



the state of municipal infrastructure in south africa  
and its operation and maintenance; an overview

Prepared by the



---

**THE STATE OF MUNICIPAL INFRASTRUCTURE IN SOUTH AFRICA  
AND ITS OPERATION AND MAINTENANCE; AN OVERVIEW**

---

**Based on a CSIR / cidb Discussion Document**

*Towards a framework for the maintenance of municipal infrastructure: In support of government growth objectives, August 2006*

Printed July 2007

---

# THE STATE OF MUNICIPAL INFRASTRUCTURE IN SOUTH AFRICA AND ITS OPERATION AND MAINTENANCE; AN OVERVIEW

---

## Contents

---

1	Background	1
2	Investigation Methodology	1
3	Selected Findings of the Research	2
4	A Widening Range of Capacity and Competence	3
5	A Sector by Sector Overview	4
5.1	Water treatment	4
5.2	Water reticulation	5
5.3	Wastewater treatment	6
5.4	Sanitation and wastewater	7
5.5	Electricity distribution	8
5.6	Municipal roads and stormwater drainage	9
6	The Underlying Issues	10
6.1	Limited financial capacity	10
6.2	Imprudent allocation of funds	11
6.3	Loss of intellectual assets	11
6.4	Dearth of guidelines, norms and standards	13
6.5	Inadequate legislation	14
7	Conclusions	15
7	Acknowledgements	15
8	References	16

## 1 Background

---

The condition of municipal infrastructure in South Africa is a crucial element in our ability to ensure service provision to all communities. The CSIR and the cidb produced a report *Towards a framework for the maintenance of municipal infrastructure: In support of government growth objectives* in 2006, that included a major section on the State of Municipal Infrastructure which is believed to be of more general interest. This report has therefore been extracted for publication.

CSIR research into the state and performance of municipal infrastructure, the state of its maintenance, and the underlying causes of this state of maintenance has been under way since 2001. The aim was to identify measures that could be taken to improve the maintenance of municipal infrastructure, and then to initiate or facilitate a process whereby the necessary actions could be taken by appropriate role-players.

## 2 Investigation Methodology

---

No record could be found of any formal broad-based audits or studies of the state of municipal infrastructure. Some services authorities, among them some municipalities, have in the past performed audits in respect of their own infrastructure. Other studies and audits have been undertaken on an ad-hoc basis. Particularly lacking is any overview of trends in the state and performance of municipal infrastructure and its maintenance.

"No comprehensive national data on the condition and age of [electrical distribution] infrastructure exists."  
(NER 2004:2)

Indeed, in many municipalities knowledge of even the extent and capacity of the infrastructure assets they possess can be patchy and unreliable. Clearly, many municipalities are not conforming to the requirements of the MFMA, Municipal Systems Act and other legislation that requires them to ensure that adequate provision is made for the long-term maintenance of their infrastructure assets.

Within the context of the immense amount of municipal infrastructure, and the often poor records that have been kept of its extent (and the generally even poorer records of its condition), the CSIR undertook a limited investigation into the state and performance of infrastructure and its maintenance. Even this limited investigation has revealed distinct patterns that allow credible conclusions to be drawn for broad categories of municipalities.

This report is based on the direct professional experience of the CSIR team and also on the findings of investigations that included:

- site visits, interviews and discussions at municipalities, and also telephone and e-mail interviews, many of which were undertaken specifically for the investigation;
- review of available reports on the state of municipal infrastructure;
- interviews, telephone discussions, correspondence and workshops with provincial and national government officials, and with employees of parastatals, NGOs, funding institutions and the private sector, many of which were undertaken specifically for the investigation; and
- a selective international literature survey, in some cases followed up by e-mail correspondence.

### 3 Selected Findings of the Research

---

The Institution of Municipal Engineering of Southern Africa (IMESA) in 2002 undertook a survey of infrastructure maintenance of seven of the larger authorities (five municipalities and two water utilities) in order to determine their appreciation and application of infrastructure maintenance (IMESA 2002).

The approach of these authorities was benchmarked against best practice in New Zealand, an acknowledged leading nation in municipal infrastructure maintenance. The pertinent findings of the study were:

- some South African authorities compare well with the New Zealand authorities in respect of many aspects of infrastructure maintenance such as knowledge of assets, demand analysis, asset creation and disposal, asset utilisation, and asset maintenance; however
- the South African authorities compare unfavourably with the benchmark in respect of strategic planning, asset accounting, and planning and making financial provision for improvement of infrastructure.

The latter is largely ascribable to the fact that these provisions are required by national legislation in New Zealand.

However, a subsequent IMESA questionnaire survey of a much wider sample of municipalities indicated a far lower level of infrastructure maintenance capability. Also, whereas a high percentage of municipalities indicated that they prepared the statutory development plans required by national government, such as Integrated Development Plans (IDPs) and Water Services Development Plans (WSDPs), anecdotal evidence and the general level of capability identified by the questionnaire survey suggested that these plans were not supported by sound analysis of infrastructure needs or definition of service levels (IMESA 2002).

Since then, the CSIR has investigated many municipalities in greater depth, visiting them and interviewing key staff, and viewing infrastructure. The CSIR also drew on reports and studies of the state of municipal infrastructure that had been commissioned by others. Pertinent findings are summarised as follows:

- a few municipalities have world-class practice in respect of many of the aspects of infrastructure maintenance (such as knowledge of assets, demand analysis, asset creation and disposal, asset utilisation and asset maintenance), although they might not be at as high a level in respect of other aspects such as asset accounting, and planning and making financial provision for renewal of infrastructure;
- on the other hand, many municipalities do not have even the basics in place, and there are gross shortcomings in maintenance policies and practice; and
- a wide range of capacity and competence between these two extremes can be found in municipalities.

Successful municipalities allocate sufficient budgetary funding to keep infrastructure preventatively maintained. They retain skilled staff and train new personnel. They plan, monitor and re-evaluate frequently.

While the CSIR assessment highlighted numerous shortfalls in the maintenance of municipal infrastructure, some municipalities around the country have achieved significant success in improving the maintenance of their infrastructure and even restoring it

Some encouraging findings were:

- good rapport between councillors and officials in respect of infrastructure maintenance;
- infrastructure asset registers that held information that is useful to infrastructure asset maintenance;
- infrastructure asset maintenance that is prioritised. For example those assets, the failure of which would put services at greater risk, are identified and these assets receive priority attention in respect of inspection, planned maintenance, holding spares in stock, and similar measures to reduce the possibility, the duration and the consequences of failure;
- improved financial provision for renewal of infrastructure. Although budgets remained inadequate, instances were found where it is appreciated that expenditure on infrastructure maintenance can save other expenditure many times over (for example by reducing water losses), and can also reduce the risk of system failure;
- attempts being made, before purchasing infrastructure, to project the maintenance requirements into the foreseeable future – and in some instances adapting new works infrastructure plans in the light of these projections; and
- understanding that it is necessary to improve infrastructure maintenance across all parts of a system – for example that it is no good just looking after assets in the form of physical infrastructure, if equivalent attention is not paid to personnel (the "intellectual assets"), for example by career path planning and succession planning.

#### 4 A Widening Range of Capacity and Competence

Municipalities range from those that are facing up to the challenges of maintaining infrastructure in a transformational environment, to those that appear to be unable even to make the attempt, because of inadequate resources, or simply lack of will.

There is a vast difference between the municipalities that have the will and the capacity to tackle the challenges of development for a society in transition, and the majority that to a large extent appear to lack this will and capacity.

The table alongside shows that local and district municipalities spend more of their budgets on capital projects than the metros do and less on operations (National Treasury 2004:30 (Table B21)). In other words, local and district municipalities budget relatively more (than the metros do) for acquiring infrastructure than they do for operating and managing it. Within the "local and district" category there exists a wide range that would, on closer inspection, often reveal an imprudent allocation of budgets.

**How much municipalities spent on capital projects vs. operations in 2003/2004**

Municipalities	Percentage of total budgets of those municipalities	
	Operating	Capital
Metros	84,4%	15,6%
Local and district	75,1%	24,9%
All municipalities	80,6%	19,4%

(National Treasury 2004:23)

The range of dependency on national transfers varies widely, from the lower level of dependency of some of the metros through to the very high levels of dependency of, mostly rural, municipalities. The lowest dependency rates ("transfers as a percentage of total municipal capital and operating budgets") for 2003/2004 were 3,0% for Cape Town and 3,2% for Johannesburg. The highest was the 92% dependency rate of Bohlabela Local Municipality (which includes Bushbuckridge) in Limpopo.

The unintended consequence of constructing more and more new infrastructure, without addressing the condition of the existing infrastructure, in the attempt to address imbalances in access to services, is a widening of the gap in infrastructure maintenance. Generally the poorest municipalities have acquired, relative to their ability to look after it, the most infrastructure, while lacking the resources to maintain the new and existing infrastructure adequately. They need concerted help to break out of their state of being unable to cope.

Gibson (2004), using National Treasury sources and information analysed for specific municipalities, examined the budgets of rural municipalities across the country. He noted that for the more impoverished municipalities, typically:

- the capital charges are low or zero, reflecting capital investment that is usually grant-funded and the inability of many municipalities to borrow on the open market;
- salaries represent over 50% of non-capital expenditure, compared to less than 30% averaged over municipalities nationwide (either because of over-staffing or because the municipality has so few other items of expenditure. This raises the question: if there is "virtually no other expenditure, how can the municipality use its staff effectively?"); and
- over 75% of the non-capital income comes from national grants and subsidies, compared to 11% averaged over municipalities nationwide.

Gibson asserted that for the typical impoverished municipality, whereas basic levels of water services have been provided, "subsequent lack of maintenance coupled with no control over the high levels of informal connections means that the majority of these schemes are no longer capable of providing a consistent daily basic water supply". Gibson concluded that "at least 90" of these municipalities are not going to be able to provide services to their indigent communities without considerable financial support from national government. (Gibson 2004)

In formulating a strategy to help municipalities, a case could be made for learning from the methods being adopted by relatively successful municipalities. Metros, in particular, are gaining in understanding of how to deal with deprived peri-urban areas falling within their jurisdiction. The measures they are putting in place, such as water pressure management and water demand management, can also be applied in helping the more rural municipalities.

## 5 A Sector by Sector Overview

---

The poor physical condition of specific categories of municipal infrastructure, with consequences for the quality of service delivery, is illustrated in the following sections. It is apparent that for a significant proportion of the municipal infrastructure, the sustained provision of services is under threat. Although this is not by any means a hard-and-fast rule, the more rural municipalities are very often less able to manage their infrastructure than are their more urban counterparts.

### 5.1 Water treatment

The most important indicator of the performance of water treatment plants is the quality of water entering the water reticulation system, the standard for which is laid down in SABS 241-2001 "Drinking water". The most common immediate cause of water quality not meeting required standards is a breakdown of plant and/or the length of time that it takes to have that plant repaired satisfactorily and for it to resume correct working. The most common causes of plant breakdown typically include inappropriate plant, faulty operating procedures, lack of routine maintenance,

and overload. Very often the underlying cause of these breakdowns is inadequate budgets or operator error or both.

For example, a visit by the CSIR to the water treatment works of three towns in the Northern Cape found that the treatment process in two of the three was not operating effectively. To all intents and purposes, raw water from the Vaal River was flowing from the works into the towns' reticulation systems. In the one case, the chemical dosing system had broken down – a readily fixable problem, but beyond the ability of any of the municipal staff responsible. In the other case, poor design and construction, together probably with inappropriate operation, had led to breakdown of the system, and the municipal staff responsible appeared to have no idea how to fix this. The third treatment works was currently delivering water to an adequate standard, but the machinery showed signs of neglect.

A year later, at least one of these works was still delivering "polluted water", in the words of a DWAF official.

At a national scale, a "self-assessment survey" of local and metropolitan municipalities to assess their compliance with drinking water quality regulations (i.e. with SABS 241-2001) revealed that only 43% were compliant (Mackintosh et al 2004). 155 municipalities (of 237 polled) responded, and, while it is acknowledged that many municipalities do not have responsibility for water treatment works, some municipalities that do own water treatment works did not respond. A sample of the data was cross-checked against drinking water quality sampling and analyses that were also undertaken. (Note the probability that the municipalities that did not respond would have had results worse than the national average.)

DWAF during 2005 appointed an external team to undertake a national "water services infrastructure asset management strategy study". The terms of reference in the request for proposals read in part as follows:

"The Strategic Framework for Water Services requires water services authorities to maintain a register of water services assets and put in place a system to manage these assets in terms of a maintenance and rehabilitation plan. This plan must be based on the principle of preventative maintenance and must be part of the water services development plan. Assets must be rehabilitated and/or replaced before the end of their economic life and the necessary capital funds must be allocated for this purpose. Unfortunately in practice this does not happen.

The Department as sector leader needs to investigate the asset management situation and provide guidance to water services institutions. Thus, the need for this project." (DWAF 2005a)

## 5.2 Water reticulation

The most common problem experienced with water reticulation systems is leakage of water. A variety of reasons could contribute to this, including the use of incorrect procedures at the time of laying the pipes, damage due to excavations taking place near to pipes, use of inappropriate pipe materials (and their consequent corrosion), inappropriate repair procedures, and the ageing of the pipes. Illegal connections exacerbate the situation.

To establish the extent of water leakage in South Africa, an analysis of leakage data from water reticulation systems operated by thirty South African water services providers was compared with international norms. Of the thirty, just over half (16) reported higher leakage ratios than the average calculated by the International Water Association for 27 supply systems in 19 countries. Seven of these 16 reported leakage ratios double or more than double the international average (Seago et al 2004:743).

It is estimated that about 27% of the water which Rand Water sells to municipalities leaks away. Of this 27%, 17% constitutes leaks in municipal water systems, and 83% leaks out on private property (Buckle 2004:33).

There have been numerous investigations into water leakages in specific municipal areas, including:

Launched in 2003, "Operation Gcin'amanzi" is a five-year programme for water services upgrading on 162 000 residential erven in Soweto. The strategy is to repair all pipes and fittings leading to and on these properties, and, with the co-operation of communities and each resident, to put a management plan in place.

The total cost of this programme at present values is R450 million. Estimated savings to Johannesburg Water (in terms of greatly reduced wastage of the water that it has hitherto been purchasing from Rand Water) when this programme is completed, calculated at present values, will be R158 million per annum. Thus the project will break even within three years. (Still et al 2004/05)

- A study of part of a Gauteng municipality found that the minimum night flow (when households should be using very little water) was 72% of the average flow, which is very high compared to a well managed system of between 10 and 30% (Rand Water 2003);
- A study in a Northern Cape municipality found that 78% of the water supplied from the town reservoirs to the system in the middle of the night as a whole was lost to leakage. When the supply was directly pumped from the water treatment works (and the pressures are higher), 81% was lost to leakage (IMESA 2004:49);
- A study in another Northern Cape municipality calculated that savings of 80% of the water supplied could be made by fixing those leaks in mains and on properties that it would be economically feasible to fix, metering of all properties and public water supply points, and pressure management (DWAF 2002:25); and
- A Western Cape municipality in 1999 commenced a programme of bulk metering of suburbs or portions of suburbs, in order to discover water demand and water loss patterns. A pressure management system was installed in 2002 in one of the areas where the potential for a "quick win" had been identified. This system, the capital cost of which was R3 million, is saving the municipality an estimated R18 million per annum in bulk water purchases (McKenzie et al 2004).

Also, a randomly selected 20% sample of 24 completed DWAF rural water supply projects in KwaZulu-Natal found that (Hemson 2003:4, 46 and Appendix 2):

- 45% "were found to be sustainable or functioning at RDP standards";
- 35% "were working but problematic" – with "problematic" defined as including intermittent operation, implemented at a lower level than RDP standard, "project income substantially below the cost of operations and maintenance", and/or "a high level of social exclusion"; and
- 20% "were not working at all – due either to problems with their external energy sources (i.e. electricity or diesel), or high levels of internal conflict within the community.

### 5.3 Wastewater treatment

The standards for the performance of wastewater treatment works are laid down by the DWAF. The most important indicator of performance is the quality of the effluent from the works, before it is discharged into the watercourse or whatever other

arrangement is agreed to in terms of the licence or other form of authorisation from DWAF for the works to operate.

A survey by the CSIR of a substantial number of the wastewater treatment works run by municipalities in Gauteng showed that many of these are producing effluent that is not meeting DWAF standards. Some of the works are producing effluent that is little distinguishable from the raw sewage that flows into the works. The reasons for this frequently include one or more of:

- gross under-budgeting by the municipality for wastewater maintenance,
- managers who have insufficient understanding of the technology of wastewater treatment, and
- officials who do not seem to be motivated to carry out their duties with the necessary care and energy.

Past neglect of a treatment works has in some cases been a prime contributor to current under-performance of some older works, but other relatively new works, some of them 12 years old or less, have clearly been allowed to run down in recent years (Wall 2005).

Similar observations were made on an inspection by the CSIR of the wastewater treatment processes of four Northern Cape towns. Two of these comprised oxidation ponds only – the one was badly neglected, and the other needed attention. The other two towns' processes were more sophisticated, and were working adequately. Of these two, however, the one badly needed better maintenance. The fourth works, less than two years old, was working satisfactorily.

For a number of years a certain Gauteng municipality has been struggling to meet consistently the DWAF standards for effluent discharge from wastewater treatment works. At least one of the wastewater treatment works is beyond repair, and needs to be rebuilt, or its treatment capacity needs to be replaced .. The situation became so critical (*inter alia*, threatening the integrity of water supply downstream of the Vaaldam), that DWAF and National Treasury agreed to become actively

involved in an effort to rectify not only the wastewater treatment problems, but also general service delivery problems in the municipality. Improvement, facilitated by a substantial conditional restructuring grant, is already evident.

"The last two years have seen significant cuts in the operational and capital budgets, which challenge the sustainability of the service and may have a detrimental effect on the long-term tariffs. .... As a result the risk of impacts on public health and the environment due to inferior wastewater effluents is expected to be prolonged. The lack of financial investment in infrastructure results in "asset stripping" and causes increased risk of mechanical breakdown and process failure while effectively escalating the eventual capital improvement cost."  
(City of Cape Town 2004:12)

#### 5.4 Sanitation and wastewater

Municipalities are usually responsible for maintaining the waterborne sanitation piped network, and frequently also the pumping facilities. The homeowner is usually responsible for maintaining on-site sanitation systems, although the municipalities are usually involved in emptying waste pits every few years.

The most common problems experienced with waterborne sanitation reticulation systems are spills from overloading of the system and from blockages caused by

roots of trees, foreign objects, breakages and deterioration of the network. Routine maintenance of sewers is required to minimise these sewage spills.

A nationwide sanitation sustainability audit was conducted in 2004/2005 to ascertain the functionality of sanitation projects completed during 1994 to 2003 (DWA 2005c). This revealed that:

- 28% of household sanitation facilities have failed or are failing;
- only 53% of municipalities have adequate maintenance capacity;
- few smaller municipalities have the skills to conduct effective maintenance of waterborne systems; and
- 78% of municipalities have no maintenance plan for ventilated improved pit latrines (VIPs).

## 5.5 Electricity distribution

Municipalities collectively account for 43% of the total volume of electricity sales, while Eskom supplies the balance. Few municipalities other than those in the larger urban areas, supply electricity themselves and these municipalities would usually be responsible for the transformers, the below-ground (and sometimes above-ground) cables and the metering systems for electricity distribution.

The most common causes of the failure of electricity reticulation systems are faulty operating procedures, lack of planned maintenance, damage (e.g. to underground cables) during construction nearby, overloading, and equipment ageing.

Referring only to municipal systems, and not to Eskom (NER 2004, section 2.3):

- most distributors carry out only breakdown maintenance and there is a lack of planned or preventative maintenance (and this is more the case as the size of the distributor decreases);
- basic maintenance (servitude clearing, line and wood pole inspections, etc) is generally not done;
- there are no asset databases, many rely on their corporate memory for their maintenance strategy and there is a lack of suitable spares or contingency arrangements;
- a bottom-up planning approach does not inform maintenance budget;
- often officials do not know what to do with condition monitoring data;
- budget deficits generally occur and are managed by readjusting maintenance expenditure downwards; and
- benchmarking the maintenance costs indicates a substantial budget gap between actual and required maintenance.

"The total backlog refurbishment requirement [for electricity distribution] in local authorities is estimated at some R11,2 billion. This represents 20% of the local distribution network replacement cost." The cumulative savings to users, as a direct result of a more reliable supplier, would within three years exceed this cost of refurbishment. (NER 2004, Section 5)

The condition of electricity distribution systems and the quality of the services delivered in South Africa is illustrated by the state of electricity distribution within a Gauteng metropolitan municipality, viz Johannesburg. During the last couple of years, in particular, power outages have been frequent and often protracted, affecting commercial areas (often during business hours) and residential areas alike. The root cause of this is principally that the planned maintenance and refurbishment

programmes came to a standstill in the late 1990s, when the municipality was in financial crisis, with consequent deterioration of equipment, growth in loading without correlating network upgrades, "band aid" repairs rather than the required refurbishment or replacement, and – but no less important – the exodus of key staff. (Padayachee 2003 and Zimu et al 2004/05)

The municipality has however turned the corner financially, and the electricity infrastructure backlog, currently in excess of R2 billion, is being tackled energetically.

## 5.6 Municipal roads and stormwater drainage

The most common cause of the failure of paved (usually bituminous) road surfaces is neglect – neglect of routine maintenance, and neglect to repair damage without delay. Neglect of surface damage or of cracking leads to water penetration of the underlying layers, and consequent erosion followed by loss of a portion of the paved surface (the formation of "potholes"). Another common cause is overloading – for example, a road might, for economic reasons, be designed in the expectation that heavy traffic will be infrequent, but the use by heavy vehicles then increases significantly, with consequent damage.

"If road maintenance is delayed, the cost for repairs, rehabilitation etc. increases exponentially. According to SANRAL [South African National Roads Agency Ltd], a delay in road maintenance of 3 to 5 years increases the required repair costs by between 6 and 18 times. Also, because of the subsequent decrease in riding quality, the vehicle operating cost of roads could easily double, with the associated ripple effect on the economy."  
(DoT 2002:81-82)

Of all the infrastructure services, roads have been usually the most affected by municipal boundary changes. When the pre-2000 municipalities that constituted the core of many of the new municipalities formed in 2000 were absorbed into geographically large entities, the additional areas usually had a roads system longer, sometimes by multiples, than that in the core municipality, and often in substandard condition.

The pavement management system records of the paved roads (i.e. not gravelled roads) of a substantial proportion of the municipalities in the Western Cape were surveyed during 2004. It was found inter alia that (Western Cape Province 2004):

- 8% of the network has deteriorated "mainly due to the lack of maintenance", to the extent that the roads need to be reconstructed – at a cost of R750 million;
- the cost of the resurfacing backlog that has accumulated is R500 million; and
- catching up on these backlogs over five years would require a six fold increase in current budgets.

Because of the two sets of municipal boundary changes that took place, in 1996 and in 2000, there are major discontinuities in the road condition trend data that many municipalities had been keeping over the years. However, one broad study conducted by the DBSA in 1998 does indicate the condition of the country's road network. At that time, the DBSA estimated that R 4.1 billion would be needed per year for the following 10 years to prevent the further deterioration of South Africa's road network. However, "treasury funds are adequate for only 60% of maintenance needs. In 1993, 25% of the road network was considered to be in a good condition. It is estimated that this figure decreased to 5% in 1997. .... If roads do not receive adequate maintenance to remain efficient transport routes, an investment of R150 billion could be wasted" (DBSA 1998:30).

## 6 The Underlying Issues

---

This section focuses on the underlying causes of the ongoing failure of many municipalities to recover maintenance backlogs, run a preventive maintenance programme and deliver a reliable, sustainable service.

The two principal systemic issues underlying this problem are:

- inadequate budgets (either because of the municipality being in a distressed financial state and thus unable to fund infrastructure maintenance or, even if the municipality is not distressed, infrastructure maintenance is not allocated sufficient budget); and
- inadequate skills (especially technical skills) and experience to plan and implement appropriate maintenance.

On the other hand, legislation (and its implementation) does not strongly enough incentivise those municipalities that do not see for themselves the need for sound infrastructure maintenance to manage their infrastructure as they should.

Furthermore, appropriate, credible and authoritative practice norms and standards and guidelines would be of value.

### 6.1 Limited financial capacity

The financial predicament that many municipalities find themselves in may be so dire that they are disempowered to effect a turnaround in any of the critical areas addressed in this document.

Ironically, this financial distress pertains to the operating budget (inclusive of maintenance budgets) only, for municipalities are able to relatively easily obtain funding from national government for capital expenditure. However, it will require a substantial mindshift before municipalities are likely to refuse further capital projects until services delivery by means of the infrastructure they currently possess is back in operational order.

The operational debt of some municipalities is so severe that, even if no further infrastructure were acquired, it could well still be impossible for them, without innovative external assistance, to catch up with existing maintenance backlogs and restore sustainable operations.

If municipal budgets for maintenance are not significantly increased, "this situation may result in lower service level standards or municipalities having to incur excessive cost to replace/upgrade infrastructure and equipment. ... The importance of preventive maintenance of infrastructure cannot be over-emphasised, as failure in this regard can result in municipalities incurring significant expenditure in future to replace assets not well maintained."  
(SALGA 2003:5-6)

It should not be forgotten that municipalities need to cope with many challenges – many of which have a financial implication. For example, on the revenue side municipalities have to cope with one or more of ongoing non-payment for services, loss of revenue where basic services must now be provided free, and loss of surplus on electricity distribution. An example on the expenditure side is the challenge that lies in funding the maintenance of the capital assets that have been acquired.

Notwithstanding the limits to its income that a municipality can do nothing about, many municipalities have considerable scope for optimising income sources that lie

within its discretion – as indeed they frequently have considerable scope for optimising their cost structure.

The mismatch between, on the one hand, the often decades-long designed life of infrastructure and the need for a municipality to manage the associated costs and revenues over that life, and on the other hand the much shorter time spans of the MTEF and the period between municipal elections, results in financial tensions that are not easy to resolve.

## 6.2 Imprudent allocation of funds

Few municipalities put enough of their budgets aside for infrastructure maintenance. The focus of municipalities (as expressed particularly in budget allocations) is so often "on the construction and commissioning of new infrastructure, and not on the maintenance of existing infrastructure" (dplg, 2004).

A view from within the DWAF is that: "Local authorities are reluctant to prioritise sanitation and related issues which have an impact on water quality, with the result that failed sewage pump stations [for example] often remain inoperative for weeks before money and resources are allocated." (DWAF, 2005).

The under-provision of infrastructure maintenance budgets is illustrated by analysis of the budgets of all municipalities for expenditure other than of a capital nature, from which it is seen that repairs and maintenance budgets constitute low percentages of the total operating budgets of municipalities; for example, a 6,8% average for Gauteng municipalities, a 4,8% average for North West municipalities, and 9,4% for KwaZulu-Natal municipalities – well below acceptable levels (National Treasury, 2004, Table B1).

This imprudent allocation could be related to insufficient understanding by elected municipal representatives of the importance of infrastructure maintenance. Furthermore, as the financial year progresses, often the first budget to be raided for funds is reported to be the maintenance budget.

## 6.3 Loss of intellectual assets

The loss of intellectual assets and key technical staff, and their non-replacement, or replacement by others less qualified or experienced, is inhibiting infrastructure maintenance and in many cases can be identified as the main reason for a breakdown of the service.

"Mbeki ... spoke candidly yesterday about the skills crisis that had in some instances led to a breakdown of service delivery. Mbeki admitted that South Africa did not have enough of the specialists needed to implement government's programme of action."  
(*Business Day* 2005)

Specific issues identified during the research conducted for this document are:

- the high turnover of staff;
- the loss of skills and institutional memory following the departure of experienced staff;
- little or no career-path planning and succession planning;
- loss of mentors following the departure of experienced staff;

"Currently, few and in some instances none of the personnel of the local authorities involved in the study [on human resources capacity] has the necessary qualifications to perform their job satisfactorily."  
(SBH Consultants 2001:29-30)

- loss not only of the most highly trained staff, but also of the middle order – in particular those who had originally qualified as artisans, and who had worked their way up through the ranks to supervisor positions;
- appointment of non-technical personnel to management positions requiring technical experience; and
- shortage of suitable and trained engineering staff in the job market.

Only 13 out of the 47 district municipalities (28%) and 42 out of the 231 local municipalities (18%) have members of IMESA (Institution of Municipal Engineering of Southern Africa) among their senior management – "an indicator that the important skill and experience of a municipal engineer is not available to many municipalities."  
(Gibson 2004:47)

Where municipalities have taken on additional complex infrastructure, they have seldom taken on the corresponding skills to manage sustainable delivery. Also, the local government transformation process has seen the loss of many key personnel.

National government documents are awash with references to "capacitating" municipalities. A list of capacitating measures usually then follows, often including short-term outside assistance, programmes to increase the skills of currently under-qualified staff, and so on. Very seldom, if ever, mentioned is any need to retain the services of current staff who are already suitably qualified and experienced. They need to be assured of attractive career paths and of salary scales and working conditions that are appropriate to their contribution and their qualifications. The departure of qualified, experienced and willing staff members inevitably inhibits the achievement of the goals of the municipality.

"Most infrastructure technical disciplines in South Africa are experiencing a steady depletion of skills and ageing of resources. The distribution sector is no exception. It is estimated that local distributors are faced with staff shortages of up to 60%. Some distributors are not appropriately staffed to comply with Occupational Health and Safety (OHS) requirements. Significant difficulties exist in obtaining and retaining competent engineers, technicians and artisans."  
(NER 2004:5)

In support of its 2005-2009 Sector Skills Plan submission, the Construction SETA (Sector Education and Training Authority) appointed SAICE (the South African Institution of Civil Engineering) to research the nation's capacity and skills development needs relating to civil engineering professionals (i.e. civil engineering technicians, technologists and engineers). A particular focus of the study has been on local government:

"Few if any municipalities have had an increase in technical staff since the [2000] demarcation change ..., yet [they] are now required to deliver, operate and maintain services over far larger areas than before, with population, and length of roads and pipes, having increased from two to 10 times in some instances."

A census of all local and district municipalities and metros revealed that, of the 278 local and district municipalities, 83 have no civil engineers, technologists or technicians, and 44 have only one civil engineering technician. "Those municipalities that have civil engineering staff report 35% vacancies" (Lawless, 2005:5).

The SAICE study also found that there are proportionately far more unfilled posts at the senior professional and technical level than in any other category of positions in local government. The fact that posts at the leadership and governance level of municipal engineering departments are largely filled, but often by managers without engineering training, stands in stark contrast to this (SAICE, 2004, Section 10.5.1).

A large proportion of the best qualified and most experienced technical staff in municipalities will be retiring in the next 10 years, taking with them much of the institutions' skill, experience and institutional memories. Data capture can ease (but not eliminate) the loss of the latter. Passing on the skills and experience will be more difficult, given inter alia that there is in most of these institutions a shortage of adequately trained younger staff, and especially of those with 15-25 years' experience, the group most able to benefit from the skills and experience transfer, and utilise what they have gained. Also, mentoring programmes are not as they could be, and staff are often too busy to mentor or be mentored.

#### 6.4 Dearth of guidelines, norms and standards

There is a dearth of appropriate practice guidelines, manuals and systems for the maintenance of municipal infrastructure.

For example, there are no published norms with respect to the resources that are required to enable good maintenance practices to be achieved. Without question there is a need for guidelines on these resources, expressed in terms such as:

"One recurring cause for concern was the lack of [provision for] asset replacement costs in water services authority budgeting. This will cause a major problem in the future when infrastructure needs to be replaced." (Balfour et al 2004:i-ii)

- the funding that should be budgeted for maintenance (subject to a host of variables that include the nature of the infrastructure, its age, how well it has been operated, its maintenance history, and many other aspects); and
- the levels of expertise that should be deemed competent to be responsible for each element of infrastructure maintenance.

(A prerequisite is a clear definition of "maintenance" in relation to definitions of other terms – such as "planned maintenance", "repair", "refurbishment" and "renewal".)

There is a variety of infrastructure maintenance manuals, IT systems, and other forms of assistance, many of them more tailored to the private sector or to experience outside of South Africa. These need to be selectively adapted and promoted to the municipal sector. Such manuals, systems and the other forms of assistance need to cover all levels, from the strategic level through to the operational and tactical levels. Very importantly, there is a need for all the above to take account of the great range in skills and other resources available to municipalities across the spectrum in South Africa. Also, there is a need for the collation of good and bad practice, for benchmarking, and for the identification or derivation of early warning indicators. This information should be disseminated in order to make it available for easy reference by municipalities. In instances where better-resourced municipalities enjoy good maintenance practice, this practice needs to be shared with less-resourced municipalities.

A parallel can be drawn with the publication *Guidelines for Human Settlement Planning and Design* (commonly referred to as the "Red Book"), which is widely used in South Africa, especially by municipalities and settlement infrastructure-design consultants. As the title indicates, this publication sets out guidelines for infrastructure planning and design. However, its scope extends only to the end of the design phase of infrastructure.

An equivalent publication on municipal infrastructure maintenance is needed. This publication would deal with all that is significant to life-cycle planning and

maintenance for sustained services delivery, including setting out standards and budgetary norms.

Other initiatives cover wider areas. Among these can be mentioned the current formulation process by the DWAF of a national water services infrastructure asset-management strategy (DWAF, 2005d), the condition survey of municipal infrastructure in the Western Cape (currently in pilot stage), and the recently published South African version of the high-level "International Infrastructure Management Manual" (based on an Australasian original). The dplg and National Treasury are also both working on initiatives.

The cidb has already launched its "Toolkit for Infrastructure Delivery Management". While this is a process designed to support public sector officials to improve the delivery of the infrastructure programmes and projects up to the commissioning stage, it can also be expanded to incorporate guidelines covering the ongoing maintenance function.

## 6.5 Inadequate legislation

Legislation guiding municipalities towards sustainable maintenance and good governance is in several respects not adequate. However, even when legislation and regulations are adequate to govern the specific actions of municipalities, they are often inadequately enforced. For example, the requirements in terms of which water-quality samples from wastewater treatment works have to be routinely submitted to monitoring authorities seem in many cases not to be complied with and, furthermore, there seems to be little capacity or will to enforce the requirements.

South African legislation is insufficiently compelling in respect of several parameters vital to sustainable infrastructure asset management. These include budgeting and monitoring expenditure for strategic maintenance, depreciation practice, defining value, and issues relating to asset records.

The Municipal Structures Act provides a legislative framework for Integrated Infrastructure Plans and Capital Investment Frameworks, part of the Integrated Development Plans, IDP, process. This needs to be managed and strengthened, so as to be more effective within the planning process.

Perhaps the most damaging shortfall in legislation is in the area of financial provision for the long-term maintenance of infrastructure. Funds entrusted to municipalities by National Treasury for capital works ought to incorporate conditions compelling municipalities to set part of these aside for ongoing operations and maintenance.

In general, South African municipalities compare very unfavourably with international benchmarks, such as New Zealand municipalities, in respect of strategic planning, asset accounting, and planning and making financial provision for improvement of infrastructure. Generally Accepted Municipal Accounting Practice (GAMAP) does require municipalities to depreciate assets, but does not prescribe that a depreciation model must be used that will determine adequately the funding to be put aside each year to meet future liabilities for infrastructure renewal. Nor does GAMAP prescribe that the money actually be put aside. By comparison, in New Zealand this provision is required by national legislation. Moreover, the level of

The replacement value of the engineering infrastructure assets (including electricity) of eThekweni Municipality has recently been calculated at R 56,4 billion. By contrast, the "book value" is recorded as R 6 billion. (Palmer and Balwanth 2005)

provision is laid down and is based on sound infrastructure asset management principles. South African legislation should require the same.

GAMAP's method for defining "value" is unhelpful – valuation is determined on the basis of historical cost adjusted by depreciation and expenditure on refurbishment. This is not of much assistance to infrastructure maintenance.

GAMAP requires that an asset register must be drawn up, but does not specify that the register should record the capacity, condition, importance and risk, and other factors essential to the register being of use to infrastructure maintenance.

However, in terms of GIAMA, it will become obligatory for public sector institutions to draw up sound multi-year infrastructure asset management plans. These have not yet been prepared, but it is in terms of the legislation envisaged that regulations will include guidelines for the organisational structures, and skilled staff are required to manage the planning and implementation of maintenance programmes.

## **7 Conclusions**

---

The investigation has shown that South Africa has many instances of adequate municipal infrastructure and service delivery, but also an increasing proportion of deteriorating infrastructure, together with poor and often unacceptable quality of services. Similarly, while some municipalities have exemplary practices in place in respect of many of the aspects of infrastructure maintenance, gross shortfalls in management policies and practice exist in many municipalities. Between these two extremes, a wide range of capacity and competence can be found.

In particular, the more rural municipalities are not coping as well with the maintenance of infrastructure (especially the more sophisticated infrastructure such as water and wastewater treatment works) as are the more urban and especially the metropolitan municipalities.

Several systemic issues contribute to infrastructure maintenance in South African municipalities, ranging from best practice through to the unacceptable. In many municipalities, budgets and staffing policies are severely inhibitive of sound infrastructure maintenance, thereby placing much infrastructure (including a significant proportion of that commissioned since 1994) at risk. The great majority of municipalities are not making adequate provision for the long-term preventive maintenance, refurbishment and eventual replacement of their infrastructure.

It is clear that many municipalities will not be able to improve their maintenance policies and practices without strong direction and assistance from national government. If municipal infrastructure maintenance is to be adequate, a great deal needs to be done.

## **7 Acknowledgements**

---

This study was undertaken under the direction of Dr Kevin Wall of CSIR Building and Construction Technology, whose leadership is acknowledged.

## 8 References

---

- DBSA (1998). "Infrastructure: A Foundation for Development. DBSA Development Report 1998", November 1998.
- Buckle, JS (2004). "New water scheme is necessary unless wastage is curbed", Engineering News, 23 – 29 July 2004.
- City of Cape Town (2004). "Water Services Development Plan. Review of the WSDP", October 2004.
- DoT (2002). "Road infrastructure strategic framework for South Africa", Draft report, Department of Transport, November 2002.
- DWAF (2002). "Water conservation and water demand management study: Emthanjeni Municipality Phase 1 situation analysis: Real losses: Final report". WRP Consulting Engineers, July 2002.
- DWAF (2005a). Terms of reference for appointment of consultants to carry a "Water services infrastructure asset management strategy study".
- DWAF (2005b). "Water services infrastructure asset management strategy study. Phase 1: status report. The state of water services infrastructure and its management: a desktop strategic study." November 2005.
- DWAF (2005c). "Nationwide sustainability audit of sanitation facilities implemented by sector departments from 1994 to 2003. Final report". Consultants PULA and Matingi, March 2005
- Gibson, S (2004). "The forgotten municipalities", IMESA conference, Mossel Bay, October 2004.
- Hemson, D (2003). "The Sustainability of Community Water Projects in KwaZulu-Natal", HSRC, undated but probably August 2003.
- IMESA (2002). "Development of a South African Version of the International Infrastructure Manual: Scoping Report", December 2002.
- Mckenzie, R, Mostert, H, and de Jager, T (2004). "Leakage reduction through pressure management in Khayelitsha: 2 years down the line", Proceedings of the WISA conference, Cape Town, May 2004.
- Mackintosh, GS, de Souza, PF, Wensley, A, and Delpont, E. (2004). "Operationalising South Africa's compulsory national standards for potable water. Practical considerations for water service authorities." IMESA conference, Mossel Bay, October 2004.
- National Treasury. (2004). *Trends in Intergovernmental Finances: 2000/01-2006/07*. National Treasury, August 2004.
- NER (2004). "South African National electricity distribution infrastructure: status report", National Electricity Regulator, April 2004.

- Padayachee, V (2003). "Maintenance and refurbishment gaps – a case study", National Electricity Distribution Maintenance Summit, November 2003.
- Rand Water (2003). "Sebokeng/Evaton pressure management project: Motivation design report". July 2003 IMESA (2004). "Upington water loss investigation", IMESA conference, Mossel Bay, October 2004.
- Seago, C, Bhagwan, J and Mckenzie, R (2004). "Benchmarking leakage from water reticulation systems in South Africa." WISA conference, Cape Town, May 2004.
- Still, A, and Mas, J-P (2004/05). Johannesburg Water, Personal communication.
- Wall, K,(2005). "Water and wastewater treatment works in South Africa: a case study of the compliance and regulatory gap". Paper presented at conference "Poverty reduction through better regulation". Johannesburg, February 2005.
- Western Cape Provincial Government (2004). "Report on roads infrastructure status in the Western Cape". Department of Local Government. March 2004
- Zimu, S, and Leshnick, B (2004/05). City Power, Personal communication.
- DoT (2002). "Road infrastructure strategic framework for South Africa", Draft report, Department of Transport, November 2002.

---

cidb contact details

physical address: block n&r, sabs campus, dr lategan road, groenkloof, pretoria, south africa

telephone: +27 (0)12 482 7200 | fax: +27 (0)12 343 7153

website: [www.cidb.org.za](http://www.cidb.org.za) | e-mail: [info@cidb.org.za](mailto:info@cidb.org.za)