

THE THIRD REPORT CARD: TRANSPORT FIXED INFRASTRUCTURE RESULTS AND CONCLUSIONS

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ABSTRACT

In 2006, 2011 and 2017 SAICE and the CSIR cooperated to produce “report cards” on the condition of engineering infrastructure in South Africa. Apart from providing condition gradings for several classes of infrastructure, the reports cards also 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.

Of the 10 infrastructure sectors assessed in the report cards, four incorporate transport aspects, viz roads, airports, ports and rail.

The paper:

- reviews the overall findings of the 2017 report card, and in particular the findings with respect to transport fixed infrastructure;
- assesses and discusses the infrastructure condition trends: 2006-2011-2017;
- assesses and reviews the infrastructure drivers, and particularly the condition of fixed transport infrastructure, identifying the key factors determining this condition; and
- draws conclusions.

BACKGROUND

A paper presented at SATC 2017 described the nature and purpose of report cards on the condition of infrastructure. It also described the historical background of the previous two report cards (SAICE 2006; SAICE 2011), the research methodology of all three report cards (i.e. including the then forthcoming 2017 card), and the key cross-sector findings of the 2006 and 2011 report cards. (Wall and Rust, 2017.) It also briefly described some effects of transport infrastructure condition – e.g. the effect of “road roughness” on vehicle operating costs. Then it gave some detail on preliminary findings with respect to the transport sector infrastructure of the 2017 report card.

The background, research methodology, and 2006 and 2011 findings are summarised as follows:

In 2006 the South African Institution of Civil Engineering (SAICE), in partnership with the Council for Scientific and Industrial Research (CSIR), released the first report on the condition of a broad spectrum of engineering infrastructure in SA (SAICE 2006). The purpose was to draw the attention of government, and the public at large, to factors underlying the condition of infrastructure, and to the importance of maintenance. Its success

was such that SAICE and the CSIR produced the next report card in 2011 (SAICE 2011), with the third being released late in 2017.

SAICE and the CSIR concluded that since 1994 significant 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 a rapid pace, in infrastructure for disadvantaged communities. However, the combination of limited resources, public sector restructuring, inefficiency, shortages of key skills and less than optimum governance, has resulted in extreme pressure on the condition of the public infrastructure asset base.

The IRCs grade public sector infrastructure (water, sanitation, solid waste, roads, airports, ports, rail, electricity and hospitals and clinics) on the following scale:

- A: World class
- B: Fit for the future
- C: Satisfactory for now
- D: At risk of failure
- E: Unfit for purpose

The methodology to compile the SAICE infrastructure report cards included:

- Compilation of basic research reports based on desk top work by the CSIR;
- Arranging for the drafting of additional reports for selected sectors where the CSIR does not have sufficient expertise itself;
- Moderation of the sector reports by SAICE experts with additional inputs where necessary and early results from an opinion survey;
- Determination of the final gradings by SAICE, and
- Writing and publication of the report card and its associated commentary by SAICE experts.

In 2016, the overall grading, i.e. averaging across all infrastructure sectors, was assessed to be a D+ grade.

The second report card released in April 2011 (SAICE 2011) concluded that there had been improvement, again 'on average', and awarded the overall grade of C-. Nonetheless it highlighted that this "marginal improvement in the average condition of South Africa's infrastructure over the previous five years" had been influenced by the major investment in national assets in preparation for the 2010 FIFA Soccer World Cup. The downside of the focus on these national assets was that it had diverted the attention of the authorities from maintenance and upgrading of their core infrastructure – with predictable consequences. The authors of the card concluded that 'the quality and reliability of basic infrastructure serving the majority of our citizens is poor and, in many places, getting worse.' (SAICE 2011, page 5)

The 2017 report card lowered the overall average back to D+ and noted that the 'apparent improvement' between 2006 and 2011 'was not a cause for complacency', and it is evident that the poor attitude to maintenance continues and is reflected in the downturn on the current overall grade.' (SAICE 2017, page 5.)

The current paper:

- reviews the gradings given in the 2017 report card;
- outlines the transport fixed infrastructure condition trends: 2006-2011-2017;

- outlines and reviews the drivers of infrastructure, and particularly of the condition of transport fixed infrastructure
- identifies the key factors influencing the condition; and
- draws conclusions.

KEY FINDINGS

Of the 10 infrastructure sectors assessed in the report cards four concern public sector transport fixed infrastructure, viz:

- roads;
- airports;
- ports; and
- rail.

Trends

The trends, from 2006 through 2011 and now to 2017, can be summarised as follows:

- Roads:
 - the gradings given to paved roads in metropolitan areas and to gravel roads in all areas have not changed from C- and E respectively;
 - National roads have improved, and are now graded B;
 - paved provincial roads have improved, and are now graded D; whereas
 - “other paved municipal roads” deteriorated and are now rated D-.
- Airports (the nine major airports owned by Airports Company of South Africa): were graded B in 2006, but in 2011 and 2017 improved to B+.
- Ports (the nine commercial ports owned by Transnet): were graded C+ in 2006, but in 2011 and 2017 improved to B-.
- Rail (some re-categorisation in this sector has made comparisons difficult but, broadly):
 - the heavy-haul freight lines were graded B in 2006 and B+ in 2011 and 2017;
 - the general freight lines were graded C in 2006, but rose to C+ in 2011 and then declined to C;
 - the branch lines grading moved from D- in 2006 to D in 2011 and to D- in 2017; and
 - the passenger lines (principally the commuter rail lines, but also the intercity passenger trains) grading moved from D+ in 2006 to C- in 2011 and to D+ in 2017.

Gautrain, newly graded in 2017, became the first sub-sector in the entire report card series to receive an A grading.

In brief, within the transport sector:

- the facilities on which the economy primarily depends, viz national roads, airports, ports and the heavy-haul freight lines – together with Gautrain – are graded highest, viz A and B; whereas
- gravel roads remain at E; and
- all other subsectors remain within C and D gradings.

This is seen in the context that, the overall grading, across all sectors, has varied from D+ in 2006, to C- in 2011, and back to D+ in 2017. The higher grading in 2011 was ascribed to the influence of the significant investment in, “national assets” in preparation for the 2010

Soccer World Cup – stadiums, ports, rail, airports and national roads. (In 2011, compared to 2006, six transport subsector gradings improved, while five remained the same.)

Data

Reliable, consistent data pertaining to infrastructure condition is a prerequisite for assessing and confirming 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. In 2017 some improvement in respect of the public transport fixed infrastructure monitoring was evident. For example:

- Four of the nine provinces have released "visual condition index summaries of road condition per percentage of network" for each of the years 2010 or 2011 through 2014 or 2015. (The other provinces have released summaries only intermittently.)
- The rail sector report produces "condition of infrastructure" tables which, in colour-coding, summarise the condition of each of the 18 "sections" of Transnet Freight Rail's core network – for example the Ermelo to Richards Bay section of the Coal Network System.

The transport sector may be contrasted with other infrastructure sectors, which in 2017 were not as fortunate when it came to availability of condition information. In the water and sanitation sector, for example – availability of condition information in the public domain has reduced in recent years.

FINDINGS: SECTOR BY SECTOR

Roads

The South African circa 750,000 km road network is managed at three levels: (a) Primary intercity, with roads of national economic importance managed by the South African National Roads Agency Limited (SANRAL) on behalf of the Department of Transport (DoT); (b) the secondary and tertiary intercity network, primary access and mobility roads largely managed by the nine provincial departments; and (c) the mostly urban roads managed by municipalities.

The condition of this road network varies greatly with category, type of road, sphere of government and geographical location. At one end of the spectrum, the condition of the 21,000 km managed by SANRAL is very good. Although the average condition of the SANRAL network has deteriorated, with more of the roads categorised as "very poor", "poor" and "fair". This is largely attributed to the extension of the mandate of SANRAL, taking over portions of the strategic road network from provinces, trebling since 1994 the length of road for which it is responsible.

SANRAL has managed to retain its high level of professional engineering expertise. On the other hand, the nine provinces have for two decades recorded a loss of experienced road professional expertise. While the larger metropolises have, to a great extent, retained their levels of professional expertise, and consequently the condition of their road networks, very few other municipalities have been as fortunate.

The most recent overview of visual condition and riding quality of national and provincial roads is that published in the 2013 State of Logistics Survey (CSIR 2013). From Figure 1 below it is apparent that, based on the proportions of "very poor" and "poor" roads, the condition of the SANRAL network and the secondary and tertiary intercity road networks of

six provinces are satisfactory. The networks of Mpumalanga, KwaZulu Natal and Free State are in the poorest condition. The impact on the efficiency, cost of freight transport and road safety is therefore negative.

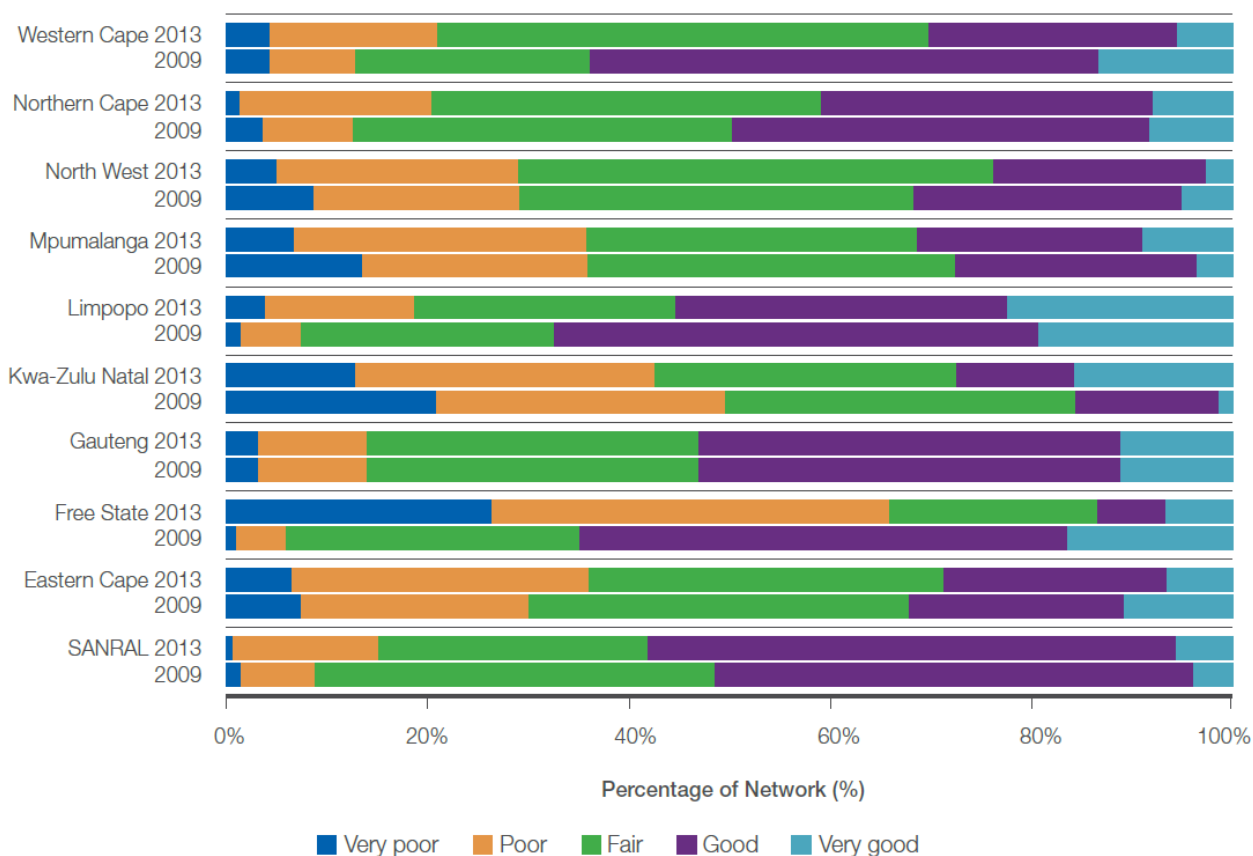


Figure 1. SANRAL and provincial roads condition data 2009 and 2013
(CSIR, 2013)

The 226,000 km gravel road network is in a very poor condition – between 40% and 90% is in a “poor” and “very poor” condition. The percentage of gravel roads falling in the “good” and “very good” condition ranges between 2% and 12%. It must be noted, however, that some of the data is not verified – in particular that from a province which, after several years of reporting in the order of 30% “fair” to “very good” for its gravel road network, fell to zero in the space of one year.

The primary contributing factors leading to pavement deterioration in South Africa are capacity constraints, lack of maintenance, high traffic volumes, overloading and poor storm-water management.

Airports

The state-owned Airports Company of South Africa (ACSA) owns and operates (i) the three major international airports, namely, Oliver Tambo International, Cape Town International and King Shaka International and (ii) six other commercial airports (Kimberley, George, Upington, East London, Port Elizabeth and Bloemfontein). The international airports account for nearly 90% of the 30 million annual passenger movements.

Several secondary commercial airports are either owned and operated by the private sector (e.g. Lanseria, Rand Airport, Kruger Mpumalanga) or by provincial governments (e.g. Mthatha) or municipal governments (e.g. Richards Bay, uMsunduzi).

ACSA is responsible for the property as a whole at its airports and in particular, the runways, terminals and some of the hangars and technical areas. ACSA is not responsible for the navigational aids and air traffic control which are the responsibility of Air Traffic and Navigation Services (ATNS).

ACSA's success in operating and maintaining its airports is attributed to its strong financial status and management. This is strongly influenced by the incentives of mandatory requirements for safety and reliability, coupled with regular and stringent inspections by, principally, the Civil Aviation Authority of South Africa (CAASA). The quality of airport infrastructure is driven more by local and international regulations than is the infrastructure of any other sector so driven. Instrument landing systems, runway approach lights and runway ground lights are the highest priority and are maintained to ensure statutory safety and reliability compliance with the International Civil Aviation Organisation (ICAO) requirements. Therefore airports are very careful to keep their infrastructure up to standard and consequently the gradings over the past three score cards have been B and B+.

ACSA budgets for infrastructure management are close to optimum. In addition it has secured adequate technical staff resources at all levels who are competent to manage and safeguard the sustainability of its infrastructure.

Commercial ports

The commercial ports are the responsibility of the state-owned company Transnet through its business units the National Ports Authority (TNPA), Transnet Port Terminals (TPT) and SA Port Operations (SAPO). The TNPA is responsible for the ports and their infrastructure, including berths, port buildings, tug and pilot services, navigable areas (therefore including services such as dredging) and aids to navigation. TPT is responsible for shoreside equipment such as straddle carriers, cranes and conveyor belts, and terminals (such as grain elevators) and their equipment. SAPO is responsible for vessel traffic and nautical services.

There are nine ports in the TNPA stable: seven major commercial ports: Saldanha Bay, Cape Town (Table Bay), Port Elizabeth, Ngqura (Coega), East London, Durban, Richards Bay, and two minor ports: Port Nolloth and Mossel Bay. Since Transnet's return to profitability a dozen years ago, there has been significantly greater emphasis in TNPA and SAPO (and indeed in all other Transnet business units) on infrastructure, both on capital investment to grow the business, and on repair and replacement of existing infrastructure.

Even though much of the port infrastructure has been ageing, it is generally maintained in an operationally serviceable condition. Regular condition monitoring of all infrastructure informs the work of the maintenance staff. This information is used to identify faults which need to be repaired, and to schedule planned maintenance interventions. The commercial ports infrastructure (defined, for present purposes, to comprise breakwaters, quay walls, terminal areas, lighting, and navigation systems) can be said to be in an acceptable condition for port operations in all the ports. Both the fixed and movable infrastructure still perform well in meeting the safety and operational standards. It would however appear from the breakwater inspections carried out periodically by the CSIR that maintenance interventions are again becoming necessary at most of the breakwaters.

All the ports have facilities for drydocking of large ships. With this capacity, ship repair, properly supported and husbanded, could be a major economic sector. However, on the TNPA books, the dry docks run at as loss, and their maintenance has been neglected.

Apart from its duties with respect to shipping – e.g. inspecting ships for seaworthiness – the South African Maritime Safety Authority (SAMSA) exercises certain regulatory functions over infrastructure at the harbours. These infrastructure responsibilities relate to navigation aids, e.g. beacons and telecommunications – these and others are governed by international agreements. These SAMSA regulations (SAMSA 2016) are a main reason that the navigation equipment at harbours is maintained at a high level.

Over the past two score cards, commercial ports have improved from a C+ grading to a B-.

Rail

Four entities, namely the state-owned companies Transnet and the Passenger Rail Agency of South Africa (PRASA), Gautrain Rapid Rail Link (Gautrain – a public-private partnership, owning only 0.3% of the total track) and the Railway Safety Regulator (RSR), are responsible for the rail sector.

Transnet, operating through its Transnet Freight Rail (TFR) division, is responsible for the management, maintenance and operations of the national freight rail network. TFR has the responsibility for an estimated 21 000 km of route. It has a 20-year budget of R201 billion to increase rail carrying capacity and cargo volumes by refurbishment of existing infrastructure, namely rail, signalling, depots, locomotives and rolling stock, acquisition of new locomotives and rolling stock, and upgrading of other rail infrastructure. This large spend is an indication of a backlog in rail renewal and upgrading and is needed to align with the anticipated 30-year demand forecasts for traffic to ports.

The condition of the export coal, iron ore and manganese heavy haul rail systems is acceptable and the infrastructure appears to be functionally adequate, with the exception of poor electrical, signalling, perway (permanent way) or telecoms conditions of specific sections of route. Table 1 below is a summary, in this case for the export ore system, of the kind of information available on the TFR database. (Green indicates “Good”, and yellow indicates “Average”, whereas red indicates “Poor”.)

Table 1: Export ore system: condition of infrastructure
(Transnet Freight Rail 2015)

Section	Forma-tion	Struc-tures	Per-way	Elec-trical	OHTE	Sig-nals	Tele
Sishen-Saldanha	Green	Green	Yellow	Green	Green	Green	Green
Hotazel- Kimberley	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green
Kimberley- De Aar	Green	Green	Yellow	Green	Green	Green	Yellow
De Aar- Port Elizabeth	Yellow	Yellow	Red	Red	Green	Yellow	Green

The rest of the TFR network appears to be in an adequate condition, except that the branch lines (length 7300 km of which only 4000 km is operational) are very prone to theft, vandalism, and insufficient or no maintenance, resulting in a poor to very poor condition. The grading for general freight lines has been graded as C, C+ and C over the three score cards.

PRASA provides commuter rail services in metropolitan areas, long-distance (inter-city) rail and bus services within, to and from the border of South Africa. PRASA rail operations are

through Metrorail and Main Line Passenger Services (Shosholoza Meyl and Premier Classe).

PRASA has embarked upon a R123 billion improvement programme 2015-2035. This includes the establishment of a local manufacturing facility for rolling stock acquisition. A spares and maintenance agreement with the suppliers has been entered into for the next 18 years, indicating serious intent to ensure a high standard of maintenance. It will take some time to eradicate the serious backlog and to observe significant improvements in service delivery. An early high priority has been upgrading of train control and signalling, in some cases replacing decades-long outdated and sometimes decrepit equipment.

Passenger lines have been graded D+, C- and D+ over the three score cards.

The 80km rapid rail network Gautrain started operation in 2010. With a growing ridership, and demands for extension of the system, the owners have strong incentives to optimise Gautrain's operating and maintenance procedures. As a new facility, the Gautrain has only been graded in the 2017 scorecard – it received an A grading.

KEY DRIVERS

The report cards have over the years increasingly recognised the importance of a number of generic factors which, taken together, often lead directly to infrastructure being in the condition that it is. In brief, the principal of these are:

- Skills: The lack of skills in many organisations responsible for infrastructure – and the impact of this on planning, procurement, design, construction and care of infrastructure.
- Funding: That few infrastructure-owning organisations allocate remotely sufficient funding to maintenance of their existing asset base.
- Systems and procedures: Particularly for infrastructure asset management; revenue enhancement; cost reduction; data collection and interpretation; sharing of information and coordination of activities (e.g. between departments); life-cycle costing; and delivery-directed (rather than blindly rule-bound) procurement.
 - (The 2017 report card highlighted that while the appropriate data might be collected, it is not often made effective use of. Especially (in the context of the report card) data on infrastructure condition – better data allows early identification of need for repair or remediation of some kind, or replacement.)
- Institutions: Institutional weakness, inhibitive of infrastructure asset management, can take many forms, such as: lack of trust between colleagues; little spirit of cooperation; rapid turnover of personnel; and lack of accountability.

The report cards have provided ample evidence of factors which generally determine if, or the extent to which, the infrastructure in the care of a particular organisation – almost irrespective of the infrastructure sector the organization is in – is likely to be adequately maintained and operated.

As noted in the 2011 report card an influential driver is “bold leadership and effective management ... irreplaceable ingredients for successful and sustainable infrastructure provision” (SAICE 2011, page 5). It can be argued that this could be the most influential driver of all. If the top leadership of an organisation is determined to improve infrastructure condition, and management is effective, it should be able to overcome – or plan around – all the constraints.

CONCLUSIONS

The process by which the third South African national infrastructure report card was 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.

Five of the six 'A' or 'B' gradings, namely SANRAL, ACSA, TFR's heavy-haul freight lines, and Gautrain, are in the transport sector. While this is gratifying for the institutions concerned, the fact that more non-transport infrastructure subsectors cannot move above 'C', which, after all, is no better than 'Satisfactory for now', should be of national concern.

Since the release of the 2017 report card, SAICE has been approached by a key national government department with a view to SAICE, in some way still to be determined, assisting government to improve the condition of infrastructure. SAICE has already raised, as a priority, the scarcity of data on the condition of infrastructure, and has requested that the department use its considerable influence with public sector infrastructure-owning entities to improve infrastructure condition monitoring.

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The three report cards are available on the SAICE website (www.civils.org.za) and (2011 report only) on CSIR research space <http://researchspace.csir.co.za/dspace/handle/10204/5807>