



ENGINEERS
AUSTRALIA

The future of transport

Discussion paper

January 2023



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Acknowledgements: Engineers Australia would like to acknowledge and thank the future of transport working group members, Dr Lisa Stafford, Miguel Loyola, Dr Scott Elaurant, Steve Kanowski, and Shalendra Ram and the Transport Australia society for their guidance and contributions to this paper.

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Executive summary

Transport delivers a considerable contribution to the Australian economy. In Australia it is estimated there are just under 20 million vehicles, traveling on average over 12 thousand kilometres per vehicle per year.¹

Over 20 per cent of these vehicles are registered freight vehicles.² Combined with this, Australia has some of the world's busiest domestic air travel routes. Recent geopolitical developments, extreme weather events and the COVID-19 pandemic, have emphasised how important a sustainable and resilient transport system is. Beyond the challenges society and the economy currently face, population growth, space limitations, induced demand related to infrastructure provision, national net zero emissions objectives and more prevalent and extreme natural disasters are major factors impacting the transport system of tomorrow. This necessitates the development and maintenance of a system which can meet the needs of today and is adaptable to an uncertain future.

Policy makers, planners and engineers need to take a long-term, systems view of the network, understanding the relationships and interconnection between transport, the community, government policy and regulations. Connecting space-efficient transport modes and transport planning with land-use planning, while applying a lens of sustainable development, resilience and focusing on equity and inclusivity is particularly important given the changing nature of transport modes and society's transport and mobility preferences. Transport systems are required to carry out the core functions of moving people and freight which have different requirements, constraints and opportunities. Prioritising new, inclusive, more efficient and lower-emissions transport types is needed, as is the funding model. To be successful in increasing productivity and reducing emissions, consumers need to adopt innovative transport options. For society to have confidence in these new modes, public dialogue is required, as is regulation and policies to integrate transport changes into the current system and support their development and uptake. In addition to technology-enhancing modes to improve efficiency outcomes, digital infrastructure solutions are required to support infrastructure design, operation and maintenance. Furthermore, adoption of digital solutions is essential to making Australia future ready, able to manage infrastructure efficiently, sustainably and safely as well as overcome the skills challenges currently plaguing the country.

Over the next decade the Australian Government will invest \$120 billion in transport infrastructure. This investment needs to be apolitical and outcome-focused through considered policy and funding allocation mechanisms. While transport and mobility are critical functions of enabling a productive and connected society, due consideration needs to be given to changing consumer behaviour and economic priorities when allocating funds. Continuing to invest in the system, based on the past, will not deliver on the needs of the future. Funding should match the importance of policy outcomes (such as sustainability and emissions reductions) rather than individual projects. Government collaboration and joint decision-making is required to agree on priority investment areas and then allocate funding within each. This can then flow down to projects based on the desired outcome.

1 'Survey of motor vehicle use, Australia' ABS (accessed 7 November 2022) <https://www.abs.gov.au/statistics/industry/tourism-and-transport/survey-motor-vehicle-use-australia/latest-release>

2 ibid

A sustainable transport system requires the implementation of strategies that support a significant reduction of emissions within the sector. Australia's legislated emissions reduction targets mean government agencies and regulators will need to give due legal regard to them. To support consistency within the transport sector and other areas of society, Australia needs to implement a mechanism to factor external costs including greenhouse gas (GHG) emissions into all stages of an asset's lifecycle.

To achieve a shared vision of a system fit for future needs, governments at all levels need to focus on collaborating to develop policy and funding mechanisms which are fit for purpose. Land-use planners, transport planners, engineers and others need to also collaborate to reduce the dependence on already congested road networks and build more locally sustainable communities. Strategic planning encompassing a 'vision and validate' approach to the transport system should consider holistic long-term needs and embrace the concept of universal design as part of improving quality of life and independence for more people.

A systems view of the network can provide more holistic approaches to safety, particularly road safety, with road trauma being one of the biggest contributors to fatalities within the transport system. Road systems and design standards need to be worked on concurrently to prioritise safety through design. Activities that reduce road trauma should be considered primarily through the design lens, strengthened by capabilities and other resources (such as funding, equipment, and data). The management of road safety also needs to take account of future modes and issues, allowing it to be agile enough to incorporate the unknown.

Lastly, as the transport system underpins Australia's economy and the wellbeing of society, it's vital there is continued investment to provide safe, sustainable and efficient movement of people and freight throughout Australia and the world. This is particularly important as the population increases and consumer behaviours change. Collaboration between Commonwealth and State/Territory governments is fundamental to achieving effective policy, new infrastructure investment and the optimisation of current assets, across all modes that will enable the sector to thrive.



Summary of questions:

Below is a summary of questions raised under each section of this paper. These questions aim to elicit feedback on the areas examined and will be used to guide feedback from members and the wider community.

1. What outcomes should Australia's future transport sector be focused on? What are the requirements of a desired end-state for Australia's future transport sector?
2. How can greater priority be given to more space, cost and energy efficient transport modes?
3. What can government do to increase the uptake of technology in the transport sector?
4. How can government support emissions reductions in the sector? What emissions reduction goals does the sector need to meet?
5. What changes are needed to improve the allocation of funding within Australia's transport infrastructure sector to achieve more effective, sustainable, safe and equitable outcomes? How can different business models contribute to more effective investment in transport infrastructure?
6. How can government agencies be more holistically responsible for project outcomes? How can the transport system be more prepared to deal with changes in technology?
7. How can different business models contribute to more effective investment in transport infrastructure? What impediments exist preventing road safety by design in Australia?
8. What mechanisms can be used to improve collaboration between transport providers and associated participants? How can rail be better utilised in the moving of goods throughout Australia?
9. How can the transport system be more prepared to deal with changes in technology?
10. How can more emphasis be placed on designing and upgrading with the concept of universal access in mind?
11. What impediments prevent road safety by design in Australia?
12. What would be the top initiatives government can take to strengthen freight transport efficiency and reliability in Australia?
13. How can rail be better utilised in the moving of goods throughout Australia?
14. What technologies are needed to support a more efficient and reliable freight network?
15. Does Australia have the engineering workforce to support the future transport system? If not, what needs to be done to strengthen the transport sector's engineering workforce?

1. Introduction

Engineers play a critical role in planning, designing, building, commissioning, testing, operating and maintaining infrastructure assets throughout Australia. They bring important insights into the critical role infrastructure plays in Australia's prosperity, including the requirements of developing a more efficient and effective infrastructure sector and the potential to account for significant reductions in carbon emissions.

Engineers Australia has developed the following two discussion papers to highlight the complexity of the transport sector and interconnectedness of the future of transport and transport sector emissions.

- **Part 1:** The Future of Transport Discussion Paper (this paper) is focused on the overall direction of the transport sector and corresponding infrastructure and transport services to support this direction.
- **Part 2:** Transport Sector Emissions Discussion Paper (in development) will look at emissions reduction trends and opportunities within the sector.

The recommendations from Part 1 and Part 2 will be outlined in a succinct Transport Directions Paper and distributed for reference and ongoing engagement.

The *Future of Transport Discussion Paper* has been developed in consultation with Engineers Australia members, external members of the engineering profession, industry, and academia. These consultations identified the key considerations to be addressed to support the future transportation needs of Australians.

This discussion paper draws on information from Engineers Australia's Transport Australia society (TAs) thought-leadership discussion papers. TAs seeks to improve public debate on strategic transport issues, and to provide valuable expert advice to governments making decisions regarding transport policy, reform, and infrastructure investment. These discussion papers can be found in the resources section of the Engineers Australia website.

1.1 About Engineers Australia

Engineers Australia is the peak body for the engineering profession in Australia. With over 115,000 individual members, 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.

This discussion paper is guided by our Royal Charter and Code of Ethics, which state that engineers act in the interests of the community, ahead of sectional or personal interests, working towards a sustainable future.

1.2 Engineers Australia's External Voice Project

Engineers Australia's strategy seeks to strengthen the engineering profession's contribution to public life and amplify the recognition for doing so. Engineers Australia's strength is its established system for contributing trusted technical perspectives to public policy debates. Engineers Australia's External Voice Project helps to unlock our value, integrating technical and engineering design perspectives into complex public policy discussions and decisions.

Through applying engineering thinking and a leadership agenda that builds alliances with community decision-makers on critical and engineering-intensive social matters, the External Voice Project demonstrates engineering is a profession that is both technically competent and socially engaged.

1.3 Purpose of discussion paper

The purpose of this paper is to engage Engineers Australia members and associated communities in a discussion about the future of transport in Australia. These discussions will inform recommendations which will be published in a directions paper. This paper will be used to encourage governments and industry to make the reforms needed to ensure Australia can meet future challenges through a robust and sustainable transport sector that meets the needs of commerce and the community.

1.4 Contact

Engineers Australia welcomes feedback on this discussion paper to help inform future work. To provide feedback please email policy@engineersaustralia.org.au



2. Adapting to change

2.1 Changing behaviour

With transport infrastructure underpinning the Australian economy, recent global events, including the COVID-19 pandemic, highlighted the importance of a robust transport network and integrated systems that allowed people to modify their travel patterns in response to changed circumstances. The rate of change experienced during the early period of the pandemic resulted in travel behaviour in cities being transformed. Travel declined, as people were either required to, or chose to, stay at home to avoid the risk of infection. The greatest impact was seen in central business districts (CBD) with businesses closed and streets deserted. At the height of the pandemic online shopping fuelled the demand for delivery services. At the same time, international and domestic air travel was severely impacted and cruise ships ground to a halt. These events emphasised the need for a transport system capable of adapting to the unknown.

As time passed and as vaccines became available, the world started to lift restrictions and many travel patterns have reverted to pre-pandemic conditions. Air travel has returned to a growth cycle and cruise ships have once again departed. Public transport has been the most impacted due to fear of infection in confined spaces. Existing CBD-focused public transport service patterns do not necessarily match new travel patterns. However, as time goes on, the impacts of the pandemic on the transport network are likely to reduce. In conjunction with this, Australia has experienced devastating extreme weather events including the 2021/22 bushfires and floods. These natural disasters have highlighted the importance of adapting our transport system to be more sustainable and resilient.

The likely main factors determining modal traffic growth in the medium to long term include population growth, space limitations on increasing capacity of the road system, induced demand related to infrastructure provision and natural disasters. As the need for travel and the way society moves has changed and will continue to in response to these factors, transport systems need to change. Policy makers, planners and engineers need to develop a transport system capable of meeting the needs of today and future populations. The Australian Bureau of Statistics projects Australia's population will reach between 28.3 and 29.3 million people by 2027;^{3, 4} with the prediction around 70 per cent of the population will live in capital cities.⁵ By around the end of the century, the population of Australia's capital cities is expected to have grown to at least three times the existing population with a larger proportion of elderly people than younger ones.⁶

For cities to cope with these increases there needs to be more investment made in space efficient transport modes. More emphasis on equity and inclusion for those with mobility issues, financial limitations or those who face other barriers to transport will also be important. Transport Australia society's *Universal design for transport*⁷ discussion paper (discussed further in section four) and the *Urban Transport Systems* discussion paper both address the need for changes in Australia's transport policy to contend with this.

Historically, one of the main ways Australia's transport networks have accommodated growth in population has been through increased road capacity. This has led to significant investment in road expansion, growing car ownership and use, increased GHG emissions from transport

3 Implications from the COVID-19 pandemic and other geopolitical events may affect this projection

4 'Population projections, Australia' *Australia Bureau of Statistics* (accessed 26 August 2022) <https://www.abs.gov.au/statistics/people/population/population-projections-australia/latest-release#capital-cities>

5 *ibid*

6 'Disability, Ageing and Carers, Australia: Summary of Findings' *Australian Bureau of Statistics* (Released October 2019) <https://www.abs.gov.au/statistics/health/disability/disability-ageing-and-carers-australia-summary-findings/latest-release>

7 Transport Australia society 'Universal design for transport discussion paper' (April 2022) <https://www.engineersaustralia.org.au/sites/default/files/2022-04/Universal-Design-for-Transport-TAs-discussion-paper-20220421.pdf>

and road safety targets not being met.⁸ International research demonstrates increasing the capacity of the road network changes behaviour so as to increase traffic and therefore does not sustainably eliminate congestion.⁹ To combat the transport needs of an increasing population, policy makers, planners and engineers need to take a long-term and systematic view of the network. Linking transport modes and transport planning with land-use planning (discussed further in section four) will play an important role. As will overcoming multiple barriers that currently exist hindering accessibility. Future transport infrastructure will need to be assessed and evaluated against broader criteria than has been the case in the past. Supporting policies will focus on:

- Discouraging increased traffic on the urban street network.
- Reducing GHG emissions harmful to health.
- Reducing fatal and serious injuries from road crashes.
- Accounting for broader economic benefits to businesses and the community, rather than small time savings on the road network.
- Increasing accessibility through a combination of universal access, physical mobility, spatial proximity and digital connectivity.
- Increased investment on space efficient transport modes.
- Promoting a high level of amenity and liveability in residential and mixed-use precincts.

The need for transport and mobility preferences have changed and will continue to do so. Personalisation of transport options (such as ride sharing), active transport, e-mobility, public transport and urban form all have a role to play in ensuring our transport system remains flexible and fit for purpose. Changes to the priorities given to different types of transport is needed (with a focus on equity) as is the investment model. In addition, there is a need to consider ways to build public dialogue around the benefits of different modes of transport to influence people's behaviours. Public education and engagement will play an important role in how changing transport infrastructure is accepted and used.

2.2 Technological advancements

Innovation and technology continue to change every aspect of society and transport is not immune. Engineers play a crucial role in creating and integrating new technologies and software to improve efficiencies and tackle challenges. Autonomous vehicles, artificial intelligence, smart technologies, new fuel sources and propulsion systems, freight and transportation management systems, mobility-as-a-service (MaaS), high speed rail, e-mobility, and drones are just some of the advancements being discussed and implemented throughout the world. These developments can have numerous benefits including increasing productivity and efficiency and reducing emissions. However, it is essential that regulations and policies relating to technology are developed to ensure unintended and unwanted consequences are minimised.

An example of this is micro-mobility and its ability to change the way commuters and planners approach the first mile/last-mile conundrum. While mass transit remains the most efficient way of moving large groups of people, getting to mass transit modes can be a challenge. Micro-mobility provides new options to move people, reducing the reliance on cars (and the need for parking infrastructure), while reducing GHG emissions. With the introduction of this type of mobility comes regulatory and policy challenges, particularly around safety and integration with the current transport system. Another example is the use of flight path optimisation and

8 Transport Australia Society 'Urban Transport Systems discussion paper' Engineers Australia (December 2021) <https://www.engineersaustralia.org.au/sites/default/files/2022-06/urban-transport-systems-discussion-paper.pdf>

9 Department of Transport (1999), Induced Traffic in Urban Areas - Technical report 397 Perth

management technologies which allow more aircraft to take-off and land each hour. The Sydney to Melbourne route has traditionally been rated as the second busiest route in the world.¹⁰ Technology supporting operations management can assist in squeezing extra capacity into the system and can reduce the need for additional infrastructure. Care needs to be taken to ensure safety is not compromised, or liveability and amenity for those living close by does not suffer. Innovation in software is also helping with travel demand management (TDM) by providing data-led consumer-orientated products to influence demand on transport networks by promoting other modes, times and routes. Effective use of TDM can change behaviours and reduce the impacts of congestion. This can help to maximise the efficiency of current assets and reduce the need to fund additional infrastructure (such as new lanes on the road network). TDM measures that reduce traffic are generally low cost and should always be considered prior to, or in combination with, introduction of high-cost infrastructure

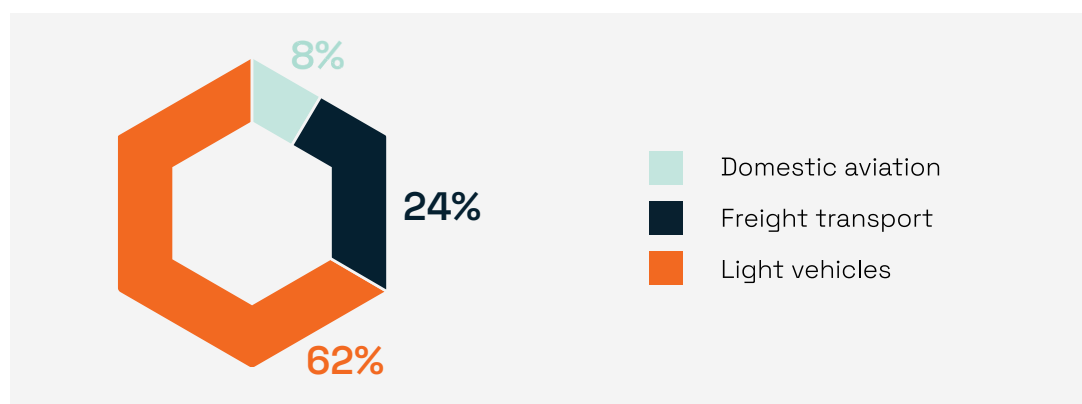
New fuel sources such as battery electric vehicles and fuel-cell electric vehicles require a change in the planning, development and investment of infrastructure and a nationally consistent approach is needed for this to be effective. The introduction of new policies and guaranteed infrastructure to serve these vehicles, whether fuelling or charging stations, needs to be a priority to assist in the take-up.

New technologies will require legislative and policy changes for their integration into the current system and to support their development and uptake. The New South Wales (NSW) Government's NSW Point to Point Transport reforms are an example of how policy needs to shift to allow improvements to the transport system, such as automation, connectivity, electrification and ridesharing, to be used and embraced. Collaboration between all levels of government is needed to provide uniformity across Australia in the take-up of new systems as well as participation from industry, suppliers and others.

Engineers Australia's *Enhancing productivity in infrastructure delivery*¹¹ directions paper outlines how innovation and the use of digital infrastructure solutions (such as digital twins, building information modelling systems (BIM), digital engineering and digital asset management tools) will ensure Australia is future ready and our infrastructure can be managed efficiently, sustainably, safely and effectively.¹² Greater emphasis is needed on integrating nationally consistent digital approaches to public infrastructure planning and operations if Australia is going to be ready for the demands of the future.¹³

2.3 A more sustainable transport network

Figure 1: Top three carbon emitters in the transport sector



10 Thorn, A 'Sydney-Melbourne back in the worlds top 10 domestic routes' Australian Aviation (April 2021) <https://australianaviation.com.au/2021/04/sydney-melbourne-back-in-worlds-top-10-domestic-routes/#:~:text=Traditionally%2C%20Sydney%E2%80%93Melbourne%20is%20the,domestic%20offering%2C%20selling%201%2C47%2C498%20seats>

11 Grady, S. 'Enhancing productivity in infrastructure delivery: Directions Paper' Engineers Australia <engineersaustralia.org.au>

12 ibid

13 ibid

While the strategies and options available to decarbonise Australia's transport sector are outside the scope of this paper, the future of transport cannot be explored in isolation of such considerations.¹⁴ Transport is the third-largest emitting sector in Australia, responsible for just under 20 per cent of national emissions (scope one and two emissions only), with light vehicles alone generating about two thirds (see figure 1).¹⁵

Australia recently legislated its emissions reduction targets including a 43 percent reduction on 2005 emissions levels by 2030 and net zero emissions by 2050. While neither target is intended to be applied uniformly across all of Australia's economic sectors, achieving this scale of emissions reductions in the transport sector will be very challenging. This is due to the emission intensive nature of transport and the vast expanse needed to be travelled due to the size of the country.

Emissions accounting is also increasingly more complex with the inclusion of scope three considerations (i.e., emissions from assets indirectly impacting on Australia's supply chains, and on a whole-of-life basis). This includes upstream and downstream emissions from the transportation and distribution of goods and services. It also includes commuters travelling domestically and/or overseas via trains, shipping and airlines as well as emissions from managing transport assets at their construction and end of life.

In the context of Australia's recently legislated emissions reduction targets, all government agencies and regulators will now need to give due legal regard to them in their advice and regulatory oversight on approvals and compliance for all new and existing transport infrastructure projects. Australia needs to adopt a mechanism to factor external costs including GHG emissions into all stages of an asset's lifecycle, from design, project feasibility assessments, ongoing use and maintenance.¹⁶ Where market incentives are either lacking and/or prove insufficient to achieve the scale and pace of emissions reduction outcomes required in Australia's transformation to a carbon neutral future, then complementary policy or regulatory intervention may be needed. It is important all transport-related climate policy and clean energy measures at the national and sub-national levels are well harmonised for efficiency and effectiveness purposes.¹⁷

Reducing emissions within the transport sector and the decarbonisation of infrastructure in Australia future are critical areas which warrant separate discussion papers. A Transport Sector Emissions Discussion Paper is currently in development, with sustainable infrastructure the next focus area within Engineers Australia's infrastructure workstream.

Section 2: Questions for consideration

1. What outcomes should Australia's future transport sector be focused on? What are the requirements of a desired end-state for Australia's future transport sector?
2. How can greater priority be given to more space, cost and energy efficient transport modes?
3. What can government do to increase the uptake of technology in the transport sector?
4. How can government support emissions reductions in the sector? What emissions reduction goals does the sector need to meet?

14 Transport sector emissions is part of Engineers Australia Climate Change workstream with a paper on the topic being developed in parallel to this work, culminating in a directions paper which pulls together both areas.

15 'Australia's emissions projections 2021' Australian Government, Department of Industry, Science, Energy and Resources (October 2021) <https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2021>

16 'Our position on climate change' Engineers Australia (accessed 31 October 2022) <https://www.engineersaustralia.org.au/sites/default/files/resource-files/2022-02/climate-change-position-statement-2021.1.pdf>

17 'National electric vehicle strategy submission' Engineers Australia (October 2022) https://www.engineersaustralia.org.au/resources/publication-library?f%5B0%5D=publication_type%3A1316&q=

3. Investing in transport

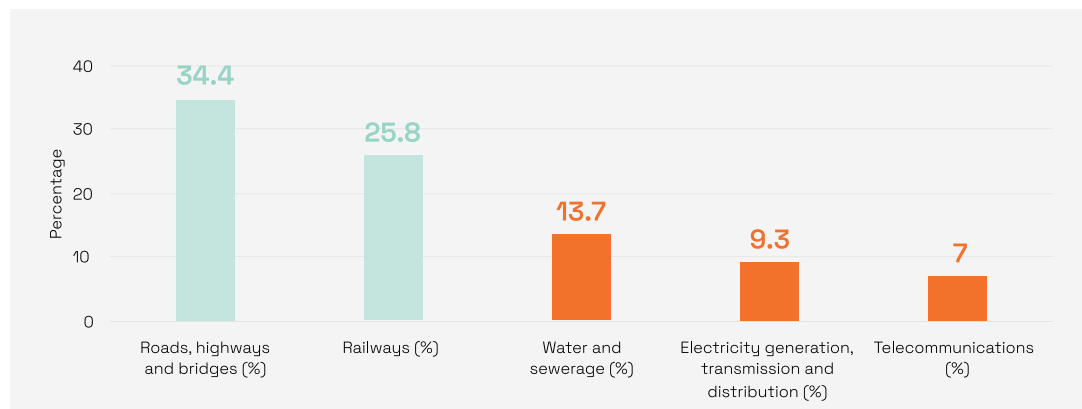
Government's involvement in infrastructure investment can be distilled down to two main reasons.

Firstly, government at all levels have a responsibility to ensure infrastructure is adequate in providing the desired outcomes for the population.¹⁸

Secondly, investment in infrastructure affects economic output making it a good way to stimulate the economy.¹⁹ Over the next decade the Australian Government has committed to invest \$120 billion in transport infrastructure across Australia.²⁰ Ensuring this investment is consistent and achieves the desired outcomes is essential to support a productive, safe, sustainable and equitable transport sector.

Despite rapid change and an unpredictable future, over half of the infrastructure stimulus funding supplied by government during the pandemic was available to transport projects.²¹ As demonstrated in figure 2, Australia's investment in new public engineering construction of roads, highways, bridges, and rail far exceeds other investments in 2020/21. While transport and mobility will continue to be important to society, the changes in consumer behaviours and preferences mean consideration needs to be given to the whole transport system. New business models for funding will also need to be considered. Continuing public investment in the transport system, based on the principles of the past, will not set Australia up for a productive and effective transport network to deliver on future needs.

Figure 2: New public engineering construction by type²²



18 ibid

19 Webb, R. 'The Commonwealth Government's Role in Infrastructure Provision' *Parliament of Australia* Research Paper no. 8 2003-4 (March 2004) https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp0304/04rp08

20 'Budget October 2022-23': Building a better future' Australian Government (October 2022) https://budget.gov.au/2022-23-october/content/overview/download/budget_overview.pdf

21 'Reforms to meet Australia's future infrastructure needs: 2021 Australian Infrastructure Plan' Australian Government, Infrastructure Australia. (accessed 26 July 2022) https://www.infrastructureaustralia.gov.au/sites/default/files/2021-09/2021%20Master%20Plan_1.pdf

22 Australian Bureau of Statistics, Insights into public investment 1/09/2021 <https://www.abs.gov.au/articles/insights-public-investment>

3.1 Allocation of funding

The current government allocation of funding for transport infrastructure is shared between the federal, state/territory and local governments, however, there is a vertical fiscal imbalance. The Constitution gives most taxation powers to the Commonwealth Parliament, whereas primary areas of government spending are undertaken by states. This has produced a discrepancy; states have significant spending responsibilities yet are more limited in their revenue-raising ability. This means the Commonwealth Government needs to provide funding in areas that are generally the responsibility of the states (roads, rail, schools, hospitals etc.).²³

Over time, this funding system has contributed to the Commonwealth Government having greater involvement in the decision-making process as to which projects should go ahead. This can hinder an efficient and effective transport system, particularly if projects are progressed based on politically driven funding allocation and not outcomes. As the operator of the transport system, states and territories are in an optimal position to make decisions about it and the responsibility for transport infrastructure needs to remain with state (and local) governments. The Commonwealth's responsibility and focus should remain on policy and funding allocation mechanisms. Consequently, structural reform of transport funding and investment is essential, such that the State/territory partners can be held accountable for project delivery and outcomes.

3.2 New models for transport infrastructure investment

New models for infrastructure investment are required and at, a base level, need to include clear rationale on where investments are made and why.

In Australia, reducing urban congestion is funded more than access equity, rural network maintenance and safety works. This is even though urban congestion is not shown to be the most economically significant issue.

Funding should match the importance of policy outcomes rather than individual project needs. To do this, governments should work together to decide on priority investment areas (safety, improving efficiency and equity, walking/cycling infrastructure), and then allocate funding within each. This can then flow down to projects based on the desired outcome.

Investment decisions and prioritisation needs to be independent of the political cycle and should have bipartisan support based on thorough and independent oversight. Transport planning undertaken as a regular, systems-based process, rather than on an ad-hoc project basis, will assist to achieve that outcome, as will greater transparency and public involvement in transport decision making. This will allow the implementation of a long-term strategy for the transport network.

As the system currently stands, political parties can be incentivised to endorse projects based on their appeal to targeted electorates, instead of those which have been properly tested or have benefit.²⁴ A publicly announced work pipeline provides continuity, which is imperative to long-term outcomes.²⁵ Infrastructure Australia's assessment framework, which is designed to provide a national standard for best practice infrastructure development, includes strategic fit, societal impact and deliverability in their assessment criteria.²⁶ These are important considerations and should be part of the model for investment decisions, no matter the size of investment.

23 ibid

24 Grady, S. 'Enhancing productivity in infrastructure delivery: Directions Paper' Engineers Australia engineersaustralia.org.au

25 ibid

26 'Overview: Assessment framework' Infrastructure Australia (July 2021) <https://www.infrastructureaustralia.gov.au/sites/default/files/2021-07/Assessment%20Framework%202021%20Overview.pdf>

Section 3: Questions for consideration

1. What changes are needed to improve the allocation of funding within Australia's transport infrastructure sector to achieve more effective, sustainable, safe and equitable outcomes?
2. How can government agencies be more holistically responsible for project outcomes?
3. How can different business models contribute to more effective investment in transport infrastructure?



4. A systems view of transport

As transport is a complex system, a systems approach is needed to consider all the stages of the transport lifecycle, from planning, design and construction, to operation, maintenance and decommissioning. A systems approach allows for the network to be examined as a whole, understanding the multidisciplinary relationships and interdependencies between transport modes, infrastructure, the community, government policy and regulations. As the population grows and new technologies emerge and develop, a more holistic view of the transport network is needed to enable the future transport system to deliver the required system performance and outcomes. These changes, combined with a high level of uncertainty about the future, makes the current tools and models used to predict and plan future transport infrastructure unsuitable.²⁷

Projects are often planned incrementally, rather than as part of a greater system using network analysis. Analysing and modelling the future by looking back cannot keep pace and deliver the infrastructure needed for tomorrow. Reforms are needed to move the planning, funding and development of transport infrastructure to a 'vision and validate' model rather than the 'predict and provide model' which has existed since the 1950s.²⁸ Part of these reforms require more collaboration between land-use planners, transport planners and other participants, to deliver 'place-changing' projects that connect people with the community in a sustainable way and serve economic needs. A greater focus is also needed on equity and inclusion, moving to a whole of journey perspective (both movement and place) and helping to increase society's health and wellbeing. Taking a systems view helps to achieve this by incorporating a wide variety of contributions from many different participants.

A systems-based approach to transport strategy, including looking at equity and inclusion, will facilitate and enhance this much needed collaboration and connection between people and place. This includes integration of new transport modes and making streets more people orientated. Active transport (walking, cycling etc.) personal mobility or e-mobility (e-bikes and e-scooters), public transport, cars, freight and delivery transport all need to work together as part of the greater system. This requires a change to our streets; limiting the need for cars competing for limited road space, enhancing community liveability, lessening environmental impacts and changing consumer behaviour.²⁹

Vital to this is the renewal and activation of streets for greater pedestrian access. Future strategies ought to recognise the needs associated with an increase in population and focus on facilitating the movement of people through the most efficient modes of transport. In high density areas (such as CBDs) the movement of people needs to be via streets that have the dual role of being public spaces, moving people and a place to meet, eat, drink and shop. Strategies also need to focus on changing consumer behaviour. Active transport modes and public transport need to be the most attractive and convenient modes, pulling people to them. The benefits of adopting a transport strategy focused on these areas includes increases in health and wellbeing and improved productivity.

The uncertainty of the future means any changes to the current system will need to be integrated into the network as it exists today. This includes designing new and modified infrastructure to be able to incorporate future advances in technology, noting solutions may be wholly comprised of or incorporate non-build elements. An example of this is the introduction of personal mobility devices onto principal shared path networks. With these devices able to travel at significant speeds, ensuring safety of pedestrians and riders needs to be at the forefront of new networks and modification of existing networks and may require changes in legislation as well as design elements.

27 Transport Australia Society 'Urban Transport Systems discussion paper' Engineers Australia (December 2021) <https://www.engineersaustralia.org.au/sites/default/files/2022-06/urban-transport-systems-discussion-paper.pdf>

28 Transport Australia Society 'Urban Transport Systems discussion paper' Engineers Australia (December 2021) <https://www.engineersaustralia.org.au/sites/default/files/2022-06/urban-transport-systems-discussion-paper.pdf>

29 Transport Australia Society 'Urban Transport Systems discussion paper' Engineers Australia (December 2021) <https://www.engineersaustralia.org.au/sites/default/files/2022-06/urban-transport-systems-discussion-paper.pdf>

4.1 Collaboration and planning

Collaboration is a critical element of ensuring the transport system is fit for future needs and delivers on the outcomes required for a productive and connected society. Collaboration can be grouped into two forms, vertical collaboration which links the different levels of government (federal, state/territory and local government) and horizontal collaboration which links planners, operators and others.³⁰ As discussed in section three, Australia's vertical fiscal imbalance makes collaboration between the federal and state/territory governments critical to ensure funding is provided based on a shared vision for the future. It is also important for land-use planners, transport planners and others to collaborate to help lessen the reliance on already congested road networks and create more locally sustainable communities. Currently, land development plans may exist, however, they don't always provide sufficient attention to the transport networks and funding required to connect these developments.³¹ Integrated planning should be required for all regional and local strategies. Changes are needed to improve the integration of urban development with transport.³² These include:³³

- Better use of urban informatics to identify trends and understand the intricacies of the system, to help inform the development and evaluation of a sustainable urban transport system.
- Developing land as mixed use providing for greater activity through density, helping to encourage and enable different modes of transport (e-mobility, public transport, active transport).
- Integrating rail options which link outer areas with central areas, to meet long term demand and reduce the reliance on cars.
- Planning and modifying streets to be connected and safe to increase usability for active transport users, local bus, and shared use public transport, micro mobility users and delivery or freight vehicles.

The move to a 'vision and validate' approach to transport system improvements requires changes in paradigms, principles and practices. Strategic plans need to set out to achieve what is needed in the long term, looking at the needs holistically and equitably. This includes:

- A need to put human welfare and the environment above simple micro-economic efficiency.
- Moving away from deterministic, short-term, single-view assessments to flexibly plan for a range of futures to be resilient when changes occur.
- A move away from reliance on traditional transport modelling and microeconomic benefits to more analysis and assessments which consider variations like real options analysis and scenario visioning.
- More holistic assessments such as the balanced scorecard approach which consider how to fairly compensate for unacceptable impacts.

30 Paulsson, A, Isaksson K, et al. 2018. 'Collaboration in public transport planning – Why, how and what?' Research in Transportation Economics, Volume 69 <https://www.sciencedirect.com/science/article/abs/pii/S0739885917302512>

31 Transport Australia Society 'Urban Transport Systems discussion paper' Engineers Australia (December 2021) <https://www.engineersaustralia.org.au/sites/default/files/2022-06/urban-transport-systems-discussion-paper.pdf>

32 Transport Australia Society 'Urban Transport Systems discussion paper' Engineers Australia (December 2021) <https://www.engineersaustralia.org.au/sites/default/files/2022-06/urban-transport-systems-discussion-paper.pdf>

33 Transport Australia Society 'Urban Transport Systems discussion paper' Engineers Australia (December 2021) <https://www.engineersaustralia.org.au/sites/default/files/2022-06/urban-transport-systems-discussion-paper.pdf>

4.2 A move to living locally

Pandemic induced lockdowns during 2020 and 2021 saw about one third of the workforce move to work-from-home arrangements.³⁴ This has produced a change in people's relationships with their local community and transport needs. Infrastructure Australia reports how neighbourhoods thrived because of stay-at-home orders and the move to social distancing.³⁵ While public transport use declined, walking and cycling picked up in communities with local amenities.³⁶ Urban fringe areas, that are more reliant on cars, did not see these same benefits.³⁷

This highlights the need to reconsider the infrastructure needs of local communities with more of a focus on the neighbourhood. The concept of the 20-minute neighbourhood is an example of how planning should change. As the name suggests, this concept is based on a person's ability to meet most of their daily needs within a 20-minute walk from their primary place of residence.³⁸ For this concept to work, it requires access to safe and accessible walking and cycling infrastructure as well as reliable and efficient public transport options and needs a mix of land-uses and housing types. It also needs to consider universal design during the planning stage to enable everyone to benefit.³⁹ The Victorian Government's long-term planning strategy, Plan Melbourne 2017-2050, uses this concept as a guiding principle.⁴⁰

A systems approach is critical to neighbourhood planning and development. It requires land-use planning and transport planning to work collaboratively with government at all levels to ensure the funding is available for the amenities required, such as high-speed internet, schools, shopping facilities, employment opportunities, playgrounds and parks and health and recreation facilities. There are many benefits to the 20-minute neighbourhood, including improving health and wellbeing through a stronger connection to community and place and reducing emissions through less reliance on cars. As this concept requires mixed land-use it also has economic benefits through increased activity and patronage to local businesses fuelled by greater density. It is recognised this concept does come with significant challenges to design and implement. New policy settings and funding models would be needed for this concept to work. However, the principles behind this type of initiative can still guide other work designed to change consumer behaviour and improve transport in Australia.

A move to prioritising local neighbourhoods should be done in conjunction with other initiatives (dependent on land area and amenities), which focus on improved facilities locally as well as increasing access to vibrant city centres. Infrastructure Australia's recommendation to '*review and reconfigure city public transport networks to optimise the number of users who can access centre-based jobs and services within a 30-minute or better performance standard*' should be adopted as a starting point.

4.3 Access for all

Designing transport as a system requires consideration of equity and inclusion. The concept of universal access allows for an environment which is accessible to everyone. This takes into consideration the needs of people with disabilities and other mobility challenges (for example, people with injuries, the elderly and parents with prams) as well as financial constraints and those who face additional socioeconomic barriers. In 2018 just under 18 per cent of

34 'Reforms to meet Australia's future infrastructure needs: 2021 Australian Infrastructure Plan' Australian Government, Infrastructure Australia (accessed 26 July 2022) https://www.infrastructureaustralia.gov.au/sites/default/files/2021-09/2021%20Master%20Plan_1.pdf

35 ibid

36 ibid

37 ibid

38 '20-minute neighbourhoods: Create more inclusive, vibrant and healthy neighbourhoods' Victorian State Government (accessed 2 September 2022) <https://www.planning.vic.gov.au/policy-and-strategy/planning-for-melbourne/plan-melbourne/20-minute-neighbourhoods>

39 Universal design is discussed further at section 4.3

40 ibid

Australians had a disability with the prevalence of this increasing with age (over 65 years).⁴¹ Using the concept of universal design, environments can be created that are usable by more people. Applying universal design processes improves quality of life and independence by facilitating the broader population to achieve peak human performance, health and wellness through equitable access to all facilities and social participation.⁴²

In Australia, the Disability Discrimination Act 1992 (Cth) (the Act) and the Disability Standards for Accessible Public Transport 2002 (Transport Standards) aim to prevent discrimination against disabled people and set guidelines for transport accessibility. The Act prevents discrimination against an individual because of disability and includes when to provide services and facilities. Transport Standards provide minimum accessibility requirements for public transport. This is contrary to global best practice, which is less about complying with standards and more about adopting the concept of universal access.

Transport Australia society's *Universal design for transport* discussion paper outlines several benefits of adopting the concept of universal access.⁴³ These include:⁴⁴

- **Accessibility benefits to individual through inclusion.** Those with a disability live a more independent life. It also benefits the broader community through good design, easing the complexity and pressure in transport system use and eliminates some of the barriers to mobility in everyday life.
- Equalising **employment opportunity and participation** by providing a safer and easier environment for everyone which helps keep working-aged people with a disability in the workforce.
- Ageing society and **enhancing quality of life** through improved access to basic needs and social engagements. Increasing access for the elderly can help to ease pressure on aged care resources. As Australia's population continues to age, these considerations are particularly important.
- Improved **standards and guidelines resulting in savings.** Greater effort in the early stages to deliver universally accessible transport infrastructure can result in savings to society in other areas because of adopting well thought-out plans and best practice approaches.
- **Boarding capacity and increasing patronage.** Enhancements made for accessibility can have advantages for all users. For example, level (train style) boarding made possible by low floor light rail vehicles and buses and stop platforms, gives faster boarding, owing to the absence of a step, which can lead to higher boarding capacity at stops.
- Universal access's ability to **enhance economic activity.** Transport designed to meet universal accessibility principles tends to result in a more walkable, easy to use urban environment which in turn leads to more economic activity.

The imperative to move to a more inclusive view of access is evident, although it is not without challenges. These are mainly seen in upgrading of existing infrastructure and systems, particularly older networks which were built to very different standards initially. Funding is also a challenge (see section three). Public transport systems fall to state and territory governments to design, build and operate (often with Commonwealth supported funding). Most funding is allocated to build new systems, rather than upgrade deficient existing systems. In addition, while

41 'Disability, Ageing and Carers, Australia: Summary of Findings' Australian Bureau of Statistics (Released October 2019) <https://www.abs.gov.au/statistics/health/disability/disability-ageing-and-carers-australia-summary-findings/latest-release>

42 'Transit Universal Design Guidelines: Principles and Best Practices for Implementing Universal Design in Transit' American Public Transportation Association (July 2020) <https://www.apta.com/wp-content/uploads/APTA-SUDS-UD-GL-010-20.pdf>

43 Transport Australia society 'Universal design for transport discussion paper' (April 2022) <https://www.engineersaustralia.org.au/sites/default/files/2022-04/Universal-Design-for-Transport-TAs-discussion-paper-20220421.pdf>

44 *ibid*

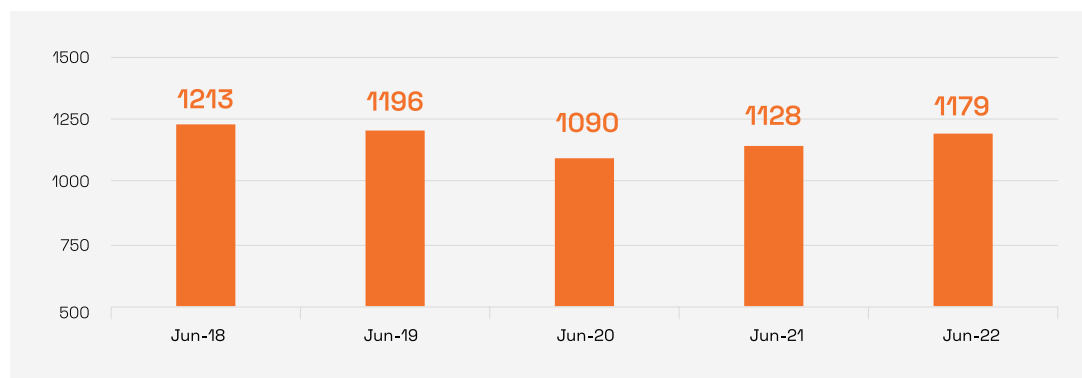
universal design requires collaboration from all parties, particularly the users, to ensure it is fit for purpose, it also requires greater collaboration between governments particularly where delineation of responsibility occurs. An example of this would be a local government responsible for the facilities available around a public transport hub or a principle shared path connecting two local government areas.

4.4 Holistic approaches to road safety

Road deaths and injuries are some of the greatest human costs of transport. Any road trauma, either injury or death, is unacceptable. Both the personal cost to the community and the financial cost to the economy make this an issue of extreme importance. As with the broader transport system, a systems approach can be used to achieve better road safety outcomes.

In the past, the engineering approach to road safety included three primary endeavours: engineer the road; educate the driver; and enforce the road rules.⁴⁵ Between 1970 and the 1990s, Australia was a world leader in reducing road crash casualties. However, it now lags most industrialised countries. As demonstrated in Figure 3, apart from a slight reduction in 2019/20 the number of deaths on Australian roads has remained steady at around 1,100. Reducing this number requires a systems view by governments (federal, state, and local), industry and the community to look to change behaviours and achieve a different outcome.

Figure 3: Road deaths in Australia (financial year, past five years)⁴⁶



Many of the traumas experienced on our roads could be prevented through a robust road safety approach. Road systems and design standards need to work together to prioritise safety through design.⁴⁷ Safety through design should be prioritised ahead of criteria such as sight distance, stopping distance, horizontal curve radii, pavement superelevation and traffic lane width.⁴⁸ All these activities contribute to reducing road trauma and need to be focused through the design lens. They must be considered within appropriate systems and processes and underpinned by staff capability and other resources (such as funding, equipment, and data).⁴⁹ Road safety management also needs to take account of future issues (such as micro-mobility) and be agile enough for innovative solutions, many of which are already known from other fields or are emerging in transport planning and transport technology.

45 'Road Safety: Transport Australia Society Discussion Paper' Engineers Australia (October 2019) <https://engineersaustralia.org.au/sites/default/files/2022-06/road-safety-discussion-paper.pdf>

46 Source: <https://www.officeofroadsafety.gov.au/data-hub/fatalities-data>

47 'Road Safety: Transport Australia Society Discussion Paper' Engineers Australia (October 2019) <https://engineersaustralia.org.au/sites/default/files/2022-06/road-safety-discussion-paper.pdf>

48 ibid

49 ibid

Section 4: Questions for consideration

1. What mechanisms can be used to improve collaboration between transport providers and associated participants?
2. How can the transport system be more prepared to deal with changes in technology?
3. How can more emphasis be placed on designing and upgrading with the concept of universal access in mind?
4. What impediments exist preventing road safety by design in Australia?



5. Strengthening economic capability

Transport is a vital component of Australia's domestic capability and economy.

A report by Engineers Australia in 2019 *Exploring national mobilisation issues in a collapse of global governance* found in the event of major disruptions to global supply chains there would be a prompt effect on transport and freight which in turn would affect the movement of goods and people.⁵⁰ Without Australia's transport networks, there would be an effect on food security, healthcare services and the ability for people to travel for work.

Subsequent disruptions experienced in 2020 to 2022 confirmed this conclusion. Across Australia there has been a shortage of supplies in major supermarkets caused by panic-buying and national border restrictions which hindered the easy movement of goods. Fuel prices have since increased due to global factors, increasing pressure on already rising household costs. Climate change induced extreme weather events are further highlighting the need for a robust, resilient and reliable transport network.

Global trends need to be considered when assessing the future of transport in Australia. In response to a shift in many major countries (United Kingdom, United States and the European Union) to move away from internal combustion engines (ICE) by 2035, many major car manufacturers will stop making petrol and diesel-powered cars by similar dates. As Australia no longer manufactures ICE cars locally, and has limited assembly of trucks and buses, there is a reliance on vehicles from the international market and Australia is subject to its trends. If Australia's uptake of new technologies and the infrastructure required to operate and maintain them isn't developed, it will find itself unprepared for unavoidable future disruptions. This will be costly in the medium to long term and may require large scale government financial support or direct investment at both a federal and state level.

Technological changes to vehicle propulsion systems, such as the adoption of battery electric and/or hydrogen fuel cell electric vehicles to replace Australia's light and heavy vehicle fleet will have macro-economic impacts. The majority of Australia's refined fuel is either imported or refined from imported crude oil.⁵¹ While the benefits of these new technologies include a reduction in oil imports for fuel refinement, there may be other unforeseen impacts (such as Australia's short term fuel security).

5.1 Enabling reliable supply chains

Australia's transport network needs to support the reliability and productivity of supply chains. *Infrastructure Australia 2021 Infrastructure Plan* identified several challenges within the transport system regarding supply chains. These include the performance of the freight network varying by location, the diversity of regional supply chains, inefficient freight operations in cities (due to congestion) and inconsistent and ineffective regulatory regimes.⁵² Unfortunately, since the 1990s, Australia's freight productivity and cost efficiency improvements have plateaued.⁵³

50 'Industry response in a collapse of global governance: workshop report for attendees' Engineers Australia (February 2019)

51 'Reforms to meet Australia's future infrastructure needs: 2021 Australian Infrastructure Plan' Australian Government, Infrastructure Australia. (accessed 26 July 2022) https://www.infrastructureaustralia.gov.au/sites/default/files/2021-09/2021%20Master%20Plan_1.pdf

52 'Reforms to meet Australia's future infrastructure needs: 2021 Australian Infrastructure Plan' Australian Government, Infrastructure Australia. (accessed 26 July 2022) https://www.infrastructureaustralia.gov.au/sites/default/files/2021-09/2021%20Master%20Plan_1.pdf

53 'National freight and supply chain strategy' Transport and Infrastructure Council (accessed 2 September 2022) <https://www.freightaustralia.gov.au/sites/default/files/documents/national-freight-and-supply-chain-strategy.pdf>

Changes need to be made to ensure safe and efficient freight movement for resources, agriculture, aquaculture, industry, consumers and other needs. These logistical chains will benefit from innovation including physical movement and transfer of goods and electronic management and payment systems.

Again, these require different approaches to investment, a wider variety of policy tools and industry development with the support of government and the private sector.

To support Australia's economic future and help improve productivity, attention needs to be given to overcoming these challenges, with investment focusing on:

- Improving access to export gateways through improved freight routes.
- Increasing the use of rail where it has the best value.
- Resilience of the network, particularly in areas prone to extreme weather events.
- Improving the development and uptake of new technologies (including digital technologies supporting productivity and new fuels).

5.2 Investing in freight systems

One of the many challenges facing transport infrastructure is a change in consumer behaviour and the growth in Australia's freight. Between 2018 and 2040, it is predicted freight carried will increase by over 35 per cent, bringing the total volume moved to over 1000 billion tonnes.⁵⁴ To meet this predicted increase in demand, the federal and state/territory governments will need to work together to ensure the required efficiency is developed through effective policy settings, new infrastructure investment and optimising current assets across all modes.⁵⁵ Governments must guarantee appropriate investment is made. They will also need to develop effective policy levers and regulations to support industry and drive productivity growth. Most domestic freight in Australia is via rail and road networks. Forward planning is essential to ensure corridors are protected and fit-for-purpose. With the development of technology and engineering solutions in this space, such as modular offsite construction, the need to enable transport of goods through our freight network is becoming more important.

The Australian Marine Complex (AMC) in Perth, is a precinct developed to improve opportunities by clustering industries together. It houses manufacturing, fabrication, assembly, maintenance and technology development. It also services the defence, marine, oil and gas, and resource industries.⁵⁶ The freight needs of this complex often require the transportation of oversize, over-mass objects via the road network. However, barriers exist for industry to move these finished products due to the lack of high-wide load corridors into the Kwinana area (where the AMC is located). Local industry often competes with international businesses who can manufacture or fabricate products overseas and ship them direct to clients in areas such as the Pilbara more easily (and with less transport costs) than locally-made products. This example highlights the criticality of a connective transport network that meets the needs of industry. For Australia to develop and maintain a manufacturing industry, particularly of oversize products, it needs to have the infrastructure to transport these products. This requires long-term planning and the protection of key corridors to provide more efficient freight routes.

54 'Smarter and targeted infrastructure investment' National Freight and Supply chain strategy Department of Infrastructure, Transport, Regional Development, Communications and the Arts (accessed 2 September 2022) <https://www.freightaustralia.gov.au/what-are-we-doing/smarter-and-targeted-infrastructure-investment>

55 *ibid*

56 'Australian Marine Complex' Development WA (accessed 2 September 2022) <https://developmentwa.com.au/projects/industrial-and-commercial/australian-marine-complex/about-the-amc>

Long-term transport planning needs to include the integration of efficient freight routes to major generators such as ports and airports. The existing process of roads being widened (or new roads built) and consequently filled with private cars needs to be addressed. Some ways in which this could be achieved include priority lanes for heavy freight vehicles and demand management, to help ease congestion on main arteries used by freight and delivery vehicles. Rail is efficient at transporting heavy freight over long distances as well as between ports and inter-modal terminals. An example of a cost-efficient policy which incentivises freight operators to invest in and use alternative modes is the Fremantle Container Rail Subsidy Scheme in Western Australia. Recognising container rail operators play a significant role in transport efficiency at the port, the Western Australian State Government established the Fremantle Container Rail Subsidy to lower costs and increase use of rail in the inner harbour.⁵⁷ Every day between five and seven trains carry between 400 and 500 containers in and out of the port.⁵⁸ The proportion of containers moved to and from the port is now around 20 per cent of all the containers coming into the harbour, which equates to removing approximately 105,000 truck movements off road every year.⁵⁹ Using rail for freight reduces emissions, road crashes, and improves freight efficiency for both road and rail transport.

Section 5: Questions for consideration

1. What would be the top initiatives government can take to strengthen freight transport efficiency and reliability in Australia?
2. How can rail be better utilised in the moving of goods throughout Australia?
3. What technologies are needed to support a more efficient and reliable freight network?
4. Does Australia have the engineering workforce to support the future transport system? If not, what needs to be done to strengthen the transport sector's engineering workforce?

57 'Fremantle container rail subsidy' The Government of Western Australia Department of Transport (accessed 4 October 2022) https://www.transport.wa.gov.au/mediaFiles/Freight-Ports/Freight_P_FS_FremantleContainerRailSub.pdf

58 'Rail' Fremantle Ports (accessed 4 October 2022) <https://www.fremantleports.com.au/landside/rail>

59 ibid

6. Conclusion

The transport sector in Australia will continue to play a vital role in the country's economic and social prosperity. Therefore, the system needs to be able to adapt to a shift in consumer behaviour and embrace technological advancements.

To achieve this, new funding models are required, with governments investing in a shared vision for the future, while appreciating the intricacies of the system. Transport is complex, and to perform optimally, collaboration is required, as is a focus on equity, inclusivity and reliability. While change is never easy, recent events have shown how critical it is plan for the unexpected and have systems which are flexible enough to adjust to the unknown.

The areas covered in this paper aim to provide a foundation for further consultation and policy development. The paper will be used to guide roundtable discussion and elicit broad feedback, leading to the development of a directions paper in 2023. The directions paper will provide solutions focused recommendations which can be implemented by the sector to improve Australia's transport system and ensure it is ready for the future.



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