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URBAN AND RURAL ENGINEERING

One hundred years ago this year, South Africa was established by an Act of Union. That Act gave us the shape and the texture that defined us as a nation. And it is wonderful that, despite all the exclusions and discriminations since May 1910, we have survived intact as a state and still live within those same, unchanged borders.

While articles in the daily press earlier this year discussed political and governance aspects of how far we have travelled as a nation over the last 100 years, Kevin Wall in this article reflects on infrastructure development and service delivery over the last century

WE FEEL OUT OF touch when we mislay a gadget that did not exist 20 years ago – so essential to our daily living has becomethe cellphone.

So, as we make ourselves "comfortable" utilising a *flush toilet*, before we pocket our *cellphones*, climb into our *cars*, switch on the *radio* or *CD*, and head through sets of *traffic lights*, on a *tarred* road via a multi-level *interchange* giving access to the *freeway* to the *airport*, to catch an *aircraft* flight that we had booked on the *Internet* and paid for electronically with a *credit card*, do we reflect on the technology and the engineering infrastructure that we so much take for granted – but which wasn't available to our forebears in 1910?

1910 – 2010 How infrastructure grew our nation



My father grew up in a home with a bucket toilet in the "uithuisie" at the end of the garden – I remember him telling me of the night soil cart calling. My mother's home had a "long drop". Both of these were in urban areas, by the way. Neither family had a bathroom inside the house – my father's family bathed in a tub in the kitchen. I myself spent my earliest years in a house in Green Point, Cape Town, which had a sanitary lane at the back. Whereas the house by then had a flush toilet, when it was built in the 1930s it was served by a bucket toilet system, hence the

sanitary lane. Neither of my parents had a telephone in their homes until they were thirty-something. (If you tell that to people of 2010, "they simply don't believe you", as Monty Python would say.)

The infrastructure investment in South Africa in terms of sheer numbers over the century is staggering, partly because of:

- population increase (population in 1910 was 6 million, while the 2010 estimate is 49 million);
- rural-to-urban migration (just a few years ago the number of urban



1 Adderley Street just after 1910. Note that it would have been one of the very few streets in Cape Town tarred at the time

2 A Green Point sanitary lane as it looks many years later

3 Getting stuck on a muddy road in 1935

■ Cape Town in 1960

- with 825 000 people being served, used an average of 158 Megalitres per day, averaging 192 litres per capita per day; while

■ Cape Town in 2010

- with a population a little over 3,5 million, uses an average of 892 Megalitres per day, averaging 255 litres per capita per day.

Over the 100 years, that is almost a doubling of consumption per capita.

More or less the same story could be told with respect to ownership of telephones (landline or mobile), personal computers (not dreamed of in 1910) and motor vehicles. Not to mention television and the use of electricity, air travel, e-mail, GPS and the Internet.

Want more evidence of the impact of infrastructure?

- The public housing programme, negligible in 1910, now houses the majority of urban South Africans.
- Thanks to containerisation, a ship, size for size (tonnage), can, for the same length of time in port, unload anything between 20 and 100 times more cargo.
- Municipal government was in 1910 severely challenged to provide services to keep pace with population growth, and *that* has not changed at any time in the hundred years since. The demands have indeed increased. As the years have gone by, municipalities have had to provide a wider and wider range of services, and more and more sophisticated services – and not, as in the earliest years, provide them mostly to those able to pay for the services.
- Slow-moving horse-drawn traffic compacted the small stones that were part of most road surfaces in 1910. Motor cars, with their faster speeds and rubber tyres, kicked these stones out of place, gradually eroding the road surface. For this and other reasons, programmes to tar major roads, starting with city centre streets, were by 1910 only just beginning.
- Cities were much more densely settled in 1910 than they are now, thereby



- dwellers exceeded that of rural dwellers for the first time);
- decreasing family sizes (and hence more dwellings, water connections, etc per thousand of the population); and
- concern for social equity, coupled with the demand for each household to have its own facilities, such as a water connection and toilet, rather than having to share with other households.

Combine this with increasing consumption per capita of engineering infrastructure services, such as available water (taps inside homes versus previously a shared

standpipe in the street, or, for the rural majority of South Africans even a generation or two ago, a well or natural source such as a spring). Combine it, too, with higher levels of hygiene (more washing), flush sanitation and more water-using devices in the home – also higher industrial and commercial usage – and you find that:

■ Cape Town in 1910

- with 155 000 people being served by the water undertaking, had an average daily total consumption of 20 Megalitres, which was an average of 129 litres per capita per day; and

facilitating public transport. Car ownership was negligible. Commuters walked to work and school, or caught a bus, or (if there was a service) the tram or train. Even the highest in the land took the train – thus, when in the 1920s a commuter train left the rails at Salt River Station and slammed into the pillars of a bridge, among the dead was the Judge President of the Cape. It was not until the 1950s that a majority of middle-class white families owned cars. Interestingly, there is some evidence that, from the 1960s on, people of colour might have purchased their first cars at a lower income threshold than white first-time purchasers would – this was at the time ascribed to their wish to avoid having to travel on the hated segregated public transport.

- Increasing private car ownership, together with households' aspirations for more dwelling space, have led to decreasing urban densities. Invariably, at the same time as density falls, population increases, hence urban sprawl. For example, Cape Town in 1904 had 115 persons per hectare, but by 2000 that figure had decreased to 39 persons per hectare. In other words, even if the population had not increased, the area of the city would have increased threefold. The establishment in the apartheid era of segregated low-income housing areas, invariably at some distance from the then existing urban areas, exacerbated an already ongoing trend.
- In more recent decades we have seen the rise of the combi-taxi industry in order to meet the needs of commuters

Prior to the 1930s, inter-city motor travel was undertaken only by the daring – and the patient! A traveller between Bloemfontein and Winburg in the 1920s complained that, over a distance of 100 miles, 73 farm gates had to be negotiated. In that same decade it became the ambition of "motor aces" to beat the Union Express train on its 30-hour journey between Cape Town and Johannesburg. After several failed attempts, this was achieved only in 1925



- 4 Visitors to the brand-new Vaal Barrage in 1923. Spanning the Vaal River over a distance of more than 400 metres, the Barrage was a monument of engineering skill at the time, with 36 sluice gates measuring 25 feet x 32 feet x 6 inches (7,5 m x 9,6 m x 15 cm) and weighing 26,4 tonnes each. The storage system could hold 61 349 Ml of water, which meant that one of the major obstacles to development on the Witwatersrand was out of the way
- 5 Engineering calculation paraphernalia from the past (photo: Dave Campbell)
- 6 Various types of locomotives in use over the 150 years since the first train journey in South Africa (stamps issued in June 2010)



for a convenient and affordable (if at times hazardous) service. This, too, has origins in the segregated townships – who remembers travelling in the overloaded Valiants of the 1960s? The taxis have largely been responsible for the steadily reducing patronage of commuter rail in those cities with such services.

- Inter-city passenger travel, in 1910 almost exclusively by rail, has long been overtaken by the relative cost and convenience advantages of road and air travel.
- Rail has also long lost its dominant position as the preferred mode of freight transport, thanks to the relative fall in the cost of road transport and the simultaneous decline in the quality of rail service.
- The year 1910, coincidentally, saw the first importation of the Model T Ford, earliest evidence that mass production might mean cheaper cars, and therefore that motoring would no longer be the privilege of the sporty rich. By 1925 there were 18 000 Fords on South African roads – almost three times more than any other make.
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- The information and communication technology (ICT) sector differs from infrastructure sectors such as transport, energy, and water and sanitation in that it is characterised by mostly private sector and parastatal service delivery providers, and also that it is not constrained



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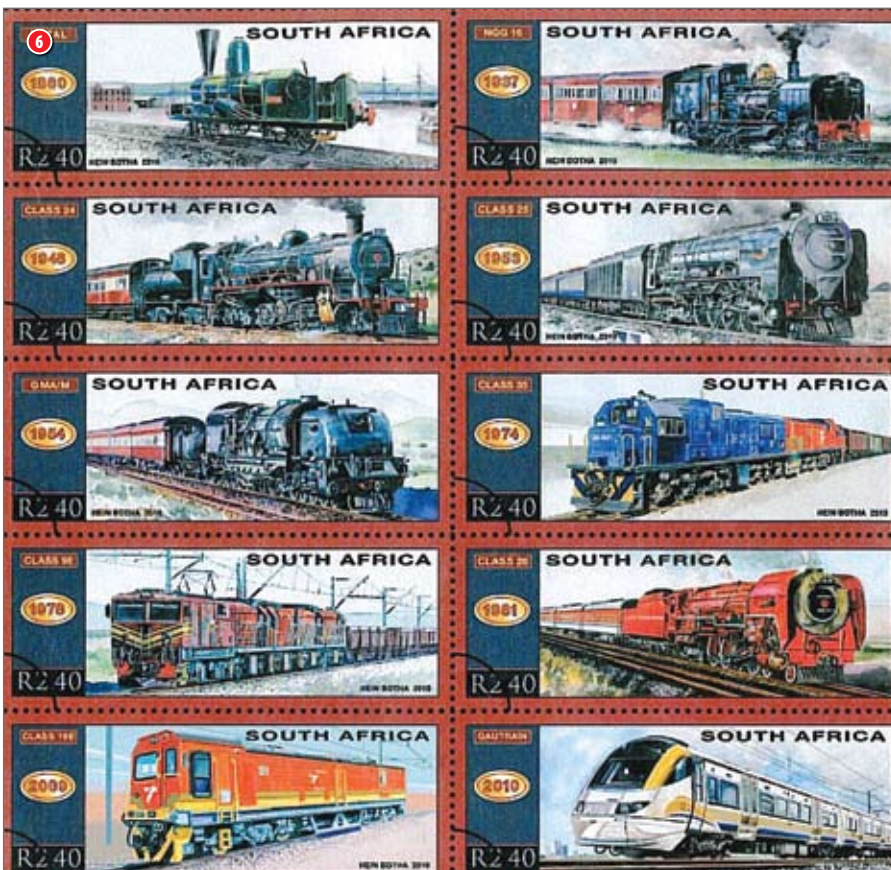
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Engineering infrastructure has indeed revolutionised the way we live, work, study, play, dispose of wastes, travel and communicate. Aircraft and the motor car, with improved roads, have revolutionised inter-city travel; the Internet (and Wiki) have revolutionised how learners prepare assignments; computers (and software) have revolutionised data sorting and analysis; aerial photography and satellite imagery have revolutionised map-making – the list could go on

by physical boundaries, although it must comply with national policies. South African landmarks include the first overseas radio telegraph message received (from London in 1924), the first overseas telephone call (between Cape Town and London in 1932), and the first television service (1976). The World Wide Web was launched in 1989, and in South Africa the first mobile telephony cellular networks were introduced in 1994. Today many ICT components are rapidly converging into smaller and more user-friendly mobile devices that are transforming the way we work, transact and play.

- Whereas electricity generation and supply had up to then mostly been in private hands, Eskom, established in 1923, gradually bought out most of the private generators of electricity. Nonetheless, several municipalities (especially the coastal municipalities) continued to generate electricity for decades thereafter. Construction of the first national transmission grid was commenced in 1969, in order to link the power stations on the coalfields with the more distant urban centres and mines – and in order to relieve these centres of their dependence on the coal trucks of the South African Railways and Harbours administration, then an arm of national government.
- Electricity distribution has for decades been shared between municipalities and Eskom. Interesting, given present

campaigns to reduce electricity consumption, to recall that in the 1930s (and right up until the 1950s) many municipalities encouraged **increased** consumption, for example by opening showrooms to retail appliances, trying to wean householders from coal and town gas. (My mother bought a stove from the Cape Town municipality's Electricity House showroom in Strand Street, for example – the Cape Sun now stands on the site.) More recently, from the late 1970s, rising concern for social equity led to the electrification of many homes in specific townships. And since 2000, in terms of the free basic services policy, the first 50 KW hours of consumption each month is supplied at no cost to qualifying households.

- In 1910 the largest dams in South Africa were those on Table Mountain. Since then a large number of massive dams, together with extensive major pipeline systems, irrigation schemes and other major water infrastructure, have been built. Although these major schemes are hugely important, having contributed greatly to changing people's lives, I won't describe them here. The same applies to the radical changes made over the years to water legislation in South Africa, and especially the changes since 1994 in what constitutes a "right" to water, the prioritisation of these rights, and who is entitled.
- The legislated health and environmental standards for water treatment works and waste water treatment works have increased steadily over the years. For example, the effluent commonly discharged to natural watercourses in 1910 would be illegal today. (That the effluent from many waste water treatment works is substandard today is of course a major cause of concern.) Interestingly, in terms of the Union Health Act of 1919, the discharge of treated effluent from a sewage purification works into a natural watercourse was prohibited, and the effluent had to be discharged onto land – this practice introduced the era of the so-called "sewage farms". This policy was changed by the Water Act of 1954, which prohibited disposal to land, replacing it with a requirement for treated effluent of acceptable quality to be discharged to natural water bodies. Significant race-based differences in access to services still very much exist,

although less than in the past. However, many of the significant differences between urban and rural households continue. Given the dispersed nature of many rural communities, and the sheer cost of providing them with infrastructure, this is to a very large extent inevitable.

Inevitable yes, but the consequences are nonetheless regrettable. A stark example is in respect of the free basic services policy introduced in 2000, since which time the first quantum of specific services consumed each month is supplied at no cost to indigent households (water, for example, 6 kilolitres per household) – while this is a much-needed benefit, it is unfortunately, for practical reasons, only available to households with access to reticulated supply. Thus, despite the massive increase in access since 1910 to a reticulated water supply, the free basic water service benefit is not available to the 12% of households, all rural, not so linked. Given the correlation between rural living and poverty, this further marginalises many of the poorest communities.

Sadly, while rolling out so much infrastructure, we have as a rule made far too little provision for maintenance. But it ought to be blindingly obvious that unreliability of infrastructure piecemeal erodes the gains made since 1910. Interruptions to services delivered by engineering infrastructure undermine the economy (no electricity in commercial and industrial areas equates to no lighting, no elevators, no machines, no mine production) and quality of life (no electricity in residential areas means no light to study by, no hot water, no microwave or refrigerator, no charging of cellphones).

Engineering infrastructure has indeed revolutionised the way we live, work, study, play, dispose of wastes, travel and communicate. Aircraft and the motor car, with improved roads, have revolutionised inter-city travel; the Internet (and Wiki) have revolutionised how learners prepare assignments; computers (and software) have revolutionised data sorting and analysis; aerial photography and satellite imagery have revolutionised map-making – the list could go on.

Truly, we live a different life to that of our forebears of 1910. Do we appreciate how much we owe to engineering infrastructure? And are we planning to maintain what has been gained? ■