

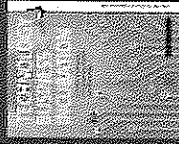
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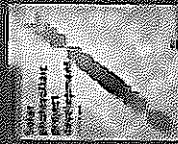
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technologies and, often, changes in the governing regulations; infrastructure development, economic development and environment are interdependent and, therefore, policies for infrastructure development need to be approached on the basis of all these considerations. Furthermore, the need for improving infrastructure in developing countries calls for a new scientific approach and techno-economic regime for solutions that can be implemented in these resource-poor countries.

The following broad areas might be considered when working towards ensuring proper infrastructure development in developing countries:

- **Planning and policy-making:** Policies for integrated infrastructure development have to be formulated by governments. Environmental impacts on ecology and water supplies and the long-term effects need to be understood. There is a need for multi-level planning to counter the ill-effects of urban growth (such as regional imbalances and informal settlement growth, and so on). The urban local bodies need to be strengthened further so as to generate capability to stimulate new growth centres with sufficient employment opportunities, and to plan for the process of urbanization. Strong institutional mechanisms as well as sound strategies for resource mobilization and investment are needed.
- **Providing employment and services in rural areas:** There is a need for generation of employment opportunities in the rural areas to eradicate poverty. Investments have to be made in agricultural as well as non-agricultural activities in rural areas in order to help address the inequalities between the rural and urban areas. Services that should be provided should prioritize water and sanitation, public transport, health centres, telecommunication facilities, improved access to governance structures, schools, vocational training centres, and economic facilitators such as cooperatives, local generation of distributed energy, and so on.
- **Transportation in urban areas:** Transportation is a key requirement for trade. Proper transport planning allows for the provision of an efficient and affordable transport system accessible by all communities, as well as pollution minimization and energy conservation. An integrated multi-modal transport system needs to be developed in many 'megacities', along with other feeder transport services to rural areas.
- **Technology intervention and knowledge networks:** The world is experiencing rapid technological innovation and there is need for disseminating knowledge between countries. A mechanism for international joint observation of infrastructure development would ensure the dissemination of knowledge and capabilities that allows lessons to be learned from projects around the world, and would raise awareness for the need for investment in infrastructure for the needs of the interdependent, globalized economy.

- **Development of financial infrastructure:** To attract Foreign Direct Investment (FDI) in the infrastructure sector, a mechanism has to be evolved to help build confidence in the durability of agreements entered into by governments, particularly since many major infrastructure projects by international institutions are seen to have failed. National capital pools need to be created for financing training and education of local bodies and technical and financial management, and to handle the difficult issues of land tenure.

The World Federation of Engineering Organizations' Committee on Engineering and the Environment (WFEO-CEE) enables the global engineering profession to address the United Nations Millennium Development Goals through the development, application and enhanced understanding of sustainable engineering practices, the adaptation of infrastructure to the impacts of a changing climate, and through mitigating the risks of natural disasters.

6.2.8 Infrastructure Report Cards

Kevin Wall and Sam Amod

Infrastructure report cards: international practice

One of the earliest report cards on infrastructure was produced in the United States of America in 1988 by their National Council on Public Works Improvement. Ten years later the American Society of Civil Engineers (ASCE) took over the reins and produced the first *Report Card on America's Infrastructure*. Since then, they have produced updates in 2001, 2003, and the most recent in 2005. The reports have gradually become more detailed and broader in scope so that now reports are produced by the State and, in some instances, by the county.

In 2006, flowing from the 2005 report, ASCE produced an action plan appealing to Congress for such actions as establishing a National Commission on Infrastructure, increasing funding for specific improvements and, most notably, promoting certain Acts that are presumably under consideration by the legislators. The ASCE initiative is well funded and is an integral part of the lobbying process that is so much a part of American public participation culture, as the following excerpt testifies:

Congested highways, overflowing sewers and corroding bridges are constant reminders of the looming crisis that jeopardizes our nation's prosperity and our quality of life. With new grades for the first time since 2001, our nation's infrastructure has shown little to no improvement since receiving a collective

D+ in 2001, with some areas sliding toward failing grades. The American Society of Civil Engineers' 2005 Report Card for America's Infrastructure assessed the same 12 infrastructure categories as in 2001, and added three new categories.

In the United Kingdom, *State of the Nation* reports have been published annually since 2000. The Institution of Civil Engineers (ICE) has also progressively elaborated their product to regional reports and they have made their grading more sophisticated by incorporating trends and sustainability aspects. In his launch of the 2006 Report, ICE President Gordon Masterton stated:

'We need to start answering the questions posed in this report. How do we intend to reconcile rising demand for water with dwindling resources? Where is our electricity going to come from in the future? How can we stop our rubbish piling up on landfill sites? How do we tackle congestion on our roads and railways?

To accomplish this transformation would require changes to the law to simplify planning processes, and joined-up government with the vision to see the necessity and economic benefit of long-term infrastructure improvements. And it would need the public to be made aware that improvement programmes, that could disrupt their daily lives, will reward them, their children and generations to come.'

Engineers Australia produced a national Infrastructure Report Card in three categories in 1999 (roads, rail and water), and in 2003 and 2005 increased this to seven categories. They have also subsequently produced State and Territory report cards.

In these cases, the intention has been for engineering professionals to provide a public opinion on the condition of infrastructure in the manner of 'expert witness'. The reception to these publications has invariably been sensationalist by the media, and the reaction from much of the public sector has usually ranged from critical to denial.

South Africa

Kevin Wall and Sam Amod

Introduction

Late in 2006, the South African Institution of Civil Engineering (SAICE) released the first ever report card of the state of engineering infrastructure in South Africa. This report 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+ through E-. Overall, it gave South Africa's infrastructure a D+ grade.

The report aimed to inform the public about the importance of infrastructure in their daily social and economic intercourse by highlighting its current condition. Furthermore, many decision-makers are technical lay-people. The report would enable better informed decisions to be made, especially regarding maintenance management and planning for new expenditure.

The publication of this first edition of the *Infrastructure Report Card for South Africa* was, by any measure, very successful and exceeded all expectations. Indeed, the report card received media coverage that exceeded SAICE's highest expectations. In addition, invitations were received from government departments and others for SAICE to engage with them in order to address issues raised in the report card. The exposure received by SAICE was the greatest it had received for many years, if not ever, all of it overwhelmingly positive. The credibility of the institution as a learned society with the authority, indeed the duty, to comment broadly on engineering infrastructure had been enhanced.

Infrastructure is a public asset. Well-maintained infrastructure underpins quality of life and economic development. All South Africans have a stake in its upkeep and operation, and all South Africans share in the expense of its construction and its ongoing maintenance. If maintenance is inadequate, social and economic growth in South Africa will be impeded, and hence the human development of the country will be reduced. The report and its subsequent versions are intended as an instrument to contribute to better-informed decisions for infrastructure development and maintenance. 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 state of repair of infrastructure – factors such as skills and finance, for example.

The report has intentionally not commented on the legacy that gave South Africa its imbalanced infrastructure distribution. Since the advent of democracy in 1994, huge strides have been made by the government to correct this balance. Ambitious plans have been made and implemented. Drinking water, sanitation, energy and transportation access have received focused attention, and – acting on its mandate – the government is continuing to invest at a rapid pace in infrastructure for disadvantaged communities.

The report has also not highlighted the stated intentions of many agencies to improve infrastructure in the future. After decades of decline, construction and infrastructure provision seem set for decades of growth, with construction forming the fastest growing sector of the economy. Construction also generates more jobs per rand spent than almost any other sector

of the economy. It is imperative that we do not continue to build only to permit decay. On the contrary, adequate budgets and maintenance management plans are required for existing and new additions to the infrastructure asset base.

The answers to many issues posed in the report are neither simple nor easy. All the more reason for the public to be better informed about the serious decisions that must be taken about our infrastructure and, where appropriate, to change our behaviour.

The role of civil (and all) engineering professionals as creators and custodians of all aspects of infrastructure has been placed at centre stage. The impact has been to raise the awareness of the public, parents, learners, educators and government to the urgency of the crisis (for example, in terms of the importance of the education of engineering practitioners).

Whereas the state of South Africa's public sector infrastructure has for some while been under the spotlight, there is now broad recognition that SAICE has provided the first national-scale credible benchmark against which progress (or not) can in future years be measured. There is broad consensus that the initiative should be sustained and extended, but that at the same time the independence of the benchmarking process should not be compromised. The new *Infrastructure Report Card* will entail an even more rigorous process, with greater consultation and finer definition of the process and particularly of the grading.

Shortages

Two key themes run as a thread through all the grades:

- the extreme shortage of engineering skills and the impact of this on planning, procurement, design, construction and care of infrastructure; and
- the lack of adequate funding for the maintenance of the existing asset base and the new assets that come on-stream each day.

The consequences of inadequate maintenance are severe, affecting the quality of life and even the very lives of people, through outbreaks of waterborne disease, reduced safety on roads and rail, inconvenience and inefficient commercial activity. The allocation of maintenance funding is often thought generous at 4 per cent of capital cost per annum. However, such allocation is rare. Moreover, it is simply not sufficient, especially when it is expected to cater for a maintenance debt that usually requires upgrading, repair or refurbishment. Roads maintenance that is delayed for one year could cost three to six times more when undertaken a year or so later.

South Africa suffers an acute skills shortage in the infrastructure sector. Just two illustrations should highlight how serious these shortages are, making clear the case for transformation:

- A recent survey by SAICE showed that more than one-third of all 231 local municipalities did not have a single civil engineer, technologist or technician. Vacancies in local government for engineering practitioners exceed 1,000, a figure which is not improving.

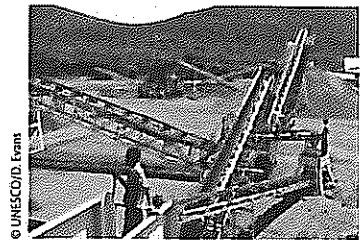
While the link between engineering infrastructure and economic growth may be clear, it is not always clear that a similar link exists with social health. It is obvious though that cleaner drinking water, proper sanitation, better shelter, access to transport and electricity, all improve the quality of life. To millions in South Africa quality may be equated with viability. Indeed, SAICE research indicates that, in general, developing countries have more doctors than engineers, whereas the opposite is true in developed countries. The reason is obvious: proper infrastructure prevents disease and sickness. It is concerning then that South Africa has only half as many engineers as doctors. By comparison, Australia, America, Western Europe and even China or India have a similar number of engineers to doctors, or more engineers than doctors. Furthermore, the ratio of population to engineer in South Africa is of the order of 3,200 to 1, twenty times less than in some of the countries just mentioned. Furthermore, the ratio amongst the white population is approximately 300 to 1 – similar to America and Western Europe – while the ratio in the African population is in the order of 50,000 to 1, which is amongst the worst in Africa and the world.

- The case for transformation cannot be clearer.

Impact of the report card

The outcome was spectacularly successful. It was the first ever publication of a consolidated report on the state of a broad range of infrastructure in South Africa (or Africa) by a credible institution, drawing attention to its condition and importance by headlining issues in a manner understandable to technical, decision-making and lay persons. It provided the headline issues requiring attention and a benchmark for further monitoring. Whereas the state of South Africa's public sector infrastructure has for some while been under the spotlight, there is now broad recognition that SAICE has provided the first national-scale credible benchmark against which progress (or regress) can in future years be measured.

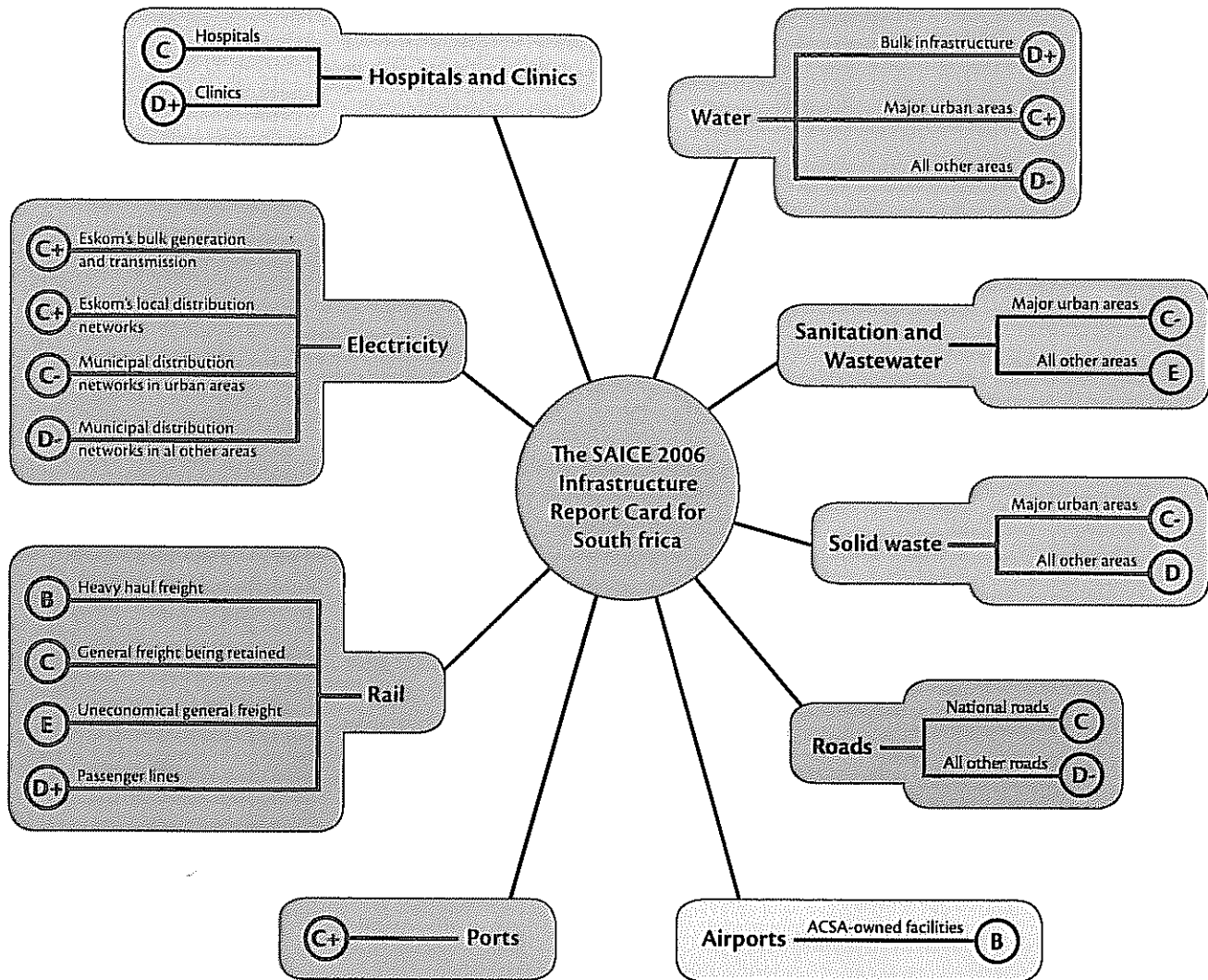
The primary objectives of informing the public and decision-makers were achieved through the numerous live interviews and presentations, print, visual and audio media exposure and discussions with client and sector organizations. Presentations were made to government departments such as National



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17 Mine, extract crystals, South Africa.

Figure 1: 2006 report card for South Africa's built environment infrastructure



The report itself is freely available on the SAICE website (<http://www.civils.org.za>).

Treasury and the Department of Public Enterprises, and also to the Transport Portfolio Committee of Parliament. The authors and the Institution have been inundated with invitations to workshops and presentations by all tiers of government, parastatal agencies and industry institutions. The exposure received by SAICE was the greatest it had received for many years, if not ever, all of it overwhelmingly positive. The credibility of the Institution as a learned society with the authority, indeed the duty, to comment broadly on engineering infrastructure had been enhanced. There is broad consensus that the initiative should be sustained and extended, but that at the same time the independence of the benchmarking process should not be compromised.

The role of civil (and all) engineering professionals as creators and custodians of all aspects of infrastructure has been placed at centre stage. The impact has been to raise the awareness of the public, parents, learners, educators and government to the urgency of the crisis, e.g. in the education of engineering practitioners. However, in the midst of these positives, we need to critically analyse the shortcomings of the IRC2006 and its process. These are combined with the aspirations for future IRCs and the specific extensions and improvements identified.

Future report cards

The refinements and further development outlined below are regarded as more ambitious than can perhaps be achieved in

the next edition of the IRC. Given the response to the IRC2006, and the expectations that have been created, it is clear that future reports cannot simply present an update of the IRC2006. It is considered a given that the new IRC will entail an even more rigorous process, with greater consultation and finer definition of the process and particularly the grading.

The following options are being considered. Rather than being mutually exclusive, they may also be considered as progressive elaborations:

Update and refine: Infrastructure condition does not alter significantly in the space of a year. Nonetheless, the first report card was not flawless and could do with a tweaking. So one option is to provide an interim report, incorporating a trend score (improvement, decline or unchanged grades since IRC2006) and possibly a sustainability score (the future ability of the asset to perform adequately with only routine maintenance, i.e. a refurbishment/renewal index); SAICE could also extend the IRC to include all or some of: Education, Housing, ICT, Public Works assets (Justice, police, and so on).

Extend the South African IRC to provide a detailed analysis by South African province or region. There have already been requests for assistance in compiling more regionally focused report cards. In addition, focus and comment on one or more of the following areas: rail and harbour facilities, Municipalities or just Metros. Undertake an economic analysis including a finer breakdown of the current areas, e.g. discuss backlogs and opportunity costs of doing or not doing specific maintenance or capital investments, benefits to society of various choices, and so on.

Extend the process to all Southern African countries, initially through the creation of a template that is populated through a desktop study, progressively elaborated into a nested scorecard for the region that permits examination of the infrastructure of each country individually, or the aggregated infrastructure of the region in a particular category, e.g. road transport, harbours, energy, among others, or through an examination of natural or economic corridors.

Clearly, these are ambitious objectives and some, if undertaken, go beyond the mandate of SAICE and will require external authority and especially substantial funding. It should be noted that each of these options stem from engagement with stakeholders post-IRC2006.

Conclusion

The impact of the *Infrastructure Report Card for South Africa 2006* has been extremely positive. Whereas the state of South Africa's public sector infrastructure has for some while been under the spotlight, there is now broad recognition that SAICE has provided the first national-scale credible bench-

mark against which progress (or regress) can in future years be measured.

There is broad consensus that the initiative should be sustained and extended, but that at the same time the independence of the benchmarking process should not be compromised.

The future of the project must also consider embracing the participation of partners such as aid agencies, SAICE's own partners such as statutory institutions, Voluntary Associations, the African Engineers Forum, the World Federation of Engineers Organization, UNESCO and others. SAICE will continue to convene the initiative through reasonable time commitment as a volunteer organization. Opinion and assistance will be sought from SAICE volunteers, but this will clearly not be sufficient. Discretion will have to be exercised regarding compensation for contributions.

USA

Alison Dickert

The report card for America's infrastructure is the signature public education and advocacy tool for the American Society of Civil Engineers (ASCE). ASCE and its members are committed to protecting the health, safety and welfare of the public, and as such, are equally committed to improving the nation's public infrastructure. To achieve that goal, the report card depicts the condition and performance of the nation's infrastructure in the familiar form of a school report card – assigning letter grades based on physical condition and needed fiscal investments for improvement. The report card can be accessed online at <http://www.asce.org/reportcard>.

The report card is a clear and concise document that lays out the scope of the problem in terms the average person can understand. In a world with ever increasing media clutter, the universal symbol of schoolhouse grades cuts through and leave a lasting – and sobering – impression.

Since 1998, ASCE has issued three infrastructure report cards and numerous status updates that depict the current state of the infrastructure and provide potential solutions for improvement. The report card receives widespread media coverage and has been cited in numerous academic studies. The nation's political leaders also rely on the report card to provide them with clear information, which they can use as a guide for policy decisions.

In 1988 when the report was first released, the nation's infrastructure earned a 'C', representing an average grade. Among the problems identified within the report card, titled *Fragile*