ENGINEERS AUSTRALIA

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Australian Infrastructure Audit 2019

A submission to Infrastructure Australia

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Australian Infrastructure Audit 2019

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1. About this submission

1.1 Engineers Australia

Engineers Australia is the peak body for the engineering profession in Australia. With about 100,000 individual members across Australia, we represent individuals from a wide range of disciplines and branches of engineering. Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community.

Engineers Australia's response is guided by our Charter and Code of Ethics which states that engineers act in the interest of the community, ahead of sectional or personal interests towards a sustainable future. Engineers are members of the community and share the community's aspirations for Australia's future prosperity.

1.2 Introduction

This submission has been informed by members of Engineers Australia in consultation with members drawn from all Engineers Australia Colleges, Committees and Learned Societies, to provide representative perspectives from their particular engineering disciplines and industries.

Engineers Australia welcomes the opportunity to provide this submission to Infrastructure Australia (IA) in response to the Australian Infrastructure Audit 2019 (the Audit). Engineers Australia applauds the 2019 Audit focus on outcomes for users and on the three key areas of access, quality and cost. Engineers Australia supports the key messages contained in the report and broadly agrees with the challenges and opportunities identified.

Many of the challenges and opportunities identified in the Audit are applicable across all sectors of Australian infrastructure. Therefore, Engineers Australia has framed this submission according to the following three issues which affect all Australian infrastructure:

- Governance and funding
- Data, cybersecurity and technology
- Standards for resilience and sustainability

Sector specific feedback is provided for the following sectors:

- Transport
- Energy
- Water

1.3 Contact details

To discuss the contents of this submission further, please contact Sybilla Grady, Senior Policy Advisor, on (02) 6270 6195 or SGrady@engineersaustralia.org.au.

2. Governance and funding

2.1 Decision making, procurement and capability

Engineers Australia recommends explicit instruction from Infrastructure Australia to incorporate technical expertise at all stages of the infrastructure project lifecycle, from procurement, to delivery and beyond.

Government decision making on infrastructure needs to be transparent, efficient and accountable in order to move away from short term planning and poor coordination, which leads to higher costs adversely affecting the environment and communities the infrastructure is intended to support.

Engineers Australia recognises that the Audit has called out issues with market depth and skills. However, we recommend that IA is more explicit in its instruction to government to incorporate technical experts in all infrastructure project phases, from decision making, procurement, delivery, operation and beyond.

The lack of appropriate skills is compounded by arbitrary decision making without adequate planning and project management. The skills deficit leads to cost blow out and delays which in turn prevent experienced project teams from moving on to other projects. Fully understanding the technical requirements and considering the whole of life, financial and non-financial costs and benefits achieves better value from procurement.

When it comes to infrastructure, procurement is not just an important administrative function, it is central to delivering quality, affordable and accessible infrastructure. Explicit direction should be incorporated into the plan for infrastructure decision makers to ensure that the procurement, design and implementation required for complex infrastructure delivery is underpinned by qualified technical experts.

2.2 Management of existing assets

Engineers Australia recommends development of a national infrastructure maintenance strategy to manage existing assets to maximum benefit.

Road and rail networks, water systems, power generation and distribution systems, and telecommunications networks are vital to our productivity and quality of life. The amount of public infrastructure we build is important but perhaps of greater consequence, is the ongoing condition and maintenance of that infrastructure and the ability to deliver services.

Poorly managed maintenance of infrastructure compromises the structural integrity of our assets, our safety and economic productivity. Not only is it dangerous, it is expensive.

Rebuilding infrastructure that has not been appropriately maintained is more expensive than proper maintenance to safeguard against premature decommissioning. Whole of life investment and utilisation of our existing assets will assist in the efficient delivery of services.

Planning is also required to consider necessary demolition, refurbishment, asset recycling and consideration of critical infrastructure vulnerability profile and management. It is essential that Australia's infrastructure program is carefully evaluated and planned to prioritise and deliver infrastructure that represents the best possible investment and use of public funds.

2.3 Funding

In order to address the infrastructure deficit that continues to grow, alternative sources of funding are required. Infrastructure planning and funding should be considered as a long-term integrated investment to promote urban renewal and resilience.

Existing infrastructure must be maintained, and new investments planned with a focus on sustainable funding and political consensus for the long term. It is essential that investment supports both financial and environmental sustainability.

The historical focus has tended to be on capital projects rather than whole of life infrastructure investment. As well as an emphasis on public private partnerships, consideration of alternative modes of funding and revenue generation, such as road user charging, value capture and Commonwealth incentivised schemes for states committing to infrastructure reform, should be evaluated.

3. Data, cybersecurity and technology

Engineers Australia recommends greater emphasis on the importance of funding innovative technology to support Australian infrastructure and the urgent need for systematic data collection, analysis and security across all sectors.

As Australia transitions to more intelligent infrastructure, sharing data will be crucial to seamless integration for interdependent systems. As such, the urgency of adequate planning for data sharing, security, privacy and control, is a challenge which affects the entire infrastructure network.

Several of the challenges and opportunities identified in the audit are concerned with data, the use of innovative technology and cybersecurity. Engineers Australia agrees that government should increase funding for the collection, analysis and security of data in the context of an increasingly connected and automated infrastructure network.

The challenges identified in the energy and telecommunication chapters, do not adequately capture the security imperative for consideration of data management in the context of Australian infrastructure. Whilst the audit does capture data issues, Engineers Australia believes the challenges associated with data management have urgent cross-sectoral significance.

There is an opportunity for greater investment in data collection to measure the success of infrastructure policy and respond to emerging needs to achieve greater resilience and quick restoration where services are partially or fully degraded.

As digitisation, data driven and smart assets transform our infrastructure systems and with infrastructure investments across Australia on the rise, there is opportunity to re-evaluate critical infrastructure policy and data requirements to map interdependencies to strengthen resilience and address vulnerabilities.

Australian governments must increase investment in pre-emptive cyber systems security analysis in preparation for an increasingly data reliant infrastructure network.

Technology has the potential to revolutionise the way we live and work. However, as technology, connected systems and integrated infrastructure become further embedded into everyday life, the risks associated with data sharing will increase. We must critically assess and analyse our cyber vulnerabilities and security management in order to keep Australia secure.

Although there are clear challenges, the benefits of digital technology are irrefutable. Government, educational providers, utilities and the private sector should conduct coordinated trials to work out how disruptive technology can be adopted in a relevant and economically justifiable way. Government should also support the emerging industries and roles that will develop or change as data-driven and Internet of Things (IoT) systems take hold. These include engineering, asset planning and operational roles.

4. Standards for resilience and sustainability

Engineers are essential to the revision of construction codes and standards to ensure resilience is embedded to withstand the changing environment.

Engineers Australia and the global community accept the comprehensive scientific evidence of climate change, the serious consequences of inaction and the necessity of innovation and adaptation. Climate change is a pervasive environmental issue that affects all people, economies and industries. It is crucial that engineers, society and government urgently adopt and implement mitigation and adaptation strategies.

Government must work to support delivery of high quality sustainable urban design to provide for high density living without compromising air quality, water and biological diversity. Emphasis needs to be placed on green infrastructure (GI) and water sensitive urban design to mitigate heat island effects and other problems associated with extreme weather.

Infrastructure planning and design will be required to address the challenges associated with climate change, making it necessary to review codes and standards to ensure they are fit for purpose now and in the future.

Engineers are essential to the revision of construction codes and standards to embed resilience and sustainability in our built environment and build structures able to withstand extreme weather events. It is critical that Australian infrastructure is designed to withstand or recover from disaster.

5. Transport

5.1 Mobility as a Service (MaaS)

Engineers Australia recommends development of MaaS policy proposals to support whole of journey transactions. A framework should be prepared now to ensure that private sector MaaS technology develops in a well-regulated and coordinated environment.

At present, MaaS is largely being driven by commercial imperatives which may or may not align with government strategic transport and land use goals. An institutional overlay is required to ensure service delivery is consistent with societal objectives.

A coordinated approach should chart the preconditions that must be in place and the obstacles to be removed to enable a healthy market for MaaS services to emerge and to remedy any potential imperfections of markets.

A fundamental shift from managing transport to facilitating an aggregated mobility offer is required, largely to accommodate changing consumer expectations and new industry dynamics created by technology. This is especially important because many new and emerging service models are developing very quickly.

Our benchmarking and research into the concept of MaaS suggests there is a general agreement that the role of the government should be to enable the innovation and delivery of MaaS rather than be the MaaS aggregator or provider. A major part of this role is ensuring that there is regulatory and legislative support for MaaS delivery.

It is important to use the potential of MaaS to address environmental and social equity and wider economic issues, to avoid MaaS providers only concentrating on commercial outcomes and delivery of services in urban and high-income areas. The goal may indeed be for a national system of mobility that will allow users to travel freely across state borders without needing to join several different systems.

Future projects and plans should be assessed through the lens of MaaS, to minimise the very real risks that major investments could be rendered redundant over the longer term. Future bus operator contracts, fleet procurement and purchase decisions will all need to account for new and emerging technologies and service delivery models. Furthermore, government agencies will need to re-consider current procurement processes and timelines that may be too long, because there is a risk that initiatives can be superseded prior to the product being operationalised.

Governments also have a tremendous opportunity, indeed responsibility, to up-skill existing workers to enable a future transportation system that incorporates all these new and emerging technologies and data. Government support is also required to ensure the necessary skills are in place within both the private and public sectors. Partnerships with the private sector are also likely to be more critical along with more flexible and responsive procurement processes to incentivise private-sector innovation.

5.2 Road safety

The Audit demonstrates that the cost of road trauma exceeds the cost of congestion. Design standards require reform to prioritise safe collision speeds and ensure consistency for maximum safety benefit.

The Audit necessarily points out that Australia is not on track to meet the objectives of the National Road Safety Strategy. To improve road safety, our safety management system needs to be reformed. The complexity of road safety requires a sophisticated, multidisciplinary, integrated and future focused response. Thorough application of engineering systems approaches to road safety offer the best opportunity to improve road safety in Australia.

Our roads should be designed to be as predictable as possible, with consistent standards and appearance, to promote automatic choice of safe speeds, at or below tolerances for serious crash risks. Our roads must be designed to be more forgiving of driver error and ensure the safety of vulnerable road users, such as cyclists and pedestrians, who are disproportionately represented in road trauma statistics.

Independent road safety audits must continually be conducted in accordance with the safe system principles and provide rigorous guidelines governing departure from standards and compensatory measures to address known deficiencies and provide the greatest safety outcomes.

Greater funding should be provided for technology development to detect risks (e.g. congestion, broken down vehicles, crashes and roadworks), advise traffic (via variable speed and warning signs and direct communications), manage traffic controls, collect and analyse data to inform safety management, and automate enforcement.

New vehicles should have higher quality active and passive safety features as a minimum requirement and optional safety features should be subsidised, including active technology. Four-star crash rated cars should be the minimum for all new vehicles, unless exempted for functional purposes, such as cranes or specialist agricultural equipment.

5.3 Connected autonomous vehicles (CAV/AV)

Increased funding to evaluate the value of network upgrades or new infrastructure to support a mixed fleet of driver operated and autonomous vehicles should be prioritised in preparation for transition to a more autonomous and connected transport network.

Closed systems such as rail networks should be prioritised for migration to driverless vehicles.

There is significant research underway to address the integration of a mixed fleet of driverless and non-driverless vehicles. Engineers Australia members have noted that research out of the UK predicts that human-operated vehicles will remain part of our transport systems up to 2050. The cost of network upgrades to support a mixed fleet is a major obstruction to automated driverless technology ubiquity.

A mixed fleet presents several risks and opportunities in future transport networks. The length of time to transition to fully autonomous cars may lead to disruptions from emerging adjacent markets such as autonomous aerial passenger-carrying vehicles. For example, if it is too difficult and slow to mix driverless and non-driverless cars, then it may be simpler to make driverless vehicles airborne and physically separate them. In this scenario the land-based networks may become less congested but significant advancements in airspace management will be required through research in Unmanned Aerial Systems (UAS) Traffic Management (UTM).

Over 30 cities including Copenhagen, Dubai, Seoul and Vancouver already operate fully autonomous trains. Migration to driverless vehicles in closed systems such as rail networks should be prioritised, particularly given the role of expanded mass transit systems in the major cities.

6. Crowding and congestion

Items 6.1 and 6.2 are provided in response to the supplementary report *Urban Transport Crowding and Congestion: The Australian infrastructure Audit 2019.*

6.1 Congestion as demand management tool

For urban transport planning purposes traffic congestion should be viewed as a demand management opportunity.

In response to the supplementary report *Urban Transport Crowding and Congestion: The Australian infrastructure Audit 2019*, the overarching observation is that the way in which urban crowding and congestion is viewed needs to change. Instead of being heavily based on consideration of cost effects, congestion should be viewed as a travel demand management tool for urban planning.

Congestion is one of the greatest challenges to economic productivity and liveability of cities. The Bureau of Infrastructure, Transport and Regional Economics (BITRE) estimates that avoidable traffic congestion cost is $16.5 billion per year with upward trends set to continue. At current rates, it's predicted that this cost will rise in excess of $30 billion by 2030.[1]

There is an economic need to mitigate costs associated with congestion. However, while car occupancy remains low, urban sprawl continues, and investment in mass rapid transit systems remains lower relative to road investment, the rate of growth of congestion will continue to outstrip road infrastructure provision. Therefore, the message, and hence the prioritisation of transport investment for cities, must change.

Average car occupancy during weekday journey to work trips across Australian capital cities has been declining over the last decade. These trips to work are when urban road networks operate close to or in an over-saturated state. A sustainable approach to reducing traffic demand and associated travel delay is to target increasing the number of passengers per car. Adoption of current low levels of car occupancy to reflect future traffic demand, risks infrastructure investment being prioritised as an issue which can be addressed with demand management measures, such as bus and transit lanes and parking pricing, and not solely with increasing infrastructure capacity.

Accordingly, more consideration is recommended to understand the implications towards investment prioritisation with increased car occupancy, through the application of travel demand measures, within Australian cities.

6.2 Long term planning

The lifecycle of infrastructure and investment periods should inform the Audit planning horizon.

Infrastructure such a roads, railways, pipelines and power and water assets are typically long-life structures. Design lives recommended for infrastructure in Australian engineering design manuals range from a minimum of 20 years (for asphalt pavements) up to 100 years (for bridge structures).

The Australian Transport Assessment Program (ATAP) guidelines typically recommends analysis periods of a minimum of 30 years for analysis of infrastructure benefits and costs. Organisation for Economic Co-operation and Development (OECD) guidelines also recommend a whole of life approach is taken to infrastructure planning.

The planning horizon for the IA audit of only 15 years is too limited. Engineers Australia recommends that future audits on transport consider a 30-year period.

7. Energy

Resilient energy systems require policy to build and test a theory of change to address challenges across the energy sector.

The Audit demonstrates the scale of the transition challenge but does not provide a clear way to address the observed challenges and opportunities in a coherent, actionable way.

The Audit provides a concise description of the challenges faced by the energy sector but does not touch adequately on the underpinning dynamics of transition and disruption. Australia is part of a global innovation chain that is creating technology and business models that challenge how we do business. As the audit intimates, renewable deployment is happening quickly, and our regulatory, governance and infrastructure planning structures are struggling to keep up. Australia, for example, has the highest rates of rooftop solar photovoltaic uptake in the world[1] – we now either need to spend billions on new poles and wires to accommodate distributed generation or choose to actively transition to the grid of the future[2].

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[1] The Bureau of Infrastructure, Transport and Regional Economics, *Traffic and congestion cost trends for Australian capital cities*, November 2015, https://www.bitre.gov.au/publications/2015/is_074.aspx

[1] Roberts, M, et al, *Solar Trends Report for Solar Citizens*, UNSW. Available at: http://apvi.org.au/wp-content/uploads/2018/12/Solar-Trends-Report-for-Solar-Citizens-FINAL_11-12-18_2_logos.pdf. Accessed 28 October 2019.

[2] Australian Energy Market Commission, *Delivering the grid of the future*, 26 September 2019. Available at: https://www.aemc.gov.au/news-centre/media-releases/delivering-grid-future. Accessed 28 October 2019.

This trend to disruption is unlikely to abate, and in our view will intensify over time. For policy makers to make sense of IA's advice in a coherent way it is not enough to make well evidenced observations. We also need to build and test a theory of change.

Engineers Australia and the Australian Strategic Policy Institute have recently released a report that explores what is required to design for resilient energy systems[3]. The resilience framework is used in recognition that in an increasingly interconnected world, future engineering choices will be guided by the need for flexibility and the capacity to recover quickly from diverse sources of disruption. Its core conclusion is that a successful policy response requires a new narrative centered around the following themes:

- Transition and transformation – recognising and working with the complexity of transformation to capitalise on opportunities and mitigate the impact of disruption;
- Innovation – understanding and supporting the role of innovation in delivering productivity gains that raise the standard of living for Australians;
- Governance – building the frameworks needed to balance the rights of existing players and those disruptors that could compromise or complement the resilience of infrastructure;
- Community and customers – revising our understanding of customers so that they are no longer viewed as passive consumers;
- Leadership – focusing on leading an orderly transition through a comprehensive plan of action, and;
- Education and STEM – ensuring we have the skills needed manage the quickening pace of technological advancement and its effect on society and the diversity of practitioners.

Engineers Australia would welcome the opportunity to work with Infrastructure Australia to develop these themes further.

8. Water

Engineers Australia recommends increased emphasis on the application of smart technologies to our utilities sectors to maximise benefits and limit risk.

Water is a critical component of our infrastructure. Water underpins our economic, environmental and regional health, productivity and environment. However, prolonged drought, ageing infrastructure, population growth and the effects of climate change has broad repercussions for our water system security.

Engineers Australia recommends enhancement of government policies to prioritise initiatives which support water security, growth and liveability, measure the implications of drought and undertake a review of economic and regulatory challenges that threaten the resilience and sustainability of our water system.

Australia will benefit from focussed support and investment in the development of innovative and disruptive technology industry. Coordinated trials across government, educational providers, the utility sector and the private sector should be conducted to establish relevant and economically justifiable adoption of disruptive technology.

An example of the advantage of harnessing disruptive technologies to support Australian infrastructure is recent investment in such capabilities in South Australia's water utility company SA Water. SA Water has worked to employ innovative technology to achieve more prudent whole of life costs and maximise efficiencies. SA water has had an operational smart network data collection and an alert analytics system since July 2017. The data and analytics are focused on:

- Smart Customer Metering
- Smart Acoustic Leak Detection Systems
- Smart Pressure Management (Network Calming)
- Smart Water Quality Monitoring
- Smart Wastewater Overflow Detection
- Smart Wastewater Odour Monitoring

Significant success has been realised with some of the systems and technology used and cross industry implementations of other analytic systems are underway, such in in the mining and energy sectors.

[3] Australian Strategic Policy Institute, *Designing for Resilient Energy Systems: Choices in Future Engineering*, October 2019

There is a paradigm shift occurring from traditional engineering forms of infrastructure data analysis, capital renewal and operational systems to a more integrated, data and analytics driven approach aimed at achieving more efficient and affordable infrastructure management, capital renewal and operation.


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