

Civil Engineering

Siviele Ingenieurswese

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SAISI SAICE





ON THE COVER

The Gautrain Project is one of largest and most exciting transportation projects in South Africa today and is expected to act as a much-needed stimulus for development. But will the civil engineering profession and the construction industry be able to deliver? See page 6

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As clear as mud ...

TO OUR COLLEAGUES who are far from the traffic and municipal woes that we have to deal with every day in Gauteng ... thank you lucky stars!

Take the new Clearwater Mall and adjacent intersections on the West Rand as an example.

The Mall and Makro are situated on opposites sides of the extremely busy Hendrik Potgieter Road. During the rains last summer the surrounding area was swamped regularly. Now that it is winter and dry, one would hope that the storm-water systems would have been sorted, but no. So when the rains start, the dangerous non-draining intersection area will again add to the woes of nearby house owners and motorists who have to contend with speedsters charging past through ankle-deep water, deluging windcreens.

The phasing of the traffic lights still has not been adjusted in spite of pleas to ...? Is it City Power, the Metro Police, Gautrans, the Johannesburg Roads Agency? Well, who cares? They all live happily elsewhere, while the dying breed of obedient road-users have to deal with the congestion and the resulting road rage and taxi lawlessness.

Gone are the days when you could take your complaints to the old Roodepoort Civic Centre, where you could see all these people more or less in one building. Now we have to address a faceless bureaucracy spread

all over Johannesburg in various buildings. Talk about divide and rule! This must be the most successful disintegration of service to the public that has ever happened!

But to get back to Clearwater and the traffic light phasing where Makro and Clearwater traffic enter Hendrik Potgieter. I wonder what that old Voortrekker, who travelled along his namesake road in an oxwagon, would have thought of more than 60 cars waiting simultaneously at the lights in Hendrik Potgieter, while only five cars, with boots full of purchases that have enriched the (also invisible) managements of Makro and Clearwater Mall, have the green light. In peak traffic motorists on Hendrik Potgieter have to wait for up to three traffic light changes before they can get past these entrances.

And how is it possible that these shopping moguls got away with creating a right-hand-lane speedway that merges to the left with slower-moving traffic about a hundred metres east and west of the intersection?

And those new right-turn traffic lights are creating so much fun. That is, if you can make out that two phases that have to be watched. You need a magnifying glass to see the little arrow that indicates the correct direction. This traffic light has in fact now made it possible for many motorists who fail to see the miniscule signage to do a right turn on red!

Since apparently there was no money

to resurface Hendrik Potgieter along this stretch after the contractors had gone through there, motorists have to negotiate a road surface that is full of joins and patches, while trying to visualise the road markings.

You will see that I do not blame the engineers. I must assume that their budgets were so low and their fees so discounted that they could not do what they would have liked to have done and what they should have done. So who should be thanked for all of this? Prosperous RSA? The could-not-care-less decision-makers? The mall and shop owners? Or the plethora of agencies and privatised government structures somewhere far away?

But there is hope. A few adjustments to the phasing of traffic lights, some road paint, clear arrows below the traffic lights, active and regular education by visible Metro Police, and some drainage and road surface improvements, and this intersection could work! And if City Power could keep the current flowing for more than one day at a time – just one day, PLEASE – we would be happy!

And maybe then those who have died will not have died in vain, and those who were injured on this stretch of Hendrik Potgieter will heal in hope. Those crosses at various places on Hendrik Potgieter must speak to somebody. They certainly speak to me. □

Transportation committee



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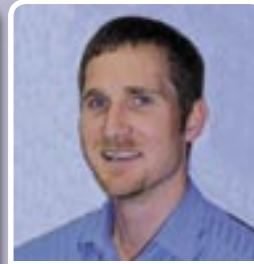
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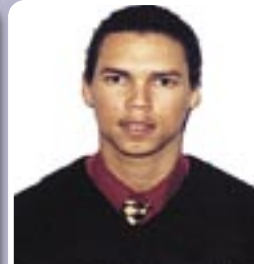
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Message from the chairman of the Transportation Division

THIS ISSUE OF *Civil Engineering* features Transportation. In the September 2004 issue, I referred to the role of the Transportation Profession of South Africa in the next ten years of democracy. This year I want to challenge you as an individual to participate and to build the profession in South Africa.

KEY FOCUS AREAS

The SAICE Transportation Division is the professional home of traffic and transportation engineers, technicians, and technologists. I am grateful for the voluntary efforts of the committee members and the sponsorship of their respective employers. The key focus areas of the division committee are to:

- Provide a mouthpiece for the transportation profession
- Maintain consistent liaison with government
- Provide input in government policies
- Promote the application of scientific planning, functional design, operation, and management of an integrated transportation system
- Promote research and development in transportation planning and traffic engineering
- Promote capacity building and skills development in transportation planning and traffic engineering

QUADRENNIAL

The Transportation Division successfully hosted the Quadrennial conference on 24–26 September 2004 at Bakubung in the Pilansberg. The transportation profession is a major role player in the progress of our nation. After ten years of democracy, the major challenges facing our country are poverty alleviation and job creation. The challenge of the transportation sector is what it could do to create sustainable employment and alleviate poverty. The contribution and role of SAICE and the Transportation Division (and the Railway & Harbour Division) to address these challenges with government were the central theme of the conference. Amongst others, we were graced with the attendance of the MEC for Transport in North West, the Honourable Jerry Thibedi, and the MEC for Transport in the Free State, the Honourable Seiso Mohai. A special thanks to Carla de Jager and the organising committee for their tremendous effort in planning the conference.

Resolutions

The critical conference resolutions are as follows:

- SAICE supports government's vision to halve poverty and unemployment by 2014.
- Transportation has an important role in alleviating poverty through job creation and increasing economic growth (10 % of GDP = R100 billion).
- The profession must motivate politicians to increase spending from 1 % to 5 % on transport infrastructure (R50 billion per annum).
- SAICE and the transportation profession should engage directly with the Department of Transport and provide assistance to the department where necessary.
- Promote engineering expertise, capacity, and accountability at all levels of government.
- There is need for a unified voice in the transport industry.

As a result, the SAICE Transportation Division is engaging with the South African Road Federation (SARF), South African Society for Intelligent Transport Systems (SASITS), the Chartered Institute of Logistics and Transport in South Africa (CILTSA), the organising committee of the South African Transport Conference (SATC), and the South African Academy of Engineers to form a representative body of transportation professionals. In future, this body of representatives will address critical matters in the transport sector with the Department of Transport.

CHAIRMAN'S LUNCHEON

The Transportation Division successfully hosted the annual Chairman's Luncheon on 22 April 2005. Olaus van Zyl, CEO of BKS (Pty) Ltd, was honoured with the Chairman's Award for outstanding service to the Transportation Profession. Approximately one hundred guests attended the function. A special thanks to Marius Kruger from UWP Consulting for organising the function.

DOT

Transportation planners and traffic engineers are instrumental in the formulation of transportation policies and regulations; planning, design, and construction of transportation facilities and infrastructure; and are ultimately the implementing agents of government's transportation policies. The Department of Transport (DOT), with Minister J T Radebe, is the visionary for transportation in South Africa, and the transportation profession too. SAICE and the Transportation Division congratulate the department on its appointment of the new director general, Ms Mpumi Mpfu,

and also welcome the new organisation structure.

GROWTH

In the past many years, the transportation profession complained about the lack of funding for planning and implementation of transportation projects. Recently, the public revealed its frustration with poor service delivery at local government level. The tide is changing. With the progress on the Taxi Recapitalisation Programme, the Gautrain Rapid Rail Project, transportation planning for the 2010 World Cup, and several other spatial development initiatives in South Africa, economic growth is inevitable.

SKILLS

However, the challenge to the profession now is, Who is going to do the work? Research done by Allyson Lawless reveals a serious scarcity of engineering skills in South Africa. President Thabo Mbeki announced in the week of 25 July 2005 the intention to solicit international expertise. On the other hand, it is unfortunate that many white male engineers are being marginalised in the public sector in an era when we so desperately need engineering expertise for service delivery, project planning, and skills transfer! South Africa is also guilty of exporting skills.

In order to sustain economic growth, job creation, and poverty alleviation, we need to produce more engineers and retain such skills in South Africa. The public and private sector must provide opportunity for mentoring programmes for graduates and skills transfer. I am convinced this is one area where the experienced generation of white males could be effective. SAICE is taking on this challenge with government.

Thus, I ask you, 'What have you done for your profession lately?' How about encouraging a learner to persevere with maths and science and to pursue a career in engineering, or sponsoring a student at a technical college or university? What about committing a few hours in the week to mentoring graduate engineers through projects and ensuring the graduate is preparing for registration as a professional?

I want to encourage the transportation profession and allied professions to continue to Make A Difference through capacity-building, skills transfer, and innovation.

'The fight is not necessarily for the strong or the race for the swift.' Shalom!

GAUTRAIN INFO

The Gautrain will comprise about 80 km of new dedicated railway line, which will allow modern, state-of-the-art trains to travel between Johannesburg Park Station, Pretoria Station and Johannesburg International Airport (JIA) at speeds of up to 160 km/h. Except for JIA, all stations will be park-and-ride sites for people to park their cars safely, amounting to some 10 000 parking areas.

The system includes an extensive road-based feeder and distribution system of 560 km, which will provide bus services every ten minutes in the peak running to and from the stations with almost 200 modern air-conditioned buses, using the same tickets as the trains.

The project will be implemented as a public-private partnership (PPP) and includes the design, construction, operation and maintenance, as well as financing, of the complete system. The

Gautrain system will be transferred back to the Gauteng Provincial Government at the end of a concession period. The concession period consists of a 54-month construction period followed by a 15-year operating period.

Construction commencement is targeted for the end of 2005, after the current negotiations have been completed. The construction period means that the Gautrain will be operational just before the Fifa Soccer World Cup in 2010.

Potential impact of the Gautrain Project on civil

ON 2 JULY 2005, the Gauteng Premier, Mr Mbhazima Shilowa, announced that the Bombela Consortium had been selected as the preferred bidder on the Gautrain Project.

The announcement followed an extended bidding period with best-and-final offers submitted early this year by Bombela and Gauliwe, and a comprehensive evaluation of these. It also followed a number of milestones in the approval process for the project.

The Gautrain Project is one of the largest and probably most exciting transportation projects in South Africa today. The project has a number of important strategic objec-

tives. It will play an important role in stimulating economic growth, in relieving traffic congestion, in promoting public transport, tourism and public-private partnerships and in changing the culture of public transport usage in South Africa. Above all it will be responsible for creating 148 000 direct and indirect jobs. The project was specifically designed to maximise the economic development opportunities around the project, and to act as a stimulus for development.

The question naturally arises what the impact of the Gautrain would be on civil engineering, civil engineers and the civil construction industry.

THE STATUS OF CIVIL ENGINEERING IN SOUTH AFRICA

The difficulties experienced during the past two decades by the civil engineering profession and the civil construction industry are well known amongst engineers. The lack of macro engineering projects and insufficient continuity in the levels of construction in South Africa during this time has created many problems for this industry. The capacity of the civil engineering industry has suffered as a consequence.

Information kindly provided by Allyson Lawless, who recently completed comprehensive research on the civil engineering

BOMBELA CONSORTIUM AT A GLANCE



BOMBELA MEMBER COMPANIES

Shareholding in the Bombela consortium:

■ Bombardier	25 %
■ Bouygues	25 %
■ Murray & Roberts	25 %
■ Loliwe Rail Contractors	16,5 %
■ Loliwe Rail Express	8,5 %

Bombardier

- Corporate office based in Montréal, Canada
- Workforce of some 59 550 people worldwide as at 31 January 2005
- Revenues of US\$15,8 billion for fiscal year ended 31 January 2005
- More than 95 % of revenues generated outside Canada
- Listed on Toronto Stock Exchange (BBD)
- Diversified company
- Revenues by business segment: Aerospace (50 %), Transportation (48 %), Capital (2 %)

Bombardier Transportation

Bombardier Transportation is the global leader in the rail equipment manufacturing and servicing industry. Its wide range of products includes passenger rail vehicles and total transit systems. It also manufactures locomotives, freight cars, bogies, propulsion and controls and provides rail control solutions.

- **Workforce:** 31 570 as at 31 January 2005

- **Countries with production presence:** 21
- **Production sites:** 46
- **Revenues:** US\$7,6 billion for the year ended 31 January 2005
- **Order backlog:** US\$21,3 billion as at 31 January 2005

Bouygues Travaux Publics

Bouygues Travaux Publics, an affiliate of Bouygues Construction, is one of the world's top global design and build civil engineering and building contractors with extensive experience in concession projects. Bouygues Construction, whose financial strength is widely acknowledged in the market, has closed eight infrastructure concession projects, including one in South Africa.

Bouygues Travaux Publics has successfully carried out over 200 km of tunnel projects and has recently completed the world's largest tunnel excavated with a tunnel boring machine under a design and build contract for a high-speed train in the Netherlands.

Murray & Roberts Limited

Murray & Roberts is a major engineering and contracting group listed on the Johannesburg

According to the latest proposals of Bombela, the civil works will be undertaken by Bouygues Construction, Murray & Roberts and Loliwe Rail Contractors. It will include the construction of ten stations (three of which are underground), 20 km of tunnel section, and 9 km of viaducts and bridges (about 110 000 m² of bridges and viaduct structures will be constructed). The works include about 10 million m³ of earthworks. Bombardier Transportation and Loliwe Rail

Express will be responsible for delivering the rolling stock with final assembly in South Africa. To accommodate the traffic to the stations, 65 road intersections in the vicinity of stations will be upgraded. In total, about 20 000 t of steel will be required to manufacture the steel rails. This is clearly a project that has a large component of civil engineering.



COVER FEATURE

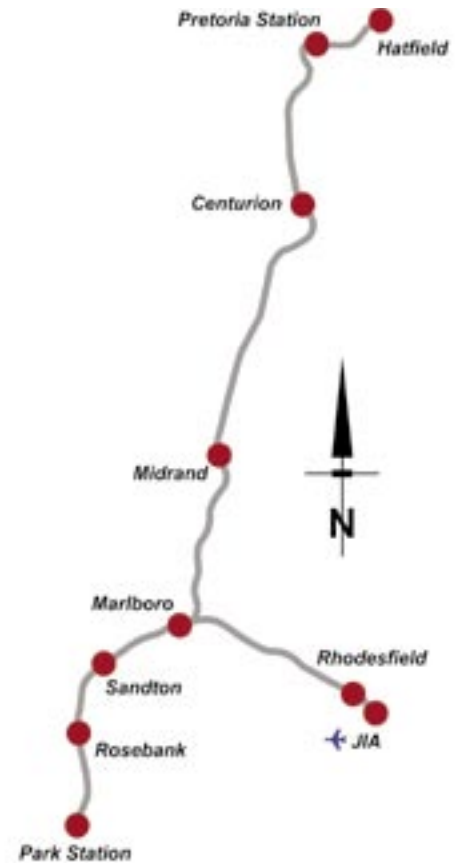
engineering

profession, indicates a dichotomy: insufficient professional engineering capacity exists, while many engineers feel they are underpaid and many consulting engineering companies struggle with insufficient long-term work load and have to compete – sometimes even at with very low professional rates for time – for work from the public and private sectors.

South Africa currently has 6 500 active qualified civil engineers and 2 000 civil technologists, of whom about 50 % are professionally registered. (About 90 % of consulting engineers are registered.) There are 7 500 technicians in the country, of whom

few have registered. Of the 8 300 civil engineers who qualified in South Africa between 1960 and 2003, 24 % have left the country and an additional 6 % are no longer in civil engineering. This means that about one third of the qualified engineers are lost to the industry. Another concern is that there are only 900 black engineers in the country, of whom only 600 are South African.

If one considers the need for engineers, it is alarming to note that 78 of the municipalities in South Africa do not have any engineers, with total vacancy levels at local government approximately 35 %. The provincial governments report vacancy levels of



Securities Exchange serving the construction economy in selected markets. It is involved in general construction, industrial and mining engineering contracting and the manufacture and supply of construction materials. Murray & Roberts has a track record in the design and build of large, complex projects and public-private sector partnerships (PPPs).

Murray & Roberts believes implicitly in the competitiveness of South African enterprise and the platform that its domestic environment creates for it to be world class.

- Corporate office in Bedfordview
- Number of employees = 24 492 (as at June 2005)
- Annual turnover R10,6 billion

The Loliwe companies

Loliwe Rail Contractors is a new BEE company whose shareholders include the Black Management Forum Investment company, Prop5 Corporation, and BEE Contractors including Blackstone, ZMK, Let Properties and others. Loliwe Rail Contractors have a collective turnover of over R360 million.

Loliwe Rail Express is a new BEE company whose shareholders include African Legend, BMFI,

Prop5 Corporation and Powerhouse, which has a twenty year track record and has delivered in excess of R1 billion of major projects in the last six years. Ten per cent of the Loliwe companies' shares are held by women.

RATP Développement

RATP Développement was founded in 2002 to operate transport networks. It is the subsidiary of RATP in charge of providing services for the operation and maintenance of public transport systems outside RATP's traditional sphere of activity.

RATP Développement is involved in transport system operations in France, Germany (Dusseldorf), Greece (Athens), Italy (Florence) and Morocco (Casablanca).

BOMBELA'S BEE REPRESENTIVITY

Bombela recognised the importance of 'active equity' and created two new black entities from the members of the Strategic Partners Group (SPG), both led by the Black Management Forum Investment Company. The two corporate entities are Loliwe Rail Contractors (16,5 %) and Loliwe Rail Express (8,5 %). These companies represent a 25 % shareholding in Bombela.

The Bombela Consortium further improves its socio-economic development (SED) proposal with the proposed creation of a feeder bus company, which includes:

- Beneficiary trust for the taxi industry
- Beneficiary trust for the members of the Chamber of Commerce along the route
- Transport operators
- Entrepreneurs along the route

Loliwe Rail Contractors

The following entities have constituted themselves into a company called Loliwe Rail Contractors through which they are participants in the Bombela Consortium:

- Black Management Forum Investment Company Ltd
- Blackstone (Pty) Ltd
- DLMIC Properties
- Joe Shibambo and Associates CC
- Let Property Developers
- Mastertrade 315 (PTY) Ltd
- PG Mavundla Projects (Pty) Ltd
- Q-tique Investments (Pty) Ltd
- ZMK Construction (Pty) Ltd
- Realeka Investments (SA) (Pty) Ltd

civil engineers of between 35 % and 50 %. Government institutions such as Transnet reported a major shortage and there are virtually no civil and transport engineers left at places such as the Department of Transport. One of the biggest problems is the skewed age distribution of civil engineers, particularly with the shortage of 30–40 year olds.

IMPACT OF THE GAUTRAIN PROJECT ON CIVIL ENGINEERING

The short time span available to complete the Gautrain before the 2010 World Cup brings its own challenges. This will have to be done at the same time as the completion of a number of new soccer stadiums and sports facilities, and the upgrading of many of the other major soccer stadiums to be used for this purpose, together with a number of legacy projects. Fast tracking processes will be the order of the day, with some overlapping activities taking place between the detailed designs and the initial clearing and construction activities. The need for qualified and experienced engineers and project managers to integrate activities is evident.

The Gautrain Project will require competent civil engineers to complete it successfully. Their services will be required by Gauteng Province (client), the concession company, the consultants responsible for the designs, the construction contractors and sub-contractors, and also the municipalities, roads authorities, SARCC and Metorail, which all need to link to and integrate with the Gautrain. Civil engineers will be needed by the independent certi-

fiers and advisors of the financiers of the project. The requirement to maximise local sub-contracting and manufacturing would promote second tier impacts on the civil engineering and infrastructure investment sectors.

The large amounts to be invested, the many people working in the area, and the need to minimise the possible negative impacts in this urbanised area, necessitate extreme care and monitoring by competent professionals to ensure that quality and safety remain paramount and that the specifications are met.

The specific objectives and efforts of the Gauteng government to promote high-density economic development in the vicinity of the Gautrain stations should contribute towards increasing land-use developments, infrastructure provision and construction activities.

It is expected that macro civil engineering projects such as the Gautrain would be a catalyst to improve the image of civil engineers in South Africa. This may help to attract more black students to this profession. This will also be an ideal training ground for young professionals, which will help to transform the profession towards a more acceptable status. With the contractual requirement to maximise local labour, it can be expected that some of the professionals who have left the country may seriously consider returning to assist with the development and to participate also in the training of young South African professionals. Some may also react to the recent international advertisements for engineers to participate in this project.

The specific requirement for technology transfer from the expatriates will contribute towards further development.

As Premier Shilowa said: 'By announcing the preferred bidder for the Gautrain Project, we as the Gauteng Provincial Government, are joining hands with the private sector in the biggest PPP project yet tackled in the country and indeed in Africa.' Reflecting on Broad Based Black Economic Empowerment and the development of SMMEs proposed by the preferred bidder, Premier Shilowa said: 'We as the Gauteng Provincial Government believe that these proposals will become benchmarks for future PPP projects in South Africa. Socio-economic development targets were set and I am delighted to say that in most cases these targets were exceeded.'

The Gautrain is therefore expected to contribute towards a lasting legacy, also in promoting civil engineering and transforming it into an acceptable, attractive and rewarding profession, long after completion of this project. Together with other infrastructure projects such as Coega and the accelerated public works programme to sustain the expected economic growth of South Africa, this will bring new hope for the civil engineering profession, but also requires a lot of planning.

► From the editor

Allison Lawless' book on imbalances in the civil engineering profession, and how to address them, will be available in the near future. It will be published by SAICE

- Tiespro 0016 (Pty) Ltd
- Prop5 Corporation (Pty) Ltd
- Loliwe contractors
- Leboneng North Investment Holding
- Biyana Development
- Powerhouse Utilities

The Loliwe Rail Contractors shareholders agreement reveals that, through its participants, Loliwe seeks to establish a representative board in which women and people with disability are represented. It further entrenches the status of HDI as a basis of the company's continuous retention and maintenance of its BEE status.

Loliwe Rail Express

Loliwe Rail Express is another company through which BEE participants take part in the Bombela Consortium. Its shareholders are:

- BMFI
- African Legend Technologies
- Enserve Africa
- Joe Shibambo and Associates
- Mastertrade 315
- Q-tique Investments
- Prop5 Corporation

The two Loliwe's jointly represent 25 % of shares

in the Bombela Consortium on the basis of which they will qualify to jointly nominate one director.

BEE companies in the Bombela Consortium

■ **African Legend Technologies (Pty) Ltd** is a South African company incorporated in 1998. It specialises in Information and Technology Solutions and is a subsidiary of African Legend.

■ **Blackstone Projects (Pty) Ltd** is a 100 % BEE company. It specialises in building, construction, steel structures and minor civil works. It is a well-known company that has distinguished itself by constructing taxi ranks in the townships. Its other major tasks include the construction of the new domestic terminal at Johannesburg International Airport (JIA).

■ **Black Management Forum Investment Holdings (Pty) Ltd** was established in 1996 as a wholly owned subsidiary company of the Black Management Forum and it is 53 % owned by BE entities, 13 % by black persons in their individual capacities, 3 % by a staff share incentive scheme trust, and 31 % by Sanlam Development Fund. The holding company BMF's objectives include the development of leadership, transforming

the black corporate landscape in South Africa, training, the creation of a database of managers as well as the development of BEE trends.

■ **Let Property Developers** was incorporated in 1987 as a sole proprietor and was founded by Mr J Letlape. The company operates a plant and equipment hire business in partnership with Realeka and is a leader in construction and sector transformation.

■ **Prop5 Corporation Proprietary Limited** was founded as an architectural company in 1985. It has since developed into a diversified multi-disciplinary skill company doing business in property development, facilities management and project management. Over the past five years Prop5 has delivered projects in excess of R1 billion in value.

■ **Realeka Investments (SA) (Pty) Ltd** specialises in civil construction.

■ **Q-tique Investments (Pty) Ltd and Tiespro 0016 (Pty) Ltd** have been established specifically to facilitate the participation of women in construction.

■ **ZMK Construction (Pty) Ltd** was incorporated in 1984 under the directorship of Mr Phillimon Siphos Zikalala. The company specialises in building construction.

THE CENTRAL CONSIDERATION that has prompted me to write this is the imbalance between those human population groups that have material security – indeed wealth – and those who do not. In simple words, the distinction between success and failure.

This is the central question and it is an old question that has attracted many answers. These have been based on such distinctions as native talent or race, divine blessing or religion, fortune or chance, material coincidence, climate, acquired skills to cope with an environment and others.

My answer to the question is mobility. But

also that mobility lies in the juxtaposition of three factors. Moreover, my answer is based on an unequivocal civil engineering precept; that the mobility to which I refer is land mobility and that this, in turn, can only be effected on structures which today we call roads. In doing so I have felt it necessary to consider what sort of developments have led to the routes which they follow and to the shapes and forms which we recognise today.

Finally, in presenting my argument, I have found it significant to pay more than lip service to the place which roads have taken in the life

of mankind. I quote Goethe: 'Philologie ohne Kunstbegriff ist einäugig' ('Scholarship without any notion of art is one eyed'.)

So I have included references to some of the ideas, images and indeed uses other than transport per se which man has attached to roads and to those who use them.

In conclusion it is attractive, if rash, to speculate on the shapes and forms which might go to make up our roads in, say, 50 to 100 years' time. What materials, what traffic and what roles they will play in daily life that are different from today?

The Golden Road to Samarkand

MANKIND IN MOTION

The immediate difficulty with a long-term view of history is to know where to start. But a good start would be the Garden of Eden about 200 000 years ago.

Now, the garden has been described as 'a place of indolence and ignorance from which it was imperative to escape in order to work and learn'. And although it must be said that the method of exit was somewhat odd, as has been pointed out, the escape seems to have led to better things for some but not for others.

Be that as it may, Eden was, as is generally agreed, the Zaire River basin and the Great Lakes area of central Africa. Here *Australopithecus* and early forms of *Homo* spread and multiplied.

This is not a treatise on anthropology or archaeology. But it is necessary to be aware of how human populations moved over time and how they were distributed at the point that one selects as the beginning of a story. Suffice it to say that for the purposes of this study we can take it that migration out of Africa had reached the stage about 15 000 years ago where most of the areas which could be described as having settled populations today were already settled at that time.

Thus from a common source and a similar process, where no group appears to have any advantages or exhibits any superiorities over another, marked differences resulted.

SUCCESS AND FAILURE

At this point it is necessary to explain what is meant by success and, by implication, failure.

Taken at its basic elements, success could be defined as the achievement of two stages:

- Comfort, which in turn can be subdivided into food or nourishment, and shelter – both structure and clothing
 - Power, or the ability to ensure safety, and control, which includes many features and has many ramifications. It can include power over the physical environment but, more importantly from a historical sense, power over family, neighbours, rivals and opponents. Control leads to discipline and the marshalling of affairs physical, political, mental, religious and psychological
- Although the differences elide into one another, it is inescapable that mankind can be divided into two groups on the basis of 'success' in the foregoing terms. Why does one group live in relative comfort, secure, and well nourished, with time to acquire the aesthetic properties such as the arts and the sciences that go to make up a civilisation? Why does another group, at the same time (that is, in the same historical age) languish in abject poverty, preoccupied only with survival, primitive in the real sense of the term?

THE PROPOSITION THAT MOBILITY IS THE KEY TO MATERIAL SUCCESS

The first element of success is comfort and the first subscription to comfort is food – not only food for immediate satisfaction but surplus for storage against future shortage and, more importantly, sufficient to support non-productive individuals such as politicians, soldiers and priests.

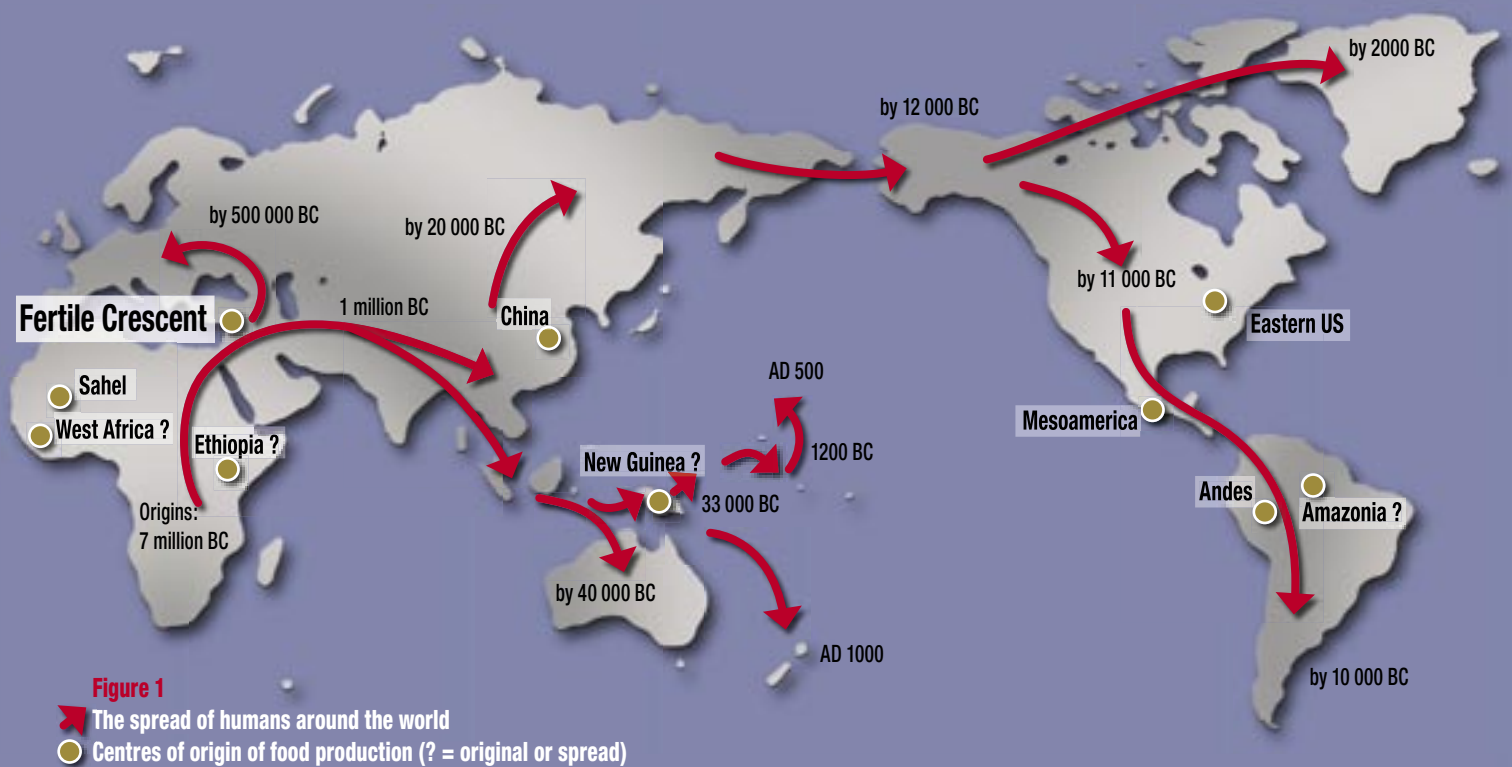
Under the heading of food are included crops and livestock and the clothing which goes towards achievement of the second subscription to comfort, which is shelter.

Research shows that centres of origin of food production can be identified with varying degrees of certainty. They are – almost certainly – South-west Asia, eastern China, eastern North America and Mesoamerica, and – possibly – Sahel and West Africa, Ethiopia, New Guinea, Andes and Amazonia.

By far the most prolific area in early food production was the so-called Fertile Crescent of South-west Asia.

The advantages which the Fertile Crescent had over other areas were:

- A Mediterranean type of climate
 - Abundant and highly productive natural flora
 - A high percentage of hermaphroditic flora
- Other areas of the Earth enjoy a Mediterranean type of climate, but the Fertile Crescent is unique in that:
- It is by far the largest.
 - It has the greatest climatic variation, leading to a high diversity of annuals.
 - It includes a wide range of altitudes leading to staggered harvests (Dead Sea – 500 m, Teheran Mountains +6 000 m).
 - It supported a diversity of domesticated large mammals (goats, sheep, pigs and cows).
 - There was less competition from the hunter-gatherers' life-style (based on wild animal herds, fish, shell fish, etc).
- So we have, in the Fertile Crescent and to a lesser extent in eastern China, centres of



comfort as defined. But what of the power that is to be added to achieve success and the final outcome of the achievement of a civilised form of life? The answer undoubtedly lies in the diffusion of the essentials of comfort away from your centre of comfort so that there is, as it were, a buffer zone between you and those (or it) that threaten you.

This second feature in the context of success is derived from the diversity of domesticated large mammals within the Fertile Crescent. Suffice it to say that: 'Eurasian people happened to inherit many more species of domesticable large wild mammalian herbivores than did peoples of other continents.'

Moreover, the suggestion is that an east-west migration is easier than north-south. Latitudinal expansion is easier than longitudinal.

So these are the factors that led to intercontinental differences in the distribution of the developments which have been described and the superiority of the Eurasian situation:

- The early onset of food production – Fertile Crescent, China
 - The occurrence and diversity of domesticable wild animals – Fertile Crescent
 - Low barriers to diffusion – east-west major axis
 - Population characteristics – settled
- Given the spread of domesticated crops and animals throughout Eurasia it is not difficult to appreciate a similar spread of ideas and technology. There is convincing evidence that complex inventions were usually acquired by borrowing, because

they spread more rapidly than they could be independently invented locally.

With this evidence in front of us it is possible to come to the conclusion that this diffusion of food, animals and ideas and the power to protect and control them has to have a practical or engineering face. This diffusion does not merely happen, something happens to make it possible and that something is the process which can be called mobility. The fundamentals of success are inherent in and achievable only given mobility, in one form or another.

ELEMENTS OF MOBILITY

However, it is necessary to define and describe mobility. We may consider that it is made up of three elements, namely the vehicle, the source of power to drive the vehicle, and the ease and safety of passage for the powered vehicle

In elaboration:

- Vehicles such that the contents are protected and progress is easy and efficient
- That there is a source of power, that is, substantially greater than manpower
- A smooth, safe surface on which the vehicle can move at maximum energy efficiency, in another word the road

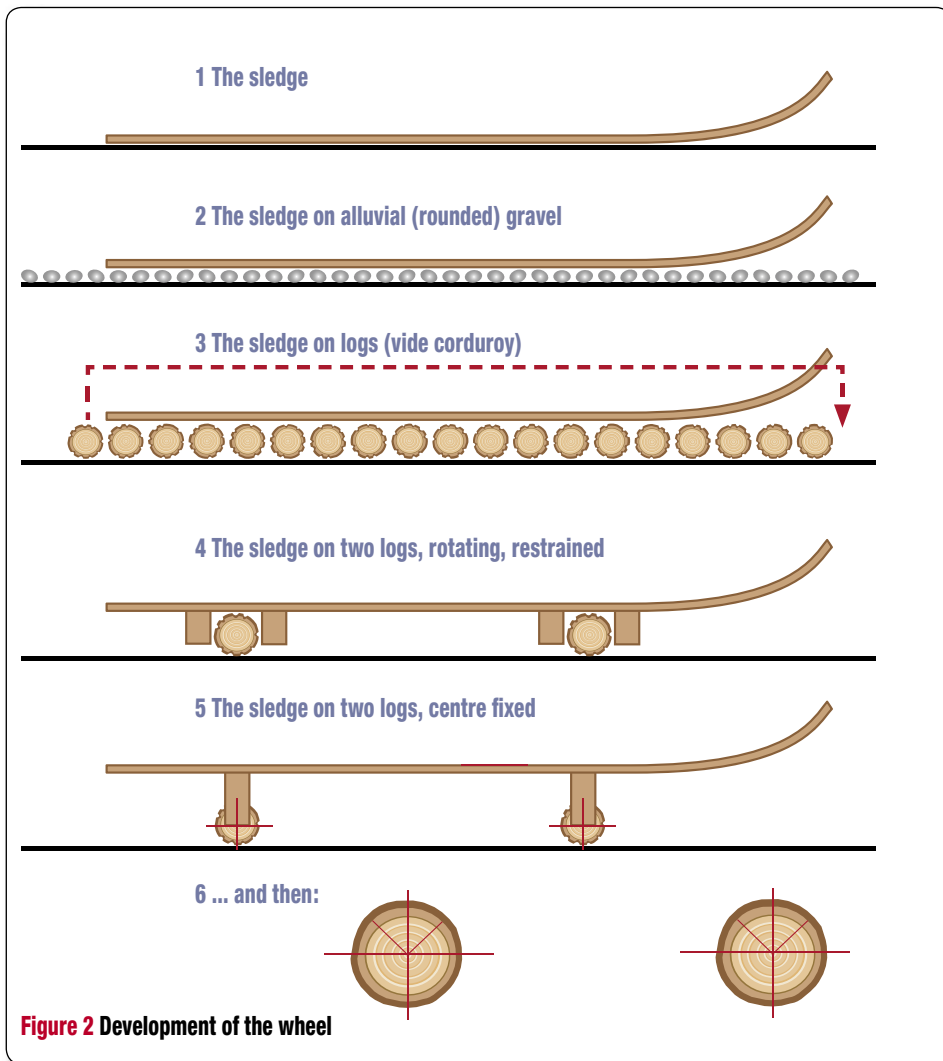
For a start, in examining the development of the vehicle, it is tempting to dwell on the wheel to the exclusion of everything else. This can be justified to a certain extent because the load-holding feature is, when all is said and done, merely a box (open-topped generally for cargo or closed for humans and other perishables). But it is also interesting to speculate on the precursor to the wheel. This was almost cer-

tain to have been skids. It seems a simple step from dragging a box along the ground to minimising friction by mounting it on two longitudinal logs to produce the primitive sledge. Whatever the progression, we have evidence of the wheel in about 3400 BC in the Black Sea area of Eurasia. It is in itself an example of the importance of mobility as it turns up within the next few centuries over much of Europe and Asia (figure 2).

The second element of mobility, the power source, now comes into clearer focus. This reference is of course to the large mammals already referred to which were pressed into the service of mankind by domestication. It is interesting to note that the appearance of the wheel follows closely on the domestication of the horse, donkey, ox and water buffalo. A mere 600 years separate them. It is tempting to conjecture that this interval, from a mobility point of view, was filled to some extent by the sledge.

The argument is surely indisputable: The cart and the horse or ox, that is, the vehicle and the source of power, in combination were (and are) the secret of the advance to success. And, of course, the two need a route, consistent accessibility to destinations from sources of surplus to areas of need, in other words, roads on which to travel.

Before we leave the main argument it should be stressed that where one of these elements existed without the other the level of success we are talking about was not achieved. A prime example is Mesoamerica. The wheel appeared in that



part of the world at a very early (indeterminate) date. However, the nearest power source, the Inca llama, was separated from it by dense tropical forests. The nearest equivalent to the horse or ox cart there, and indeed in China, for many centuries was probably the wheelbarrow, until the Spanish conquistadores introduced the horse in the 16th century.

ROADS AND CIVILISATION

If transportation between human settlements can be accepted in the technological bracket that has been proposed, it is of more than passing interest to see how roads featured in and shaped human development.

A major consideration must have been the choice of route between centres. This is often dismissed as following game trails or local pedestrian routes. This dismissal is not supported by reports. For example, records often show the careful selection of high ground, where possible, first to avoid flooding, but second and as important, for safety's sake to be able to view the surroundings and the route ahead and avoid ambush and other hazards. Another obvious route requirement would have been to minimise the distance. Finally the soil characteristics along the way between origin and destination must have

had a powerful influence, as well as the abundance or scarcity of suitable materials within the corridor.

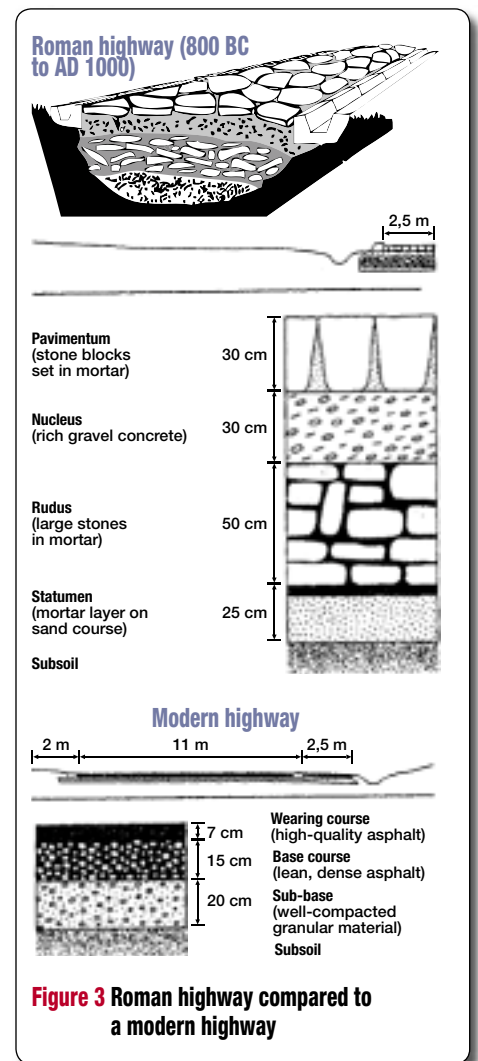
One of the more interesting coincidences of ancient history is that the invention of the wheel happened at about the same time as writing. Consequently, on the last point of construction and materials, there are no literary records of roads and how and what they were made of before about 3500 BC. Archaeological effort, concentrating quite naturally on settlements, reveals little. Thus detail is not available of the early road networks between the ancient centres of Egypt, Mesopotamia and other centres of civilisation in the Fertile Crescent.

Nevertheless it is possible to speculate on a progression based on a theme – as with routes, so with road building processes and materials choice. A few illustrations follow.

Compaction

Compaction accompanied by the careful use of murrum (laterite, ferricrete) – the word common to South-east Asia, India and East Africa – was probably the first road construction process.

Compaction could also have been maintained by careful control of traffic, so we



can say that the road builder used the customer to help maintain the road. However, there is a possibility that the method used was not dissimilar to that used on country roads in India not so long ago. This method employs the hand scattering of the murrum in thin layers followed by compaction with goat herds. In central Asia the sheep or yak would replace the goat.

Cord – du – roi ('corduroy')

Speculation also has it that early roads, possibly through difficult low-lying terrain, where periodic swamp conditions might apply, were paved, if not reinforced, by timber logs laid transversely across the road. This would have been an economic solution in the heavily wooded country which occurs over a substantial area of the 'Northern Flatland' in mid-Eurasia.

Wood blocks

In case the idea of wooden roads is too easily dismissed, the streets of London were paved with close-fitting timber blocks, set and coated with coal tar, well into the 20th century.

Asphalt

Natural asphalt occurred and indeed occurs as waterborne lumps in springs



Figure 4 Via Appia et Egnatia



Figure 5 A Thug demonstrating his technique

and rivers throughout Mesopotamia, Kirkuk and ancient Susa. Indeed Diosorides refers to the Dead Sea as Lake Asphaltitus. In about 600 BC the so-called Procession Street in Babylon was paved by Nebuchadnezzar, who boasted that he 'had made a road glistening with asphalt and burnt brick'.

*Its due praises were sung, in their difficult tongue,
By full many an old Babylonian.
Good King Nebuchadnezzar, his epitaph says
Looked on asphalt with great approbation
For his roads and his walls, for his bathrooms
and halls
Not to mention indoor sanitation.
A WJ [Shell]*

What is noteworthy is that there was an enormous gap between what appears to have been a ready use of bitumen-based materials in ancient times and the discovery of the Trinidad Lake by the Devonshire sailor-cum-marauder Sir Walter Raleigh in 1595. All this time similar asphalt lakes at Val de Travers, Limmer and Seyssel in Europe were well known but had to wait until the 19th century before they were exploited for footpath and eventually road surfacing.

STONE BLOCKS

The development from gravel ('murrum') to stone blocks, hand knapped, seems to

be a natural progression. Of course the Roman roadway cannot escape attention in this context. However, the monumental design which we know must have started with an elementary layer to which successive strengthening courses were added. Did they have a traffic-based design but all we can see today are the major routes? It is difficult to analyse. Indeed the sheer depth, 1,1–1,3 metres at its full design, is difficult to contemplate.

Whatever the answer, there is no doubt that to the Roman mind a road meant defence, conquest, stability, civilisation and influence from the 3rd century BC to the 15th century AD. The Roman road echoed to the tread of the Roman legions in maintaining the Pax Romana for 18 centuries. A prime example has to be the Via Appia and the Via Egnatia: Rome to Brindisium (figure 4), Epidamus (on what is now the Albanian coast) to Thessaloniki, in Macedonia.

Finally we can easily translate the Roman methods into the 19th-century Europe of Tresagnet, Telford, Metcalf and MacAdam and thus into the present day.

PREMIX ASPHALT

With the introduction of natural asphalt, followed closely by refined bitumen, it is not difficult to see that the very effective waterproofing qualities of both came to be recognised. Coupled with MacAdam's strong but porous matrix of single-sized

aggregate particles the so-called penetration layer was a natural outcome.

The inevitable development of this two-stage process was to pre-mix the two ingredients off-site, deliver to site and spread in an even layer on a prepared base or sub-base. Thus bitumen or asphalt macadam and the development of premix asphalt. Hot-mix asphalt, as we call it today, was originally the subject of innumerable patents with as many names: Warrenite, Bitoslag, Bitulithic, and so on. The outcome was a specification developed in the US in the town of Topeka in Kansas, which incorporated all particle sizes smaller than half an inch. This was followed by the modified Topeka asphalt mix, unpatented.

ROADS AND HUMAN DEVELOPMENT

But roads have meant more to mankind than the physical structure itself.

The personal experience not only of access but also of the process of travel to other climes and people provides a value. Travel by road has enhanced the human experience, enriched but indeed sometimes endangered it.

Economics and trade

A feature of road travel which has been with us from time immemorial is tax or tolls, even if only to pay for the road's maintenance. There is evidence, however, that road tolling was often the sole means of taxation. Many Indian cities have an-

cient 'octroi' posts at every gate where one eighth of the load from the surrounding farms was unloaded for the local rajah or newab. Indian texts of the 4th century BC refer to tolls.

Warfare

The natural relationship between mobility, in this context the speed with which military forces can be deployed, is obvious. Once again the Roman road system immediately comes to mind and perhaps the most evocative is the Via Appia.

Nationalism

I use the term in its broadest sense embracing patriotism, unification and the engendering of a sense of community among otherwise disparate and diversified tribes. The modern example is the state highway system of the US. I know that it will be argued that this was initiated by defensive strategy, but it has since been readily acknowledged that its contribution to national unity has been inestimable.

Roads in art and symbolism

Examples of roads in the arts are too numerous to dwell on. One, ancient and possibly not so obvious, is the opening quatrain from the Rubaiyat of Omar Khayyam. The 12th-century Persian astronomer quotes the customary signal to wake the caravan at dawn and prepare for departure. The master threw a stone into a pool or cup of water as an analogy for the start of the journey through life itself or for episodes and experiences:

*AWAKE! For the Morning in the Bowl of Night
Has flung the stone that puts the Stars to Flight:*

*And lo! The Hunter of the East has caught
The Sultan's Turret in a noose of Light.*

Roads in human behaviour

One of the features of human behaviour associated strongly with roads is the custom that the travellers keep to one side of the road. Not only that, but one country prescribes the left and another the right side. It seems obvious in today's high-speed traffic, but when did it start and why?

There is little doubt that the custom is inherited from classical Greco-Roman times, if not before. The left-hand side was, from time immemorial, the chosen side as it exposed the sword arm of those approaching. But what of the right-hand side? It seems that this started relatively recently, shortly after the French Revolution, in the last decade of the 18th century. During the ancienne régime the aristos rode down the left-hand side of a road leaving the sans culotte to keep to the right. After the guillotines had done their work, 'sea-green incorruptible' Robespierre suggested that, as

there were no more aristos, all should now keep to the right. Did Napoleon concur realising that the sword had lost its usefulness and that the musket is best presented in defence to the left? ▶ [See also Graham Ross' article on page 41 – Ed]

Crime

There are countless examples which could be used to illustrate the abuse of the road by the criminal element. Roads have been haunted by highwaymen, footpads and the like since the start of civilisation. However, one example stands out: the Thugs in the central areas of Deccan India up to the beginning of the 19th century. The word thag, familiar today in the English language as 'thug', is the Hindi word for 'deceiver' and in turn from the verb to deceive, 'thagana', the art of deception being 'thagi'.

Travel in those days in India, as elsewhere, was in groups for safety. The Thugs hunted in bands that attached themselves to caravans and descended on their fellow travellers at night, having 'deceived' them until the night of the attack into thinking of them merely as part of the caravan. They ingratiated themselves by entertaining the travellers with song and dance and story telling. Their method of operation was disciplined and unchanging. The gang would gather at dead of night outside the serai, and a puja (prayer, ritual) in the name of Kali, the Hindu invocation of death and destruction, would be carried out by taking sugar. The Thugs would then descend upon the sleeping travellers and massacre them in toto. As a reward from the goddess for carrying out her objective, they were entitled to take the goods and wealth of their victims for themselves. It was the proud boast of the Thug that he never shed a single drop of human blood because the method of execution was strangulation using a 'rumal' (handkerchief or scarf) with a rupee sewn into one corner. The rumal was flung round the victim's neck with one hand and caught with the other. A quick twist and the job was done (figure 5)!

THE ROAD INTO THE FUTURE What of the future?

■ **Air travel** In 50 to 100 years it will have disappeared as a routine method of long-distance travel. It is far too expensive in terms of transportable fuel. The liquid and gas hydrocarbon fuels on which it relies today are not inexhaustible and must gradually peter out.

■ **Sea transport** of freight by sea must have an assured future. Passenger transport will be confined to the idle rich for tourism in its own right but also for 'residence' – for the same class of human being, of course.

■ **Rail TGVs** are definitely the future mode

of long-distance passenger travel. They offer the same seamless and smooth measure as air travel, even if at a quarter of the speed, but have the supreme advantage of giving the traveller scenic, social and cultural experience.

In addition, the future of rail transport for bulk land freight transportation must be assured by economics.

■ **Roads** This form of transportation will go on for as long as man inhabits the globe. The vehicles will change to more rational forms. Personal vehicles will become smaller and will probably be designed for the single individual. The power will be derived from biomass products (ethanol), the fuel cell, hydrogen cell or methane gas.

As for the construction of roads into the future one speculates on some variant of the cobble or CBP (concrete block pavement) as the surfacing medium for urban roads. One thought, however, in the context of global warming and of the Kyoto Protocol, is that the production of cement currently accounts for some 7 % of CO₂ emission, and rising at 5 % per year, will result in the increasing use of recycled concrete aggregate (RCA).

For rural roads the exhaustion of good murrums or calcretes will mean the increasing use of recycled existing structures and the use of sands and 'sour' soils stabilised with recycled wastes from the chemico-plastic industry such as HDPE (high density polyethylene) and lignites from the pulp and paper industry. One thing is clear and that is that bitumen and asphalt are on their way out. Bitumen is too valuable as a fuel – as with coal tar today, so with bitumen in the next century.

... and so the road goes on ... into the future
... and as it did in the past.

SAMARKAND

In October 2004 the International Road Federation (IRF) arranged and hosted the 3rd International Silk Roads Conference in the city of Xian. This was the first such gathering to be held in China. Between Xian and Istanbul lie some 16 000 km of the Silk Road trade routes. And there we find, at the centre of the Silk Road network, the ancient city of Samarkand! The creation of Tamburlaine the Great, Sword of Islam, Conqueror of the World, the Scourge of God, it was from this city, in what is now Uzbekistan, that the Tartars subdued and ruled Asia throughout the 14th century.

The IRF, the countries along the routes and many others are committed to restoring this network to its ancient use – carrying passengers and goods across the continents.

When will we realise the same dream in Africa? □



Menlyn node to be developed

THE MENLYN NODE in the east of Pretoria is experiencing significant levels of development and severe levels of traffic congestion. The eastern suburbs are popular residential areas and are also sought after for commercial and business developments. Rapid development in the area has resulted in severe levels of congestion to the extent that further growth is hampered by insufficient road capacity.

The Menlyn node is bounded roughly by the N1 Eastern Bypass, Atterbury Road, General Louis Botha Drive and Garstfontein Road. The node currently comprises approximately 400 000 m² approved business floor space, some of which has not been taken up yet. Indications are that the size of the node may more than double in the near future.

The City of Tshwane Metropolitan Municipality and the South African National Roads Agency (Sanral) have launched a number of major projects to upgrade the road network, some of which are discussed below. Initial investigations started in 1995 and have now reached the detail design stage. Construction is expected to commence in 2006. The investigations have not been completed and the proposals have not been finalised, however. Because funding for the project is limited, a phased implementation might be required. The environmental impact assessment still has to be completed and additional issues may possibly be iden-

tified that could affect the road upgrading improvements.

MENLYN NODE SPATIAL DEVELOPMENT

The Metropolitan Municipality has generated a city development strategy in which a set of development initiatives and interventions have been identified for the next 20 to 30 years. A number of focus areas have been specified, including the maintenance and development of established urban areas, such as the business district and the south-eastern areas of the city. Continued support of these areas by maintaining services and expediting market-driven initiatives is considered crucial for the overall development. The strengthening of key economic clusters to gain leverage from growth trends in manufacturing, government and business services is one of the key elements of the strategy, and public investments in transport and communications infrastructure are vital for such strengthening.

The Menlyn node is one of the projects of the integrated development plan formulated for the area. According to this plan, a overall framework must be investigated and drafted for the development with the emphasis on strategic urban management directives to ensure coordinated, integrated development with specific reference to the identification and preservation of core residential areas, business nodes and expansion, nodal expansion, impact and need for buffer zones/inter-

faces, mixed land uses, intensity or density of development and the formulation of an appropriate physical framework to sustain and enhance economic development.

The Menlyn Node Spatial Development Framework (MNSDF) was formulated to address issues specifically related to land use in the node. One of the most important principles for development in the area is that residential areas should be protected from the impact of development. The residential component is considered a major asset of the city and the preserving, strengthening and extending it is a priority. To protect the residential areas, a development edge is proposed that will serve as a buffer area between residential areas and the node. This will be achieved through physical barriers, street closures and other measures.

The MNSDF has identified specific precincts in and adjacent to the Menlyn node where land use changes and densities can be accommodated. This involves redeveloping certain areas to very high densities while others can be developed to high, medium and low intensities. Such developments will be allowed subject to the condition that the road network can accommodate traffic generated by the developments.

ROAD IMPROVEMENT PROPOSALS

The proposed improvements to the road network surrounding the Menlyn node are aimed at increasing the capacity of the



network and improving the accessibility of the node. The following improvements have been proposed:

- Atterbury Road is a major east–west arterial immediately north of the node, with an interchange on the N1. The section of the road adjacent to the Menlyn node currently has a varying cross section. In some locations it consists of a dual carriageway with three or more lanes per direction, while in others it is a single carriageway with two lanes per direction. The intention is to improve the road to full dual carriageway standard with at least three lanes per direction and additional through-lanes at certain locations.

A new intersection is planned to provide a link with Dallas Avenue and Ingersol Road. At this intersection Atterbury Road will be converted to a one-way couplet in the vicinity of the intersection to maintain progression along Atterbury Road and provide additional capacity at the intersection. This intersection would help to relieve the congestion currently being experienced at the Lois Avenue intersection.
- Garstfontein Road is another major east–west arterial immediately south of the Menlyn node. Currently no interchange is provided with the N1, but the intention is to provide a new interchange that will provide access only to the south. The section of Garstfontein Road adjacent to the Menlyn node is currently a four-lane dual carriageway and the road would be widened to three lanes in both directions to provide additional capacity to the new interchange on the N1.
- General Louis Botha Drive is located immediately to the east of the Menlyn node. Currently it is a four-lane dual carriageway road north of Atterbury Road and a single carriageway road further south. The dual carriageway would be extended up to Garstfontein Road to improve the capacity of the road network in the north-south direction.
- Lois Avenue is a major four-lane dual car-

- riageway internal to the node. No major improvements will be implemented on this street, but minor improvements may be required to improve intersections.
- Dallas Avenue is currently a local street in the node, but the intention is to extend the street in both the north and south directions to link with Atterbury and Garstfontein roads. The street will provide additional north–south capacity and will significantly improve accessibility to the eastern part of the node.
- Aramist Avenue is a local street in the node that links with General Louis Botha Drive. The intention is to extend the street further west to link with Lois Avenue. This will improve the east–west capacity of the system and improve accessibility to the node.
- Ingersol Road is a local street to the north of Atterbury Road that serves some developments on the northern side of Atterbury Road. It is also a collector street that serves residential developments to the north of the node. To spread the traffic load on intersections on Atterbury Road, extensions are planned to provide links to three intersections on Atterbury Road. Traffic calming measures have already been implemented on the northern section of the street but may be expanded to reduce traffic intrusion in the residential area.

N1 EASTERN BYPASS IMPROVEMENT PROPOSALS

Sanral will be responsible for upgrading the N1 between the R21 and N4 interchanges. This will include upgrading existing interchanges, adding new interchanges, and providing collector-distributor roads, climbing lanes and crawler lanes.

- **Lynnwood Road Interchange** Lynnwood Road is a major east–west arterial located to the north of the node. There is an interchange on the N1 freeway, but it currently only serves traffic to and from the south. Ramps are required to serve traffic to and from the north. Providing such ramps

► From left to right:
 Atterbury Road from the proposed location of the intersection with Dallas Avenue with Menlyn Park and other developments in the background (viewed from the east)
 Lynnwood Road Interchange on the N1 with Meiring Naudé Drive on the left (viewed from the north)
 The Menlyn node development

is complicated by the intersection with Meiring Naudé Road immediately east of the interchange, because traffic volumes are high and the capacity of the system needs to be significantly improved. A further issue is the limited space for road construction because the interchange is surrounded by residential developments.

A variety of interchange layouts were investigated, including conventional diamond, clover and single-point configurations. Many of these alternatives could not accommodate the projected traffic volumes or were found to be very costly. The proposed interchange will consist of a diamond configuration on the western side and a partial clover on the eastern side, while the intersection with Meiring Naudé will be a single-point interchange. The proposed configuration will improve the capacity to and from Meiring Naudé Road and provide for ramps to and from the north.

■ Collector-distributor (C-D) roads between the Lynnwood Road and Atterbury Road interchanges

The Lynnwood Road and Atterbury Road interchanges are spaced closely together, so that severe weaving problems are experienced. There are no north–south supporting roads in the area, with the result that this section of the N1 freeway is used to carry local traffic between Lynnwood and Atterbury roads.

To address these problems C-D roads are planned between the interchanges in both directions. The current three lanes on the N1 will be maintained, while an additional three lanes will be provided on the C-D roads, resulting in 12 lanes along this section of the freeway (six on the freeway and six on the C-D roads).



► From left to right:
 Garstfontein Road and some of the surrounding Menlyn node developments (viewed from the west)
 Atterbury Road Interchange on the N1 with the Menlyn node in the background (viewed from the west)

Space is limited, so the median and current road verges will be utilised to provide road space. A wire rope barrier on a narrow painted island will separate the C-D roads from the N1 freeway.

■ **Atterbury Road Interchange** This interchange was previously a diamond interchange with limited capacity. A loop was recently constructed to serve northbound traffic from the interchange and significantly improved the capacity of the interchange. The loop was constructed with a 25 m radius and could be accommodated without realigning other ramps or roadways, so significant cost savings were achieved.

A similar loop will serve southbound traffic. The gap between the two bridge decks will be filled in to provide eight lanes along Atterbury Road. These improvements will significantly augment the capacity of the interchange to accommodate traffic movements to and from the N1 as well as traffic travelling along Atterbury Road.

■ **Garstfontein Road Interchange** Garstfontein Road is located immediately south of the Menlyn node. No interchange is currently provided on the N1, but the intention is to provide an interchange that will only serve traffic to and from the south. This would remove some of the traffic load from Atterbury Road, which would lead to significant improvement in the capacity of the road network.

Various interchange configurations were investigated. Owing to limited space, it was decided to implement a single-point interchange on the N1. Because of the location of the Atterbury Road Interchange, it is not possible to provide ramps to and from the north, and ramps will therefore be provided only to and from the south. The bridge over the N1 will be widened to double Garstfontein Road over the freeway.

■ **Rigel Avenue Interchange** This interchange serves Rigel Avenue, Delmas Road and (indirectly) Hans Strijdom Drive. Delmas Road and Hans Strijdom Drive are major

arterials, while Rigel Avenue is a residential collector. It is currently a diamond interchange with limited capacity and high levels of congestion are being experienced. The interchange configuration is being evaluated but no decisions have been made.

■ **Climbing and crawler lanes** In addition to these improvements, a number of climbing and crawler lanes will be provided along the N1 freeway. The lanes will accommodate slow-moving heavy vehicles on long upgrades and steep downgrades.

TRAFFIC MODELLING AND ANALYSIS

Extensive traffic demand modelling for the node was undertaken via traffic demand models for the city and the area surrounding the node. Traffic demand on the roads surrounding the node is expected to nearly double over the next ten years (to 2015).

It will be possible to accommodate the expected increase in traffic demand through the proposed road network upgrading, but there will be limited opportunity to accommodate additional traffic. There is thus a limit to the extent of development that can be supported by road traffic. Further expansion in the area would require more people to use alternative, more efficient modes of transport.

PUBLIC TRANSPORT

A major emphasis during the project will be to provide public transport facilities. Traffic studies have indicated that there is a limit to development that can be supported by road traffic and a significant shift to public transport will be required if further developments occur.

Provision will be made for facilities such as bus and taxi stops on the road network. A taxi holding is also needed in the area, which will be provided at a suitable location in the node. Particular attention will be given to the needs of pedestrians and an extensive system of walkways will be provided. The possibility of an improved bus service to the adjacent residential areas is also being investigated as a measure to reduce private vehicular travel.

URBAN ENVIRONMENT

The proposed road improvements will have a marked impact on both the hard and soft

urban spaces of the node. The road projects would therefore provide an opportunity to enhance the urban environment of the area. To this end, urban design and landscape design inputs were obtained from the early stages of the project to ensure that these aspects were not neglected or handled as add-ons after the road designs have been completed.

Particular attention will be given to place-making concepts to create an urban environment with a unique sense of place. From an engineering perspective, this implies that road alignments, levels of surfaces and streetscape elements such as visible engineering and public transport infrastructure will be integrated with the urban environment to enhance the three-dimensional form and character of the area. The roads will not only be designed for their engineering function, but also to provide a pleasant urban environment.

PROJECT FUNDING

The total cost of the planned improvements to the N1 is currently estimated at R100 million and those to the street system at R50 million. Sanral will be responsible for the cost of the improvements on the N1, while the costs of improving the street system will be shared by the City of Tshwane Metropolitan Municipality and private developers in the node.

Alternative methods of obtaining contributions from private developers are being evaluated. The alternative methods include the following:

- The creation of a special benefit assessment fund into which contributions can be made
 - The creation of a city improvement district to provide a mechanism for levying additional contributions in the node, and
 - Extension of bulk or external service contributions from developers to cover the cost of the proposed improvements
- Additional funding sources that are being investigated include issuing municipal bonds; public-private partnerships; and selling municipal property in the area.

CONCLUSION

The Menlyn node is a major development with many implications that pose challenges for planners and designers. Because of issues such as surrounding residential areas, limited space for road improvements and limited funds, it was necessary to find innovative solutions not only to the engineering design, but also to aspects such as financing and urban design. The project is perhaps not as large as other engineering projects in South Africa, but it is important because of its impact on development and the innovative approaches to engineering design, integration with urban design and financing. □



Freeway management project for Gauteng

THE SEVERE TRAFFIC CONGESTION on Gauteng freeways has a negative effect on productivity, the running costs of vehicles, the time people spend with their families, and the environment. More often than not, it is too costly to provide additional road capacity within the restricted space and alternative solutions must be explored to optimise congestion management.

Another important aspect in the management of freeways and congestion is the management of incidents such as crashes or breakdowns. Speed of response to an accident has a direct influence on the safety of people who may be involved in the emergency and the extent of congestion caused by stationary vehicles.

Sanral, together with provincial and local authorities, is implementing an intelligent transport systems (ITS) project whereby technologies will be used to manage traffic and provide road users with traffic conditions on a real-time basis on freeways in Gauteng.

PROJECT AREA

The area covered by the pilot project encompasses all the major national and provincial freeways in Gauteng, but to test certain ITS applications the project focused on the Ben Schoeman Highway. In June 2005 the Johannesburg Roads Agency (JRA) provided funding for the extension of the pilot project along the M1 to Empire Road.

AIMS AND OBJECTIVES

For the implementation of this pilot ITS project Sanral has the following aims:

- Improved incident management
- Reduced congestion
- Increased road safety
- Evaluation of the effectiveness of its technologies with a view to possible further deployment

These aims will be achieved through the use of several forms of ITS technology, including a centralised network management centre (NMC), closed circuit television cameras (CCTV), variable message signs (VMS), loops and other traffic detection and traffic information devices, as well as continuous monitoring of the systems and their impact on improved road network operations. Further research and experimentation will take place during the five-year operational phase of the project to determine tailor-made solutions for local conditions and road users.

A key component of the project is the interaction between and enhancement of existing incident management systems (IMS) to facilitate emergency and incident response by improving lines of communication and the speed and efficiency of notification between the location of the incident and the IMS.

INFRASTRUCTURE/SYSTEMS

For the Ben Schoeman section, the following systems will be implemented:

- Fibre optic communication backbone for communication between the field devices and the network management centre
- CCTV cameras
- Variable message signs
- Inductive loops traffic monitoring equipment
- Ramp metering

For area-wide freeway monitoring, the following systems are being considered:

- Electronic vehicle identification readers at approximately 3 km intervals
- Web cameras at the same positions
- Semi-dynamic road signs at decision points such as systems interchanges where expected travel times between an origin and destination will be displayed
- Wireless communication
- Modems to provide communication links between field devices and the network management centre

Both the Ben Schoeman and the area-wide systems will be managed at the network management centre.

Some of the infrastructure and systems are discussed in more detail for clarification.

NETWORK MANAGEMENT CENTRE

The network management centre (NMC) will receive all the inputs from the various sensors via a communication backbone, process them and provide the required output. In basic terms, the role of the NMC is that of an overall coordination function because of the large number of roleplayers and existing centres. The system architecture provides for the independent operation of the major modules. However, we foresee that one module will be designated the overall system server and coordinator.

The following main functions will take place at the NMC:

- Visual monitoring of the network from real-time video and webcam feed
- Detection of incidents from information received from field devices
- Reception of calls from the public
- Determination of travel times on the road network
- Dissemination of information to the public via radio reports, variable message signs, semi-dynamic message signs, website, SMS, etc
- Direct liaison with emergency services for the effective management of incidents
- Direct liaison with the public transport call centre to inform about traffic conditions, incidents, traffic prediction, and planned events
- Debriefing sessions with affected parties after incidents

MOTORIST/PUBLIC TRANSPORT INFORMATION

Dissemination of information to motorists and public transport users is one of the primary services provided by the network management centre. Motorist information involves the activation of communications media to relay information about traffic conditions and incidents to motorists. This information assists motorists in selecting their mode of travel, route, and departure times. By influencing motorist behaviour (by recommending diversion routes around an incident, for example), authorities can improve travel conditions and traffic flows. Motorist information can be categorised as pre-trip or en route.

Pre-trip information can provide the motorist with current roadway and/or transit information before he or she decides on the time, mode, and route of travel. Whether it is provided to motorists at home, in the workplace, or in multi-modal locations, this capability can help relieve congestion by providing information so that motorists can reroute, delay the start of the trip, shift modes, or avoid travel altogether.

Pre-trip information

On-line services to access the Internet are one way of disseminating pre-trip traveller information. A website for the Gauteng freeway network will show:

- Real-time traffic flow information via colour-coded maps
- Expected travel times between various points on the freeway network
- Road closure information (eg construction or maintenance)
- Real-time video images (still captures or streaming video)
- Camera selection
- Travel advisory information for route planning
- Links to other websites
- News and weather

Pre-trip traffic information will also be available via radio reports, SMS services and a call centre.

En route information

En route information will provide the motorist with current roadway and transit information while travelling. Roadside variable message signs and highway advisory radio messages will provide information about traffic congestion, incident and construction locations, weather advisories, special events that may impact on a particular section of roadway, and alternative routes. In-vehicle and personal mobile devices can provide en route information for

motorists and transportation providers. The private sector will be involved in the provision of these services.

To disseminate area-wide information and to assist the public with route choice, semi-dynamic signs will be erected at certain decision points, such as systems interchanges. For example, vehicles approaching the R21/N1 interchange on the N1 from the north will see a sign such as this:

Expected time to travel to:	
Buccluech Int	83 min
Jl Airport	18 min
Gilloollys Int	26 min
CRASH NEW RD	

The motorist can use this information to decide whether to travel to Johannesburg via the R21 or the N1. In this example, delays will be experienced on the N1 because of a crash at New Road Interchange. It would

therefore be a better option to travel to Johannesburg via the R21 from Pretoria. The information on these signs will be updated with real-time traffic data from electronic vehicle identification (EVI) readers placed over the freeways at approximate 3 km intervals. These readers will read electronic tags that will be distributed to road users. Each tag has a unique ID, which will enable us to spot it through the network. It is not necessary for the tag to be linked to a specific vehicle, thus the issue of privacy can be addressed.

COMMUNICATION BACKBONE

Sanral investigated various options in order to achieve a cost-effective communication backbone. There are two main ways of achieving communication between the network management centre and field devices:

- Wire line communication – copper, fibre, etc, and
 - Wireless communication – WLAN, microwave, GSM, etc
- After evaluating the bandwidth requirements for high resolution, 25-frame-rate picture quality from the CCTV cameras and system redundancy, it was decided to use fibre optic for the communication backbone for the Ben Schoeman project. The extension of this backbone to the M1 and M2 will result in a good primary system situated centrally in the Gauteng metropolis. A secondary wireless system can then be linked cost effectively to the fibre optic backbone.

PROJECT STATUS

Sanral awarded the contract for the installation of CCTV cameras, the fibre optic communication backbone, and video display system to Bona consortium. The contract commenced in March 2005 and is scheduled for completion in October 2005. The contract for the refurbishment of the network management centre was also awarded. Construction work is scheduled for completion in September 2005. The contract for system integration, variable message signs (VMS), traffic detectors and radio and telephony is scheduled for award in 2005. The total project, including area-wide implementation, should be fully operational by the end of 2006.

CONCLUSION

This project will be the first integrated freeway management project in South Africa. The deployment of ITS at project level will allow Sanral and other roads authorities to evaluate the feasibility of ITS to improve network management and road safety. Furthermore, information dissemination to the public will enhance the principles of Piarç, which promote a shift from purely managing a road network to managing the road network and its users. The lessons learned through this project may prove valuable in terms of the management of traffic in the 2010 Fifa World Cup, when it will be essential to manage the road network and incidents effectively. □



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References available on request

Road cost allocation in South Africa

PREVIOUS EFFORTS to highlight how road users have become tax milk cows have indicated that trucks might not be carrying the proportion of the road costs that they cause when compared with cars. This is largely due to the costly impact of trucks on road pavements (even when trucks are legally loaded, that is, not overloaded) and to their road safety implications. It was concluded that a more equitable user charge for trucks is still lacking. This article is a first effort to allocate road costs to the various road modes in order to establish whether truck traffic on South Africa's roads is being 'subsidised' by car traffic.

ESTIMATE OF ROAD INVESTMENT IN SOUTH AFRICA

Characteristics of road travel

Table 3 below shows vehicle numbers as well as the total travel by various vehicle classes as estimated for South Africa.

Cars and LDVs form 90,5 % of the vehicle pool, but account for only 85,7 % of the vehicle kilometres travelled. In South Africa many people use small trucks as their first vehicle, rather than a car, which explains the relatively high proportion of travel by LDVs. Heavy vehicles contribute more to the vehicle

kilometres travelled than their portion of the vehicle pool – 8,3 % versus 5,1 %.

Annual expenditure on roads and cost apportionment

The exact annual expenditure on all roads in South Africa is difficult to ascertain, because, inter alia, at least four groupings are involved, namely:

- Central government – National Department of Transport (NDOT) and the National Roads Agency
- Provincial governments – nine of them
- Local government – all cities and towns in South Africa
- Private toll concessionaires

Spending by the private toll concessionaires latter has been increasing but could be considered small in relation to the rest and is excluded here. The estimated spending by

the rest is reflected in table 1.

Most of the budget for policy, strategy and implementation was earmarked for bus and rail operating subsidies, namely R1,43 billion for buses and R1,78 billion for rail (R3,21 billion in total). The amount of money that the NDOT allocated for the operation, management and maintenance of roads was therefore less than R1 billion and assumed to be approximately R400 million.

Local government

Spending by local government on the maintenance and construction of roads is financed from property taxes, development fees and other revenue, which includes provincial grants. From a total budget of R10 billion+, the City of Cape Town spends approximately R400 million on road maintenance and construction. If this were to be considered 15 %

Table 1 National Department of Transport (budget for 2000/01)

	R-million
Administration	30,502
Regulation and safety	774,711
Policy, strategy and implementation	3 288,396
Total	4 093,609

Table 2 National Roads Agency expenditure on proclaimed national roads (non-toll) 1999/2000

	R-million
Construction	158,960
Maintenance	460,381
Administration	155,741
Total	775,082

Table 3 Vehicle numbers and distance travelled

	Number of vehicles		Distance travelled	
	Total (10 ⁶)	%	Total vehicle km (10 ⁹)	%
Cars	4,076	64,2	73,173	56,2
Light delivery vehicles (LDVs)	1,667	26,3	38,434	29,5
Minibuses	0,255	4,0	6,702	5,1
Buses	0,027	0,4	0,977	0,8
Heavy vehicles	0,324	5,1	10,851	8,3
Total	6,349	100,0	130,137	100,0

Table 4 Provincial road budgets, 2001 (R-million)

	Construction	Maintenance	Administration	Total
Mpumalanga	81,247	114,744	20,491	216,482
Western Cape	133,676	235,417	46,831	415,924
Gauteng	112,651	187,65	43,167	343,468
Free State	1,986	142,448	11,315	155,749
North West	33,786	182,544	53,804	270,134
Eastern Cape	109,4	237,569	36,486	383,455
KwaZulu-Natal	262,59	391,949	65,812	720,351
Northern Cape	1,311	49,446	4,879	55,636
Limpopo	37,973	365,743	182,99	586,706
Total	774,62	1 907,51	465,775	3 147,905

Table 5 Road cost allocation – percentages

	Cars/LDVs	Minibuses	Buses	Trucks	Total
New capacity	11,4	1,1	0,2	2,3	15
System preservation	11,2	5,6	1,9	56,3	75
System enhancement	5,0	0,5	0,5	4,0	10
Total	27,6	7,2	2,6	62,6	100

Table 6 Road cost allocation

	Total cost (R-million)	Cost/km (R)
Cars/LDVs	2 070,0	0,019
Minibuses	540,0	0,081
Buses	195,0	0,200
Trucks	4 695,0	0,433
Total	7 500,0	0,058

of the total spending in South African cities, then the total annual spending in the metropolitan areas on roads is ±R3,0 billion.

Total spending on roads

In view of the above, the total spending on road maintenance and construction in South Africa for 2000/01 is estimated to have been approximately R7,5 billion. To allocate this

spending to the various vehicle classes is not simple. The distribution of costs, based on American practice as well as judgement, is given in table 5.

Should this be accepted, then the total cost, as well as the cost per kilometre for the various vehicle classes, is as in table 6.

If on average cars consume (say) one litre of fuel for every 10 km, then the fuel levy payment for cars is roughly 12 cents per kilometre. This is six times the road cost that they cause, should the assumptions made above be accepted. If trucks consume on average one litre of fuel every 4 km, then the fuel levy contribution of trucks is 30 cents per kilometre, which is only two-thirds of the road cost that they cause.

All road vehicles pay licence fees and excise tax on imported parts, etc. Licence fees for trucks are high in relation to cars – it

is estimated that the truck population (large and small) pays approximately double the licence fees of cars. The fuel levy on its own constitutes approximately two-thirds of the total taxes that road vehicles have to pay. If this is taken into account, the car population pays road user taxes of ±18 cents per kilometre while the truck population pays road user taxes of ±45 cents per kilometre. While cars pay roughly ten times the cost allocated to them, trucks pay approximately the same amount as their road cost.

CONCLUSION

This cursory estimate of road cost allocation for the South African road network confirms previous views that road users as a group pay substantially more than is spent on road construction and maintenance. In addition, trucks (as a group) do not contribute proportionally for their use of the roads and could be considered to be ‘subsidised’ by motor cars. This disparity is unfair and points to the need for a more equitable roaduser charge for trucks. New technology such as satellite tracking has now been applied successfully elsewhere (Germany) and presents one of the possible options. The real tax milk cows on South Africa’s road network are car users. □



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e-Transport

Smart solutions for new world economies

THE THIRD INTERNATIONAL conference of the South African Society for Intelligent Transport Systems (SASITS), held from 10 to 13 May in Cape Town, has raised hopes for addressing various transport challenges that face South Africa.

ITS is an interdisciplinary profession that developed from the convergence of traffic engineering, information technology and telecommunication. It arose from the dire need to look at the world's growing transportation problems with fresh eyes.

The focus of the conference was to promote the deployment of global best practice solutions appropriate for local conditions and to build bridges with countries with similar needs. Focus areas of special interest were ITS challenges in new world economies, safety (road safety and transport safety and vehicle-related crime), public transport, and congestion management.

The high-profiled conference was attended by delegates from Argentina, Chile, the US, the UK, Wales, Sweden, France, Belgium, Croatia, Nigeria, Malawi, Iran, Saudi Arabia, India, Japan and Australia.

THEME AND NATURE OF THE EVENT

The theme was 'e-Transport: Smart Solutions for New World Economies'. The field of ITS applications in new world economies has emerged as a significant market with good business prospects.

Countries with so-called 'new world economies' face transport challenges that are somewhat different from those in highly industrialised countries. 'New world economies' refer to countries that are in transition and typically experience challenges such as fast urbanisation, growing populations and a need to expand its transport infrastructure. New world countries have transport priorities different from industrialised nations with established infrastructure that often have legacy systems in place.

The clear need of countries with new world economies to use ITS technologies to leverage innovative solutions to their transport needs and the absence of inhibiting legacy systems make these countries a special category in the global ITS market. The conference proved to be an invaluable opportunity for countries with new world economies to discuss issues of mutual concern, share best practices and investigate products and services best suited to their unique needs.

KEY ELEMENTS OF THE CONFERENCE

Several key aspects and/or issues were identified during the course of the conference.

These aspects are not necessarily new within the context of ITS deployment in countries in transition (or anywhere, for that matter), although new perspectives and insights were developed in some cases.

Cooperation between ITS associations

A new level of collaboration between national ITS bodies was experienced. In the past years discussions between these bodies (especially between countries in transition) largely involved sharing experiences of creating ITS awareness and how to get started. The emphasis shifted: experiences were being shared regarding successes in ITS deployment and unique ways of solving various problems. The overall message is that ITS deployment is happening!

Co-ownership of ITS

More than one department or ministry must take ownership of ITS. Because of its multi-functional nature, ITS should not be guided by only one department (for example the Department of Transport), but also by those taking responsibility for Trade and Industry, Communications, Science and Technology, Safety and Security, Health as well as the Legislature. Institutional collaboration and interoperability aspects will benefit from other departments also taking responsibility at a national or federal level.

Sensitivity for culture

Fear for new technology – the unknown – is not always considered by deployment agencies. The user does not always have the same level of literacy or access to information as is the case in industrialised countries. To introduce new technology in the former environment and to ensure user acceptance is a challenge. Even though South Africa (and large parts of Africa) has embraced cellular technology, new technology will only be accepted if it really fulfils a need.

Champions for ITS

Individuals that will promote, support and work towards deployment of ITS within their working environment, are needed both at senior government official level (where the technical aspects of projects are dealt with) as well as political level (where decisions are taken). These individuals are required to have a wider understanding of transport and

communications issues, and should act as 'integrators' in their sphere of influence.

Poverty – man vs machine

The deployment of ITS in an environment where poverty and other social needs (education, health and housing) will always be given priority presents specific challenges. If ITS deployment agencies do not ensure that their ITS programme create job opportunities and lead to other social benefits, their initiative is likely to fail. Specific care should be taken that the introduction of technology does not lead to any loss in jobs.

At the cutting edge of new technology deployment

Owing to the lack of legacy systems (which more than often is the case in countries in transition), it creates opportunities to leapfrog technology. Instead of being the dumping ground for current technology products at the end of their life cycle, countries in transition could be a test bed for new technologies. Meaningful partnerships should be explored.

Standards and architecture

In an environment where the institutional capacity often is lacking to ensure sustainable ITS deployment, the extensive development of standards and architecture is questionable. Rather, the focus should be on ensuring that critical standards are in place that will ensure open systems, competition between technology providers and efficient and effective deployment. Standards and architecture should be endorsed from international bodies where appropriate or adjusted slightly to suit the local environment. Furthermore, the development of an in-depth architecture (which is unlikely to be maintained or 'enforced') is probably not practical in countries in transition. The focus should probably rather be on guidelines for effective ITS deployment.

CONCLUSION

Major sponsorship by the City of Cape Town as well as the Western Cape Provincial Government ensured that this event was a true showcase for the local ITS industry and the country at large. The conference was a catalyst to help focus collective attention to the role of technology in providing solutions to our transport challenges.

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Improving efficiency in the movement of cargo on roads through overload control

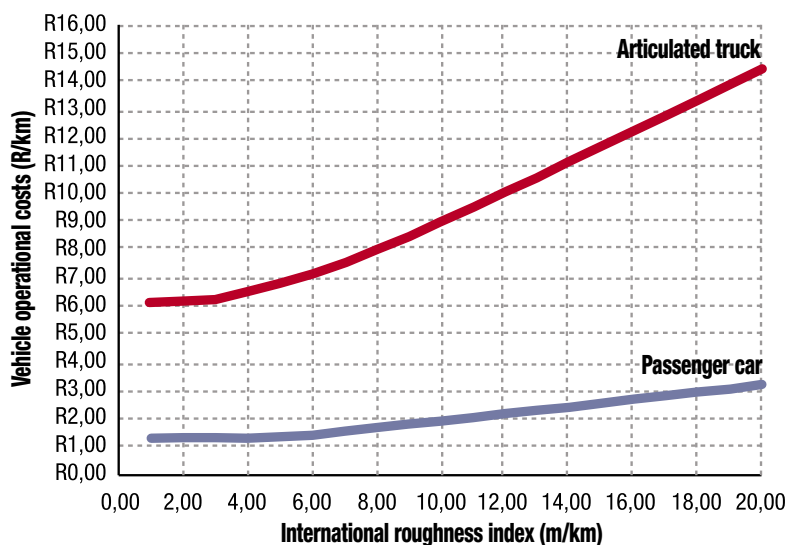


Table 1 Vehicle operating costs vs road condition ('98R)

The graph indicates that the operating costs of an articulated heavy vehicle may be as much as 50 % higher on a moderately damaged road than on a good surfaced road. If the same vehicle were to travel on a severely damaged road, operating costs may increase to as much as 250 % higher than would be the case if the vehicle travelled on a good road (graph prepared by Sanral)

ROAD DAMAGE caused by heavy vehicle overloading in South Africa is costing the country an estimated R600–800 million per annum. In addition, transport costs incurred by road users as a result of bad roads is estimated to amount to billions per annum.

Accelerated road damage has a ripple effect that negatively impacts on the economy. For instance:

- A damaged road poses a hazard to road users and increases the risk of accidents
 - ➔ accidents increase the burden on the economy due to accident compensation
 - ➔ the loss of breadwinners increases demands on the social security system
 - ➔ and the loss of productive people reduces the work capacity and spending capacity of families.
- Damaged roads reduce the average speed of traffic, thus increasing travel time. This may have significant implications for heavy vehicles in terms of turnaround

time and cargo throughput from production areas to end markets, thus impacting negatively on trade and revenues.

- In addition, damaged roads increase vehicle operating costs through higher fuel consumption, regular maintenance, and unproductive time during vehicle repair. In the case of heavy vehicles this cost may be transferred to the client through service charges, thus increasing the cost of doing business.

CURRENT REALITY

Government has been confronted with various forms of heavy vehicle overloading, including sophisticated overloading by the 5 % tolerance margin (that is, an extra 2,8 t payload); repeat overloading by operators; and severe overloading up to and beyond 100 %.

Heavy vehicle operators have become experts in this practice over time. Observed tendencies include:

- Budgeting for admission of guilt fines in the event that overloaded trucks are caught
 - Using technology to monitor overload control operations, namely using cell phones to warn truckers of overloading operations
 - Studying escape routes to inform the selection of routes for cargo transport
 - Using corrupt measures to avoid charging and prosecution
 - Using backup vehicles to offload excess loads when caught, only to reload upon release to continue with the journey
- Law enforcement authorities have been stretched in terms of resources in an attempt to curb these practices. However, because of current challenges such as a shortage of traffic officers, the low salaries of traffic officers, lack of weighbridge infrastructure, and poor coordination of processes, the success rate has until recently not been at the desired level.

GOVERNMENT'S RESPONSE TO CHALLENGES

The Department of Transport (DOT), in partnership with road traffic authorities, completed the National Overload Control Strategy (NOCS) in March 2004. The NOCS' basis for development was threefold: to protect road infrastructure, improve safety on the roads, and ensure the seamless movement of cargo. This strategy reinforces other key strategies within the DOT, including the Road to Safety Strategy, the Strategic Framework for Roads, and the Freight Logistics Strategy.

The NOCS has 11 main focus areas:

- Improvement of weighbridge infrastructure – which involves the development and upgrading of overload control infrastructure in strategic locations across the South African road network
- Extension of liability for overloading – involving the inclusion of provisions in the National Road Traffic Act (NRTA) to include the cargo consignors and con-

signees in prosecutions for heavy vehicle overloading

- A review of the 5 % tolerance – which involves the revision of the of the current 5 % tolerance to 2 % of the gross vehicle mass (GVM)/gross combination mass (GCM) in line with the recommendations of a weighbridge survey that was conducted during the development of the NOCS.
- Definition of habitual overloaders – involving the inclusion of provisions to classify an operator as a habitual overloader if the operator is found to be a frequent overloader.
- Engagement of the short-term insurance industry – to brand overloaders as high risk in order to introduce steep insurance premiums in an effort to discourage overloading.
- The promotion of public-private partnerships – to increase the role of the private sector in the provision of overload control infrastructure, the supply of hi tech equipment for overload control and in overload control operations.
- Strengthening cooperation with the Department of Justice – to elevate the profile of overloading offences in courts and to ensure stiff penalties for guilty offenders.
- Promotion of self-regulation in the heavy vehicle industry – which is intended to foster a partnership with industry to ensure proper load management, vehicle roadworthiness and driver fitness. This is a win-win situation whose main benefit for industry is the improvement of efficiency in operations while for government it would be infrastructure protection and savings in law enforcement costs, among others.
- The training of officers and the improvement of law enforcement operations in order to ensure that law enforcement officers are adequately qualified and trained to execute overload control effectively – this includes the improvement of training material at traffic colleges as well as the upgrading of operational manuals for overload control.
- The introduction of portable weighing equipment – ensuring dedicated research to continuously improve this technology in order to offer desired accuracies for not only heavy vehicle screening but for prosecution purposes as well.
- Introduction of fees and penalties – which seeks to strike a balance between the amount of damage that heavy vehicles inflict on the road network and the fines imposed on overloading culprits. A

new administrative fee will be introduced over and above traffic fines for damage caused on the roads.

CURRENT DOT PROJECTS

- Allocations have been made in the 2005/06 MTEF period to assist provinces with the upgrading of strategically important weighbridges.
- The Load Accreditation Programme (LAP) is being expanded (see page 27). This self-regulation initiative was started in the timber industry and the DOT intends to expand the programme to other industries. Talks are currently under way with the coal and paper and pulp industries.
- A special overload control unit is being established. The unit will target the worst overloaders in South Africa in terms of severe overloading and repeat overloading. Mobile load control units with high-precision weighing scales will be used to enable 'on the spot' charging, producing evidence that will be admissible in court.
- Procedures for overload control operations are being developed to standardise practice across the country and promote best practice in overload control operations. □

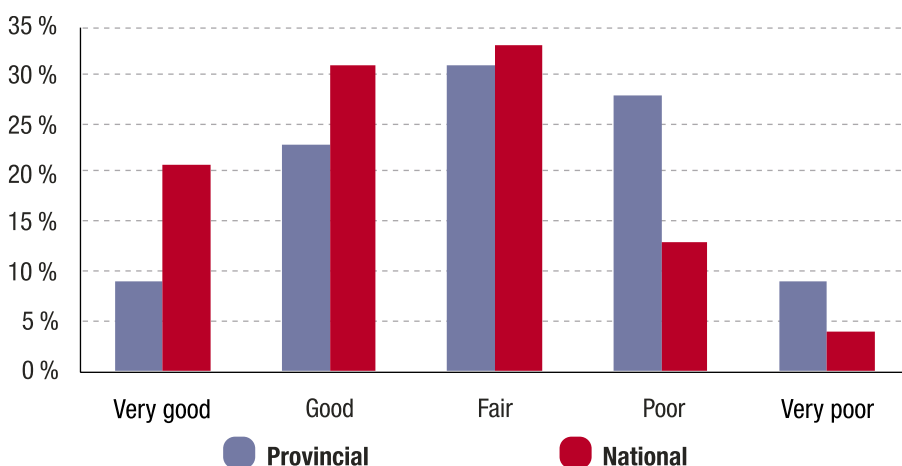
Good corporate governance in the transport of heavy goods

Table 1 Overloading statistics in the Free State, KwaZulu-Natal and Mpumalanga, 2003*

Cargo	Number of vehicles weighed	Number of vehicles overloaded	% Overloaded	Average overload (kg)	Percentage exceeding 5 %
Containers	7 283	669	9	2 174	5
Coal	3 029	2 238	74	1 671	45
Steel	2 447	980	40	1 671	25
Chemicals	2 264	737	33	1 032	7
Logs	1 617	1 032	64	1 772	14
Timber	1 527	699	46	2 282	22
Sand	1 478	955	65	2 172	45
Fuel	1 610	590	37	1 028	3
Cement	1 222	895	73	1 742	32
Sails	1 162	457	39	878	4
Bricks	1 138	520	46	1 803	28
Meat	888	458	52	1 528	43
Coils	797	239	30	1 048	9
Oranges	747	429	57	1 775	34
Paper	721	326	45	1 640	24

*These statistics are likely to be under-reported as most provincial weighbridges are situated on national routes and a large proportion of the provincial road infrastructure is un-policed in terms of heavy vehicle underloading. Note too that timber statistics reflect the status before the improvements achieved through LAP.

Figure 1 Condition of road network



Source: CSIR, Transportek – 2004

THERE IS A GROWING appreciation amongst consignees and consignors of heavy goods that they may have wittingly or unwittingly benefited financially in the past from illegal transport practices. LAP offers a recognised mechanism to companies to demonstrate their acceptance of responsibility.

SAFETY

Many businesses have realised that by abdicating their responsibility to ensure the safe, legal transportation of their goods, they often contribute to a climate in which transporters have a low regard for the laws of the country and in which ethics and safe operating practice are ignored in the pursuit of low costs.

The temptation for consignors to accept these illegally achieved low transport rates is great and the impact large. Clearly if a consignor was to employ the services of a haulier who broke the law (whose drivers for example work 14 hours a shift), this would put pressure on the haulier's competitors to do the same. As the consignors, as well as the hauliers, now enjoy a competitive advantage over their competitors, the pressure to perpetuate this unsatisfactory situation forces others to follow suit.

Statistics maintained by the Department of Transport (DOT) support the view that overloading, un-roadworthy vehicles and driver exhaustion are all major contributors to our appalling accident record. These include some of the following statistics:

In the past century some 400 000 people were killed on our roads. The past three years a minimum of 12 000 people were killed at a cost of R8 billion per year and untold misery. In 2003, 16 % of truck, taxi and bus drivers could not produce a valid driver's licence – this represents some 210 000 drivers. In 2003, 7 % of these drivers were under the influence of alcohol, 20 % had worn or damaged tyres, 8 % had no brake lights and 41 % had exceeded the speed limit in rural areas.

OVERLOADING

The complicity of consignees and consignors in overloading is easy to illustrate. The statistics in table 1 show an appalling picture.

Table 2 Estimated increases in heavy vehicle operating costs for the national and provincial road networks in various conditions

Network condition scenario	Percentage increase in SVOC* compared to the perfect road network	Estimated increase in annual heavy vehicle operating costs
Ideal	2 %	R3,0 billion
Current: National	5 %	R0,8 billion
Provincial	9 %	R12,2 billion
Total		R13,0 billion
Deteriorated	15 %	R22,5 billion

*SVOC: Standard vehicle operating costs

Source: CSIR, Transportek – 2004

It is the view of the South African National Roads Agency Limited (Sanral) and the Road Freight Association (RFA) that: 'Unless all parties involved in the loading, moving and receiving of goods practise good corporate governance and take joint responsibility for their behaviour, the practice of overloading, operating un-roadworthy vehicles and exploiting drivers shall continue along with the accelerated deterioration of our road infrastructure. As a country competing in the global markets, we simply cannot continue in this manner.'

THE COST OF DETERIORATING ROADS

It is ironic to note that those who enjoy the short-term benefits of overloading stand to lose the most in the longer term.

J F Kennedy once said: 'It's not our strong economy that gave us our good roads, it's our good roads that gave us our strong economy.' South Africa's road infrastructure has always been seen as outstanding. However, the graph (figure 1) shows a disturbing picture, particularly for the provincial road infrastructure.

It is estimated that 60 % of unnecessary

road damage is caused by overloaded vehicles and that certain commodities are contributing to the accelerated deterioration of the infrastructure, the effect of which is quantified below.

Table 2 illustrates the current and potential additional cost to the South African transport sector as a result of road damage.

With the cost of logistics in South Africa at approximately 15 % of GDP versus our global competition of 8,5 % (15th Annual States of Logistics Report – CSIR), South Africa simply cannot afford any further increases in transport costs as a result of overloading.

CHANGES IN LEGISLATION

Government, through the DOT, has initiated a national overload control strategy which works hand in hand with the national freight logistics strategy. The strategy recommends new legislation that makes the consignee and consignor jointly responsible for overloading, introduces heavier fines, increases provincial weighbridges and is suggesting a strategy to review the maximum permissible mass per vehicle on provincial roads. The process of prosecu-



John Barton (CEO Mondi Business Paper); Richard Borain (Transport Director Forest Services); Minister Beki Cele (Minister of Transport, Safety and Security in KZN); Rynardt Pieterse (Transport Manager of LT Plant); Andries Smith (MD of Timberland Contractors)

tion is likely to be slow and potentially very expensive to all concerned.

WHAT IS LAP?

The Heavy Vehicle Load Accreditation System (LAP) is a self-regulating programme. The Australian Road Industry was one of the first in the world to recognise the benefits of self-regulation. LAP is similar to the Australian approach and is a process of self-regulation where consignees, consignors and hauliers aim to reduce overloading, improve safety, driver wellness and efficiency of heavy vehicle transport in the country.

HOW DOES LAP ACHIEVE THIS?

LAP provides the following:

- A system where consignees, consignors and hauliers can be accountable through a process of self-regulation
- The ability to assess overloading and transport efficiency in the supply chain
- An accreditation system for hauliers called the Heavy Vehicle Load Management System (HVLMS)

ADDITIONAL BENEFITS

LAP is focused on attaining concessions for compliant hauliers. These include:

- Eliminating the unnecessary weighing of vehicles at provincial weighbridges (already attained in KZN)
- Discounted insurance premiums
- A fair and stable environment in which hauliers can operate
- The investigation of and possible introduction of performance-based standards (PBS) in the country. This system is used in Canada, Australia and New Zealand, where substantial reductions in transport costs have been achieved.

WHO IS PART OF LAP?

LAP is chaired by the Road Freight Association (RFA) and represented by Sanral and has representatives from the participating industries and DOT. The project is managed by Martin Steenkamp of the National Productivity Institute (NPI).

SUCCESSES THUS FAR

LAP has been piloted in the timber industry, where incidences of overloading were reduced by 30 % in the first 20 months of the project.

The three timber hauliers who have been accredited thus far are seen with dignitaries at the accrediting ceremony held in Durban in 2004.

HOW DOES LAP WORK?

For industries and companies wanting to participate in LAP:

■ **Step 1:** Independent monitoring of overloading of consignees or consignors wishing to 'take the lead' is undertaken by LAP. Results are posted on www.laponline.co.za in a spirit of self-regulation and transparency. In some cases confidentiality is maintained for a period to allow compliance without embarrassment.

In industries where weighing is not undertaken this step is ignored. It is self-funded by the industry and the NPI is paid by the participants to coordinate this process.

■ **Step 2:** Once critical mass has been reached, a steering committee for each participating industry is established under the banner of the national steering committee. The committee's task is to implement a system of accreditation of hauliers in that industry.

■ **Step 3:** Funding with participating industry players and government is arranged to properly define the haulier accreditation process. This process is facilitated by the NPI and the National LAP Steering Committee.

■ **Step 4:** The rules of accreditation of hauliers in the supply chain (of a new industry) are evaluated against the existing Heavy Vehicle Load Management System (HVLMS) and adjusted where appropriate.

■ **Step 5:** Transporters are trained to implement the HVLMS in order to comply with the audits.

■ **Step 6:** Auditing and accreditation of hauliers.

CONCLUSION

Financial support in the form of 'seed-funding' from the DOT has encouraged greater alignment with the DOT's National Freight Logistics and Overloading Strategy. The leadership of the RFA and the support of Sanral have also been important factors in achieving this alignment. □

QUOTES FROM LAP PARTICIPANTS

'If we sort out un-roadworthy vehicles we will reduce accidents by 30 %.'

► **Sipho Kumalo**, CEO, Road Freight Association

'LAP is levelling the playing fields, something transporters on their own couldn't achieve.'

► **Reynard Pieterse**, Operational Manager, LT Plant

'LAP can save the trucking industry significant time and financial costs and improve the logistics of transporting goods by road.'

► **Skumbuzo Macozoma**, Chief Director: Integrated Infrastructure Network Development, DOT

'LAP makes business sense; we challenge other industries to support the process.'

► **Mike Edwards**, CEO, Forestry South Africa

'LAP through PBS offers the industry the opportunity of the biggest quantum leap in cost reduction in the last ten years.'

► **Des Armstrong**, Manager Transport Technology, Mondi Business Paper

'LAP has benefits for every citizen of the country.'

► **Geoff Ackermann**, Sanral

'Innovations such as LAP come from the ability to be brave and creative, and from having an open mind – not only for doing new things, but even more so for ceasing to do things as we always have ... LAP is rewarding for us all; we need to do more together to build on this success.'

► **John Barton**, CEO, Mondi Business Paper

Health and safety in the bituminous products industry

LAUNCHED IN 2002, the Southern African Bitumen Association (Sabita) Focus Group Centre for Occupational Safety, Health and Environmental Conservation (COSHEC) opened the door to wide-ranging reforms designed to install global standards of health, safety and environmental conservation in South Africa's bituminous products industry.

As a result of South Africa's re-integration into the world community in the 1990s, many of these reforms, and the development of new laws relating to health, safety and environmental (HSE) issues, have been influenced by law in foreign jurisdictions and international legal standards.

Sabita's executive director, Piet Myburgh, said that inherent in the pursuit of global standards of HSE in South Africa 'is the understanding that we live in a finite world with limited resources, which must therefore be managed as judiciously as possible'.

The policies and principles that guide Sabita's HSE initiative include the following:

- Sustainable development is the underlying principle of environmental management.
- The precautionary principle is the basis for a conservative approach to the regulation of adverse impacts. In terms of this principle, if the impact of a specific action is not clearly understood, then these actions should not be undertaken.
- Adverse environmental impacts should be dealt with proactively by avoiding them or, where this is not possible, by limiting them.
- A partnership exists between the state, the public and industry to achieve sound environmental management.'

COSHEC's ultimate goal is to introduce and maintain global standards in the quality of health, safety and environmental conservation in southern Africa's bituminous products sector. Implicit in this goal is the understanding that any endeavour to advance quality products, services and methods will not proceed without due consideration of their effect on the risk of exposure of workers to health and safety hazards and any harmful effects on the environment.

Strategic themes pursued by COSHEC since its inception include:

- Promoting HSEQ corporate responsibility in the industry through the dissemination of global best practice, encouraging voluntary acceptance and participation in a process of incident reporting, and the compilation of a database
- Identifying hazardous situations, and developing guidelines covering product handling, worker protection at plants,

worksites and laboratories; ensuring conformance with best available technology (BAT); compliance with relevant legislation, and product disposal

- Developing and presenting courses on safety in the handling of bituminous products

Focus areas that have been developed to meet these strategic themes include:

- **Safe working practices** A safety-training course in the handling of liquid bitumen has been initiated. The course will be directed at trainers in members' companies who would then initiate training programmes with other employees at times that suit the individual companies. The content will cover ancillary processes that are considered hazardous.
- **Disposal of surplus bitumen** Safe and responsible procedures for the disposal of bitumen to selected land-fill sites have been developed in conjunction with the Department of Water Affairs and Tourism (DWAF). This follows the submission of a technical report, sponsored by Sabita, proving that bitumen does not present any health or environmental hazards at ambient temperatures, and can be safely disposed of at selected landfill sites meeting for example GB+ or possibly even GB- classification.
- **Use of coal tar in road construction** Bitumen, which is manufactured from crude oil by distillation, is non-toxic, non-volatile and resistant to water and weathering. As such, it does not present any health or environmental hazards at ambient temperatures, and studies on bitumen emissions arising from heating have shown minimal risk of health effects in exposed workers. Coal tars, in contrast, are produced by the pyrolysis of coal, and are complex combinations of hydrocarbons, phenols and heterocyclic oxygen, sulphur and nitrogen compounds. Bitumen and coal tars both contain polycyclic aromatic hydrocarbons (PAHs), but the concentration of PAHs in low and high temperature coal tar products is significantly higher than in bitumens. As a result, the carcinogenic potential of coal tars has been well recognised and widely accepted since 1985 by the International Agency for Research on Cancer (IARC).

The document also notes that the leachability of coal tar products is significantly higher than that of bitumen, posing a higher threat to surface and groundwater supplies, and to aquatic life.

COSHEC has therefore undertaken

to support and assist roads authorities in their efforts to discontinue the use of coal tar in their projects and to identify and encourage the use of bituminous alternatives to coal tar.

- **Incident reporting** A draft guideline outlining a Sabita procedure for incident reporting has been produced, and COSHEC has agreed that this initiative should be advanced by sharing safety information with industry members on a monthly basis. Participants will be asked to share information about safety incidents or near-misses.
- **Laboratory solvents and cleaning agents** Information is currently being sought from COSHEC'S UK sources to ascertain methods and materials used globally to minimise the risk of exposure to hazardous substances commonly used in laboratories as solvents or cleansing substances.
- **Global cooperation on HSE** COSHEC is in contact with other agencies in the United States, Australia, Europe and elsewhere to establish joint ventures aimed at promoting best practice in this field and cooperation on facing global challenges.
- **Risk assessment and safe working practices** Under the guidance of COSHEC, Sabita is currently in the final stages of preparing a guideline document on the assessment of risk on construction sites. Including guidance on the development of policy and its implementation, and comprehensive details on safe working practices for a wide range of plant, machinery and operations, this document has been designed to assist the bituminous products industry in the implementation of best available techniques (BAT) and compliance with HSE legislation.

'Although there are a number of specific acts and regulations dealing with particular resources, the Constitution of the Republic of South Africa Act 108 of 1996 contains overriding principles for environmental management,' Myburgh said. 'Chapter 2 includes a bill of rights containing 25 fundamental rights that the state has undertaken to guarantee and protect. Specific reference is made to "an environment that is not harmful to health and well-being" and any infringement of these rights could result in prosecution and possible civil damage claims.'

'This is a clear mandate to the courts and to government to ensure that environmental and safety policies are kept in line with international standards and norms,' said Myburgh. ■

Transport lifeline for passengers with disabilities



WHEN SOUTH AFRICA's public transport system was established, accessibility for passengers with disabilities was not a factor. This is evident from even a casual inspection of our public transport facilities and vehicles. Gaining access to commuter rail stations generally requires commuters to climb stairs into the building and then to ascend/descend a long flight of stairs to and from an overbridge to reach the platform.

To gain access to buses passengers must climb three or more steps and negotiate a change in direction, while gaining access to minibus taxis means that other passengers are delayed while one pulls oneself into the crowded vehicle.

And all this assumes that, somehow, the person has managed to get him- or herself from home to the public transport stop!

As a demonstration project for the bid for the 2004 Olympic Games, the City of Cape Town Municipality initiated the Dial-a-Ride service. This project was funded by the Department of Transport, the Western Cape Provincial Government and the City of Cape Town, with the Western Cape Network on Disability providing expert advice. Three converted panel vans and a minibus were fitted with specialised equipment to restrain wheelchairs. Passengers from Khayelitsha and Mitchell's Plain were eligible to use the service once they had registered with the network through the Cape Town Association for the Physically Disabled or the Cape Town Society for the Blind. The demonstration project was operated by Golden Arrow Bus Services (Pty) Ltd and proved so successful that in October 2002 it was extended to all physically and visually impaired passengers living within the city boundaries.

The extended fleet comprises seventeen vehicles – thirteen converted panel vans and four converted minibuses. It continues to be funded by the Department of Transport, the Western Cape Provincial Government

and the City of Cape Town. The operator is iKapa Tours and Travel (Pty) Ltd, who won the tender to provide the services for four years. The service is available to anyone with a visual or physical impairment who lives in the municipal area of Cape Town and cannot use other forms of public transport because of their lack of accessibility.

It provides kerb-to-kerb public transport on demand seven days a week from 6 am until 7 pm.

A potential user has to register by completing a simple form that is available at a variety of locations including All-Pay centres, day hospitals, disabled people's organisations and the City of Cape Town website. The form must be signed by a professional care provider who certifies that the mainstream public transport system is not suitable for that person's use. Should an application be considered questionable by the city or the operator, the user is referred to a specialist for examination.

To book the service the passenger telephones the operator on a toll-free number. Repeat bookings are allowed for passengers who use the service to travel to and from work. Trips to hospitals and other medical facilities are generally restricted to non-peak periods.

All vehicles are fitted with imported specialist passenger and wheelchair restraint systems. Wheelchair restraints clip onto the front and back of the wheelchair, and lock into one of the tracks in the panel van's floor. The passenger restraint is a full harness, which is also fixed to the floor tracks, and provides support even if a passenger has little upper body control. The panel vans are also fitted with underfloor lifts that are operated by the driver. These lifts have



a safe working load of 280 kg and are fitted with twin handrails to provide extra support for a person in a wheelchair. The minibuses are provided with ramps with a gradient that does not exceed 1:4.

The extended service has proved a complete success with almost 3 700 registered users to date. ■

► FACT FILE

- Number of registered passengers
3 679
- Average number of passengers each month
6 005
- Average kilometres travelled each month
138 605 km
- Number of converted panel vans
14
- Number of converted minibuses
3
- Average number of passengers per vehicle per day
11



MOUNTAINPASS

The first mountain pass built in South Africa

JAN VAN RIEBEECK, the fellow who was dumped on the shores of Table Bay in April 1652 and told to supply passing ships with fresh vegetables and other provisions, had to get timber from up Kirstenbosch way. So on 26 May 1653 he built a two-wheeled carpenter's cart on which he balanced the trees and things, and on 30 May 'in order that the cart may run over the road more easily, others were sent with picks, mattock, shovels and spades to level the road somewhat, being rather uneven'. To supplement their praiseworthy construction efforts, it is recorded that this 'wagen pad na't Bosch' had to be kept maintained by occasional flurries of men with picks and shovels.

A noteworthy event, road transport and the essential supporting road building

and road maintenance activities had arrived in South Africa!

Now, when they had chopped down all the nice trees in Kirstenbosch (talk about sustainable development!) they had to look for another source of timber. So they moved on to Hout Bay where, as the name implies, at that time there were lots of trees.

Commander Wagenaer, in charge at the time, said, 'Let there be a road over Bosheuvel so that we may cut timber in the Hout Bay valley'. Thus, on 18 August 1666 Lieutenant Schut and 24 soldiers went out 'towards the evening with some crowbars, picks and shovels in order to make a road'. If they only had the rest of that day to build the road, it really cannot have been much of a highway!

However, apparently the road was used successfully. With time the traffic grew, and we find that the road was lengthened and improved by order of Commander Simon van der Stel in 1679 and that further road work was done in early 1693.

In fact, this pass and the road to Hout Bay never looked back. It was improved at regular intervals, until it reached the state you see today.

Now, some people will tell you that the road up to the Silvermine plateau (what we today call the Ou Kaapse Weg) was the first mountain pass built in our country, but in my opinion Cloof Pass, the timber road over Constantia Nek, deserves that title. □

Transportation engineering at Tuks

UNDERGRADUATE AND POSTGRADUATE training in transportation engineering in the Department of Civil and Biosystems Engineering at the University of Pretoria is continuing with ever increasing numbers. This bodes well for an industry that is suffering from shortages in skilled human resources.

Recent research has made significant contributions to solving burning issues. A brief description and some of the main outcomes are given below.

Modelling car ownership in post-apartheid South Africa

Being able to predict trends in car ownership and use is important for local authorities in planning for road and public transport provision in our congested cities. Realising that available models of car ownership employ increasingly useless and unacceptable categorisation of people according to race, Mathetha Mokonyama explored a new approach based on the income and dwelling type of households. In Johannesburg, for instance, households in higher-density townhouse-type developments are found to own more cars than those in traditional single family dwellings in lower density neighbourhoods, with corresponding impacts on their tendency to depend on car travel for their transport needs. Thus housing density on its own inadequately explains car ownership in South African cities. Mathetha's findings are now being used to develop and test scenarios for future interventions for congestion relief in the City of Johannesburg.

A new formula for establishing bulk service contributions from developers

Bulk service contributions are often levied by municipal and local authorities for the provision of road infrastructure from developers. These contributions are to compensate for the road network upgrading to cater for traffic generated by the new development. In South Africa such contributions are normally established on the basis of the peak-hour trip generation of a development. Jaco de Vries developed a formula whereby the developer contribution is calculated according to the AADT-kilometres of trips generated by the development. The bulk service contribution is therefore in proportion to the overall use of the road network taking into account peak and off-peak trips. This work is being implemented by some of the local authorities in Gauteng.

Engineering properties of aggregate-lime-natural pozzolan mixes

Depletion of and the environmental impact of traditional borrow pits means that alternative materials need to be investigated. Tanzania has abundant sources of natural pozzolan. Arip Olekambanei's research focused on identifying the engineering properties of different sources of pozzolan when mixed with sand and lime. Strength development was similar to that of cement, and it was found that achieving the required density at a compaction moisture content below optimum reduced the shrinkage. These findings are being implemented in Tanzania in projects where pozzolans were specified.

Modelling an airline service

The African airline industry suffers from high fares and indirect routing from one country to another. This obstructs the development objectives of African development. Brigett Ssamula developed an airline cost model that permitted an evaluation of cost structures

for travel between various cities, and the optimal aircraft allocation depending on demand. This cost model can be used in multilateral negotiations in developing desired route options for Africa, based on trip generation, distribution and hubbing.

Relating material properties to erosion potential

There is significant economic and environmental need to minimise erosion on unsurfaced areas. In addition, stakeholders are directly affected in that erosion of roads leads to poor riding quality, can impinge on safety, requires unplanned maintenance, and affects travel costs. Understanding the role of material properties in the erosion process holds a key to managing the problem. In a laboratory study, Henrico Range found that, as is well known, the plasticity index (PI) has a significant effect on resistance to erosion. However, the higher the degree of compaction, the better the erosion resistance, virtually independent of the PI. The importance of compaction is a common thread in recent unpaved road performance results, and is in contrast to allowing traffic to compact a regravelled road. □



Transportation Division honours **Olaus van Zyl**

THE CHAIRMAN'S AWARD for Meritorious Service to the transportation engineering profession was awarded to Olaus van Zyl, CEO of BKS, earlier this year.

In accepting the award, Van Zyl said: 'In my career in this profession of nearly 30 years (excluding my excursion of eight years into another arena) it was always a pleasure to go to work and even to work long hours. This is so because of the very interesting projects and challenges and the nice people you work with, even though it is not a profession you can get rich from.'

Van Zyl explained that in the engineering field, transportation engineering is one of the disciplines where you work the most with people, right from the politicians to the man in the street. Many of them consider themselves to be experts because they use the transport system every day and have their own perceptions of what is wrong and what should be done to put it right. It is thus not only a challenge to find the right technical solution, but often a bigger challenge to propose and sell technical solutions in the right way. The old truth that you can develop the best engineering solution in the world but if you can't sell it, it means nothing, is today more valid than ever. He said, 'I sometimes hear colleagues blaming the decision-maker for not accepting the proposed solution, but often it is our own inability to sell it that is to blame. I believe this aspect is one of the aspects that make our profession so interesting and so challenging.'

'I also believe that we have too few engineers and transportation experts in politics in our country. In China they have ten million civil engineers and close to half of the members of their cabinet are engineers. We work with the development of our country, and with its infrastructure and services. We should also be there where the decisions are taken. We must get out of our technical comfort zones and take up our rightful positions (and I nearly said: "or forever hold your peace").

'My first transportation engineering project ever was in 1968 and it was to investigate the location of the new Ellispark. We looked at sites in Kempton Park, Roodepoort, Randburg and Germiston. In the end we recommended that it should stay where it was mainly due to accessibility and parking advantages. Since then I have worked on many interesting and exciting projects. Today, close to the end of my career, I am privileged to work on the Gautrain Project, one of the largest and most challenging transportation projects ever tackled in South Africa.'

Van Zyl said that he has also been privileged to be in government when after 1994 the transportation policies were revised. 'Since 1994 we have adopted good transportation legislation in this country. Our challenge is to ensure that it is implemented, and also to ensure that we get our fair share of the funds required for transportation. Throughout my whole career this was a challenge and it will stay one, because there will always be competing needs for the available limited budget. This is another reason why we must have our people in decision-making positions.'

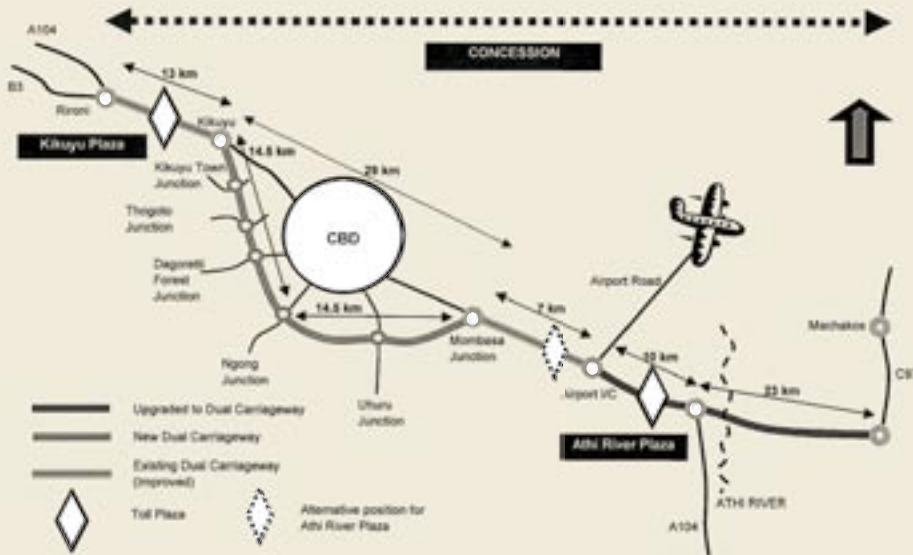
ADAPT OR ...

Said Van Zyl: 'I believe in the future of our country and also in the future of us as engineers and transportation professionals. But then we must be willing to change – also in our profession. Circumstances change and governments and decision-makers change. Therefore we must also adapt. Our success will depend on our ability to change. One of our biggest challenges is with public transport, a change to public transport, with providing people with acceptable alternative modes of transport; public transport that I and other car users will use. Gautrain will definitely help.'

Ha also considered the alternative of huge traffic jams, which would be too ghastly to contemplate. Van Zyl encouraged his colleagues to be part of the solution and not the problem. ■

Kenya's Northern Corridor

A lifeline for the East African economy



THE NORTHERN CORRIDOR between Mombasa in Kenya and the Ugandan border is one of the most important corridors in East Africa as it serves Kenya and the landlocked neighbouring countries west of Kenya.

ECONOMIC GROWTH AND DEVELOPMENT

The government of Kenya identified the Northern Corridor as an excellent investment opportunity for the private sector to ensure long-term sustainability and efficient transportation along the corridor.

Kenya's economic growth is intrinsically linked to the improvement and continuous maintenance of the 1 200 km corridor because it serves as an economic lifeline for the transportation of goods between the Port of Mombasa and Kenya's capital, Nairobi. Other important economic centres and activity nodes are also connected to Nairobi by this route.

PROJECT TEAM

BKS was appointed for the project because of the company's expertise in toll road development, road design and management throughout the continent. BKS, in association with TolPlan Consulting of South Africa and CAPEconsult, a Kenyan consulting engineering and management firm, was thus appointed to do a detailed assessment of the viability of road concessioning in Kenya as a means of facilitating and promoting the restoration of the country's primary road infrastructure network.

VIABILITY OF A ROAD CONCESSION

The first phase of the project entailed:

- An assessment of the economic, financial and technical feasibility of road concessions

- The preparation of a clear options paper that outlined the various alternatives and options
 - Identification and quantification of the associated costs and benefits for the government of Kenya, road users and private investors
 - Recommendations for the best approach with regard to concessioning
- Phase II involved:
- Determining the specific components of the road network that would be suitable for concessioning
 - Identifying appropriate financing and cost recovery mechanisms, such as road-user charges
 - Formulating a transparent framework that made provision for the award of concessions to private investors, performance criteria, contract supervision and monitoring, economic and safety regulations, and penalties and dispute resolution
 - Drafting and providing enabling legislation
- BKS was directly responsible for data collection and analysis, traffic counts and traffic data analysis, preliminary pavement evaluations and pavement rehabilitation designs, economic and financial analysis to determine the associated costs and benefits, preparation of the concessioning framework and enabling legislation, as well as organising and holding stakeholder workshops.

The initial feasibility study showed that the corridor could be developed and maintained as four individual toll road concessions.

A TRANSPARENT PROCUREMENT PROCESS

The procurement process for identifying a concessionaire will be competitive and

transparent, using the build-operate-transfer (BOT) process. The government of Kenya will enter into a concession contract with the successful concessionaire for a concession period of at least 30 years.

The concession contract is prepared on the basis that a newly formed special purpose company will undertake the toll road project and the construction works will be undertaken by an independent contractor.

The agreement between the government of Kenya and the concessionaire will be in terms of several performance-based engineering and highway contracts.

INVESTMENT BY DEVELOPING AGENCIES

Several development agencies, such as the World Bank and European Union, have assisted the Kenyan government over the past few years in improving the Northern Corridor by means of grants and loans. These investments have contributed to ensuring the implementation of lower and more affordable toll tariffs. The planned concessions will also safeguard these prior investments and ensure long-term sustainability in the corridor. The new concession will also free up government funding for investment in other needy sectors of the economy, thus contributing to overall improvements in the country's infrastructure which could, in turn, lead to increased tourism and greater capital investments in the country.

BENEFITS OF THE CONCESSION

The toll strategy for the Northern Corridor concession is fully equitable for the road user and the fee-for-service will apply. The toll tariffs will never exceed the benefits received by the road user in terms of reduced vehicle operating costs, reduced travel time, improved safety and convenience. In addition, a high standard in road infrastructure and transportation facilities is guaranteed for a long period because of the concession.

The additional bypass roads will allow long distance traffic to avoid the congestion in the Nairobi city centre, which will result in a significant saving in road user costs. The urban road user and commuter in Nairobi will also benefit greatly since travel into and out of the Nairobi city centre and towards the airport will become quicker and easier, given the rehabilitation of Mombasa Road (A104) and the construction of the new Southern Bypass.

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Some early South African *road traffic regulations*

TO START OFF, let me muse as to whether it is right to travel on the left.

In about 1000 BC the approaches to Tyrins, the Arcadian Greek fort near Argos, were designed so that the gate sentries had a clear view of the right sides of approaching people. This enabled them to see whether their swords were sheathed (friends) or drawn (unfriendly people) and to take any necessary action. It had to be the right side because shields were carried on the left arm. It follows that on the march one would regard with deep suspicion any character sidling up on one's left with his sword or other sharp weapon concealed behind his shield, and so one and all, being of necessity cautious people, would 'keep to the left'.

Marching and riding on the left had the added advantage for those equestrians bearing swords that it was easier to draw one's sword and smite hip and thigh of a traveller coming the other way if that traveller was on the sword-wielder's right-hand side.

It would appear that the Romans kept to the left when rushing around Europe during their 2000 years of conquest. There had been uncertainty about this over a long period, because the straight roads they built have been so much used and so much maintained over the past 2000 years that little original material remains. But finally a chap called Bryn Walters, of the Association for Roman Archaeology in Britain, was able to rule that they drove on the left. And why was he able to do so? Because he found a long disused track to a similarly long disused quarry from which the Romans had won stone for the construction of a nearby major temple. The ruts made by laden carts exiting the quarry were naturally much deeper than those made by unladen carts returning to pick up another load – and from this he could determine that they kept to the left.

Later, in 1300 AD, Pope Bonifacio VII, to facilitate the orderly movement of the pilgrim corteges of that day, laid down that traffic should keep to the left, thus formalising what was probably the custom of most travellers. His ruling was then

generally observed throughout Europe.

However, in France they had taken things a bit further by laying down that the left-hand side of the road was reserved for the use of the aristocracy, the common people being banished to the right-hand side. (Presumably when aristocrats coming one way met commoners going the other the commoners removed themselves into the adjacent ditch!) In the late 1700s, after the French Revolution, Robespierre proclaimed that since there was now no more aristocracy to use the left-hand side of the road, ALL the now-equal people should use the right-hand side of the road. (A typical piece of political *non sequitur*!)

Along came Napoleon Bonaparte, who conquered great portions of Europe, winning battle after battle, not only because of the superior fighting calibre of his troops but also because of his ability to move his Grande Armée, troops, artillery and colossal support trains, rapidly – fifty kilometres a day – to places where they were least expected. (He appreciated that transportation was then, as now, the key to economic – or any other – expansion.) To facilitate the rapidity of movement of his armies Napoleon enforced Robespierre's proclamation. (We might note that then, as now, regulations and laws were of themselves absolutely useless: they have to be enforced to be effective!) It has been suggested that another reason for Napoleon being so keen to keep to the right might well have been that he appreciated that the era of the sword was being superseded by that of the musket, and while a sword is more easily wielded on the swordsman's right side a firearm points more naturally to the bearer's left. A fascinating thought!

Be that as it may, the countries of western Europe conquered by Napoleon – and this included Holland – had perforce to change their custom of travelling on the left to comply with the French 'keep to the right' ruling. Britain of course was among those countries that continued to 'keep to the left'.

Now, here in the Cape the British had taken over the territory and terminated

the rule of the Dutch East India Company in 1795. The Dutch next held the Cape from 1803 until 1806, when the Earl of Caledon, governor and commander in chief, arrived to run things the British way again.

On 23 June 1809 the governor issued a proclamation controlling road traffic which must be one of the earliest, if not the earliest, in South Africa. He did this because he was concerned that 'accidents frequently happen ... from the negligence or misconduct of the Drivers of Carriages, and particularly of Bullock Waggons'.

Caledon, being British, proclaimed, *inter alia*, that all vehicles should now keep to the left-hand side of the road or street.

So this became the right thing to do here, and we South Africans have driven on the left ever since!

But the governor had other bright ideas about traffic control.

In the same proclamation (1809) he decreed that 'should any damage be done to either Carriage, Cart, or Waggon, whilst on its proper side of the road, by another out of its place, then and in that case the owner' shall be liable for costs and a fine.

Fair enough, you say. But Caledon didn't leave it there – he thought ahead and ruled that in order that the proprietor of each cart or wagon might more easily be determined, so that the rulings in the Proclamation might be enforced, he required all vehicles to be registered with the fiscals or the landdrosts (magistrates) of their respective districts. They would then receive a number which they 'shall cause to be painted in white figures of at least one inch and a half in length, on a black board one foot square, together with the owner's name, and the District in which he resides, which board shall be placed on the right side of each Cart or Waggon'.

And we South Africans, driving on the right side of the road, which is the left side, have displayed distinguishing number plates on our vehicles ever since. ■

EASY-TO-USE COMPLEMENT TO CAD TOOLS

ROAD GEOMETRY, LITERATURE ...

INSTRUCTIONS AND recommendations dealing with the geometry of road infrastructure projects are numerous, and such a package of rules or examples could be symptomatic of the set – indeed definitive – characteristic of this branch of civil engineering. However, if we refer to the data from DIRR (road research international documentation), a lot of research dealing with road geometry and its subsidiary installations is in progress in Europe and the rest of the world. This research approaches themes such as parking, space geometry and turning paths, thus proving the evolutionary and innovative characteristic of this established branch of engineering. All this research – and the norms that derive from it most of the time – has a common goal: to give the planner efficient design, development and control tools.

Considering this abundance of literature, it is quite legitimate to question the relevancy of cur-



AutoTURN menu

rent and future research; are current instructions or norms not sufficient? Certainly not, because the literature does not cover all the possible configurations, and from one normalised case to the next it is not always easy, or even possible, to interpolate the values of the desired intermediary configuration.

To mitigate the weaknesses of the literature, planners use computer tools which are better adapted to special cases, since they can tackle each case in a personalised way.

... AND COMPUTER PROGRAMS

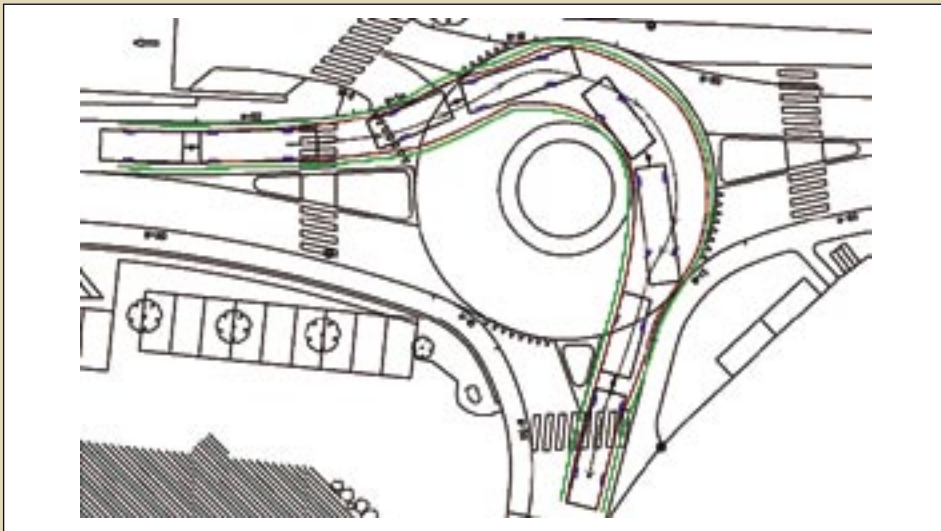
Among the numerous plan simulation tools is AutoTURN, which has been developed for 14 years by the Canadian firm Transoft Solutions. After making its mark across the Atlantic and in Australia the program is beginning to spread on the continent. Even though this tool was known to certain European institutions in its earlier versions (Régie Autonome de Transports Parisiens, Aéroport de Paris, Ecole Polytechnique Fédérale de Lausanne) it is with Version 5 (launched in 2004) that the program gives

the engineer definitive help with its relevance and simplicity.

AutoTURN is above all a computer program for the interactive tracing of turning paths. It is designed as a supplementary module for two well-known CAD tools: AutoCAD and MicroStation. It fits in with them as a simple supplementary menu.

How does AutoTURN work?

With the help of the mouse, AutoTURN allows one to direct a vehicle on the screen and to make it carry out manoeuvres such as parking and forward and backward turns as simply as a child moves a miniature car on an imaginary circuit, with the difference that this program does not allow the user to go beyond the turning limits of the vehicle. These limits depend above all on the geometric characteristics of the vehicle (dimensions, maximum turn radius, articulation between the elements of the vehicle), but also on the chosen speed, the inclination of the road, and the lateral friction coefficient of the pavement.



Turning simulation in a roundabout with an articulated vehicle

Uses

AutoTURN is used mostly in two fields: infrastructure designing and control of existing projects or infrastructures. On the basis of turning paths that will be generated for determining vehicles, one can for instance draw the minimum necessary infrastructures.

But much more than direct designing, the control of plans and the verification of the viability of existing infrastructures are the favourite domain of this tool. For example, any public transportation firm regularly faces problems generated by new urban planning (roundabouts, traffic moderation) or the acquisition of new rolling material with important dimensions. How can one be sure of the viability of itineraries in such a case? AutoTURN allows rapid verification where tests in real size would necessitate considerable investments in time, material and financial means. In addition to road projects, AutoTURN can be used for other studies such as parking, traffic moderation, rail/road transfer interfaces, industrial zones, covered markets, seaport and airport installations.

But which vehicles?

AutoTURN was designed to simulate the movement of road vehicles and airplanes. But it can also be used for any object on wheels which moves on a plane surface. We can thus extend its field of appli-

cation, for example, to the following objects: rolling gantries for the replacement of airport runway elements, loading bridges for seaport installations, baggage trailers, stretchers or hospital beds, caddies for large commercial surfaces, maintenance machines for industrial surfaces. To allow the planner to test his projects with maximum relevance, a library of standard vehicles corresponding to the norms of numerous countries is provided with the product. As far as airplanes are concerned, the choices cover an extended scale of types and existing models: Airbus, Boeing, Commuter, McDonnell, and several military planes. Whenever needed, planners can define their own road vehicles or airplanes, based on a list of vehicle types. If the required type of vehicle is not represented in the library, the user can create special design types with up to 10 elements (1 tractor and 9 trailers), each one having 0–9 fixed or steering axles on 2–6 wheels.

What evolution, and for whom?

AutoTURN is always open to improvement. Indeed, most developments and new functions of this tool derive from comments and requests from users. They are the ones who are mainly responsible for its evolution.

VAE SWITCHED TO A NEW TRACK

VOESTALPINE SHIENEN, the rail specialists in Donawitz, signed a contract with Danielli from Italy for a completely new construction of a rail rolling mill in Donawitz, Austria. The 66 million investment will expand and strengthen the market position as a leading rail supplier by constructing the most innovative rail rolling mill in the world. The entirely new UFR (ultra flexible rolling mill) design of the plant makes it possible to completely and optimally adapt production schedules and modes to the current trends and demands of the market.

The robot-controlled SCC system will reduce loss of time during roll and equipment changes. In the world's record time of only 15 minutes, changes to the facility can be made to switch production from one rail section to another. The modernisation will increase productivity, improve the utilisation ratio of the plant and will improve the very tight production tolerances that have already been achieved. Finalisation and start-up of the new plant is scheduled for February 2006.



VAE Austria has developed a self-contained fully sealed locking system, called the Spherolock. Mostly made of turned parts, the locking system can no longer become dirty and the initially applied lubrication of the lock components are to be removed by climatic influences. VAE SA has combined the Spherolock with a locally developed hydraulic drive and detection system and applied it to a 1:20 turnout with three operating points. The hydraulic

system features both a mechanical and hydraulic retention device at each of the three hydraulic cylinders for safety purposes. Both these devices have been developed to be trailable in emergency situations to minimise damage to the other costly components.

Major damage caused by hot boxes and defective brakes are a headache for any rail operator. The VAE hot box and brake detection system automatically checks the condition of axle bearings on running trains as well as blocked brakes on stationary trains.

This system is installed on rails or in hollow steel sleepers and is designed to collect temperatures of different types of axle bearings, such as roller bearings, slide bearings and wheel sets. The VAE HOA/FOA is a contactless, stationary thermometer for axle bearings and wheel sets of rail wheels passing the measuring spot at up to 400 km/h. A purpose-designed scanning feature scans axle bearings in the same direction, as the train is moving. Hottest spots are securely recorded and the absolute temperature of the axle bearing is measured. The FOA can be installed as a stand-alone system that measures wheel set temperatures up to 650°, locating blocked shoe brakes.



The VAE Roadmaster 2000 is a turnout monitoring system that continually monitors the actual operating condition of the connected turnouts and components. The monitoring system is a non-interacting, expandable modular system that contains all advantages of an independent system analysis. As the turnout condition is permanently monitored and an assessment of nominal and actual values is made via the integrated expert system, a condition-oriented maintenance can be carried out and

life-cycle costs of the monitored turnouts and components can be considerably reduced.

NEW KIMBERLEY PRISON

THE NEW KIMBERLEY PRISON will house some 3 000 inmates. The prison site alone covers 27 ha and will be completely cleared with no vegetation remaining. According to Eddie Schön of Copad Engineers, the design of the prison was dictated by different criteria to other projects and a lot of research was done into the infrastructure demands of a prison before any work could commence.

The prison is currently one of four prisons being constructed and is a joint venture between Copad Engineers and Stabilis Development for the civil engineering services. 'I was fortunate enough to be part of the design team on the assignment and immediately acquired interactive infrastructure design software Civil Designer to help us cope with the project,' says Eddie.

In the joint venture, Copad Engineers has been tasked with the bulk earthworks as well as the sewer and storm water aspects, while the design itself was handled by Stabilis Development and Copad Engineers in a joint capacity. The state-of-the-art prison comprises a series of linked, but separate, cell blocks each housing 250 inmates. The centre has been designed with a modern sickbay, a facility for social workers, training facilities, two soccer fields, and housing facilities for prison warders. 'Owing to the project size, the municipality had to provide additional water, as there was simply not enough to meet requirements. A brand new 8 km sewer line will serve the prison, the adjacent mental hospital as well as 3 000 residential units,' explains Eddie.

One of the design challenges on the project included the security fence. It had a very specific slope requirement and could not be more than 6% at any point. 'Clearing the site will entail removing some 60 000 m³ of hard rock, with another 62 000 m³ of red earth needing to be excavated. We have also imported another 60 000 m³ of material that will be mixed with our cut material. The total earthworks require cutting,

moving and compacting approximately 170 000 m³ of material and there is a lot of shale and dolerite which makes the site very interesting,' says Eddie.

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TARFIX SETS THE STANDARD FOR LABOUR-BASED SEAL CONSTRUCTION

WITH THE ONGOING DRIVE to introduce labour-based alternatives to all facets of road construction, the traditional chip and spray market has proven to be one of the most challenging. However Tarfix, manufacturers of high-quality bituminous road surfacing materials, has made a remarkable impact on the surfacing sector of the industry with the introduction of its highly effective 'Chippy' labour-based method of surface sealing for all types of road.

Chippy is the first manually operated chip spreader. It was invented and patented in South Africa, and is also produced here, but is now being used in the international arena. Chippy was originally designed and developed by Deon Pagel, a leading proponent of labour-based construction in South Africa and a director of Tarfix.

The Chippy method of sealing was put through its paces when Tarfix was contracted in November 2004 to upgrade a road in Mpumalanga from gravel to blacktop standard.

The road in question was a 15,1 km gravel surface linking the villages of Marapiyane and Senotlelo. Its condition was so bad that access between the two villages had become markedly limited.

Work commenced at the beginning of December 2004, with the initial project duration being projected as five months. However, the department requested that Tarfix complete the project before its financial year-end of 30 March 2005.



The layerworks were carried out with conventional mechanical equipment, but when it came to the construction of the seal, Chippy was used.

Chippy can be used for the construction of most types of surface seal, including single, double, cape seal and graded stone seal. Importantly, the use of Chippy in no way compromises cost or quality of the end product.

From a labour point of view, this innovative invention has successfully converted an activity that was previously highly mechanised to a labour-intensive operation. During construction of a seal, the Chippy method creates job opportunities for as many as 65 people. This is more than ten times the number of workers required for the traditional mechanical operation.

The accuracy that a small hand-operated chip-spreader is able to achieve when placing the graded stone aggregate is an outstanding feature. 'This

would normally be done by a mechanised chipping unit and tipper trucks involving only a few labourers,' says Deon Pagel, projects director of Tarfix.

Ultimately the Mpumalanga project was a resounding success on a number of levels; it was completed on time, within budget and proved to be a cost-effective solution. In addition, a large number of local workers were employed and trained during the course of the construction, and traffic can now move easily in all weather conditions over the 15,1 km stretch of road between the two villages.

Caryn Chamberlin
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NEW BOARD MEMBERS FOR VELA VKE

Dr Nakedi Mathews Phosa has joined the board of directors of Vela VKE as non-executive chairman and Dr Tebogo Job Mokgoro as non-executive director responsible for transformational leadership.

Dr Mathews Phosa is well known in political and business circles. He rose to prominence after the 1994 general elections when he became premier of Mpumalanga Province. As a qualified lawyer, Dr Phosa is still a senior partner in the law firm he



Dr Mathews Phosa



Dr Job Mokgoro

started in Nelspruit in 1981. He also holds four other significant directorships, as well as being a chairperson of Unisa and of Innibos Arts Festival and deputy president of Die Afrikaanse Handelsinstituut. He speaks eight languages and is an accomplished poet, his work having been published in both English and Afrikaans!

Dr Job Mokgoro is a graduate of Fort Hare, the University of North West, and the University of Toledo, Ohio, and has been active in the university and professional services environment all his working life. Job Mokgoro is a highly honoured academic, and a published author of many papers on public service, management and transformation. Today he is MD of his own policy and management consulting firm, Job Mokgoro Consulting.

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ALTERNATIVE FUNDING FOR THE MAINTENANCE OF INTERSECTIONS

In the past traffic signals were often installed at the request of a few influential people, or as legend has it, the mayor or ward councillor needed to get into town quicker from home and thus 'requested' traffic signals to be installed. In small towns, traffic signals were always seen as a status symbol to show that a village had progressed from village to town.

After 1994, when we had our first democratic elections, things started to change. Municipalities are prioritising and traffic signals are now only installed when absolutely necessary.

Where it comes to the replacing of aged or outdated controllers (some of them as old as 15 years) the same funding problem exists.

But is it possible for a city or town to have their controllers replaced every ten years at no cost to the city or the taxpayer? Syntell (Pty) Ltd, a leader in the supply and maintenance of traffic management systems, believes this can happen by using alternative methods of funding:

■ **OPTION 1** New controllers can be purchased to replace existing outdated controllers. This can be

funded by concluding a service level agreement with a supplier.

The agreement could include the service provider replacing all traffic controllers older than say ten years, accident damaged, or in need of upgrading. This would fall under maintenance and can be funded from the operating budget rather than the capital budget.

As the rate would be fixed over a period of time (subject to escalation), the council would be in a position to budget for its operating expenses to keep its traffic signals operating, thus avoiding unforeseen, unbudgeted expenses.

■ **OPTION 2** The city could enter into a public-private partnership (PPP) agreement with a service provider, preferably one that manufactures traffic controllers and specialises in law enforcement. Monies generated from this law enforcement initiative can be used to finance and maintain traffic controllers.

Currently several municipalities have law enforcement PPP agreements with companies where a company supplies speed or red light violation cameras to the municipality at 'no charge'. Usually costs for the upkeep of cameras and the processing of fines are borne by the service provider. The income generated by the fines is used to pay for the services rendered by the service provider.

Unfortunately, the municipality's portion currently goes into their general coffers and cannot be used to offset any specific expenditure.

In this option the traffic offenders directly foot the bill for the replacement of traffic controllers and not the ratepayers,

■ **OPTION 3** The city could enter into a PPP agreement with a service provider that can provide advertising as a source of generating revenue.

The city provides the service provider with advertising rights throughout its municipal area to allow the erection of billboards, advertising on bus shelters, controller cabinets, etc.

As with the previous options, revenue generated from advertising will be used to cover the cost of supply, installation and maintenance of traffic controllers – again, not the ratepayer!

WHICH OPTION?

In emerging countries, where there are other priorities, the way forward is to look at alternative sources of revenue to fund the maintenance of traffic intersections:

- Should it be the ratepayers?
- or the traffic offenders?
- or the advertisers?

CPD for civil engineering professionals becoming a reality

SEVERAL YEARS AGO SAICE Council approved the principle of continuing professional development (CPD) and, since then, SAICE has encouraged its members to ensure that they keep abreast of developments and knowledge in their areas of expertise in order to maintain their competence. ECSA will institute a system of CPD, starting in 2006, which will be linked to renewal of registration from 1 January 2007 for all registered persons according to the policy set out in its policy document. SAICE is excited about the inclusion of membership of a voluntary organisation, which automatically gives members one credit per year. Other services that our 'volunteers' do, for example mentoring, tertiary accreditation, professional reviews, and authoring papers, will also be recognised. This extract aims to give you the background and categories in which CPD will be recognised. (The full policy document is available on www.ecsa.co.za.)

Section 22(1) of the new Engineering Profession Act 2000 (Act 46 of 2000) requires that a registered person applies for the renewal of his/her registration with ECSA 'at least three months prior to the prescribed expiry date of his/her registration'. CPD will be used as the mechanism to determine renewal of registration, giving Council the opportunity to comply with both the renewal of registration and CPD requirements. It is not ECSA's intention to 'police' each and every registered person's development, but rather to create a culture of CPD.

The international agreements concluded between ECSA and other international engineering bodies also require the maintenance of competence through a system of continuing professional development. South African registered professionals would therefore need to undergo CPD to

maintain their international recognition.

CPD REQUIREMENTS

After the initial phasing in of the first renewal of registration, CPD will run in five-year cycles, in which every registered person will be required to accumulate 25 credits in order to retain registration. The registered person will be required to accumulate a minimum of three credits per year. Additional credits earned in one particular year may be carried over. Details of the different categories of CPD activities are listed below.

The table gives details of when the initial renewal and subsequent renewals will be required according to the original date of registration.

CATEGORIES OF ACTIVITIES FOR CPD CREDITS

CPD credits must be obtained in at least two of the three categories listed below, with at least one credit per annum from Category 1. The maximum credits which may be accumulated annually in each category are also indicated.

Category 1: Developmental activities (4 credits = 40 hours (10 hours/credit))

Attendance of structured educational/developmental meetings will be credited on the basis of one credit per ten hours of attendance. A full day activity will be regarded as being for ten hours and a half-day activity will be regarded as five hours and hence half a credit. A maximum of four credits (40 hours) may be accumulated annually in this category, including activities such as conferences, congresses, large group workshops, lectures, seminars, refresher courses and colloquiums.

Category 2: Work-based activities

- Engineering work: two credits = 800 hours (400 hours/credit)
- Mentoring of candidate practitioners: one credit = 50 hours (50 hours/credit)

Since registered persons also remain current by performing their day-to-day engineering responsibilities, a weighting of one credit for every 400 hours per year for engineering-related work (including management) is awarded in this category. A maximum of two credits for 800 hours per year may be earned in respect of this activity.

The mentoring of candidate persons in the workplace, in-house skills training sessions and career guidance will be recognised as CPD with a maximum of one credit for 50 hours per year.

Category 3: Individual activities

- Membership of a recognised voluntary association: one credit (not linked to hours)
- Other activities: three credits = 30 hours (10 hours/credit)

Membership of an ECSA-recognised voluntary association (eg SAICE) will result in a maximum of one credit per annum.

Other activities include and will be credited as follows:

- Part-time lecturing to undergraduate and postgraduate students: one credit for every ten hours of lecturing
- Supervision of students undertaking postgraduate studies: two credits per year
- Oral examinations of final year and postgraduate students: one credit for every ten hours of active involvement
- Evaluation of M dissertations and PhD theses by external examiners: two credits per year
- Publication of research in peer-reviewed journals: a single author – two credits per publication. Where a paper has a number of authors, one credit per publication per author
- Publication of technical articles: one credit per article published
- Papers presented at conferences or congresses / poster presentations: one credit each
- Participation in statutory, professional, institutional, technical or non-technical committees or task groups: one credit for every ten hours of active participation
- Evaluation of educational programmes at universities and universities of technology (technikon) for accreditation purposes: one credit for every ten hours of active involvement
- Evaluation of educational qualifications for ECSA's Qualifications Examination Committee: one credit for every ten hours of active involvement

Year of first registration			1969	1970	1971
	1972	1973	1974	1975	1976
	1977	1978	1979	1980	1981
	1982	1983	1984	1985	1986
	1987	1988	1989	1990	1991
	1992	1993	1994	1995	1996
	1997	1998	1999	2000	2001
	2002	2003	2004	2005	2006
	First renewal of registration	2007	2008	2009	2010
Number of credits required for first renewal of registration	5	10	15	20	25
Second renewal of registration	2012	2013	2014	2015	2016

Example A registered person who registered for the first time on 15 March 1983 will have to renew his/her registration by 15 March 2008. That person will be required to have ten credits for the first renewal of registration. That registered person's second renewal will be in 2013, where the normal 25 credits will be required. Since the system will be implemented on 1 January 2006, that person will be required to submit details of his/her CPD activities for the first year up to 14 March 2007 within 30 days after 14 March 2007.

- Evaluation of competence and applications for registration for ECSA's Registration Committees and Professional Advisory Committees: one credit for every ten hours of active involvement
 - Relevant additional qualifications (these are exceptional allocations): A completed post-graduate qualification: five credits
 - Self-study which includes, but is not restricted to, studying of journals or electronic or computerised material: one credit for every ten hours of study
- All activities under this item must be verified
A maximum of three credits (30 hours) may be accumulated in this category.

The role of SAICE and other voluntary associations

ECSA expects recognised voluntary associations to assist their members in identifying CPD activities which meet their needs and to present CPD activities as stipulated. These associations will also be responsible for the validation and monitoring of courses, seminars and conferences offered for CPD credits by other providers.

ECSA has given approval to voluntary associations recognised as such in terms of the Act, as well as accredited tertiary educational institutions, to run activities which will be acknowl-

edged for CPD credits.

All other bodies, such as private companies or state organisations, would need to have the contents of every event they provide for in this category of CPD approved by the recognised voluntary association for the discipline or category of registration concerned and for the assignment of the appropriate credits.

The SAICE Education and Training Panel is currently finalising its plan to ensure that our members receive the optimum service. Follow-up articles will appear in the coming months. □

FORUM

LETTERS

GAUTENG – A RECIPE FOR DISASTER

IT IS NOT OFTEN that I feel moved to contribute to a discussion or argument on a subject discussed in *Civil Engineering*. However, the article by Dawie Botha struck a very loud cord, which deserves comment as it not only concerns Johannesburg and its surroundings, but also is becoming more and more relevant to other large population centres throughout South Africa.

Just prior to reading OPINION I had the occasion to spend a few days in Johannesburg on business after an absence of a number of years and was subjected to the very thing Dawie discusses. Upon arrival in the early evening of a Sunday and travelling along the Western Bypass, I was held up twice by 'bumper bashing', which resulted in a trip of nearly two hours from Johannesburg International to Sandton. And this on a Sunday! In the following days I was also subjected to the various peak hour traffic jams in both directions.

Coming from Cape Town, I thought that I was used to the snail pace of early morning traffic, but realised that Capetonians still have something to look forward to!

It is obvious that the authorities are powerless to even attempt to find a solution to the infrastructure problems we are facing on a daily basis and in my opinion will not be able to solve them by 2010 unless there is a 180° change in their thinking. Not only are they not capable of solving our transport problems, but they are also not performing in those fields which they have set as absolute priorities, that is, provision of housing with the relevant services. As Dawie Botha points out, no one appears to have the will to even attempt to suggest solutions to the

problems that are slowly strangling the engines of productivity.

Do we have the wherewithal to tackle the problem? Yes, we do have the capacity, except it has been retired, retrenched or has left the country and we are left with inexperienced engineers, architects, quantity surveyors, project managers and supervisors who, mostly through no fault of their own, are out of their depth. The authorities can make use of the pool of 'old hands' as consultants to pass on their knowledge and help solve a massive problem.

C C Wetter

THREAT OR OPPORTUNITY

HI DAWIE

I recently read your article (Nov/Dec 2004 Vol 12 No 11) re 2010: Threat or Opportunity.

My experience in roads is limited but having now lived in Vancouver, Canada, for nearly eight years (and there are lots of South Africans here) I have to agree with you that the rule to turn right, on red (left of course in SA) at traffic lights is a significantly good traffic move. Although not well obeyed here, one is lawfully expected to stop first before turning.

The other rule here, which may or may not be suitable in South Africa, is the high occupancy vehicle (HOV) lane. The use of these lanes, which have replaced the fast lane in lots of areas of the highways, is restricted to vehicles with a minimum of two and sometimes three occupants. This of course is to encourage business

people/shoppers to travel together and thereby reduce traffic.

I must say that I look forward to receiving my magazine and wish all well in South Africa.

John Chesterman

ENGINEERING A BETTER LIFE FOR ALL

BOB BLYTH's 'Lesson for Engineers' on page 3 of the July magazine was a challenge to all of us – to restore the appreciation of the world out there for the great benefits engineering has brought to our civilisation and way of life. Engineering is indeed a major contributor to a better life for all; the better life so often proclaimed by politicians.

Surely one of the ways to achieve this realisation is through our universities where the lecturers should impart to the students the understanding of engineering's essential and pivotal role in producing the facilities for the better life. The aspirant engineers should be encouraged to recognise this and to be ready to speak out on it.

This does not, of course, excuse all of us from making sure our voices are heard, on what we do and the projects we bring to fruition.

Engineering deals with hard and 'concrete' facts, which trains people to separate the true from the false – much needed in a world where strivings for political power or greed often produce confusion, uncertainty, and lack of resolute action and performance in the delivery of services.

R W (Bill) Schutz



Dawie's chronicles of his recent 'sabbatical'

CONTINUED ...

THE NETHERLANDS

Rotterdam PROBUS club

I was invited to give a talk to this club for retired professionals and businessmen.

Their list of members reads like a who's who. Once a month they meet for lunch, listen to a talk, and then leave in quite a jolly mood.

I'm seldom able to go abroad, give a talk in Afrikaans (noga!) and be understood fairly well.

One of the members was appointed to give a warning signal if I spoke too fast ... The same member recited some Afrikaans poems from his school days in Holland – notably the one about Die Muskiet: 'Van jou sal net 'n bloedkol bly – my naam is Van der Merwe.'

I chose to tell them the South African story and to bring my personal ancestry into the storyline. My message explained the urgency of building capacity at all levels and emphasised the importance of education, education, education.

The chair expressed their appreciation and even surprise at the positive and exciting message that was conveyed about South Africa, its people and its struggles! Some were evidently worried that we would walk the Zimbabwe road ...

I went away with a sense of achievement – having given them a different perspective from the rather bleak view of our future that some of them held.

Thank you to Ria's cousin, Dr Pieter Looije, who is a member of PROBUS, for inviting me – it was a privilege – VIR VOLK en VADERLAND.

KIVI – Koninklijke Instituut van Ingenieurs van Nederland

My second visit in ten years to this 140 year old institution in The Hague had been planned as a courtesy visit, to introduce us to the new management, and to leave copies of our *Foundation for the Future*, magazines and our presidential address.

We were received with grace and coffee and within an hour we had covered topics such as international reciprocity and unity in institutional structures (since they represent the full spectrum of engineers in Holland) and interchanged ideas about capacity-building.

We agreed to exchange magazines regularly

and I suggested they encourage their South African members to visit us in Midrand. Theoretically our Dutch connection should be stronger!



At the Koninklijke Instituut van Ingenieurs van Nederland in The Hague: Dr Pieter Looije, Drs Ing Bouke Bosgraaf, Dawie Botha, Eng Piet Gillissen and Ria Botha

Design à la Gaudi

At the Kunsthal in Rotterdam a comprehensive exhibition of Gaudi, the celebrated Spanish architect, entertains and educates. Gaudi's designs are still controversial and unconventional. He observed nature and translated its geometry and inherent characteristics into his flowing and unbelievable structures.

His design for the ceiling of Bellesguard follows the principle of leaf construction. The ceiling at Caso Batlo follows a fossil scale pattern. In the Sagrada Familia he uses the inspiration of the nautilus shell to design a 'circular' stairway.

His grasp of gravity forces was organic and phenomenal. To provide extremely stable structures, he constructed what are called hanging models. These models were made for example by connecting small chains, hanging them from a flat board, viewing them in a mirror below and then designing the structure in the form of the mirror image! Hey presto!

He used this idea to construct inclined columns that eliminated the need for horizontal members.

I believe a little bit of Gaudi in our school and engineering curricula would do a lot of good – both to understand forces and to teach the

principles of sustainable structures that are in sync with nature.

De Zuiderzeewerken

Een volk dat leeft, bou aan zijn toekomst ... En toe word die Suidersee die IJsselmeer.

Dit was 'n voorreg om die Groot Afsluitdijk te besoek. Dis uiters moeilik om oor so 'n ongelooflike stuk werk in 'n paar woorde te vertel, maar ek probeer.

Vir ons as droëlandbewoners is dit skrikwekkend om te dink dat meer as 'n vyfde van Nederland onder seevlak lê. Nog moeiliker om te verstaan dat as daar nie rivierdyke en seeduine was nie, 'n stormvloed die helfte van die land onder water kon plaas!

'n Fransman was so onder die indruk van die werk van die Hollanders 'om hulle voete droog te hou' dat hy geskryf het: 'God het die wêreld geskape, behalwe Nederland – dit is die werk van die Nederlanders.' Hulle het egter eers teen die middel van die 13de eeu na Christus begin bou aan die dyke.

Aan wie was en is hierdie groter Holland



Saluting Eng Cornelis Lely, father of the the Afsluitdijk, which connects North Holland with Friesland. The dike is a fundamental part of the larger Zuiderzee Works, damming the Zuiderzee, a saltwater inlet of the North Sea, and turning it into a freshwater lake, the IJsselmeer

te danke? Ingenieurs en waterdeskundiges! Die meer bekende ingenieur Lely is dus vereer met die benaming van nuwe stad, Lelystad, in die Oospolder van die IJsselmeer.

So 'n bietjie statistiek oor die afsluitdyk:

Die 30 km lange dyk vervang 300 km dyke op die voormalige Suidersee-oewer en is 7,5 m bo



seevlak. Die laaste opening is afgesluit op 28 Mei 1932. Die Suidersee was sowat 3,5 tot 4,5 m diep en het 'n kleibodem gehad – wat belangrik was vir die bou van dyke sowel as vir die latere gebruik van die seabodem as landbougrond.

In die 1700s kon die Nederlanders groter gebiede begin drooglê toe 'n draaikop vir meulens ontwerp is. Dit het beteken dat die kop na die wind gedraai kon word en meer pompure moontlik was, ten spyte van windveranderings.

Stoommeulens is in 1854 te werk gestel.

Die afsluitdyk het oorspronklik die see met 350 000 hektaar 'teruggedryf'.

Merkwaardige konstruksies – 'n besoek werd! Die see is teruggestoot, die land is vergroot, 'n kortpad-verbinding is geskep, 'n varswatermeer druk die soutwater terug, reuse-ontspanningsgebiede is geskep, plek vir woonplekke is geskep, en dit was alles vantevore see – dank aan die ingenieur en sy span!

A month in Holland spoils one for ever. Trams and trains and buses and clean, working taxis do it. And of course bicycles ... in their thousands.

SWEDEN

Then Sweden ...

We went by train from Ostersund to Stockholm in style and comfort. It was quiet, fast, comfortable and clean. In six hours we travelled 500 km.

But I wanted to come home – longing for our own country and its sun, sea and stars. I would have loved to bring back Europe's transport systems in my luggage and roll them out like magic carpets. It would increase our time in Gauteng for leisure, family and friends and would replace our discussion topic of traffic with something else for a change.

Wishful thinking ...?

Swedish Institution of Civil Engineers (SVE)

Jan Jerström and his wife, Elsa, became well known to us in the late 1990s when they represented the SVE at ASCE conventions in the US. Jan had been in charge of the SVE head office for many years and was editor of their magazine.

Our friendship eventually led to two visits to South Africa – the first by Jan to see the Lesotho Highland Scheme and to travel on the Blue Train; the second when the family travelled through South Africa on the Shongololo for 21 days.

(Sadly, Jan passed away the evening of 10 August – a great shock to all ...)

A meeting with the current director, Bo Wennerstrand, finally materialised. My visit entailed a four-hour flying train journey from Ore near Trondheim to Stockholm to meet them. I was welcomed with great enthusiasm.- We had

lunch (Norwegian salmon and potatoes and a Danish Carlsberg), talked about professional issues and paid a short visit to the museum where the great medieval ship the Vasa is preserved. And then ... I missed my 16:27 train to Ostersund by a mere minute. That meant I was stranded in Stockholm station for another eight hours ...



Stockholm: Bo Wennerstrand, managing director of the Swedish Society of Civil and Structural Engineers, Dawie Botha and Jan Jerström, previous MD of the Society

International networking is hard work – but it is gratifying, even to see the South African rand among the 15 or so foreign currencies available at the station. The Swedish language is related to Afrikaans, and with a little grammar sense you get a long way without too much asking.

So it was back to Ore in the north-west, a 500 km journey on the night train. Thank you, colleagues, for your hospitality and goodwill – we will meet again to exchange magazines and discuss professional issues. ■

Event	Date	Additional info	Venue	Contact
SAICE Afternoon Lecture Series	28 September 2005 – Transportation: CoJ Strategic Public Transport Network 5 October 2005 – Geotechnical: The Geotechnical Practice in SA with particular reference to the Menard Pressure Meter Test 12 October 2005 – Professional Issues: Professional Registration for Civil Engineers 19 October 2005 – Structural: Topic to be advised 26 October 2005 – Environmental: Sustainable Engineering 1 November 2005 – Geotechnical: Pipe Jacking and Trenchless Technology 16 November 2005 – Professional Issues: Identification of work and ECSA CPD Requirements	Speaker: Zwelakhe Mayabe Speaker: Dr Michael Pavlakis Speakers: Johan Pienaar, Carla de Jager Speaker: To be advised Speaker: Marco Pauselli Speakers: Paul le Roux, Alastair Goyns, Bernie Krone Speakers: Ron Watermeyer, Johan de Koker	SAICE National Office	Elsjé T 011-805-5947 F 011-805-5971 aaylward@saice.org.za
Finite Element Method in Practice	3–7 October 2005 (Cape Town) 10–14 October (Durban) 7–11 November (Johannesburg)	Presenter: Roland Prukl	University of Stellenbosch, Bellville Campus CS Holdings Durban University of Johannesburg (RAU)	Elsjé T 011-805-5947 F 011-805-5971 aaylward@saice.org.za
Landfill 2005 Conference	20–21 October 2005		Greensleeves Castle Hillcrest, Durban	Lia Russell T 031-717-2300 F 031-702-0435 ktechptn@kaymac.co.za
Environmental Applications of Geochemical Modelling	21–23 November 2005		University of the Witwatersrand Johannesburg	Lesley Stephenson T 011-717-7031 stephensonl@ebe.wits.ac.za
4th International Conference on Unsaturated Soils	2–5 April 2006	Abstracts 13 May 2005 Draft papers 15 August 2005	Carefree Resort & Villas Carefree, Arizona	Robert Silverstein T 703-295-6234 rsilverstein@asce.org www.asce.org/conferences/unsat06 Gerald (Jerry) Miller gamiller@ou.edu