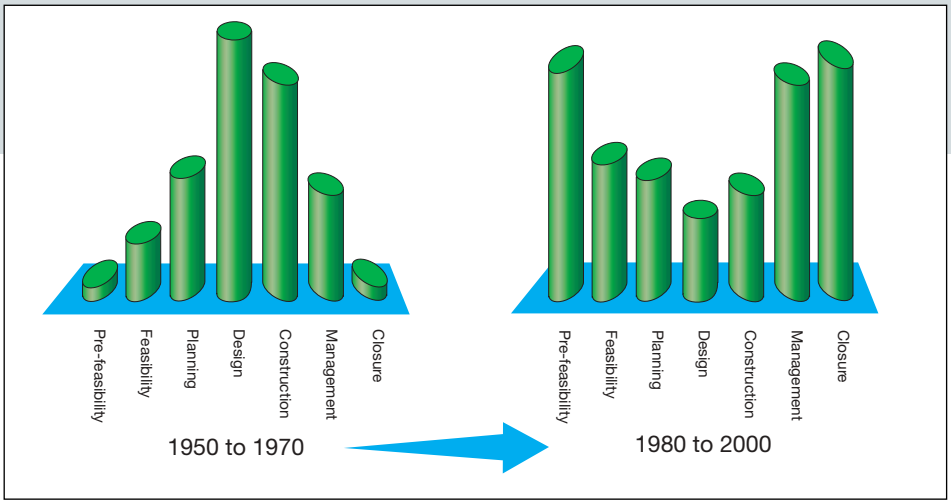

Figure 1 Shift in civil engineering activities over the life-cycle of typical infrastructure facilities (Abbot 1996)

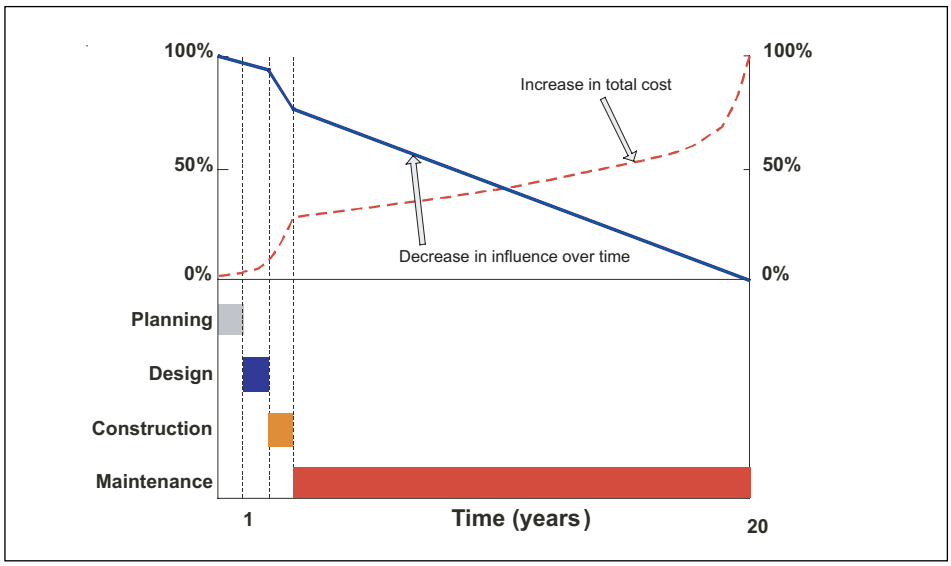

Figure 2 Influence levels of different phases on the total life-cycle cost (adapted from Haas et al 1994)

PLANNING, DESIGN AND construction activities have traditionally been the main focus in actual practice and consequently also formed the focus of undergraduate training and education of civil engineers. 'Upstream and downstream' engineering activities normally tended to be seen as outside the realm of civil engineering, as they were deemed less technical and analytical than hard-core 'mid-stream' focus areas.

But the civil engineering industry has experienced a paradigm shift in recent years in a number of ways. One of the most significant has been an appreciation of the full life-cycle cost and associated maintenance and management of civil engineering fixed asset infrastructure.

The recent shift of emphasis towards an increased involvement in 'upstream activities' (such as pre-feasibility and feasibility) and 'downstream activities' (such as management and closure) is clearly illustrated in figure 1. If these activities were to be shown on a time scale over the whole life of a fixed asset, the 'downstream activity' of maintenance and management in particular would take up to 95 % of the whole life of the fixed asset. The largest portion of the life of fixed asset infrastructure therefore deals with the maintenance and rehabilitation of the facility and represents a present worth of cost which will usually be larger than the initial construction cost. Typically it results in up to 70 % of the total cost of the life-cycle of infrastructure assets and is illustrated by a hypothetical situation depicted in figure 2.

MAINTENANCE AND REHABILITATION OF FIXED ASSETS

The maintenance and rehabilitation of fixed assets have traditionally been neglected in undergraduate training and education. Even at postgraduate level this aspect has been a Cinderella-type subject until recently.

Concepts such as fixed asset management, infrastructure asset management, asset life-cycle costing and management, and integrated infrastructure management and maintenance are increasingly becoming buzz words in this field. It shows a growing awareness of the importance of the life-cycle maintenance, rehabilitation, closure and management needs of civil engineering-type fixed asset infrastructure.

Commercialisation of infrastructure asset management is a clear indicator of the paradigm shift in this field in South Africa and abroad. The all-in-one model of owner, manager and maintainer of fixed assets is largely seen as ineffective and inefficient. The newfound openness to possibilities of commercialisation and even privatisation has led to the development of innovations such as build, operate, maintain and transfer concessionaire models. Such concessions have found application in South Africa in areas such as toll roads, water networks and supplies, and the building and management of prisons and other government facilities.

THE NEED

Having identified the need for education and training in this field, major industry roleplayers such as Spoornet, Sasol and (the then) Iscor approached the School of Engineering at the University of Pretoria (UP) for a master's programme in asset maintenance and management. Based on input from these roleplayers, the Master's in Engineering Management (MEM) and Master's in

SHORT COURSES

A number of short courses have been developed specifically for the railways environment by the Chair in Railway Engineering at UP. Briefly they are the following:

- *Introduction to Multidisciplinary Concepts in Railway Engineering* covers the principles applicable to the various fields of railway engineering and gives a general background to the functioning of railway transport systems. The course develops an appreciation for the complexities and multidisciplinary interrelationships of the railway system.
- *Advance Concepts in Railway Infrastructure Maintenance* details concepts used in the maintenance of railway infrastructure. It covers the best practice philosophies used in railway infrastructure maintenance to the different railway-engineering fields and develops an integrated approach to maintenance resource optimisation.
- *Best Practice for Wheel and Rail Management* is based on the manual published by the International Heavy Haul Association (IHHA) in 2001. It draws on information presented to 16 international IHHA conferences and technical sessions between 1978 and 2000. This was integrated with the latest knowledge with the assistance of the IHHA's International Review Panel under the guidance of its Technical Review Committee. The course assists in investigating the root causes of wheel and rail damage and understanding the wheel/rail system. It provides a systems approach to wheel and rail management.
- *Geotechnical Aspects for Railway Engineering* covers the principles and functions of the layered-track foundation system, discusses its drainage and failure modes, and explains how these relate to track performance. Various case studies are included. Fundamentals of the railway track substructure are discussed, as well as problems and solutions related to its interaction with the track.
- An additional course is being developed and will be presented in 2005. *Railway Asset Management* will introduce the general principles of railway asset management. The course will cover the key aspects of the management of a railway asset with a life-cycle and will discuss railway asset management as part of a system and of the business plan. It will develop an understanding of the appropriateness of the design of the railway system that the maintenance engineer and/or manager is managing to the existing and future business needs together with the development of life cycle maintenance plans and the ability to adapt it to changing business requirements. The course is developed in conjunction with Spoornet and the International Union of Railways (UIC).

These short courses form part of a portfolio of railway-specific multidisciplinary courses that are designed to develop into a fully-fledged Railways Asset Management (RAM) course. The RAM course will pitch at master's degree level and has the support of the international railways fraternity.

Project Management (MPM) curricula were restructured to offer a Master's degree in Asset Management (MAM) comprising three domains of specialisation: asset management (mainly focusing on moveable assets), the maintenance of fixed assets, and management and life-cycle engineering. These three areas have the same core modules as the original MEM and MPM, but have different, domain-specific modules.

No purpose-built undergraduate, postgraduate or short course in this specific niche area is currently available in South Africa.

The proposed specialist asset maintenance and management MEM and MPM degrees do offer the opportunity for inclusion of other fields of interest, for example specialist Railway Asset Management (RAM) courses.

For short courses to be presented in 2005, see the advertisement below. All these courses qualify as 16 credits for domain-specific modules in the fixed asset domain.

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Compiled by Pieter Louw

Railway civil engineers who served as presidents of SAICE and its forerunners

RAILWAY CIVIL ENGINEERS played an enormous role in the development of the vast South African rail network, and in the past 100 years no fewer than 23 of these men served as presidents of SAICE and its institutional forerunners. Although three of them, Jeremia Jennings, Dirk de Vos and Ron Watermeyer, had already moved on to other fields of interest within the profession by the time they were elected presidents of SAICE, it was as railway civil engineers that they had made their first contributions to the profession.

The presidential addresses of this formidable body of past presidents from the railway engineering fraternity yield interesting comments and snippets of wisdom that still have bearing on the broader civil engineering profession today.

John Brown (1903)

John Brown, first president of the Cape Society of Civil Engineers, was in the employ of the Cape Government Railways, eventually becoming Engineer-in-Chief: 'This Society is destined to supply a want which has long been felt by members of the profession in this country, that is, a means of meeting together to rub shoulders and knock off any angular points which exist.'

Alan Grant-Dalton (1905)

At the time of his election as president, Alan Grant-Dalton had succeeded John Brown as Engineer-in-Chief of the Cape Government Railways: 'The days of guessing and rule of thumb have gone. For a young engineer to be successful he must continue to keep himself thoroughly well informed on the progress made in whatever special branch of engineering he may decide to adopt, and the helping hand of one who has already climbed successfully is not to be despised.'

Arthur M Tippett (1908)

With the establishment of the Union of South Africa in 1910, Arthur Tippett became Chief Engineering Advisor of the newly formed South African Railways and Harbours (SAR&H). He appealed to society members to continue presenting professional papers at their monthly meetings. 'Any work, no matter how small, has a professional interest, and is worth recording. What may appear of little moment and less interest to me may be just the work on which some other engineer is seeking information.'

Harry H Elliott (1910)

Harry Elliott expressed concern about unqualified and incompetent men practising civil engineering and about the fact that there was no law against such practice. He advised members to 'form a very strong Society of thoroughly competent men, whose opinions will be respected, looked up to and sought, not only by the public but by the Government, and in the course of years the public will be educated to the fact that it is in their own interests to employ men whose opinions and advice have stood the test of time'.

Alan D Tudhope (1912)

As Maintenance Engineer with the Cape Central Railways Alan Tudhope said that 'the Maintenance Engineer has a great variety of more or less interesting problems to deal with in his daily occupation, so that to him it is not merely a question of supervising the packing of sleepers and provision against wear and tear and senile decay of sleepers, rails and fastenings'.

James Mackenzie (1915)

James Mackenzie saw a great future in agriculture and promoted the provision of bulk storage facilities for grain, as well as the bulk transportation of grain by rail. Coupled to this was the need for irrigation works without which the country could not advance agriculturally: 'It must be realized that the destiny of the country and of the engineer is wrapped up together. For instance, without irrigation works this country cannot advance agriculturally.'

Mansergh D Robinson (1918)

Mansergh Robinson supported the change in gauge from 4 ft 8 in in to 3 ft 6 in, basing it on sound economic principles. At the time the prosperity resulting from the discovery of gold and diamonds could obviously not be foreseen. He said that 'it is quite justifiable for a State to undertake any public work even though it may not in itself promise an immediate or direct profit, provided it is a means of increasing the prosperity and promoting the development of the State'.

Major Angus J Beaton (1923)

Major Beaton, who wrote numerous papers on railway engineering, avidly encouraged the presentation of papers. He made an appeal for the establishment of a fund to award a medal to the authors of best papers: 'There must be a considerable mass of really valuable information buried in the notebooks of many investigators, or relegated to the mausoleum of forgetfulness, which, if published, would advance human knowledge in many directions.'

Theodore H Watermeyer (1926)

Theodore Watermeyer, who became General Manager in 1933, elaborated on engineering education and the prospects for civil engineers in this country, and added: 'I would say to the young engineer, at all costs do not neglect your general education, including literature and art. It gives one a wider outlook on life and broadens one's views. The engineer does not have to deal entirely with dry mathematics and formulae, as so many suppose. A good deal of his time is taken up with the genus "homo sapiens" with all his faults, weaknesses and vagaries.'

Robert C Wallace (1929)

Robert Wallace, who became Chief Civil Engineer in 1920, advised younger engineers on how to go about the surveying of routes for proposed railway lines in rugged countryside: 'In more difficult country locomotion may be on horseback or on foot. It may then be necessary to run traverses with a light tacheometer with say a 3 in circle through any particularly difficult portion of a possible route. Before commencing any inspection or survey, it is advisable to call on resident landowners to solicit their advice and assistance. The South African farmer usually has a very good idea of locating a road, and his local knowledge is always of value.'

George H Whitehouse (1935)

George Whitehouse, who became Chief Civil Engineer in 1930, said: 'The profession of a civil engineer is a calling which adds to its achievements year by year. It is a profession whose rules and conduct are rarely broken by any of its members. It is a profession where character and what is accomplished stand for more than cleverness. It is a profession whose foundation and being is to do service to the community, to harness the forces of nature for the use and convenience of man.'

William A Moyers (1940 and 1941)

Assistant General Manager (Technical) William Moyers voiced his concern that, while their efforts influence everyday life and play a large part in the development of the country, properly qualified civil engineers were not protected in South Africa. 'The medical profession is closely controlled and the legal profession is also fully protected. Can there be any doubt then that in the interests of

the public and of the profession similar safeguards for properly qualified men should be applied to engineering?'

F S de V von Willich (1942)

Starting off with the Cape Government Railways in 1901 as an assistant draughtsman, F S von Willich retired as Chief Civil Engineer of the SAR&H. His presidential address concerned the development of transportation from Babylonian times, also covering the development of rails, gauge and sleepers over the centuries: 'The railway is a specialized form of road, designed to carry heavy loads, and with a low resistance to traction; and also allows speed in the case of railways designed for public transportation.'

William Marshall-Clark (1948)

William Marshall-Clark, General Manager of the South African Railways, said: 'I do not think there is any other country in the world which owes its development as much to overland transport as does South Africa. The reasons for this are due, firstly, to the complete absence of navigable rivers, and secondly, to the fact that the mineral wealth of South Africa is located deep in the interior.' He also predicted future severe road congestion in Johannesburg. 'Consideration should be given to the construction of a railway, largely underground, to serve the Alexandra Township in the northern suburbs of Johannesburg. Whenever traffic, whether passenger or goods, is really heavy over a definite route and period, rail transport is the most economical and efficient.'

Alfonso F Bruyns-Haylett (1950)

In his presidential address Alfonso Bruyns-Haylett, who pioneered the 1 920 ft (585,2 m) continuously welded rail, spoke mainly about the development of aerial photography and its use in the location of railways, as well as of the economics of railway location: 'Any engineer can complete a job where money is no object, but the true criterion of an engineer is the completion of work at the minimum cost without detraction from the soundness of the job. In order to accomplish this, first class organization and accurate estimates are essential.'

Pieter J Louw (1953)

Pieter Louw became Assistant General Manager (Technical) of the SAR in 1950 and president of the Institution in the year of its 50th anniversary. In his address he made mention of the considerable development of the railways by comparing 1903 figures to those of 1951: 'The heaviest engine in use at the time (1903) was the Reid 10 with a tractive effort of 28 274 lb compared to the present-day performance of the GL Garratt with a tractive effort of 78 650 lb. It is noteworthy that the number of engines has only doubled in the fifty years, but they were able to haul over seven times the total tonnage of goods and nearly eight and a half times the number of passengers.'

Henry R Moffatt (1956)

Yet another Chief Civil Engineer who served SAICE as president was Henry Moffatt. He stated that it was not generally recognised how the economy would suffer if engineers and scientists were not available: 'Besides fundamental training in the engineering sciences, a good engineer must also develop other qualities which are in some respects equally as important. He must be an organizer and planner, a leader of men and an administrator, and he must appreciate the fundamentals of statistics and finance … We as engineers are often responsible for the expenditure of very large sums of money for the raising and maintenance of the present standard of living and we therefore carry a big responsibility in the life of the country, both for the present and the future generations.'

Jeremia E B Jennings (1958)

Jeremia Jennings stated that 'civil engineering undertakings deal with the use and control of three groups of materials. The first comprises the structural materials (eg steel, concrete, timber, stone) which may be controlled by specification and tests, and the science of their behaviour and use is known as "theory of structures". The second is water and its use known as "hydraulics". The third group consists of the rocks and soils of the earth's crust upon which every civil engineering structure must be founded and the science of these geological materials is known as "soil mechanics". These three subjects form the basic disciplines in civil engineering.'

Frederick Jackson (1964)

As SAICE president, Frederick Jackson was involved with the negotiations that would eventually lead to the registration of professional engineers. In his address he shared his views on the traffic congestion in Johannesburg: 'During peak hours a greater number of people enter the city from the east and west than from the north, but in spite of this the congestion here is not nearly so great, seemingly because workers from the east and west make use of rapid rail transport. I think the planning of rapid transit routes in our larger cities should be proceeded with as soon as possible if a satisfactory means of rapid transit is to be available to future generations.'

Archibald M Steel (1966)

Archibald Steel effected the introduction of technical aids for engineers through the introduction of the post of engineering assistant on the South African Railways on an organised basis of education, training and employment with clear avenues of advancement in the service. By the time he was elected president of the Institution, he was also Chief Civil Engineer. He pointed out the importance of educating the public who did not seem to grasp the science and scope of civil engineering: 'Civil engineering is the practice by which man started organised human society, the foundation of his civilisation and the practice by which he has continued to advance.'

Dirk de Vos (1969)

In his address Dirk de Vos elaborated on the challenges that were presented by the Professional Engineers Act No 81 of 1968, which resulted in

During peak hours a greater number of people enter the city from the east and west than from the north, but in spite of this the congestion here is not nearly so great, seemingly because workers from the east and west make use of rapid rail transport. I think the planning of rapid transit routes in our larger cities should be proceeded with as soon as possible if a satisfactory means of rapid transit is to be available to future generations …

the formation of the South African Council of Professional Engineers. About career guidance he said that 'it is imperative that the Institution ensures that career guidance teachers are well-informed concerning engineering in general and civil engineering in particular, and that their libraries and career files are stocked with the right type of literature. We simply have to move out of our beloved back rooms and ensure that the profession and the works of civil engineers are widely publicized.'

Hendrik Loots (1984)

Having reached the position of Deputy General Manager (Transport Media), Hendrik Loots retired from the SAR in 1983, becoming president of SAICE the following year. His address urged engineers to 'plan, prepare or perish. The civil engineer must make a contribution to reduce the effect of inflation by working smarter – using his skills and expertise, innovation, initiative and training. Training is most important.'

Ron Watermeyer (2004)

Ron Watermeyer's address focused on a sustainable lifestyle for the 21st century. 'Civil engineering professionals need to adopt a broader view on what constitutes sustainable development and change their mindset to provide solutions that satisfy sustainable development objectives. They need to find ways to provide construction works that do as little harm as possible to the environment while providing a higher quality of life for the current generation, without compromising future generations. This necessitates the adoption of ethical values based on sustainable development imperatives. Sustainable development is a journey and not a destination.'

Acknowledgment

David B Botha, *Foundation for the future – civil engineering in South Africa*. □

AFRICAN BUSINESS ROUND-UP

THERE'S BEEN A LOT GOING ON in Africa lately. On the trade and economic fronts, the Egyptian government is privatising the Bank of Alexandria. The IFC acquired a minority stake in the Africa Reinsurance Corporation while Absa acquired a 50 % controlling stake in Banco Comercial Angolano. Tanzania hopes to increase its sugar output by 19 % in the current financial year. Egyptian exports were worth US$7,695 billion in 2004, a 24 % increase on 2003, and could increase further as JAC is to assemble Russian UAZ 3163s, Gazelles and Sobols vehicles in Egypt. The EU has banned beef imports from Swaziland. The tourism authorities of Uganda and Kenya have spelled out expansion plans; meanwhile, US tourists visiting Kenya increased by 50 % in the first three months of 2005. Safmarine won the Lloyds Loading List Schedule Integrity Awards for its UK services to South Asia, South and West Africa and South America. The strong exchange rate is causing problems in the Namibian fishing industry.

Turning to energy and chemicals, the Egyptian government is privatising the Egyptian Fertilizers Company SAE and Libya's Sirte company is advertising for companies to build a gas pipeline and compression facilities. Shell, BP and Gulf Keystone were each awarded exploration blocks in Algeria. Sasol is to provide technology and finance for a US$1,7 billion GTL plant in Nigeria. The NNPC, ChevronTexaco, BG and Shell signed an MOU covering the Olokola LNG project in Nigeria. Equator and Peak Petroleum Industries Nigeria signed an agreement to develop two oil and gas discoveries offshore Nigeria. Premier Oil announce an oil discovery in Egypt while India's Videocon Industries is to invest US$100 million for a 76 % stake in an oil field in Sudan.

In the electrical sector, South Africa's DME has called for expressions of interest in building and operating thermal power stations. Nigeria is to construct gas turbine power plants in seven states and a hydro-power plant in Mambilla, Adamawa State. Installation has began of a new 50 MW thermal electricity-generating plant in Uganda where the government will also provide about Sh2,6 billion to Kilembe Mines to extend power to rural areas in the Kasese district. Electrification of Zambia's Kaputa district is to start by mid-June.

In mining and minerals, South Africa's gold production fell by 8,8 % to 342,7 tonnes in 2004, the lowest level of gold production since 1931, and 2005 could show a further fall as more marginal mines are closed. Albidon reported a new gold discovery at Nefza, Tunisia. Pan Palladium (PGM, South Africa), Cassidy Gold (gold, Guinea), Randgold Resource (gold, Mali), Mount Burgess (diamonds, Namibia) and Jilbey Gold (gold, Burkina Faso) all reported positive results on their projects. Impala (platinum, South Africa), African Copper (copper, Botswana), Cream Minerals (diamonds, Sierra Leone) and Sunridge Gold (gold, Eritrea) have kicked off new projects. The Botswana government renegotiated its Debswana contract with De Beers. Barrick Gold and Falconbridge finalised a joint-venture agreement regarding the Kabanga nickel deposit in Tanzania.

In the finance arena, the World Bank has granted US$2,92 million to help Morocco fight iron deficiency anaemia and US$25 million to the Kenyan government for its anti-corruption campaign. The African Development Bank is to provide Sh2 billion for a new Kenyan rice project. The IMF completed the fourth review of Rwanda's Poverty Reduction and Growth Facility. US companies Auerbach Grayson and Falcon Management have made investments worth US$5 million in Zambian companies listed on the Lusaka Stock Exchange.

Still on projects, Mauritius is to embark on a light rail transit project. The Nigerian federal government has approved about N11,7 billion contracts for the provision of water, healthcare, power, civil service and prison reforms and roads while Kwara State government has signed a contract agreement worth N826,3 million for the design, expansion and refurbishment of the Asa Dam. Econet Wireless Kenya will spend US$500 million to roll out its cellphone service in Kenya over the next five years. Kenya is to upgrade six airports. Disa Vascular has secured R13 million from the Industrial Development Corporation to expand its local manufacturing capacity. The South African government will invest R193 million over the next three years to develop national and transfrontier parks. The Global Fund on Aids, TB and Malaria has called for proposals for African projects.

On the political front, Ecowas member states have agreed to implement a uniform external tariff structure in the region. Botswana and Mozambique signed two bilateral agreements, one abolishing the visa requirement between the two countries. South Africa and Mozambique also signed a visa waiver agreement.

Mbendi News

GAUTRAIN UPDATE

THE GAUTRAIN PROJECT, which is one of the largest and probably most exciting transportation projects in South Africa today, and indeed Africa, is making good progress.

Two consortia qualified to participate in the rest of the procurement phase of the Gautrain Project. A the time of going to press, the successful consortium was expected to be announced by the end of May.

- Bombela Consortium consists, inter alia, of Bombardier Transportation (rolling stock manufacturer), Bouygues and Murray & Roberts (construction companies), Strategic Partners Group (Black Economic Empowerment – BEE) and RATP Development (rail operator)
- Gauliwe Consortium consists, inter alia, of CAF (rolling stock manufacturer), Dragados and Grinaker–LTA (construction companies), Tirisano Consortium and Ufudu (BEE) and Metro de Madrid (rail operator).

GAUTRAIN FACTS

- 104 000 passengers per day are estimated to travel on Gautrain
- Approximately 78 new commuter rail coaches will be manufactured
- Approximately 250 new bus coaches will be used
- 3,6 million train kilometres and 674 million passenger kilometres will be travelled per year
- 10,6 million bus kilometres will be travelled per year
- 260 000 concrete sleepers will be manufactured
- 20 000 tons of steel will be required to manufacture the steel rails
- 112 000 m^2 of bridges and viaduct structures will be constructed
- More than 9 000 new parking bays will be required
- 65 road intersections in the vicinity of stations will be upgraded
- 48 000 jobs will be created during construction
- 1 200 permanent jobs will be created once in operation
- More than 1 200 CCTV cameras will be used on the system

The new Gautrain service will run on a 1 435 mm gauge rail track, which is wider than the current RSA gauge rail track of 1 065 mm. This wider gauge is the predominant gauge used worldwide and will allow the Gautrain higher speeds at high levels of comfort and safety.

TARFIX WINS RECOGNITION WITH SABITA AWARD

TARFIX, A MANUFACTURER OF high-quality bituminous road-surfacing materials, have been awarded the South African Bitumen Association (Sabita) Award for Outstanding Achievement in Asphalt Technology 2005 for the development of the 'Chippy' labour-based method of surface sealing roads and sealing gravel roads.

The South African road network consists of approximately 535 000 km of roads, of which only 118 000 km are surfaced. It is estimated that ± 80% of these roads are surfaced by means of single, double or Cape seals. Very often when asphalt roads are maintained this is done by means of the application of a variety of seals, using bitumen or modified bituminous materials. Tarfix's objective of introducing a labour-operated chip-spreading device, the 'Chippy', was to carry out this type of road surfacing by means of labour-intensive methods, without compromising on quality and remaining cost efficient.

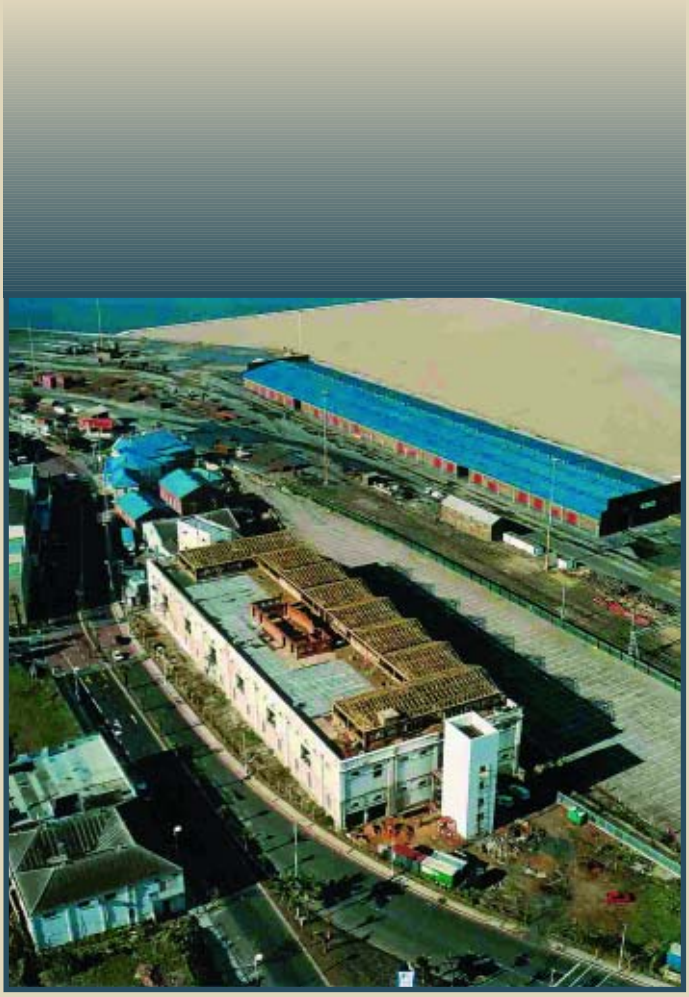
This innovative invention has successfully converted an activity that was previously mechanised into a labour-intensive operation. Where only six labourers were previously required, now at least 65 people are gainfully employed and learning new skills via Tarfix's resurfacing method. The company's hand-operated chip spreader, or 'Chippy', has created enormous job opportunities in the road-surfacing sector and allows for the development of the smaller contractor into this discipline.

Tarfix supply seven provincial roads authorities as well as numerous municipal and local authorities throughout the country, and are regarded as the market leader in the field of cold applied asphalt materials which again has enabled small contractors to develop as road maintenance service providers.

Cost-effective methods of upgrading gravel roads to surfaced roads, using largely in-situ material, must be further explored as a cost-effective alternative to re-gravelling, says Kevin MacKinnon, CEO of Tarfix. Kevin emphasises that the company is dedicated to producing quality products as well as embracing the principles of job creation and skills transfer within South Africa. 'We focus on quality service delivery of our product as well as economic empowerment. To this extent we have always been committed to creating employment and including the small contractor in our projects. Tarfix offers these contractors assistance ranging from training, securing of products and equipment through to technical assistance and project management of appropriate projects and programme,' he says.

Most tenders currently specify disciplines such as clearing and grubbing, grass cutting, drain clearing, fencing and the erection of crash barriers to be suitable for small contractors participating in larger roads projects. 'Our aim at Tarfix,' says MacKinnon, 'is to develop small contractors beyond these menial activities into reliable service providers at all levels.'

011–708-4794
tarfix@mweb.co.za



An aerial view of the site where Protekon will construct the new rail terminal, between harbour sheds and the Queen's Warehouse in Point Road

NEW DURBAN PORT RAIL TERMINAL

AFTER THE DURBAN PORT development plan had identified a need to construct a rail terminal within the proposed Mutipurpose Terminal in the Port of Durban, Protekon was appointed by the National Ports Authority (NPA) to undertake the design and construction of the new terminal near the existing harbour sheds to facilitate the transfer of bulk cargo from rail to road and vice versa.

The revised scope of work includes the following:

- A new rail link to provide rail access to Berth A. This rail link – together with a road access – is to be maintained for the full duration of the contract period
- Uplifting of existing trackwork for the proposed terminal (2 800 m)
- Demolition of existing buildings
- New trackwork within the Cato Creek rail yard (1 100 m of ballasted track)
- Four new concrete crane beams with new S60 rail, approximately 390 m long
- Five rail tracks (25 truck lengths each). Three of the tracks are to be built on track slabs. The one line will be used to facilitate rail-shunting movements from Cato Creek Yard
- The terminal will be predominately operated by the gantry cranes. Forklifts will be used for odd loads only
- The central rail tracks are to be built on ballast. This ballast profile will act as a drainage medium
- A pipe and chamber system for future communication cables
- Protection of existing services during construction
- New power supply to gantry cranes
- Repositioning of existing high mast lights, and
- A new link road from the terminal to Shepstone Road

The refurbishment, installation and commissioning of gantry cranes from Pier 1 will be done in stages.

This aspect of the project is being funded by South African Port Operations (SAPO).

John Powell
031-361-6072

Interior of the MHA workshop of SAPO provided by Protekon at Maydon Wharf, Durban Port

NEW SAPO MAYDON WHARF WORKSHOP CONTRACT COMPLETED

A MODERN FACILITY FOR the Maydon Wharf Mechanical Handling Appliances' (MHA) maintenance and servicing division was recently completed by Protekon. The new workshop and support facilities will be used for servicing and maintaining the large forklift and reach stacker fleet operated by SAPO in Maydon Wharf at the Port of Durban.

Protekon Port Solutions was tasked by SAPO with relocating the existing MHA Workshop to the new site at the corner of Jenkyn and Shadwell roads in Maydon Wharf, after the existing site was earmarked for future development.

Yolanda Sim, Protekon's Registered Engineering Technician, says the project was multi-disciplinary with input from Protekon's Engineering Services, Architects, Quantity Surveyors, Electrical Engineers and Construction. Protekon Engineering Services performed the project management function.

The designs had to allow for access by 70 t forklifts (measuring 10 m x 4 m, with 8 m high masts) and 45 t reach stackers (measuring 8 m x 4 m and capable of stacking up to five containers on top of each other). Consequently the entrance had to be 8,5 m high.

The project was divided into three phases. The first two phases concentrated on clearing the new site and upgrading the existing buildings; the third focused on providing a new workshop and fuelling area. The construction of the workshop and ancillary facilities comprised the following:

- A 175 m^2 workshop area with reinforced concrete floor, 1,5 m deep services pit and a wash bay
- A steel portal frame structure with aluminium sheeting, polycarbonate sheeting strips and 1,5 m diameter round aluminium louvres
- A new compressor room, attached to the main building
- Oil silt separator with skimmer
- Reinforced concrete fuel bund, bowser and fuelling slabs, with specially designed bollards and canopy, and
- Various services including domestic and fire water supply, compressed air lighting and electrical services, welding points, fire-fighting equipment, storm water system and an effluent pipe system

The area around the building was surfaced with crusher run base and asphalt wearing course.

Sim said one of the biggest challenges was relocating or accommodating underground existing services ('some of which were not anticipated') unearthed whilst excavating in the area of the new workshop. These include fibre optic, Telkom, and electrical-cable sleeves. Various alterations to the structures had to be made to accommodate these services.

'Another challenge was to carry out all the construction work in an operational area traversed by, among others, the 70 t forklifts and 45 t reach stackers – programmed only to serve their client needs.'

The construction work was recently completed.

John Powell
031-361-6072

INFORMATION SHARING TO ACCELERATE PROJECT DELIVERY

THE RECENT INFRASTRUCTURE-RICH development budget from Minister of Finance Trevor Manuel could see the collaborative capacity of civil engineering firms being tested.

Proposed projects include:

- The Berg River water scheme in the Western Cape and more development of the Olifants River and Groot Letaba River dam systems in Mpmulanga
- The construction of hydroelectric pumped storage scheme at Braamhoek and two coastal gas turbines
- Upgrading the COALlink line to Richards Bay and the Sishen–Saldanha link
- Investment of about R27 billion in electricity transmission and distribution networks over the next five years

In addition, a R21,2 billion municipal infrastructure grant over the next three years aims to eradicate backlogs in township roads, water and community centre projects. The proposed provincial infrastructure grant is R13,2 billion for roads, schools and clinics.

The scale of some of the projects, stringent BEE requirements and government's focus on accelerated project delivery are likely to see firms coming together in consortiums.

The structure of these groups should be focused on accelerating project delivery, not impeding it.

That's the view of Helen van der Schyff, business development manager at design software company, Autodesk.

She says consortiums limping along with outdated software will find it difficult to cope with the demands of collaborative projects.

Van der Schyff says design intensive consortiums require software that will help them share information quickly, accurately and securely.

Never before has Autodesk's general design software, AutoCAD, featured such strong collaboration tools. The new AutoCAD 2006 features eTransmit, which groups and delivers multiple DWG and related files to multiple recipients with all the information (xrefs and fonts).

Helen van der Schyff
011-805-1555
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SCT COURSE IN REINFORCED CONCRETE ANALYSIS AND DESIGN

FOR THE FIRST TIME EVER, the Cement and Concrete Institute School of Concrete Technology (SCT) will be presenting a two-module course in structural reinforced concrete design aimed at practising engineering graduates.

For the convenience of students, both modules will be presented after hours at the SCT in Midrand. Delegates may elect to register for both parts in succession or for one module only.

Part 1, Reinforced Concrete Basics, will run from 29 August to 10 September. This includes principles of limit state design, structural analysis, design of beams for flexure and shear and design for serviceability.

Part 2, Design of Reinforced Concrete Structures, will follow from 24 October to 5 November and includes specialised subjects such as two-way edge supported slabs, punching shear, torsion, design of stairs as well as prediction of crack widths and deflections.

The course will be presented by two structural engineers – Dr Vernon Marshall and Dr John Robberts – both experienced lecturers and authors of numerous publications on their subjects. A comprehensive design guide explaining all aspects covered in the course is included in the course fee.

The cost of each module is R3 000 (excl VAT).

Bookings and Enquiries
Zoë Maré or Rennisha Sewnarain
011-315-0300
sct@cnci.org.za

HIGH SPEED WITH RITTAL KNOW-HOW

AS OF 2007 A HIGH-SPEED LINE shall connect the cities of Amsterdam, Rotterdam, Brussels and Paris. The railway line makes it possible that passengers will be carried in future with a speed of 300 km/h.

To realise this major project the Dutch government has instructed, among others, Siemens. The global player trusts in Rittal know-how in the field of power distribution and tunnel safety and applies 309 Rittal enclosures in the four tunnels.

The construction of the 'Hoge Snelheidslijn' is one of the major infrastructure projects in the Netherlands. The high-speed line shall reduce travel time from Amsterdam via Rotterdam, Antwerp and Brussels to Paris to a maximum of three hours.

Over the medium term this project aims at connecting the Netherlands to the European high-speed railroad network. The first section of this project comprises the connection Amsterdam–Brussels and will be realised by the consortium of Infraspeed BV, Siemens Niederlande NV. This railway line goes through four tunnels in which specially equipped tunnel enclosures will be installed for power distribution and safety support. Each tunnel has two tubes that are divided by a partition wall. The enclosures are mounted in special niches every 300 m or partly directly on the tunnel wall in short distance (approximately 2,5 m) to the line.

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CONCRETE SKILLS FOR THE DESIGNER AND CONSTRUCTION SUPERVISORS

THE TRAINING DIVISION of Contest Concrete Technology Services is nearing completion of what the company says is the first national skills development programme in practical concrete technology prepared in the outcomes-based format required by CETA (Construction Education and Training Authority).

Bruce Raath, head of the Contest training division, said: 'A request for registration of the skills development programme was sent to CETA several months ago after a plea for the development of such programmes was made by the training authority. The KwaZulu-Natal office of CETA has indicated that the learner material completed to date was written in the correct format, but no reply has as yet been received from the CETA head office. Application has also been made to the Engineering Council of South Africa (ECSA) to have the courses accredited for its Continuing Professional Development programme.'

Raath says the learner material is written for a Level 4 learner – which would correspond to matric, early university or technikon – and would be ideal for those in a supervisory capacity on a construction site. When accreditation is received from CETA, it will be possible to award credits to competent candidates towards the attainment of the National Certificate: Supervision of Construction Process (SAQA Reg 49053).

Antoinette Marais, Contest Training Manager, remarked: 'We have had amazing success with our subject-specific, one-day training courses and also the courses run by us under licence to the Cement and Concrete Institute (C&CI). In fact, the courses have been oversubscribed and had a waiting list on occasion. We will advertise and start running the Concrete Supervisor's skill programme as soon as it is completed and will award credits to candidates as soon as CETA registration is achieved. Our aim will be to run courses in the evenings or over weekends to accommodate the needs of supervisors who cannot be released from site during working hours.'

Raath, an external examiner for the University

of KwaZulu-Natal for many years, added: 'The Concrete Supervisor's course will be the first of many, and the popular, one-day courses on subject-specific topics will be rewritten into the CETA format to satisfy the requirements of unit standards already registered by the SA Qualifications Authority (SAQA). The course currently under preparation will be adapted to suit the requirements of candidates at higher levels, but the content already exceeds the university concrete materials syllabus because of the time constraints imposed by the volume of work that has to be covered in those qualifications. Candidates at lower levels who work daily with concrete will also be catered for.'

He added that all current Contest training material satisfied the draft requirements created by ECSA for CPD development, which is now compulsory for all Professional Engineers. 'Confirmation from ECSA that credits may be awarded is awaited shortly. It is indeed gratifying to see the growing number of professionals and site staff who have already attended the Contest one-day and C&CI courses and have been awarded certificates.'

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www.contest.co.za

PROTEKON HANDLES PORT OF CAPE TOWN REEFER EXPANSION PROJECT

FEW PEOPLE VISITING the busy and popular V&A Waterfront realise that not far away – and within the confines of the same port – is the busy Cape Town Container Terminal, a hub of activity 24 hours a day, 362 days a year. In past months, industry has put increasing pressure on the terminal to provide additional stacking capacity for refrigerated containers ('reefers') used for the storage of perishable goods.

SAPO approached Protekon to form part of its project team to design the layout of the new reefer stacking area and also the new empty stacking area.

New stacking space for refrigerated containers at Cape Town Container Terminal provided by Protekon as part of a R34 million SAPO contract

Charles van Wyk, Client Manager for Protekon Port Solutions, Cape Town, said: 'The solution was to consolidate various blocks of terminal land broken up by access roadways into an area large enough to accommodate the required reefer points. This involved the relocation of fuelling and stacking facilities, the demolition of redundant buildings and facilities, the construction of a stacking yard for empty containers and the provision of a new access road. The value of the Protekon portion of the project is about R34 million.'

Construction commenced in October 2004 with the proviso that portions of the reefer points be made available to SAPO from mid-March 2005. Shortly after starting on site – as a result of further pressure from industry – Protekon received a request to bring the provision of these points forward for commissioning at the end of January 2005.

Theunis Steenkamp
031-361-6072

Text **Ron Watermeyer**
FSAICE, FIStructE, FICE

Willie Claassen
FSAICE, FAArb, MIMESA

Differences between GCC 1990 and GCC 2004 arising from requirements to comply with the CIDB Standard for Uniformity in Construction Procurement

UNIFORMITY IN PROCUREMENT documentation can be achieved, provided there is a complete separation in the component documents that make up a procurement document (that is, the conditions of tender, the conditions of contract, the specifications and methods of measurement and payment). Should this be done, different conditions of contract, or for that matter, payment systems, can be used without affecting the remaining component documents.

This approach was proposed in the Green Paper on Public Sector Procurement Reform in South Africa (Ministries of Finance and Public Works, 1997). The Department of Public Works' National Working Group and the Interministerial Task Team for Construction Industry Development endorsed the approach in 1999 and 2000, respectively. This approach to procurement documents is embodied in SANS 10403, 'The Formatting and Compiling of Construction Procurement Documents', and the Construction Industry Development Board's Standard for Uniformity, which is based on the provisions of SANS 10403.

SANS 10403 and the Construction Industry Development Board (CIDB) Standard for Uniformity in Construction Procurement (published in *Government Gazette* 26427 of 9 June 2004) provide a series of standard headings of component documents based on an 'offer' and 'acceptance' process, where the component documents have the meanings assigned in table 1.

The 'General Conditions of Contract for Works of Civil Engineering Construction' (GCC 1990) was developed around one contracting strategy (design by employer) and the SABS 1200 series of specifications for civil engineering works. It was developed on a 'closed system' basis in terms of which each document had to be read in conjunction with the other documents. The management of the works and other constraints relating to the delivery of the works were predominantly embedded in GCC 1990. SABS 1200 provided the remaining requirements for the management of the works and other constraints relating to the delivery of the works as well as the technical specifications and methods of measurement and payment.

SABS 0120, 'Code of practice for use with standardized specifications for civil engineering construction and contract documents', established the manner in which schedules of quantities are to be drawn up and the SABS 1200 series utilised.

GCC 1990 was modified by the Committee of Land Transport Officials and republished by SAICE as the General Conditions of Contract for Road and Bridge Works for State Road Authorities (COLTO 1998). The COLTO version, apart from making some minor modifications to the risks, obligations and liabilities of the parties, removed most of the management requirements and located them in the General Section of the COLTO 'Standard Specifications for Road and Bridge Works for State Road Authorities' (1998). This version of GCC 1990 was designed to be used in conjunction with the COLTO specifications.

The General Conditions of Contract for Construction Works (GCC 2004) replace GCC 1990 and COLTO 1998, satisfy CIDB requirements for a standard form of contract, and are suitable for

Table 1 SANS 10403 definitions of component documents

Tender notice and invitation to tender	Document that alerts prospective contractors to the nature of the supplies, services and engineering and construction works required by the employer and contains sufficient information to solicit a response
Tender data	Document that establishes the tenderer's obligations in submitting a tender and the employer's undertakings in administering the tender process and evaluating tender offers
List of returnable documents	Document that lists everything the employer requires a tenderer to submit with his tender submission
Returnable schedule	Document that a tenderer is required to complete for the purpose of evaluating tender offers or a document which, when a tender offer is accepted, forms part of the subsequent contract
Offer and acceptance	Documents that formalise the legal process of offer and acceptance
Contract data	Document that states the applicable conditions of contract and associated contract-specific data that collectively describe the risks, liabilities and obligations of the contracting parties and the procedures for the administration of the contract
Pricing instructions	Document that provides the criteria and assumptions which it will be assumed in the contract, that the tenderer has taken into account when developing his prices, or target, in the case of target cost contracts
Activity schedule	Document that breaks down the scope of work into a series of activities to allow contractors to be paid a lump sum upon the completion of each of the activities
Bill of quantities	Document that lists the items of work and the quantities and rates associated with each item to allow contractors to be paid at regular intervals an amount equal to the agreed rate for the work multiplied by the quantity of work completed
Scope of work	Document that specifies and describes the supplies, services, or engineering and construction works which are to be provided and any other requirements and constraints relating to the manner in which the contract work is to be performed
Site information	Document that describes the site as at the time of tender, to enable the tenderer to price his tender and to decide upon his method of working and programming

use in procurement documents that are prepared in accordance with the provisions of SANS 10403, 'Formatting and Compilation of Construction Procurement Documents'.

GCC 2004 retains the language, style and ethos of GCC 1990 and COLTO 1998. As such, GCC 2004 retains as far as possible the wording of these documents and remains a form of contract primarily for use in contracts where the contractor undertakes construction on the basis of full designs issued by the employer and bills of quantities are used for payment purposes.

ACCOMMODATING THE PRINCIPLES OF SANS 10403 IN GCC 2004

Definitions, interpretations and general provisions

The following terms are introduced in GCC 2004:

- *Bill of quantities*: The document so designated in the pricing data that lists the items of work and the quantities and rates associated with each item to allow the contractor to be paid at regular intervals an amount equal to the agreed rate for the work multiplied by the quantity of work completed.
- *Contract data*: The specific data, which together with these General Conditions of Contract, collectively describe the risks, liabilities and obligations of the contracting parties and the procedures for the administration of the contract.
- *General items*: Items contained in the bill of quantities which relate to general obligations, site services and facilities or which cover elements of the cost of the work which are not considered as proportional to the quantities of the Permanent Works.
- *Pricing data*: The document that contains the bill of quantities and provides the criteria and assumptions which it will be assumed in the contract that were taken into account by the contractor when developing his prices.
- *Scope of work*: The document that specifies and describes the works which are to be provided and any other requirements and constraints relating to the manner in which the work is to be performed.

It should be noted that:

- The term *bill of quantities* replaces *schedule of quantities*.
- The term *contract data* includes the contract specific data that was previously located in the *appendix* (the document so designated in, and forming part of the tender) and the *Special Conditions of Contract* (any addition to, departure from or amendment of these General Conditions of Contract as set out in the Special Conditions of Contract forming part of the tender documents).
- The term *scope of works* includes *drawings* (all drawings, calculations and technical information forming part of the tender documents (other than information contained in the specifications) and any modifications thereof or additions thereto from time to time approved in writing by the engineer or delivered to the contractor by the engineer) and *specifications* (the document so designated in the tender documents and any modifications thereof or addition thereto made or agreed to in terms of the contract).

The terms listed in table 2 have been redefined.

The term *form of offer and acceptance* is not defined in GCC 2004, as the form is included in the document. The *form of offer and acceptance* is identical to that contained in SANS 294, 'Construction Procurement Processes, Procedures and Methods', and the CIDB Standard for Uniformity in Construction Procurement. It replaces the pro-forma tender and agreement provided for in GCC 1990.

Modifications have been made to the following terms:

- *Contractor*: The phrase 'whose tender has been accepted by or

Table 2 Terms that have been redefined in GCC 2004

Term	GCC 2004 wording	GCC 1990 wording
Commencement date	The date that the agreement made in terms of the form of offer and acceptance comes into effect	The date of delivery to the contractor of a written notice from the employer or the engineer requiring him, in terms of Clause 12, to commence the execution of the works
Contract	The subject of the agreement made in terms of the form of offer and acceptance and such amendments or additions to the contract as may be agreed in writing between the parties	These General Conditions of Contract and special conditions, specifications, drawings, tender, written records of matters agreed after the submission of the contractor's tender, letter of acceptance and agreement executed in terms of Clause 5, together with other documents which the parties have agreed in writing shall form part of the contract and such amendments or additions to the contract as may be agreed in writing between the parties
Contract price	The total of prices provided for in the agreement made in terms of the form of offer and acceptance subject to such addition thereto or deduction there from as may be made from time to time under the provisions of the contract	The tender sum* subject to such addition thereto or deduction therefrom as may be made from time to time under the provisions of the contract

** Tender sum is defined in GCC 1990 as 'the amount of the Tender after adjustment in respect of correction of errors or extension in the priced Schedule of Quantities and changes in the amount concerned or referred to in the Letter of Acceptance or in the Agreement executed in terms of Clause 5'. Tender is defined as 'the Contractor's priced offer to the Employer for the execution and completion of the Works in terms of the Contract, with such modifications as have been agreed upon in writing between the Employer and the Contractor as accepted by the Employer in the Letter of Acceptance, including the Appendix, the priced schedules and any other documents forming part of the Tender'.*

on behalf of the Employer' is replaced with 'named in the Contract Data'.

- *Due completion date*: The term *appendix* is replaced with *contract data*.
- *Employer*: The term *special conditions of contract* is replaced with *contract data*.
- *Engineer*: The term *special conditions of contract* is replaced with *contract data*.

In line with the principle of there being a complete separation between conditions of tender and conditions of contract, the terms *tender, tender documents* and *tender sum* have been omitted.

Matters that relate to material covered elsewhere in a procurement document

Table 3 identifies the GCC 1990 clauses (and subclauses) that cover subject matter other than that pertaining to the scope of work that has not been in included in GCC 2004.

Requirements and constraints relating to the manner in which the contract work is to be performed

Table 4 identifies the GCC 1990 clauses (and subclauses) that cover subject matter that should be included in the scope of works and

Table 3 GCC 1990 clauses that have not been included in GCC 2004 on the grounds they should be addressed elsewhere

GCC 1990 clause 3(1)	Marginal heading Available data	Reason Data must be included in the site information
3(2)	Contractor deemed to have inspected the site	Clause does not belong in contract data. Note that: ■ The tender data (F.2.7) provides for a compulsory site visit if deemed necessary ■ Site information provides the data upon which the contractor can rely in the preparation of his prices ■ Pricing requirements can be inserted in the pricing instructions
3(3)	Contractor to base his tender on the tender documents	Contractor is to price in accordance with the pricing instructions to provide the works in accordance with the scope of works. The claim if circumstances are different from technical information given may be handled in terms of other provisions of GCC 2004, eg Clauses 3, 13, 41 or 47
3(4)	Contractor to satisfy himself as to the correctness of his tender	Clause belongs in pricing instructions, if anywhere
4(3)	Copies of contract document	Matter dealt with in tender data (see F.3.16 and F.3.18)
5	Agreement	Matter dealt with in form of offer and acceptance

references where these items may be found in SANS 1921-1, 'Construction and Management Requirements for Works Contracts: Part 1- General Engineering and Construction Works'.

Table 4 GCC 1990 matters dealt with in SANS 1921-1

GCC 1990		References in SANS 1921-1
Clause	**Marginal heading**	
13(3)	Use of land	4.1.1(j) and 4.9.3
14(1)	Basic survey references	4.1.2
14(2)	Contractor's responsibility for setting out	4.5 and 4.15
14(3)	Errors in setting out*	4.5 and 4.15.3
16(1)	Custody of drawings and specifications	4.1.11 and 4.1.12
16(2)	Contractor's copies	4.1.11
16(3)	Documents to be kept on site	4.1.1(m)
16(4)	Register of drawings	4.1.1(m)
23(2)	Accommodation and care of employees	4.14
34	Signs and lighting	4.14.6 and 4.18

** The claim if survey data is incorrect or for delay in giving survey references may be handled in terms of other GCC 2004 provisions, for example Clauses 3, 13 or 41.*

TO: ALL CORPORATE MEMBERS

NOMINATIONS FOR ELECTION OF COUNCIL FOR 2006

Nomination for election to Council must be accompanied by a Curriculum Vitae of the nominee not exceeding 75 words. According to a 2004 Council resolution, candidates are requested to submit a focus statement. Please see Section C.

The CV will accompany the ballot form and the format of the CV is shown below.

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

Please Note: Nominations received without an attached CV will not be considered.
Closing date: 29 July 2005.
Acceptable transmission formats: e-mail, fax and ordinary mail. All ballots are treated with due respect of confidentiality.

If more than 10 nominees from Corporate Members are received a ballot will have to be held.

If the ballot is to be held, the closing date for the ballot will be 31 August 2005.

Notice of the ballot will be sent out using two formats:

- By e-mail to those Corporate Members whose electronic addresses appear on the SAICE database, and
- By normal surface mail to those members who have not informed SAICE of an e-mail address.

AAN: ALLE KORPORAATLEDE

NOMINASIE VIR VERKIESING VAN RAAD VIR 2006

Nominasie vir verkiesing van die Raad moet deur 'n Curriculum Vitae (van nie meer as 75 woorde nie) van die genomineerde vergesel wees. Volgens 'n 2004 Raadsbesluit, word kandidate versoek om 'n fokusverklaring te voorsien. Sien afdeling C asseblief.

Die CV sal die stembrief vergesel en die formaat van die CV is soos volg.

Afdeling A: Inligting aangaande die genomineerde se bydrae tot die Instituut.
Afdeling B: Inligting aangaande die genomineerde se loopbaan, met spesiale verwysing na posisies in siviele ingenieurswese gehou, ens.
Afdeling C: 'n Kort verklaring van wat die kandidaat wil promoveer/bereik/instel/bydra, of sy of haar belangstellingsveld.

Let Wel: Nominasies ontvang sonder 'n aangehegte CV sal nie oorweeg word nie.
Sluitingsdatum: 29 Julie 2005.
Aanvaarbare versendingsformate: e-pos, faks en gewone pos. Alle stembriewe word behandel met die nodige geheimhouding.

Indien meer as 10 nominasies van Korporaatlede ontvang word, sal 'n verkiesing moet plaasvind.

Indien 'n verkiesing gehou moet word, sal die sluitingsdatum 31 Augustus 2005 wees.

Kennisgewing van die verkiesing sal deur middel van twee formate gedoen word:

- Per e-pos aan die Korporaatlede wie se elektroniese adresse op die SAISI-databasis verskyn, en
- Per normale landpos aan die lede wat aan SAISI 'n e-pos adres voorsien het nie.

D B BOTHA PrEng/PrIng
Executive director/Uitvoerende direkteur
14 April 2005

THE SOUTH AFRICAN INSTITUTION OF CIVIL ENGINEERING

Nomination for Election of Members of Council for the year 2006 in terms of Clause 3.1 of the By-Laws

In accordance with Clause 3.3 of the Constitution, the Council has elected Office Bearers for the Institution for 2006 as follows:

President	**Mr Sam Amod**
President Elect	**Mr N A MacLeod**
Vice-President	**Mr J J de Koker**
Vice-President	**Prof E Kearsley**
Vice-President	**Mr A M Naidu**
Vice-President	**Dr M van Veelen**

In terms of Clause 3.2.4 of the Constitution, the following are ipso facto members of the Council for the ensuing year:

The Retiring President	**Mr M R D Deeks**
The two most recent Past Presidents	**Mr R B Watermeyer**
	Mr M F Allie

Clause 3.1.1 of the By-Laws reads as follows:

'Every candidate for election to the Council shall be a Corporate Member and shall be proposed by a Corporate Member and seconded by another Corporate Member.' Nominees accepting nomination are required to sign opposite their names in the last column of the nomination form.

DIE SUID-AFRIKAANSE INSTITUUT VAN SIVIELE INGENIEURSWESE

Nominasie vir die verkiesing van Lede van die Raad vir die jaar 2006 in terme van Klousule 3.1 van die Regulasies

Ooreenkomstig Klousule 3.3 van die Grondwet het die Raad die volgende Ampsdraers van die Instituut vir 2006 verkies:

President	**Mnr Sam Amod**
Verkose President	**Mnr N A MacLeod**
Vise-President	**Mnr J J de Koker**
Vise-President	**Prof E Kearsley**
Vise-President	**Mnr A M Naidu**
Vise-President	**Dr M van Veelen**

In ooreenstemming met Klousule 3.2.4 van die Grondwet, is die volgende persone ipso facto lede van die Raad vir die komende jaar:

Uittredende President	**Mnr M R D Deeks**
Die twee mees onlangse Presidente	**Mnr R B Watermeyer**
	Mnr M F Allie

Klousule 3.1.1 van die Regulasies lees soos volg:

'Elke kandidaat vir verkiesing tot die Raad moet 'n Korporaatlid wees en moet deur 'n Korporaatlid voorgestel en deur 'n Korporaatlid gesekondeer word.' Genomineerdes wat hul nominasies aanvaar, word versoek om hulle handtekening teenoor hulle naam te plaas in die laaste kolom van die nominasievorm.

NOMINATION FORM 2006 / NOMINASIEVORM 2006

10 Corporate Members 10 Korporaatlede

SURNAME VAN	FIRST NAMES VOORNAME	PROPOSER VOORSTELLER		SECONDER SEKONDANT		SIGNATURE OF NOMINEE HANDTEKENING VAN GENOMINEERDE
		Signature Handtekening	Name in block letters Naam in drukletters	Signature Handtekening	Name in block letters Naam in drukletters	

Please fax this form, together with the CV of the nominee,
to SAICE National Office, for attention Memory Scheepers, by 29 July 2005
Fax number 011-805-5971

Faks asb die vorm saam met die CV van die genomineerde terug aan
SAISI Nasionale Kantoor vir aandag Memory Scheepers, voor 29 Julie 2005
Faksnommer 011-805-5971

Ireland looks to SA to help with engineering shortage

Knowledge Base joins hands with leading Irish recruitment company

WE HAVE ALWAYS KNOWN that our South African engineers rank among the best in the world. It therefore comes as no surprise that countries like Ireland have expressed an interest in South Africa to help address the significant shortages in many of the professional construction occupations. Among the shortages that have been experienced, placements for civil engineers, quantity surveyors and to a lesser degree architect and site managers appear to be most urgent.

Numerous positions within the construction and civil sectors have been identified in Ireland. 'The contractual working periods that have been identified by the client range between one and three years. We welcome applications from our top engineers and look forward to marketing South Africa's best,' says Knowledge Base Recruitment Specialist Yvonne Beebee.

According to Yvonne, ideal candidates should possess a degree in civil or structural engineering with a minimum of three years design experience. Candidates should also have a strong bias towards construction and ideally have some structural experience. Attractive salary packages accompany all positions on offer.

Positions in Ireland include:

CIVIL ENGINEER

The services of a qualified civil engineer are requested for business parks, road projects, transportation studies and related initiatives. The right candidate will be provided with full project management responsibility and salary is negotiable according to the candidate's level of experience. Company benefits are included in the package.

CONSTRUCTION ENGINEER

A structural engineer with at least 3–4 years' experience is requested for a small but expanding consulting engineering practice. Civil experience is preferred with solid building experience in building structures. Salary is commensurate with experience and benefits include pension, health and a parking allowance.

PROJECT MANAGER

Assistant Project Manager required with 1-2 years' experience in a multidisciplinary engineering and construction environment. Candidate should be degree qualified with excellent communication and presentation skills.

QUANTITY SURVEYOR

Senior quantity surveyor required with five years' relevant experience. Must have excellent communication skills.

CONSTRUCTION FOREMAN

A minimum of three years' experience in a similar position is preferred with strong organisational skills. A project management qualification would be a distinct advantage but is not essential. An attractive package is available for the right candidate.

Other positions include draughtsmen, structural steel draughtsmen, construction buyers, architects, architectural technicians, contracts managers, site managers, site engineers, environmental engineers, CAD technicians, estimators, concrete co-ordinators, contracts manager as well as junior, intermediate and graduate quantity surveyors.

Vincent Bester, the Managing Director of Knowledge Base, is extremely pleased with the partnership and views the acquisition of international skills by South Africa's top engineers as a positive step forward.

Interested candidates may visit the Knowledge Base Recruitment website at www.knowbase.co.za or call Yvonne Beebee on 021-701-1850 for further details on the above positions

DIARISE THIS!

Event	Date	Venue	Contact
Handling Projects in a Consulting Engineer's Practice ***Wolf Weidemann***	4–5 August 2005	SAICE National Office Thornhill Office Park Midrand	Lungelwa Lamani*
Business Finances for Built Environment Professionals ***Wolf Weidemann***	9–10 June	SAICE National Office Thornhill Office Park Midrand	Lungelwa Lamani*
Young Geotechnichal Engineers & Practitioners YGE 2005	13–15 June 2005	Swadini Mpumalanga	stephensonl@ebe.wits.ac.za
Concrete Repairs (one day)	14 June 2005	Contest Concrete Technology Services Westmead, Pinetown, Durban	Antoinette Marais Tel 031-700-9394 antoinettem@contest.co.za
Obtaining Environmental Authorization: A Strategy	13–14 July 2005	Midrand	Lungelwa Lamani*
Assertiveness and Conflict Resolution for Managers	2–3 August 2005	Midrand	Lungelwa Lamani*
X-Pert Proactive Management and Planning	15–18 August 2005	Centurion	Lungelwa Lamani*
SAICE Wits/Pretoria Afternoon Lecture Course	3–31 August 2005 7–28 September 2005	SAICE National Office Midrand	Lungelwa Lamani*
Practical Concrete Surface Beds (one day)	23 August 2005	Contest Concrete Technology Services Westmead, Pinetown, Durban	Antoinette Marais Tel 031-700-9394 antoinettem@contest.co.za
Vaalco Conference	19–20 September 2005	Johannesburg	Lungelwa Lamani*
Railway and Harbour Division Symposium	28–29 September 2005	Eskom Convention Centre Midrand	Jill Lubbe Tel 011-873-0200, Fax 011-872-1713 jlubbe@grinaker-lta.com
Landfill 2005	20–21 October 2005	Durban	Peter Davies nphuntpld@kaymac.co.za

** Lungelwa Lamani's details: Tel 011-805-5947; Fax 011-805-5971; llamani@saice.org.za*