Civil Engineering

Icivili Enjiniyering

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Commuter response to a high occupancy vehicle lane

Some lessons from the N1/M1 trial

■ Can commuters be expected to form more lift clubs to deal with rising peak hour travel times? ■ How fast will people respond to travel demand management strategies? ■ How effective are high occupancy vehicle lanes in reducing congestion?

THESE ARE SOME OF THE QUESTIONS that need to be answered as South African cities grapple with increasing traffic congestion. One way of addressing the need for using existing road space more efficiently is implementing high occupancy vehicle (HOV) facilities. HOV facilities place restrictions on the use of traffic infrastructure during certain parts of the day, usually through minimum vehicle occupancy requirements. While experience with HOV lanes is extensive elsewhere – notably in the United States, where over 130 projects are in operation – local application of the concept has been limited to pilot projects and bus/taxi lanes on freeways and central city links. Several authorities, including the South African National Roads Agency (Sanral) and some cities, are actively planning for HOV lanes for both private and public transport vehicles.

Experience in the US has been mixed, but there appears to be general agreement that under the right conditions, HOV lanes can provide significant benefits. These can include improving the person moving capacity of a freeway, decreasing travel time and increasing reliability for HOV users, and promoting public transport use, which has wider social benefits.

An opportunity arose to assess the short-term impacts of HOV lanes locally during Public Transport Month in October 2006, when the Department of Transport piloted the HOV concept on the busy N1/M1 corridor between Pretoria and Johannesburg. The five-day pilot was primarily aimed at creating public awareness of the types of measures that might be used to promote higher occupancy modes of travel. It was too short to evaluate any long-term impacts of HOV lanes. However, it did produce some useful insights into the extent to which commuters are willing to respond to interventions that combine penalties for single-occupant car use (in the form of much increased travel times in general lanes) with incentives for shifting behaviour towards higher occupancy modes. The rate at which car users are able (and willing) to adapt their

1 *Location of the HOV trial, 23–27 October 2006*
A *On the first day of the trial high violations of the HOV lane caused congestion even in that lane*

commute behaviour, for instance by changing their departure time or forming lift clubs, is relevant to accurately assess the likely impacts of many travel demand management strategies.

The purpose of the article is to report on some findings around the short-term impacts of the HOV trial, from a transport planning and travel behaviour perspective. Some lessons learned are pointed out, but the intention is not to provide a detailed traffic engineering assessment of the operation of the lane or of the success of the experiment.

THE N1/M1 HOV TRIAL

The HOV lane was introduced for five days between 23 and 27 October 2006 on the N1 and M1 between the Brakfontein Interchange near Pretoria and the Parktown Interchange close to the Johannesburg CBD (figure 1). The corridor carries more than 160 000 vehicles per day and suffers chronic recurrent congestion.

On each day, the lane was in operation in the peak direction during the following times:

- **Morning peak** 06:00 to 09:00 in the southern direction towards Johannesburg
- **Afternoon peak** 15:30 to 18:30 in the northern direction towards Pretoria

When in operation, the right-hand (median) lane was reserved for HOVs with three or more (3+) occupants. Prior studies suggested that 2+ lanes would be swamped by the existing traffic. Temporary road signs were erected upstream and along the length of the HOV lanes, but no lane markings were added (see photographs). Variable message signs also informed motorists of the lane restriction.

To promote the formation of lift clubs and public transport use, the Department of Transport (DOT) provided temporary park and ride services, with dedicated midibuses circulating between dedicated parking facilities in Pretoria and Johannesburg.

Table 1 Level of compliance during morning peak, southbound

Location of surveys	Percentage of vehicles in HOV lane conforming to 3+ rule				
	M 23/10	T 24/10	W 25/10	T 26/10	F 27/10
Nellmapius	43%	No surveys	n/a	43%	Taxi industry protest on M1 and N1 freeways No surveys
Samrand	18%		21%	28%	
New Road	21%		n/a	41%	
Allandale	21%		32%	36%	
Woodmead	7%		17%	24%	
Grayston	6%		n/a	16%	
Glenhove	13%		11%	16%	
Rockridge	6%		n/a	6%	

B *Temporary HOV lane on N1 (southbound) and signage*
2 *Level of compliance at Allandale off-ramp during the morning peak*
3 *Vehicle flow pattern on N1 at New Road*
4 *Vehicle volumes on N1 at New Road (all lanes, Thursday)*
5 *Person throughput, 6:00 to 9:00, N1 at New Road*

ENFORCEMENT, COMPLIANCE AND PUBLIC PERCEPTION

The HOV trial generated public debate and awareness well beyond the ranks of those actually using the corridor. This was at first mostly prompted by frustration at the significant delays experienced by non-HOV drivers during the first few days of the week. Newspaper reports headlined 'N1 rule infuriates drivers' and 'Confusion as N1 project begins' reported motorists initially taking up to two hours longer to get to work. The negative reports seemed to die down later in the week as motorists started to make other plans to avoid these delays. Further criticism was voiced over the inconsistency of law enforcement (especially resentment about the impunity of violators) and insufficient communication around the provision of park and ride alternatives. In fact, utilisation of the park and ride services was very low.

Consequently, public support for the concept of HOV lanes was mixed. A Synovate survey conducted afterwards found that about half of Gauteng motorists surveyed deemed the experiment to have failed. Surprisingly, though, an equal number said HOV strategies should be tried again (but with an improved communication effort). Thirty per cent felt HOV lanes could be effective in actually reducing traffic congestion (perhaps revealing a lack of understanding of the benefits of HOV facilities).

Traffic officers played an important role in promoting awareness of the lanes by visibly stopping violators and informing them how the lane worked. No fines were issued. The levels of violations varied significantly across the corridor and over time. Survey data shown in table 1 indicate that the level of compliance was consistently higher on the northern (N1) section than on the southern (M1) section, and that it improved at most locations over the course of the week. This improvement is perhaps related to the easing of congestion in the general lanes that was observed as the week wore on, thus reducing the incentive to violate the HOV lane.

Compliance over the course of the peak period also varied significantly (figure 2). Compliance at the Allandale off-ramp, for example, was the best during the highest peak hour, from 06:15 to 07:15. Compliance reduced both before and after this hour.

Observations carried out at the Sanral Network Management Centre clearly indicated that this was related to the level of law enforcement. Once law enforcement officers arrived at the section, compliance became significantly higher.

FLOW AND SPEED IMPACTS

It is instructive to consider the impact of the HOV lane on the total throughput of the corridor, both in terms of vehicles and persons. One of the main objectives of HOV lanes is the maintenance or even improvement of a highway's person moving capacity in the face of rising demand.

Figure 3 shows the traffic volumes recorded on a section of the N1 for several weeks prior to, and the week of, the HOV trial. A massive drop in peak volumes is seen on Monday 23 October, the first day of the HOV trial. The vehicle flow rate of the freeway was severely reduced by a combination of underutilised capacity in the HOV lane, increased demand (and severe congestion) in the general lanes, and a reduction in overall capacity caused by partial blocking of the HOV lane by law enforcement officers.

However, as the week wore on the peak flow recovered to levels of around 6 500 vehicles per hour by the end of the week. Looking at figure 4, however, showing vehicle counts in the course of Thursday 26 October, it is apparent that the peak flow occurred at around 5:45 am, before the onset of the HOV lane operation. Once HOV restrictions started at 6:00, flow dropped considerably, and only recovered by 9:00. Over a five-hour time period (between 5:00

and 10:00), total vehicle throughput dropped from the usual 25 170 (average for the previous three weeks) to 22 500 vehicles – an 11% decrease.

The person throughput on the corridor shows a similar pattern. Figure 5 shows a significant drop in person volumes on the Monday, but throughput almost recovered to its previous levels by the end of the week. As can be expected given the reduced vehicle flow in the general lanes, the person throughput was significantly higher in the HOV lane than in the other lanes. Overall, the HOV lane did not improve the person capacity of the corridor within the short time period of its implementation, but might have done so if the HOV lane utilisation allowed to improve over a longer period.

Insufficient travel time information was available to determine if the aggregate travel time for all motorists decreased. Significant speed differentials were observed between the HOV lane and the general lanes, but this varied across the length of the corridor. On the N1 section, motorists in general lanes travelled at an average speed of about 20 km/h as compared to about 65 km/h in the HOV lane. On parts of the M1, speeds were more similar across all lanes, as higher violation levels and more weaving into and out of the HOV lane caused congestion.

The speed differentials imply a time saving of about 2 minutes per kilometre for HOV users on the N1, which is higher than the common guideline stating that effective HOV lanes require savings of about 0,6 minutes per kilometre (1 minute per mile). We do not need congestion quite as bad as that seen on the N1 during the HOV trial week to have successful HOV interventions.

CHANGES TO COMMUTER BEHAVIOUR

Commuters not in high occupancy vehicles may be able to respond to an intervention like the HOV lane in at least four ways:

- Increasing their vehicle occupancy by forming lift clubs, or using public transport, in order to gain access to the HOV lane
- Shifting their departure time to avoid congested periods
- Shifting their travel route to a less congested corridor
- Not making the trip at all

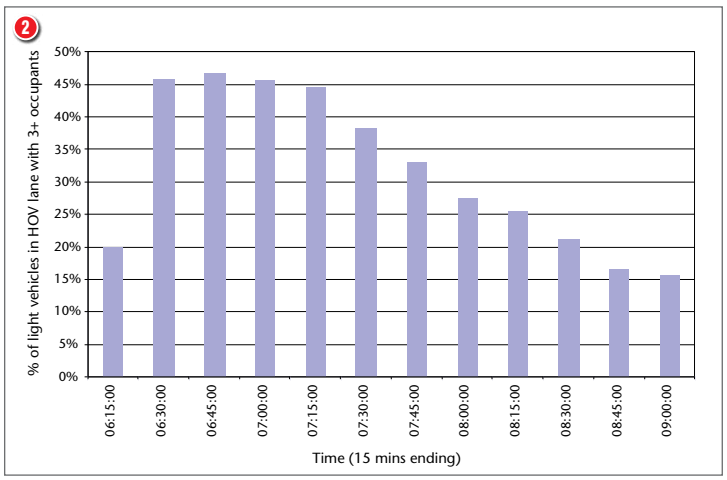
From a transport planning perspective, it is useful to examine the magnitude of each of these shifts observed.

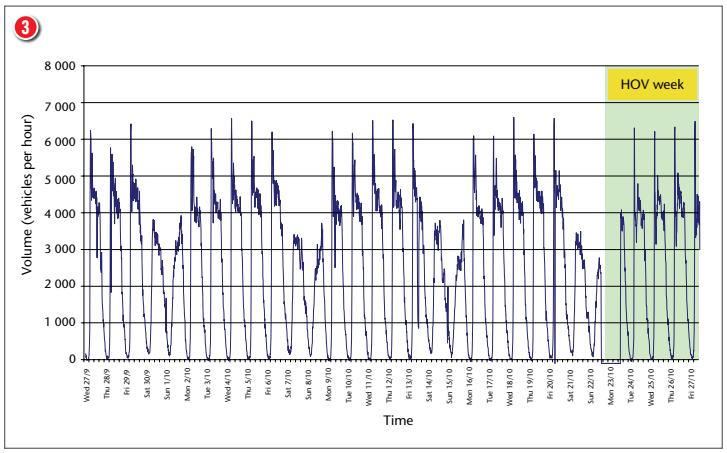
Changes in vehicle occupancy

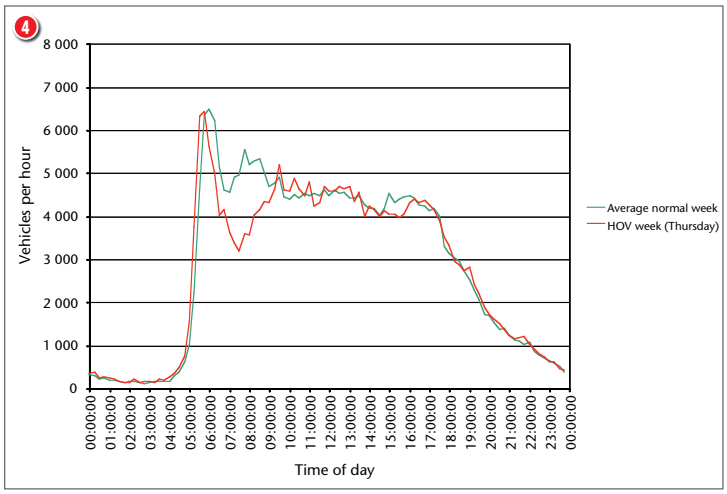
Figure 6 shows the distribution of persons by vehicle occupancy on the Monday and Thursday of the HOV trial, and also for normal conditions before and after the trial, at a typical location. Public transport vehicles constituted less than 5% of all vehicles throughout the period; the shift to public transport modes is considered negligible.

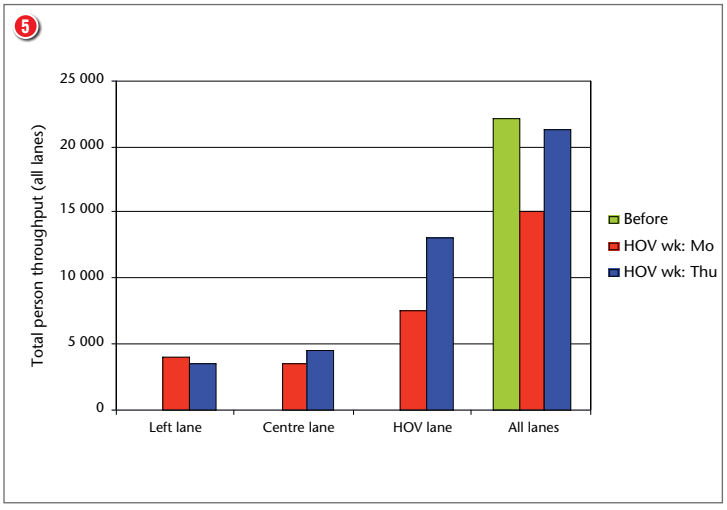
However, a shift in vehicle occupancy among private car users is apparent. During normal operations, about 20% of all passengers are in 3+ vehicles. Occupancy counts on the first day (Monday) of the trial are not representative of any actual shift in occupancies, as the severe flow reduction in general lanes biased the counts towards higher occupancy vehicles in the free-flowing HOV lane. By the Thursday of the trial, when the bias effect was no longer there (as peak period queues abated by 9:00), the percentage of passengers in 3+ vehicles had almost doubled to 38%. A lane-by-lane comparison shows that by far the majority of HOV commuters made use of the HOV lane. The proportion of people in single and double occupancy vehicles had both reduced over this period. By the end of the HOV trial, about 3 200 or approximately 15% of commuters had changed from 1 or 2 to 3+ vehicles. Even within a short period of four days some significant change in occupancy behaviour was thus detectable.

Further occupancy observations were made on the Thursday following the trial. At this time, the proportion of people in 3+ vehicles was still higher than before the HOV trial, at 27%. This suggests that the trial may have had a longer-term impact on occupancies, with some commuters choosing to remain in the lift clubs formed during the previous week. How long these arrangements

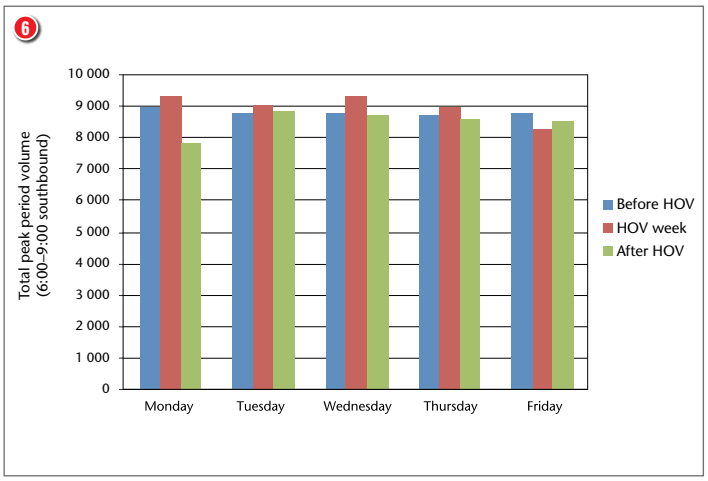








Thirty-six per cent of Gauteng motorists interviewed by Synovate noted an increase in traffic on other roads during the HOV week. To assess the extent of route diversion by N1 commuters trying to avoid the congested freeway, traffic volumes on the R21 was assessed over the same period. The R21/R24 is the only freeway corridor parallel to the N1, and can be expected to have been the main diversion option



C *Enforcement of HOV lane through physical inspection of vehicles*
D *Use of variable message signs to inform motorists of HOV lane restriction*
6 *Occupancy distribution (persons), 6:00 to 9:00, N1 at New Road*
7 *Comparative vehicle volumes on R21 parallel freeway*

persisted we do not know, but there is indeed evidence that short-term 'shocks' such as the five-day HOV trial may cause a lasting behaviour change among car users in congested corridors.

Changes in departure time

From figure 4 it is apparent that the peak flow shifted by about 15 minutes, from 6:00 to 5:45. No information is available on the actual departure times of commuters, but the data support the conclusion that many single-occupant drivers decided to leave home earlier in order to clear the HOV corridor before the lane restriction went into effect.

The average shift in departure time was about 15 minutes. The data indicates that at least 3 800 or 17% of commuters shifted their departure times in response to the HOV intervention.

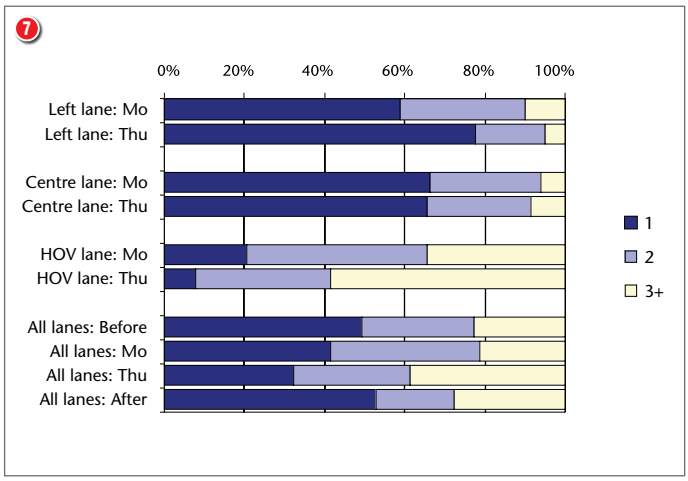
Changes in route choice

Thirty-six per cent of Gauteng motorists interviewed by Synovate noted an increase in traffic on other roads during the HOV week. To assess the extent of route diversion by N1 commuters trying to avoid the congested freeway, traffic volumes on the R21 was assessed over the same period. The R21/R24 is the only freeway corridor parallel to the N1, and can be expected to have been the main diversion option.

Figure 7 shows the peak period volumes on the R21 near Pretoria for the week before, during, and after the HOV trial. There is evidence of an increase in vehicle flows on all days of the HOV week except Friday. (On the Friday traffic volumes on most Gauteng highways were irregular as a result of the impact of a strike by the taxi industry.) The additional traffic varied between about 200 and 500 vehicles, as compared to both the weeks before and after the trial. This amounts to around 6% of normal flows, which is within the typical day-to-day variation observed in three-hour flows. It is therefore not possible to conclusively state that flows increased on the R21, but the pattern would tend to suggest that some small amount of route diversion did occur. Assuming conservatively that all diverting motorists were single occupant drivers, it follows that around 2% of regular N1 users had responded to the HOV trial by changing routes. This is a low estimate, however, as it ignores those diverting to other alternative routes, especially on the M1 section.

Suppression of trips

The best way to assess trip suppression as a result of the HOV intervention would have been to do individual surveys, but as these were not done, one can make a rough estimate of the level of trip suppression from the difference between the before-period travel-



lers and the sum of motorists on the N1, and those who diverted to other routes. For the Thursday of the HOV trial week, the number of motorists travelling on the N1 past New Road (for example) was about 800 below pre-trial levels. This corresponded roughly to the estimated rise of users on the parallel R21, suggesting that there is no evidence of any significant reduction in overall trips.

CONCLUSIONS

The analysis of the behavioural adjustment of commuters in the N1/M1 corridor showed a discernable ability amongst some motorists to adapt to HOV interventions. Approximately 15% of commuters switched from low occupancy to high occupancy vehicles – a surprisingly high number, given the almost negligible utilisation of park and ride and public transport options. At least an estimated 17% changed their departure time by about 15 minutes on average to avoid the congestion caused by the HOV lane restriction. At least 2% switched to parallel routes. While in no way indicative of the long-term behavioural change that HOV lanes (or other TDM-type strategies) can induce, these results do suggest that South African commuters are both willing and able to respond to such interventions if both the stick (in this case severely increased travel times for non-HOVs) and the carrot (faster than usual travel for HOVs) are applied. Of further interest is the speed of adaptation – it took merely three to four commute days for some travellers to adjust, and for the peak to return to its normal magnitude and duration.

Useful lessons can also be learned from the operation and marketing of the trial. It appears that the choice of a 3+ (as opposed to a 2+) occupancy limit was appropriate, given the occupancy distribution on the corridor and the arguably higher than expected shift towards HOVs. Not surprisingly, enforcement of the lane was crucial, not only in terms of lowering violations and ensuring effectiveness, but also generating a positive public response. The lane itself seemed to work better on the northern side of corridor. On the M1 section more closely spaced ramps caused more weaving and reduced speeds on the HOV lane, while restricted shoulder space on the median hampered enforcement efforts, ultimately reducing the lane's effectiveness. Commuters seem to easily disregard HOV restrictions if (a) enforcement lacks, (b) frustration is high, or (c) the legitimacy of the lane is questioned when it is obviously not working. Effective marketing, and good planning and design can presumably avoid these problems in the future.

Acknowledgment

The Department of Transport provided some of the data on which this analysis is based. Their assistance is greatly appreciated. The views in the article do not necessarily reflect those of the DOT.

References are available on request

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A sustainable transport model for South African cities

THE URBAN TRAN:SIT Programme focuses on sustainable transport and energy issues in the context of South African cities. Transport has been highlighted as a key determinant of sustainable cities, particularly in terms of energy consumption. The transport sector in South African cities represents between 40% and 55% of total energy consumption. This energy consumption has major impacts on CO_2 emissions and local air pollutants, which contribute to climate change.

Although the need for action in the transport sector has been realised, the South African transport system remains generally inefficient, with increasing private vehicle use. Local government capacity is stretched and officials are often focused on dealing with more immediate pressures on the transport system, with the result that sustainability is neglected and problems escalate over the years. It is critical, however, that sustainable planning and implementation be given adequate attention and resources if we were to break this cycle.

The aim of the Tran:SIT programme is to build capacity in local government to develop more sustainable transport policy, strategy and implementation in order to reduce global emissions, improve air quality and improve the economic efficiency of the sector.

The programme is currently based in Cape Town through a partnership between the City of Cape Town (CCT)'s Transport Department and Sustainable Energy Africa, although there is a network of interested partners throughout South Africa. The three-year project has been funded by the British High Commission to facilitate sustainable transport planning and implementation in Cape Town. The programme aims to work from within the department through the appointment of a sustainable transport professional, who is working through plans and projects that promote sustainable transport and will direct policies and strategies toward sustainable transport. The professional acts as a change agent within the Transport Department and, together with the Tran:SIT team, works through sustainable transport dilemmas and practical local government challenges in order to mainstream sustainable transport thinking. The partnership includes the Urban Transport Research Group at the University of Cape Town, who provide content support and advise on technical issues. One of the successes of the programme is the strong partnership that has developed through these three key partners.

One of the key aspects of the Tran:SIT Programme is capacity-building: not only in the Transport Department, but throughout the city and – more broadly – in other local authorities, government departments and other stakeholders. A multi-layered network has been developed as part of the capacity-building process, which comprises the following elements:

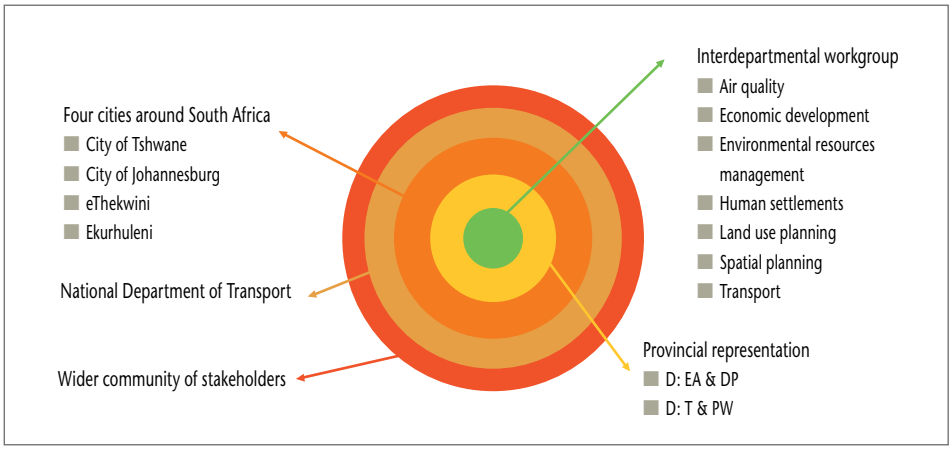
- A local network made up of City of Cape Town departmental and provincial government representatives who discuss sustainable transport on a local level and how it should be integrated with the City of Cape Town projects
- A city network of key cities throughout South Africa which will focus on sharing information around project implementation and lessons learned from these experiences. The city network will include focused workshops and seminars on relevant aspects of sustainable transport
- The third network will consist of any stakeholders who are interested in sustainable transport. This is a virtual network, with information dissemination taking place through the website and other means discussed below

The Tran:SIT Programme includes information development and dissemination in order to increase knowledge around sustainable transport and assist in its implementation in South Africa. Various methods are used to share this information, including a website dedicated to the project (www.sustainable.org.za/transit), a bimonthly newsletter which focuses on a different sustainable transport theme for each edition and printed information booklets on different aspects of sustainable transport. Monthly seminars will be held at the City of Cape Town offices focusing on planning for sustainable transport on a city level. These will consist of an expert presentation on a specific topic followed by a question and answer session.

The project was initiated in September 2006 and the sustainable transport professional joined the City of Cape Town in January 2007. The programme is moving along steadily. With sessions taking place with key stakeholders and plans for demonstration projects finalised, the interest in the project is increasing. The key challenge is to ensure that interest and awareness are seen in implemented projects and policies and strategies with a strong sustainability focus, both in their objectives and their budget and project allocations.

The Urban Tran:SIT Programme is not seen as the solution to integration of sustainable transport within all transport planning activities, but is the first step in a longer process of changing thinking, planning and implementation of transport activities. □

Visual representation of the urban Tran:SIT programme networks



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Innovative design and construction technique

for the bridge abutments of the temporary construction road along Viaduct 3 of the Gautrain Rapid Rail Link

BOMBELA CIVILS JOINT Venture (BCJV) approached Kaytech Engineered Fabrics to offer an alternative design for the abutment walls of a temporary road bridge crossing Allandale Road. The temporary bridge runs parallel to Viaduct 3 of the Gautrain Rapid Rail Link (GRRL) route and will carry construction traffic during the construction of the viaduct. Kaytech approached ARQ Consulting Engineers to prepare a design for the abutment walls consisting of a geosynthetic-reinforced backfill, dry-stacked, concrete block retaining wall system. As far as the authors are aware, this is one of the few applications in South Africa of this type of retaining system used as bridge abutments directly carrying the weight of the bridge deck and applied traffic loadings.

PROJECT DESCRIPTION

Viaduct 3 of the Gautrain Rapid Rail Link crosses Allandale Road south-east of the Pretoria Main Road (R101). A temporary access road has been constructed parallel and to the immediate west of the GRRL route. The temporary access road crosses Allandale Road via a three-span steel-girder bridge supported by two median piers, the total span of the bridge structure being around 69 m. The abutments and wing walls are required to limit the encroachment of the approach fills onto Allandale Road and the nearby electrical pylons. The placement of the bridge structure and the natural fall of the ground require

The design methodology was largely influenced by the temporary nature of the abutment structures. The abutments and wing walls were designed for a 'serviceability' life not exceeding five years

1. *First placement of RockGrid PC reinforcement*
2. *Stepped concrete foundation with base block*
3. *Southern abutment wall nearing full height*
4. *Southern abutment wall*

abutment heights of 6,3 m and 6,9 m for the northern and southern abutments respectively.

ARQ prepared a conceptual design based on a dry-stacked, concrete block facing using Concor's Enviro wall segmental blocks. The solid concrete blocks are well suited to carry the imposed loads without cracking, provide a good structural interface with the geogrid reinforcement and additionally are shaped to facilitate construction of the retaining wall at the specified final angle of 85 degrees.

The approximately 9 000 m^3 of weathered granite backfill within the reinforced zone were strengthened with Kaytech's RockGrid PC product. RockGrid PC is a new-generation high-strength composite geotextile that offers the reinforcement characteristics of geogrids and wovens in conjunction with the favourable hydraulic qualities of nonwoven geotextiles. The material exhibits a high-tensile modulus (high tensile strength at low elongation) of 18 kN/m, 45 kN/m and 100 kN/m at 2%, 5% and 10% strain (ISO 10319) respectively, providing excellent reinforcement characteristics and minimum deformation. RockGrid PC furthermore demonstrates a very low creep tendency. As a composite reinforcing geotextile, RockGrid PC provides sufficient drainage capacity within its plane, that is, transmissivity is high, enabling it to reduce pore pressure build-up in the reinforced soil thereby improving the shear resistance and stability of the overall structure.

DESIGN METHODOLOGY

The design methodology was largely influenced by the temporary nature of the abutment structures. The abutments and wing walls were designed for a 'serviceability' life not exceeding five years. The design considered the concrete block facing as a lining to contain backfill and not actively contributing to resisting lateral forces. The geogrid reinforcing within the backfill serves the dual purpose of anchoring the facing units as well as restraining movement of the wall through the frictional stresses mobilised between the geogrid and the backfill material. The backfill material and applied loads thus both create lateral pressure and interact with the imbedded geogrid layers to resist it. The overall stability of the wall against sliding and overturning was calculated by considering the reinforced soil block as a rigid mass.

FINITE ELEMENT METHODS

An interesting aspect of the design was the use of finite element methods to assess the internal stability of the reinforced backfill and the expected movements under the applied vehicle loads. An overall 'factor of safety' was calculated by means of a 'strength reduction factor' (SRF) method. This method also facilitates the prediction of the tensile forces that are generated within each layer of the imbedded geogrid.

PROJECT STATUS

Construction on the northern and southern abutment walls started concurrently in February 2007 and was practically completed by end April 2007. Kalode Construction completed the work in the allotted time to land the deck on the required date. The abutment and wing walls are monitored for movement and regularly inspected for signs of distress. The temporary bridge structure has been carrying traffic for approximately one month and appears to be functioning as designed.

CONCLUSION

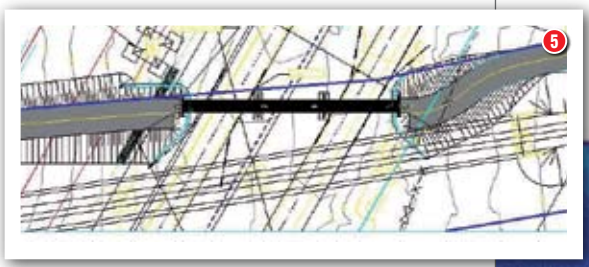
The use of a dry-stacked concrete block facing in conjunction with a geogrid-reinforced backfill zone provided a cost and time-effective solution to the requirements for the temporary abutment walls required to cross Allandale Road. □

The temporary bridge structure has been carrying traffic for approximately one month and appears to be functioning as designed

5 *General layout of Viaduct 3 and the temporary bridge structure*
6 *Contour plot of maximum shear strains and graphical depiction of tensile forces generated within the geogrid reinforcement*
7 *Typical cross section of the northern and southern abutment walls*
8 *Northern abutment wall nearing full height*
9 *Steel girder units in place*
10 *Southern abutment wall supporting the bridge*

PROJECT TEAM

- **Client** Bombela Civils Joint Venture
- **Designers** ARQ Consulting Engineers
- **Suppliers** Kaytech Engineered Fabrics; Concor
- **Contractor** Kalode Construction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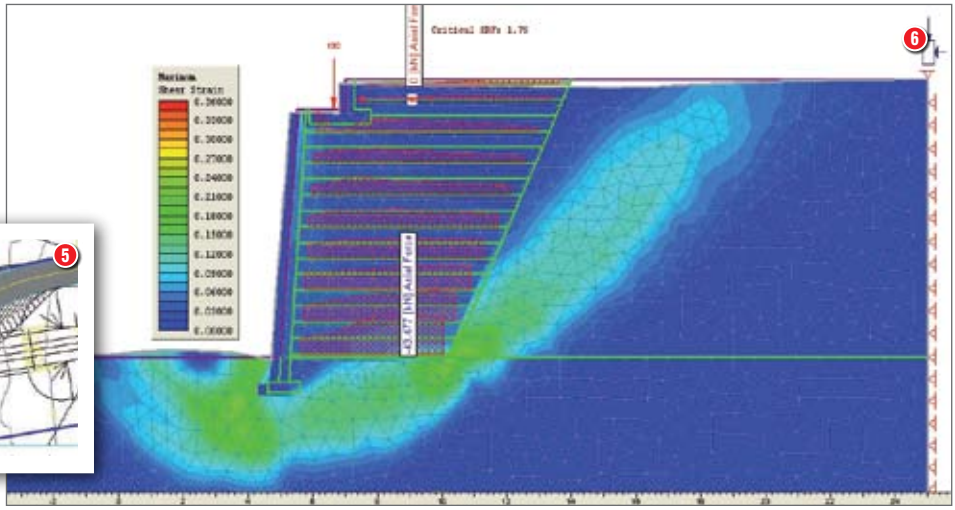
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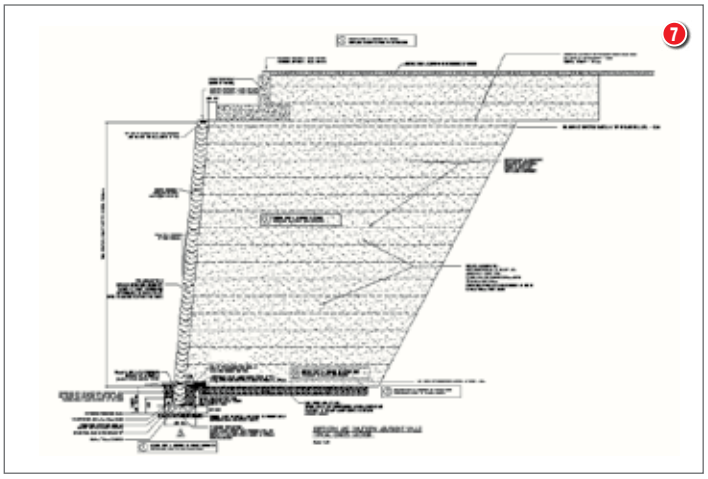
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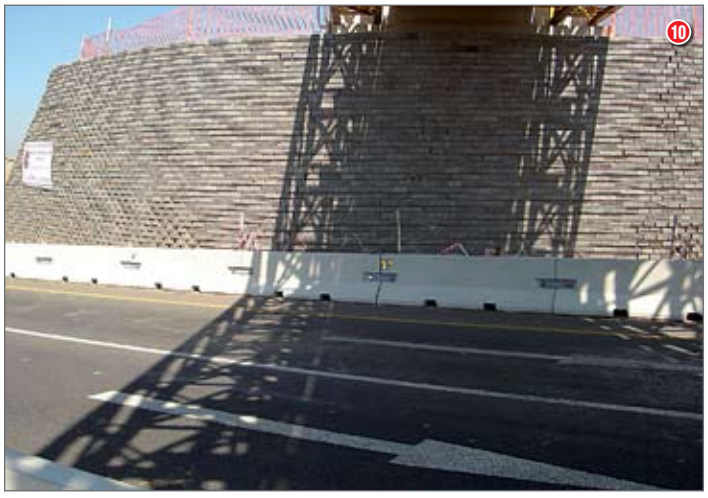
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Implementing the 2007 Public Transport Strategy and Action Plan

From the President's State of the Nation Speech on 9 February 2007: 'Our programme in the social sector for this year will also include ... implementing detailed plans for passenger rail and road transport including the Bus Rapid Transit System in the Metros and recapitalisation of Metrorail ...'

From the Minister of Transport's Budget Vote Speech on 27 March 2007: 'As has been highlighted by President Mbeki in the State of the Nation Address, Bus Rapid Transit systems provide an exciting and innovative mechanism for implementing high quality public transport networks that operate on exclusive right of way and which will incorporate current bus and minibus operators into a high quality system with no loss of income or jobs.

'The department has been engaging the metropolitan cities and related provinces in this regard and BRT Phase 1 scoping plans have been completed or are under way in Johannesburg, Tshwane, Cape Town, and Nelson Mandela Metros. It is envisaged that detailed planning will be completed in September 2007 for implementation to commence, in order to meet our 2010 Phase 1 target.

'In this regard I would like to encourage current minibus, bus and rail operators in these cities to work closely with Government in creating a win-win model for implementing BRT systems, which together with the Rail Priority Corridors will serve as the primary mobility network in our large cities and will be prioritised as an attractive alternative to private car use'

THE APPROVAL OF the Public Transport Strategy and Action Plan by the Cabinet in March 2007 and the related statements of the President and Minister of Transport provide a clear mandate to the three spheres of government to fast track the implemention of Phases 1 and 2 of a high-quality integrated rapid public transport network (IRPTN) in up to 12 cities and 6 districts in the period 2007–2014.

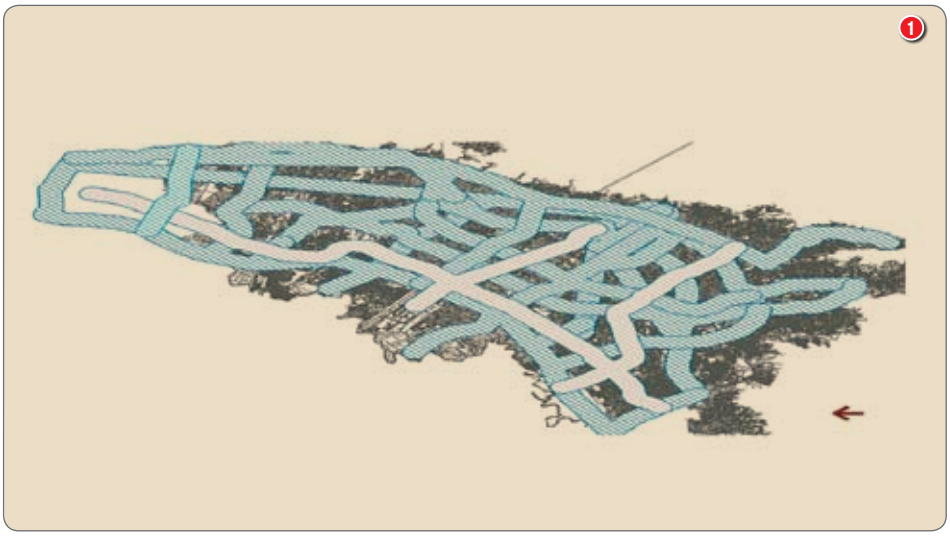
This is a mandate that the transport sector dare not fail to execute – especially as the National Household Travel Survey (NHTS, 2003) showed that 38 million people live in households with no access to a car and are hence dependent on public and non-motorised means of transport.

In addition to the challenge of basic access, the growth in car use is already undermining the sustainability of South Africa's larger cities – comparisons of the data from the 1995 October Household Survey and the 2003 NHTS reveal that public transport modes used to work grew by 10%, while car use to work grew by 20% in this period.

In short, the passenger transport sector is at a crossroads in 2007. It is time to act decisively now. The choices made in the 2007–2010 period will lock in transport usage patterns for at least the next 30 years.

With car use to work in the metropolitan cities already averaging around 45% of trips, the question is: 'Do we make a decisive trade-off and choose a more sustainable alternative now, or do we wait until we have 90% of work trips by car (like Los Angeles or Perth)?'

Every year we delay implementing high-quality public transport networks, every R500 million highway interchange we expand (as is proposed in several cities), and every additional few thousand airport or mall parking bays we build (at a cost of R50 000 per bay) mean that it will



1 Legacy – public transport network coverage: putting 85% of the six metro cities' current 16 million inhabitants within 1 km of a public transport service network line (the width of the line represents a distance of 1 500 m)
2 Strategic phasing, 2007–2010

be far more difficult and costly to retrofit a high-quality public transport, walking and cycling network on top of the car-based sprawling land use that we are continuing to encourage with our current choices.

WHY INTEGRATED RAPID PUBLIC TRANSPORT NETWORKS?

The essential feature of the Public Transport Strategy (2007–2020) is the phased extension of mode-based vehicle recapitalisation into integrated rapid public transport networks (IRPTNs). These networks comprise an integrated package of rapid rail and bus rapid transit (BRT) priority corridors – especially in major cities.

The Public Transport Strategy has two key thrusts: accelerated modal upgrading and IRPTNs.

Modal upgrading focuses on the 3–7 year transitional period and deals with improving the quality of the public transport fleet and its current operations. This includes minibus recapitalisation and Metrorail coach refurbishment. Modal upgrading, while necessary in the short term, is nevertheless insufficient in terms of achieving a high-quality service in the medium term.

Hence the need for IRPTNs, which focus on a 4–20 year period. IRPTNs aim to implement high-quality networks of car competitive public transport services that are fully integrated, have dedicated right of way and are managed and regulated by a capable transport authority.

The longer-term vision until 2020 is to develop a system that places over *85% of a metropolitan city's population within 1 km of an IRPTN trunk (road and rail) or feeder (road) corridor.*

A further goal *for the metropolitan cities by 2020 is to achieve a mode shift of 20% of car work trips to public transport networks.* In 2003 there were 1,85 million workers in metropolitan cities who used a car to get to work. A doubling of this to, say, 3,7 million in 2020 would mean attracting 750 000 (20%) of these workers to public transport networks.

By 2014, Phase 1 and 2 network implementation needs to be in place in the six metropolitan cities and at least Phase 1 implementation completed in the six smaller cities and six rural districts. Successful implementation over the Phase 1 and 2 periods (2007–2014) in 18 of South Africa's total of 53 metropolitan and district municipalities will see the improvement in public transport services for potentially over half the country's population. This is an ambitious programme for the overhaul of public transport and will require a concerted effort by the three spheres of government and all other stakeholders.

Figure 2 maps out the phasing of the implementation effort.

Phase 1 IRPTN package (bus rapid transit and rapid rail corridors)

The action plan proposes that network implementation comprise a standard basic package that can be adapted for local city and district conditions. In general, and especially for the larger cities, this will require a city-wide controlled network of rapid public transport corridors together with a fine grained feeder system of smaller buses, taxis, bicycles, pedestrian access as well as metered taxis and park and ride facilities.

IRPTNs comprise Metrorail priority corridors and bus rapid transit systems that ultimately integrate into a seamless network offering a standardised high quality of service for the user. In this regard, the priority rail corridors as

identified in the Consolidated Regional Passenger Rail Plan of 2006 will need to be continuously upgraded to meet a rapid rail standard. Similarly, the road-based component of the IRPTN will need to attain a bus rapid transit level of service.

Rapid rail and bus rapid transit service standards entail high frequencies, fast journeys on priority right of way, 16–24 hour operations, attractive station precincts and facilities, modern vehicles, secure environments and good customer service. The IRPTN will not be a conventional bus, taxi or rail service. It will be a rapid public transport service – with the entire network operating seamlessly and legibly as a single 'mode'. In this regard, the network will have a common branding and marketing image and critical image factors such as cleanliness, security and real-time user information will be actively managed to a high standard. These same principles have worked for some of the world's leading low-cost airlines and will also be progressively applied to South African public transport networks (see figure 3).

The key to a high-speed service is the development of dedicated median busways and enclosed stations with pre-board fare payment for road trunk corridors and dedicated infrastructure and priority slots for passenger rail corridors. Pre-board fare payment, level platform boarding and multiple vehicle doors significantly reduce the vehicle dwell time at a stop for both road and rail trunk corridors and hence drastically improve speeds and journey times.

Figure 4 highlights the core components of the network package as well as the critical implementation building blocks, namely a network implementation plan, transport authority control over the network, and maximum inclusion of existing operators in the network.

IMPLEMENTATION PROGRESS AND LESSONS TO DATE

Since Cabinet approval in March 2007, a DOT team has met with each of the 12 cities and related provinces that are targeted for Phase 1 and 2 implementation. The aim has been to support cities to think in terms of Phase 1 networks and to move towards network scoping plans and subsequently onto more detailed network operational plans. It is the latter that will form the detailed funding case to the National Treasury and the Public Transport Infrastructure and Systems Fund. This fund currently stands at around R9,2 billion – of which a large chunk is aimed at public transport networks.

The aim of Phase 1 networks is to invest in infrastructure and systems in order to maximise operating efficiencies and hence reduce or even eliminate operating subsidies.

In addition, the DOT has commissioned an expert review of the plans of the five cities that are considering some form of BRT system.

Some of the lessons emerging from the initial implementation effort to date are the following.

Not all cities are at the same level of preparedness – especially when considering the 30 month timeline for Phase 1 to be operational by 2010

For example Johannesburg is relatively advanced with its operational plan for Phase 1 of its Rea Vaya BRT network. This plan provides good estimates of passenger demand, fare revenue, network costs, infrastructure requirements in terms of busways, stations, terminals, depots, and fleet sizes for trunk buses, feeder buses and complementary buses that can operate in both mixed traffic and on the busway.

The cities of Tshwane and Cape Town have approved BRT scoping plans but need to speedily move to completing high-quality operational plans in 2007. Nelson Mandela is currently implementing a bus priority system that is not a full BRT system and here too they need to complete an operational plan.

Buffalo City are about to finalise a network scoping plan and will need to move to operational planning soon.

EThekwini is focusing more on its inner city services and the challenge here is to develop an operational plan for the fully restructured city-wide network – including the North South Priority Rail Corridor and its feeder systems.

Rustenburg have just developed a Phase 1 network concept that adopts priority lanes for public transport services. Mangaung have mostly proposed static, standalone infrastructure upgrades but are now considering converting the Mangaung Activity Corridor into a Phase 1 BRT system.

Mbombela have some ideas about a trunk-feeder bus network that still needs to be finalised. The same applies to Msunduzi. Polokwane and Ekurhuleni are still to be engaged with regard to converting from basic infrastructure upgrades such as ranks and interchanges to a dynamic integrated network approach.

Owing to the historical lack of public transport network implementation in South Africa, there is a default focus on infrastructure design before having done a detailed operational plan

Only Johannesburg has done a detailed network operational plan, which in turn determined the scope of the different pieces of network infrastructure – based on demand. Most of the cities have not done any detailed operational planning and are too quick to go over to infrastructure design. The key lesson is that infrastructure is determined by operations.

There is a lack of attention to user-oriented planning – with a casual approach in some cities to forcing several transfers

The key to designing good networks is to offer routing options that minimise the need to transfer. Ideally less than 50% of users should transfer and those that do should not have to transfer more than once. Forcing too many transfers tends to make public transport unattractive and uncompetitive in comparison with cars.

There is a lack of overall network planning that provides a detailed context for Phase 1

The overall network vision and scope ideally should be in place even before selecting Phase 1. In addition, there should be a careful plan at the outset as to the sequencing of future network phases.

There is a focus on separate CBD services that force a transfer

Some cities are looking to design separate CBD services, which will mean that all passengers coming into the CBD will have to transfer and pay twice. It is better to route network corridors through the CBD so that they penetrate as much as possible. There is no need to have a separate CBD service if there is a proper network in place. In addition, the CBD routing design should be done last – after having figured out how the network corridors will enter the CBD and route through it.

There is a focus on vehicle specification before having done a proper operational plan

Some cities are moving too quickly to explore options for technology such as vehicles and smartcard systems – these ideally are supposed to be derived choices that follow a detailed operational plan. It is user demand that dictates vehicle specifications and not what suits vehicle manufacturers.

There is a tendency to see the rail priority corridors as only needing refurbished coaches

The rail priority corridors have to go beyond coach upgrades to becoming the core line in an integrated network sector. This means that joint network operational planning needs to be done by the cities and SARCC-Metrorail. This should involve feeder services to the rail corridor, station precinct upgrades, etc. In addition, for the rail corridor to achieve rapid transit service levels, careful attention has to be paid to vehicle speeds, track access, station dwell times, etc.

There is a tendency to confuse basic bus lanes with a BRT system

A BRT system is not a bus system. It is rather a high-quality rail-type service that uses rubber tyres. Hence the importance of median busways, median stations, closed stations, pre-board fare payment, platform-level boarding, etc. These all combine to create a rail-type service on rubber tyres and hence go way beyond the capacities and speeds of conventional bus services. The importance of median stations in the future network is underestimated as it allows for easy platform-to-platform transfers within a closed system environment.

CONCLUSION

The race is on for South African cities to break the low-quality public transport mould and to implement Phase 1 IRPTNs by 2010. Given that we in South African have never done high-quality public transport networks before, ever, it is important to tap into the expertise of those who have worked on several of these systems in the developing country context.

While the cities have made a tentative start, the DOT and the provinces are committed to providing maximum support and funding in order for us to collectively achieve the targets for Phase 1. In this regard, the challenge is to be able to support cities to think in terms of high quality networks of services and to be able to execute in a manner that is focused on providing maximum service quality to the user.

3 *Characteristics of successful low-cost airlines that apply to integrated public transport service networks*

Service category	Product and operating features
Vehicle	Single type to minimise costs
Routes and airports	Uncongested
Fares	Low, simple, and unrestricted
Distribution	Electronic – ticketless
Service	Single-class, high-density
Frequency	High
Punctuality	Very good
Staff	High productivity, high morale
Customer service	Friendly and responsive

4 *Strategic approach, 2007–2020*

Vision: From basic commuter operations to accelerated modal upgrading and IRPTNs!

- Eighty-five percent of all residents within 1 km of rapid public transport network by 2020
- Upgraded modal fleet, facilities, stops and stations
- Extended hours of operation (16–24 hours)
- Peak frequencies 5–10 minutes; off-peak frequencies 10–30 minutes
- Full special needs and wheelchair access
- Safe and secure operations monitored by control centre
- Electronic fare integration when making transfers
- Integrated feeder services including walking/cycling and taxi networks
- Integration with metered taxi services and long-distance intercity services
- Car competitive public transport option – enables strict peak period car use management

Critical implementation building blocks

- IRPTN implementation plan
- Transport authority control over integrated network
- Maximum stake for existing bus/minibus sector in rapid public transport network

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Preparing for the 2010 FIFA World

ON 12 JULY 2007, a one-day symposium was held at the CSIR to discuss the progress being made in the transport sector towards the successful hosting of the 2010 FIFA World Cup.

The symposium was held under the auspices of the South African Transport Conference and organised by the Transportation Division of the South African Institution of Civil Engineering (SAICE).

The symposium was opened by Jan Coetzee of SAICE's Transportation Division, who stated that in order to prepare ourselves to successfully host a sporting event of this scale, we would need to employ the law of small differences with historic consequences. Vital ingredients in the recipe for success were a culture of constructive criticism and a passion to succeed.

LOCAL ORGANISING COMMITTEE (LOC)

The South African Organising Committee's (SA OC) vision is that the 2010 FIFA World Cup will seek to strengthen the South African and African image and promote new partnerships with the world as we stage a unique and memorable event. The committee has added a fourth pillar to their objectives, namely providing a social legacy, the regular pillars being the business of the sport, building of the fan base, and competition infrastructure.

The vision is to provide a high-quality transportation service for the World Cup that meets all event mobility needs while ensuring a lasting legacy for South Africans. The strategies are, among others, to ensure the provision of a high-quality transportation service to FIFA expectations and uniformity in the provision of transport services in host cities and throughout the country.

Some of the transport projects that need to be developed and implemented in time for the World Cup are the following:

- High-quality transport plans for FIFA rights holders, and the development, by transport authorities, of high-quality transport plans for all other World Cup participants
- Transport infrastructure and systems
- A vehicle fleet for 2010 and all related FIFA/LOC events
- High-quality parking space management services
- Applying the transportation IT system to ensure competitive transport service provision

Key milestones ahead are the preliminary draw plan, the Organising Committee Transport Strategy, the 2010 Transport Operational Plan, the Confederations Cup Plan, the Final Draw Plan, other FIFA/LOC events leading up to 2010, and finally the World Cup itself in 2010.

PUBLIC TRANSPORT INFRASTRUCTURE AND SYSTEMS GRANT

On receiving the rights to host the 2010 FIFA World Cup, priority was given to World Cup-related projects. A transport action plan for 2010 was developed to guide preparations for the event. The Public Transport Infrastructure and Systems Grant (PTIS) was established in March 2005 to improve public transport infrastructure and systems in South Africa. Priority statements were developed by host cities, other municipalities and provinces to motivate allocations of PTIF funds to their projects. Allocations have been approved based on recommended project proposals and a monitoring and management contract for PTIS spending is in place.

6 *Allocated PTIS funding by category*
7 *Allocated PTIS funding by venue city*

The projects qualifying for PTIS funding should prioritise public transport; satisfy both long-term mobility (legacy) and event-specific mobility requirements; provide continuity from planning to execution; be executed in accordance with government procurement and related requirements; should be based on local integrated development plans (IDPs) and integrated transport plans (ITPs) (that is, addressing community access and mobility needs); and be practical and implementable ahead of 2010.

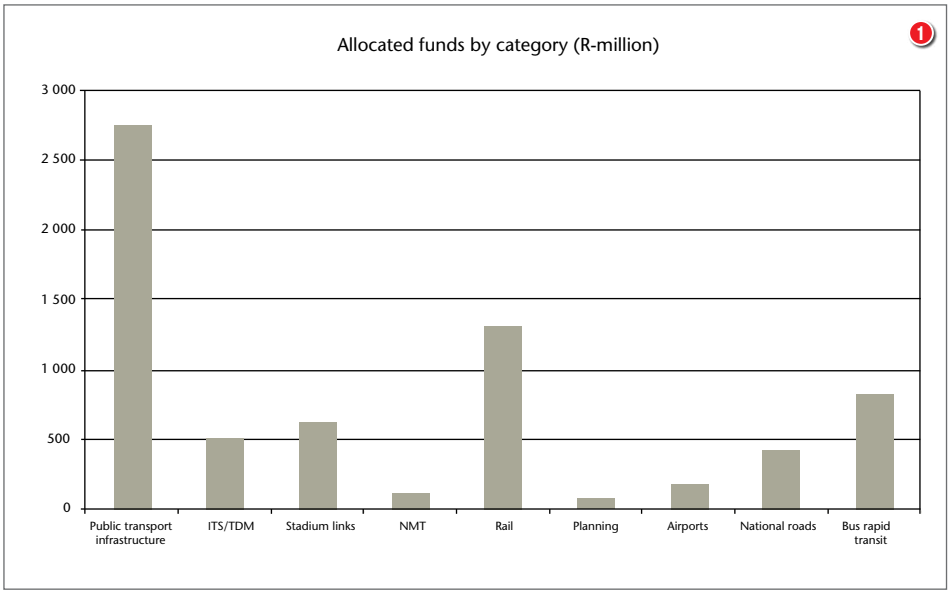
The PTIS budget amounts to some R9,2 billion, of which approximately R6,9 billion has already been allocated by project category and venue city. A team of monitoring and evaluation experts has been appointed with a mandate which has been expanded to include project management and technical assistance where necessary. The team reports monthly to the national Department of Transport and has been able to identify weaknesses/challenges with respect to project implementation and spending.

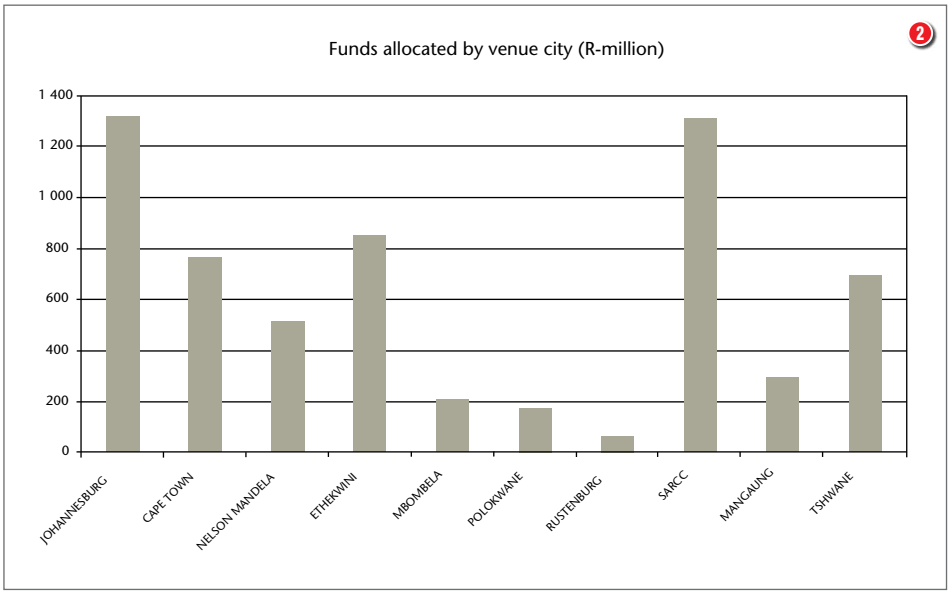
TRANSPORT OPERATIONAL PLANS

The Department of Transport is currently calling for the preparation of transport operational plans for the 2010 FIFA World Cup period. The purpose of these plans is essentially the following:

- To create an integrated, prepared understanding of all roles touching on the transport sector

Cup


1
Allocated funds by category (R-million)
3 000
2 500
2 000
1 500
1 000
500
0
Public transport infrastructure
ITS/TDM
Stadium links
NMT
Rail
Planning
Airports
National roads
Bus rapid transit


2
Funds allocated by venue city (R-million)
1 400
1 200
1 000
800
600
400
200
0
JOHANNESBURG
CAPE TOWN
NELSON MANDELA
ETHEKWINI
MBOMBELA
POLOKWANE
RUSTENBURG
SARCC
MANGAUNG
TSHWANE

- To maximise the use of all existing transport resources through a carefully orchestrated plan
- To properly integrate transport, security, and emergency response planning
- To identify specific needs for specialised services and prepare for those services
- Over time, to detail the full operational response from transport service contracting, operating schedules, command, control to manpower and volunteer training and deployment identifying costs, revenues and fund allocation
- To communicate this operational plan to all stakeholders – particularly the general public and football match spectators

The operational plans from all subsectors and venue cities must be of similar high quality, address the same key principles, and specify in increasing detail the exact operations for the World Cup event and integration with all other sectors - hence the need for an overarching framework plan. The Department of Transport's World Cup Office will manage the development of the World Cup transport operational plans for the 2010 FIFA World Cup period, in conjunction with key cities, provinces, and transport public entities. The department is currently developing an initial national transport operational plan (INTOP), as well as guidelines to assist the host cities and provinces with city wide, and regional operational planning.

INTOP will comprise a number of subsector plans which include host city plans (in collaboration with the provinces), a distance surface transport plan, an aviation sector plan, a cross-border movement plan, a road infrastructure network plan, a road traffic management and road safety plan, and a freight and logistics plan. The FIFA Family Transport Operations Plan is an LOC responsibility. All of the above plans are currently being prepared.

NATIONAL ROAD NETWORKS

The South African National Roads Agency (Sanral) have identified freeway projects within 30 minutes travel time at freeway speed of the venue city stadiums, which translated to a 50 km radius around each stadium. Funding will be either via treasury or user pay/toll principle. The projects planned or currently under way are as follows:

- Johannesburg (Soccer City (FNB) and Ellis Park) – The N17 Soweto link, the N12 ORTIA airport link and various Gauteng freeway improvements to the N1, N3 and R21
- Pretoria (Loftus) – Improvements to the N1 between the R21 and the N4, improved access to ORTIA and improvements to the Atterbury and Lynnwood interchanges
- Rustenburg (Royal Bafokeng) – Improved link between Johannesburg and North West/Rustenburg/Platinum Corridor, R512/PWV3 corridor upgrading
- Mangaung (Bloemfontein) (Vodacom Park) – Upgrading and rehabilitation of the N1 and R30
- Polokwane (Pietersburg) (Peter Mokaba Stadium) – Provision of eastern bypass with interchanges and links to stadium
- Mbombela (Nelspruit) (Mbombela Stadium) – Currently busy with the route determination and preliminary design of a ring road system
- Nelson Mandela Metro (Port Elizabeth) (Nelson Mandela Stadium) – N2 bypass is currently being upgraded as part of the Coega development
- Durban (Kings Park) – Upgrading of the N3 and the N2, with new interchanges and links to the N2 to accommodate King Shaka International Airport
- Cape Town (Green Point) – Unlikely to see any upgrading before 2010

Sanral is committed to integration of its road network improvements with planning in other sectors, which incorporate the integration of travel demand management (TDM) and public transport initiatives. They plan to make allowance for high occupancy vehicle (HOV) facilities within their Gauteng improvements and integrate with bus rapid transit (BRT), strategic public transport network (SPTN), commuter rail, the Gautrain services, and park and ride facilities. Intelligent transportation systems (ITS) will be deployed on all freeways. Closed and open toll systems are being considered for routes that will be tolled.

AIRPORTS

The Airports Company of South Africa (ACSA)'s strategy for 2010 is to provide adequate capacity for air traffic during event, provide a construction free airport during tournament and to ensure that all development is sustainable. In order to achieve this acceleration of the major capacity infrastructure projects is envisaged in the original medium term development plans, so that completion of the construction can be achieved by the end of 2009. National airports form an integral part of the 2010 programme.

Capacity improvements are planned, or are under way, at O R Tambo International Airport, Cape Town International Airport, Durban International Airport and the new La Mercy Airport. In addition, terminal extensions are scheduled for East London, George, Bloemfontein, Kimberley and Upington airports, public parking provision is being expanded at Port Elizabeth, East London and George airports, and additional aircraft stands are being provided at George Airport.

At all of the airports, the predicted 2010 capacities will exceed the predicted World Cup demands.

COMMUTER AND DISTANCE RAIL

Local and international expectations are high for a rail response during the 2010 World Cup. Under-investment remains a defining feature of passenger rail in South Africa, together with a negative public perception of the services. The short-term turnaround is expected by 2010.

The major challenges facing the rail sector are rolling stock condition and availability, poor performance (punctuality, availability, reliability, comfort and safety), aeging asset base and functionality, theft and vandalism, safety and security, accessibility of rail for the poor, capacity, responding to passenger demand, budget constraints and engineering-driven versus business-driven solutions.

The National Passenger Rail Plan has advocated a priority corridor investment strategy, which through strategic choices can set rail on recovery path towards sustainable growth. The 'turn-around strategy' incorporates a number of PTIS projects, including the provision of new/refurbished rolling stock of 2 000 coaches by 2010 and the provision of regional rail operational plans for 2010, aligned with host city requirements.

Additional upgrades planned include station upgrades, pedestrian facilities, and the reintroduction of the railway police to improve security of station precincts and on the trains.

VENUE CITIES

From a transport perspective, the venue cities are at varying stages of readiness. As part of the INTOP process, a new programme of requirements will be placed before the cities to ensure their readiness operationally for 2010. Currently some of the cities are embarking on the expenditure of PTIS funding through the provision of enhanced public transport facilities, ITS measures, and preparing high-level transport operational plans. Some have already produced detailed operational plans for the event days. The Department of Transport is currently putting in place support mechanisms to ensure that those cities that are lagging behind will receive the assistance they need to ensure that all of our venue cities are ready to host this event.

CONCLUSION

As transport professionals, stakeholders, service providers and government, we owe it to the country and the continent to make a success of 2010. Government has decided that an efficient and effective public transport system is the primary legacy to be derived from 2010. The implementation of the first phase of this public transport system has to start in the next few months, as we only have 2,5 years left before the event. A month-to-month target approach will be required to achieve the deadlines. □

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Promoting transit-oriented development

Towards an implementable model*

This article explains the means through which transit-oriented development (TOD) can be used to boost housing affordability and the implications of this for meeting the needs of the gap market in the South African context.

The base rationale behind TOD is the desire to decrease car usage by increasing public transport usage and the use of non-motorised transport. This is achieved through making public transport more accessible and the use of non-motorised transport more attractive. Generally, this is realised by locating housing in relatively close proximity to a public transport stop; encouraging mixed use development which reduces the need to travel long distances to access good, services and work opportunities; and increasing the density of developments to provide higher thresholds for public transport provision and commercial activity

THE GAP MARKET

A feature of the South African urban housing situation that is receiving increasing attention from housing policy-makers and strategists (such as the City of Cape Town) is the existence of the so-called 'gap market', namely households earning in the R3 500 – R7 500 band. These households do not qualify for subsidised housing, as they earn above the threshold for such housing. On the other hand, they are not able to access market-provided housing, mainly for two reasons: the limited availability of housing affordable to such earners, and the previous reluctance of lending institutions to enter this segment of the market.

In general, such households would be likely to have at least one member in regular waged employment and harbouring what may be regarded as 'middle-class' aspirations. Certainly they would wish to move from what is often desperately inappropriate accommodation in shared and overcrowded formal housing units, or in backyard shacks and converted garages, to more substantial housing. Their aspirations would include the ambition to acquire private transport and to use it to avoid the inconvenience, squalor and insecurity currently associated with public transport services across all three of the major modes (commuter rail, scheduled buses, unscheduled minibus taxis).

At the national level, the 'physical need' of households in the 'affordable housing market' (with incomes in the band R2 500 – R7 500 per month) was estimated to be some 666 700 units in 2006 and was projected to increase to around 726 800 units in 2010. Obviously, not all households in this income band contribute to rising levels of car acquisition and use in the population as a whole. Nationally, the number of households with access to a car increased by 808 000 or 33% between 1995 and 2003. Data from the 2003 National Household Travel Survey suggest that much of this increase would be accounted for by households earning more than R6 000 per month – a stratum in which the car ownership level rises to 1,2 cars per household from 0,6 cars per household in the R3 000 – R6 000 per month income band. (The car ownership level drops to 0,2 cars per household for households with incomes below R3 000 per month.)

Although the available data remain somewhat sketchy, it nevertheless seems reasonable to infer that there is a significant segment of 'gap market' households – particularly those in the middle to upper ranges of the associated income band – in which the acquisition of private transport is being, and has been, actively pursued.

Recognition of this possibility points towards a potential opportunity to address two of the most critical issues presented by current urban development trajectories in South Africa's major cities in an appropriately integrated way. On the one hand, there is a manifest need to deal with the unacceptable housing situation of a sector of the population which provides a critically important component of the urban labour force under conditions that must

**This article is based on a paper presented by the above authors at the South African Transport Conference (SATC) 2007. The SATC paper built on an earlier review of the high-level strategic and institutional implications of promoting transit-oriented development (TOD) in metropolitan Cape Town and on a detailed investigation of the possibility of facilitating TOD in the Atlantis Corridor of Cape Town, undertaken as research towards a dissertation in the University of Cape Town's Master of City and Regional Planning Programme.*

impact negatively on general productivity levels. On the other, there is an imperative to contain, and if possible reverse, the trend towards car ownership and use that is both an effect and a cause of declining levels of public transport usage in the major cities, particularly within this sector of the population. The rationale for this latter imperative is clearly embodied in the legislative and policy frameworks currently intended to govern urban transport provision.

LOCATION EFFICIENT MORTGAGE

The approach within which a related cluster of issues has been addressed in the US urban context has been labelled 'location efficient development', with the key mechanism deployed in its implementation: 'location efficient mortgage' programmes. In essence, 'location efficient development' is 'residential and commercial development located and designed to maximize accessibility and overall affordability' and is usually promoted as part of a 'new urbanist' or 'smart growth' strategy package to reduce 'automobile dependency'.

The basis of 'location efficient mortgages' (LEMs) is that higher mortgage to income ratios can be offered by financial institutions in recognition of savings on household budgets achieved through residence in areas considered to be locationally efficient, where overall transport costs are lower as a result of reduced private vehicle ownership and use. 'Location efficient' areas are those in which residents are not dependent on cars for their daily activities and can walk (or cycle) to access both public transport and the majority of goods and services used in daily life. Clearly, TOD schemes would be considered 'location efficient' and residents could be considered to qualify for LEMs.

In the US, where there has been fairly extensive experience with LEM programmes, a mortgage bond applicant with a monthly income of $2 100 would qualify for a bond of $115 611 in a 'location efficient' area compared to a bond of $76 058 elsewhere, calculated at the standard bond repayment to income ratio of 28%. In South Africa, lending institutions generally do not allow a bond repayment to income ratio of more than 30% and do not take the impact of transport costs on household budgets into account.

It is possible, however, to model the savings in transport costs that could potentially accrue to a household through substituting travel by public transport (and walking or cycling) for acquisition and use of a car, and to project what this might translate to in terms of additional mortgage bond finance within an LEM-type programme. Table 1 summarises the results of such a modelling exercise for 'typical' households falling into two income bands within the 'affordable housing' market segment of the population. This provision modelling indicates that additional bond affordability of approximately R150 000 can be achieved by not purchasing and using a 1300 cc vehicle costing R30 000. If the vehicle is purchased but not used extensively, the additional bond affordability would be in the order of R85 000. As the price of the engine capacity of the vehicle increases, so do the savings. For a 1600 cc vehicle costing R125 000 the savings if the vehicle is not purchased would allow an additional bond affordability of approximately R385 000 and if the vehicle is purchased but not used extensively the additional bond affordability would be approximately R113 000.

Table 1 Potential impact of an LEM-type programme on the 'affordable housing market' (in rands)

HOUSEHOLD A ('gap market'): two adults, two children		HOUSEHOLD B ('lower middle income'): two adults, two children	
Annualised cost of car ownership and use • 1300 cc vehicle, R30 000 purchase price • 20 000 km per year routine travel		Annualised cost of car ownership and use • 1600 cc vehicle, R125 000 purchase price • 20 000 km per annum routine travel	
Fixed costs Running costs	8 000 15 590	Fixed costs Running costs	32 600 18 950
Total	23 590	Total	51 550
Annualised cost of public transport use • Adults R172 per month train fares each • Children nominal R50 per month each		Annualised cost of public transport use • Adults R172 per month train fares each • Children nominal R50 per month each	
Adults Children	4 128 1 200	Adults Children	4 128 1 200
Total	5 328	Total	5 328
Potential savings per year		Potential savings per year	
• Car sold/not acquired (alternative a)	18 262	• Car sold/not acquired (alternative a)	46 222
• Car not used routinely (alternative b)	10 262	• Car not used routinely (alternative b)	13 622
Potential additional bond finance (LEM)		Potential additional bond finance (LEM)	
• Alternative a	152 180	• Alternative a	385 180
• Alternative b	85 510	• Alternative b	113 510
Notes • Vehicle fixed and running costs based on Automobile Association rates 2006 (assuming fuel cost R6,45/litre) • Public transport costs based on 2003 NHTS data for average costs of travel to work by train • Additional bond finance calculation based on assumption that repayment of R100 000 worth of bond finance is R1 000 per month			

source: T Marks, Transit oriented development for the Atlantis Corridor: a facilitation framework, Master of City and Regional Planning Dissertation, School of Architecture, Planning and Geomatics, University Of Cape Town, 2006.

CONCLUSION

While the model obviously could be refined and elaborated, even these necessarily crude preliminary calculations suggest that the establishment of an LEM-type programme which deploys some version of the 'affordability index' used in the US could significantly improve the standard of accommodation accessible to households in this segment of the market. Under present conditions in South African housing markets, this would substantially extend the downward 'reach' of private sector developers and represents an important and necessary 'demand-side' intervention to facilitate the provision of appropriate housing stock in 'efficient' locations.

However, the essential precondition for such locations to qualify as 'efficient' is the existence of a public transport system able to serve effectively both the current and anticipated travel demand patterns of at least the 'public transport-car aspirant' and 'public transport-captive' segments of the resident population. Moreover, while fundamental, instituting an effective, city-wide public transport system constitutes just one of the 'supply-side' interventions required to facilitate 'location efficient development' in the form of TOD. The other major such intervention would be the establishment of an institutional framework encompassing relevant agencies in both the public and private sectors, and specifically geared to deliver the appropriate forms of development in suitably 'efficient' locations. □

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International

Experience and best

The word 'liveable' denotes a desirable quality of life, economic soundness, social health and environmental viability. Liveable cities are human oriented, environmentally friendly, economically viable, efficient and socially sound. Fundamental to the generation of such a liveable environment is the integration of transport and land use planning to ensure the production of development scaled to human needs, with excellent access to public transport and non-motorised transport facilities, while allowing an appropriate level of car access. Government's policies are to encourage public transport, walking and cycling over the use of the private car. This article demonstrates how a coordinated spatial, urban design and transport planning approach can provide a transport system that will reduce the present excessive dependence on the private car while providing a more efficient transportation service that supports, rather than impeding the development of a liveable community

LAND USE AND TRANSPORT systems are inextricably linked – if one is to change, the other must respond. Land use planning decisions have a significant impact on transport needs, car ownership and public transport viability. Transport technology and planning has a similar impact on land use, influencing the locational demands of businesses and households.

In many respects, land use planning and transport planning have failed to provide positive urban environments. Increasingly, many cities are faced with serious traffic congestion, declining public transport networks and residential and business environments that are mono-functional and sterile.

Historically, land use planners have attempted to separate different land uses. This thinking has its basis in the unpleasant mixed use areas of cities that grew rapidly during the industrial revolution. The split between residential and industrial areas was originally facilitated by the development of transport technology which allowed people to travel the increased distances necessary to live away from their place of work. This desire to separate different land uses in order to maximise the benefit that each can derive from its location has guided land use planning until fairly recently, particularly in the South African context. In addition to the over-separation of land uses, planners have also been responsible for focusing on planning for cars, which has resulted in urban environments which are built at very low densities with large road reserves and are not at a human scale.

Transport planning in many cities has focused primarily on the facilitation of car transport to the detriment of other modes of transport. The result has often been a decline in public transport systems and degradation of the pedestrian environment to the point that non-motorised means of transport are no longer feasible.

Of late there has been a demand for a change in the style of transport and land use planning resulting from the variety of negative externalities arising from an over dependence on cars. From a transport perspective, the major problem is increasing traffic congestion, often exacerbated by a lack of alternative means of transport and a need to travel due to the separation of land uses.

As our understanding of the environment has developed, it has become apparent that the reliance on the car, with its internal combustion engine, is not sustainable. This unsustainability has two elements: (1) the production of greenhouse gases that are a by-product of the combustion of either petrol or diesel, and (2) the finite nature of these fuel reserves and the increasing demands being placed on these reserves as more fuel is demanded by



practices

growing economies.

Concerns have developed within the urban planning profession regarding the quality and liveability of many modern urban environments. The claim is made that many of the newer environments are mono-functional and sterile and fail to meet the needs of people who work and live in them. Of particular concern are the effects of urban sprawl, which results in loss of valuable farm and environmental land, increasing travel times, decline in transit ridership, increasing crime levels, decline of CBD areas and a host of other social ills.

These concerns have lead to a reconsideration of the traditional separation of land uses and resulted in the ideas of new urbanism which is focused on the development of mixed use urban environments focused on encouraging transit ridership and non-motorised transport. The primary cause of sprawl and its negative externalities is the low density of many new developments. The need to accommodate cars in large numbers exacerbates the problem of low density, as more land is required for road reserve and parking. Low densities reduce the population in an area, impacting on the viability of public transport and commercial and retail activity. The result is the development of 'big box' retail centres to which people have to drive, and the decline of public transport networks as high frequency services are not economically viable with low population thresholds. People are forced to drive more often and further, thereby exacerbating traffic congestion and fuel consumption with its attendant problems.

Apparent from the foregoing is the need for better transport systems that offer a range of transport options without maximising any one. To complement these transport networks, there is a need for better human environments that minimise the distances that people are required to travel in order to access the goods and services, social networks and recreational opportunities that are necessary for everyday life. In addition, these new environments should facilitate the development of all modes of transport, particularly non-motorised modes of transport that have a limited environmental impact.

In order to achieve this end, there is a need for integrated planning that considers both transport and land use together in order to develop urban environments which support a range of transport options and at the same time meet the needs of the people who use them. Such planning is necessary if truly sustainable cities are to be developed.

Transport planning needs to consider solutions to transport problems in an integrated and systemic manner. The basis for this needs to be the integration of different modes of transport and the acceptance that there is not one form of transport that should be dominant, but rather a range of options should be offered. Of particular importance is the need to ensure that car dominance in transport planning no longer prevails and, instead, means are found to make public transport more efficient and convenient and non-motorised forms of transport are planned for and the use of such is encouraged.

In order to produce the types of urban environments that support public transport and non-motorised transport usage, three factors must be improved: density, mix of land use and pedestrian friendliness. Higher-density environments are able to support a range of retail, commercial and transport services. The result is that people live closer to the retailers and service providers that they need to access on a regular basis and can often do so using non-motorised means of transport. Higher density results in more people using an area, which equates to more potential transit users. Increased demand for transit results in more frequent services with attendant increasing efficiency and convenience; thus, encouraging more users. In the United States a general correlation between density and public transport usage has been identified, with a 10% increase in density resulting in a 5% increase in public transport usage.

Mixing of land uses allows people to access all of the goods and services that they require without having to travel long distances. People are often able to access the retail, commercial and service activities that they use on daily basis using non-motorised transport; hence, reducing the number of vehicle kilometres travelled. Mixed land use also encourages people to use public transport. They do not feel the need to have a car at work, as they do not have a sense of being 'stranded' when they are able to access all of the goods and services that they require.

When mixed land use and higher density are correctly combined, ensuring that commerce, retail and services are located close to public transport routes and terminals, a further incentive for public transport use is found. In such cases public transport users are able to consolidate trips. It becomes possible to drop the children at a school or crèche on the way to the transit stop; or on the way home it is possible to purchase essential groceries and collect the laundry while walking home. If people are required to use their cars for one leg of their trip, it is likely that they will continue to use the car for the rest of their journey.

If the urban environment is not pedestrian friendly, then all of the above will

have been wasted. For public transport facilitation measures to work and non-motorised means of transport to be used, the pedestrian environment has to be such that people are prepared to walk. If the pedestrian environment discourages walking, people will not use public transport as all public transport trips have an element of walking and regardless of how close goods and services are to places of work or residence people will still drive.

INTERNATIONAL SUCCESS STORIES

The problems identified above have been a concern for transport and land use planners for decades and attempts have been made throughout the world to provide the solutions outlined above. When combined correctly, these solutions have proved to be highly successful in the development of quality urban environments. Below are some examples of interventions and developments which have been highly successful.

In the 1950s and 1960s **Munich in Germany** was one of the most congested cities in Europe. In the late 1960s a multimodal transport plan was developed for the city. The plan comprised the development of a regional rail system (S-Bahn) and an underground rapid transit system (U-Bahn). Streets around the city centre were improved and traffic flow in the city centre was impeded, while some of the most congested streets were pedestrianised. By the early 1970s a 12% shift in modal split in favour of transit occurred for travel into the central area. Since the 1970s car ownership in Munich has remained high, but the modal split has continued to change in favour of transit usage.

Melbourne in Australia has been rated as one of the most liveable cities in the world. This is due, in no small part, to the Melbourne Metropolitan Strategy. The strategy set a series of priorities to boost the attractiveness of Melbourne as a place to 'live, work, invest and do business'. Part of the strategy was an integrated transport plan that ensured that land use and transport planning contributed to produce an urban environment with high levels of accessibility, using a range of modes of transport. Melbourne integrates train, tram, bus and car transport to ensure high levels of public transport access and acceptable levels of car access. Much work has been done on the production of pedestrian areas within central Melbourne and new layouts for suburban residential areas have been developed that focus on producing mixed use areas that facilitate pedestrian and transit trips.

There is no doubt that integrated transport and land use planning can be effective on a city wide scale, but it can also be effective at a smaller area scale, improving the liveability of an area within a city. This can be seen in the effectiveness of a number of new urbanist projects and transit-oriented developments.

In **Washington and Portland**, in the **United States**, transit-oriented developments that aggressively promote transit have experienced an average increase in transit ridership of 58%. Not only has ridership increased in these developments, but there has also been a change in car ownership patterns in these developments. Only 35% of households in transit-oriented developments own two cars as opposed to 55% for the city as a whole.

Orenco Station transit-oriented development on the outskirts of Portland has significantly higher transit usage rates than the rest of the region, with 22% of residents regularly using transit as opposed to 5% for the rest of the region.

A comparison of two neighbourhoods in **Chapel Hill, North Carolina, US,** indicates that residents of the new urbanist neighbourhood made 22% fewer car trips and were three times as likely to walk as residents of a similar neighbourhood (in relation to size, location and demographics).

There is no doubt that integrated land use and transport planning can result in significant changes in travel patterns, with a shift from car dependence to higher levels of transit ridership and non-motorised transport usage. These changes can bring about far-reaching improvements in terms of liveability by reducing time spent commuting and increasing accessibility, while improving the quality of the urban environment.

THE SOUTH AFRICAN CONTEXT

In South Africa, specifically the Western Cape, a change in travel patterns is taking place. Increasingly there is a move away from traditional public transport modes such as buses and trains to taxis. The Western Cape has the highest rate of car access in the country, with 45% of households having access to cars.

Nationally, 60% of households that have access to cars spend nothing on public transport. This indicates that these households us the car exclusively as their means of transport. Clearly there is a shift to road-based transport. The effect of this is increasing congestion in the urban areas. South Africa has not reached the same point as the United States, where more than 90% of households have access to cars and transit usage is as low as 5%. It is still possible to encourage people to return to transit, which they have a history of using.

It appears that there is something of a disjuncture within government policy between the objectives of government in relation to the promotion of public transport and the requirements for traffic impact assessments. The *Manual for Traffic Impact Assessment* provided by the Department of Transport requires trip generation rates (for car trips) to be produced through the analysis of existing similar developments or the use of the *South African Trip Generation Rates* booklet. Modal split is produced by observing existing modal split for similar developments within the area. Essentially, this ensures that the existing situation of car-dominant planning is enforced for future developments by ensuring that the current trip generation rates and modal split, with associated low dependence on public transport, is maintained. This has implications for the road network and parking areas that must be developed to meet the future demand. The problem is exacerbated by the demand that the 75th percentile demand be used, further exaggerating the over design of road infrastructure.

On the other extreme, government policy calls for an increase in public transport usage and a prioritisation of public transport over private vehicle usage, with the aim of shifting modal split. The Western Cape's Moving Ahead: Cape Metropolitan Transport Plan has suggested a policy of staged target modal splits and aimed to achieve a modal split of 66:34 (public:private) by 2005. In addition, Moving Ahead calls for a reduction in trip length.

Clearly, traffic impact assessment policy is at odds with the government's stated public transport policy. It will be impossible to shift the modal split in favour of public transport if future transport planning is required to cater for private transport demand at the current level. Such planning will produce an environment that is dedicated to providing for private car usage and not for the needs of public and non-motorised transport users. Only when future demand is considered in the light of targeted modal split will transport planners be able to provide for the needs of public transport users.

CONCLUSION

The integration of transport and land use planning offers the potential to produce positive environments that are at a human scale while at the same time providing high levels of mobility. Fundamental to this process is the shift in transport planning away from a focus on providing for car users to balancing the needs of all transport users instead. In order to achieve this end, it is necessary to reconsider traditional traffic impact assessment techniques and instead produce a transport impact assessment. Such an assessment will allow the development of a composite understanding of all transport needs and not simply those of car users. With such a composite understanding it is possible to develop an infrastructure plan that can appropriately respond to these needs while producing a high-quality urban environment which does not prioritise any single user to the detriment of other users. □

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Comparative advantage in the rail freight sector

THE PERENNIAL PROBLEM in the rail industry is 'knowing what your real costs are'. It usually takes either a successful privatisation, or a failed concession deal, before railway businesses get anywhere near to knowing the true cost of providing the services which they offer.

Paul Samuelson, one of the greatest economists ever, offers a solution to this problem. He would call it the theory of 'comparative advantage'. In practical terms the theory simply advocates concentrating your best efforts on whatever it is that you are better at. It offers a useful 'rule of thumb' for railway organisations that don't know what their true costs are and hence are uncertain as to where they should prioritise their investment.

Comparative advantage theory offers a way around the problem of uncertainty by putting to you the question: 'In what market areas does your technology perform better relative to the other business areas potentially available to you?'

If you know the answer to this question, and invest accordingly, you will never find yourself in a worse situation than you are in now. If you know the answer yet keep on investing the way you always have, your industry will almost certainly head downhill faster than it is already! And if you don't know which service offer you are better at, then you are in the wrong industry.

This comparative advantage principle was applied in South Africa's recently approved National Rail Commuter Plan. Subsidy was rising, patronage falling, and there was no strategy to put things right. Government was becoming impatient and hinted very strongly that there would be no more money unless a sound case for investment could be made.

The financial evidence suggested that only a very drastic pruning of services could prevent total network failure. But this 'cut to the bone' option seemed draconian and also premature and so was set aside. Rail industry 'lifers', on the other hand, argued that it was simply a problem of investment backlog and that government should bite the bullet, fix everything and then they would show what a railway could really do. This 'big bang' option was also ruled out because the cost was prohibitive and there was no evidence that it would work anyway.

What the South African Rail Commuter Corporation (SARCC) did instead was to work out where their commuter rail technology could still be expected to work efficiently. A set of criteria was developed to answer this question. Each and every section, or corridor, of the commuter network was appraised against these criteria in a process undertaken jointly by rail operators and city transport planners. The result was a ranking of corridors for investment purposes into 'A', in which circumstances were optimum for winning market share and where investment should be boosted significantly; 'B', where market share could be retained and where investment should be sustained (these were then designated 'priority rail corridors'); 'C', for which the case for further investment rail needed to be re-evaluated; and 'D', where there was no apparent case for rail at all.

By demonstrating that they knew in what circumstances their technology performed best, and building a clear strategy around this information, the SARCC was able to secure a doubling of government investment in their business, and with a very real prospect of additional private sector investment on top of this.

What happens if one applies the theory of comparative advantage to the rail freight sector in South Africa? What is rail freight better at? This is not the same as asking what are the costs of running container trains. Nor is it asking what is the cost per ton/km on the Richards Bay coal export line. In the case of the coal line anyway, Transnet probably does have a reasonably accurate handle on its costs: this is relatively easy when a single-commodity rail service is involved.

If Transnet really wanted to find the most economic role for rail it, would be asking: 'What is rail freight better at?' But instead of focusing on this easy question, Transnet is trying to answer a much more difficult one. They are wondering how many billions of rands they should be investing in winning container business back from the road hauliers. The question is not only difficult; it is actually impossible to answer with any degree of certainty, for the following reasons:

- Transnet cannot price time
- Transnet cannot price security
- Transnet cannot price flexibility
- Transnet cannot price reliability

If one can't price these things – which road hauliers have to do every day or else they go out of business – then you will have absolutely no idea how much it will be necessary to spend to capture a given amount of general cargo market share from the road industry.

On the other hand, Transnet can predict locomotive procurement costs confidently; it can plan infrastructure maintenance costs quite accurately, and it can forecast lifecycle operational costs in considerable detail. For these reasons it is able to enter into very long-term and highly profitable contracts for the export

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Gansbaai to Bredasdorp

Promoting social and economic growth

THE GANSBAAI TO Bredasdorp road is situated in the southern region of the Western Province. It links the towns of Uilenkraalsmond, Baardskeerdersbos and Elim to the larger regional towns of Gansbaai in the west and Bredasdorp in the east. The upgraded road (± 62 km in length) closely follows the existing road and will be upgraded to a bitumen surfaced standard. Budgetary constraints mean the road project will be developed in phases.

The road project is located on the Agulhas Plain, which falls within a global hotspot for plant diversity and threatened plant species and is a recently declared Unesco World Heritage Site. Thus, the biophysical environmental assessment provided a number of planning and design inputs to the upgrading process.

The area that the road passes through is also rich in culture, especially the Moravian mission station settlement at Elim – a declared provincial heritage site – which is one of the best preserved settlements of its kind in South Africa. The village of Baardskeerdersbos has received a preliminary 3A provincial heritage grading. Both towns required a unique planning approach to ensure that the road infrastructure design is appropriate to a cultural heritage site.

The road upgrading had been identified as an important investment in the Overberg District Municipal 'local economic development' (LED) planning, in terms of agricultural and tourism developmental priorities.

It was in the above context and in accordance with the principles of the Expanded Public Works Programme (EPWP) that the Department of Transport and Public Works recognised that a different infrastructure implementation approach was required to unlock the environmental, cultural and economic developmental potential associated with this project.

A HOLISTIC ROAD PLANNING POLICY

The department developed a holistic planning and design philosophy which can be summarised through attributes such as design consistency, innovation and flexibility, employment/training creation opportunities, and value engineering.

Although infrastructure design is shaped by the relevant codes of practice and design manuals, there is within these codes of practice significant opportunity for 'flexibility and innovation' without sacrificing 'design consistency'. The innovation and flexibility opportunities for this project were introduced into the project through an

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of bulk materials. It is also able to apply these costing skills fairly successfully in retaining a number of other bulk and semi-bulk products.

Given these advantages, Transnet should be investing mainly in expanding its range of reliable and highly profitable bulk freight services and not chasing a moving target where it knows neither the price it must offer to win the business nor how many billions of rands it will have to spend to secure it.

But instead of this logical approach, Transnet is ploughing ahead with plans to invest billions of public money into the highly uncertain venture of pulling back market share from the trucking industry. It is public money because the highly profitable monopoly operations that generate Transnet's massive investment capability are a grant from the state.

The passenger rail sector has started to focus its investment plans on corridors where it knows that commuter rail can expect to do better. None of these are profitable services. But SARCC/Metrorail now know which routes make relatively better sense for the transport technology that they have available. And, as long as they sticks to their guns and actually achieve a refocusing of their investment, the future for passenger rail in South Africa may be expected to improve over time.

If only our rail freight sector would act in accordance with the same 'SA (Pty) Ltd' economic principles that may secure a turnaround for the commuter rail sector! At present it is investing according to narrow 'Transnet (Pty) Ltd' corporate principles. This will sadly not have the effect that they desire; that of reducing transport costs in South Africa. It will do the opposite. But if Transnet were to subject their investment plans to national cost benefit appraisal criteria the result would be much more investment in bulk freight and a lot less investment in market sectors where road freight technology offers a much higher quality supply chain solution.

But of course this would require a separate solution for non-bulk freight. And, interestingly, the application of the same economical principles leads to the conclusion that massively increased investment in road infrastructure would indeed be a far more economical way of accommodating massive growth in freight than trying to win general cargo back to rail.

While this may be the subject of separate article, the key conclusions of the present author's analysis of different approaches to accommodating freight growth on the Gauteng–Durban corridor is that a separate dual-two highway for trucks, parallel to the N3, would create a lot more capacity per billion of rands invested than any scenario of rail sector expansion. □

1 *Pipe laying (to line and level) learnership: practical*
2 *Close-up of bricklaying practicals*

unconventional contract arrangement of a 'design and construct'. The selection of this contract arrangement of placing the road designer and road constructor in the 'same team' was to encourage innovations in design, functionality and constructability, with particular relevance to employment creation and training. In addition, a design and construction tender process was structured to encourage maximum labour opportunities, within the constraints of technical and economical feasibility, without compromising the quality of the end product.

The work and training opportunities were structured around two concepts, namely the integration of the design and construction functions, with a contract award system that gives preference to labour-enhanced designs and construction, and the government's Seta learnership programmes, which encourage private sector employers/entrepreneurs to take on additional employees for one- or two-year learnerships.

In this contract, incentives were put in place for contractors to be innovative in the recruitment of learnerships, that is, employment opportunities connected with the road construction and other work opportunities in other economic sectors such as agriculture, tourism and fishing. Experience elsewhere has suggested that without these innovations, the increase in employment opportunities would be short term and unsustainable.

In the context of road engineering the road authority, the designer and the constructor have to reconcile a number of design/construction/operational parameters into an overall design approach to the project. Such planning and design parameters would be mobility and access, environmental and social impacts, safety (both during and post construction), employment opportunities, construction, maintenance and lifecycle costs (including road user costs). The value engineering framework provided a management technique to actively seek an appropriate balance between economic value and functionality.

The contract documentation was structured in such a way as to allow contractors to develop and motivate value engineering departures or modifications to the base bid requirements and thus encouraged the use of their specialist construction experience and management skills. This was a significant departure from the usual approach.

PLANNING AND DESIGN PROCESS

Consulting engineers HHO Africa were appointed to prepare the preliminary design and contract documentation for the 'design and construct' tender process. In parallel with the engineering design process, environmental consultants were appointed to undertake a combined scoping and environmental impact assessment (EIA) report. One of the deliverables of the EIA report is the environmental management plan for the project.

Similarly, management consultants were appointed to undertake a socio-economic review of the region and to identify learnership and training opportunities while preparing the local labour database.

ROAD INFRASTRUCTURE AS A DEVELOPMENT CATALYST

At all levels of planning, the road upgrading had been identified as a critical infrastructure investment. The agricultural area through which the road passes is experiencing considerable agricultural investment in terms of new vineyards, orchards and export flower farms.

The Integrated Tourism Development Framework for the Western Cape has identified various tourism priorities for development. One such area is the Cape Agulhas region. The gravel roads east of Gansbaai have been identified as 'missing links' impeding tourism flows from the Cape Metropole to the Cape Agulhas region.

The Cape Agulhas Tourism Development Framework Report sets out the new tourism infrastructure which is being planned to enhance tourists' experience of their visit to the most southerly tip of Africa. The future positioning of Cape Agulhas as a tourist destination will be enhanced by the creation of the Cape Agulhas National Park just to the west of Cape Agulhas.

During the preliminary design and the environmental scoping phases it was realised that the terms of reference for road planning in Elim and Baardskeerdersbos needed to be expanded to address a number of urban design issues. An urban designer/architect was appointed to prepare a concept plan for these settlements, in association with the engineering consultants.

The road construction contract was used as part of the economic development strategy for the region, by creating an economic stimulus to local business and new employment opportunities arising from increase in visitors. The creation of new skills was an important element of meeting local expectations.

ROAD INFRASTRUCTURE AS AN EMPLOYMENT AND TRAINING CATALYST

The project embraces the EPWP objectives of reducing unemployment and poverty by 'making unemployed people employable' and 'creating opportunities towards human fulfilment'. It follows a different strategy to that spelt out in the EPWP guidelines in that it cannot be categorised as a labour-intensive project, but rather as a labour-enhanced project with a strong vocational training thrust.

There are two alternative contract/tender approaches to implementing employment-intensive infrastructure works:

- **Method 1** Specific employment-intensive methods of construction and/or manufacture for various elements of the works are specified in the tender documents. Often a minimum rand value of labour (expressed as a percentage of the total contract value) is given as a minimum target. This is an essence the approach propagated in the EPWP guidelines
- **Method 2** Alternatively, the tenderers can choose the technology, design and construction methods in order to maximise the use of labour that is deemed to be cost-effective and compatible with the end product specifications. With this approach minimum contractual targets (expressed in person days and black contractor participation) are given

In terms of the design philosophy adopted, the latter was the method of choice. This method encourages the tenderers to use their design and construction skills, their innovation and creativity, to arrive at an optimum economic mix of equipment, technology, materials and labour in order to produce a winning tender. Hence, the tender evaluation criteria have been developed to encourage the maximum use of labour, in particular local labour.

Initially local labour was defined as labour that is resident in a corridor of some 10 km on either side of Gansbaai to Bredasdorp and Struisbaai. The database listed individuals who had expressed an interest to be employed as unskilled workers or as registered learnerships in industries that are compatible with the Overberg Economic Development Plan.

REVIEW OF PROJECT ACHIEVEMENTS

The total road investment (estimated to be of the order of R300 million) is an important investment signal for the Overberg Region which allows the tourism development projects of the Cape Agulhas National Park and the Cape Agulhas Tourist facility to proceed. The construction of the road to bitumen surfaced standards will constitute the last link of the premier coastal tourism route from Gordons Bay through Hermanus to Cape Agulhas and the De Hoop Nature Reserve.

Employment creation and training will hold important benefits for the region, provided there is continued investment in infrastructure. Consequently the longer-term employment of those who have completed learnerships and/or SMME training is an important component of the local economic development plans for the local municipalities of Overstrand and Cape Agulhas.

The two regional commercial centres Gansbaai and Bredasdorp have been identified as the primary beneficiaries of the construction spend in the region. The contract expenditure on black-empowered local business in the Phase 1 contract already amounts to more than R30,525 million, and with the completion of the road the towns of Elim and Baardskeerdersbos are expected to receive a major economic injection. In Elim various developments are planned, for example a tourism office, restaurant, coffee shops and a wine estate.

The selected tenderer, Haw & Inglis Contractor (Pty) Ltd, submitted one of the best employment and training proposals and proposed the largest number of non-construction learnerships. Their training strategy sought to create sustainable jobs in the region in the designated economic sectors. It should be noted that at June 2007 the contractor has exceeded his contractual labour target of 200 000 weighted man-days. It is estimated that through this contract arrangement six to seven times more people have been employed and trained than would have been in a conventional machine-intensive construction project.

PROJECT CHALLENGES

The publicity surrounding the perceived employment opportunities offered by this project raised local expectations of training and employment. This aspect needs to be carefully managed by the project management team prior to tender and by the construction team during the construction period. □

While Jo'burg sleeps …

O R Tambo gets a facelift

The next time you land or take off from O R Tambo International Airport, spare a thought for the contractors, Rand Roads and Black Top Surfacing, who have been working through the night rehabilitating the main runway and Yankee taxiway for a year. Planning and timing each night's shift was critical to ensure that not even the tiniest pebble remained on the runway at sunrise when the night's work had finished

AIR TRAVEL HAS become so commonplace today that we think nothing of it, nor of the myriad of activities that are essential to keep an airport and the airlines running efficiently. Runways take an extremely heavy pounding and, with passenger safety a top priority, it is essential that they are maintained in pristine condition.

Rand Roads, in joint venture with Black Top Surfacing, had already completed a runway for Johannesburg International Airport (now O R Tambo) in 2003 when it won two new contracts on tender. The first one, awarded in April 2006, was to rehabilitate the Yankee taxiway and the second, awarded a month later, was to rehabilitate Runway O3R/21L, upgrade the lighting system to meet International Civil Aviation Organisation (ICAO) requirements, widen the runway by 15 m and construct two new rapid exit taxiways (RETs) on the main runway.

Work on the Yankee taxiway was completed in November 2006, in time for the new Airbus A380's first visit to South Africa. The runway was completed in May 2007. Although the two projects overlapped, work was carried out by two separate teams with their own plant and equipment.

Operations for secondary runway strengthening had to be carried out at night so as not to disrupt normal air traffic movements

The jobs were both particularly challenging, considering that the taxiway and runway could not be closed down during rehabilitation. With the taxiway and runway fully operational during the day, contractors were only given access to the site at 21:30 each night, handing it back to Airports Company South Africa (ACSA) by 6:30 the following morning. Work actually finished at 5:30 so that each day an hour was spent tidying the site, painting markings and – most importantly – ensuring that not even the smallest stone remained on the surface. ACSA's Fire and Rescue Department would then inspect the section that had been worked on and give their approval before the site could be handed back to ACSA. Before the shift started, the Fire and Rescue Department would also inspect the runway for any damage that needed repairing. Repairs would be done at

An aerial view of the main runway with the Yankee taxiway on the right and a rapid exit taxiway being constructed

the beginning of the shift.

Working in the dark under floodlights with flashing strobe lights from vehicles is never easy and surveying under these conditions as well as adhering to strict tolerances has proved particularly challenging,' says 'Rand Roads' project manager, John Hamilton.

Added to this, there were three paving teams (on each project) working in a small area – roughly 150 to 200 linear metres across the width of the runway – lots of plant and haulage vehicles which had to stay within demarcated lines, limited working time and often in extremely low temperatures. In winter the wind chill factor meant that all personnel had to wear special freezer suits; and achieving compaction on the premix at low temperatures was also a challenge.

Keys had to be milled on each side of the section being worked on both longitudinal and transverse, to tie in the new layers with the existing ones. Both the new and existing layers had to be surveyed to ensure there were no steps or gradients greater than 0,5%.

The three asphalt plants which supplied premix to both sites had to be ready before each shift so if it was raining or rain looked imminent, the suppliers could delay the manufacturing process. It was also vital that exactly the right quantity of premix was ordered for each shift so that all the scheduled tasks could be completed.

'Planning was the most important aspect of these projects,' says Gary Catin, Rand Roads' contracts director. 'A status meeting was held every evening two hours before the shift began with the foreman and supervisors to determine exactly what had to be done and by what time. An hour before the shift, ACSA's Fire and Rescue Department were informed at the "kick off" meeting, where work would be taking place, safety issues, contingency plans and haul routes, and they in turn would confirm the hand-over time.'

While both projects were in progress, around 150 truckloads of premix had to make their way through tight security checks and demarcated lanes to the site. The two projects combined used 64 270 tons of asphalt surfacing 101 635 tons of asphalt base.

YANKEE TAXIWAY

This R63,5 million project comprised doubling the width of the taxiway from 30 m to 60 m, as well as repairs to the Delta apron. The taxiway is 3,6 km long and runs parallel to the 03R/21L runway.

'We worked on a new section of the taxiway every night. This involved milling and replacing the existing surface with a bitumen-treated base and overlay followed by an asphalt wearing course,' says Coen Naicker, Rand Roads' project manager. 'Allowance also had to be made for electrical ducts that were required every 15 m for new central line lights. Ducts had to be installed on the base course before the final asphalt wearing course was laid.'

The only differences between the Yankee taxiway and the main runway were that the taxiway did not require the same amount of central strengthening and the special ultra-thin friction course layer. As the taxiway was being substantially widened – 15 m on either side of the existing taxiway – considerably more excavation and earthworks was required. This was carried out by sister company Grinaker-LTA Roads and Earthworks, as was the case with the main runway and RETs.

The consulting engineers for this project were Arcus Gibb.

MAIN RUNWAY

The consulting engineers responsible for the design of the runway rehabilitation were Stewart Scott International. Both the longitudinal and transverse grade of the runway was redesigned and the runway pavement strength had to be able to withstand the anticipated aircraft loading for the next ten years, including the Airbus A380. The value of the rehabilitation and new RET contract is R134,7 million.

Similar to the Yankee taxiway, the existing surface of the main runway, which is 3,52 km long, first had to be milled out in the centre (16 m) of the runway and a thick layer of bitumen-treated base was applied to strengthen this section. It was built up in levels so as to alter the transverse gradient to a 1,5% slope for better water run-off in line with international standards.

A special ultra-thin friction course layer with extra stone content was applied on the centre 58 m of the runway using a new spray paver purchased specially for this project. The paver applies the tack coat and asphalt in one operation. Although this has already been done on some South African roads, this was the first time it had been used on a South African runway. The main advantage is that it improves skid resistance and reduces maintenance. It also reduces spray from tyres during rain.

The new 7,5 m shoulders each side of the existing runway were required to accommodate the wingspan of the Airbus A380. Once the earthworks had been completed, the shoulders were constructed using an emulsion-treated base. This was done using an in-situ recycler which mixes gravel and cement and adds water and emulsion in one operation. This surface is then compacted. Similar to the taxiway, ducts had to be installed at 15 m intervals below the final layer of wearing course for the central line lights. Once the electrical ducts were in place, the area could be paved. Manholes on either side of the runway also had to be moved to make way for the shoulder.

RAPID EXIT TAXIWAYS

The two new rapid exit taxiways (RETs) are located on the western side of the runway and are approximately 2 000 m apart. They will allow more planes to land as those which have just landed can leave the main runway more quickly.

As these RETs were new, the site had to be excavated, base and asphalt layers added and temporary and permanent paint markings painted onto the surface. New centre line and lead-on lights were also required.

A new asphalt ultra thin friction course was also added to an existing RET (Echo taxiway) as part of the main runway contract.

'Working around live taxiways with a large labour force also increased the risk of an incident but there were no accidents during both these projects,' says Catin. □

Contracts awarded in Gauteng Freeway Improvement Project

CONSULTING ENGINEERING AND project management group SSI – a DHV company, part of the Gauteng Freeway Joint Venture – were recently awarded two contracts, together valued in the region of R1,5 billion, for the design and supervision of upgrades to two sections of the major freeways around Johannesburg and its immediate suburbs.

The other members of the JV are Goba, NTSU Engineering Consultants and Semenya Furumele Transportation Engineers.

These projects are elements of the greater South African National Road Agency Limited's Gauteng Freeway Improvement Project – a massive R14 billion undertaking that will see some 500 km of road around Pretoria, Johannesburg and Ekurhuleni being upgraded or constructed to reduce congestion and improve safety. It is the biggest single undertaking of its kind in 20 years, in terms of national road projects.

The two sections awarded to the Gauteng Freeway JV are on the N1 highway from the 14th Avenue Interchange to the Buccleuch interchange and on the N3 between the Buccleuch Interchange and the Geldenhuys Interchange – amounting to some 40 km of road. A somewhat uncommon inclusion in the scope of work is the assessment of the first kilometre of cross roads on either side of the freeway at Interchanges.

SSI's Pieter van Niekerk says the sections awarded to his JV probably amount to the biggest road project the JV has been involved in for the past ten years. The respective 12 month design contracts were awarded in December 2006.

'We've only just finished the initial assessment work required for these two sections and we're now beginning with preliminary design,' says Van Niekerk. 'This is a fast-track project that will see construction begin as early as 2008, for completion by December 2009. Work on our two sections, as well as the other six sections that complete the overall project, are scheduled to run concurrently.

'Because of the extremely high traffic volumes involved, both sections of road have required us to look at a level of design that's never been done before. On the table at the moment are options like ultra-thin concrete and high occupancy vehicle (HOV) lanes. We're also doing noise level reviews as part of our environmental impact assessments.'

14TH AVENUE TO BUCCLEUCH

The 14th Avenue to Buccleuch section includes the four access interchanges of Beyers Naudé, Hans Strijdom, William Nicol and Rivonia Road.

This section is part of the extensive freeway network and parts of it were completed as far back as 1978. The N1 improves the West Rand's regional accessibility as well as through traffic from Bloemfontein to the south, Pretoria and

▶ *Typical section of the N1/N3 highway which is to be upgraded – looking west towards the Rivonia Road junction in Rivonia*

Polokwane to the north, the East Rand via the N3 to the east and Kimberley via the N12 to the west.

The N1 route plays a major role in business development on the West Rand and is an important national strategic asset. The annual vehicle operating cost incurred on its network of roads is very high, so it's critical that the N1 operates as effectively as possible as a major arterial in the Gauteng network of freeways.

'We're looking at a ten-year design horizon for this section that includes improving interchanges with the addition of new and auxiliary lanes and increasing traffic capacity, as well as making provision for intelligent transport systems (ITS), ramp metering and HOV lanes. A major priority is to make appropriate provision for public transport vehicle movement,' says Van Niekerk.

The JV's task includes evaluating the integrity of the current road surface and recommending rehabilitation measures capable of achieving at least a ten year 'no maintenance period' after completion of the works. Other elements of this contract will look at bridge clearances and upgrading, road drainage, maintenance and upgrading of road signage, freeway lighting and managing traffic during the construction phase.

BUCCLEUCH TO GELDENHUYS

'Traffic at peak times on most sections of the N3 is at capacity or approaching capacity during the peak hour,' says van Niekerk. 'Heavy vehicle demands by 2010 will be around 20% higher than they are now and from 2010 onwards, we can anticipate a 6% per annum heavy vehicle traffic growth rate.

'Cabinet is looking at the possibility of tolling sections of this highway and if this happens, then from 2010 onwards high occupancy vehicles will increase and this should reduce light vehicle traffic growth.

'Part of our plan for our section of this highway is to widen the road median and outer edges to add a fourth lane of traffic in both directions, which will relieve the current problematic congestion. Further widening on the outer edges will provide auxiliary lanes at all on- and off-ramps at interchanges, while other improvements include widening of off-ramps and bridges and resurfacing the road.'

The interchanges in this section are Van Buuren Road, Gilloolys, Linksfield, Modderfontein, London Road and Marlboro Drive. □

'Cabinet is looking at the possibility of tolling sections of this highway and if this happens, then from 2010 onwards high occupancy vehicles will increase and this should reduce light vehicle traffic growth'

A legacy of success

Bosal Afrika's Industrial Division is also central to the success of the local business, as it produces tubular products such as tube lengths and manipulated products for the Bosal Automotive Divisions, as well as various industrial and building applications

BOSAL WAS FOUNDED on humble beginnings in Holland in 1923, but it has grown into a global leader in the automotive realm. Currently the Bosal Group is one of the largest automotive component manufacturers in the world as a tier-one supplier to the original equipment (OE) sector and the aftermarket industry.

Originally known as 'Firma Karel Bos', the company was established in Alkmaar, Holland, by Karel Bos, a blacksmith who specialised in gas welding and cutting, which formed the basis for the transformation of his business that originally catered for horses to one that produced replacement parts for cars – particularly exhaust systems.

His son, also named Karel Bos, was born in 1928 and immigrated to South Africa after World War II, where he set up the company that became the starting point for the Bosal Group as it is known today.

Bos established Bosal Plant 1 in Pretoria in 1952 to produce aftermarket exhaust systems, and by 1959 the company was manufacturing its first OE systems. Rapid local and international expansion followed, with the first overseas plant opening in Canada in 1966, and a European base established in Antwerp in 1968.

Over the ensuing decades, the Bosal Group blossomed around the world, with various distribution and manufacturing facilities established in Germany, France, UK, Denmark and Switzerland in the 1970s. The first distribution site in the US opened in the 1980s, along with subsidiaries in Spain and Ireland.

Bosal's exceptional growth continued in the nineties as the company entered new markets in the Czech Republic, Mexico, Brazil and Argentina.

In the modern context, Bosal International has developed into a global leader, employing over 6 000 people in 42 manufacturing plants and 27 distribution centres located in 24 countries. In 2005 alone, the company's turnover exceeded €815 million (R7,7 billion).

The company is currently headed by third-generation Karel Bos, born in 1961, who succeeded his father as chief executive officer in September 2000 – although Bos senior is still closely involved with the strategic direction of the Bosal Group and maintains his trademark entrepreneurial hands-on approach.

The Bosal Group is Dutch registered and headquartered in Lummen, Belgium, but the South African operation, Bosal Afrika (Pty) Ltd, remains an integral part of the business and maintains its leading position as a manufacturer and supplier of exhaust systems, catalytic converters, towbars, jacks, various tubing products and agricultural irrigation equipment – both for the South African and export markets.

Bosal Afrika is an OE supplier to Nissan, Ford, Mazda, Mitsubishi, Volkswagen, Isuzu, Toyota and Opel, as well as boasting the most comprehensive range of aftermarket exhaust systems, including long-life stainless steel units, performance exhausts and silencers for truck, bus and industrial applications.

Testifying to its quality reputation and proven international status, Bosal's various manufacturing facilities in Pretoria are ISO 16949 accredited, including Plant 1 (exhausts) and Plant 3 (jacks and toolkits) in Koedoespoort, as well as Plant 4 (towbars) in Waltloo.

Bosal boasts EC approval for the wide range of towbars and catalytic converters exported to Europe – the latter produced at the specialised Plant 10 in Koedoespoort and featuring Bosal's patented Radial Flow Converter design that is more efficient and cost effective than traditional ceramic-type converters.

Dedicated research and development centres are located at Plant 1 for exhausts and Plant 4 for towbars, allowing the teams to design, develop and test various components that comply with the necessary local and international government regulations and SABS standards, and building on Bosal's innovative and competitive edge in this field.

Bosal Afrika's Industrial Division is also central to the success of the local business, as it produces tubular products such as tube lengths and manipulated products for the Bosal Automotive Divisions, as well as various industrial and building applications.

Other products that fall under the Bosal Afrika umbrella include the wide selection of irrigation equipment from House of Irrigation, and the Enerpac hydraulic equipment range.

Bosal has clearly enjoyed a meteoric rise to the forefront of the automotive component industry, and is recognised as a true world leader with a pioneering spirit and a reputation for peerless quality – traits that make it the definitive benchmark for the sector, and provide a formidable platform to further entrench the success and growth of the Bosal Group as a whole.

And, under the focused and unwavering direction of the Bos family, the company's future looks even more promising than its exceptional 84-year history.

'We have clear ambitions to strengthen Bosal further as an independent and privately owned company,' explains Bosal Group CEO Karel Bos. 'The objective is long-term growth and the continued strength of the group as a tier-one supplier to the automotive industry, as well as reinforcing our leadership in the aftermarket sector.' □

Gautrain site visit

1. *Viaduct 3 and the temporary bridge over Allandale Road*
2. *Shaft 5: Light at the top of the shaft*
3. *Preparing for blasting: Park Station shaft and gallery*
4. *Aerial view of Sandton Station*

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PROFILE OF THE DUBAI METRO

Supported by a superlative and extensive infrastructure in transportation, telecommunications and finance, Dubai is well endowed to manage some of the world's most sophisticated, remarkable and ambitious projects to date.

As part of its modernity drive, vision and concerns for the environment, the Dubai government commissioned studies to evaluate most efficient and cost-effective solution to combat traffic congestion and its pollution by-product; the recommendation of these studies were the creation and development of a metro for Dubai City.

The government of Dubai has created a Roads and Transport Authority (RTA) on 1 November 2005. The Dubai Metro is the flagship project of the RTA in terms of its approximately 15,5 billion dirhams' total investment (inclusive of project management fees and utility diversions); state-of-the-art engineering and technological challenges; visibility throughout the city, being an architectural showpiece; and its direct role in providing social benefits.

The Dubai Metro will be a catalyst for improving real estate value, economic development and urban regeneration along its main route and arteries. In addition, it will create an additional source of employment opportunities for the local population and the region.

The new metro will be a fully automated, driverless railway system. It will be constructed and delivered in two stages, Red Line (Stage 1) and the Green Line (Stage 2). In the congested central areas of the city, the metro lines will be built mainly underground, which will constitute the majority of the Green Line, whereas the Red Line will span along the famous Sheikh Zayed Road, on a viaduct.

Completion dates

- The Red Line (Phase 1) is planned to be completed and to start generating revenue by September 2009
- The Green Line (Phase 2) is planned to be completed and to start generating revenue before March 2010

Dubai Metro

'Gautrain' in a desert country

DUBAI, BEING ONE of the fastest growing cities on earth, is experiencing at least one of Murphy's laws these days. This is based on the engineering logic that if a city's infrastructure does not keep up with the city's development growth, everybody will sit daily in traffic jams – sometimes for hours.

With an average annual growth of more than 6% and an increase of some 7% in the number of vehicles, the authorities realised that merely building more roads will not solve all traffic problems.

Initial feasibility studies for a metro system started as early as 1997 and were completed in 2000. The importance of an expanded public transportation system soon became apparent, as well as adapting transport policies that will focus on traffic regulation in and around the city. Further planning studies were carried out (2000–2002) proposing a major metro rail line along the length of the city, as well as additional circular rail lines within the CBD.

In the period 2002–2005 a sequence of detailed planning studies followed which led to a design and build contract being awarded to a consortium now known as Dubai Urban Rapid Link (DURL). The consortium is made up of international companies including

the Japanese companies Mitsubishi Heavy Industries, Mitsubishi Corporation, Obayashi Corporation, and Kajima Corporation, as well as the Turkish company Yapi Markezi. The client for the Dubai Metro is known as the Roads and Transport Authority (RTA), which was formed in 2005 by the Vice-President of the United Arab Emirates (UAE), HH Sheikh Mohammed Bin Rashid Al Maktoum (who is also the Ruler of Dubai). The Dubai Metro has since become one of the flagship projects of the RTA.

AIMS AND OBJECTIVES

The Dubai Metro will be implemented as an alternative mode of transport with three main goals: to reduce the dependency on car use, to reduce the travelling time in and around the city, and to help reduce traffic-borne pollution. As Dubai is a 'tax free' city, and fuel and cars are cheap compared with many other countries, everybody is driving his or her own car. Also, the desert heat makes public transportation less attractive.

The Dubai Metro will link one end of the city to the CBD and Dubai International Airport on the other end. Provisions will be made for park and ride facilities near some of the main stations. Interlinked bus and taxi routes as well as water bus routes ('abra' boats) will complement the Dubai public transportation network. The objective is the implementation of an integrated transportation system that will give Dubai citizens and tourists the flexibility to travel in and around Dubai with fewer traffic delays than currently experienced. It is hoped that, over time, people will begin to make more use of public transportation – which is already happening in many other countries.

PROJECT DESCRIPTION

The Dubai Metro will be constructed in two phases. The first phase (called the Red Line) will be the link from the south end of the city (towards the capital Abu Dhabi) along the length of the city towards the Dubai CBD. The Red Line runs next to the main highway, Sheikh Zayed Road, which forms the main traffic artery of Dubai. (This highway is basically the equivalent of South Africa's Ben Schoeman freeway.)

The Red Line covers a length of approximately 52 km, and most of it is elevated. There are 23 elevated stations along this rail line with one station at grade and four stations underground. The elevated sections consist of single and multiple pile foundations, single piers and pier caps which are linked together with pre-cast rail segments. The Red Line is planned to be completed by September 2009.

The second phase (called the Green Line) will form a semi-circular route within the Dubai CBD. The Green Line will have elevated as well as underground sections. The total length of the Green Line is 23 km, of which about 8 km will be underground. The underground section is constructed using tunnel boring machines (TBMs) and cut-and-cover construction methods. The elevated section will have 12 stations while the underground section will include eight stations, including two intersection stations. The completion date of the Green Line is March 2010.

1 *Artist's impression of the completed metro rail along Dubai's main highway*
2 *Metro map*

The maximum speed of the trains will be about 90 km/h. By 2010, a total of 79 trains (five-car as well as three-car trains) will be in operation – 62 on the Red Line and 16 on the Green Line. Trains will be driverless and air-conditioned. Some of the train car compartments will be earmarked for exclusive use by women and children as well as VIPs (first class) to allow for the cultural uniqueness of this Arabic city. The trains will all run on the standard 1,435 m rail gauge.

The total cost for the two phases is estimated to be around R30 billion.

CHALLENGES AND INNOVATIONS

Ironically, one of the main problems being encountered during construction is traffic congestion. In a city of traffic jams it is a major challenge to build diversion roads to accommodate construction. Limited space and relocation of main services and utility lines complicate matters even further. To add to this, all service authorities in Dubai require a no objection certificate (NOC), which gives formal permission to relocate services. The process of obtaining NOCs

leads to bureaucratic paper work delays that add in no small measure to the pressure of completing the project on time.

A project for temporary traffic management (TTM) was awarded to South African company Africon to provide traffic management plans (TMPs) for these diversion works. The TMPs involve the study of current traffic conditions to find possible diversion roads, or the implementation of temporary roads that will limit the impact of construction activities in and around Dubai.

The importance of proper TMPs became clear for the underground cut-and-cover construction sections, particularly in the CBD where major intersections were planned to become huge holes in the ground (or rather, sand). As a result Africon's team looked at geometric solutions as well as traffic engineering solutions. Various options were tested for each area under construction. Where a reduction in capacity was expected, traffic modelling and analysis became imperative in order to predict the impact of construction on traffic diversions.

The influence of major diversions and other traffic restrictions in the current road network was analysed by using the Regional Transportation Demand Model for Dubai. Classified 24-hour electronic traffic counting formed part of the process to ensure accuracy in modelling.

From the traffic modelling and analysis the expected traffic flows during the metro

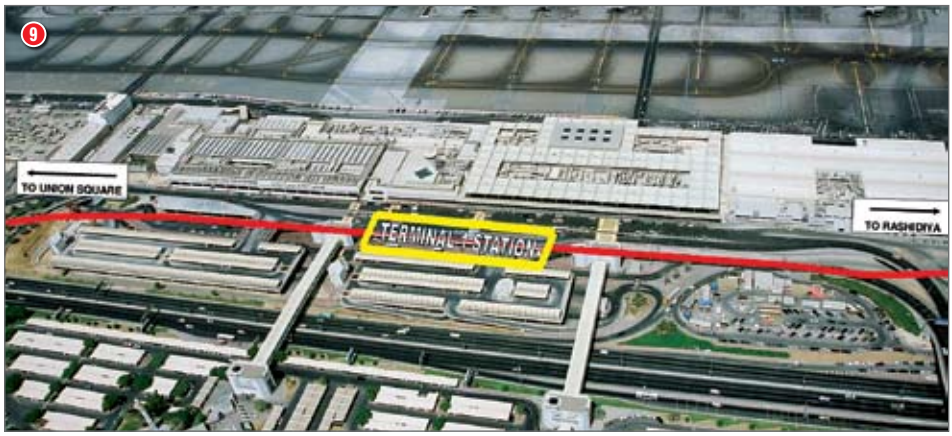
construction for the diversion works could be determined by using traffic engineering software such as Vissum/Vissum, Sidra and Synchro. Output from these software packages helped to develop the mitigation measures required to re-establish acceptable levels of service and operating conditions. These included upgrading alternative routes, restricting certain routes (by implementing one-way systems or reversing traffic flows), closing roads and building new diversion roads.

The Japanese construction companies are using another innovation: mobile launching gantries are used to construct the elevated viaduct rail segments. The gantries can move forward between two piers while the pre-cast segments are lifted in place for linking, glueing and stressing. With these launching gantries, viaduct spans can be assembled in two days.

Two pre-cast yards were built to complete the task of making thousands of piers caps and viaduct segments. All the pre-cast segments are usually hauled to site in the early morning hours to limit the impact on day-time traffic.

PROJECT STATUS

At present approximately 7,5 km (15%) of the elevated viaduct rail sections have been completed. This includes pile foundations, piers and piers caps linked together with the elevated pre-cast rail viaduct segments. About 90% of the viaduct pile foundations and about 55% of the piers have been completed. The construction of the stations is also proceeding well, with 20 of the 24 elevated stations



3 and 4 The elevated viaduct rail structure consisting out of the substructure piling foundations followed with the piers, pier caps and the segments for the rail structure spans
5 Example of a Type 1 elevated station
6 Example of a Type 2 elevated station
7 and 8 Some of the areas where the elevated Red Line will pass. Many of the elevated sections are constructed within limited space and construction is made even more challenging by existing roads and services
9 Dubai International Airport Metro Station

substructure foundations completed (70% of the piling work).

CONCLUSION

The future of city travel lies in the increased use of integrated public transportation systems. These need to be planned and refined to make it more feasible to use public transport. But this will only happen when the level of user-friendliness is such that people will voluntarily switch to public transport. If the system does not provide a proper level of flexibility, people will switch back to individual car transport, which enables them to individualise route planning and timing.

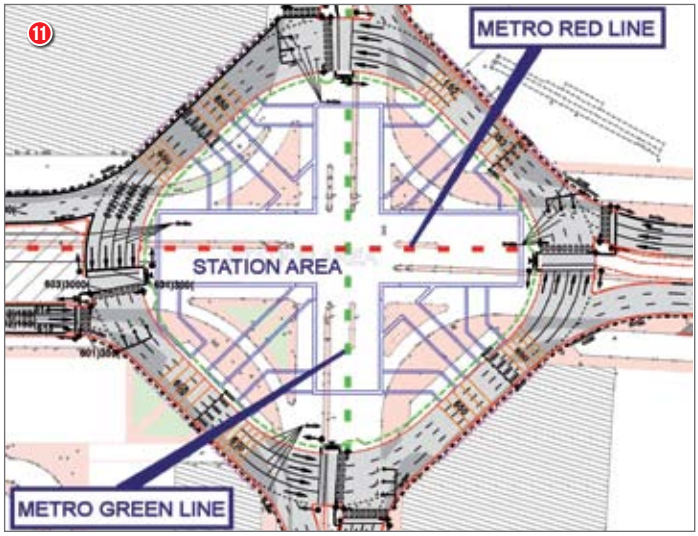
PROJECT TEAM

Like any other similar metro line construction, the teams involved can be numbered in the hundreds and even thousands of skilled people. The Roads and Transport Authority (RTA) Rail Agency under the management of HE Eng Mattar Al Tayer (chairman of the board and executive director of RTA) form the management team from the client's side and Systra-Parsons are the engineers. On the contractors' side the main parties involved are Mitsubishi Heavy Industries, Mitsubishi Corporation, Obayashi Corporation, Kajima Corporation and Yapi Markezi. This does not include the numerous subcontractors and consultancies.

▶ MORE INFO

Please visit www.rta.ae

10 Work area for gantry assembly
11 Traffic management by implementing a traffic circle around the cut-and-cover construction area: Bur Juman Station
12 and 13 Launching gantries are being used to assemble the rail spans. Pre-cast segments are hauled to site and lifted into placed one segment at a time. Single-span construction can be done within two days
14 Pile cap construction along Sheik Zayed Highway
15 Construction of rail segments with launching gantry



New National Library

building nearing completion

THE NEW R230-MILLION South African National Library in Pretoria is re-writing the perception of a traditional library. Gone are the cramped, dark and dusty corners commonly associated with this kind of building. This new structure will give readers ample space, seating and light to become absorbed in the rich heritage of literature housed in its spacious halls.

Book collections and other facilities currently scattered around the Pretoria area will be moved into the new building, forming the heart of the written word in the city. To encourage the public to enter the library, the raised entrance piazza will be used for public exhibitions and street art forms, and ground-level windows on the two main large double-volume reading rooms will further encourage readers to visit.

The media information on the building simply describes a 'modern glass and brick building', understating the 40 000 tons of concrete used in the coffer slabs for the floors and the roof, as well as for the supporting columns. All this will mostly be clad by brickwork, covered by ceilings, painted or filled in with double-volume glazing.

The soaring columns are the only evidence that a vast concrete skeleton supports the structure, many tons of books in the collections and the live mass of an expected 1 800 library users per day. These columns, cast in brand-new forms to ensure high quality surface finishes and sand-blasted to expose the concrete's 13 mm aggregate, support the floors as well as the massive roof covering the width of an entire city block. At the front of the building, five triple-height sandblasted columns support the roof over the main entrance, and others inside the building support a floating floor.

To get the 22 000 m^3 of in situ concrete placed, Site Engineer Rudolph van Dyk and the WBHO/Rainbow JV team laboured for many long hours. The pour on the 400 m^3 coffer slabs started at 05:00 every Thursday morning and finished around 19:00 that night – even Radio Jacaranda got on board, giving constant updates of traffic flow around Struben Street as the readymix trucks discharged into the WBHO pump! 'You don't have the luxury of delays when you're pumping such large slabs,' says Rudolph. 'You learn to rely very heavily on the dispatcher sending loads on time, every time.'

With 33 000 m^2 of flooring, the total mass of concrete in the building is 1 200 kg for each square metre of reading space – a solid grounding from which the National Library readers' knowledge can soar.

Holcim Readymix is proud to have been chosen by WBHO/Rainbow JV to produce and deliver the concrete for the National Library of South Africa

FALSE ECONOMY

PENNY WISE, POUND foolish – that's what South Africa is, at least when it comes to expenditure on roads maintenance. By skimping on maintaining roads now, local authorities are creating exponentially higher maintenance costs in the future, and are effectively slowing down critical government service delivery in the meantime.

This is the thrust of a series of Local Councillor Empowerment Programme (LCEP) seminars, with the theme 'Deferred road maintenance is false economy', being hosted around the country by the South African Bitumen Association (Sabita). So far seminars have been held in Cape Town and the City of Tshwane, and several more are planned for the City of Johannesburg, Ekurhuleni, eThekwini and the Nelson Mandela Metropole in the second half of 2007.

Aimed primarily at elected municipal councillors, but also council managers and officials, the seminars focus on the importance of asset preservation. In addition to providing local government representatives with valuable insights into the principles of the new Government Immovable Asset Management Bill and how it impacts on fixed assets such as roads, highlighting the status of the road network in their region, and presenting an overview of best practice and solutions to maintaining a road network, the seminars also afford public representatives and Sabita members a golden opportunity to interact in an environment of learning and empowerment.

An intention of the series of LCEP seminars, says Sabita CEO Trevor Distin, is 'to optimise the involvement of Sabita members, particularly those members operating in areas where seminars are to be conducted. These members will be invited to set up small exhibition stands or display their equipment to inform councillors of available best practice technology.'

These seminars represent the third generation of LCEP roadshows offered by Sabita. The first series of nearly 100 seminars, presented in 1997 and 1998, was to stress the importance of roads to newly elected councillors, as well as the role they played in the management and implementation of road provision. In 2002 the LCEP format was changed from that of facilitation-based workshops to a public awareness programme showing the benefits of good roads to the social and economic development of previously disadvantaged communities. The latest series aims to address the urgent need to improve communication between elected officials and appointed officials, in order to adequately tackle the backlog in maintenance of South Africa's ageing roads infrastructure.

The World Bank estimates that between 2,5% and 3,5% of the value of road assets should be spent on their maintenance – but the seminars in Cape Town and the City of Tshwane showed that their 2006/07 budgetary allocations for maintenance amounted respectively to 0,6% and 0,9% of asset value. In Cape Town, that translates to a maintenance budget shortfall of R497 million for a single year; in Tshwane, it is R293 million. Yet the reconstruction cost of a road that has not been maintained properly for 20 years escalates to 18 times that of resurfacing a road that has been kept in fair condition. It is clear, then, that deferring maintenance for budgetary reasons is indeed false economy.

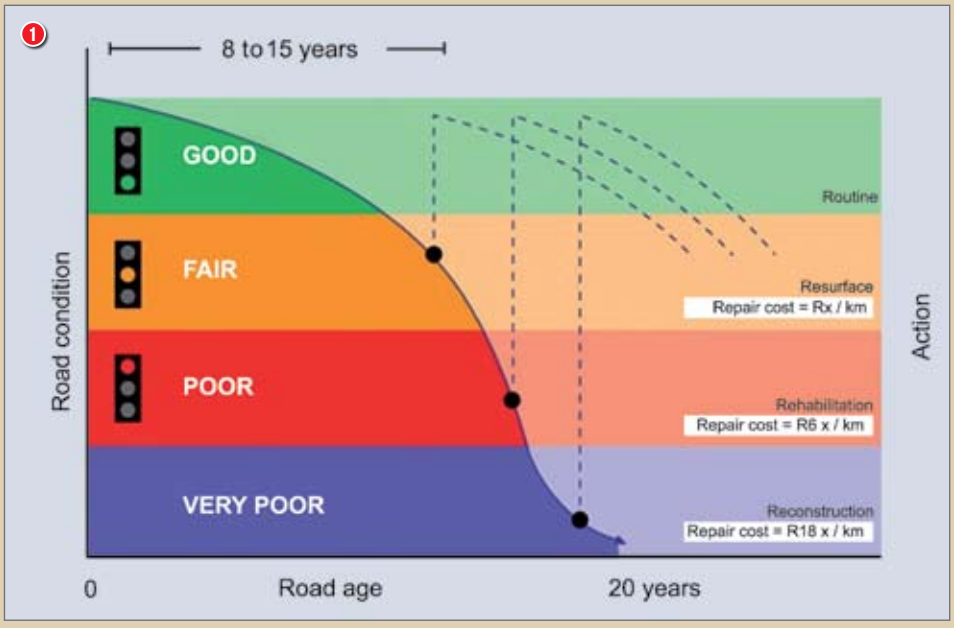
In addition, Distin points out, the LCEP programme aims to emphasise the value that roads contribute to other important social assets such as schools, hospitals and business development nodes.

'These assets, underpinned by a well-maintained road network, in turn drive economic growth and improvements to the quality of life enjoyed by residents. Effective maintenance programmes in our cities and towns would facilitate the broadening and deepening of South Africa's public capital, fuelling new development and a quantifiable improvement in the quality of life and services – especially in disadvantaged areas,' he says. 'Furthermore, a well-maintained road network helps create jobs and sustainable enterprise development. It allows us to build capacity in the Industry through the development and training of people to conduct road maintenance.'

Councillors' reaction to the seminars has been uniformly positive, both in verbal comments at the seminars and in responses contained in evaluation forms circulated to attendees. Many of the councillors appreciated valuable aspects of the seminars, such as the importance of timely road maintenance, assistance in understanding budgets in relation to infrastructure provision, explanation of the processes involved in road construction, and grasping the role played by infrastructure in social and economic development.

'These LCEP seminars will go a long way to helping elected officials, many of whom have no previous experience of infrastructure provision, operation and maintenance, to make correct and timely decisions about what is best for the communities they serve. At the same time, the seminars will give Sabita members much better insight into what is needed at local government level – especially specific municipalities' needs, as well as what their challenges are and what can be done from Sabita's side to ensure that South Africa has a well-maintained roads infrastructure.'

So why not move from a penny-wise, pound-foolish disposition to one of a stitch in time saving nine, by embarking on appropriate road maintenance and thereby preserving one of our municipalities' largest assets: its road network?



1 *Road deterioration with age*
2 *Surfacing of gravel roads using labour*

SOUTH AFRICA SET TO BENEFIT FROM EU RESEARCH PROJECT

A EUROPEAN UNION (EU) initiative aimed at increasing road transport research cooperation between Europe and the emerging markets of Brazil, China, India, and South Africa continues to gain momentum with a two-day meeting of key partners and stakeholders recently held in Pretoria. The Council for Scientific and Industrial Research (CSIR) is coordinating the activities of the project, code-named Simba, in the South African region.

Funded by the EU Research Framework Programme, the Simba project has established a collaboration network of key stakeholders in the fields of intelligent transport systems (ITS), infrastructure and automotive development. According to the CSIR's Kobus Labuschagne, SIMBA project coordinator in South Africa, the Pretoria meeting, known as the South Africa National Event (SANE), aims to augment existing networks and define further those transport priorities identified at the Simba regional workshop held in December 2006.

'The project has reached a stage where we need to develop firm proposals and identify actions and processes in support of Simba's main objective, which is to increase road safety, mobility and transport efficiency through the exchange of technological know-how and best practices,' Labuschagne says.

South Africa's road transport priorities include issues such as the deterioration of road infrastructure, and improved mobility and road safety. The country's high accident rate, with approximately 498 000 traffic accidents, 46 500 serious injuries and 13 000 traffic fatalities occurring every year, remains one of the biggest challenges.

Labuschagne points out that the South African government has already put in place many innovative and far-reaching policies to address mobility, safety and infrastructure management, including the introduction of ITS to deal with the increasing congestion on South Africa's urban roads and improve public transport for the 2010 World Cup. 'Simba is playing a valuable role in identifying additional urban traffic solutions for South Africa,' he says.

The Pretoria meeting was attended by about 70 participants, including international delegates representing the European partners of the project. 'We believe that the Simba SA National Event has the potential to bring about a fresh, collective local focus on transport research and development, and to set the scene for visionary science, engineering and technology development in this field,' Labuschagne says.

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LOGISTICS SURVEY CALLS FOR DRASTIC CHANGES TO FREIGHT NETWORK TO PREVENT GRIDLOCK

SOUTH AFRICA'S FAST-growing economy and the resultant increase in freight movement and traffic volumes are placing huge pressure on the country's already strained logistics infrastructure. The third annual State of Logistics survey, authored by the CSIR and Stellenbosch University, and sponsored by Transnet and the CSIR, highlights the challenges of implementing logistics strategies in a developing economy.

According to Hans Ittmann, CSIR logistics and supply chain expert and co-author of the report, the second State of Logistics survey published in 2005 focused on defining the research priorities for developmental logistics, while the 2006 study explores the challenges of implementing logistics strategies in the macro-economic, industry and small business development contexts.

The 2005 logistics cost is 14,5% of the GDP, which is a slight decrease from 14,6% in 2004 and 14,8% in 2003 (the 2003 and 2004 figures have been adapted because of GDP adjustments by the South African Reserve Bank). 'While this is not significant, the increase in the contribution of the transport cost from 62,5% in 2003 to 63,1% in 2005 is disconcerting,' says Jan Havenga, from the Department of Logistics at Stellenbosch University. 'The total land transport in the South African economy increased by 8% to 1,4 billion tons. This growth was captured by road – the rail transport tonnages have now remained more or less stagnant for the past decade. Considering the predicted growth in the economy, it is clear that revolutionary change is required in the long-haul road/rail relationship to avoid road gridlock.'

In addition to supplying a macro-economic perspective, the survey explores challenges in the fast-moving consumer goods (FMCG) sector and in government service delivery. In both of these environments, goods and services need to be delivered over the entire national geography, and ineffective supply chains directly impact consumer satisfaction.

'The South African FMCG sector is a study in complexity: not only is the consumer market growing rapidly, the consumer profile is also changing and the industry has to adapt accordingly,' says Ittmann.

'Our research has shown that the FMCG logistics system is inefficient, with key supply chain performance indicators that are only halfway towards benchmark figures. The challenge is to alleviate those inefficiencies through the implementation of key collaborative efforts that meet joint objectives. Significant effort is required to move from partial to full implementation and to realise potential financial benefits.'

Government service delivery in a constrained environment is critically dependent on supply chain efficiency and innovation in service delivery supply chains. The survey includes a study of Thusong service centres, which provide a hub of activities and a variety of services through local, provincial and national government. These centres create an opportunity to demonstrate the benefits of implementing a customer-focused supply chain and provide a platform for the use of mobile technologies such as SMS services to make eGovernment a reality.

A small business development perspective is also included in the survey. 'The key feature of small businesses in the second economy is low-volume supply chains,' says Ittmann. 'Two types of strategic approaches, namely logistics streamlining and economic mainstreaming, have the potential to improve the performance of low-volume supply chains.' Case studies of the implementation of these approaches demonstrate the possibilities for the sustainable reduction of logistics costs and improved access to markets.

To support sustainable change in the logistics industry, the survey identifies a number of critical issues and actions, including a balanced strategic focus within the transport portfolio of the Department of Transport and a measurable implementation plan, a useful information base to support macro-economic and industry decisions; continuous commentary on the industry by the research and consulting fraternity; transfer of learning between established and upcoming industries; and localisation of global practices by logistics service providers.

'For South Africa to continue competing in the global market it is essential that a comprehensive picture of the state of logistics is maintained, that the logistics research agenda is set, agreed on and, critically important, acted upon. All the key players should collaborate in achieving the goal of making this country a truly competitive-nation,' Ittmann concludes.

The full report is available at www.csir.co.za/be/SOL2006.pdf.

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WSP STRENGTHENS ITS STRUCTURAL AND CIVIL OFFERING

WSP GROUP AFRICA (Pty) Ltd has acquired LC Consulting Johannesburg, a specialist structural engineering consulting firm.

LC Consulting started off as Lillicrap Crutchfield Consulting Engineers with offices in Dubai, Sandton and Cape Town. In 2003 the company split into three separate companies: LC Consulting Dubai, LC Consulting Johannesburg and LC Consulting Cape Town.

SRK Consulting (SA) (Pty) Ltd, part of the South African founded, global group of consulting engineers and scientists, has been awarded the ISO 9001:2000 certification, recognising an international standard for quality management. The photograph shows Brian Middleton, managing director of the company, and Sue King, quality manager and information specialist with SRK, with the ISO 9001:2000 certificate

All three of these companies are specialist structural engineers and they are probably the leaders in structural engineering in their respective geographical regions.

Last year, WSP Group Africa acquired LC Consulting Dubai in order to strengthen the local WSP office's structural component and to target some of the tall buildings under development in the Middle East.

WSP Group Africa has for some time been one of the largest mechanical and electrical consulting engineering firms in South Africa and has only been involved in structural engineering since early 2000.

WSP Group Africa CEO Andrew Mather says: 'It's part of WSP's strategy to grow through strategic acquisitions and organic growth. The acquisition of LC Consulting Johannesburg will not only increase our capacity in structural engineering, it will also make us one of the leading structural engineering firms in South Africa.

'This acquisition will allow us to increase capacity and become a truly multidisciplinary firm with equal strength between the different disciplines, better equipping us to handle multidisciplinary appointments, especially as we move into Africa.'

LC Consulting Johannesburg MD John Truter adds: 'Moving forward, we will have access to global trends and technologies, giving staff the opportunity to work on some of the world's leading projects. It will also enable us to take on much bigger jobs.'

MORE INFO

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CHALLENGING ELEVATIONS

YOU WILL FIND one of the most beautiful sites in the Cedar Creek estate in Gauteng situated within the greater Cedar Lakes environment. This breathtaking area with elevations of up to 60 m has amazing views that stretch as far as the eye can see. To Edwin van Rensburg from Lidwala Consulting Engineers this site would be any resident's dream, but proved to be one of the most challenging terrains to work on.

The formidable venture, which was requested by the Absa Development Company, started its construction phase in August 2005, but the first infrastructure project designs for the housing development began as far back as 2001. 'There were endless challenges with this project. One of the biggest stumbling blocks was the registration of the existing waterways by the Department of Water Affairs and Forestry (DWAF).'

'DWAF wanted to register the two waterways in the private development as a public space while the ABSA Development Company wanted the area to be a private open space. The matter was later settled in court and the area was registered as a private space,' explains Edwin.

Lidwala Consulting Engineers was responsible for the design of all the services for each of the 440 stands. They also did the designs for four dams and the bridge. Besides a challenging infrastructure design compounded by a steep terrain, the dams alone proved quite interesting. 'Dams had to be resized according to specific standards and then modelled on infrastructure design software Civil Designer. The software is a joy to work with, as you can create nifty 3D models for the client and the landscape architect,' says van Rensburg.

According to Edwin, the road construction proved very challenging with an average terrain slope of 1 in 5. To add to this, nearly 2 000 m^3 of rock had to be excavated and the contractor had to import large volumes of material for the construction of the bridge. 'When I say that a lot of material was used for the construction of the bridge I mean 20 000 cubes of G5 material to be exact,' notes Edwin almost in disbelief.

Edwin also assisted with the design of the Cedar Lake development adjacent to Cedar Creek. 'The development of Cedar Lake was positively received by the residents of Cedar Creek, as it would help reduce the prospect of illegal squatting. Prior to the development of Cedar Lake, the area was just a couple of hectares of open space. Beyond the river, however, was a large 20 ha informal settlement. Residents were afraid that if the settlement grew, it would eventually spill over the river and encroach on their open space. With the development of Cedar Lake this risk would be reduced.'

The landowner of the informal settlement has tried to remove the people from his ground, but to no avail. The intention is to market the ground and sell it to prospective buyers, as the ground is likely in increase in value with the development of Cedar Creek and Cedar Lake.

According to Edwin, working with the locals from the informal settlement was extremely satisfying. 'Although we used mainly conventional construction methods because of the high volume of earthworks and excavation that had to be done by machine, we tried to include labourers from the informal settlement so that they could take pride in the development. This presented an ideal solution to the existing crime problem. Of course we did not expect that all the electrical cabling would be stolen overnight after it was installed the previous day,' he says wryly.

Despite the many challenges posed by the Cedar Creek development, Van Rensburg is pleased with the progress to date. Cedar Creek stands range from 900 to 3 000 m^2 in size and are being sold for between R800 000 to R1,2 million each. The R50 million project is currently in its final phase of completion.

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GRASSFENCE KEEPS THE SOIL IN PLACE AT SIMBITHI

AWAY FROM THE chaos of the concrete jungle, on the KwaZulu-Natal North Coast, lies Simbithi Eco-Estate, 430 ha of natural coastal paradise with dense, indigenous riverine vegetation, valley wetlands, undulating hills and breathtaking vistas.

Simbithi is a way of preserving nature as much as it is a way of preserving a lifestyle. It is the first development of its kind in the area and sets a footprint which other projects of this genre are likely to follow. Every possible precaution has been taken to minimise environmental impact – geology and soil assessments, water resource and drainage appraisals, land use and vegetation studies, and aesthetic, historical and cultural appraisals have all been carried out to ensure the establishment of a development perfectly in tune with the natural surroundings.

Work is progressing well with the construction of homes and facilities which residents will enjoy. However, during the shaping of the new fairways on the Simbithi golf course, contractors WBHO encountered erosion problems. Large cut and fill slope areas in highly erodible Berea Red sands were exposed to the elements during the rainy season which required an effective and durable erosion control solution.

'WBHO approached us regarding the erosion problems which had cropped up,' says Garth James, Kaytech's technical marketing director. 'After a site inspection, we proposed they use our Grassfence as the most-suitable erosion control measure for this exclusive development.'

Grassfence is a coarse, nonwoven polypropylene staple fibre geotextile combined with a PET reinforcing mesh coloured to blend naturally with the landscape for aesthetic appeal. The product is placed vertically on posts to prevent sediment carried by water migrating downstream or downslope.

'Grassfence prevents soil scour and provides high throughflow for the surface water run-off while trapping and filtering out the fine sediment in suspension,' says James. 'These benefits, among others, convinced the client to use this durable Kaytech product.'

Functions include:

- It prevents sediment and/or soils from contaminating downstream aquatic developments
- It immediately solves and prevents further scour and gulleying problems typical to cut areas and the toe of fill slopes
- It retards downstream or downslope flow velocities
- It provides high throughflow while filtering out fines
- It is coloured to blend naturally with the landscape
- It is lightweight and easy to install

Grassfence (2 500 m were used at Simbithi) has also been successfully installed on the cut slopes of the N3 between Harrismith and Van Reenen's Pass.

▶ MORE INFO

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▶ *These photographs show the installation of the Grassfence from two different aspects*

The life and work of Charles Michell

THE LIFE AND times of Charles Cornwallis (Collier) Michell (1793–1851), the first true civil engineer in South Africa, are vividly portrayed in a new coffee table-sized biography published in 2006 by Fernwood Press. The book on 'that able and indefatigable officer', who for twenty years served the Cape Colony in its most formative years, as surveyor-general and chief civil engineer, is by barrister-at-law Gordon Richings, with a foreword by a great-great grandson, Andrew Michell H Pain.

In this account of Michell's life and work, the considerable achievements of this multi-talented man – principally remembered today by the mountain pass named after him and which he surveyed in 1830 – are described and illustrated by many of his previously unpublished sketches, watercolours and engravings. The book has recently come to the attention of the editor of *Civil Engineering*, who asked for a review of it. What a delightful task this has been!

In *The life and work of Charles Michell* the author introduces the reader in a series of twelve thematic chapters to the man Charles Michell, his West Country roots, Michell as Napoleonic and frontier war soldier, professor of military engineering, geographer and surveyor, builder of roads and passes, architect and civil engineer, designer and promoter of lighthouses and harbour works, and family and public man. The author finally looks at Michell's retirement and death, and the book concludes with an appendix on his art.

This is a book that belongs on the bookshelves of every civil engineer with an interest in history and in the reception rooms and libraries of every firm involved in civil engineering. The book is amply illustrated not only with the work of Michell but also of contemporary artists and adjudged a valuable new piece of Africana.

But who was Charles Michell? Thanks to the work of Dr Graham Ross he is not totally unknown to present-day South African engineers, but mainly acknowledged for his work on mountain passes. He is also the Mitchell (sic) of Mitchells Plain and of Michell Street in Fort Beaufort, but mentioning only the places named for him will be doing a total injustice to the man. Charles Michell steps forward from the pages of the book as the epitome of the well-rounded English gentleman that made England the great country it was, never being afraid to put himself on the line doing his duty as he saw it and meeting the ideals he believed in. Yet, his weaknesses are also evident that prevented him from perhaps becoming a much greater figure.

The book does not only portray Michell and his works, but also paints a vivid backdrop of the times he lived and worked in. Born on 29 March 1793 in Exeter as the second son and fourth child of Sampson Michell and Ann Shears, he grew up in Lisbon, Portugal, where his father found work with the Portuguese navy, eventually being promoted to the rank of admiral. In October 1807 the French invaded Portugal and the Portuguese royal family fled to Brazil while Sampson and his family returned to England. Leaving his family in England, Sampson continued to Brazil where he died in January 1809, shortly after being appointed as commander-in-chief of the Portuguese navy. Charles' elder brother joined the British navy, outlived his younger brother and died in January 1893 as Admiral Sir Frederick Michell KCB.

Charles enrolled as a gentleman cadet at the Royal Military Academy Woolwich from where he received his commission in the Royal Artillery in October 1809, to join the British forces resisting Napoleon in Portugal. He served with great credit in the storming and taking of Badajoz in April 1812, the same event where the later Sir Harry Smith met his Lady. He also served with distinction in the battles of Vittoria and Toulouse, where he was wounded. During convalescence he met and married, after eloping with her, the love of his life a French lass, Anne d'Arragon. For his service in the Peninsular War he was awarded the Peninsula medal and a gold clasp.

He stayed on in Lisbon after the war for a while, using his spare time from military duties furthering his education in military science and mathematics, but also painting techniques and other art forms such as copper engraving.

Quite naturally the post-war period saw drastic reductions of the army in both Britain and Portugal and in September 1817, Michell was put on the retired list and placed on half pay, but simultaneously promoted to the rank of captain. The following years saw the family in difficult straights. They stayed on for a while in Portugal, with Michell trying to obtain a post in the Portuguese army, before going back to Exeter in 1820. From this period dates a testimonial by one of his commanding officers, Sir Benjamin D'Urban, that refers to Michell as an 'Engineer and Gentleman and an officer of uncommon merit and talents'. Unfortunately for Michell this was to no avail, but their paths were destined to cross again in the Cape, where Michell served D'Urban, again with distinction.

Life in England being too expensive for his income of £120 per annum, he resettled his family in France for the next three years where he occupied his time with drawing and painting.

In March 1824 Michell landed a post as teacher of military drawing at Sandhurst. In 1825 a more senior post, the professorship of fortification, fell open at Woolwich. Michell applied and after a short probation was confirmed in the post on 25 December 1825. He was also promoted to the rank of major in January 1826. It was also as Major Michell that he came to the Cape in 1828.

One of the outcomes of the Napoleonic wars was the change in control of the Cape moving permanently from the Dutch to the British in 1806, with the Cape Colony as it

became known ruled by autocratic governors, mainly military men. Civil disquiet with this state of affairs, particularly after the landing of the 1820 Settlers, led to a commission of enquiry in 1823 that investigated all aspects of the Colony's administration and made recommendations for reform. This included the institution of an office of surveyor-general with a salary of £800 per year. However, government service being government service, put its own slant on this recommendation, reducing the salary to £700 per year and combining the office with that of civil engineer and superintendent of works, creating an opportunity for the entrance of Michell, but by the impossible work load also impairing his efficiency and in the end affecting his health.

Michell and family arrived in the Cape on 21 October 1828, paid his respects to the governor, Sir Lowry Cole, to whom he had been introduced as 'Mitchell', and set to work. This included setting to rights the chaos in surveying, undertaking a triangulation traverse from Cape Town to Tsitsikama, serving in the Sixth Frontier War, and planning and constructing passes, lighthouses, waterworks, public buildings and churches. A busy life indeed, but he always found some time to further his interests in the natural sciences and to sketch or paint. Included amongst his sketches is the renowned sketch of paramount chief Hintza of the Xhosa nation. (Incidentally, sensitive readers must be warned that the extracts from documents of the time reflect the terminology then used.)

Michell can also be viewed as the father of forestry in the Cape and was instrumental in stopping the waste of the Tsitsikama forest ongoing at the time. He was undoubtedly the first engineer to engage in public participation, publishing in the *South African Commercial Advertiser* in December 1828, shortly after his arrival, his proposals for the construction of Sir Lowry's Pass,.

Undoubtedly Michell's most productive period came towards the end of his career, under the financial genius of government secretary John Montagu. Michell had also been promoted to lieutenant-colonel by now. Montagu's first priority was to devise a scheme for the improvement and construction of public roads. (Were our present-day politicians but so enlightened …) This included the formation of a Central Roads Board, on which Michell served with Montagu. The first road to receive attention was the link across the sands of the Cape flats to Sir Lowry's Pass. This road is at present known as Voortrekker Road, the main thoroughfare through Maitland, Goodwood, Parow, Bellville and Kuilsrivier, before it curved south-east to join the national road beyond Faure.

The road was built using convict labour, giving rise to the Afrikaans expression *hardepad* for a prison sentence with hard labour. Montagu also imported exotic hakea and Port Jackson wattles to stabilise the sand. In this he was successful, but he also created an environmental problem of no small proportion. Today the only real memorial of this venture is the bridge over the Lourens River. This is the bridge that possibly also inspired the Institution's coat of arms.

Next to follow was the realignment and construction of Cradock Pass, a site of Michell's famous engraving of a wagon labouring across the mountain. This engraving also formed the artwork of one of the stamps issued in 1938 in commemoration of the Great Trek. However, by the time the pass was completed, its construction interrupted by the Seventh Frontier War, Michell was in ill health and could not attend the opening ceremony in January 1848.

One of Michell's last legacies to the Cape was to bring Andrew Geddes Bain to the attention of the Road Board. Bain was duly

appointed and commenced construction of the pass through Mostert Hoek in 1846, following Michell's survey. Unfortunately, by the time the pass was completed and named after Michell in December 1848, Michell had already returned to England.

Ailing from his heart and having suffered from a stroke, Michell, his wife and youngest daughter, Anne, left the Cape in February 1848. Staying with relatives on a meager pension, Michell spent his last days continuing to paint and engrave. Death came the day before his 58th birthday, on 28 March 1851.

The book concludes with a discussion and appraisal of Michell's art, a subject worthy of a study by itself.

Taken on the whole, it is not a book for light reading or reading in one session, but eminently suitable for whiling away half an hour or so at a time, with the thematic approach lending itself to such reading. On the other hand the thematic approach makes it difficult to get to grips with the events that influenced Michell's life and the development of his character. In a few instances it has also led the author to side issues that distract from an appreciation of Michell himself. Overall the book is beautifully finished and should take pride of place in any collection or library.

In addition to a full and varied legal career the author, Advocate Gordon Richings, professes a keen interest in nineteenth-century Cape history, on which he has published a number of articles. His interest in Charles Michell began during his student days in Cape Town on finding a heraldic stained glass window commemorating Michell, in St Pauls Church in Rondebosch. Over the years he has assembled a vast body of material on Michell and his times, from which he has crafted this beautiful and valuable addition to the literature on the men and events that helped to shape the South Africa of today. He now lives outside Taunton in Somerset, England.

Various editions are available, including a collectors' edition.

Dudley Garner

MORE INFO

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International

Bridge Building Competition finals held

THE FINALS OF the annual BKS-SAICE International Bridge Building Competition organised by SAICE was held at St Albans College in Pretoria on 31 August 2007. BKS was the main sponsor of the event.

At this exciting contest St Johns College from Zimbabwe proved to be too much for their competition. Their bridge withstood 62,5 kg before it succumbed to the load! Second was George Campbell High School, Durban, and third Hoër Tegniese Skool Daniël Pienaar from Uitenhage.

Regional finals for the competition are organised by SAICE branches countrywide. The finalists from all the regions then compete for the sought-after shield, as well as a cash prize for team members and their schools.

Seventeen schools from across South Africa, as well as from Namibia and Zimbabwe, competed in the finals this year. The teams – consisting of three learners each – constructed a model bridge from wood dowel sticks and glue according to a technical briefing. The bridge building kits consist of 25 sticks of 3 mm nominal thickness. On completion, the glue is allowed to dry for a few hours.

This event always culminates in a bridge-testing ceremony. Each bridge is tested on a rig (put under pressure) to destruction. However beautiful the bridge, it is broken to determine a winner. The bridge withstanding the highest load is the winner.

The schools came from as far afield as Stellenbosch, Bloemfontein, Upington, Durban, Port Elizabeth, Stutterheim, Walvis Bay and Zimbabwe. A first for the competition was the all-girl team from Bloemfontein – in the regional competition their bridge could not be broken!

Because of its practical, hands-on nature, this event has become SAICE's most successful initiative in attracting learners to civil engineering and promoting a general awareness of the profession. The competition provides a career guidance opportunity and gives pupils the opportunity to not only build real bridges but also bridges between people, cultures and countries.

SAICE initiated the bridge building competition years ago to further high school learners' use of mathematics and science in an engineering context in order to grow the profession. The competition forms an integral part of some schools' activities and is recognised on the same level as academic or sports achievements. In some schools it has been incorporated as part of the curriculum.

Although there can be only one winner, all learners benefit by taking part and getting to meet other people and learners from all the corners of Southern Africa – all of which made possible through the generosity of BKS and the other sponsors.

There is little doubt that the annual bridge building competition has, since its inception, captured the imagination of learners and teachers, who return for more excitement every year!

Watch this space for more bridge building photos in next month's issue! – Ed

Bridge Building Competition 2007

	(1) School	(2) Aesthetics 16	(3) Mass of bridge (g)	(4) Load carried (kg)	(5) TOTAL (2)+200 x ((4)/(3))
1	ST JOHNS COLLEGE	19	118	62,5	124,93
2	GEORGE CAMPBELL HIGH SCHOOL	21	135	55	102,48
3	HOËR TEGNIESE SKOOL DANIËL PIENAAR	22	116,6	40	90,61
4	DOMINO SERVITE HIGH SCHOOL	19	139,9	40	76,18
5	HOËRSKOOL OVERKRUIN	17	122,9	35	73,96
6	HOËR TEGNIESE SKOOL BELLVILLE	21	113,6	30	73,82
7	HOËRSKOOL UPINGTON	18	130,6	35	71,60
8	BLOEMFONTEIN INDEPENDENT TEAM	20	146,5	32,5	64,37
9	WALVIS BAY HIGH SCHOOL	21	112,2	20	56,65
10	PORT NATAL HIGH SCHOOL	20	155,4	25	52,18
11	STUTTERHEIM HIGH SCHOOL	17	149,9	25	50,36
12	EMPANGENI HIGH SCHOOL	20	132,1	20	50,28
13	HARRISTON HIGH SCHOOL	19	147,4	20	46,14
14	REDHILL HIGH SCHOOL	13	148	20	40,03
15	HOËRSKOOL BEN VILJOEN	17	135,6	15	39,12
16	HOËRSKOOL STELLENBOSCH	17	118,5	10	33,88
17	Above 40	14	82,7	5,2	26,58

The winning load: St Johns College, Harare

A metropolitan railway for Johannesburg

So, what's new ...

TRANSPORT OF PASSENGERS and freight – whether by oxwagon, stagecoach, railway or road – plays an integral part in the economic growth of a country.

The railway line from Cape Town to Wellington was completed and opened to a full regular steam service in November 1863. Then followed a hiatus in the development.

This prompted the following extract from a letter written by Colonial Railway Engineer John Fred Bourne to the Colonial Secretary in London, dated 12 April 1865:

> Why should we go to the expense to increase the production of the land, when we cannot get even what we do produce to market at paying rates?
>
> He added:
>
> In every country in the world increased facilities for transport and communication have been attended to with the most beneficial and economical results, both to the inhabitants and to the revenue, so much so, that the progress of the railway system can be taken as a measure of the civilization of a country.

The result, however, was disappointing – the extension of the line to Worcester was only completed in 1876, some 13 years later.

PROPOSED RAIL COMMUTER SYSTEM FOR JOHANNESBURG

The same remarks can be applied to the metropolitan transport of the City of Johannesburg.

It is not a matter of what the city can afford, but what it cannot afford not to provide.

In 1946 a joint railway and municipal group was formed to investigate the provision of a combined underground and surface metropolitan railway passenger service for Johannesburg. It is recognised worldwide that the most efficient and effective way of moving people within a densely populated metropolitan area is by means of a rail-guided mass transport system.

Two SAICE presidents addressed the issue in their presidential addresses many years ago:

- William Marshall Clark (SAICE president, 1948) and general manager of the South African Railways at the time, was a member of the investigating team of 1946. He stated: 'I predict severe road congestion in Johannesburg and consideration must be given to an underground commuter system to serve Alexandra and other areas. Transportation is of vital interest in the world and is becoming more complex in a modern society.'
- Frederick Jackson (SAICE president, 1964) remarked that in 1946 an investigation committee comprising municipal and railway officials analysed the rapid transport system of various countries. They 'found it feasible and reasonably inexpensive to provide Johannesburg with an underground system as being the most efficient and advantageous yet admittedly the most expensive. It is essential to plan the routes and acquire the land at this stage.'

Although a rough route was proposed at that stage, no further action was taken. The reason apparently was that it was not within the ambit of the Railway Act to provide a metropolitan railway network. The Johannesburg Council was to provide the funds to build the line and it would be operated as a guaranteed line, by the South African Railways, as was the case with private sidings and the extensions of main lines for the sole purpose of serving a private company.

A change of government and the proclamation of the Group Areas Act brought about the development of the South-Western Townships (Soweto). A commuter line from Soweto to Johannesburg became a necessity in the early 1950s. At the one end, the line was to run from New Canada Junction to Naledi. Fred Jackson, then resident engineer Reef Construction, proposed that at the other end the line should take off at Crown Station and end at West Street, which was on the earlier proposed route of the underground commuter system for Johannesburg.

The Crown–Westgate line was built in 1955/56 and the route plan indicated the proposed route of the M1 motorway in the vicinity of Westgate. Consideration had to be given to the siting of the station for the future extension of the line to link up with the extension of the Booysens-Faraday line.

At the time of the building of the Crown–Westgate line, further preliminary routes were investigated.

From the junction of the Westgate line extension to the Faraday line extension the line was to be partially constructed cut-and-cover down Eloff Street and tunnelled under the new Johannesburg Station (which was still under construction) with an underground station and pedestrian connections to the mainline station.

The tunnelled route would be extended to exit in the vicinity of the current Harrow Road exit of the M1 motorway. It would be extended further above ground, virtually following the route of the present M1 to serve Alexandra, and then turn sharply in a southwesterly direction to join up with the Braamfontein Spruit tunnel under the Witwatersrand in the vicinity of Milpark and Braamfontein yard, then exiting and linking up at Crown Station.

Should an underground commuter railway system be contemplated today, the proposed route will have to accommodate the Gautrain Park Station.

P H Louw

If you have to go, you have to go!

WHETHER WE OR ANYBODY else likes it or not, we have to get to work and we have to go shopping and we sometimes like to go on holiday as well.

The good news is that we are still moving and that we can still get around, albeit at ever-increasing costs: personal costs in terms of time and money; doctor's fees for stress; cost to company; cost to country …

- But there is more good news: Sanral and other authorities have announced plans and budgets to address a number of major problems, although some people only see the problems as challenges and not as problems – and serious problems for that matter
- And still more good news is that most of our senior engineering professionals will be able to extend their active

Dear Commuter …

Are you ready and mature enough:

- For a left-turn-on-red rule at intersections to ease traffic congestion on main arteries, since you will be getting to your destination faster?
- To consistently obey traffic markings, signals?
- To stop at stop signs?
- To apply courtesy rules like allowing merging?
- To refrain from pushing your way across two lanes at on-ramps?
- To accept HOV lanes?
- To take the bus, rapid bus, train, monorail, Gautrain and taxi, if these are convenient and safe?

working life by ten to twenty years and just maybe they can assist in resolving the transportation mess (or is it a transportation legacy)?

- Good news is that advertisers on radio, CD sellers and Bluetooth agents are making more money than ever, because we are spending between 10% and 15% of our 24/7 lives commuting
- Good news – this time for oil producers – is that they are earning billions of dollars to as we crawl along our expensive freeways, which will now become even more expensive, since the bells are tolling for more tolls
- Good news is that we are getting a Gautrain and a Rea Vaya Rapid Bus Transit system and just maybe even a monorail in Gauteng and new, bigger taxis
- Good news is that, just maybe, Spoornet, Transnet (or is it Waitnet?) will reinvent itself and hopefully the continuous reorganisation of organisations will ultimately come to an end
- Good news is that Sanral are currently rebuilding roads to replace those destroyed by coal transport trucks and chrome ore transport trucks running from Rustenburg to Richards Bay … presumably because Transnet are not competitive?
- Good news is that we may be getting more shoulder lanes – but what about the faulty electronics like those on the M1 between Buccleuch and Allandale?
- Good news is that we are scheduled to get rid of the notorious diamond intersections, which are not an effective model for mega-cities
- Good news is that we will get holidays and bans on driving in 2010 when we have to clear the roads for the FIFA World Cup
- Good news is that we are getting HOV lanes
- Good news is that Gautrain will be more than a train, and that it will be served by a feeder system with 300 buses
- And hopefully seamless ticketing systems are on their way

One could therefore easily come to the conclusion that all is well in the land of mañana, milk and honey. But is it really?

Allow me some observations:

- Plans to extend our Gautrain should start *now* to many more destinations across Gauteng, otherwise it will be a question of too little, too late
- Will we have an out-of-control taxi operator community, forever? A metro police force spokesman was recently quoted in the Star Metrowatch column as saying: 'The motorist will have to learn to live with taxis'
- Authorities are paralysed because of a lack of experienced transportation staff
- Even minor bumper bashings are enough to close down a freeway for hours. And even though this is sincerely appreciated, six to eight emergency vehicles converging on one incident is an overkill (pardon the pun)
- We keep hearing the Minister of Finance saying 'I have allo-

Who is responsible?

In the Belgium town of Damme a motorist was killed in a vehicle accident at a poorly lit intersection.

The mayor of the town was successfully prosecuted for negligence in terms of the responsibility of the local authority to safeguard the public. He was ordered to pay a fine, but promptly appealed the sentence.

And guess what – the Higher Court subsequently handed down a jail sentence for the mayor!

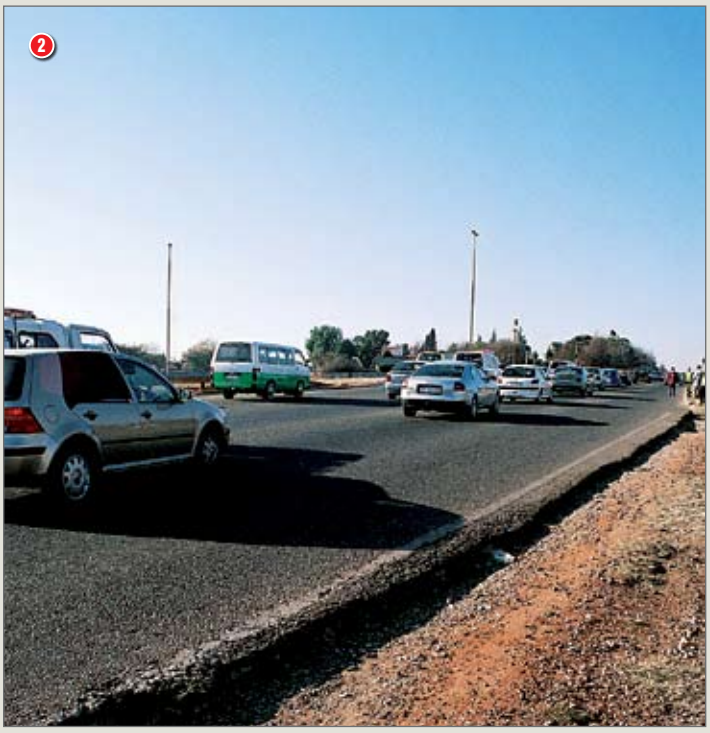
Maybe this is the way to go in South Africa, particularly since our transportation engineering professionals are complaining that the decision-makers are tying their hands by failing to provide funding and competent staff structures, and 'disregarding' their recommendations.

In the light of this:

Who will be sued – the Local Authority, Provincial MEC, National Minister, Agency Board chair:

- When there are no traffic lines on a street or road such as the notoriously chaotic Hendrik Potgieter Road (in Afrikaans fittingly known as 'Hendrik Rillerweg')?
- When a taxi crashes in an intersection after ignoring a painted no-go island and passing on the left?
- When a pedestrian is killed when crossing the R511 at Diepsloot because there are no fences, or the fences are broken, or there is no bridge?
- In case of a pile-up or damage to a vehicle because of a road that is too smooth or potholed?
- When poor design leads to fatal accidents in the streets adjacent to a shopping centre?

It is just a question of time before those who are accountable, or should be accountable – road and local authorities – will have to stand up in court



cated substantial funds', but the provincial and other authorities say 'We do not have enough money' and then somebody else says 'The budgets are underspent by up to 80%'. Whom must we believe and whom should we be blaming?
- We witness and listen to political in-fighting about monorails. Now you see a monorail, now you don't!

WHAT IS SAICE DOING ABOUT THIS?

- Our Transportation Division has done excellent work to draw the attention to these issues through the Transportation Report Card
- *Numbers and Needs* and the ENERGYS programme emanating from it have energised the government into rebuilding engineering capacity at municipal level
- The SAICE Report Card made a number of people sit up and take notice of the dilemmas we find ourselves in
- A SAICE delegation met the Parliamentary Portfolio Committee on Transport at the end of May, courtesy of our very own member of parliament, Lemias Mashile. The discussion focused on whether we are prepared for 2010
- We have requested a meeting with the Minister of Finance to discuss the anomalies in reports stating there is ample funding versus the lack of funding reported by provincial and local structures
- And much more

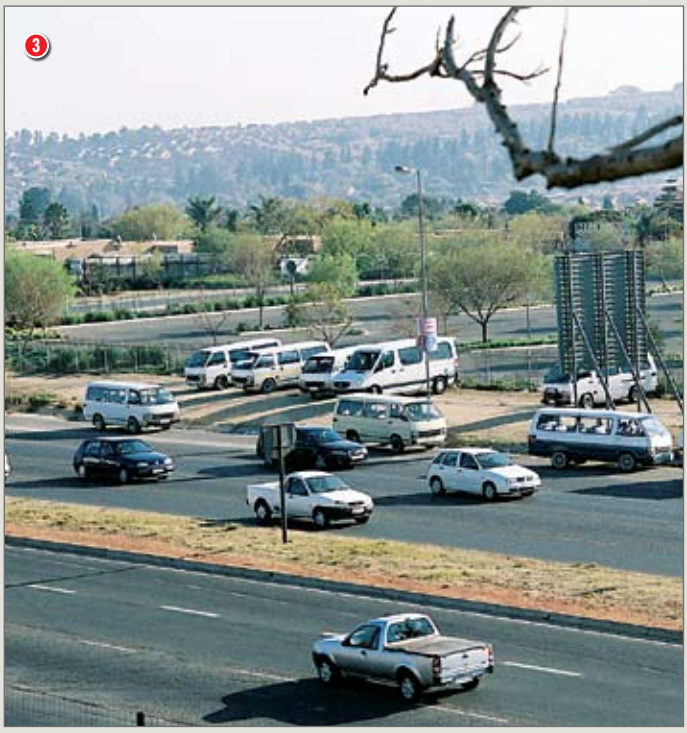
and defend themselves. My question is: will the responsible engineer(s) be brave enough to stand up as well?

Or can our decision-makers absolve themselves with a street sign that says, 'Caution: Potholes' – or even worse, 'Beware, for your own safety'! (Helllooo, 2010 …)

1 *Obscuring the view at dangerous intersections, here on the corner of Hendrik Potgieter and Jim Fouché roads. Traffic laws are not enforced*

2 *Eastbound on Hendrik Potgieter Road, at the intersection with Jim Fouché. As a result of severe congestion, motorists who want to turn to the south jump the queue by veering off on to the gravel, causing the disintegration seen here*

3 *'Thanks for shopping with us. But note that we do not allow our employees' transport on our premises.' Consequently employees from Makro and Clearwater Shopping Mall, situated on opposite sides of Hendrik Potgieter Road, have to catch their transport in the busy Hendrik Potgieter. Taxis are forced to park alongside Hendrik Potgieter. There are no facilities, and paper and softdrink cans are everywhere*



REFLECTIONS

Congestion question

Is traffic congestion adversely affecting your car's engine? According to AA technical services' Colin Mussett, most definitely.

When sitting in heavy traffic behind another vehicle travelling at 15 km/h on a road designed to carry vehicles safely at 120 km/h, have you ever wondered what the cost of congestion is?

According to an article in *Northside* (27 July 2007), your engine is running for a significantly higher number of hours between services that it was designed to do.

Stop-start driving in heavy traffic, combined with South Africa's high temperatures and the elevated levels of dust and particles in our air, places severe stress on an engine, says Mussett.

Stop-start driving also enriches the air-fuel mixture with additional fuel, causing the engine to become less efficient.

The article then analyses congestion costs:

- At idle speed, a 1600 cc petrol vehicle uses an average of 1,5 litres of fuel every hour. That means if you sit in traffic for an additional 469,7 hours, you'll waste about 705 litres of fuel per year, and at R7 per little it will cost you R4 956
- This 469,7 hours spent in traffic translates into 19,57 full days. At an average salary of R8 000 per month (R45 per hour), the cost will be R21 136 per year
- If 80 000 people commute between Pretoria and Johannesburg daily, over one year 56,4 million litres of fuel will be wasted; R394,8 million worth of fuel will be wasted; the cost in time will be R1,69 billion; and 1,57 million days will be wasted

The Dutch are grappling, too …

Everybody knows the notorious Dutch *files* (not pronounced 'faailes'!). In the *NRC Handelsblad* of 30 April 2007, Professor H A J de Ridder cites numerous disadvantages of travelling by car in congested cities and discusses some alternatives. He comes to the following conclusion:

> *Sommigen denken dat de kilometerheffing de auto kan terugdringen. Daarbij word gewezen op het success van de congestieheffing in Londen. Daar lukt het omdat er en veel sneller alternatief is in de vorm van een frequent rijdend en fijn vertakt metrosysteem met een enorme capaciteit. Omdat een dergelijk alternatief er hier niet is, zal de (op zich redelijke) kilometerheffing de filedruk niet verminderen. Net als bij het parkering gaan de automobilisten gewoon betalen om te rijden.*

In other words, the Dutch are of the opinion that they don't have any real alternative transportation system that would lure motorists out of their cars and into public transport … Where does that leave *us*, then … □

DIARISE THIS!

Date	Event and CPD validation number	Presenters/ venue	Contact details
18 September – Grahamstown	Structural Steel Design to SANS 10162:1-2005 *SAICEstr06/00050/09*	Greg Parrott	Sharon Mugeri Cpd.sharon@saice.org.za
18–19 October – Cape Town	Business Finance for Built Environment Professionals *SAICEfin06/00004/08*	Wolf Weidemann	Dawn Hermanus dhermanus@saice.org.za
17 & 18 September – China	5th International Conference on Current and Future trends in Bridge Design, Construction and Maintenance	ICE, China	Dayle Long Dayle.long@ice.org.uk
17–21 September – Gauteng	The Application of the Finite Element Method *SAICEstr06/00018/08*	Roland Prukl	Dawn Hermanus dhermanus@saice.org.za
18–19 September – Gauteng 15–16 October – Cape Town	Handling Projects in a Consulting Engineers Practice *SAICEproj06/00003/08*	Wolf Weidemann	Dawn Hermanus dhermanus@saice.org.za
19–21 September – Cape Town	Compaction of road building materials *SAICEcons06/00012/08*	M White	Dianne Myles sarfuse1@acenet.co.za
7–10 October – Cape Town	SAHF International Conference & Exhibition *ProvSAICEot07/00156/07*	www.sahf.org.za	Naomi Eady events@sahf.org.za
8–11 October – Cape Town (V & A Waterfront)	Cave Mining	www.saimm.co.za	lara@saimm.co.za +27-11-834-1273
9–12 October – SAICE House, Midrand	Pro-Active Project Management Principles *SAICEproj07/00150/10*	André Nortier	Sharon Mugeri Cpd.sharon@saice.org.za
24–26 October – Johannesburg (Indaba Hotel)	Construction Contract Management *provSAICEcon07/00171/07*	www.iqpc.com/za/construction	registration@iqpc.co.za +27-11-669-5000
24–26 October – Durban	The 71st IMESA Conference	ICC Durban www.imesa.org.za	confplan@iafrica.com +27-12-667-3680
30–31 October – Cape Town	Technical Report Writing *SAICEbus06/00014/08*	Karl von Buddenbrock	Sharon Mugeri Cpd.sharon@saice.org.za
4–9 November – Johannesburg (Emperors Palace)	'HELP in Action' – Local Solutions to Global Water Problems	www.wisa.org.za	Taryn van Rooyen conference@soafrica.com

For more information on courses, venues and course outlines please visit **http://www.civils.org.za/courses.html** or contact **cpd.sharon@saice.org.za**