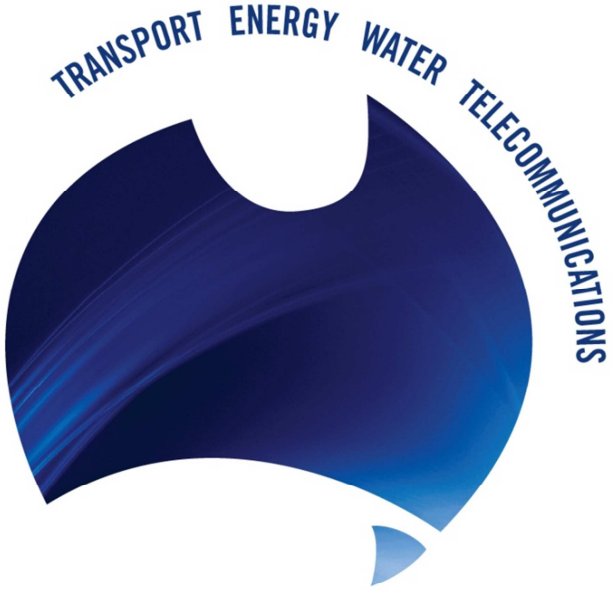
infrastructure report card 2010

Australia

ENGINEERS
AUSTRALIA

infrastructure report card 2010

Australia



ENGINEERS
AUSTRALIA

www.engineersaustralia.org.au/irc

Australian Infrastructure Report Card 2010

ISBN 978-0-85825-925-6

All Report Cards can be downloaded from www.engineersaustralia.org.au.

Principal Author: Leanne Hardwicke, Director, International and National Policy, Engineers Australia

Contributors:

- Peter Taylor FIEAust CPEng, Chief Executive, Engineers Australia
- Rolfe G Hartley FIEAust CPEng EngExec FIPENZ FEIANZ, Past National President Engineers Australia
- Ian Pedersen HonFIEAust CPEng EngExec GAICD, Past National President Engineers Australia
- Athol Yates MIEAust, Australian Security Research Centre
- Andre Kaspura, Policy Analyst, Engineers Australia

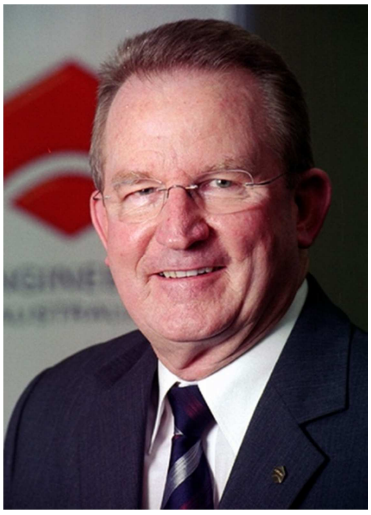
ENGINEERS
AUSTRALIA

Engineers Australia
11 National Circuit, Barton ACT 2600
Tel: +61 262706555
Fax: +61 262734200
www.engineersaustralia.org.au
email: policy@engineersaustralia.org.au

Contents

	Communiqué		i
1.	The Report Card Project		1
2.	Infrastructure Developments		3
3.	Cross-Sector Challenges		7
	3.1	Economic and population growth	7
	3.2	Climate change	8
	3.3	Investment in infrastructure	9
	3.4	Strategic planning, coordination and integration	13
	3.5	Infrastructure performance and management	15
	3.6	Skills	15
	3.7	Practical sustainability actions	16
	3.8	Rural/urban disparities	16
	3.9	Intelligent infrastructure networks	16
	3.10	Fly in–fly out workforce	17
4.	Infrastructure Sectors		19
	4.1	Roads	19
	4.2	Rail	21
	4.3	Airports	24
	4.4	Ports	25
	4.5	Potable water	27
	4.6	Wastewater	28
	4.7	Stormwater	30
	4.8	Irrigation	31
	4.9	Electricity	32
	4.10	Gas	34
	4.11	Telecommunications	35
5.	Rating summary		37

Chief Executive's Communiqué



I am very proud to present the 2010 Infrastructure Report Card for Australia.

Engineers Australia has long held the view that the quality of Australia's infrastructure is an indicator of the nation's current and potential economic, social and environmental wellbeing and viability. We have been providing independent commentary on Australia's infrastructure for many years.

This report follows on from three previous national reports, the latest of which was released in 2005. In 2005, we identified that meeting demands for new infrastructure and maintaining, upgrading or replacing ageing infrastructure was a major challenge facing Australia.

There had been significant under-investment in infrastructure across the nation, which was imposing constraints on all parts of the economy and the community. We called for coordinated planning frameworks, and cooperation between governments as being vital to providing Australia's future infrastructure needs. Most importantly, we believed that Australia would benefit from the establishment of a national infrastructure council to provide independent advice about infrastructure priorities of national significance.

In the intervening five years, Australia has experienced significant economic and population growth, and some improvements in infrastructure. It has also weathered the global financial crisis (GFC). Spending on infrastructure has increased and there is now a much better understanding of the role that infrastructure plays in sustaining a viable economy. We have seen the establishment of an independent infrastructure advisory body at a national level, Infrastructure Australia, and a priority setting process that will apply more rigour to project funding decisions. Many jurisdictions have developed infrastructure plans, though of variable type and quality.

This 2010 Infrastructure Report Card for Australia is distilled from individual state and territory outcomes, with appropriate weighting given to the relative size and economic importance of each. The ratings of each state and territory show that there have been limited impacts resulting from the early work of Infrastructure Australia and the federal government's GFC stimuli. Given the long lead times for major infrastructure, it is not surprising that there is a mix of no change, slight improvement and slight deterioration in individual infrastructure types. Five years ago, the result was a C+ overall and remains a C+ in 2010.

The question remains as to whether this is good enough. It would be unrealistic to expect an overall 'A' rating, which would be unaffordable and unrealistic. In my view, a 'B' or 'B+' should be the goal. A 'C' rating reflects infrastructure that is only adequate and in need of major changes.

Overall, Australia's infrastructure is in need of some major improvements. There is still much to be done and we face significant challenges.

Economic growth depends on our addressing the backlog of nationally significant infrastructure works. This will require a greater focus on ongoing maintenance and renewals as well as new infrastructure to meet demand. Australia will experience significant population growth, which will further increase demand for new and more effective infrastructure, delivering higher levels of service.

Climate change will require us to approach infrastructure provision and maintenance in a new way to cope with extreme weather events, warmer temperatures, drier climates and predicted sea level rises.

The investment in infrastructure has still not caught up with the estimated $700 billion shortfall caused by years of under-investment. Engineers Australia's engineering construction index charts for each state and territory provides some guidance. The overall index for Australia has increased at a modest rate to almost $250 million per 100,000 population during the last 20 years. Only Queensland and Western Australia, the resources states, have exceeded the national average: all other states and territories lag behind to varying degrees.

The lack of long-term strategic planning, coordination, integration and cooperation between levels of government remains a severe constraint on Australia's infrastructure. Australia has an extremely fragmented regulatory and planning framework. There are many federal bodies that are responsible for regulation, policy or investment in infrastructure, and there are dozens more at the state and territory level, each having different and often competing responsibilities and interests. Add to this the 700 local governments. This is a major weakness in the Australian system, which requires a willingness to cooperate between the various spheres of government to deliver efficient outcomes for the community.

We urgently need harmonisation of road and rail rules in Australia, and the agreement to set up a national regulator for various transport sectors needs to be implemented.

Planning requires a hierarchy of documents beginning with overarching strategic plans, regional plans and sectoral plans. These must not conflict with each other or with national sectoral plans. There must be better integration across sectors and jurisdictions. The proposed national strategy documents for ports, freight, energy and water are much needed, as are strategies for sustainable cities, particularly focusing on transport issues.

Priority setting for projects must be based on the advice of Infrastructure Australia at a national level following rigorous analysis and justification. States and territories would benefit from advisory bodies operating on similar principles to Infrastructure Australia and following the assessment guidelines that the national body has developed. Priority setting should include all infrastructure sectors. Underlying principles in any planning documents need to include productivity, liveability and sustainability. *S*ustainability is not only about the natural environment, but includes economic and social issues, equity, affordability and effectiveness. Planning regimes must remain flexible and open to change, given that forecasts often turn out to be inaccurate.

Land use decisions must give priority to infrastructure that is nationally significant, sustainable, affordable and is vital to state and territory interests. Land use decisions must be integrated with infrastructure priorities and urban encroachment on ports and airports must be curbed. Australia's economy is dependent on trade, which, in turn, is dependent on ports and airports. To operate efficiently, there must be good road and rail transport links from ports to metropolitan and regional centres.

We also need to be realistic in terms of our capability to deliver benefits from infrastructure. Political, business and community expectations about new or improved infrastructure are often raised to unrealistic levels, resulting in unnecessary public criticism and blame when projects do not achieve their expected outcomes. New projects are often described in transformative terms and claimed that they can be delivered in short time frames. However, in reality, the vast majority of these projects provide only incremental improvements and all have lengthy design, construct and commissioning phases.

One area that needs particular attention is the sharing of financial and operational risk between public and private participation in projects, which needs to be equitable for both parties.

All infrastructure owners must have adequate data on their infrastructure assets, and must utilise this to plan and fund maintenance and renewal programs. Maintenance may not be the most newsworthy activity, but it is the most essential in ensuring the longevity of any infrastructure asset.

Australia is experiencing clogged ports, congested roads and other bottlenecks. Infrastructure Australia has identified priority projects costed at $83 billion for nationally significant infrastructure. The question as to how this will be funded needs to be answered. Innovative funding solutions must be found using the experiences and learnings of other states or countries.

Australia's infrastructure issues are long-term. They are well beyond an electoral cycle and the highs and lows of the stock market. Having a vision for Australia and for big infrastructure projects is needed and getting the priorities right through an independent strategically focussed process is essential.

Engineers Australia recommends the following to ensure that Australia's infrastructure, will in time, meet the needs and expectations of Australia.

Recommendations

All governments must:

- Deliver more efficient infrastructure outcomes and develop innovative funding models to provide the required infrastructure
- Harmonise infrastructure planning and regulation through improved cooperation and collaboration between all levels of government, business and the community.
- Address the imbalance between urban and rural and remote communities regarding access to high quality, reliable infrastructure
- Develop plans and implement projects in all sectors in advance of need, and either build in capacity for growth or preserve land in all infrastructure sectors, particularly for ports, airports and transport corridors
- Encourage private sector funding for infrastructure and where infrastructure delivery models include the private sector, have the appropriate allocation of risk to deliver the best project outcome.

State and territory governments must:

- Develop long-term infrastructure visions and plans that accommodate projected economic growth and population increases
- Establish independent planning infrastructure advisory groups to provide advice on infrastructure priorities and provide infrastructure planning and funding advice.

Infrastructure owners and managers must:

- Improve the maintenance of existing assets, through adequate funding and asset management plans
- Integrate climate change mitigation and adaptation into infrastructure plans

Peter Taylor

Chief Executive

1. The Report Card Project

Engineers Australia has been rating infrastructure since 1999. In 1999, 2001 and 2005, national report cards were published. In 2003 – 2005, infrastructure report cards for all states and territories were published. This exercise was repeated in 2010, with all state and territory report cards being released progressively throughout the year.

This Australian Infrastructure Report Card provides an overview of the findings of the 2010 state and territory report cards and gives a commentary on national policy initiatives. The report card provides a rating on the quality of Australia's economic infrastructure and makes a number of recommendations about future actions to ensure that Australia's infrastructure, in time, will meet the needs and expectations of the business and government sectors and the wider community.

Ratings used are comparable with those of past report cards. The rating scale is detailed below.

Rating scale

Letter grade	Designation	Definition*
A	Very good	Infrastructure is fit for its current and anticipated future purposes
B	Good	Minor changes are required to enable infrastructure to be fit for its current and anticipated future purposes
C	Adequate	Major changes are required to enable infrastructure to be fit for its current and anticipated future purposes
D	Poor	Critical changes are required to enable infrastructure to be fit for its current and anticipated future purposes
F	Inadequate	Inadequate for current and anticipated future purposes

**Fitness for purpose is evaluated in terms of the needs of the community, economy and environment using criteria of sustainability, effectiveness, efficiency and equity.*

Engineers Australia produces the report cards to:

- Raise the awareness of politicians, media, business and the public that infrastructure underpins the community's quality of life and that inadequate infrastructure impedes economic and social growth, and reduces environmental and societal sustainability
- Generate debate on the adequacy of the infrastructure (including condition, distribution, funding and timing) required to meet society's needs
- Increase appreciation of the value of developing an integrated and strategic approach to the provision of infrastructure
- Raise awareness of the new challenges facing Australia's infrastructure due to climate change, change in demographics, demand increases, resilience and sustainability
- Improve the policy, regulation, planning, provision, operation and maintenance of infrastructure

Engineers Australia's infrastructure report cards highlight issues relating to Australia's physical infrastructure, outlining key themes and areas for improvement.

The reports provide readers with the ability to understand the complexity, scope and issues facing our infrastructure, which should lead to an increased level of understanding by the general community.

This 2010 Australian Infrastructure Report Card provides an up to date strategic overview of Australia's infrastructure that other organisations can use when they undertake detailed analysis of particular infrastructure types. It also provides a benchmark that the community can use to identify needs and evaluate alternative infrastructure priorities over time.

There is much public debate and discussion about infrastructure at present. These discussions have common themes that are very similar to the views that Engineers Australia has been presenting for many years. They highlight the importance of well-maintained and timely new infrastructure in the national economy.

As the leading advocate for the engineering profession, Engineers Australia will continue to be the major source of independent policy advice on matters related to infrastructure.

2. Infrastructure Developments

For most of the twentieth century, economic infrastructure in Australia was used to promote national and regional development. As well, it provided employment opportunities and improved the quality of life of all Australians[1].

Prior to the 1970's, infrastructure was generally provided on the basis that it was to effectively operate and satisfy demand for many decades.

The 1980's and 1990's saw a focus on maximising utilisation rates of infrastructure. One consequence of this approach was that there was little redundancy or long-term expansion capability in the system, which resulted in operations being severely disrupted when failures occurred or the system approached capacity.

This coincided with the introduction of National Competition Policy, and with commercialisation and privatisation of government service providers. Governments saw infrastructure systems as a source of revenue, and a return on investment to "infrastructure "owners" was required. The dividend that was demanded was sometimes at odds with the level of investment required to maintain the service at the required level. Returns to infrastructure owners were maximised by reducing operational costs, usually by deferring maintenance and renewals or shifting from preventative to responsive maintenance.

In the 1990's, Engineers Australia called for a new approach to the maintenance of existing infrastructure and the provision of new infrastructure.

In the early 2000's, evidence appeared of a growing gap between required and delivered maintenance and renewals and in 2001 and 2005 Engineers Australia reiterated the call to put infrastructure higher on the public agenda.

In its 2005 Australian infrastructure report card, Engineers Australia noted that Australia's infrastructure was generally in an adequate state, but that:

- Significant parts of Australia's infrastructure were ageing and nearing the end of their economically useful lives
- Funding commitments were either inadequate or yet to be identified to support the substantial costs of renewal and replacement
- Planning and political processes did not provide the necessary long-term focus
- Only limited infrastructure information was available in some key areas.

More than one hundred years after Federation, the development and maintenance of our infrastructure assets were suffering from a lack of integration, co-ordination and a general lack of long-term planning.

Engineers Australia put the view that infrastructure planning, maintenance and development become a coordinated priority for Federal, state, territory, and local governments.

The 2005 report made two key recommendations:

1. *That the planning and provision of infrastructure become a true partnership between the three spheres of government, business and the community.*
2. *That the Council of Australian Governments take immediate steps to establish a National Infrastructure Council to provide independent advice on policy, planning and delivery of infrastructure in Australia.*[2]

The report also recommended certain functions for the National Infrastructure Council.

The mid-2000's saw more public recognition by Australian governments about the positive relationship between investment in infrastructure and productivity and a recognition that infrastructure is a key determinant of comparative advantage between countries and international trade, which was essential for Australia's economic success. This period saw a new wave of infrastructure capital projects as it had become apparent that peak demand was exceeding capacity. Some states and territories developed plans for various infrastructure sectors or geographic regions.

Shortly after the 2007 Federal election, the new Australian Government announced a different national approach to planning, funding and implementing the nation's future infrastructure needs. The *Infrastructure Australia Act 2008* established a statutory body, Infrastructure Australia, and established the position of Infrastructure Coordinator to support that body. The work of Engineers Australia was acknowledged when the enabling legislation was introduced to both houses of the Australian Parliament.

The role of Infrastructure Australia is to advise governments, investors and owners of infrastructure concerning:

- Nationally significant infrastructure priorities
- Policy and regulatory reforms desirable to improve the efficient utilisation of national infrastructure networks
- Options to address impediments to the development and provision of efficient national infrastructure
- The needs of users
- Possible financing mechanisms.[3]

Engineers Australia wholeheartedly welcomed the establishment of Infrastructure Australia, and has been monitoring the work of the organisation since its inception.

In 2008, Infrastructure Australia completed an audit of Australia's transport, water, energy and communications infrastructure and created an initial 'Infrastructure Priority List'. This list was primarily generated on the basis of submissions rather than properly justified infrastructure priorities. This was understandable because of a lack of detailed research at this early stage of Infrastructure Australia's existence.

Infrastructure Australia published national public-private partnership guidelines in November 2008, and since that time has undertaken work on a national ports strategy; a national freight network strategy; an energy strategy; a water strategy; and a national framework for public transport network planning.[4]

In the 2008-09 Budget, the Australian Government announced the establishment of a Building Australia Fund. Allocations from the Fund were to be guided by Infrastructure Australia's national audit and infrastructure priority list.

Around this time, there was public discussion of an infrastructure deficit, with estimates ranging from $445 billion to over $770 billion.[5]

The output from Infrastructure Australia provided the basis for tranches 2 and 3 of the economic stimulus packages that assisted Australia through the global financial crisis. Engineers Australia believes that the Building Australia Fund will need to expand significantly if it is to provide much needed nationally significant infrastructure.

Engineers Australia is pleased to see that Infrastructure Australia is establishing rules for evaluating and justifying infrastructure proposals, as well as streamlining complex public-private partnership arrangements around infrastructure projects. This will ensure rigour around the arguments for proceeding with major infrastructure projects that has been lacking in many instances in the past. If implemented, it may provide for equitable and appropriate risk allocation in public-private partnerships.

The latest report to COAG in June 2010 sets out Infrastructure Australia's updated reform and investment priorities. These include reform recommendations based on better asset utilisation that are expected to bring about economic, social and environmental benefits with significantly less financial and other costs than investment in new capacity.[6] The 2010 priority list includes initiatives at varying stages of development, which have been categorised as: ready to proceed; threshold; real potential; or early stage.

Infrastructure Australia's 2010 report states that it will take a more proactive approach to priority setting and will reduce its reliance on submissions. This approach is welcomed by Engineers Australia and accords with the recommendations in the 2005 Australian Infrastructure Report Card that an Infrastructure Advisory Council determine priorities for nationally significant infrastructure.

The advent of Infrastructure Australia and its project selection process has given impetus to improved planning and priority setting in some jurisdictions. State and territory governments have developed a variety infrastructure plans over the years.

These plans have been of variable quality and coverage. Some are sector specific, with no overarching strategic plan, while others are plans for a geographic area covering all key infrastructure sectors. Some have provided a strategic long-term approach to planning and delivery of infrastructure. Others have provided a wish list of potential infrastructure projects without evaluation of priority or potential productivity and economic benefit to the State or the nation.

From an examination of the state and territory infrastructure report cards published by Engineers Australia in 2010, it is clear that expenditure on maintaining existing infrastructure and providing new infrastructure is well below what is necessary. As well, there is still a lack of strategic and coordinated infrastructure planning and prioritisation across many infrastructure sectors.

There are many cross sector and sectoral challenges that need to be faced before Australia will progress toward having the infrastructure it needs to support the delivery of essential services, drive economic growth, and support the environmental and social aspirations of the current population and future generations.

The following sections outline the cross sectoral and sectoral specific challenges for Australia's infrastructure.

3. Cross-Sector Challenges

3.1 Economic and population growth

The growth in Australia's population and the economy will see a significant increase in demand for expanded and new infrastructure.

Australia's economy is dominated by the services sector, yet its economic success is based on an abundance of agricultural and mineral resources. Australia's comparative advantage in the export of primary products is a reflection of the natural wealth of the Australian continent and a small domestic market, and Australia's continued success depends on efficient infrastructure.

Growth in our economy directly increases demand by businesses for infrastructure services, and indirectly by consumers due to their raised standard of living. The 2010/11 Federal Budget forecasts a positive growth outlook for the Australian economy, which is expected to grow by 3 ¼ percent in 2010/11 and 4 percent in 2011/12.[7] While yearly growth may be relatively small, it is important to note that the compounding of small yearly growth will result in significant growth over a decade. According to the Treasurer's statement to Parliament in October 2010, "*Our economy is strong. Job creation is strong. Our fiscal position is strong.*" [8]

However, some state and territory governments and many local governments have limited resources due to small revenue bases. As a consequence, infrastructure provision often lags demand, and if this continues, the economy may be inhibited from expanding to its full potential in certain jurisdictions. Innovative means of funding infrastructure, including greater contributions from the Australian Government and industry may be required.

Australia currently has a population of around 22 million people, with about 13½ per cent of those (less than 3 million) aged 65 and older. By 2050, the population is projected to grow to nearly 36 million people, with nearly 23 per cent of the population (more than 8 million) aged 65 plus. This projection is based on a continuation of long-run trends in fertility, mortality and net overseas migration.[9]

Figure 3.1: Australian Population Projections – high and low growth assumptions[10]

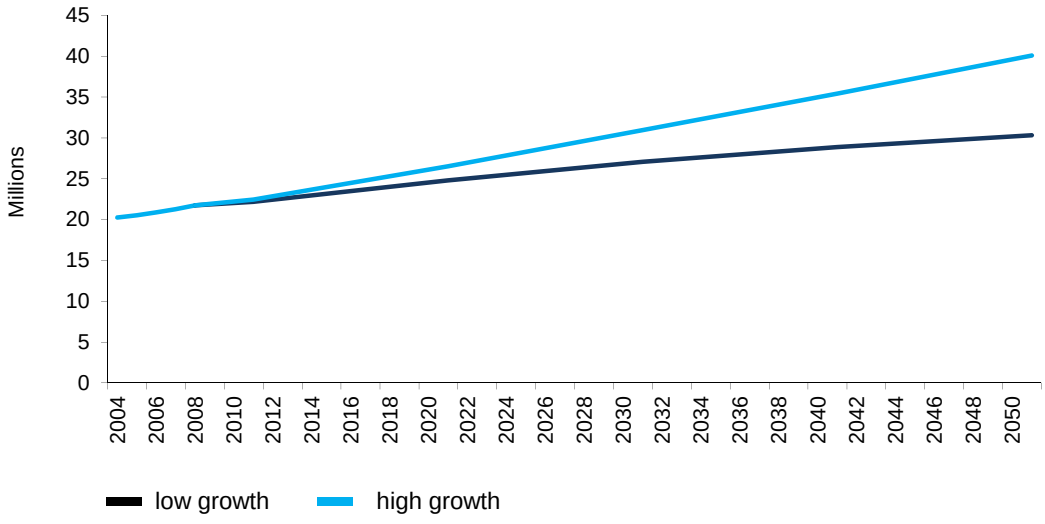


Figure 3.1 shows Australia's population projections along high and low future growth paths. It shows that Australia's population will expand from 21,015,000 in 2007 to 40,086,600 (91 percent increase) in 2051 under high growth assumptions, or 30,306,600 (58 percent increase) under low growth assumptions. A growing population will accelerate the demand for all transport, water, energy and telecommunication services.

3.2 Climate change

Climate change will have a notable impact on infrastructure over the long-term, and has the potential to negatively affect infrastructure services. The degree of impact will depend on which climate variable changes, the magnitude of change and the rate of change. Climate changes over the next 50 years are expected to be:

- Higher temperatures
- Drier average seasonal conditions
- Increased frequency of extreme weather events including storms
- Increased risk of bushfire
- More frequent and severe droughts
- Sea level rise.[11, 12]

Key infrastructure impacts of the above will include:

- Significant reduction in the amount of water entering dams, placing greater emphasis on water demand reduction and manufactured water
- Increased flooding due to more frequent extreme rainfall events exceeding stormwater and drainage infrastructure capacity
- An increase in storm intensity causing structural damage due to increased wind speed and hail intensity
- Sea level rise exacerbating coastal erosion, coastal inundation and the intensity and frequency of storm surges, all of which damage coastal infrastructure including stormwater and roads
- Higher temperatures causing degradation of road and building materials, damage to building foundations and gas and water piping, and increased flooding and bushfire risk
- Increased rail buckling and signal failure, and road fatigue due to more frequent hot weather
- Surges in electricity demand leading to brownouts caused by more frequent heat waves.

Many areas of Australia have been experiencing a drying climate for several decades and some infrastructure sectors have responded to this new environment. This is most obviously seen in the development of desalination plants. However, other infrastructure sectors have not factored in the drying climate. For example, there is little consideration of its impact on coastal stormwater systems and roads. Despite recent rains in some areas of Australia, governments must continue to factor the drying climate into future infrastructure plans. Demand management measures will also need to be factored into future infrastructure plans to take account of the drying climate, particularly for water and energy.

It is significant to note there are different levels of uncertainty attached to predictions of change for each environmental variable.

For instance, there is a high level of confidence in the predictions that Victoria's rainfall is decreasing in winter and spring, and there will be increased risk of bushfires in Victoria. There is moderate confidence in predictions that there will be decreasing annual average stream flow and increased drought frequency, intensity and duration in Victoria. There is low confidence in predictions that there will be abrupt changes, such as a step-change in rainfall, rapid melting of polar ice sheets or changes in global ocean currents; and changes in small-scale storm phenomena, such as tornadoes, hail and wind-gusts.[13] Similar levels of uncertainty exist about predictions to changes to different environmental variables in each State and Territory.

3.3 Investment in infrastructure

There are no measures of the stock of infrastructure for Australia. The state and territory governments and the Australian government do not have consistent statistics on the annual flows of infrastructure investment or consistent capital budget statistics. The following assessment uses ABS engineering construction statistics to track trends in infrastructure investment in Australia. The statistics used measure the amount of engineering construction work done in the nominated period measured in dollars.[14] The engineering construction statistics are not identical to financial statistics on infrastructure investment, and do not reflect actual financial outlays on infrastructure. However, the trend in engineering construction is a fairly accurate representation of the trend in infrastructure expenditure.

The figures below illustrate the investment in economic infrastructure over a 25-year period, and include roads, bridges, railways, ports, electricity generation and transmission facilities, water and sewerage facilities and telecommunications facilities. The figures show annual engineering construction on economic infrastructure (measured in millions of dollars in constant 2007/08 prices) relative to population (measured in 100,000's) expressed as an index number. The figures show whether engineering construction on economic infrastructure is tracking faster than population growth or slower than population growth, and how engineering construction on economic infrastructure in the states and territories compares to the national trend.

Figure 3.2: Engineering Construction on Economic Infrastructure in NSW and Victoria

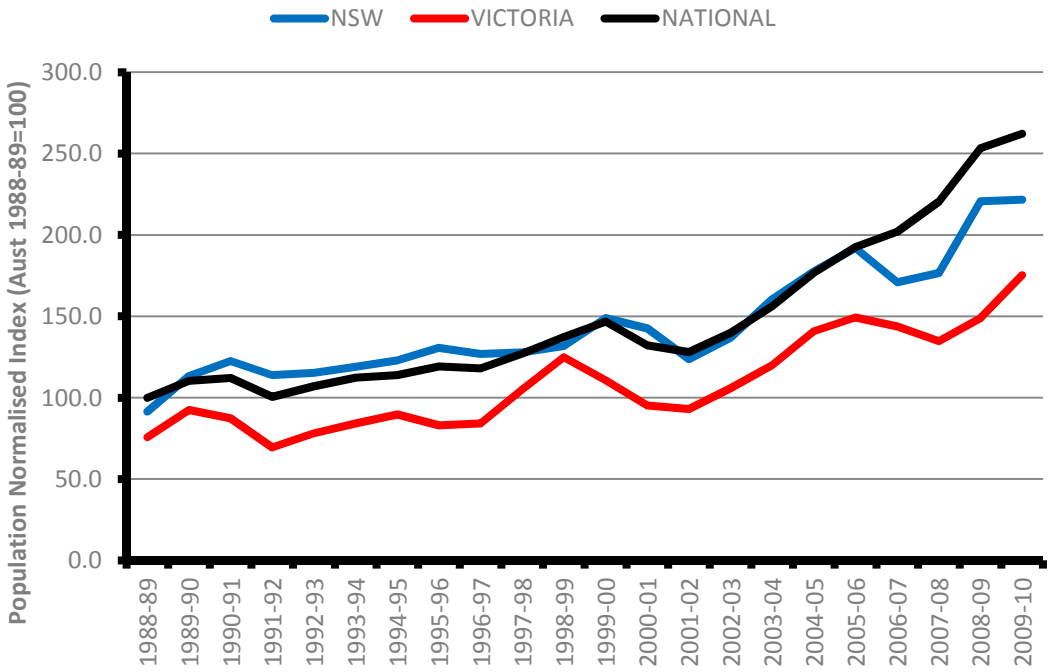


Figure 3.2 depicts engineering construction data for NSW and Victoria. Since 1989/90 NSW spending has tracked faster than population growth. NSW tracked very close to the national average until about 2006, when there was a sudden fall. It took two years to recover from this, but the rise between 2007/08 and 2008/09 still left NSW well below the national average. The NSW trend was flat in the last year while the national trend continued to rise.

From 1988/89 until 1997/98, the Victorian trend tracked slower than population growth. It increased above it for one year in 1998/99 and then fell below it for another two years. From 2002-03 onwards, Victoria has tracked above population growth. Victoria has consistently tracked below the national trend. Since about 1999, the gap between the Victorian and national trends has widened, suggesting a slower response to infrastructure investment.

Figure 3.3 depicts engineering construction for Queensland and Western Australia. Queensland has consistently tracked well above population growth. Queensland began its trend line well above the national average and has stayed above it for 20 years. Like the national trend, growth to 2000/01 was relatively slow. It faltered for three years, before recovering in 2003/04. Since then, the Queensland trend has been much faster than the national trend, except in the last year, when Queensland growth stopped and national growth continued. The level of Queensland activity in 2009/10 remained well above national activity.

Western Australia has consistently tracked faster than population growth. From 1988/89 to 2001, other than a four year growth spurt, the Western Australian trend was very close to the national average. From 2001 onwards, the Western Australian trend accelerated dramatically, with an ever widening gap to the national average. This coincides with the minerals boom.

Figure 3.3: Engineering Construction on Economic Infrastructure in Queensland and Western Australia

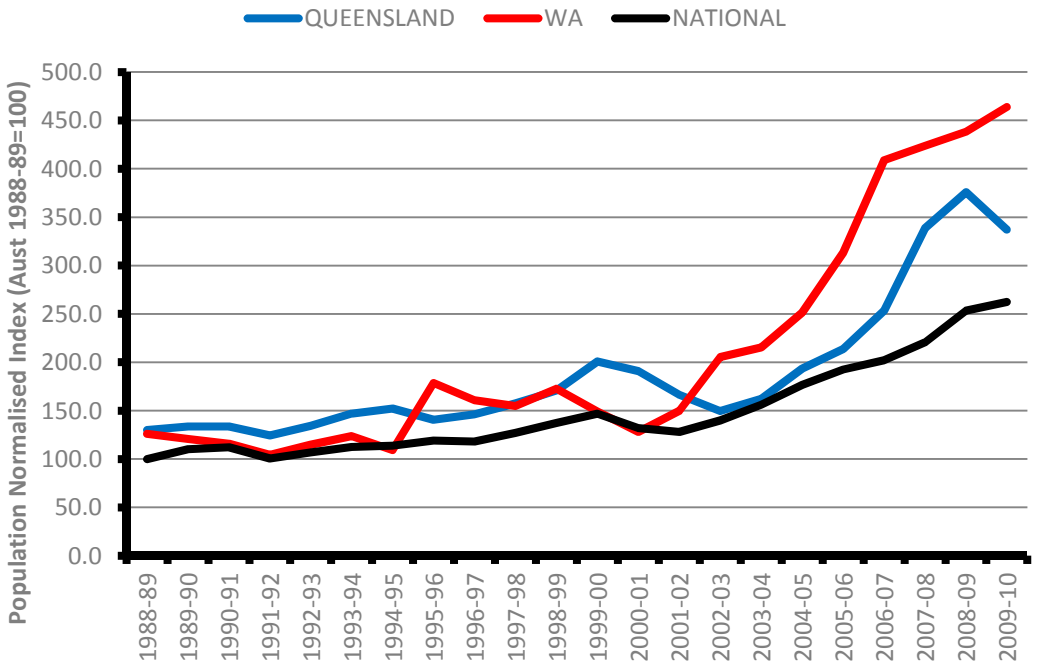
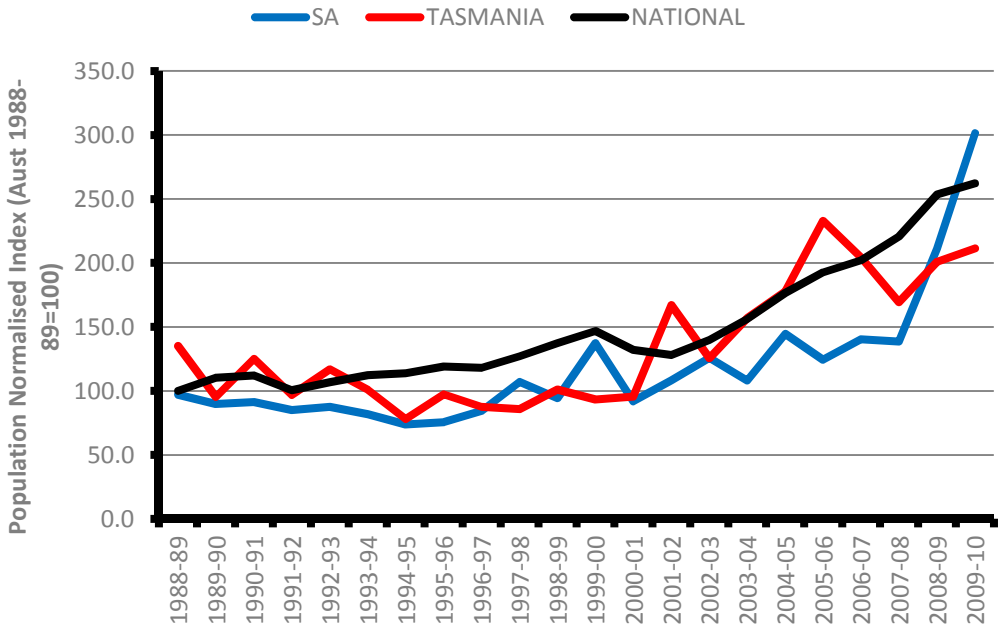


Figure 3.4 depicts South Australia and Tasmania.

Figure 3.4: Engineering Construction on Economic Infrastructure in South Australia and Tasmania



Until 2001/02, with the exception of one year, the South Australian trend tracked slower than population growth. From 2002/03 it tracked faster than population growth. The South Australian trend was below the national trend until 2009/10, when it accelerated above it.

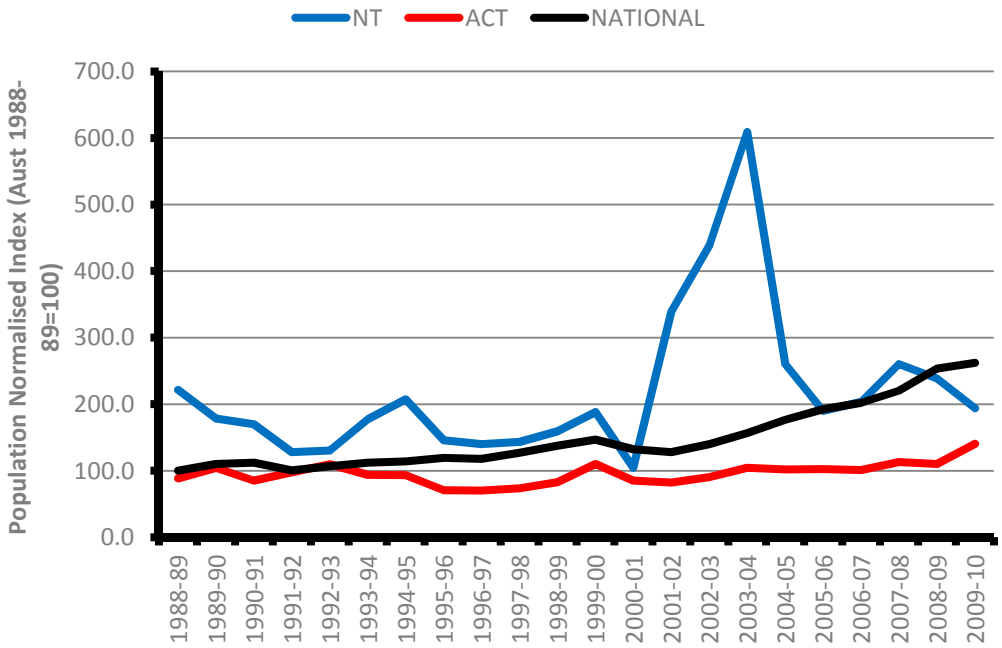
The trend in Tasmania more or less kept up with population growth until 1993/94 and then slipped below it until 2001/02. Until 2003/04, the Tasmanian trend was below the national trend, except for isolated years. From 2003/05 to 2006/07, it kept up with or was above the national trend, but in the last three years has been well below the national trend.

Figure 3.5 depicts the Northern Territory and the Australian Capital Territory.

Because of its size, the Northern Territory is difficult to evaluate. The Northern Territory trend has been consistently above population growth. It has also typically been above the national trend. Infrastructure investment in the Northern Territory is particularly variable. The huge peak is the simultaneous construction of the Alice Springs to Darwin Railway and several electricity generation and transmission assets.

The ACT trend has tracked either in line or below population growth until 2007/08. Since then, it has tracked above population growth. Except for some isolated years before 1993, the ACT has tracked well below the national trend.

Figure 3.5: Engineering Construction on Economic Infrastructure in the Northern Territory and the ACT



Overall, the 1990's to mid-2000's in Australia was a period when infrastructure spending was below the long-term average, as infrastructure providers sought to increase efficiencies from existing infrastructure in preference to building new infrastructure. The consequence today is that infrastructure is mostly working at capacity, which requires an extremely high quality of operational management, particularly as operational failures or infrastructure breakdowns can have an immediate and cascading impact, affecting a large number of people and businesses. Since the mid-2000's, most infrastructure sectors have developed plans for a massive expansion in capital works projects. This infrastructure is mostly to meet existing demand rather than provide excess capacity to meet future demand.

A large proportion of Australia's infrastructure is reaching the end of its life or has reached its capacity. Increasingly, governments will have to spend money on new capital projects to replace ageing assets and to meet the needs of an expanding population and increasing minerals and gas exports. The investment required over the next decade will be significant. Coupled with this will be the need to ensure that maintenance occurs to the required level to ensure that the lowest life cycle cost is extracted for the infrastructure. While short-term savings can be made by reducing maintenance, the result is inevitably more expensive, disruptive major renewal projects. An outcome of a lack of past infrastructure spending and increased demand as a result of economic and population growth has been the increase in taxes, rates and charges to fund the backlog of infrastructure.

The need for some infrastructure will override a less-than-optimum benefit-cost ratio. There has been a devaluation of non-economic externalities and policy intent. Based solely on economic returns, justification for a particular project may not exist from the infrastructure owner's perspective, but from a broader perspective it may be justified. There needs to be a way of capturing the non-economic and policy factors in any analysis.

Economic principles should not be the sole determinant in deciding to construct a nation building project. For instance, the decision to go ahead with the electrification of cities and towns may not have occurred on the grounds of initial low take up when first introduced.

The long-term possibilities of infrastructure need to be considered in infrastructure planning and funding decisions..

Investment needs for infrastructure exceed the availability of funds, hence the need to consider a wide range of funding options alongside a priority setting process. Funding mechanisms range from public sector financing (whether by debt or reserve funding), infrastructure bonds, public-private partnerships, favourable taxation treatment for infrastructure investments or other creative means.

Further institutional reforms may also be needed. Infrastructure assets are large fixed assets with significant capital costs that take time to construct. There are high risks associated with private sector investment, which can lead to under-investment. Supporting the private market is essential. Australia needs to have well designed markets, regulation and institutions. These would allow the private sector to participate more fully in the delivery of energy, water and transport in particular, as these areas are capable of supporting well-functioning markets with price signals as the mechanism for encouraging investment and use. The national electricity market is a good example of this.

Challenges to appropriate infrastructure funding include:

- Ensuring that high levels of investment are maintained over many years
- Balancing investment on capital works, maintenance, renewals and upgrades against investment in reducing/managing demand
- Capturing the non-economic and policy externalities in a decision support model and giving them appropriate weight with economic factors
- Selecting the best-value source of infrastructure funding
- Ensuring that new infrastructure projects receive funding for both the capital works and maintenance
- Managing the roll-out of major projects so that a number of large projects are not implemented simultaneously.

3.4 Strategic planning, coordination and integration

Efficient infrastructure provision requires sound strategic planning, coordination and integration. This involves coordination across infrastructure modes, such as between road and rail, and across stakeholders, such as all levels of government, the private sector and the community.

Such an approach increases the likelihood of decisions being made that complement one another, rather than undermine all. However, implementing such an approach is both time consuming and costly. The challenge is to ensure that such an approach occurs in the shortest time possible and at the lowest cost.

Infrastructure drives the productivity, liveability and sustainability of cities, towns and regions. Optimising all three is a considerable challenge that requires planning, coordination and integration.

Strategic planning requires a long-term perspective which, for cities, can exceed 100 years. Coordination requires bringing together all stakeholders, including the owners, operators and builders of the infrastructure, the infrastructure users and the community in the planning process and negotiating mutually acceptable outcomes. Integration requires linking infrastructure plans with broader land-use objectives, as well as ensuring that the plans for different infrastructures complement one another.

The level of strategic planning for the infrastructure that state and territory governments have direct responsibility for has improved since the last Australian Infrastructure Report Card in 2005, but is not at the optimum level to provide the best outcomes for the community. Plans are sometimes sector specific, with no overarching strategic plan, while others are plans for a geographic area covering all key infrastructure sectors. Some have provided a strategic long-term approach to planning and delivery of infrastructure. Others have provided a wish list of potential infrastructure projects. A planning hierarchy is needed so that plans align with national, state or territory and regional specific challenges and allow for an appropriate priority setting process.

The integration of planning between state and territory governments, local government and the Australian government still requires considerable improvement. The timelines of planning processes also need improvements as does the need for plans to reflect the community's interest rather than a political interest of the local, state or territory, or federal government.

In terms of land use and infrastructure planning, the lowest cost infrastructure provision occurs on greenfield sites where development has yet to occur, or inside corridors in developed areas that have been set aside in decades past. Developments in built-up or unpreserved areas are not only expensive and disruptive, but are also politically difficult. Consequently, greater effort should be given to ensuring that infrastructure is in place early in an area's development, as well as preserving corridors for future infrastructure enhancement.

Efficient transport networks require supportive land use developments. Examples are to build high density residential and business areas along transport corridors, and provide accessible rail or other public transport to major new developments. It also requires that once decisions on land use and transport planning are made, both the land developers and infrastructure providers build the infrastructure as envisaged at the appropriate time. There have been a number of instances where land developments have proceeded, but the transport infrastructure provision has been delayed or cancelled, resulting in an area being under-served. This has led not only to congestion and long transport times, but also to social exclusion.

Demand management must be an integral part of future infrastructure planning. Managing demand for infrastructure services is a way of reducing the need for new infrastructure and increasing the efficiency of existing infrastructure. Its benefit is demonstrated in the outcomes of the demand management practices implemented by the water sector. There has been less effort put into demand management in the transport sector, primarily due to the lack of an effective pricing mechanism that takes into account the economic, social and environment cost of the transport task. It also requires that alternative transport modes are available or that the need for the transport task can be reduced without significant adverse effects on the consumer.

Challenges to improving planning, coordination and integration of infrastructure include:

- Ensuring that plans balance productivity, liveability and sustainability goals, and explicitly identify any trade-offs that have to be made
- Recognising that strategic plans are based on forecasts that often turn out to be inaccurate (e.g. population growth or traffic demand) and consequently all plans have to be continually adapted so that their long-term vision can still be achieved
- Ensuring that planning occurs across sectors and includes both private and public asset owners
- Ensuring that there is planning integration and harmonisation between all levels of government

- Controlling overly-optimistic expectations of what the strategic plan can achieve (e.g. containing growth within boundaries, achieving high levels of infill, increasing economic activity in areas of social disadvantage), the ease of its implementation, and the ability to maintain a consistent vision over decades
- Ensuring that plans not only address growth areas, but also address the very large outer suburban areas and regional towns that today have inadequate infrastructure
- Making unpopular decisions such as changing economic activity or relocating populations in areas that are unsustainable
- Implementing a long-term land-release program to meet the housing needs of a growing population and address housing affordability.

3.5 Infrastructure performance and management

Infrastructure performance is judged differently by infrastructure owners, operators, users and other stakeholders. Some stakeholders give priority to financial returns, while others focus on service quality. Regardless of the measure used, infrastructure cannot perform efficiently without adequate maintenance and renewal.

A proven technique to extract the best value from infrastructure is through sound asset management. Some infrastructure providers already have sophisticated asset management plans and systems in place, but some are still developing them. Many local governments have made considerable progress in this area through the adoption of the National Asset Management Strategy and the Australian Infrastructure Financial Management Guidelines of the Institute of Public Works Engineering Australia. Once developed, asset management plans must be funded to allow their implementation.

Challenges to improving the performance and management of infrastructure include:

- Increasing the supply of infrastructure through the building of new infrastructure or increasing the utilisation of existing infrastructure
- Reducing/managing infrastructure demand by methods such as introducing pricing regimes that reflect the fixed cost of provision and time of use
- Developing infrastructure performance measures that reflect the priorities of all stakeholders
- Building detailed information on infrastructure demand and supply, and infrastructure conditions, to allow for better allocation of resources.
- Raising the average quality of asset management plans and systems across the country.

3.6 Skills

There is an engineering skills shortage in most infrastructure areas and this is predicted to continue and increase in the future. The shortage will become exacerbated not only due to increased demand for staff to work on infrastructure projects across the nation, but also due to the large numbers of engineering practitioners retiring over the next decade, and an inadequate supply of graduates.

The next decade will see a number of very large infrastructure projects being simultaneously designed, constructed and commissioned. This unprecedented program of works will require large skilled workforces in both the public and private sectors. A significant risk is that due to skill shortages, projects will be delayed and costs will be far more than anticipated.

As well, having and utilising technical expertise is a pre-condition to being an informed buyer of infrastructure planning, design, construction, operation and maintenance of products and services. It is crucial that buyers are well informed so that they are able to:

- Select and justify the option that offers best value for money
- Select and justify an innovative solution
- Appropriately allocate and manage risks by providing relevant technical details in tender documents and enter into equitable contracts
- Prevent contractors taking advantage of the buyer's lack of knowledge.

All governments need to maintain their informed buyer status, which can be challenging due to budgetary constraints and finding appropriately competent and experienced staff.

3.7 Practical sustainability actions

Infrastructure must contribute to sustainable economic, social and environmental activities. While infrastructure projects over the last decade have increasingly focused on environmental sustainability, less attention has been given to economic and social sustainability.

Challenges in improving infrastructure's contribution to sustainability include:

- Ensuring that decisions on infrastructure reflect the fact that its physical life is typically between 20 and 50 years, but can be over 100 years with refurbishment
- Designing the infrastructure to operate under changed rainfall, temperature and wind speeds due to climate change
- Ensuring that sustainability principles are embedded into project decision-making, including principles of affordability and equity
- Designing infrastructure that meets both current needs and those arising over the medium-term, and that has the capacity to be expanded with minimal disruption and at a low cost to meet the needs that will arise over the long-term.
- Designing infrastructure that maximises the use of recycled elements and minimises total resources use.

3.8 Rural/urban disparities

There is a significant difference in infrastructure quality between rural and urban infrastructure. Given the lower population base and hence the income available for infrastructure providers, a gap is expected. Effort should be given to closing this gap for equity reasons and for the pragmatic reason that improved infrastructure in regional and rural areas may encourage more metropolitan businesses to relocate there, thus reducing pressure on the crowded capital and major cities. Population growth will also increase the size of regional towns and cities. Therefore, planning for future infrastructure in these regional areas should occur sooner rather than later.

3.9 Intelligent infrastructure networks

Infrastructure of the future will be increasingly intelligent. Intelligent infrastructure has attached or built-in components (e.g. sensors and cameras) that are able to collect and transmit information about its physical state. This information can be used to identify when water pipes require maintenance, when traffic conditions should be changed to improve flows, and which route motorists should use to minimise travel time.

Currently, too little of Australia's infrastructure could be called intelligent. Challenges to building intelligent infrastructure include justifying the cost of investing in intelligent infrastructure, designing network-wide intelligent infrastructure systems, and providing a process so that third parties can access infrastructure data and exploit it.

3.10 Fly in–fly out workforce

A fly in–fly out workforce results in highly transient populations in regional areas. While a fly in-fly out workforce is important to the success of many current resource projects, these workers do not contribute to the community base in the same way that locally-resident workers do. Consequently, while an area may have a large number of workers, they do not have the community services that would be expected for such a population. Transient workers can distort the local economy and infrastructure needs compared to other regional towns, for example by requiring larger airports and community facilities, both provided by local governments. Effort needs to be made to increase the attraction of these towns for residential workers to create a more balanced economic base and community. The infrastructure demands caused by fly-in fly out workers also need to be recognised by the state, territory and Australian governments when allocating grants to local governments in particular.

4. Infrastructure Sectors

4.1 Roads

Roads have been given an overall rating of C, with national roads rated C+, state roads C, and local roads D+. Based on these ratings, Australia's roads range from adequate to poor condition. The community and business expects an integrated multi-modal transport network that has good accessibility and reliability and is delivered effectively. Given the legacy nature of transport infrastructure, meeting these expectations will be difficult in the short and medium-terms.

The key issues around road infrastructure in Australia relate to reducing road traffic (by moving commuters onto improved accessible public transport, and moving the freight task from road to rail), improving road asset utilisation, long-term strategic planning (including integrated land use planning and planning for growth),and increased funding, particularly for local roads.

The traditional response to increased road demand, evidenced by congestion, is to build more roads and make their operation more efficient. This might involve introducing no parking zones during peak periods and optimising traffic signal operation. However, this imposes a heavy cost on governments and demand will continually exceed supply in peak periods.

Improved methods to moderate demand are required. These include introducing paid parking, improving public transport, cycling and walking and encouraging split shifts and working from home. Another effective way to decrease road traffic and congestion is through appropriate road usage pricing. This may include a road usage charge that combines congestion costs, road damage, environmental and other secondary damage impacts. Given that tolls are one of the few existing road pricing mechanisms employed in NSW, removing them as was done recently on the M4 without implementing a comprehensive road usage pricing mechanism is a retrograde step.

Because of rising congestion, encouragement should be given to alternative transport modes to shift people and freight movement away from individual road vehicles and to discouraging multiple and frequent trips. This will require better rail, bus and active travel options, as well as changing business practices such as just-in-time deliveries.

Improving road asset utilisation rather than building new roads is an important approach to getting value for money from road investment. Ways to improve efficiency include targeting roadwork on points of connection, building links between existing road networks, minimising the impact of road works, ensuring quick clearance of traffic incidents, improving traffic signal coordination, and prioritising road space for high occupancy vehicles or 'high value' movements.

The road freight task is increasing. This task needs to be managed effectively if economic efficiency is to be maintained. At the same time, this increase is causing significant road damage and social impacts.

While there needs to be improvement in freight efficiency, such as by improving freight corridors, there also needs to be greater consideration of the broader economic and social impacts of increased freight movement. The costs include increased pavement damage, urban congestion and reduction in the quality of life of those living along freight corridors. For example, Sydney's Port Botany container terminal is planned to significantly increase the number of containers being imported/exported in the next 20 years on a road and rail network that is currently near congestion gridlock.

Managing the impacts of increasing axle loads is an issue for all roads. Increased axle loads can accelerate pavement damage, particularly on older and weaker pavements. Improving the quality of pavement requires additional upfront expenditure, but results in lower whole-of-life costs.

Harmonisation of truck load limits between state, territory governments and between local governments is urgently required to improve efficiency in the road freight sector. In some areas, it is reported that B-Double trucks are not permitted over local government roads.

Improving the efficiency and safety of key freight and passenger corridors is also an issue. High productivity vehicles offer significant freight efficiency gains. However, sections of the country's road network are unsuitable for these vehicles, which mean that more vehicle trips occur and less direct routes are used. Improvements are required in making key routes capable of supporting current and future high productivity vehicles. Unless these roads are improved, business will experience higher transport costs, governments will experience higher road maintenance costs and community safety may be jeopardised.

Improving bike infrastructure is also necessary to improve the future road network. In many cities, there is insufficient infrastructure for bicycles, and improvements will only occur if special funding programs and budgets for bike infrastructure are provided. Constructing new bike infrastructure from existing transport budgets will result in infrastructure being rolled out at a much slower pace than the community expects.

Long-term strategic planning needs to occur to improve major regional and inter-capital routes. This is becoming increasingly important as Australia's non-metropolitan population expands and travel between regional and capital cities increases. For instance, key priority routes are the Pacific Highway and the Melbourne to Brisbane route. These routes need to be covered by strategic plans that cover both road and rail infrastructure, integrated with land use plans. The integrated regional transport plans will deliver increased transport efficiency while protecting the wellbeing and sustainability of local communities. Improving regional and inter-capital routes will also increase the speed of regional development and consequently may slow capital city growth.

Integrated plans will need to ensure that land use decisions to slow the growth in urban boundaries, reserve land corridors for future roads, and focus on building in designated growth corridors are maintained over many decades. The amount of funding for both new roads and maintenance will need to increase significantly, especially in regional Australia where funding has lagged that provided for major capital cities.

The gap is widening between the funds required to maintain and improve local roads, and what is actually being spent. Funding is required to close the gap, with specific attention given to renewing and upgrading bridges on local roads. Local governments have responsibility for a large number of timber bridges that are deteriorating, and maintaining these bridges is very costly.

Funding is also required to maintain road quality in the face of greater freight volumes. Many local roads were not designed for the increased traffic volumes, higher axle loads and the total tonnage that they currently carry, nor do local governments have the ability to fund their maintenance.

Developing the optimal mix of road and rail for bulk freight movements, and ensuring the relevant component of 'user pays' in funding the infrastructure and/or appropriate apportionment of road usage revenues are issues that will need to be addressed sooner rather than later.

4.2 Rail

Rail has been given a D+ rating. Rail infrastructure includes metropolitan passenger networks, freight and regional passenger services, grain lines, the interstate networks and private railways. The low rating has been given on the basis that urban rail networks cannot cope with demand. There is a need for a high speed rail network along the eastern coast of Australia to ease airport congestion and to reverse the trend of declining regional rail utilisation, which is resulting in more road traffic. The interstate network and Pilbara railways in particular are in a good condition.

Improving the efficiency and productivity of existing rail networks is a challenge in many jurisdictions. For instance, increasing train length, load capacity, operating speed and turnaround time will require considerable improvements in rolling stock, below-rail infrastructure, and port-rail connections and intermodal hubs. The investment to achieve improvements will require substantial investment over at least a decade. Hundreds of millions of dollars will be required to make significant improvements. For example, to build a new efficient alignment from Brighton to Oatlands in Tasmania will cost between $300 million and $500 million alone.[15]

Achieving improvements in rail infrastructure will require significant expenditure. For instance, in NSW, the Sydney Metropolitan Transport Plan predicts that the population in Sydney will increase by 550,000 people by 2021. A considerable proportion of this growth is predicted to occur in Western Sydney and the plan recognises the need for public transport infrastructure improvements, especially rail, to service this growth area.

There is a need to expand rail networks to enable access by a larger proportion of the population in urban areas. As a general rule, rail infrastructure should be provided in advance of new developments or corridors should be reserved, rather than waiting for the areas to house a sufficient population to make rail services viable. For instance, there are several areas in south east Queensland that do not have access to rail services and have no land corridors reserved for future rail infrastructure. There are currently no mass transit services to Perth's north-east, with the exception of buses. Given that this area is one of the six major developing corridors, a mass transit service will become increasingly important. Such a service would benefit about 250,000 people.

Because there is no rail reservation in this area, building a rail line will require significant land resumptions or tunnelling, both of which would be expensive and have political impacts. While a light rail or improved bus services would assist in servicing this area, they cannot provide the speed and mass movements required for the growing population.

In South Australia, the *30 Year Plan for Greater Adelaide* predicts that the population will increase by 560,000 people over the next 30 years. A considerable proportion of this growth is predicted to occur north of Adelaide and the plan recognises the need for public transport infrastructure improvements, especially rail, to service these growth areas.

The current public transport program to improve Adelaide's public transport, while large in the South Australian context, falls well short of the required funding to deliver the public transport infrastructure improvements outlined in the plan.[16]

Crowding and congestion on rail lines is an issue that needs to be addressed in Sydney, Melbourne and Brisbane. Low customer satisfaction with crowding in peak times, together with the lack of significant improvement in train reliability is an ongoing concern in NSW on CityRail and CountryLink services. Congestion on services delivered by Citytrain in Brisbane is also an issue. While there has been some reduction in congestion during morning peaks, congestion during afternoon peaks has been rising. Significant infrastructure and operational improvements will be required to improve passenger satisfaction and comfort in the face of growing levels of patronage. These improvements include additional track capacity, separating freight and passenger lines, and signalling system improvements.

There is a need to address Brisbane's cross-river rail congestion. The current river crossing infrastructure is rapidly reaching its capacity and additional infrastructure is required as a matter of urgency. This will be extremely expensive, but essential in providing additional rail services to cope with growing rail patronage and the need to support a developing Brisbane and the broader south east Queensland region.

Victoria also suffers from overcrowding and delays. The Victorian Government and rail operators are undertaking a range of initiatives to address these problems. However, many metropolitan lines are reaching capacity, and the only ways to significantly increase capacity are by building major additional lines, large-scale duplication, expanding the rail fleet, rebuilding signalling and control systems, and/or redesigning the network to allow very high frequency services.

Travel times also require improvement. For instance, the rail service between Sydney and its neighbouring centres of Wollongong, the Blue Mountains and Newcastle are, in several cases, slower than in the past. For instance, the train between Newcastle and Sydney took 2 hours and 26 minutes in 1937 and today takes 9 minutes longer, and the train between Gosford to Sydney took 70 minutes in 1960 but today takes 94 minutes.[17] The challenge is to increase the speed, reliability and convenience of these trips so as to increase their attractiveness compared to road.

It will be essential to increase rail freight to accommodate the greater freight task, with minimal impact on roads and communities through which the freight passes. Impediments to implementing this include rail connections with ports, inadequate intermodal facilities, closure of rail lines and the comparative pricing advantage of road in many cases.

In terms of freight, improving the interstate and regional freight rail line, and their intermodal connections is necessary. The Australian Government, through its 2009 *Nation Building* package, is enhancing the Defined Interstate Rail Network in most states. However, due to inadequate rail connections to ports and road-rail hubs, the opportunities for increased rail freight cannot be realised. Improvements to all elements of the supply chain are required.

Multi-use intermodal terminals are essential to increasing rail volumes, and driving down transport costs. While the ARTC provides the interstate mainlines, private sector operators generally provide the intermodal terminals. To maximise the benefits from these terminals, all stakeholders (e.g. local government, local businesses, community and transport operators) should be involved in their planning and funding in proportion to the benefit that they derive from them.

Freight network improvements could occur by separating shared passenger and freight networks. This is particularly needed in Sydney and Brisbane. For instance, the only dedicated freight lines in south east Queensland are the ARTC leased line and the line to the Port of Brisbane beyond Dutton Park. Consequently, freight and passenger traffic share the same tracks. Passenger services have priority resulting in considerable disruption, particularly in peak periods. Freight traffic can also adversely affects passenger services during these periods. Separating freight and passenger services in south east Queensland has become critical. The above factors are also inhibiting the operational efficiency of the Port of Brisbane.

Upgrading is required for the Adelaide to Darwin line to enable carriage of heavy bulk freight. When the railway was originally built it was expected that there would be more intermodal freight trains than have materialised. Conversely, the number of bulk mineral trains has exceeded expectations. Heavy bulk trains are more likely to cause pavement compression and lead to track misalignment issues, particularly following heavy rain. Significant increases in heavy bulk transport will require the existing infrastructure to be upgraded to avoid imposing operational restrictions.

Determining the future of the country grain network is an issue in some states. The short-term future of the country grain network in NSW is secure, but there is uncertainty about its long-term prospects. Any decision on its future needs to recognise the long-term costs of closing lines, including additional road traffic and maintenance, and the increased cost of hauling grain by road.

For Western Australia, a number of grain lines are not viable given their quality and the comparative price advantage of road transport. However, their closure will have significant community impact, principally due to increasing volumes of road transport and the cost of road damage and road infrastructure upgrades. For example, as country towns do not have road bypasses, through-town traffic will increase. Traffic through south-eastern metropolitan Perth will also increase markedly if road grain freight into Kwinana increases. Thus, while the closure of rail lines will save the need for re-sleepering, it will increase road related costs. Therefore, determining the future of the grain lines requires an assessment of both the direct and indirect costs.

Improving and upgrading rail infrastructure to deal with future coal exports is an issue in NSW and Queensland. Rail infrastructure needs to be upgraded beyond the Liverpool Range in NSW to open up the Namoi Basin for coal exports. While coal lines in the Hunter region continue to improve, additional coal exports from the nearby Namoi Basin will also require improved rail access in that region. Optimising the coal supply chain and developing coal rail infrastructure capacity in line with coal capacity demand in Queensland is required. The rail network is one element of the coal supply chain, the others being ports and mines. The entire chain needs to be optimised to maximise transport efficiency.

Ideally, the capacity of the infrastructure needs to meet current demand and the development of additional capacity should be delivered for the time it is required, rather than building excess capacity years in advance of when it is needed or creating additional capacity well after it is required. Optimising the coal supply chain and developing coal rail infrastructure in line with coal demand is challenging due to the number of parties involved in the coal supply chain and the fact that demand varies as global demand fluctuates.

Developing and planning for appropriate light rail or other mass transit systems is an issue that needs to be considered in some jurisdictions for the future. For instance, currently, a light rail or other mass transit system in the ACT could be justified if built at a sufficient scale (at least 54 km of track) as any smaller network would not attract the required patronage to make it viable.

As population density and numbers increase, commencement of such a network becomes more important. It is imperative that the work continues to define and reserve potential corridors, identify potential technological options, and work with the private sector to develop such a network. Light rail in Hobart may also be viable in the future.

High speed rail has been discussed many times in the past, and the announcement of a feasibility study in October 2010 by the Australian Government is welcomed. At some stage, a high speed rail network will become essential for the east coast of Australia. It is important that rail reserves are set aside for this so as not to constrain options. This includes a route to service Canberra.

Delivering integrated land-use and transport planning outcomes is an issue across Australia. Without creating integrated land-use and transport outcomes, the existing deficiencies of rail infrastructure will become more commonplace and be repeated in new population centres that will then impose huge costs on future generations. The potential efficiency of the rail network and urban planning outcomes will continue to be constrained until this occurs.

4.3 Airports

Airport infrastructure has been given a B- rating. Airports are critical infrastructure and while major airports across Australia are in generally good condition, they all face similar challenges in achieving improvement to cope with future demands. Capital city and major regional airports are in good and improving condition, but the long-term viability of smaller regional airports will depend on ongoing government financial support.

The major issue facing large airports is aligning on-airport development with local land-use plans. This is the responsibility of the Australian Government. Many airports have experienced on-airport retail and commercial development that has caused significant problems for commuters, off-airport businesses and airport users. While the secondary uses of land at airports have been of benefit to the community and the airport owners, these uses should not prevent the provision of air services. This means ensuring that there is suitable space for further airport expansion, and ensuring that structures do not adversely affect the wind environment at the airport.

In many cases, conflict between local planning controls and airport development has resulted in a reluctance by local and state governments to fund roads to cope with activities that they have not approved. Funding mechanisms that allow airports to contribute to the cost of upgrading and maintaining off-airport infrastructure associated with the growth of the airport are needed. Airports need to provide a clear picture of future developments to enable greater synchronisation with off-airport infrastructure upgrades.[18]

Meeting long-term passenger and freight growth is also a challenge for some major airports. In the short and medium-terms, there is sufficient capacity at Australia's major airports. However, if Sydney Airport is to meet expected growth, in the longer term, a second major airport will be needed in or near Sydney. A second new parallel runway at Brisbane airport has been planned for over 20 years and in 2007 it was approved by the Australian Government. It is expected that the new parallel runway will be operational at the end of 2015.

Funding for infrastructure expansion at Darwin airport is needed. Melbourne Airport will also need an additional runway in the longer-term. Once Melbourne Airport has reached its capacity in several decades, the development of additional airports to augment Melbourne Airport as a freight and passenger hub will be required.[19] Perth Airport will require additional taxiways and another runway in the long-term.

Maintaining the financial viability of regional and remote airports and aerodromes is an issue for all state and territory governments. Larger regional airports have the capacity to meet growing regional passenger and freight needs by raising charges. However, a challenge for many regional and remote airports is funding the maintenance of ageing infrastructure and expanding infrastructure to meet heavier aircraft and new security requirements. There is a growing gap between funding needs and airport revenues. Increasing reliance on "fly-in fly-out" workers adds to these problems.

The Northern Territory faces additional problems because of its remoteness in ensuring regional airports and remote airports and aerodromes remain viable. Given the importance of these to their communities, it is essential that the airports and aerodromes remain operational. This can be difficult for those communities that do not have sufficient resources.

A number of major regional regions in Western Australia will experience growth through resource development requiring new infrastructure. The low air passenger numbers in rural Western Australia means that passenger fees are high on a per capita basis, in order to satisfy investment and reasonable rate of return needs.

4.4 Ports

Port infrastructure is rated B- and is in good condition, requiring relatively minor changes to be fit for current and medium-term purposes.

A common issue across Australia's ports is meeting future container growth. Container freight volumes are expected to grow for the foreseeable future. Over the short to medium-term this growth can be accommodated by developments underway at many ports that are providing additional stevedoring capacity and infrastructure upgrades. But the picture is different in the long-term.

For instance, future growth in container freight cannot be accommodated solely at Port Botany due to development restrictions. This will need to be facilitated at the Port of Newcastle, bringing with it the challenge of integrating any new container facilities at the Port of Newcastle into intermodal hubs/supply chains. This will allow consolidation and dispatch of containers at the hub, rather than at the ports, which can focus on rapid loading and unloading of containers, and optimising transfers.

For the Port of Brisbane, the growth cannot be accommodated unless fundamental changes occur. Growth will create more congestion, delays and pollution as a result of the huge traffic movements and this will be untenable from the perspective of the exporters and importers, and the community. Future port developments will need to be integrated into intermodal hubs/supply chains where consolidation and dispatch of containers occur, rather than at the ports.

In Tasmania, it is expected that its ports will soon be at full capacity.[20] Growth can be accommodated at Hobart, Burnie and Devonport in the short-term. However, over the long-term, growth cannot be accommodated at these ports. Instead, significant changes will be required including upgrades to existing intermodal facilities, reclamation to provide increased storage and handling areas to increase freight capacity, and port specialisation.[21]

Fundamental changes at Victorian ports are also needed. The Victorian Government has released several port and freight plans that are focused on improving ports as part of enhancing supply chain efficiency.

Key projects identified to improve supply chains include:

- Donnybrook/Beveridge interstate freight terminal, north of Melbourne, which will be the first of a new network of suburban freight terminals to take pressure off the Port of Melbourne[22]
- Melbourne freight terminal network, activity centres and freight corridors
- High capacity rail and road transport links on the principal freight network connecting the metropolitan freight terminals and the Port of Melbourne.

These projects need to be funded and implemented to enable ports to cope with future growth in an economic, social and environmentally sustainable fashion.

In Western Australia at the Port of Fremantle, growth in container freight cannot be accommodated solely at the Inner Harbour due to capacity restraints and development restrictions. New berths will need to be constructed outside the Inner Harbour. A future challenge will be the need to integrate any new container facilities at the Outer Harbour of Fremantle into intermodal hubs/supply chains.

Western Australia also faces a challenge in meeting bulk mineral export demand. Maintaining the level of growth seen in mineral exports in Western Australia over recent years will require significant investment in port infrastructure. The timely funding, development and construction at existing ports and the development of the Oakajee and Anketell ports is expected to be needed to meet demand.

Provision of infrastructure at the Port of Darwin in line with demand and as part of the supply chain is essential. The port is one element of a supply chain, with other elements including rail and mines. The entire supply chain needs to be optimised to maximise transport efficiency. Ensuring that the port expands in line with demand is challenging due to the number of parties involved and the rate of growth in export demand – currently faster than infrastructure can be delivered.

Integrating land use decisions with port development is a major problem for many major ports. Ports require large amounts of land and generate significant road and rail traffic. Ensuring compatible land use around ports is challenging due to the typically high value of land around ports. The need to consider future port requirements when making nearby urban development decisions is essential. Local governments need to consider the port's future requirements and ports need to better contribute to local and regional planning. Urban encroachment and other developments should not prevent the efficient functioning of the port. The road and rail connections to ports need to be continually upgraded in line with demand, ensuring that corridors are preserved to allow for future road/rail expansion.

Congestion around ports is an increasingly important issue. For instance, easing the landside bottlenecks at Port Botany will be more difficult as total throughput continues to grow, particularly given their expansion plans. The NSW Government's stated objective of a 40 percent rail modal share of freight to and from Port Botany by 2016 appears to be unachievable, with currently only 23% of freight being moved by rail. However, the proposal to establish a major freight hub at Moorebank so that port arrivals at Port Botany can be moved straight to Moorebank by rail, then customs-cleared and on-shipped from there should assist in this regard.

Urgent consideration needs to be given to new rail access clear of urban development for the Port of Brisbane.

Road and rail congestion is also an issue in Tasmania. Road connections are inadequate at Hobart, Burnie and Devonport, and rail connections are inadequate at Bell Bay, Devonport and Hobart. While the problems at Hobart Port will be removed with the construction of the Brighton Hub, addressing these problems at the other ports is important to improve freight supply chain efficiency.

A particular issue for the Northern Territory is sustainable funding of barge landings. With the potential transfer of the barge landings to local governments, funding for their operation, maintenance, renewal and expansion must be provided. Landing charges, if levied, have very limited ability to recover the cost of providing this essential service.

A challenge for Western Australia is building and regulating private sector port developments. The majority of both current and future Western Australian port developments will be driven by the private sector, particularly for iron ore and LNG. In the Western Australian context, guiding and regulating the shape of private development and optimising the role of existing port authorities in working with the private sector will be a major challenge.

Servicing growth in mining exports is of concern in South Australia. The growth in mining will require more export ports capable of handling Capesize and Panamax vessels. These ports will need to be multi-user and will need to have efficient rail and road access.

4.5 Potable water

Potable water has been given a rating of B-, meaning that the infrastructure is generally in good condition, with minor changes needed to meet current and future demand. The major challenges for potable water relate to adequate supplies for the future, continuing demand management measures, and utilisation of recycled water.

Population growth will see demand increase, particularly along coastal areas, which will require new services and sources of water. For instance, it is expected that the coastal non-metropolitan NSW population will grow by 34 percent between 2001 and 2031, and this will require a significant expansion of water and wastewater services. For some local water utilities, obtaining the necessary funds from service fees will be difficult and additional funds will be required. Some cooperative arrangements are in place in this regard. For instance, the central NSW councils (CENTROC) undertook a study and conducted modelling to assess the demand for the next 50 years so as to improve their water management.

Managing water supply to meet demand requires consideration of reduced long-term average inflows due to climate change and more frequent droughts that are longer and drier. While building larger storages may be needed, there is no guarantee that they will fill. Low inflows mean that there will be a greater reliance placed on water supply from outside catchments and non-rainfall-dependent water sources such as recycled water. Maintaining a reduced level of water consumption will also be essential, and will be increasingly difficult with the growing population and increased frequency of high demand on hot weather days.

Ensuring that water supply matches demand over the short, medium and long-term will be an ongoing challenge. Climate change will affect the level and quality of supply from catchments. Managing these risks requires a better understanding of their potential impacts. The 2001 to 2008 drought focussed attention on the need for and acceptance of demand management measures, water efficiency and increasing potable water substitution. With recent rains, and as water supplies increase, there is a danger that complacency will set in and individual support for conservation and reuse may diminish. This increases the importance of locking in water efficacy through mechanisms such as the Water Wise Rules and the requirement for new houses to meet BASIX, the Building Sustainability Index.

Most states and the ACT have been very successful at reducing demand. However, this remains a challenge for the Northern Territory. Darwin's per capita water consumption is the highest of all Australian urban centres. Reducing demand, rather than increasing supply, is a much more cost effective way in addressing water constraints. In addition, some of the ground water supplies are non-renewable and some remote communities in the Northern Territory may not be viable into the future if demand is not reduced.

With the development of water-sharing plans for surface water and groundwater slowing the growth in extraction, and rainfall delivering more water following the end of the drought in the eastern States, waterway health is improving. However, balancing the needs of the environment with the community and industry will always be challenging due to the growing demand for water from a rising population and expanding economy. Continual work needs to ensure that extraction rates are sustainable, even during periods of extended drought.

Water prices should reflect the true cost of water. This is an important demand management tool, as well good business practice.

Eliminating unsafe water supplies to communities is an issue for Tasmania. There are 23 drinking water supply systems that do not have any water treatment processes. This means that about 5,000 people are on permanent boil notices. Ensuring that these communities have safe water supplies is critical. In the Northern Territory, there are a number of urban centres where water quality does not meet Australia Water Drinking Guidelines. While only Tennant Creek is at significant risk from microbiological contamination due to its lack of disinfection, many other centres have water that exceeds physical and chemical guidelines. Addressing these will require significant investment in water treatment plants, which may not be possible in the medium-term.

Improving remote communities' water supplies in the Northern Territory is also a future challenge. While the aim of the Territory Government is to ensure that remote communities have access to high quality water, this may be difficult to achieve in the medium-term as there is a large number of small communities with aesthetic water quality problems (scale and totally dissolved solids) that will require significant infrastructure investment.

A particular issue for South Australia, NSW and Victoria is the protection of water supply in the Murray Darling Basin River. This water is a critical potable water supply for many communities in these States. Protecting the river may become more challenging due to the problems of developing a sustainable plan for water across the entire Murray-Darling Basin.

4.6 Wastewater

Wastewater infrastructure has been rated B-. Generally, urban sewerage and treatment infrastructure is efficiently managed and effective. An issue that affect wastewater is the failure in many instances to use recycled water - a waste of a valuable resource. Some specific challenges are outlined below.

As infrastructure ages, the number of sewer main breaks and chokes increases. Remedial action needs to be taken. The need for renewals of sewer mains is expected to increase markedly over the next decade, requiring significant additional expenditure.

Expansions and upgrades of sewerage infrastructure are increasingly being required due to a combination of population growth and a return to more normal sewage flows after years of drought in many areas of Australia. The drought reduced the amount of wastewater entering the sewers as people used less water due to water restrictions and personal conservation efforts, and there was less rain water infiltration into sewer networks.

Therefore, the sewage output per person over the last few years was less than the long-term average. Given that many sewerage systems are already operating above the design guidelines, a return to normal conditions will see total sewage flows increasing faster than population growth. The scale of the expansion of wastewater infrastructure will be significant, creating a funding challenge for infrastructure owners.

Stormwater and groundwater entry into sewerage networks can increase costs for wastewater treatment and increase the number of sewer overflows. It can also be a significant contributor to the salinity of treated wastewater. As a sewerage network ages, more water entry points appear due to tree root damage, pipe failures and ground movement. A combination of an ageing network, coupled with a return to normal rainfall patterns is likely to result in a significant reduction in system performance.

Climate change impacts for sewerage infrastructure occur as a result of rising sea levels combined with storm tides, ongoing drought, intense rains and rising average temperatures. Ongoing drought reduces the volume of flow causing pipe blockages and treatment challenges. Intense rains cause capacity problems, and rising temperatures can increase odour complaints. Climate change and sustainability strategies are needed across the country.

The increase in the environmental standards for discharge wastewater quality requires more expensive technology. Not only is this technology difficult to fund for local governments, it is technically challenging to install and operate.

Providing sewerage infrastructure in line with high levels of growth in indigenous communities is an issue for the Northern Territory as is maintaining water quality in Darwin Harbour. The growth rate in indigenous communities is very high and will require expansion in infrastructure and improvements in asset management. Raw sewage is still entering Darwin Harbour, which is not acceptable. Even after the Larrakeyah outfall is closed, nutrient loadings from Darwin's wastewater treatment facilities may still cause water-quality problems.

The use of recycled water continues to be an issue. Wastewater can be a valuable resource in certain circumstances. However, its use depends on consumer demand and public attitudes. Recycled water can be used as a source of potable water, typically by injecting it into a water reservoir. This is called *indirect potable reuse*. Recycled water can also be used to replace potable water supply used for non-drinking purposes by industrial, agricultural and to a smaller extent, domestic customers.

Recycled water can also be injected into underground aquifers where it can be extracted during periods of high demand. Aquifer recharge is also used to deliver environmental benefits such as displacing saltwater that has infiltrated into coastal aquifers or preserving the water levels in wetlands that are maintained by groundwater.

The benefits of recycled water include reducing the volume of nutrient-rich water entering coastal and riverine ecosystems, and supplying nutrient-rich solids for agricultural purposes.

Demand for recycled water by industry is principally driven by its cost. Continuing assistance by governments may be required to ensure that the cost of recycled water does not rise higher than potable water. Increasing the acceptance of direct and indirect potable reuse remains a challenge for governments. While governments are preparing infrastructure projects to deliver this, the community may oppose them. Changing community attitudes to direct and indirect potable reuse is critical to ensuring that the recycled water resource can be exploited.

4.7 Stormwater

Stormwater has been given a C rating, meaning that major changes are required for it to be fit for its current and future purpose. Issues affecting stormwater infrastructure relate to water sensitive urban design (WSUD) principles not achieving their expected success and climate change. There has been a focus on water quality rather than flood prevention, which means that a decade has been lost in reducing flood risk. Many old urban areas will experience overland flooding in many jurisdictions with the return to more normal rainfall patterns. .

Due to the expanding size of Australia's capital cities and other major urban centres, and the increased run off due to increased roof sizes, more roads and urban infill, the total amount of stormwater runoff is increasing. This has the potential to overwhelm the existing infrastructure, which has been designed for the current level of runoff. This also has the potential to erode waterways and destroy ecological habitats, as well as to increase the total volume of pollutants such as nutrients, sediment and litter, carried into local waterways, ponds and lakes. Dealing with this requires the widespread use of WSUD principles, and the stormwater implications of infill projects need to be given higher priority during project development.

The widespread implementation of WSUD principles is critical and is being increasingly applied as a way of minimising the impacts of urbanisation on waterways. WSUD involves techniques to treat, store, and infiltrate stormwater runoff onsite rather than simply facilitating rapid discharge of stormwater to the environment. WSUD measures include rainwater tanks, green roofs, infiltration systems, permeable pavements, urban water harvesting, swales and constructed wetlands.

As an example, the effective implementation of WSUD in the Darwin region requires strong government leadership, clearly-stated WSUD design objectives and supporting strategic land-use planning (i.e. structure planning and master planning), infrastructure planning and development assessment decision-making. While some elements of these requirements are in place today, some are not.

WSUD techniques employed in the tropical north need to be customised for its rainfall, meaning that they will be significantly different from those used in southern Australia. WSUD has considerable potential in arid areas but it will require research and experiments to determine appropriate practice.

Climate change is an issue for stormwater infrastructure. The science indicates that more extreme rainfall events will occur, resulting in more frequent and severe instances of overland flooding, particularly due to both the heavier rainfall and the large amount of blockage-causing debris which builds up. Managing this risk involves identifying future rainfall patterns, locating areas that are vulnerable to overland flooding, and changing the design specifications of stormwater systems to accommodate the changed rainfall pattern.

The last few years have seen a shift in stormwater focus from drainage and flood protection to water quality improvement and stormwater harvesting. Part of the reason for this has been the lack of any significant flood events over a decade or more, resulting in flooding risks receiving a lower priority. However, flooding risks in many older parts of urban centres still remain, and stormwater works to improve drainage and flood protection in these areas need to be undertaken.

The quantum of stormwater assets continues to increase as do problems arising from the increase in impervious areas in older suburbs, and the approaching end of life of assets. This will require an increase in funding for stormwater maintenance and renewal.

Stormwater is a major water source. Water businesses and developers have implemented projects to capitalise on it. However, the projects can be expensive and are only viable in certain circumstances, making their widespread use uneconomic and impracticable.

Some jurisdictions face the challenge of improving stormwater asset management information. Given that they are worth billions of dollars and provide an essential community function, data needs to be produced as the first stage towards improving their asset management. While the stocks of engineered assets are generally known, most asset owners do not include information on their vegetated stormwater systems. Without this baseline information, it is difficult to identify any gap between the current and desired infrastructure performance and to measure improvements. Until information exists, it will be difficult for local and state and territory governments to identify and justify significant investments in upgrading priority areas.

Rural areas serviced by rural drains are not designed to achieve urban drainage outcomes. Consequently, rural drains may need to be upgraded or replaced with ones that are more appropriate when urban developments expand into rural areas. This is not an issue in large urban redevelopments where drainage plans are developed, but can be where there is incremental expansion into areas where there are existing rural drains.

Stormwater carries a significant volume of nitrogen into waterways which can lead to toxic blue-green algal blooms in freshwater and degrade seagrass in coastal waterways. Reducing the volume of stormwater and pollutants entering coastal areas and inland waterways remains a challenge.

4.8 Irrigation

Irrigation infrastructure has been given a C rating. Irrigation covers the application of water to cultivated land or open space for the growth of vegetation or crops.

The challenge in achieving improvements in irrigation infrastructure is adapting irrigation to a sustainable water supply. This means preventing water over-extraction and irrigation causing land degradation and ensuring that drought and climate change impacts on water resources can be catered for within water allocation and licensing arrangements.

Climate change is likely to decrease the total amount of rainfall and runoff, and the volume available to irrigators. As the population and the economy grow, total demand for water will also increase. For instance, the National Water Commission estimates that in the order of 30 percent less water could be available for irrigated agriculture in northern Victoria in the years ahead.[23] Thus the water supply for irrigation is likely to decline over time, making the continual irrigation efficiency improvements more important, and the cessation of irrigation likely in marginal areas.

Water resource plans are likely to recommend a reduction in consumptive water usage meaning that the volume of water available to irrigators will decline. Therefore, water efficiency needs to increase, water needs to be used on the most valuable agriculture produce, and more opportunistic irrigation needs to occur.

Improving and adapting irrigation infrastructure may be difficult due to the physical constraints on existing infrastructure or the high cost of replacing it. Improvements in irrigation infrastructure will rely on the rollout of automated technology that has the flexibility to adapt to changing water availability and shifting customer demand. A challenge to achieving this is to ensure that water organisations price their services so that the technology can be maintained and adapted over its service life.

Sustainability of the water supply from the Murray River looms large in discussion in irrigation infrastructure. For instance, over-extraction of water from the Murray River upstream of South Australia, degradation of its ecological systems, and increasing demand for its water for potable uses, will all mean that the quality and volume of water from the river for irrigation in South Australia is increasingly uncertain.

The *Garnaut Climate Change Review* (2008) estimated that because of climate change, there could be a loss of half the irrigated output from the Murray–Darling by 2050 if agricultural practices do not change.[24] While the Basin Plan currently under development is meant to provide certainty in water allocation, it may not achieve this outcome. Even if it does, it may substantially reduce the amount of irrigation water available. Consequently, irrigators may not have the confidence to invest in irrigation infrastructure improvements as they are unsure whether they will obtain a financial return for doing so.

Despite the increase in salt interception schemes, salinity is still rising in the Murray River. A significant contributor to this is reduced flows in the river that result in less dilution and higher salt concentrations. This may ultimately be offset by reduced irrigation reducing irrigation-caused salinity. Increased infrastructure is still likely to be required to maintain salinity at acceptable levels.

4.9 Electricity

Electricity has been given a C+ rating, meaning that major changes are required before the infrastructure will be fit for its current and future purposes. Major issues around electricity are that generation investment has been deferred and major improvements are needed in distribution and transmission. The development of a renewable energy sector in Australia is not occurring as rapidly as it might if a carbon pricing policy was in place.

New generation plants will need to be built for a growing population. Investment in generation assets is principally determined by the private sector. With concerns about the financial viability of coal-fired plants due to the pricing of carbon and the increased attractiveness of renewable energy due to the Renewable Energy Targets, investment over most of this decade has been in wind and gas-fired plants.

A significant expansion of low cost, reliable generation will be required to meet future demand. The viability of novel large scale generation, specifically nuclear, geothermal and solar thermal power, needs to be examined from a technical, political, financial and environmental perspective by governments as this is unlikely to be undertaken by the private sector due to risk in the current carbon environment.

Base-load coal-fired plants are not being developed. Instead, gas-fired plants are being built as they are quicker and cheaper to construct, and less subject to carbon pricing. However, their cost of generation is far more sensitive to gas prices, which are likely to become more volatile due to the internationalisation of Australian gas prices. Providing economic base-load generation will become increasingly important as existing coal-fired plants reach their technical end of life. All options should be considered in the provision of base-load power.

Electricity networks are ageing. A significant rise in the level of upgrades and renewals of network infrastructure is needed, requiring a large pool of labour resources. The costs of the components of providing electricity – generation, transmission, distribution and retail – are all increasing, adding pressure for significant rises in the price of electricity. Given that significant investment in electricity infrastructure is required to meet rising demand, artificially holding down prices will result in an under-investment in infrastructure leading to reliability and quality of supply problems. A challenge will be to establish an electricity cost that ensures sustainability of infrastructure and is still affordable for our communities.

Peak demand is currently growing faster than average demand. Peak demand growth needs to be reduced to the level of average demand growth to improve network reliability and security, and maximise asset utilisation. Achieving significant reduction in demand, particularly given air-conditioning demand on hot days, will be a major challenge. Demand management has significant potential to reduce peak demand. However, typical approaches, such as paying large consumers to scale back demand on peak electricity demand days, will not work in all jurisdictions due to different demand profiles. Techniques specific to these jurisdictions need to be employed for demand management to have a significant impact.

One initiative under way to advance demand management is the Smart Meter rollout. These meters will provide two-way communication between electricity meters and distributors, making more immediate information about electricity use available to all parties. The meters will enable granulated time-of-use pricing to be implemented. The demand impact of these meters will depend on the difference between peak and non-peak price, take up rate of new time-of-use tariffs, and how customers respond to price signals.[25] There are various structural and cultural reasons why demand management has had limited impact on electricity consumption, and changing practices will be required to realise the benefit of managing demand. The NSW government has recently allowed significant price increases in electricity charges and this may change the community's demand (usage) of electricity over the next few years.

Providing reliable supply will be a challenge in the future. Climate change may lead to an increase in extreme weather events, such as wind storms and heatwaves. While networks must be planned and maintained in such a way as to take account of weather, increasing reliability in the face of extreme events is very costly. Rising community expectations for reliable electricity and an increased number of sensitive electronic devices in households, is placing increased pressure on electricity distributors to reduce interruptions and their duration. Continued improvement in extreme weather preparation and response will be required.

A traditional electricity network involves a one-way transfer of electricity from bulk suppliers to customers. With the advent of embedded generation, energy will be flowing in multiple directions requiring changes in infrastructure and network management. To accommodate these changes, investment will be required. As well, innovation needs to be encouraged in the sector. The electricity sector is slow to change due to a combination of sunk costs, and natural conservatism arising from focusing on delivering secure and reliable power. However, technologies are now available that can deliver improved and lower cost electricity supplies, but these will require substantial changes in current practice. These include new generation sources, such as fuel cells, embedded generators and smart grids, which need to be deployed where cost-effective.

There has been a poor uptake in the development of renewable energy generation. This needs to be rectified. While it is recognised that renewable energy sources will not provide stable and continuous energy supply to offset fossil fuelled base load generation, there has been inadequate development in this area over the last five years. While there are plans in place that will see more development of new technologies, they are still in their infancy.

The next few years will see if geothermal power is a practical technology to reliably deliver base-load generation. If it is proved technically, it may fail economically due to the cost of building the required infrastructure to connect it to the national transmission networks. A challenge will be to enable geothermal power to contribute its potential in a way that is equitable for other electricity asset owners and electricity consumers.

Integrating wind generation into the network is an issue. For instance, wind generation in South Australia is already reaching capacity constraints, particularly on high wind and low demand days. Locating generators in areas where there is greater network capacity, increasing dynamic control and augmentation of the transmission system (including interconnectors) are all ways to increase wind power generation. Making these changes can have significant cost impacts that must be shared appropriately.

There is a need to prepare for an increasingly intelligent network, with proliferating network-integrated digital technologies, and growing numbers of small and micro generators such as solar/photovoltaic and wind linking into the network. Electricity providers are currently planning for smart grid networks that provide real-time information on electricity supply and the ability to remotely control the network. Increased initiatives are required both to accelerate the development and deployment of smart network technology.

4.10 Gas

Gas infrastructure has been given a rating of B- and is generally in good condition.

One of the challenges to achieving improvements in gas infrastructure is managing security of supply. There is increasing gas demand across the nation driven by gas-powered electricity generation plants, industry growth and liquid natural gas exports, plus the potential of less warning time for security-of-supply events.

A lack of pipeline redundancy in some instances exposes some jurisdictions to massive disruption if the pipeline is damaged or shut down. Risk management of loss of supply must be effective, and given the vulnerabilities in gas production and transmission infrastructure, loss of supply is a major risk that needs to be continually monitored.

A further challenge is providing appropriate infrastructure in the face of future climate change and evolving energy policy. Gas infrastructure has developed to meet demand and supply changes that have been mostly predictable since the 1990's. The future shape of national and international energy and climate change policies is likely to significantly change demand, supply and consumption patterns.

Given the uncertainty over the demand for natural gas arising from the introduction of a carbon tax, other policy settings such as the Mandatory Renewable Energy Target and the internationalisation of domestic natural gas prices, it is very difficult for infrastructure owners to be confident in their decisions about investment. The actual shape of the policies cannot be predicted with confidence, resulting in it being extremely difficult to design the gas network today, to be able to cope with unknown future developments.

The growth of the distribution network has slowed in many jurisdictions. Expanding the network through servicing urban infill and unserved areas is expensive. Below a critical market size, economies of scale are not available for distribution network owners, resulting in higher costs, lower service levels and reduced competition. The Queensland, Tasmanian and Northern Territory distribution systems are currently small-scale compared to networks in other States, meaning that there are fewer economies of scale. Western Australia's domestic gas infrastructure was created to deliver gas to a small number of large consumers, and, consequently, the distribution network evolved as an adjunct to this. It has limited capacity to supply new small industrial customers, and therefore gas is not available in certain areas. As well, certain areas of Adelaide, such as the Adelaide Hills, are not connected to the reticulated gas network.

A challenge will be increasing the distribution networks' capacity and profitability in the face of decreasing average consumption arising from the impact of solar hot water, increasing appliance efficiencies, increased energy awareness and climatic warming. Growing the network may require additional incentives for network operators that recognise the environmental benefits of natural gas.

4.11 Telecommunications

Telecommunications infrastructure is rated C, meaning major changes are required to be fit for current and future needs.

Australia's future productivity will be increasingly dependent on digital solutions. High speed digital infrastructure will enable substantial advances in the delivery of education, health, energy, transportation and social services. The proposal to deliver ubiquitous high speed digital infrastructure is supported. The proposal to use optic fibre as the transmission medium provides scope to upgrade over time as transmission equipment improves.

A visionary approach to telecommunications infrastructure is required as telecommunications will be instrumental in delivering future economic growth and social benefit.

Telecommunication infrastructure has become an essential service upon which productivity and lifestyle quality rests. The Australian Government in partnership with other levels of government, industry and community needs to establish a vision for the future that provides for the exploding use of telecommunications. It requires supporting regulation to translate this vision into reality. The National Broadband Network (NBN) should address this to a significant degree, but it lacks a focus on providing high speed broadband services in a mobile context.

A challenge for improvements to telecommunications infrastructure is creating a value proposition for ubiquitous high speed broadband. The NBN aims to provide universal high speed broadband access, and it is claimed that this will deliver significant improvements in business efficiency and innovation, and quality of life improvements. However, while there is no doubt that its huge capabilities and universal access will be welcome, the cost of the NBN will be significant. Thus a challenge facing the NBN will be in creating over the medium-term large enough numbers of suppliers, consumers of services and products running over the network, to make the infrastructure investment justified.

Selecting optimal technologies may also be an issue. There are many technologies that telecommunications companies can deploy. All have trade-offs such as cost, risk, capability and compatibility. The selection of technologies is critical in preventing stranding of assets, particularly for smaller telecommunication companies that do not dominate the market, and for those wishing to be compatible with the NBN.

In some jurisdictions, utilising Government-owned communications infrastructure is an option that requires consideration. For instance, the NSW Government owns substantial infrastructure assets through Government utilities, such as TransGrid. As a result of this extra capacity provides an opportunity to provide broadband services into communities through leveraging the existing Government assets.[26] Smart networks are being rolled out by electricity and transport infrastructure organisations. These all rely on telecommunications. If there are opportunities to capitalise on the roll-outs to improve the provision of telecommunication services to under-served areas, these developments should be capitalised on.

Strengthening the resilience of the telecommunications backbone is required. The telecommunications network has become an essential service and its loss causes significant economic and social consequences. As telecommunication becomes embedded into more aspects of commercial and everyday life, ensuring its resilience and robustness becomes increasingly important. This requires reducing single points of failure and other vulnerabilities, and preventing unintentional disruptions such as by accidentally cutting through cables with a backhoe.

The significant disparity in the quality of service between rural and metropolitan users needs to be addressed. A challenge is in balancing market-driven telecommunication developments and government intervention to create a competitive telecommunication industry that delivers affordable and widespread access. Telecommunication infrastructure investment decisions are made by telecommunication providers on the basis of market decisions, and/or the ability to access government subsidies. Consequently, areas of good financial returns have better telecommunication capabilities than other areas. Areas that are served by a single provider generally experience higher prices and lower quality services than areas with competitive provision.

The NBN will provide social and health benefits to rural and regional areas through the availability of computer-based diagnostic and monitoring services. For social and economic reasons, improved services are required for under-served areas. This invariably requires some form of government intervention. For instance, much of the non-urban population in Queensland and Western Australia cannot access telecommunication services that are common in urban areas.

This is because it has not been commercially viable for the privately-owned telecommunications companies to do so. In areas where services are available, they are often expensive due to the lack of competition. While the NBN will increase the availability of broadband, it will not increase the availability of mobile phone coverage.

Because of the low population density across most of the Northern Territory, there is no business case for commercial organisations to provide telecommunication services in low density locations. Consequently, it falls to government to provide the services. Both the Australian Government through the NBN and the Indigenous Communications Program, and the Territory Government are funding new telecommunication infrastructure but their resources are limited. An additional approach that should be pursued is to facilitate Territory-based industry and the community to consolidate their requirements so that shared funding infrastructure can be built more rapidly, such as with the Arnhem Land Fibre Project.

5. Rating Summary

State and Territory Rating Summary

	Rating	Comment
ACT	B-	The findings of the ACT Infrastructure Report Card identify that most of the ACT's infrastructure is in a good condition. There are three exceptions to this: rail; wastewater; and stormwater. While these findings are good compared to other jurisdictions, there are several challenges to maintaining or improving these ratings in the future. These include the need to expand infrastructure to meet growing demand and a changing climate, which has the potential to lead to water shortages and high energy consumption due to cooling needs.
NSW	C	NSW's infrastructure is in average to poor condition. There has been a significant underinvestment in all sectors over a long period of time. This includes road congestion, the poor condition of regional and rural roads, and bridges in need of urgent upgrade in the transport sector alone. Other sectors face similar issues. Over the next decade, there will be significant expenditure on new infrastructure, but significant improvements will only be achieved by both building more infrastructure and employing demand management techniques to moderate demand.
NT	C+	The Territory's infrastructure has mostly been rated as still requiring major improvements, with a smaller number of infrastructure sectors being assessed as good. While improvements are planned or underway in all infrastructure sectors, many of these initiatives are either not funded or not expected in the short-term. The adequacy of infrastructure in the future will depend significantly on three key factors - the speed and magnitude of the resource sector's growth, the magnitude and location of population growth, and the ability of the Territory Government and infrastructure owners to access investment funds and invest in anticipation of demand growth.
QLD	C+	Queensland's infrastructure has mostly been rated as still requiring major improvements, with a smaller number of infrastructure sectors being assessed as good. The assessment notes that many infrastructure sectors are facing significant problems, which, if not addressed, will lead to a substantial reduction in their future performance and quality. The challenges in addressing these problems are considerable, given the scale of under-investment in maintenance and renewals and the ongoing increase in demand driven by population growth and the impact of climate change.

	Rating	Comment
SA	**C+**	South Australia's infrastructure is mostly rated as only adequate meaning major changes are required to enable infrastructure to be fit for its current and anticipated future purposes. There has been little improvement in most sectors over the past five years. The ratings for the State reflect that its infrastructure is stressed. In metropolitan areas, this is evident from traffic congestion and public transport inadequacies. In regional areas, it is evident in road quality and inadequate broadband availability. The State experiences particular constraints not faced by most other States, such as its low population density requiring extensive infrastructure with a low utilisation rate, geographic barriers around Adelaide limiting its growth to the north-south axis, and low rainfall requiring diversity in its water sources. Critically important is maintaining existing infrastructure rather than waiting for it to fail and then replacing it.
TAS	**C**	Tasmania's infrastructure is mostly rated as adequate or poor. This rating reflects that the State's infrastructure is stressed, as illustrated by 'boil water' notices and rail derailments. While greater utilisation can be extracted from existing infrastructure by building missing links and instigating demand management, significant investment in new infrastructure is required to address well-known problems in existing areas as well as meeting future demand. Sustaining the necessary high level of investment will be challenging due to the numerous demands for government and private sector investment.
VIC	**C**	Victoria's infrastructure is mostly rated as only adequate meaning major changes are required to enable infrastructure to be fit for its current and anticipated future purposes. This rating reflects that the State's infrastructure is stressed. In metropolitan areas, this is evident by traffic congestion and public transport inadequacies. In regional areas, it is evident in wastewater treatment problems and inadequate broadband availability.
WA	**C+**	Western Australia's infrastructure is generally in adequate to good condition. There are some high quality components as well as areas that need significant improvement. While the dramatic increase in demand due to population and economic growth has resulted in areas of infrastructure stress, at an economy-wide level, the State's infrastructure is generally fit for purpose. However, in many areas, the infrastructure is at near capacity and is ageing. This means that further increases in demand can only be accommodated through substantial network expansions and refurbishments. This will require substantial investment from governments and industry, broad engagement in future focused planning, and supportive regulatory regimes to sustain high levels of investment and meet community expectations.

References

[1] Productivity Commission, *Reform and Australian Productivity*, November 1999, p.6

[2] Engineers Australia, Australian Infrastructure Report Card, 2005.

[3] Infrastructure Australia functions, available at http://www.infrastructureaustralia.gov.au/function.aspx

[4] Infrastructure Australia, Getting the fundamentals right for Australia's infrastructure priorities, June 2010, Australian Government, p. 8

[5] Infrastructure Partnerships Australia, 2009, Financing Infrastructure in the Global Crisis, available at Http://www.infrastrcuture.org.au/content/financinginfrastrcutre.aspx

[6] Infrastructure Australia, Getting the fundamentals right for Australia's infrastructure priorities, June 2010, Australian Government, p. 9

[7] Budget 2010-11 Budget Paper No. 1, Statement 2 Economic Outlook, available at http://www.budget.gov.au/2010-11/content/bp1/html/bp1_bst2.htm

[8] Global and Domestic Economies, Ministerial Statement, Parliament House, Canberra, 18 October 2010, http://ministers.treasury.gov.au/DisplayDocs.aspx?doc=speeches/2010/026.htm&pageID=005&min=wms&Year=&DocType=

[9] Treasury, Intergenerational Report, http://www.treasury.gov.au/igr/igr2010/report/pdf/IGR_2010.pdf

[10] Australian Bureau of Statistics, Australian Demographic Statistics 3101.0, March 2010, pp. 16, 23

[11] Department of the Environment, Climate Change, Energy and Water, Climate Change in the ACT, webpage,http://www.environment.act.gov.au/climate_change/climate_change_in_the_ACT, accessed 8 June 2010.

[12] Department of Climate Change, Victoria: Summary of projected impacts webpage, http://74.125.153.132/search?q=cache:bpu4mq0JqOEJ:www.climatechange.gov.au/impacts/regions/tas.html+Victoria+site:climatechange.gov.au&cd=2&hl=en&ct=clnk&gl=au.

[13] Department of Sustainability and Environment, 2008, Climate Change in Victoria: 2008 Summary, p. 5.

[14] Australian Bureau of Statistics, 8755.0 - Construction Work Done, Australia, available at http://www.abs.gov.au/

[15] Legislative Council, 2009, *Estimates Committee A (Sturges) – Part 1 Hansard,* 23 June, p.20.

[16] South Australia Division of Engineers Australia, 2009, *Response to the 30 year Plan for Greater Adelaide*.

[17] March Hartwich, Oliver and Buckingham, Jennifer, 2009, *On the right track: Why NSW needs business class rail*, p. 3.

[18] ACT Government, 2009, Submission on the Canberra International Airport 2009 Preliminary Draft Master Plan, p. 10.

[19] Victorian Government, 2008, Victoria's National Infrastructure Audit – Final Report to COAG and Infrastructure Australia, p. 49.

[20] TasPorts, 2009, Annual Report 2008-09, p. 20.

[21] Tasmanian Government, 2008, Tasmanian Government submission to the National Infrastructure Audit, p. 37.

[22] Department of Transport, 2008, The Victorian Transport Plan, p. 13.

[23] National Water Commission, 2009, *Australian water reform 2009: Second biennial assessment of progress in implementation of the National Water Initiative*, p. 203.

[24] SA Government, 2009, *Water for good*, p 112

[25] Victorian Auditor-General, 2009, *Towards a 'smart grid' – The roll-out of Advanced Metering Infrastructure*, pp.26, 27..

[26] Department of Lands, 2009, *Submission to the Backhaul Blackspots Initiative*, p. 4.