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**LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND
SUSTAIN WATER, SANITATION AND HYGIENE SERVICES**

**Reporting the condition of South Africa's
water sector infrastructure**

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The purpose of the “national infrastructure report cards” of the condition of engineering infrastructure in South Africa has been to draw the attention of government, and of the South African public at large to the importance of maintenance, and to factors underlying the state of repair of infrastructure. The success of these report cards, published in 2006 and 2011, has been such that a new report card is currently being prepared. Whereas completion of this, the third report card, will not take place until around mid-year, the objective of this paper is to briefly describe the background to and purpose of infrastructure report cards and the process by which the South African report cards are compiled, to discuss key findings of the previous report cards, and to describe the third report card's preliminary findings for the water sector.

Introduction

In 2006 the South African Institution of Civil Engineering (SAICE), the largest of the learned societies in the engineering disciplines, in partnership with the Council for Scientific and Industrial Research (CSIR), Africa's largest research and development organisation, released the first “report card” assessment rating of the condition of public sector engineering infrastructure in South Africa (SAICE 2006). The purpose of the report card was to draw the attention of government, and of the public at large, to the importance of maintenance, and to factors underlying the condition (state of repair) of infrastructure. Its success was such that the CSIR and SAICE brought the second report card out in 2011 (SAICE 2011; Wall, Amod and Rust 2011), and are again working together to prepare a third, scheduled to appear later in 2017.

It is anticipated that the findings of this next report card will be widely debated because, in the last few years, service delivery problems, particularly those attributable to operation and maintenance of infrastructure, have received heightened attention across the country – and have manifested in the many so-called “service delivery protests”. (Note 1).

Whereas publication of the new report card will only take place some months after this conference paper has been written, in the paper may be found:

- the background to and purpose of infrastructure report cards and the process by which the South African report cards are compiled;
- key findings of the previous report cards, with a particular focus on water sector infrastructure; and
- a preview of some of the findings of the forthcoming water sector reports.

The purpose of, and models for, infrastructure report cards

Infrastructure report cards are a reflection at a point in time on the condition of built environment infrastructure, i.e. that part of the nation's public sector capital stock which produces services that are consumed by households, such as hospital services, drinking water, sanitation, electricity, or facilitates economic activity, such as electricity, public transport, roads and ports. This infrastructure is a public asset. All in a nation have a stake in its upkeep and operation, and all, directly or indirectly, share in the consequences of its neglect.

The SAICE and CSIR have modelled their work on the report cards published from time to time by the American Society of Civil Engineers (ASCE) and the British Institution of Civil Engineers (ICE). The ASCE was in 1998 first in the field with its initial “Report Card on America’s Infrastructure”, and has since settled into a regular pattern of publishing every four years (the last was in 2013 (ASCE 2013), and the next is due later this year.) However, both they and the British have brought out specialist reports, of various types, in the intervening years. For example, the most recent ICE report focused on Scotland’s infrastructure (ICE 2016). A recurrent theme in the American reports has been the cost which the perceived deficiencies in the infrastructure condition are imposing on the American economy, businesses and households. The most recent report focusing on this theme was “Failure to Act: Closing the Infrastructure Investment Gap for America’s Economic Future”, which appeared in 2016. (ASCE 2016).

These infrastructure report cards are intended to draw the attention of both government and the public at large to the importance of maintenance, and to factors underlying the condition of infrastructure – factors such as skills and finance, for example. Whereas they have little technical value to infrastructure professionals, the intention is that they be put to good use in macro level planning, lobbying for infrastructure funding, stimulating debate and highlighting the actions that engineers believe are needed to improve the condition of a nation’s infrastructure. By publishing them, learned societies and institutions provide more than information – they commit to a role of advocacy.

The South African infrastructure report cards

Since the advent of more representative government, in 1994, massive strides have been made to correct infrastructural imbalances. Drinking water, sanitation, education, energy and health infrastructure have received focused attention, and government is continuing to invest at rapid pace in infrastructure for disadvantaged communities. However the combination of limited resources, public sector restructuring, inefficiency, and shortages of key skills has led to extreme pressure on the condition of the public infrastructure asset base.

SAICE decided about a dozen years ago that the many reported incidents of failure of engineering infrastructure, and the negative effect which the poor condition of infrastructure was having on quality of life and economic development, was of sufficient concern that it should compile a "report card" of the condition of infrastructure. It approached the CSIR for assistance with the research component – which assistance was readily given – and, in 2006, the first "National Infrastructure Report Card" was published. (SAICE 2006)

This, the first ever report card of the condition of engineering infrastructure in South Africa, highlighted “the observations of the professionals responsible for the planning, construction, operation and maintenance of our nation’s life-support system”. It graded infrastructure (water, sanitation, solid waste, roads, airports, ports, rail, electricity and hospitals and clinics) on a scale from "A+" ("in excellent condition"), through to "E-" ("unfit for purpose"). (Note 2.) Overall, it gave the infrastructure a D+ grade.

The second report card, again a CSIR/SAICE partnership, was launched in April 2011. (SAICE 2011) This covered ten sectors (Note 3), one more than in 2006. These were further divided into 27 sub-sectors. It was found that, in comparison to 2006, nine of the sub-sectors showed improvement, twelve remained unchanged and four had deteriorated. The Public Schools sector and the Fishing Harbours sub-sector were new and were therefore not given trend indicators. Overall, a grade of C- was awarded.

This overall improvement from a grade of D+ in 2006 reflected marginal improvement in the average condition of South Africa’s infrastructure over the previous five years, influenced by the heavy investment in, especially, national assets such as stadiums, ports, rail, airports and national roads, much of this in preparation for the 2010 FIFA Soccer World Cup. However the downside of the attention given to these national assets was that it too-often diverted attention of the authorities from their core business of maintenance and upgrading of other infrastructure – with predictable consequences. Thus the authors of the second report card strongly cautioned against a perception that the rise to C- in the average grading across all infrastructure sectors represented a blanket improvement. On the contrary, “the quality and reliability of basic infrastructure serving the majority of our citizens is poor and, in many places, getting worse. Urgent attention is required to stabilise and improve these”. (SAICE 2011)

Note that the South African report cards have not commented on backlogs as expressed in the absence of infrastructure to serve certain areas and communities. It is the condition of existing infrastructure which is the focus, together with the effect of that condition on service delivery (e.g. that a badly operated and

maintained water treatment works is sometimes unable to supply the town for days at a time). Also important is consideration of the factors which lead directly to infrastructure being in this condition.

Every effort has been made to ensure that information gathered for the report card, and the report card gradings, have been strictly comparable from report card to report card. Only if this is the case can the trend analyses be valid.

Research methodology 2006, 2011 and 2017

The methodology used in 2006 and 2011 has worked well, and therefore the new report card is being prepared along more or less the same principles. The third report card is at the time of writing (early 2017) well underway. As in previous years, the key roles of the two parties are:

- The CSIR takes responsibility (including carrying its costs) for compilation of the basic research reports, and also the authors of each infrastructure sector report give their view on possible gradings; whereas
- SAICE takes responsibility (including carrying its costs) for moderating the sector reports (including reviewing alternative evidence, and bringing that into account if advisable), and then taking an all-sector view of the recommended gradings, followed by determination of the final gradings to be published, and for everything to do with writing of the report card itself, its launch, and any following up.

In summary the following research methodology was previously followed by the CSIR – and is again being followed currently:

- Drafting sector reports (mostly desktop work) for infrastructure sectors which have been identified and for which it has the required in-house expertise;
- Arranging for the drafting of reports for selected sectors where it does not have sufficient expertise itself; and
- Contributing to the process of grading and to the drafting of the report card itself.

For the purposes of reviewing the CSIR output, SAICE has – and will again – call together a number of peer review groups, selected for their knowledge and expertise in each sector, to review the CSIR output and reach consensus on grading of the condition of infrastructure in each of the sectors as mentioned above. It will then, and taking into account the difficulty of comparing “apples” (e.g. airport infrastructure) with “oranges” (e.g. roads in municipal areas) with “plums” (e.g. public sector schools infrastructure), and so on, attempt to reach agreement on an average grading for all public sector infrastructure in the country.

The same research questions are being posed to the current report card team as were posed to the earlier teams. These questions are simply stated:

- What is the condition of key elements of South Africa's infrastructure in public (i.e. as opposed to private) ownership?
- How does this compare with the previous assessment(s)? What is the overall trend, and what are the trends by sectors?
- What contributes to the condition and its trends? What recommendations can be made?

A new feature in 2017 will be an opinion survey, the objective of which is to collect data on the views of professionals and members of the public who are not involved in the report card process, in order to augment the report card's assessments. The timing of this is still being considered. One proposal is that its findings are incorporated in the 2017 report card. An alternative proposal is that the survey is sent out round about the same time as the report card is released. This would assist publicity for the survey, and would presumably lead to a better respondent rate than might otherwise be the case. Also, the results should be available, and could be released, sometime after release of the report card, thereby extending the period of government and public interest in the topic of infrastructure condition and what should be done about it.

It should be noted that the South African report cards have been a locally-led initiative, albeit inspired by UK and USA precedents. The CSIR and SAICE have the proven capability to undertake them without assistance from outside the country.

On the other hand, CSIR and SAICE have considered extending the process to other Southern African countries, assisting them to undertake similar, or reduced-scale, exercises of their own. Unfortunately other priorities in both organisations have inhibited more than token progress in this regard. The only (and minor) exception has been where the engineering institution in one African country, viz Nigeria, decided to embark on a report card of their own, resourced from within Nigeria. In this instance they sought only limited general guidance from SAICE – which they received. Their report card appeared in 2016 (Nigerian Society of Engineers 2016).

Key findings of the report cards

Although the focus of these report cards is on the condition of the infrastructure, increasing importance has over the years been accorded to recognising the factors which lead directly to this infrastructure being in the condition that it is.

In both 2006 and 2011, two key themes (or “drivers” or constraints) ran as a thread through all the grades. The first was the shortage of skills and the impact of this on planning, procurement, design, construction and care of infrastructure. The second was that grossly insufficient funding is allocated to maintenance of the existing asset base and the new assets that come on-stream each day.

South Africa suffers an acute skills shortage in the public sector infrastructure sector. Whereas this is understood in certain circles of government, any measures which might have been taken to address it, seem to have had little effect. An illustration should highlight how serious this shortage is. A survey undertaken by SAICE some years ago showed that more than one-third of the 231 local municipalities did not have a single civil engineer, technologist or technician. (Lawless 2007) The survey has since been repeated, and it was found that the situation has, if anything, worsened. Whereas the number of civil engineering staff had increased, the amount of engineering infrastructure for which they were responsible had increased by an even greater amount. Furthermore, the experience of the staff had on average fallen, and the number of engineers had reduced, many engineers having been replaced by technicians or technologists. (Lawless 2016)

After skills, the second key constraint was the lack of adequate funding for the maintenance of the existing asset base and the new assets that come on-stream each day. An annual maintenance budget allocation of 4% of replacement cost is commonly regarded as the minimum needed to keep assets in good condition. However, such allocation is rare. Moreover, 4% would certainly be too low if – as is usually the case – the budget is expected to cater for a maintenance backlog which requires rehabilitation or refurbishment in addition to routine maintenance.

In 2011, a third key theme, viz the need for systems and a systematic approach, also ran as a thread across all the grades. Such an approach would enhance the integration of services and maximise the use of scarce human and infrastructural resources. It will also reduce the incidence of failure, as constant data collection on condition allows early identification of acute and chronic weak points in the delivery chain. Not receiving (or not listening to) early signs of failure can be costly in financial terms – the old English saying “a stitch in time saves nine” is apposite.

The shortage of critical data pertaining to infrastructure condition was identified in 2006 and 2011. Reliable, consistent data is a prerequisite for the urgently required shift from reactive “repair” to planned “maintenance”. Data which is systematically captured and analysed enables planning, prioritisation of targets and adequate budgeting for maintenance. While it is pleasing to report that, with most of the 2017 sector reports to hand at the time of writing, there has been some improvement in data availability and reliability in some sectors (e.g. much of the public transport fixed infrastructure), this has not generally been the case for the water sector. Most importantly, whereas the national Department of Water and Sanitation has for a number of years released to the public domain the “Blue Drop” reports on the condition of water systems and the “Green Drop” reports on the condition of wastewater systems, in the last couple of years these reports have been issued only after some delays, and usually in abbreviated form to the public – although reports on their infrastructure have been more timelessly released exclusively to the owners of the infrastructure (usually municipalities).

There is much evidence that public sector procurement practices downplay, or even ignore, life-cycle costing. That is, at (say) the time of initial purchase of the infrastructure in question, the bid with the lowest capital price is favoured, even though accepting this bid usually means significantly more expensive maintenance and repair costs in the long term.

The water sector

The two earlier report cards are available on the SAICE website (<http://saice.org.za/services/saice-topical-publications>) or (2011 report only) on CSIR research space (<http://researchspace.csir.co.za/dspace/handle/10204/5807>), so all that is incorporated in this paper is a very brief summary of only the water-related grades from 2011, noting in particular the trends from 2006 to 2011.

As follows (from SAICE 2011, pages 6 and 14-16):

- The highest grading in the water sector, viz C+, went to water services in major urban areas;
- The next highest grading, viz C-, went to wastewater services in major urban areas;
- The grade of D- was awarded to both water services in other urban areas and to the bulk water infrastructure portfolio (including dams and major pipelines) owned by the national Department of Water and Sanitation; and
- the lowest grading of any of the 27 subsectors, viz E-, was given to wastewater services in other urban areas.
- With respect to trends 2006-2011, three of the above subsectors showed no change, whereas two, viz the wastewater services in “other” urban areas and the bulk water infrastructure portfolio, each moved down by one notch.

At the time of writing, the first drafts of all the 2017 water sector reports have been received. Preliminary findings (if not the final findings) of all of these will be available by and will be summarised at the WEDC conference. Meantime, the following can be shared (the bulk water infrastructure portfolio is excluded):

- The average condition of the infrastructure in each water sector subsector shows little change since 2011.
- However there are striking differences from municipality to municipality, and in particular it can be noticed how the infrastructure in some major urban areas is improving – or at least holding its own – in contrast to the downward trend in water sector infrastructure in many other areas.
- There are striking differences also between provinces. Municipalities in two of the nine provinces – in one in particular – are showing evidence of consistent improvement, whereas municipalities in two other provinces appear to be firmly on a downward trend.

Findings

While government should not change its drive to provide new infrastructure to address backlogs, the challenge is to supplement this by at the same time also focusing on the maintenance of both new and old infrastructure. If this is not done, the already considerable legacy of that infrastructure which is dysfunctional for want of sound operation and adequate maintenance in the past, and which therefore needs rehabilitation or replacement at considerable cost, will increase rapidly. Infrastructure, once created, is unrelenting in its demand for maintenance, and this demand will escalate increasingly the longer it is ignored.

Conclusions

The process by which the third South African national infrastructure report card is being compiled has been well tested. The two co-operating organisations, viz the CSIR and SAICE, are well resourced, and have a depth of understanding of the infrastructure sector and the circumstances in which infrastructure is well looked after, and delivers reliable services – or is not well looked after, as the case may be, and what in particular can lead to a deterioration of the condition of the infrastructure, and consequent falling reliability of the services.

Whereas there is a wealth of information on infrastructure condition in the public domain for some sectors, for other sectors this is not the case. Often, what is available, is incomplete and/or so dated that it cannot be used for report card purposes other than as a limited contribution to understanding the condition. Despite this, the research team is well positioned to compile a balanced view across all sectors, to identify trends, to identify key issues, and to make sound recommendations.

It is anticipated that, by the time of the 2017 WEDC conference, all of the sector reports would have been completed, checked, edited and peer-reviewed, and the process of evaluation by SAICE will be well advanced. It is also probable that the grading by the SAICE expert panels will have commenced, even if it is not completed. The writing of the text of the report card, together with short summaries of the sector reports, will hopefully be well advanced.

There is also an outside chance that the report card will have been completed and released to the public – but only an outside chance. However if the report card has been released, then the presentation at WEDC may constitute the first public event, subsequent to the launch of the report by SAICE and CSIR, at which the findings of the report card will be revealed.

References

- AMERICAN SOCIETY OF CIVIL ENGINEERS. 2013. *2013 Report Card for America's Infrastructure*.
- AMERICAN SOCIETY OF CIVIL ENGINEERS. 2016. *Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future*.
- INSTITUTION OF CIVIL ENGINEERS. 2015. *The State of the Nation: Infrastructure 2015: Scotland*.
- LAWLESS, Allyson. 2007. *Numbers and needs in local government – civil engineering, the critical profession for service delivery*. South African Institution of Civil Engineering, Midrand.
- LAWLESS, Allyson. 2016. *Numbers and needs in local government – update 2015*. Proceedings: annual conference of the Institute of Municipal Engineering of Southern Africa. East London. October 2016.
- NIGERIAN SOCIETY OF ENGINEERS. 2016. *Nigerian Infrastructure Report Card*. Nigerian Society of Engineers. Abuja.
- SOUTH AFRICAN INSTITUTION OF CIVIL ENGINEERING. 2006. *The SAICE infrastructure report card for South Africa: 2006*. Midrand. November 2006.
- SOUTH AFRICAN INSTITUTION OF CIVIL ENGINEERING. 2011. *The SAICE infrastructure report card for South Africa: 2011*. Midrand. April 2011.
- WALL, Kevin, AMOD, Sam, and RUST, Chris. 2011. *An assessment, by the engineering professionals, of the condition of infrastructure in South Africa*. Paper presented at WEDC, Loughborough University, 2011.
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Notes

Note 1: There is much evidence that in many of these “service delivery” protests the service delivery element is subsumed into wider issues, often including unemployment and ongoing struggles between rival political factions.

Note 2: The meaning of the grades is as follows:

- “A”: Infrastructure is comparable to the best internationally. It is in excellent condition and well maintained, with capacity to endure pressure from unexpected events.
- “B”: Infrastructure is in good condition and properly maintained. It satisfies current demands and is sufficiently robust to deal with minor incidents.
- “C”: Infrastructure condition is acceptable although stressed at peak periods. Investment in the next few years is needed if serious deficiencies are to be avoided.
- “D”: This infrastructure is at risk. It is not coping with demand and is poorly maintained. The likelihood is that the public will be subjected to severe inconvenience and even danger if the infrastructure does not receive prompt attention.
- “E”: Infrastructure has failed or is on the verge of failure, exposing the public to health and safety hazards. Immediate attention to it is required.

Note 3: The 10 sectors covered in the 2011 SAICE/CSIR national infrastructure report card were.

- Water and sanitation services infrastructure.
- The large-scale water resources infrastructure owned by national Department of Water and Sanitation (at the time known as the Department of Water and Forestry).
- Solid waste management.
- Roads.
- Airports the responsibility of the parastatal Airports Company of South Africa.
- Commercial ports.
- Rail permanent way and structures.
- Electricity generation infrastructure.
- Health care infrastructure.
- Public ordinary schools infrastructure.

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