PAPER 1

What does "Smart City" mean for African municipalities? Investigating the current status, enablers and restraints, and the future of Smart City adoption in Africa.

Dr Pieter Crous
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Smart Cities have been (and are being) implemented globally, most notably in Singapore in Asia, but also in other prominent cities in India, Denmark, Finland, England and the USA. Smart Cities are cities that use technology for the management and monitoring of infrastructure, customers, personnel, finances, and systems within the city. A Smart City enables efficient management of municipal infrastructure, including water, sanitation, roads, stormwater and electricity.

Municipalities within Africa are faced with significant challenges related to the management of infrastructure. Most notably, Africa has seen rapid urbanisation over recent decades, and this trend is expected to continue. It is projected that 70% of the world will live within cities by 2050. Therefore, it is imperative that African cities be resilient, and able to accommodate and manage the population influx. Herein, Smart Cities are perceived as facilitators for sustainable development. Furthermore, the Constitution of South Africa requires that basic services are prioritised for all, as everyone has the right to basic services. The question posed, therefore, is how can Smart City concepts be implemented within the African context, and should these concepts be considered at this time?

This paper investigates the drivers for Smart City implementation within African municipalities. The Smart City concept in this paper is considered to include African cities, towns, townships, or rural areas. The paper aims to indicate that, despite the adoption of the Smart City concept globally, there are key sectors within African local governments that would unlock the adoption of the Smart City concept to realise sustainable, resilient, efficient cities of the future. The hypothesis of the study was that technology, although an important factor, is not the limiting factor to the implementation of Smart Cities in Africa, but that the adoption of Smart Cities requires an enabling environment with financial and institutional support driving integrated efficiency, security, sustainability, and community engagement into all operations of the city. Effective Smart City implementation takes cognisance of the various critical success factors in making cities vibrant and liveable.

The primary research was obtained through a multi-criteria analysis of the maturity level of the adoption of Smart Cities within the various municipal infrastructure sectors within the African continent, including South Africa. The primary data was gathered through a comprehensive questionnaire consisting of qualitative and quantitative data. This research is complemented by a review of the current Smart City frameworks, or strategic approaches, used globally and within Africa.

PAPER 2

Application of condition assessment principles to the Blackmac Outfall Sewer

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South Africa's municipal engineers, and others involved with providing basic services, face a multitude of challenges. Amongst these are technological developments and demographic changes resulting from urban densification. Those responsible for technical decisions can be overwhelmed with these challenges and this influences their decision-making. The underlying basic principles ensuring quality services are not always followed.

Recent water shortages have highlighted that South Africa is a water-scarce country. New pipelines alone won't resolve the future water supply and wastewater disposal problems. Many problems with the poor performance of existing pipelines have probably been designed or built into these assets. The holes below the surface are actually the assets; the pipelines merely line these 'holes', ensuring their effective and efficient operation. Rehabilitating the existing 'holes' to enhance their performance can significantly reduce the service backlog. However, before making such decisions, it is essential to assess their condition.

Great strides have been made over the past decade in developing multisensory inspection systems that provide a visual and quantified representation of conditions inside pipelines. This information, in combination with the loading conditions, means that a corrosion and structural analysis of a pipeline's ability to meet its hydraulic and structural requirements can be done and its remaining life estimated.

This approach was applied to an 8 km section of the Blackmac outfall sewer, consisting of 800 mm to 1 000 mm diameter coated fibre cement pipes, installed during the mid-1980s across the Cape Flats. Most of the 4 km upstream section was in use with just sufficient capacity for the required flow. Although corroded, the pipe's structural integrity was still adequate, justifying rehabilitation with cured-in-place pipe. The downstream section was not in use at the time, had inadequate capacity, sections were severely corroded and it was suspected that there were collapses.

The remaining life analysis confirmed that sections had collapsed. Based on this analysis, the decision was taken to replace this section with polyethylene-lined concrete pipes. At the end of 2016, contacts for rehabilitating the upstream section of this sewer and replacing the downstream section were awarded.

This is probably the first time in South Africa where combining the latest developments in multi-sensor inspection techniques with established basic principles was used to determine the remaining life along a sewer of this length and diameter. This assessment provided the information needed for deciding to rehabilitate one portion and to replace the remaining portion.

PAPER 3

Drill and Blast Utility Tunnel Constructed beneath Highly Sensitive Equipment at McGill University Hospital

Dr Jean Habimana
C/O Hatch Ltd

Three kilometres of utility tunnels distribute a variety of services between the buildings of the McGill University downtown Montreal, Canada campus. These services include high-pressure steam, supply and return of chilled water, sprinkler and drain lines as well as natural gas and high-voltage electrical conduits. Expansion of university facilities and deterioration of the existing tunnels required the construction of new tunnels. A particular challenge for the University was the design and construction of a utility tunnel to replace an older, deteriorated facility. This required construction of a drill and blast mined tunnel within a particularly sensitive urban environment, with limited rock cover of only 8 m, directly beneath an operating neurological surgical and research hospital.

To maintain all hospital activities during tunnel construction, the contract imposed constraints on drill and blast excavation related to time of blast, peak particle velocities, blast air-overpressure and audible blast noise measured. These limits had a direct impact on blast design elements including overall powder factors, charge weights per delay, and round lengths. The contract allowed for the conducting of test blasts to permit gradual relaxation of blast-design criteria.

The paper provides planning and design considerations that were used in evaluating applicable construction methods, the process used to set baseline parameters and a monitoring programme, and construction implementation. It will also present experience gained during construction that will be of interest to sensitive urban environment drill and blast projects worldwide.

PAPER 4

Planning for completeness, planning for the future. Engineers and finance aligning

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The completeness of data and collection thereof is a key, fundamental issue faced by entities throughout South Africa. Data is the key driver for accurate and appropriate decision-making and planning, in particular for budget and maintenance needs.

It is with this in mind that we present a case study of activities, processes and systems/tools developed and implemented in the Mangaung Metropolitan Municipality. This paper will present practical steps and processes developed to ensure that an entity may be in a position to, with a higher degree of reliability, verify and certify the completeness and underlying accuracy of the data – from completed project and inspections, and as-built information provided by consultants, to developing a Renewal Expenditure Plan for assets and ascertaining budgetary needs.

This paper will further present the tool (a software application known as SAM – SMEC Asset Manager), with its modules (financial, projects and mobile), which encapsulate agreed processes and 'gates' – allowing users, custodians and decision-makers to more reliably plan for future needs based on the data collected and deemed to be complete.

Data collection is typically the largest workload portion of an asset management programme, accounting for 80% to 95% of initial costs. Procedures and processes were developed for the municipality to enhance the completeness of data sourced, starting with the information from completed projects, as part of the capitalisation process, and obtaining data more cheaply from the source – i.e. from project managers who are actively involved in the projects. Data confidence is aided by the computer system; capturing payment details and correlating this with the financial system, on a transactional level.

Upon completion and submission of final certificates, this information is verified by the project team and signed-off with engineering and financial reconciliation before month-end. The SAM software is utilised to ensure data completeness and the linking with the financial systems on a month-to-month basis. This is processed through a step-wise interface provided by the software.

The process of collecting and verifying data from finance and engineering merges the two worlds and allows the municipality to produce monthly financial and technical registers, with the subsequent benefit of more accurately calculating Remaining Useful Lives and determining Renewal Expenditure and budgets. The added benefit of the systematic processes and systems is that the entire audit process and trail of information (from source to sign-off) is transparent and auditable, evidenced by a more seamless and less strenuous audit period.

PAPER 5

Formulation of the City of Tshwane Comprehensive Integrated Transport Plan

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The Compilation of the Comprehensive Integrated Transport Plan (CITP) for the City of Tshwane (CoT) is intended as a strategic plan to assist the city with the determination of transportation-related needs, resulting in the identification of potential future action plans and projects. The CITP further prioritises the identified projects and programmes and allocates funding requirements, which, in turn, will be taken up in the Integrated Development Plan and Medium Term Expenditure Framework for the city.

The formulation of the CITP, amongst others, entailed a process of data collection and processing; stakeholder consultation in order to concretise the vision, mission and set objectives; the formulation of public transport, transport infrastructure, traffic engineering, freight, and financial/institutional strategies; and ending with the identification and prioritisation of action plans and projects and finally the allocation of budgets to make the projects a reality.

Right from the onset, the CoT CITP has been developed with an over-arching sustainable transport theme in mind and, in doing so, all chapters of the CITP have been developed with this integrated focus, thereby doing justice to the city's Transport Vision of "A transport system developed to support a sustainable city".

The transport goals and objectives, aligned with the city's mission and thus the targetsc which the city aims to achieve, were:

- Plan and develop a transport system that improves accessibility and mobility while enhancing social inclusion
- Provide a fully integrated public transport system
- Develop a transport system that drives economic development
- Improve the safety and security of the transport system
- Develop a transport system that reflects the image of the city
- Develop an efficient, effective, development-oriented public transport system that integrates land use and public transport plans
- Develop a transport system that is environmentally sustainable.

Never before in the history of Tshwane has so much detailed information been collected for a single planning process. Amongst others, household travel surveys, on-board travel surveys, roadside interviews, vehicle and pedestrian traffic counts have been collected. Similarly, extremely detailed Transport Demand Modelling has been done as part of the execution of the project. The Metropolitan-wide Macro-model (EMME/4), as well as 13 Micro-models (Aimsun), done for each of the core areas selected for future development and/or current growth points have been done.

During the process of developing the CITP, thorough integration took place between this project and the Integrated Rapid Public Transport Network, or A Re Yeng Bus Rapid Transport project, which is in the process of being rolled-out throughout the city.

PAPER 6

Innovative design and construction methodologies for the construction of the Cape Flats 3 Bulk Sewer ensuring sustainable conveyance of sewerage effluent for the next 100 years and more

Clyde Mario Koen
C/O City of Cape Town

The challenges facing the City of Cape Town's implementation of the Sewer Master Plan are the provision of sustainable bulk sewer systems, which will ensure not only basic services, but a sustainable long-term bulk sewer service allowing for the growth and densification of the various catchments. The sustainability of the bulk infrastructure is not only a function of basic service delivery, but a balance between operational maintenance and efficiency of the bulk sewer system.

With the flat natural gradients of the Cape Flats, constructing a gravity system will exceed the design parameters for a bulk sewer system, resulting in siltation and reduction in capacity. The route options through narrow and densely populated corridors increased the complexity of gravity sewer design and construction, whereas a more basic approach was used to determine the final route option.

The upgrading of the existing pump station was key to the decision to consider a rising main instead of a gravity main. The cost advantages of having upgraded electrical motors ensure the best efficiency on the system curve of existing pumps as well as enable the design team to deliberate on a rising main for the total length of 4 800 m .

The flow velocity and corrosion protection were important factors in the design to ensure effective operation and reduce the impact of pressure transients in case of pipe or power failure.

The highly congested, but best, route could only be traversed by implementing continuous shoring systems in these areas to mitigate the dangers of the deep construction depth and the loose Cape Flats sandy soils. This open-trench system would cause substantial interruptions to a large part of the city and would require the rerouting of traffic for extended periods during construction. The City of Cape Town's project team subsequently decided to consider the micro-tunnelling option for 1 200 m of pipeline on the most congested parts of the route. With the recent introduction of the ductile iron jacking pipes, the benefit of having one homogenous material for the total length of the pipeline was favourable and was, hence, selected as the preferred pipe material. The micro-tunnelling was successfully installed across eight sections with a high degree of precision, ahead of schedule and within budget.

This paper will demonstrate the challenges faced with the installation of a new bulk sewer pipeline with the innovative approaches to bulk sewer design and the implementation thereof.

PAPER 7

The Product Study of Compressive Creep in Geocomposite Drains applied in Civil Engineering Works

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C/O Maccaferri Africa

There are various problems in civil works caused by the presence and movement of water underground. Associated problems, such as seepage and piping, beneath a structure can lead to unwanted structural damage or failure. To avoid these, it is important to control the movement of water by using efficient and reliable drainage systems. Traditionally, granular drains with a geotextile are used for these systems. These traditional drainage systems can be difficult to install, particularly on slopes; and depending on the availability of the material, they can lead to high costs.

The use of geocomposite drains to substitute the traditional drainage method is not a new concept and can often be more advantageous. The installation of these products can be easier and faster, making it more economical. With the correct product knowledge, a more accurate and reliable design can be achieved, especially with relation to the long-term performance; whereas granular drains characteristics can change unpredictably over time, leading to underperformance and subsequent consequences. There are many different geocomposites on the market. The wide range of specifications can make it difficult to select the correct product to be applied. Thus, it is important to understand the properties and specifications required depending on its application.

This paper discusses the relevant properties in drainage design, based on Darcy's Theory, for a subsoil geocomposite drainage system. To understand the correct design parameters, it is necessary to understand product information. To this end, it is important that these products undergo extensive laboratory testing to define their characteristics. This paper further expands on the laboratory testing that should be done on geocomposite drains to define their performance. The development of Compressive Creep can be the most influential factor relevant in long-term performance. It is further elaborated how this phenomenon should be taken into account for long-term design life.

PAPER 8

Benefits and risks of civil service smart apps for government

George Gerber
C/O Uhambiso Consult

The internet of things (IoT) and application (app) economy in South Africa can provide the benefits of mobility for many aspects of civil service and commerce, as well as support business growth and broader access to government resources. Globally, the number of devices connected to an IoT platform is expected to increase significantly, from 400 million in 2015 to 3 billion in 2020, as governments and industries begin to explore IoT solutions to solve region-specific challenges. The presence of 29 million smart devices in South Africa is a significant indicator of the potential growth of apps in industry.

Working principle

Sensors embedded in physical equipment stream data back to the cloud, where it is analysed by software. The processed results are then sent to the relevant authorities on their mobile devices. The system can be automated to respond to the key metrics and adjust its operation to improve its performance.

Benefits of civil service apps to government

A key benefit for government is the ability to collect big data and derive meaningful and accurate information from apps for use in policy-making, interventions and support measures. With these big data foundation blocks, government can solve higher-level issues, such as managing real-time demand and energy costs.

While most providers focus on the productivity and efficiency verticals, as those offer higher profit margins, solutions that address regional challenges, such as managing supply and demand between different systems, will also grow.

Remote data gathering allows for rapid response to accidents or incidents. Maintenance-oriented sensors on physical equipment provide an early warning of when components are likely to malfunction, improving uptime and reducing chances of service interruptions.

New opportunities, but also new risks

The rising dependence of economic and social systems on information technology has directly increased the risks to these systems from cyberattacks. By making attacks more expensive or less profitable, the economics of the attack process can be changed and the success rate of attacks reduced. Crowd-sourcing and sharing information about attacks more broadly is one of the critical initial steps that can be taken to improve security.

Technology readily available

The technology is readily available but South Africa will need to invest in next-generation IoT support staff to maximise the benefits of this technology. A live demonstration of a water and sanitation app will be given.

PAPER 9

Development of a Public Transport Strategy for Mbabane, Swaziland.

Lourens Swanepoel
C/O Royal HaskoningDHV

Public transport in and around Mbabane is facing a number of challenges, including traffic congestion in the CBD, inadequate public transport services, an overcrowded central public transport facility and problems managing the services. The Municipal Council of Mbabane subsequently identified the need for the development and implementation of a Public Transport Management Strategy and Action Plan. The main objective was to develop a practical plan with clear actions and identified projects, linked to budgets, which can be implemented in order to reduce traffic congestion in Mbabane and increase public transport patronage. The public transport management strategy developed for Mbabane has been built on 5 solution pillars.

The integrated network of public transport services serves all main land uses and links residential areas around the CBD with work opportunities in the Mbabane CBD. The bus rank operates in an orderly fashion, but in order to streamline the operations, and specifically the flow of vehicles and commuters, the introduction of a number of low-cost, high-impact implementation possibilities have been suggested.

To enable physical integration with the safe off-street transfer of commuters from one mode to the next, the loading and off-loading activities of buses, kombis, midi-buses and metered taxis need to be split from the holding or ranking of vehicles.

Certain additional functions, such as transport planning, transport infrastructure management, land-use planning, through-ticketing and fares, management of the call centres and management of the issuing of permits have to be added to the city's administration:

In order to solve Mbabane's traffic congestion, a number of solutions and/or alterations to the status quo need to be made. These solutions, among others, centred around parking infrastructure, NMT infrastructure, freight & logistics movements, road safety & law enforcement and traffic light signal settings, all improve the traffic flow within the CBD and, thereby, reduce congestion.

A more customer-oriented focus with the creation of a Public Transport Information Centre, a toll-free complaints hotline, a text or SMS reporting system, and a public transport website is proposed where all public transport-related information is provided and through which feedback can be provided. In order to measure performance, periodic monitoring and evaluation of the public transport system is proposed in the form of Key Performance Indicators (KPIs).

PAPER 10

Towards community ownership and management of rural water supply schemes

Robyn Tompkins & Mark Schapers
C/O JG Afrika (Pty) Ltd

A paper by Mark Schapers (2015) looked at "the complex arrangement between technical, political and social structures" in rural (ground) water supply schemes in KwaZulu-Natal and concluded, among other issues, that greater successes are observed when the technical and social components have a greater interaction.

In rural Botswana, water supply sustainability is a significant issue, as there are small, remotely located populations, and therefore the unit cost of supply, as well as operations and maintenance costs (both in terms of finances and human and other resource deployment), are extremely high. Botswana has recently approved (as of October 2016) a new policy which calls for the establishment of water committees in rural communities, moving toward a community-based management model – such as is used in Namibia. The project targeted the Habu community (1500 people) and used elements of the highly successful Namibian Community-based management approach, contextualised for the new policy in Botswana. The methodology was to use a simple scheme design, and also develop a governance and technical training course (including management tools).

In addition, the community-based management structures were established. Finally, a simple tariff system was designed and implemented in the community. The project was implemented in collaboration with the relevant government structures in Botswana, and the assets (infrastructure) ownership will be transferred to the Government of Botswana as represented by those structures. The tariffs collected from the community, by the water committee are therefore kept by the community in lieu of an O&M contract, which is a highly unusual structure in Botswana.

The governance training and management tools have worked extremely well in the community, and most of the households have registered and are paying their monthly fee to collect water from the 5 standpipe taps - one per ward. The committee includes two caretakers and 5 water monitors who manage the volume of water collected by each household. People in the community have proved to be willing to pay for their water, and the taps are well managed. Both the caretakers, and the water monitors are paid a stipend out of the tariffs collected. The committee is in the process of arranging a donation from an external source for fencing materials and are also planning to construct an office. The scheme is in its fourth month of operation and is growing each month. It could be a model for sustainable rural water management for remote communities in Botswana.

PAPER 11

Water shortages, sanitation needs – the unifier of Cape Town a century ago

Dr Kevin Wall
C/O University of Pretoria

A century ago, the municipalities in the Cape Town area unified, a process motivated entirely by the need for services reform. Indeed, the need for adequate water was, by far, the single most compelling reason. Some of the smaller municipalities were dependent on boreholes and springs, and had no provision for further growth.

Other municipalities had explored options in the mountains distant from the urban area, but none of them individually had the resources to embark on any of these schemes. Once unified, the new City Council of Cape Town inherited the water problems of each municipality, and was forced to take action. Construction work on the first big water scheme began in 1918 – none too soon, because, before it was completed, water rationing had to be imposed.

PAPER 12

Utilising bitumen-stabilised material and triaxial geogrid in the rehabilitation of a busy urban arterial

Colin Raman
C/O NAKO ILISO

The rehabilitation of a 1.5 km length of dual carriageway in McGregor Street, Bloemfontein, was carried out by incorporating a triaxial geogrid beneath a bitumen-stabilised material (BSM) base.

The existing pavement was severely distressed, requiring strengthening of the existing pavement layers. The traditional pavement design solution would require a layerworks depth of 700 mm and, thereby, the encroachment on the numerous existing services located at a shallower depth. Furthermore, the road is located in a built-up area with the existing drainage system, sidewalks and levels of the accesses to adjacent private properties fixed. This meant that the pavement could not be strengthened by raising the level of the existing road surface. There was also a need to minimise traffic disruptions as Macgregor Street is a busy arterial carrying approximately 10 000 vehicles per day.

A shallow pavement design was required that would be quick to construct while still providing the required pavement strength. This was achieved by using a triaxial geogrid beneath a BSM base. An investigation was made into a technology that uses a multi-axial-reinforcing geogrid that significantly reduces the pavement thickness. Typically, the existing pavement is excavated to a shallow depth to install the geogrid, followed by a granular stabilised or unstabilised base and surfacing.

The materials design for the BSM layer also had to take cognisance of the reuse of all the materials from the existing upper pavement layers to reduce the cost of importing new construction materials. The upper pavement layers were selectively milled to a depth of 250 mm and the different milled layers stockpiled separately. The optimal mix proportion for the BSM layer was determined through laboratory tests for varying proportions of milled material from each stockpile together with imported crushed stone material, which was limited to only 10%. Foamed bitumen was used as the stabilising agent.

The BSM layer was paved in two 125 mm layers over the triaxial geogrid followed by a 40 mm thick surfacing consisting of A-E2 modified asphalt.

PAPER 13

A unique way to plan and to start implementing a WCWDM programme quickly and easily, from an extremely robust foundation

Derek George Hazelton
C/O TSE Water Services cc

It has become abundantly clear that all WSAs need to achieve No Drop certification as soon as is practical – which is estimated to be between 4 and 6 years. This is not just because South Africa is a water-scarce country. A lack of WCWDM programmes has also resulted in wasted capital expenditure on supply augmentation, and in the financial position of the water services sections of many WSAs being financially bankrupt. The resultant reliability of water supplies is so poor that it has resulted in violent protests with substantial damage to property and even deaths.

The author of the paper believes that WSAs are slow to start implementing WCWDM programmes because officials do not recognise how to measure their current situation easily or how to calculate the water savings and financial gains of implementing such a programme.

The author, therefore, explains how these WSA requirements can be achieved.

The former can be done using very simple water volume and money balances. The paper describes how to do this.

The latter is more of a challenge as it requires a sound estimate of the minimum economically achievable System Input Volume (SIV). This SIV will be made up of the water that needs to be supplied to customers and the total water losses that will occur in the water distribution system, assuming it is well managed. The paper describes how to calculate these two variables and how to use the results to calculate the water savings and financial gains.

Except for the domestic water demands, all the information should be readily available from the WSA's own records. The author has, therefore, calculated the domestic water demands for each of the approximately 20 000 sub- and main places, LMs, metros, and DCs for each of South Africa's nine provinces, using the results of the 2011 Census. It is planned to make the results available, as excel spreadsheets, on the DWS website. The paper describes how the demands have been calculated.

The paper ends by motivating people to begin planning a WCWDM programme immediately, and recommending how to get such a programme approved by the Municipal Council.

PAPER 14

Using technology at the Rustenburg Local Municipality to address the ultimate basic principle: failure to plan is planning to fail

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Management of water resources and related municipal infrastructure is crucial in water-scarce South Africa, a situation highlighted by the current drought. Rustenburg Local Municipality is no exception with variable rainfall, intersected by exponential population growth and significant mining operations. In light of this, Rustenburg identified the need for the improved management of its water and sewer infrastructure and related processes. A solution would need to include: consolidation of and easy access to infrastructure information; system performance results; and a plan to accommodate anticipated future growth within the municipal boundaries.

The first step is to establish electronic water and sewer hydraulic models by collating data from numerous sources. The second step is to load the hydraulic models with real-world demands through the analysis of municipal water billing information, conversion to water consumption and spatial distribution within the models. Once accurate hydraulic models are established the models are analysed to identify critical areas and prioritise actions to improve the existing system performance. Projects were then identified as a result of the analysis and a number are already being implemented. Mid- and long-term projects form the master plan to accommodate a potential doubling of the present water demand over the next 45 years.

Another challenge facing the Rustenburg Local Municipality is to effectively identify, quantify and collect consumers' debt. Improved revenue enhancement strategies have become central to building and supporting a financially sustainable municipality. This challenge was addressed by the conversion of the billing information into accurate and consumable information; non-metered and non-paying consumers are identified, spatially represented and quantified. Key areas were identified to optimise the use of resources and progress is monitored to ensure that improvements are being made.

All the information gathered and converted is displayed on the IMQS web platform. This allows for the latest network models and billing information to be displayed on a number of interactive maps in a user-friendly environment, facilitating rapid access to and interrogation of municipal infrastructure and billing information at a pipe-by-pipe and stand-by-stand level of detail. This information allows Rustenburg municipal staff to easily monitor system performance and identify the need for timely interventions.

The initial project was completed within 10 months and the systems are now maintained on a monthly basis.

At Rustenburg, technology has become a driver of innovative change to overcome service delivery challenges and satisfy infrastructure-related demand. Rustenburg has made great strides towards becoming a smart-solutions-centred municipality.

PAPER 15

Rehabilitation of roads in high-risk areas

Robert de Vries
C/O Knight Piésold

Knight Piésold was appointed on 17 November 2014 by Transport for Cape Town to rehabilitate various roads in Bishop Lavis, Cape Town.

The R124 milion contract with a construction period of 28 months was awarded to NMC Civils. Construction works commenced on 21 April 2016 and the anticipated completion date is 9 October 2018.

The 20 km of roads are to be rehabilitated by the following methods:
- Cold in situ recycling of existing base course layers
- Crack and seat of existing concrete roads
- Construction of asphalt wearing course, using:
- Colto continuously graded (med), using 50/70 pen-grade bitumen
- Colto continuously graded (med), using A-E1 modified binder
- Colto continuously graded (med), using A-E2 modified binder using 70/100 pen-grade bitumen

Approximately 13 km of the roads consist of a concrete base with an asphalt overlay. The riding quality of the roads is very poor due to the uplifting of the existing asphalt surfacing at the concrete joints as a result of thermal expansion and contraction of the asphalt surfacing and concrete slabs. The works involve the milling-off of the existing asphalt surfacing, cracking (by means of physical blows of a weight dropped onto the slabs) and seating (by a 25 tonne pneumatic roller) of the existing concrete slabs, joint sealing and resurfacing with a 40 mm thick asphalt layer consisting of A-R1 modified bitumen rubber binder.

For the successful completion of the project, we regard the involvement and cooperation of the local community as important. Monthly meetings are held with community and business leaders in order to establish mutual trust and respect and the professional conduct of the site personnel is promoted on daily basis.

Some of the major challenges experienced to date have been:
- public safety and the prevention of children playing in work areas and on construction plant
- effective and safe traffic accommodation as a result of major traffic congestions during peak hours, which are exasperated by especially taxis and horse carts, ignore the traffic signs
- the theft of temporary traffic accommodation signs on an almost daily basis
- the safety of site personnel and theft of construction equipment and plant as a result of working in a high-crime area and gangster-related activities. Gunshots are heard on a regular basis.

It is the intention of the construction team to complete the works within budget, on time and to the required specifications as per the employer's requirements.

PAPER 16

eThekwini's efficient efforts in water conservation at Municipal Treatment Plants: A simple, small-scale method to direct water reuse.

Samista Jugwanth
C/O AECOM SA (Pty) Ltd

Water scarcity is a universal concern. And whilst investigations into the most effective large-scale solution oscillate between building new dams, desalination plants or the more controversial water reuse plants, the eThekwini Water and Sanitation (EWS) Design Branch has been applying the principles of direct water reuse in a simple yet effective manner.

In the larger EWS wastewater treatment plants, final effluent undergoes tertiary treatment in order to create a non-potable water supply – i.e. a large-scale grey-water system that is used for on-site process demands such as wash water, chemical make-up, etc. This demand is significant; a typical 65 Mℓ/day treatment plant can use up to 2 200 m^3 of water a day for this purpose. Depending on the cost rate of water applicable, this could produce savings – excluding costs – in excess of R600 000.00/month.

AECOM further optimised the design in order to suit installation for private industrial developments – with particular reference to those located in rural African areas where services are lacking and house treatment facilities are required. The use of this non-potable water supply was then extended to irrigation, truck and external facility washing, flushing of toilets, etc.

This presentation will identify possible non-potable water demands in both municipal and typical industrial plants and examine the water-quality specifications that will need to be adhered to in order to service these demands. The different forms of tertiary treatment used at EWS's municipal treatment plants will be briefly compared in terms of cost, ease of operation and maintenance, culminating in a discussion of the optimised system. The costs of the necessary mechanical and civil infrastructural components will be compared to the benefits achieved by potable water savings with one of the recently upgraded plants used as a case study. Finally, the automation controls required in order to maintain sufficient non-potable supply and protect end-users will be explained and common installation problems listed.

Sustainable engineering and the conservation of water and energy must be promoted in both macro- and micro-cosmic levels. The system explained and detailed in this presentation has been tried and tested by EWS and AECOM, and can be easily implemented in both municipal and industrial treatment facilities. This effective, small-scale solution is a tangible step towards combatting water scarcity. Widespread implementation thereof has the potential to result in substantial financial, social and environmental benefits.