CHAPTER 6.6:

INFRASTRUCTURE SECTOR

ABSTRACT

Power, water, telecommunications and transport are the infrastructure services that underpin economic and social activity. Water and sanitation infrastructures are crucial for society, especially during a pandemic in which hygiene plays a critical role in alleviating the spread of the disease. By and large, the infrastructure sector (departments, primary service providers such as Eskom, Transnet, water boards, and the private sector) managed to maintain continuity of services throughout the Covid-19 pandemic. Electricity demand dropped substantially during the lockdown; nevertheless, capacity shortages still caused episodes of load-shedding. The way Eskom implemented its disaster management plan showed that it was resilient and (largely) lived up to its value of 'zero harm'. For the water and sanitation sector, existing systemic problems around coverage and reliability compelled government to rush expensive emergency supplies to water-stressed communities. Although such temporary measures provided services, sustainable, long-term solutions are required. Demand for information and communications technology services escalated rapidly as staff switched to working from home, and students and learners sought online teaching resources. Steps were taken to assist online learning by zero-rating education sites, but these fall short of providing ubiquitous, affordable services. Attention has shifted to infrastructure as a means to stimulate growth as a core part of the Economic Reconstruction and Recovery Plan. New approaches are being pursued to select, implement and fund projects that will, hopefully, address the problems referenced in this review of the power, water, telecommunications and transport sectors. Note that these conclusions on the strengths and limitations of the Covid-19 response are still preliminary and will be refined based on stakeholder consultations and feedback from readers.

DISCLAIMER

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ABBREVIATIONS AND ACRONYMS

CSIR	Council for Scientific and Industrial Research
eduroam	education roaming
GW	gigawatt
ICASA	Independent Communications Authority of South Africa
ICT	information and communications technology
MW	megawatt
SAICE	South African Institution of Civil Engineering
SANRAL	South African National Roads Agency Ltd
SANReN	South African National Research Network
SIDS	Sustainable Infrastructure Development System
SIP	Strategic Infrastructure Project
TENET	Tertiary Education and Research Network of South Africa
TVET	technical and vocational education and training
TWh	terawatt hour
WASH	water, sanitation and hygiene

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INTRODUCTION

Power, water, telecommunications and transport are the infrastructure services that underpin economic and social activity, without which life as we know it is inconceivable. In a disaster situation, ensuring service continuity is a high priority. This is when existing problems are thrown into sharp relief, and gaps where services are most needed are frequently exposed. This chapter examines the role of the infrastructure sector departments, primary service providers (Eskom, Transnet, water boards, etc.), employees and private sector players in maintaining continuity of infrastructure services during the Covid-19 pandemic.

While these role players have by and large managed to keep services going during the pandemic, the broader context paints a less favourable picture. Over the last decade the composition of public finances has shifted away from investment towards consumption (Chapter 6.1). Thus, even before the onset of Covid-19, resources for expanding infrastructure and maintaining existing assets had not kept pace with inflation. Furthermore, in many cases both the implementation of projects and the quality of spending were poor, as is clear from evidence put before the Judicial Commission of Inquiry into Allegations of State Capture. Slowing economic growth from 2015 onwards, worsened by unreliable power supplies, has seen South Africa's fiscal position deteriorate. Public infrastructure budgets have been squeezed. The February 2020 Budget saw cuts of 5% over the three-year expenditure planning cycle. A further R10 billion was cut from conditional infrastructure grants in the June 2020 Special Adjustment Budget, which reprioritised funding towards the Covid-19 relief package and provincial health allocations. The same crucial priorities featured in the February 2021 Budget. Public sector infrastructure spending projections to 2023/24 amount to R791 billion (12% of the total budget). Government has honoured its commitment to capitalise the Infrastructure Fund and provide funding for water and sanitation, energy, and transport and logistics projects (National Treasury, 2021).

Across the infrastructure network sectors examined in this chapter, common themes of skills shortages, inadequate maintenance, inadequate cost recovery and service breakdowns show that the problems are deeper than budget constraints. This is evident from the water and sanitation sector, where systemic problems with managing services in small towns and rural areas remain unsolved. Government mobilised successfully to provide emergency supplies for unserved communities. Schools without water and sanitation were similarly provided with temporary services to weather the first wave of the pandemic, but those were expensive stopgap measures instead of the permanent solutions required. Basic municipal services are essential infrastructure services for public health. The chapter sounds a warning that municipal finances have been severely strained in responding to Covid-19 and may require support from national government in future.

Construction and transport activities were badly affected by the lockdown, as all but emergency operations were suspended. Activity resumed once lockdown levels were eased. Now the country is pinning its hopes on the construction sector to anchor the Economic Reconstruction and Recovery Plan unveiled by President Cyril Ramaphosa in October 2020. Infrastructure is uniquely able to both stimulate growth and respond to the socio-economic needs of the country and its people. A new

system to improve the selection and implementation of infrastructure projects has been set up, along with funding approaches to crowd in private capital, private sector skills, and concessional loans to reduce pressure on the fiscus and drive the recovery.

The rest of this chapter looks first at the energy sector, followed by water and sanitation. Next is information and communications technology (ICT) and telecommunications, and then transport and construction. The section concludes with preliminary lessons learnt, which will be refined based on stakeholder consultations and feedback from readers. Research conducted for each sector drew upon the domain expertise of the author(s), national statistics, briefing documents issued by government departments, documents from state-owned companies and other infrastructure organisations, and interviews with specialists from these organisations.

Note that any conclusions on strengths and limitations in the Covid-19 response are still preliminary and will be refined based on stakeholder consultations and feedback from readers. This report focuses on the first and second waves of the pandemic. Infrastructure services during the further progression of the pandemic will be discussed in the second edition of the Country Report.

ENERGY

THE ELECTRICITY LANDSCAPE

South Africa's electricity demand is met mostly by coal-fired power stations (79% in 2019), which are primarily owned and operated by Eskom, the national power utility. Eskom supplies over 95% of the country's total electricity demand, with the remainder being met by municipalities, imports and independent power producers. Annual electricity production stood at 254 terawatt hours (TWh) in 2010, from where it has trended slightly downwards each year. Production in 2020 was only 234 TWh.

The local power system has seen sporadic periods of supply–demand imbalance for over a decade now. Load-shedding events (initiated by Eskom as a controlled response to unplanned events to protect the electricity system from a total blackout) occurred in 2007–08, 2013–15 and since 2018. This imbalance and consequential load-shedding have been driven by a combination of factors, including the delayed commissioning and underperformance of new-build coal generation capacity at Medupi and Kusile. Also, Eskom's coal fleet energy availability factor has been degraded – the annual average energy availability factor fell from 76,4% in 2016 to 65% in 2020. In contrast, the planned energy availability factor in the Integrated Resource Plan 2019 was 72,5% and 70% for 2019/20 and 2020/21 respectively (Oberholzer & Nxumalo, 2020). The ongoing load-shedding in 2020 demonstrates the inescapable reality of an inadequate power system that still requires urgent attention. About 63% of the year's total load-shedding occurred before the lockdown. Still, despite the lower demand during the economic slowdown, Eskom had to implement stage 2 load-shedding in July, August and September 2020 (Eskom Holdings, 2020).

IMPACT OF COVID-19 ON ELECTRICITY DEMAND

One of the primary impacts of a national lockdown is an unprecedented drop in electricity demand. Globally, countries that went into lockdowns (35% of the global population) experienced average weekly reductions in electricity demand of more than 20%, while overall reductions of 25% have been seen (IEA, 2020). For 2020, the International Energy Association expected reductions in global demand for coal (-8%), oil (-9%) and electricity (-5%), with an overall fall in global energy demand of 6% (IEA, 2020). This would be the largest reduction in global energy demand in 70 years and seven times larger than the impact of the 2008/09 global financial crisis.

Mines are a major consumer of electricity and also supply coal for the production of electricity. During the lockdown, the production of coal for electricity generation was declared an essential service, and mining operations continued. All other mining activity was stopped during alert level 5 (except for care and maintenance), which contributed to lower demand for electricity. Mining operations were allowed to resume during alert level 4, initially with 50% of the workforce, and they gradually returned to full production (see Chapter 6.5 for more detail on mining).

The profile of South Africa's hourly residual demand (electricity that has to be generated from conventional power stations) from 29 March 2020 to 17 January 2021 is shown in Figure 6.6.1, while the 2020 weekly residual demand is shown in Figure 6.6.2. Peak residual demand dropped by up to 11,0 gigawatts (GW) during alert level 5 (average 5,7 GW), by 8,7 GW during level 4 (average 3,3 GW), and 7,3 GW during level 3 (average 0,9 GW). During the five weeks of level 5 lockdown, a 23–26% reduction in weekly energy demand occurred relative to expectations at the beginning of 2020. For 2020 as a whole, residual energy demand fell by some 13 TWh; overall demand was about 6,7% lower than expected for 2020.

Figure 6.6.1: Hourly residual demand, 29 March 2020 to 17 January 2021
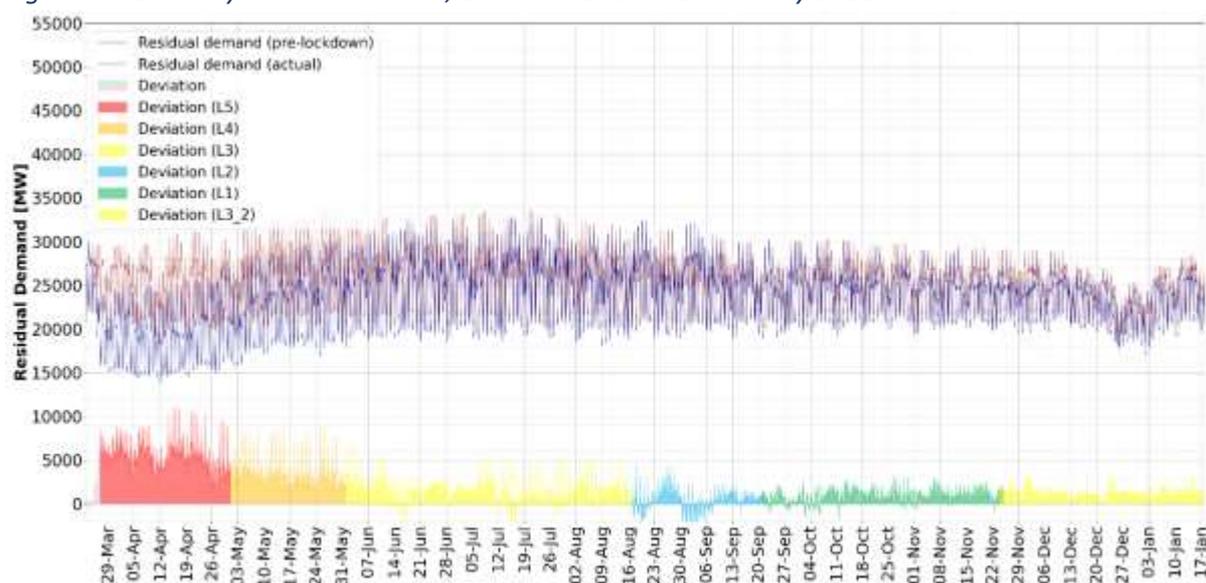
Source: Calitz & Wright, 2021

As the economy reopened further under alert level 3, the return of electrical demand was near immediate; the weekly deviations were already below 5% by end-August 2020. The move to alert levels 2 and 1 from July to September again saw an increase in demand. This, combined with a low energy availability factor, meant that Eskom experienced significantly higher open cycle gas turbine usage, especially in July and August when load factors were approximately 11%. As noted, the state-owned enterprise was forced to implement periods of load-shedding in July, August and September.

Figure 6.6.2: Weekly residual electricity demand, 2020
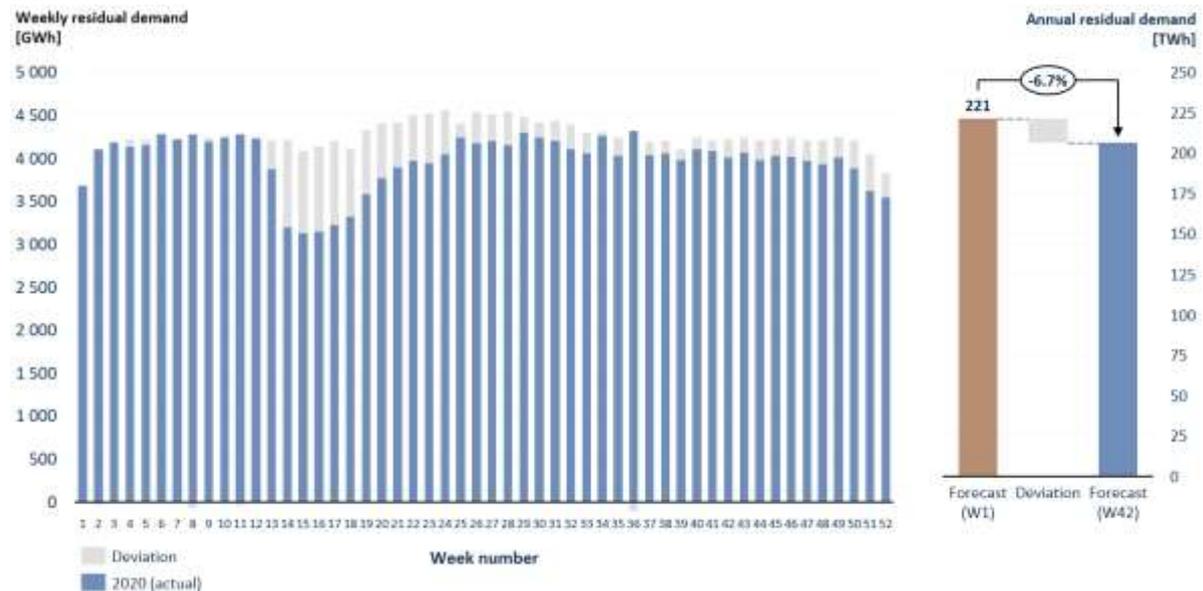
Source: Calitz & Wright, 2021

The lower energy demand during the pandemic allowed Eskom to undertake short-term maintenance to address emergent issues in the generation fleet, including those that contributed to partial load losses – about 2000 MW (Mathebula, 2020). However, the lockdown and related restrictions meant that some reliability outages had to be delayed to later in the year.

ESKOM'S RESPONSE TO THE PANDEMIC

In terms of Eskom's disaster management plan, which is updated annually, it plans for 11 national disaster priorities. A pandemic is one of these. Under its authorised disaster response plan, Eskom's full emergency structure was activated to deal with the pandemic.

Eskom's response to major incidents is led centrally by its strategic Emergency Response Command Centre. The centre coordinates the organisation's tactical response across its various areas of business through emergency structures called tactical command centres. These structures are regularly exercised and were activated across the organisation by 6 March 2020.

Eskom's incident command system is based on the incident command system implemented in the United States after the 9/11 event. This system is designed to respond at short notice and in real time – and served well in coordinating the response in the areas of operations, logistics, safety, compliance

(with the Disaster Management Act and regulations), employee and public communications, and liaison with stakeholders (including regular updates on the state of the system to disaster responders from other sectors and organisations).

In terms of Eskom's pandemic planning and standard operating procedures, the organisation's Covid-19 response was informed by its chief medical officer and its Human Resources Tactical Command Centre. The group chief executive led its internal and external communications, chairing daily briefings by the Emergency Response Command Centre and group executives during the initial lockdown. Extensive internal communications included safety messaging, standard operating procedures, and morale-building through news features on employees at the frontline.

Along with other state-owned enterprises, Eskom acted quickly to support government, making the Academy of Learning available to the Gauteng Department of Health as a quarantine site (Tlhakudi, 2021). Its incident response included innovations led by its research and development department. The research function developed a groundbreaking N-95 mask at a fraction of the cost of traditional masks; it also designed a ventilator and a walk-through sanitiser station.

Eskom benchmarked its pandemic response to that of other organisations. It also led an international task force on Operational Resilience (Covid-19) to collate experience and recommendations from the world's largest grid operators (the GO-15 organisation). Communication with international counterparts was instrumental in decision-making. Eskom utilised its international network to help manage its response to Covid-19; this included a particular focus on system operations, given the related risks to national control. Contingency plans for the standby National Control Centre were activated twice; both were successful without any interruption to operations (Fick, 2020).

Assessment of Eskom's responses showed the organisation was resilient and (largely) lived up to its value of 'zero harm'. Very good processes, procedures and controls were instituted rapidly at the start of the pandemic, in many cases even before the national lockdown had been announced. Strong leadership was evident at multiple levels of the organisation, and the relationship with trade unions was constructive. Also, a project was initiated to identify opportunities arising from the pandemic, such as cost savings through changing work and travel arrangements (Etzinger, 2020).

Box 6.6.1: Koeberg nuclear power station

Given the strategic importance of Koeberg, a specific focus on this nuclear power station is warranted, although many of the interventions summarised here were applied across Eskom's operations (Bakardien, 2020).

At the start of lockdown, Eskom saw a significantly reduced workforce on site, with the majority working from home. Covid-19 mitigation measures were applied, involving social distancing, increased use of personal protective equipment, strict cleaning regimes, a ban on visitors and staff travel, and body temperature measuring of all persons, using fixed thermal scanning for accuracy,

Work regimes were revised (e.g. maintenance resources had been put on a two-week rotation roster – all returned for outage). Certain statutory or nuclear safety-related maintenance activities had to be continued; however, elective work was reduced or interrupted. Operating business changed to avoid contact (e.g. through the use of electronic tools).

Key personnel were kept in isolation. A staffing strategy was adopted with a team in self-quarantine, which ensured the ability to maintain the staff levels required by the regulations and maintain safe operations. This was critical – even if a nuclear plant is shut down, the decay heat due to the used fuel needs to be managed.

Eskom shared learnings with other utilities; Koeberg, through the World Organization of Nuclear Operators, attended bi-weekly world conference calls to share Covid-19 best practices.

Koeberg Unit 2 was placed in extended cold reserve because of challenges with implementing a refuelling outage and the need for international contractors.[1] The travel ban affected the international resources needed to support the outage. A handful of essential activities could not be undertaken by site/local personnel, mainly because of the need for special tooling.

Koeberg experienced minimal impact on the supply chain because its stocks were adequate. Emergency spares needed during outage were difficult to obtain at times, but no safety impact was evident.

A weekly engagement session was established with the Nuclear Regulator to deal with all aspects/regulatory questions and requirements related to Covid-19. All statutory maintenance and testing were performed, and some routine maintenance was postponed following evaluation as per the equipment reliability process.

The emergency response plan was confirmed to be fully functional and implementable even in the hard lockdown. A few additions were made to enhance the ability to limit interaction – for example, the method of call-outs was adapted to allow the use of text messages to supplement the paging system, removing the need for human interface in handing over pagers.

Attention was given to the Covid-19 impact on human performance (mental stress, hot working conditions, and face masks) during pre-job briefs and observations; this had been highlighted as a significant risk to nuclear operators internationally. Modifications were made to job risk assessments for Covid-19 conditions. A clinical psychologist was deployed to monitor and engage (mainly operating) staff to help identify and manage stress brought on by the pandemic situation.

New communication services were started, with a daily (and subsequently weekly) newsletter focused solely on Covid-19. The Preventive and Social Medicine online communication tool was used to inform staff of all cases of infection and was updated on a weekly basis.

A staffing strategy was developed to ensure that resource numbers for critical functions were maintained. Vulnerable employees were identified, and their risks assessed. A contract tracing protocol was put in place for positive tests. An extensive return-to-work protocol was established to manage recovered cases. Leadership was provided by a full-time manager to manage the Covid-19 strategy and plan, aided by Covid-19 compliance officers. A full-time, on-site medical service (with a doctor) supported the initiative.

Mass testing was performed. Following 100% Covid-19 testing, only 1,7% of the workforce (asymptomatic positive individuals) was removed from the workplace. No on-site infections were reported.

WATER AND SANITATION

THE WATER AND SANITATION LANDSCAPE[2]

Water and sanitation infrastructure is crucial for society, especially during a pandemic in which hygiene plays a critical role in limiting the spread of the disease. Hence, it is of paramount importance to secure safe and reliable water and sanitation infrastructure to protect public health. In South Africa, the Department of Water and Sanitation is responsible for most large water resource infrastructure

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[1] Senior government officials stepped in to assist critical investment projects and strategic sectors: 'We were able to coordinate intergovernmentally through various spheres (transport, flights, visas etc.), and we were able to bring the people into the country' (Carim & Hoosen, 2021).

[2] Water service denotes water supply to users, involving the abstraction and treatment of raw water and distribution to consumers. Sanitation services comprise on-site sanitation and the collection and treatment of wastewater to produce high-quality effluent that can be safely discharged to the environment or reused.

and for the planning and implementation of large water resource development projects, such as the construction of dams and inter-basin transfer schemes. Other key role players include the following:

1. The *municipalities* operate some local water resource infrastructure (e.g. dams and boreholes) and bulk water supply schemes; supply water and sanitation to consumers (households, businesses and industries); and operate wastewater collection and treatment systems. Most water services infrastructure is located in and under the management of municipalities, except for the bulk services provided by water boards.

2. The 13 *government-owned water boards* operate some water resource infrastructure, bulk potable water supply schemes (selling to municipalities and industries), retail water infrastructure, and wastewater systems.

3. *Community-based organisations* run some small water schemes in rural areas.

4. *Publicly or privately owned companies* provide some water services.

South Africa is a semi-arid, developing country with average rainfall of 450 mm/year, about half the world average of around 860 mm/year (Kongolo, 2011). Its primary water sources are unevenly distributed; therefore, it depends on vital storage reservoirs to maintain reliable water supplies and has had to develop a sophisticated bulk transfer operation to augment supply to water-scarce areas.

The basic domestic water use component (of 25 litres/person/day) translates to 490 million m^3/year or 11% of the total domestic water use of 4,5 billion m^3/year. Many rural settlements still have insufficient water resources to meet their basic water needs. Without effective metering and billing, consumption in urban and rural areas could rise to over 7 billion m^3/year, resulting in an increase in total water use of close on 20 billion m^3/year (DWA, 2015). If it continues to use the remaining water resources at its present rate of consumption, South Africa could run out of drinking water by 2030.

WATER AND SANITATION INFRASTRUCTURE

An infrastructure report card for South Africa developed by the South African Institution of Civil Engineering (SAICE, 2017) indicated that both *water resource and water supply infrastructure* generally follow the national trend of being at risk. Bulk water resource infrastructure is not coping with increased demand and is poorly maintained, putting it at risk of failure. Although water supply infrastructure in major urban areas is satisfactory for now, SAICE highlights the need for medium-term investment to avoid serious deficiencies. In peri-urban and rural areas, the water supply infrastructure continues to be at risk. While South Africa is one of the few countries that preserve the constitutional right for all of its citizens to be provided with an environment not harmful to their health or well-being, the provision of clean and safe drinking water remains unequal. Significant disparities in water supply infrastructure persist between rural and urban communities. In almost all urban areas, the infrastructure for water treatment and supply to consumers is of high quality, whereas in rural areas it is poor or non-existent (Mackintosh & Colvin, 2003, Momba et al., 2004, Khabo-Mmekoa & Momba, 2019). Urban communities are provided with safe drinking water that meets the South African National Standard Drinking Water Specification, and households have access to pipes or taps indoors.

In contrast, rural communities rely on open water sources or collect water from communal standpipes outside their houses and have to store it until needed (Khabo-Mmekoa & Momba, 2019). This situation is exacerbated by a lack of funding and experience in local authorities to plan and design water infrastructure for their communities (DWAF, 1994).

Access to an improved water source is generally defined as a household supply of 20 litres of water that can be fetched within a 30-minute round trip, a distance of about 1 kilometre. In South Africa, access means a household supply of 25 litres of potable water per person per day within 200 m. Table 6.6.1 shows the percentage of South African households with access to piped or tap water inside their dwellings, off-site or on-site between 2014 and 2019; this highlights the persistence of disparities in access to water between provinces. Household access to water declined in all provinces, except Gauteng, between 2014 and 2019.

Table 6.6.1: Household access to piped water, by province, 2014 to 2019

Province	2014	2016	2017	2018	2019
Western Cape	98,9	98,7	98,7	98,7	98,5
Eastern Cape	78,7	76,4	74,2	75,1	73,9
Northern Cape	96,0	96,0	96,0	95,3	94,0
Free State	95,2	93,2	92,8	91,1	91,9
KwaZulu-Natal	87,8	84,2	84,5	86,6	85,4
North West	87,2	86,7	85,8	85,2	82,1
Gauteng	96,5	97,5	97,1	97,1	97,6
Mpumalanga	87,2	85,4	85,5	86,5	85,2
Limpopo	79,6	75,1	74,7	74,1	70,0
South Africa	90,1	89,0	88,6	89,0	88,2

Note: Access to piped water in dwellings or off- or on-site.
Source: Stats SA, 2020

As is the case for water, access to *sanitation infrastructure* varies widely between rural and urban areas and between provinces. Nationally, access to adequate sanitation infrastructure (e.g. flush toilets connected to public sewerage systems or a septic tank, or a pit toilet with a ventilation pipe) stood at 82,1% in 2019; the most urbanised provinces, such as the Western Cape (94,5%) and Gauteng (90,0%), have the highest access. The lowest access to this type of sanitation infrastructure is in Limpopo (63,4%) and Mpumalanga (63,7%).

Sanitation infrastructure, including wastewater treatment, reflects these disparities. Currently, there are 826 municipality-owned wastewater treatment works in South Africa. In terms of Green Drop performance categories, 824 wastewater treatment plants and 152 municipalities were assessed in 2016. The majority of those plants (259) were high risk, 218 plants were medium risk, 212 plants were at critical risk, and 135 plants were low risk. SAICE (2017) classifies sanitation infrastructure in major urban areas as satisfactory; however, in other areas, sanitation infrastructure has already failed or is on the verge of failure, potentially exposing the public to serious health and safety hazards. Sanitation

infrastructure in these areas requires immediate action, as devastating events, such the deaths of school children in latrines, have underscored. Challenges facing the country in providing adequate water and sanitation infrastructure are summarised in Table 6.6.2.

Table 6.6.2: Challenges around access to water and sanitation infrastructure

Water infrastructure	
• Ageing bulk infrastructure • Most already reached end of useful life and require refurbishment or replacement. • Large dams developing capacity problems and require urgent refurbishing. • Serious concerns about funding for maintenance. • Farm dams deteriorating fast because of a lack of maintenance. • Pollution problems increased. • Maintenance of existing infrastructure • Skills shortage	• Major strides in provision of water since 1994, but services unsustainable due to focus on quantity, not quality. • Water quality a serious problem nationally; Blue Drop certification helping to improve water quality management in municipalities. • Water wastage (leakage) still too high. Shortage of skilled personnel and officials. • Increase in strikes in urban and rural areas – an effort to force improvement in services. • Financial mismanagement and fraud increased.
Sanitation infrastructure	
• Serious problems with management of many wastewater (sewage) treatment works. • Wastewater leakage and spillage, especially into major rivers, still too high. • Many anecdotal accounts support low grading for sanitation. • Frequent problems with on-site sanitation, ventilated improved pit toilets fill up, no capacity for emptying.	• Lack of buy-in from users. • Inadequate operation and maintenance capacity; shortage of skilled personnel. • Lack of knowledge, and inappropriate solutions implemented. • Sanitation backlog increasing due to unsustainable infrastructure.

WATER, HYGIENE AND SANITATION (WASH)

Environmental hygiene plays a crucial role in preventing many diseases and preserving water resources and the natural environment. Washing hands after using the toilet is vital to control infectious diseases. In 2019, less than half (43,6%) of households indicated that their members usually washed their hands with soap and water after using the toilet. The use of soap and water to wash hands was the highest in Western and Northern Cape (both 60,5%) and the lowest in Limpopo (28,4%) (Stats SA, 2020).

GOVERNMENT RESPONSE TO THE CRISIS

The Covid-19 pandemic has highlighted the value of public services related to health. Ensuring a safe and reliable water supply and maintaining proper sanitation have become ever more critical during the pandemic. Limited access, low reliability, and poor quality of WASH infrastructure present risks to vulnerable groups in both rural and urban areas. Informal settlements, townships, rural areas, and (urban and rural) homeless people have been prioritised as highly vulnerable communities, because they have trouble accessing water and sanitation resources during the pandemic (Hara et al., 2020).

The Department of Cooperative Governance and Traditional Affairs took a strategic decision to use the district development model as a framework for implementing Covid-19 measures. The framework aims to break down 'silos' in government by promoting integrated planning and service delivery implementation across all spheres of government at the district or metropolitan scale. Disaster management approaches were to be integrated into the model, with political and operational structures in the municipal sphere to be located within the district and metropolitan municipalities rather than in the local municipalities. Capacity from national government would be deployed where necessary to district hubs in high-risk areas (Harrison, 2020). While the district development model had not yet been applied comprehensively across South Africa, the department's decision has allowed some early lessons to emerge; these are discussed below.

Water-stressed communities: The need to ensure a safe and reliable water supply and maintain adequate water and sanitation infrastructure was ever more critical during the Covid-19 pandemic, especially to enable preventative measures. The pandemic revealed the complexity of WASH infrastructure investment backlogs and inequalities. Government addressed the historical access gap through emergency supplies (e.g. water storage tanks, water trucks and sanitisers) to water-stressed communities in the short term (Monyane et al., 2020). The Department of Water and Sanitation secured exclusive access to water tanks from manufacturers and purchased these for municipalities in water-stressed communities. The targeted beneficiaries were low-income, vulnerable communities. Easily accessible areas were identified within municipalities for water tankers to be stationed, such as schools and hospitals. Rand Water was appointed as the implementing agent for the initiative.

The department originally set aside R306 million for this initiative as part of the 2019/20 Budget. Because the pandemic lasted longer than expected, tankering services were extended for 90 days (until end-August 2020) at an additional cost of R200 million. By 31 July 2020, the National Command Centre reported that 6107 (69%) tanks had been installed. By 30 September 2020, this had increased to 8125 (91%) tanks. The number of tankers (306) remained the same (AGSA, 2020).

The rapid roll-out of emergency water supplies was not without problems. The Auditor-General (AGSA, 2020) noted issues such as inconsistent quality of tank installation. Audits in Limpopo, the North West and Gauteng during July and August 2020 showed that some 16% of the sampled tanks were empty. Other problems included the theft of a 5000-litre water tank installed at the largest graveyard in Letlhabile, Madibeng at a cost of R20 000 (Basson, 2020). While the provision of tankered water was a significant intervention that reached many people, 'we found sites with no tanks and tanks without water, which indicates that the planned achievements of this initiative to supply water to communities in need may not have been met in all instances, as intended by the department' (AGSA, 2020:219).

On 31 August 2020, Rand Water stopped all tankering services. At the time of the review, the department had not indicated how Rand Water would demobilise the tanks or how tankering services would be sustained for existing tanks until a more permanent solution had been found (AGSA, 2020).

Water and sanitation in schools: Progress has been slow in addressing the apartheid-era infrastructure backlogs in schools. This left school infrastructure in many areas unprepared to deal with the pandemic. To help prepare schools for reopening, the Department of Basic Education provided a R610 million phase I relief package from the conditional school infrastructure backlog grant to supply emergency water to 3173 selected public schools in six provinces (excluding Gauteng and the Northern and Western Cape, where facilities were deemed adequate); it also provided R50 million for emergency school sanitation. The provinces (excluding Limpopo and the Western Cape) reprioritised a total of R650 million from their conditional infrastructure grants to fund the provision of water. By 30 September 2020 the total expenditure on emergency water and basic sanitation services for schools stood at R160 million (AGSA, 2020). Phase II of the programme is intended to provide permanent tank installations. Portable toilets, which were rented for only three months (in alert level 5), were temporary solutions to historical problems that need to be addressed sustainably and permanently ([Brener, 2020](#)). Audits of the programme have since revealed problems with information accuracy, quality and cost controls (AGSA, 2020).

There have been large reductions in the education conditional grants in the pandemic, most notably in the education infrastructure grant, which funds infrastructure for addressing backlogs in the schooling system. Because of these cuts, 1938 school infrastructure projects have been suspended or delayed. In other words, these temporary interventions have come at the expense of long-term, permanent improvements to school infrastructure ([Brener, 2020](#)).

Two *lessons for the district development model* emerged from the disaster:

- Districts are an important scale for coordination; yet, in the more rural provinces, they are territorially vast, with their structures physically and institutionally distant from communities. In these cases, the local equivalent of district command councils was set up during the pandemic.
- Arrangements put in place in March and early April did not pay sufficient attention to extending structures to the community (or ward) level. Instead, they were overly focused on the logistics of managing a vertically arranged system. But containment and social support (e.g. screening, contact tracing, communication, identification of vulnerable households, and distribution of food parcels) require information, support and coordination as close to the ground as possible. As the pandemic took hold, it became apparent that places with functioning ward structures (most notably KwaZulu-Natal but also individual municipalities elsewhere) had a significant advantage. By July, the need for ward-based approaches was widely accepted, and there was talk of adapting the district development model to include this grass-roots component. However, for some provinces, this adaptation came late in the life cycle of the pandemic (Harrison, 2020).

IMPACT OF COVID-19 ON WATER AND SANITATION

Water and sanitation infrastructure had a direct effect on sustaining public health in the pandemic. Major water and sanitation services deficits made it harder to contain the virus, especially in urban areas (Butler, 2020). Covid-19 affected the sector in the following related aspects:

- *Revenue losses for utilities:* Lockdown and travel restrictions have resulted in revenue losses for utilities because of the decline in water demand from large industrial and commercial users and the inability of vulnerable groups to pay their bills. Thousands of desperate residents have been complaining about municipalities cutting off the water supply to residents who are in arrears. In some cases, water has been cut for no apparent reason. Most of these complaints to the department's call centres originated in the Western Cape, KwaZulu-Natal and Gauteng (Northglen News, 2020). Supply disruptions led government to employ emergency measures, and municipalities were requested not to cut water supply in the lockdown. 'Efforts should be focused on fighting the spread of the virus' (DWS, 2020).
- *Lack of capacity and infrastructure:* In cities and towns, especially in poor communities, water utilities and municipalities often lack both capacity and infrastructure to ensure a continuous, equitable and safe water supply under emergency conditions (Srivastava et al., 2020)
- *Decline of capital expenditure:* New capital projects have been delayed as municipalities prioritised operating expenses in the short to medium term. These projects include raising Hazelmere Dam in KwaZulu-Natal, Tzaneen Dam in Limpopo, and the Olifants River Water Resources Development. The delay has contributed to contractual and claim disputes, a loss of public confidence, illegal mining, water shortages, and the transfer of a project from Lepelle North Water to the Department of Water and Sanitation. The project completion dates had been between March 2020 and 2021 (Johnson, 2019).

ROLE OF MUNICIPALITIES

Municipalities were at the frontline of governance, bearing much of the burden, and they require targeted support into the future. Although relegated to the margins of decision-making, they were responsible for the bulk of implementation during the crisis. Municipalities had to maintain essential services while accepting an expanded range of functions (some possibly outside their constitutional mandate) at a time of falling income. The short-term consequences for municipalities in terms of pressure on finances and personnel, and on their ability to maintain functions, were severe, but the medium- to long-term consequences may be even worse. There is a possibility – even a likelihood – of a public finance crisis at the local level, with serious implications for the provision and maintenance of infrastructure and services, and for public stability and safety. Some of the worst consequences of the reduced revenues and increased budgetary demands may be played out over a long period. This requires increased support to municipalities from provincial and national government, along with more innovative responses to service delivery by the municipalities themselves (Harrison, 2020).

WATER AND SANITATION INFRASTRUCTURE BEYOND COVID-19

Water and sanitation infrastructure can contribute to more efficient services, better public health, and economic growth. It is, therefore, crucial for government in general and the Department of Water and Sanitation in particular to address the challenges listed in Table 6.6.2. Addressing these challenges would require political will, capacity building, finance, data and information, and accountability. In the

medium term, the focus should be on people living in informal settlements, the poorest and most marginalised communities, who often rely on communal water points and toilets, private vendors, water tankers and the like. Preparing for future pandemics would require upgrading and redesigning water and sanitation infrastructure to ensure sustainable supplies of water of acceptable quality.

ICT AND TELECOMMUNICATIONS INFRASTRUCTURE

The pandemic has tested the telecommunications and information and communications technology (ICT) infrastructure of most countries. Lockdowns and the need for social distancing required people to conduct their business in different ways. ICT and services were core to solutions for e-health, online education, e-commerce and entertainment. Arguably the ICT sector was less affected by the pandemic; instead, telecommunications companies benefitted from providing these services.

The pandemic highlighted ICT deficiencies in the public sector. Managing the crisis required accurate and timely flows of data and effective modelling, but the lockdown meant that many functions of governance could be sustained only through online communication. There was a huge disparity in access to, and the quality of, ICT infrastructures and services. Government agencies still largely dependent on manual systems were severely affected in terms of functionality (Harrison, 2020).

As demand for ICT services and infrastructure increased, global conditions and travel restrictions delayed access to vital components (e.g. fibre-optic cables). South Africa had been developing a strategy to roll out connectivity – the SA Connect initiative aimed to reach 90% of the population by 2020 and 100% by 2030 by rolling out fibre beyond affluent areas and extending ICT to underserviced areas. Progress on SA Connect had already been delayed, and Covid-19 compounded the problem.

IMPACT OF THE PANDEMIC ON ICT

A report from the International Telecommunications Union (Giovannetti, 2020) showed that the spread of the pandemic across regions and nations follows patterns of underlying social and economic inequality, among them digital exclusion. People in areas with poor broadband coverage cannot access distance learning, e-commerce or healthcare information. In sub-Saharan Africa, only 53% of the population has decent (4G) connectivity, while the figure for Eastern Europe is 78% (Okeleke, 2020). Dr Charley Lewis, independent ICT analyst and researcher, points out that with South Africa's low Internet penetration rate, only the privileged few can leverage the digital opportunities that ease adherence to social distancing rules. Other barriers are demand-side, such as limited affordability and digital illiteracy. These are important considerations for understanding the impact of Covid-19 on South African society and how this divide affected communities in areas such as public health, access to data, and affordability. In general, for connected households, the pandemic has been survivable; for digitally marginalised people, however, Covid-19 has been an altogether different story.

Telecommunications networks were largely resilient in coping with higher demand. Participants at a round table hosted by Dr Raul Katz (ITU, 2020) came to conclusion that:

- Accessible ultra-broadband technologies (e.g. fibre to the home) appear to be better prepared to respond to spikes in network traffic.
- Countries with the largest deployments of accessible ultra-broadband have seen less slowdown in latency and download speed.
- Wi-Fi capacity has been stressed by an 80% increase in personal uploads to cloud computing platforms; peaks from video conference calls required additional spectrum to be assigned for unlicensed use.
- The pandemic has had an almost immediate impact on the financial performance of digital infrastructure companies. Annual revenue is expected to fall by about 10%, and media companies were expecting a significant decline in advertising revenue.
- Increased traffic has resulted in faster capital expenditure to expand capacity, while spending on projects such as network modernisation has been deferred.
- Future sources of funding to fill the gap could include governments or development finance institutions. For example, the International Finance Cooperation is deploying a US$2 billion line of credit and is seeking investment opportunities.

Reporting in the financial press on South Africa's ICT sector shows that it had likewise been affected, both positively and negatively. On the one hand, apps were built for Covid-19 screening and tracing based on the Internet of things. On the other, cybercrime increased. Other impacts included:

- *E-commerce* (online shopping) is a major driver for ICT services, as many people resorted to online shopping to avoid crowded public spaces. However, the adoption of e-commerce was hampered by the limited connectivity in the country, along with a fear of cybercrime. Retailers are also at various levels of preparedness – some large corporates were better prepared with infrastructure and services, while some smaller businesses were negatively affected.
- *Alternative working conditions:* Most sectors evaluated how businesses could continue without employees having to travel to offices, for both employees and employers. Connectivity coverage for employees at home is critical for such initiatives.
- *Online education:* The education sector looked at alternative ways of providing content, through either full online education or delivering content online to allow students and learners to access the material (see Chapter 5.2 on education).
- *Data access for decision-making purposes:* Government had to establish mechanisms to help it understand the spread of the virus and its impact on communities. This required the ICT sector to respond with services and infrastructure within a very short period.
- *Research and development to combat the virus:* Significant ICT-supported research was necessary to develop vaccines and processes to combat the spread of the virus.

MEASURES IMPLEMENTED BY THE PUBLIC AND PRIVATE SECTORS

After South African schools closed on 18 March 2020 for the lockdown, online learning and teaching were compromised by weak ICT infrastructure and exorbitant data costs. This highlighted the inequalities in the country's spatial planning and distribution of resources. Most schools in affluent

communities could implement mechanisms to support online learning, while few others could afford such initiatives (Chapter 5.2). In an effort to mitigate the impact of Covid-19 on the 2020 academic year, the Ministry of Higher Education, Science and Innovation established a task team to support the efforts of higher education institutions to save the academic year. As part of these efforts, the Council for Scientific and Industrial Research (CSIR) was asked to help develop a *geo-spatial modelling capability* to map and analyse the levels and quality of Internet connectivity across the country for remote learning. The analysis sought to determine the number of technical and vocational education and training (TVET) students without any coverage (3G or 4G), TVET students without 4G coverage, university students without any coverage (3G or 4G), and university students without 4G coverage. It also considered whether there were nearby facilities, such as libraries, campus sites and sites connected to the South African National Research Network (SANReN), that students without any network coverage could potentially access.

The Independent Communications Authority of South Africa (ICASA) assigned emergency temporary spectrum to the local telecommunications industry in April 2020 in expectation of higher data usage. It also made regulatory concessions to the industry, such as relaxing the tariff notification filling requirements and providing frequency spectrum relief throughout the lockdown. This enabled operators to accelerate the roll-out of *affordable data access*; some even offered additional capacity at no extra cost. Vodacom and MTN reduced data prices by at least 30% and 50%, respectively, from 1 April. Furthermore, most operators zero-rated Internet sites that were crucial for education (see Chapter 5.2 on education).

The South African ICT industry formed a voluntary consortium to identify opportunities for the sector to release the required resources. The task team aimed to develop responses to support relevant state structures, business and society at large to help combat the pandemic. It produced a report on ways of implementing online education in a sustainable manner. This suggests that existing state broadband assets (e.g. at state-owned enterprises) and spectrum allocation should be consolidated to provide the necessary connectivity. A model to provide ICT equipment to learners is also necessary.

The Department of Health needed a *dashboard* with regular updates on the status of the Covid-19 infections and the spread of the disease. The CSIR, with the National Institute for Communicable Diseases, built a platform that utilised existing capabilities to provide this dashboard. It was clear that for this system to function at national level, a private cloud environment was necessary; this was supplied from the National Integrated Cyberinfrastructure System, which provides cloud computing platforms to government. To help the *contact tracing* and tracking initiative, data from mobile operators was utilised – the Bluetooth functionalities on smart phones are activated, and apps alert users when they have been in contact with a person infected with Covid-19. Another method used aggregated data from mobile phones without user intervention; this was anonymised to provide movement trends to help authorities in areas where social distancing might be neglected.

Successes, challenges and recommendations

Contact teaching will remain susceptible to disruptions from external factors such as Covid-19. Over 430 000 teachers in South Africa's 25 154 ordinary schools teach more than 12 million learners daily, according to the Department of Basic Education. This excludes private schools and schools for learners with special educational needs. Shamira Ahmed, principal researcher and economist at Research ICT Africa, indicates that the pandemic is likely to increase digital inequality, unless policymakers and regulators respond swiftly. She emphasised that Basic Education's strategy 2015–20, which includes policies to facilitate e-learning platforms, requires implementation.

The zero-rating of some academic sites by mobile operators is a good initiative. However, the broader use of the Internet for accessing learning materials led to sites that were not zero-rated; these easily depleted users' data allowances. Mobile data is not sustainable when students are supposed to be spending hours online; better forms of access should be explored.

The Department of Higher Education and Training obtained information on their students to identify challenges they face away from campus. However, help in this regard was slow to reach students because of the prolonged procurement process under the National Student Financial Aid Scheme.

As proposed by the ICT industry, using the spare capacity of state-owned enterprises for responding to the pandemic and supporting marginalised communities is critical for sustainable connectivity. In this regard, the Department of Communications and Digital Technologies stated, 'The business case is being developed for a state digital infrastructure company. The business model is not finalised but depending on how its mandate pans out and depending on the availability of funding, its mandate could be a full national carrier or a national open access network that could cover the rural areas as well' (Jordan-Dyani, 2021).

Such a move should be coupled with the proposal to license the spectrum with conditions to provide connectivity to poor communities. Eduroam (education roaming) is a secure, worldwide roaming access service developed for the international research and education community, operated in South Africa by the Tertiary Education and Research Network of South Africa (TENET) and SANReN. It can be extended beyond the campus environment to the metros to help students connect. For the health sector, a dedicated network similar to SANReN could be a better option.

Using information from mobile phones for tracking contacts is potentially a good solution, bearing in mind the limitations of technologies such as Bluetooth and triangulation. Issues of privacy remain a barrier in this regard, and regulatory issues could assist in getting this technology fully utilised.

TRANSPORT AND CONSTRUCTION

INTERNATIONAL SITUATION

Internationally, and particularly in developing economies, the transport infrastructure sector faces several challenges. Key among these is a lack of capital for investing in new infrastructure and for upgrading and maintaining infrastructure to address both socio-economic (e.g. rural accessibility, urbanisation, passenger and freight logistics) and environmental challenges (climate change). Globally the infrastructure gap is widening, particularly around maintenance (PWC, 2020). The Covid-19 pandemic added a whole new set of challenges, which to some extent also affect the infrastructure sector (Torres & Garcia-Kilroy, 2020). These include travel and supply chain disruptions, as well as changes in human behaviour, such as remote working and networking. This could potentially lead to a permanent shift in working patterns and possibly even alleviate pressure on transport networks and supporting infrastructure. Travel bans and social distancing also had a direct impact on the availability of labour, which had a significant impact on the construction industry. Because of the lockdowns and the associated impact on labour availability and disruptions to the supply chain, project management teams had to prioritise health and re-examine their approach to project delivery and maintenance.

The pandemic also resulted in an economic contraction, which not only brought a sharp increase in unemployment but also affected infrastructure investment. Funding earmarked for construction and maintenance was redirected to initiatives such as unemployment benefits and healthcare; this widened infrastructure deficits and made funding even more challenging. Several countries, including South Africa, have opted for increasing investment in infrastructure as a means of rebuilding the economy. With construction (and maintenance) being a labour-intensive sector, this effort would also contribute to job creation. The focus on 'shovel-ready' projects that do not require extensive planning and design means this initiative could quickly boost economic output.

SITUATION IN SOUTH AFRICA

The *construction* sector employs about 1,3 million people, which stayed relatively constant from the first quarter of 2019 to the first quarter of 2020. At the time of the pandemic, the construction industry had been in distress for several years: it faced declining government infrastructure spending (and hence, a lack of work), late or non-payment, rising material costs, lower profit margins, and illegal construction site invasions, which resulted in company closures and job losses.

In the run-up to the 2010 World Cup, South Africa witnessed a surge in infrastructure development, including the Gauteng Freeway Improvement Project. However, since then there has been a shortage of major construction projects, resulting in a slowdown in the construction sector. Public sector capital expenditure on infrastructure has declined. According to a 2019 report by Statistics South Africa, the country's 757 public sector institutions spent R250 billion on fixed assets in 2018, R272 billion in 2017, and R283 billion in 2016. This reduction in capital expenditure by the public sector contributed to

companies such as Group Five and Basil Read having to undergo business rescue processes in March 2019 and June 2018, respectively (Zingoni, 2020).

The construction sector was hit hard by the pandemic. When the national lockdown started on 27 March 2020, all construction activities were put on hold, save for emergency repairs and maintenance of essential services infrastructure. This contributed to a further contraction of the sector. Data from Statistics South Africa for the second quarter of 2020 showed the construction sector declining by a seasonally adjusted and annualised rate of 76,6%. The value it added to the economy saw a year-on-year change of -30,7% in the second quarter of 2020, as against -2,2% and -0,9% in the previous two quarters. Gross fixed capital formation declined by a seasonally adjusted, annualised rate of 59,9% (quarter-on-quarter), because of decreasing investment in construction (-76%), residential buildings (-77%) and non-residential buildings (-81%). In October 2020, the South African National Roads Agency (SANRAL) reported slow budget expenditure, owing to the suspension of construction activities and project delays, and revenue loss because of lower traffic on toll roads, mainly in the second quarter of the year. In the same month, Minister Patricia De Lille confirmed that the construction industry was one of the most severely affected by the economic downturn, having contracted by 14,2%.

Transport infrastructure projects financed through public-private partnerships, and particularly those that rely on user-pay principles to generate capital for upgrades and maintenance, are particularly vulnerable to shocks such as those caused by the pandemic. Examples include the Gautrain and the N1, N2, N3 and N4 national road concessions. In the hard stages of the lockdown, road and rail usage, and therefore the revenue collected from users, fell significantly. SANRAL reported a revenue loss of R640 million between April and October 2020 because of lower traffic on toll roads in the lockdown (Arnoldi, 2020). Similarly, the N1/N4 toll road concessionaire, Bakwena, reported in July 2020 that light vehicle traffic fell by 84% and heavy vehicle traffic by 56% from normal levels during alert level 5 and by 58% and 36%, respectively, during level 4. During level 3, traffic volumes improved to 72–79% of pre-lockdown volumes for light vehicles and to 80–88% for heavy vehicles (see also Chapter 6.4).

As noted, the construction industry contracted sharply during the pandemic (Odendaal, 2020). However, construction sites were reactivated for full operation on 1 June 2020 when South Africa moved to alert level 3. This was due in part to the Construction Covid-19 Rapid Response Task Team (2020), a voluntary body comprising a range of professional and industry bodies, which provided sectorial guidance and support to government. SANRAL reported that its construction sites were at 100% capacity from August 2020 (Arnoldi, 2020). Now the construction sector has been reactivated, it needs to rebalance its focus if it wants to 'build back up and better'.

Box 6.6.2: Transnet SOC

Transnet identified the risk that Covid-19 posed to the organisation relatively early – it implemented its business continuity response process in January 2020, initially focusing on heath protocols. In March 2020 it escalated the response and devised an approach based on enhanced communication, responsiveness and adaptability to augment and support normal business functions. This resulted in the Transnet Covid-19 Command Centre being established, primarily a coordination and communication-focused nexus of information on the pandemic designed to support internal decision-making. The command centre brought

together critical functions, tailoring its focus to key requirements (e.g. employee health and safety, operational continuity, legal and regulatory compliance, ICT, and human resources).

The pandemic and lockdown posed serious disruptions to Transnet's operations. As part of its normal course of business, Transnet must interact with and facilitate trade between international and interprovincial entities, customers and suppliers. In practical terms, employees who work in close proximity and in environments not conducive to sterilisation would be exposed to potential infection. Transnet acted to protect employees and ensure a safe operational environment through the use of the highest available quality of personal protective equipment. It also instituted home screening, issued tools to employees for effective self-screening, implemented companywide sterilisation with targeted post-case clean-up, and issued an ongoing work-from-home instruction to all support staff and employees at high risk from the virus.

In parallel to the employee health and wellness focus, Transnet introduced a high-intensity operations workstream in the Covid-19 Command Centre as a coordination function, bringing together various decision-makers to enable safe operational activities, depending on regulatory, legal/contractual, financial and operational factors. Part of its role was to monitor, and coordinate the response to, the pandemic's impact on the company's infrastructure; in this regard, two key themes emerged:

- Disrupted planned maintenance activities in the initial stages of the lockdown (rolling stock maintenance depots being disrupted because of Covid-19 cases, planned infrastructure maintenance being delayed due to suppliers being shut, etc.)
- An increase in criminal activities causing operational disruptions (pipeline 'hot taps', cable theft, etc.).

These incidents caused significant day-to-day operational disruptions. While they occurred more often during the lockdown, they fit the existing pattern of threats to Transnet's infrastructure. To help mitigate the spike of incidents, multifaceted approaches were adopted, including the creation of reserve teams to supplement lost capacity, close engagements with law enforcement and private security firms, community engagement, and advertisements placed to educate communities on the impact and risks of theft and vandalism.

Source: Naidoo, 2020

INFRASTRUCTURE INVESTMENT FOR ECONOMIC GROWTH

Government acknowledges that infrastructure-led growth, as part of the economic growth strategy, is an effective and significant way to support the economy while also responding to socio-economic needs. Infrastructure investment, together with the use of public land and buildings, is a critical lever to achieve spatial and economic justice by connecting people, integrating communities, and bringing people closer to work opportunities. Infrastructure investment not only addresses new infrastructure; it also deals with the maintenance and repair of existing infrastructure.

In May 2019, all government infrastructure was brought together in the reconfigured Department of Public Works and Infrastructure in an attempt to address fragmentation in infrastructure delivery. Infrastructure South Africa was established in 2020 as the single point of entry for infrastructure projects across the country. It is the administrative arm tasked with addressing blockages, unlocking funding, and monitoring implementation.

Through engagement with all tiers of government, 276 projects were identified and assessed using the Sustainable Infrastructure Development System (SIDS) methodology. This methodology had been developed to identify, consider, evaluate, approve and implement workable infrastructure projects in order to ensure bankability. Such evaluation is necessary to ensure that the projects/programmes are functional from a financial, intersectoral and needs perspective, and that they address inclusivity and transformation. They are also assessed in terms of their ability to advance the national development

goals in support of, inter alia, the National Development Plan. The approach furthermore emphasises skills development, training and education. As a last step in the SIDS methodology, the infrastructure value chain of the project/programme is determined, as well as its costs, benefits, and financial aspects, including its financial viability.

Of the 276 projects, 50 projects and 12 special projects were found to be compliant with the SIDS methodology. Several labour-intensive public programmes to upgrade rural roads and build bridges were also identified (the *Welisizwe* programme). These 50 projects and 12 special projects were gazetted on 24 July 2020 as Strategic Integrated Projects (SIPs) in terms of the Infrastructure Development Act (No. 23 of 2014, as amended). In the transport sector, 15 projects to the value of R47 billion were gazetted (DPWI, 2020a). The potential job creation through the implementation of these projects is estimated at 50 000 (DPWI, 2020b).

The implementation of these SIPs forms part of the Economic Reconstruction and Recovery Plan introduced by President Cyril Ramaphosa on 15 October 2020. This plan focuses on how the public and private sector, government, labour and communities can work together to use the pandemic as a window of opportunity to build South Africa back up, better, through the creation of jobs, primarily through infrastructure investment and related mass employment programmes. The 62 SIPs are at various stages of the project life cycle and will create jobs and stimulate the economy over several financial years (DPWI, 2020c).

To ensure active implementation of the infrastructure build programme, an Infrastructure Fund has been operationalised to provide the capacity to prepare and package projects; by end-October, government had already committed R100 billion over ten years to this fund, while expecting R340 billion in private sector investment for some of the 62 SIPs.

As noted, Infrastructure South Africa was established to help facilitate such investments. It has been addressing constraints that used to hamper infrastructure delivery. These institutional arrangements will help ensure that implementation is fast-tracked in line with the objectives of the Economic Reconstruction and Recovery Plan. Infrastructure South Africa has also been adapting the procurement framework to enable public-private partnerships to mobilise private sector funding, given the constrained state of public finances.

Three funding channels have been established for infrastructure projects:
1. *Funding from the private sector*, including international funding institutions, multilateral development banks, development finance institutions and commercial banks.
2. *Blended financing,* where the public and the private sectors invest in the Infrastructure Fund, overseen by a committee comprising members from both sectors.
3. The *fiscus*, with the National Treasury allocating funding to departments, state-owned entities (e.g. SANRAL and Transnet), infrastructure grants, and the like. The Green Infrastructure Bond instrument is another option for exploring alternative financing sources for green, energy-efficient, climate-resilient infrastructure.

The purpose of the Economic Reconstruction and Recovery Plan is to rebuild the national economy. At the cabinet meeting of 2 April 2020, President Ramaphosa stated that infrastructure investment and implementation, through an immediate and purpose-driven recovery plan, was the flywheel that would kick-start the economy. It would also stimulate the construction sector, which has been hit hard by years of underinvestment even before the pandemic. Since April 2020, government has accelerated the development of systems and processes to enable the fast-tracking of infrastructure projects, including the establishment of Infrastructure South Africa and the Infrastructure Fund, so as to create employment and boost economic output. This approach is in line with those of many other countries, who agree that infrastructure can play a key role in recovering from the crisis, given its impact on productivity, growth and job creation. The upscaling of public-private partnership programmes and the implementation of blended finance solutions, such as the Infrastructure Fund, will be key to reducing pressure on the fiscus and driving the recovery. The accelerated implementation of SIPs, with support from Infrastructure South Africa to remove constraints, will be key in this regard. For the transport infrastructure sector, this implies the accelerated implementation of projects in SIP 21 (Transport), SIP 25 (Rural Bridges *Welisizwe* Programme), SIP 26 (Rural Roads Upgrade Programme), and SIP 27 (Upgrading and Repair of Township Roads in Municipalities Programme).

PRELIMINARY LESSONS LEARNED

Priorities for post-pandemic recovery must be driven by learnings from the social, economic and fiscal consequences of the health crisis. This requires institutions, infrastructure (e.g. for digital inclusion), relationships, systems and processes for long-term recovery and resilience (and, indeed, for addressing growing emergencies such as social inequality and climate change). It also requires shifting away from hierarchy and instruction towards collaborative governance and social compacting (Harrison, 2020). Lessons in particular sectors are as outlined below.

ENERGY

Certain processes could be improved in any future lockdown. For example, there is a need to, at short notice, issue permits to critical staff (both on-site and for rapid call-outs). The national permitting system was unnecessarily onerous and could easily have been streamlined by allowing designated essential service employees to use their access cards for the first two weeks of lockdown while permits were being printed. Furthermore, permits issued under a higher level of lockdown should be valid for lower levels without needing to be reissued. Finally, coordination with disaster responders in other sectors proved very helpful.

ICT AND TELECOMMUNICATIONS INFRASTRUCTURE

The pandemic highlighted both ICT's enabling role and gaps in coverage and access. In this regard, recommendations include a proposal by the ICT industry to use the spare fibre capacity of state-owned enterprises for the health and education sector; to prioritise licensing of spectrum in underserviced

areas and link this with the provision of services to these sectors; and to expand eduroam capabilities beyond campuses to help students access broadband facilities.

WATER, SANITATION AND BASIC MUNICIPAL SERVICES

Critical issues for subnational governments in future include managing the impacts on public finance; maintaining services and infrastructure; developing new (especially digital) infrastructure; supporting vulnerable households and communities; supporting the economic recovery (and especially small businesses); and reconfiguring governance based on the lessons of the pandemic.

TRANSPORT INFRASTRUCTURE AND CONSTRUCTION

Key requirements are the development and endorsement of standards for the transport infrastructure sector, and the construction sector in general, on how to operate during an abrupt, pandemic-type crisis. As a minimum, these should include mandatory protocols under the Occupational Health and Safety Act. This could involve delegated authority to representative industry associations to develop sector-specific mitigation measures for continued, risk-controlled operations for consideration and approval by a national advisory panel (see the recommendations for the transport industry in Chapter 6.4). Building greater resilience to cope with shocks to continuing operations, be they from extreme weather events or pandemics, is a key learning from Covid-19.

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