

AUSTRALASIAN RAILWAY ASSOCIATION

Submission to

INQUIRY INTO AUSTRALIA'S RAIL INDUSTRY

SENATE STANDING COMMITTEES ON RURAL AND REGIONAL
AFFAIRS AND TRANSPORT

April 2016

KEY POINTS

- Rail is critical to Australia's economic growth and productivity, international competitiveness, social enhancement and environmental sustainability. Rail is a prominent employer, with close to 200,000 people working in the industry.^[i] It is also an important activity generator, with close to \$45 billion in committed investment in the next 5 years.^[ii]
- Government must work together to support the rail sector through collaboration and long term vision. Lack of cohesion between State and the Federal Governments has seen sporadic investment and a lumpy demand which stalls the growth of the sector. Passenger rail provides means to relieve city congestion. In the case of Freight, Inland Rail requires an immediate commitment.
- The rail manufacturing sector has a significant impact on the local and regional economy, with \$4 billion annual turnover and more than 15000 people employed in the sector in over 330 firms across the country (particularly in NSW, VIC and QLD).^[iii] Weakening of the rail manufacturing sector will affect national and regional growth, impact jobs and the livelihoods of Australians.
- Greater harmonisation of standards, regulations and procurement practices across all rail sectors is required. Best practice in tendering will reduce the cost burden.
- People are the most critical element of the industry. Greater diversity in rail should be encouraged. Governments and industry must work together to attract young and talented workers to the industry. This will help bring about a more innovative future for rail and its patrons.

THE SIGNIFICANCE OF THE RAIL INDUSTRY WARRANTS SPECIAL ATTENTION AND INVESTMENT FROM GOVERNMENTS. OUR NETWORKS OF INFRASTRUCTURE AND SERVICES CONNECT PEOPLE AND COMMUNITIES, SUPPORT FREIGHT TRANSPORT ACROSS THE COUNTRY, HELP DELIVER OUR RESOURCES TO OVERSEAS MARKETS AND CONTINUE TO GENERATE ECONOMIC GROWTH AND EMPLOYMENT.

AN AUSTRALIAN SOLUTION IS REQUIRED.

THE ARA: THE PEAK BODY FOR AUSTRALIAN RAIL

The Australasian Railway Association (ARA) is the peak representative body for companies engaged in the rail sector. Membership is comprised of all freight and passenger operators in Australia, track owners and operators, manufacturers and suppliers, contracting and consulting organisations.

Further details available at www.ara.net.au and Appendix 1



17 Freight Members



15 Passenger Members



7 Light Rail Members



94 Manufacturers, Suppliers and Contractors



Details of ARA's services and activities are available at www.ara.net.au.

THE RAIL INDUSTRY TODAY

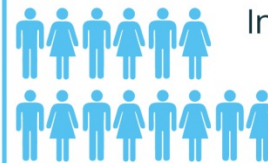
In 2013 – 14, Australian railways carried almost **1.3 billion tonnes of freight**, a 25% increase from 2012-13. The task was dominated by bulk movements, which accounted for **98% of the overall freight task**.



Australia's current railway network is around **33,000 route-kilometres** long.



An additional **452 route kilometres** are currently under construction.



In 2013, Australian heavy and light rail operators provided **850.3 million passenger trips**.

This is equal to **16.4 million passenger trips** per week or **2.3 million people** travelling by train every day of the year.

Across all sectors, the industry employs upwards of **200,000 people**.



\$45 billion in investment in the next 5 years.



NOT JUST A MODE OF TRANSPORT

One passenger train takes **525 cars** off the road.

One freight train takes **110 trucks** off the road.

In one year, **one passenger train reduces carbon emissions** by the same amount as planting 320 hectares of trees.

Road accidents **cost Australia up to 1500 lives, 30,000 serious injuries and \$35 billion** every year.

Did you know?

The Inland Rail project is expected to take seven hours off transit times between Melbourne and Brisbane, while removing trucks from the Pacific, Newell and Hume Highways, and further boosting regional development along the entire 1,700 km route.

Further details on page 15.

RAIL MANUFACTURING SECTOR: A CLOSER LOOK

\$ 4BN
Annual Turnover

\$ 1.6BN
Contribution to the
Australian economy



330 firms, 90% SMEs

15,000 people



150 years of design, manufacturing
and maintenance capability

CURRENT CHALLENGES

Challenges for Australian Infrastructure

- Growing and urbanised population - almost 66% of our population living in an area equivalent to only 1% of Australia's land mass.
- Expanding and geographically spreading cities - 74 per cent of Australia's population is expected to live in capital cities by 2061.
- Congested roads – cost of metropolitan congestion rising to around \$30 billion by 2030.
- Rising costs of living and lower housing affordability.
- A growing freight task – Australian freight task is projected to double by 2030.
- Increasing greenhouse gas emissions - On a per capita basis, Australia is the highest carbon emitter in the OECD and one of the highest in the world
- The need to increase national productivity levels through strategic investment and economic infrastructure
- Increasing connectivity and accessibility of the networks
- Sub-optimal and non-competitive infrastructure markets
- Improving service standards and facilitating rural and regional growth (close the infrastructure gap faced by remote communities)

Challenges for the Rail Manufacturing Sector

- Unknown size and value of the Australian rail manufacturing sector
- Volatile rollingstock procurement cycle
- Variations relating to rollingstock specifications
- Matching rail capabilities with future opportunities
- Supply chain inefficiencies
- Maximising international opportunities
- Maintaining skills based on reliability of networks

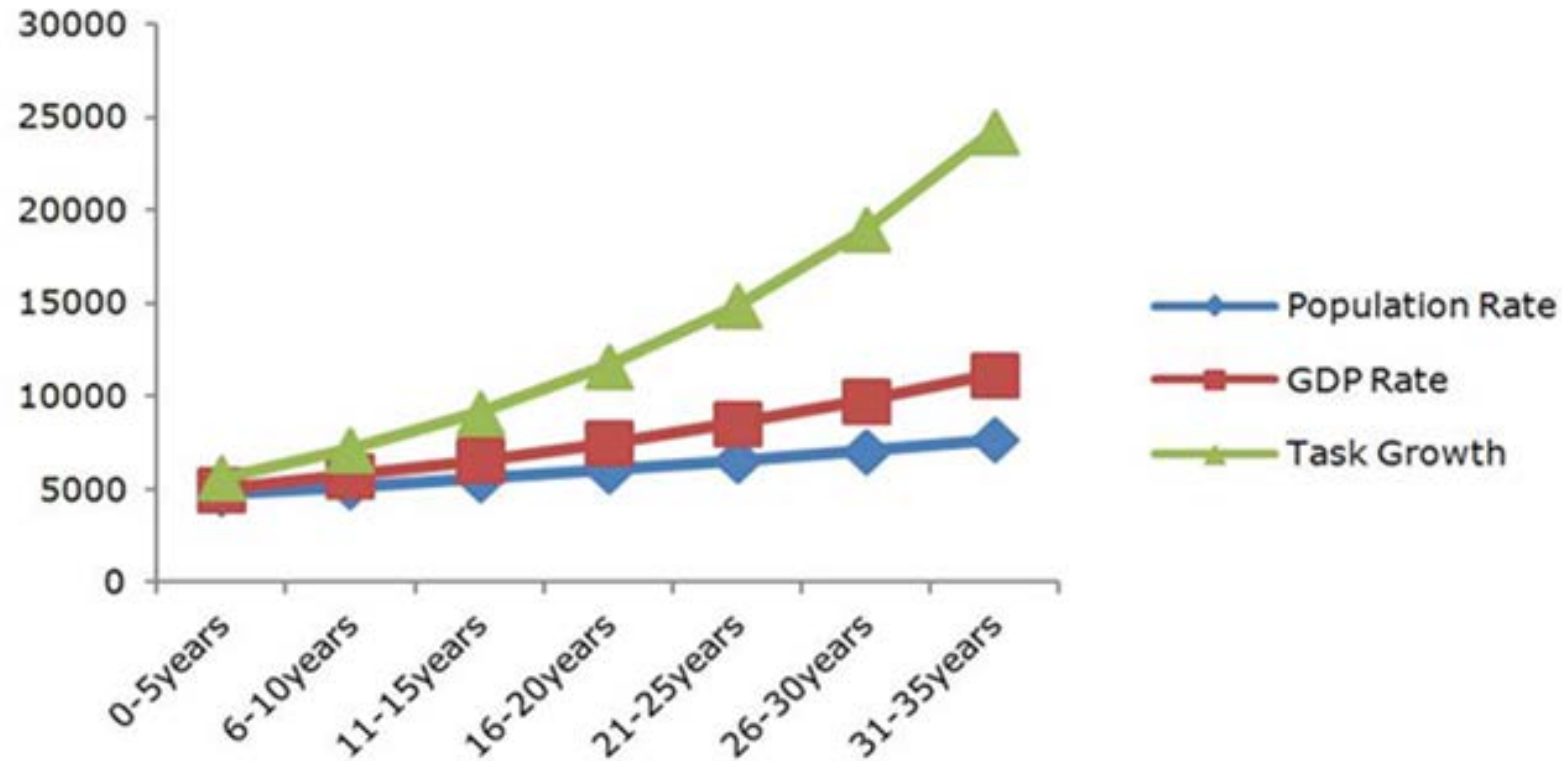
Did you know?

- 1900 railcars will need to be replaced while a further 1100 railcars will be required within the next 10 years to support patronage growth (equivalent \$9 billion in expenditure).
- Projected patronage growth shows that Australia will need 11000 railcars in the next 30 years.
- Over the next 30 years, state governments could spend at least \$30 billion on procuring rollingstock.
- More efficient planning around purchases can save governments nearly \$6 billion on their upcoming rail projects.

Sources: DIISR, A Profile of the Railway Manufacturing Industry in Australia (2011); Deloitte Access Economics, Opportunities for Greater Passenger Rollingstock Procurement Efficiency (2013)

PROJECTED GROWTH IN RAIL MANUFACTURING SECTOR

National Passenger Car Growth Profiles over 35 years as of May 2012



Source: Orion Advisory, The Future of Australian Passenger Rollingstock (2012)

ADDRESSING THE CHALLENGES

- Invest in productive and efficient rail infrastructure including rollingstock.
- Continue supply chain development activities e.g. Entrepreneurs' Infrastructure Programme and a program similar to ASEA
- Pursue rolling stock demand issue with states (benefits to be made through greater coordination of procurement). This could include the preparation of integrated long term rollingstock strategies, the development of a national rollingstock pipeline database and the development of cross-state procurement arrangements.
- Harness innovation through R&D Tax Incentive, Rail Manufacturing CRC
- Ensure the continuity of critical skills development and training
- Pursue harmonisation of specifications issue through the development of harmonisation principles and harmonised rollingstock standards
- Utilise mechanisms such as ICN to identify and update the pipeline of opportunities and link to local supply chain.
- Continue international engagement - the global market is key. Have a strategic agenda with Austrade to pursue key markets and events.

Capitalising on international opportunities

To facilitate a growing and strong industry and attract incoming investment, local rail suppliers must lift their sights towards global opportunities. A strong relationship with Austrade will achieve a deeper understanding of rail's capabilities and bolster connections into international markets. Well-targeted missions, supported by Austrade's in-market expertise will add a new dimension to the global reach of Australian rail suppliers.

Procurement

Procurement policies should maintain a focus on the principle of 'full, fair and responsible' opportunity to supply for Australian infrastructure and rollingstock providers. A consistent and effective Australian-wide procurement policy for local industry participation should be developed.

**Victoria is leading the way.
Other jurisdictions must follow.**

Harmonisation

With increasing demand by government, Australian rail supply competitiveness would be considerably stronger if type-approval harmonisation and coordination of standards and specifications becomes a priority. This would benefit all suppliers, by minimising unnecessary costs and duplication, keeping business on-shore and increasing the speed of approval and delivery. The Deloitte report shows that more efficient planning around purchases can save governments nearly \$6 billion on their upcoming rail projects.

INVESTING IN THE FUTURE - SECURING THE PIPELINE

ARA - PIPELINE OF OPPORTUNITIES

ARA has documented as at November 2015 announced rail projects of significance out to the mid-2030's.

Among the projects documented are those where there is funding uncertainty and those which are conceptual. However, the projects documented have been announced publicly and it is now imperative to remove the uncertainty and secure the projects to provide this certainty beyond the electoral cycles of our federal and state governments.

The pipeline must be maintained and regularly updated to provide an accurate picture of the opportunities going forward. This will enable rail industry suppliers and contractors to better plan their inputs and contribution to the projects. An up-to-date pipeline will facilitate greater coordination between customers, essentially state and territory governments, to consider smoothing the demand curve. This will generate a greater opportunity for suppliers to address capability, maximise productivity and efficiency and to harness resources, particularly workforce skills in meeting the demand.

Attention must be directed towards maintaining an accurate representation of the pipeline of projects going forward.

There is alignment between the position of Infrastructure Australia and the ARA in developing the pipeline.

A copy of the pipeline is available at Appendix 3

On 17 February 2016, IA released its Australian Infrastructure Plan and Priority List. The Plan sets out recommendations for improving Australia's infrastructure over the next 15 years, while the Priority List outlines 93 specific projects that should be targeted for completion. In total, 48 projects and initiatives involve passenger or freight rail as the sole focus or in some potential capacity, 28 of which are passenger rail initiatives.

INFRASTRUCTURE AUSTRALIA'S INFRASTRUCTURE PLAN & PRIORITY LIST

Infrastructure Australia and state infrastructure bodies are at one with ARA on developing and adhering to a pipeline of infrastructure projects in rail and related transport opportunities. Interoperability between various transport modes is a priority, a position that ARA supports. A response from the Commonwealth to the Infrastructure Australia report is awaited. It must lock in the identified priorities.

ARA does not believe the only source of funding for major rail infrastructure investments rests with governments. Lack of funds is so often offered as an excuse for lack of action. Alternative and innovative sources of funding must be explored here and internationally, including PPP's, superannuation funds, infrastructure investment vehicles, value capture and the like.

Infrastructure Australia's Priority List is annexed - Appendix 4

ARA CALLS FOR A WHITE PAPER FOR RAIL

The ARA has proposed that a Rail 'White Paper' along the lines of that recently announced for Defence be developed.

In rail it is each state and territory government that makes the expenditure decisions, each setting its own standards and priorities with little coordination. By contrast, in Defence it is the sovereign Commonwealth Government that makes national expenditure decisions resulting in substantial benefits to that sector.

The ARA instanced the \$195 billion expenditure commitments in the recent Defence Industry White Paper. In particular, over the next decade, \$230 million is to establish a 'Centre for Defence Industry Capability'; \$730 million for research on next generation technologies; and \$640 million for a Defence Innovation Hub. The ARA believes that similar commitments for innovation and to build Australia wide rail industry capability simply don't occur.

Rail is a victim of the frailties of our Federation. The states must come together at the upcoming Transport Industry Council (TIC) meeting in May and propose that the Commonwealth work with the States to prepare a 'White Paper' that would deliver for rail similar capability and innovation initiatives that are in prospect for Defence.

As well rail and defence capabilities overlap in many areas. This requires a cohesive approach to building capability in both sectors.

INFRASTRUCTURE DÉTENTE

ARA and Infrastructure Australia are currently exploring opportunities to conduct a "Détente", supported by the Commonwealth and the States, to bring together the key players with a stake in rail. The proposal is to examine the key ingredients for maximising the opportunities for local companies and to address barriers so as to reap the benefits of securing the pipeline.

The draft agenda for the proposed "Détente" is annexed - APPENDIX 5.

ROLLINGSTOCK IS INFRASTRUCTURE & MAINTENANCE IS KEY

Engineering & innovation capabilities are key to reliability

It cannot be contemplated that as supply sources move off shore, our engineering capability can be eroded. Rail investments have a 30 plus year life expectancy. Customers demand reliability, latest technology and preventative maintenance whether in freight or passenger operations. The capability to maintain our infrastructure, including rolling stock, must be locally available and on call.

Rail infrastructure is not just tracks, stations, tunnels, signalling and the like. It is also about rollingstock.

To achieve our growth and employment ambitions, we must:

- seek to maximise local content in our rollingstock;
- build efficiencies into the supply chain; and
- work with the States to harmonise their approach to demand.

Industry must play its part in building efficiency in the supply chain.

It is imperative that States work together to rationalise the divergent standards they impose on suppliers and to smooth out the lumpy demand curve.

MAINTENANCE OF EXISTING ASSETS IS CRITICAL

When it comes to assessing the key elements of competitive bids, it is imperative to factor in the issue of long term maintenance. We must retain our maintenance capability in the local market. It would be folly to do otherwise. Our rollingstock infrastructure is here for the long haul and we must maintain it in top working order.

GROWING LOCAL INDUSTRY (LOCAL CONTENT)

Support for local content must be commercially and technically sound

WHY LOCAL CONTENT?

- Direct economic contribution to the state and the nation
- Secure future for local industry
- Economic activity generation via jobs creation
- Basis for export
- Adopted solution for specific local needs
- Local technical support

DID YOU KNOW?

In **G20** countries, while many enjoy the benefits of free trade agreements, local content requirements for rollingstock projects exceed 50%. These requirements are implemented through both formal legislation (USA) and indirect regulatory approaches (Europe).

In **Victoria**: Victoria is leading the way on local content. The Government launched 'Trains, Trams, Jobs 2015 – 2025', a ten year strategy that will see 100 new metropolitan trains, 100 new trams and a massive expansion of its regional fleet. The strategy also imposes 50% local content in new rollingstock orders to give manufacturers and the entire supply chain a secure future. There are incentives which apply if there is more than 50% local content.

ICN

Industry Capability Network (ICN) is a business network that introduces Australian and New Zealand companies to projects large and small.

ICN has the potential to link to the pipeline of opportunities. Local companies must be technologically and commercially sound to exploit these opportunities.

Automotive Supplier Excellence Australia (ASEA) program commenced in 2007 and was specifically focused on assisting Tier 1 companies in the Australian automotive supply chain to improve their competitiveness and sustainability. In 2009 the Program was expanded to include the Tier 2 and 3 companies, as they are also key players in optimising the supply chain.

The vision of ASEA is to be the "Preferred provider of sustainable business improvements" with a mission of "Assisting companies to look at their business in new ways to achieve world class levels of competitiveness".

This initiative should be adapted to the rail industry.

ROLLINGSTOCK PROCUREMENT REFORM

The procurement of passenger rolling stock is a complex, costly and time consuming process. Depending on the size and complexity of the order, procuring a train could take around 5 to 7 years, and in some instances up to a decade, from the point where a decision to purchase a new train is made to actual delivery of the first car.

Costs of Procurement

The cost of planning, procuring, designing and building new trains can be substantial. A significant proportion of the cost of procuring a new train lies in the planning and design stage, even for trains based on proven platforms. For rolling stock based on new specifications, the design costs can be considerable. In a UK context, the design costs associated with the development of a new rolling stock platform can be as high as £100m (A\$224m).

Invariably, the level of costs incurred will depend on the nature of the order, the nature of the rolling stock being purchased and the practices of the manufacturer. Approximately half of whole of life costs is spent prior to operations. A significant proportion of costs are spent on planning and design. Consultation suggests that prior to the commencement of primary build, the cost incurred due to planning and design typically accounts for up to 20% of whole of life costs. This is consistent with UK research. This level of cost is not surprising given the relatively high levels of customisation typically applied to Australian trains. Approximately 30% of whole of life costs are incurred during primary build. The remaining 50% of whole of life costs are incurred during operations. Even during operations, capital costs can account for over 50% of ongoing costs, incurred through changes in componentry, refurbishments and disposal.

Next Steps

- Optimise the value of rolling stock per order to better ensure that economies of scale can be achieved
- Smooth the level of production to assist in achieving economies of scale and improve industry planning.
- Reduce the variations in standards to minimise designs and production costs.
- Address the upfront financial burden of rolling stock purchases to increase the ability to procure based on need rather than on when funding is available
- Encourage greater coordination of production and procurement between industry and government to improve visibility and encourage production efficiencies.

Appendix 6: Deloitte Access Economics, Opportunities for Greater Rollingstock Procurement Efficiency (2012)

INFRASTRUCTURE PROCUREMENT

Tendering processes have a significant impact on the outcome of public infrastructure development. These are time consuming, slow, expensive and do not always promote new technologies and innovation. Furthermore, the financial burden is placed on all bidders, not just the successful one, requiring the wasteful expenditure of considerable resources before construction begins. Design costs can sometimes comprise fifty per cent of tender costs, while tenders also routinely involve the submission of documentation relating to non-design issues such as workplace relations and health and safety management. The consequence is that tendering is becoming cost prohibitive.

The Productivity Commission summed it up:

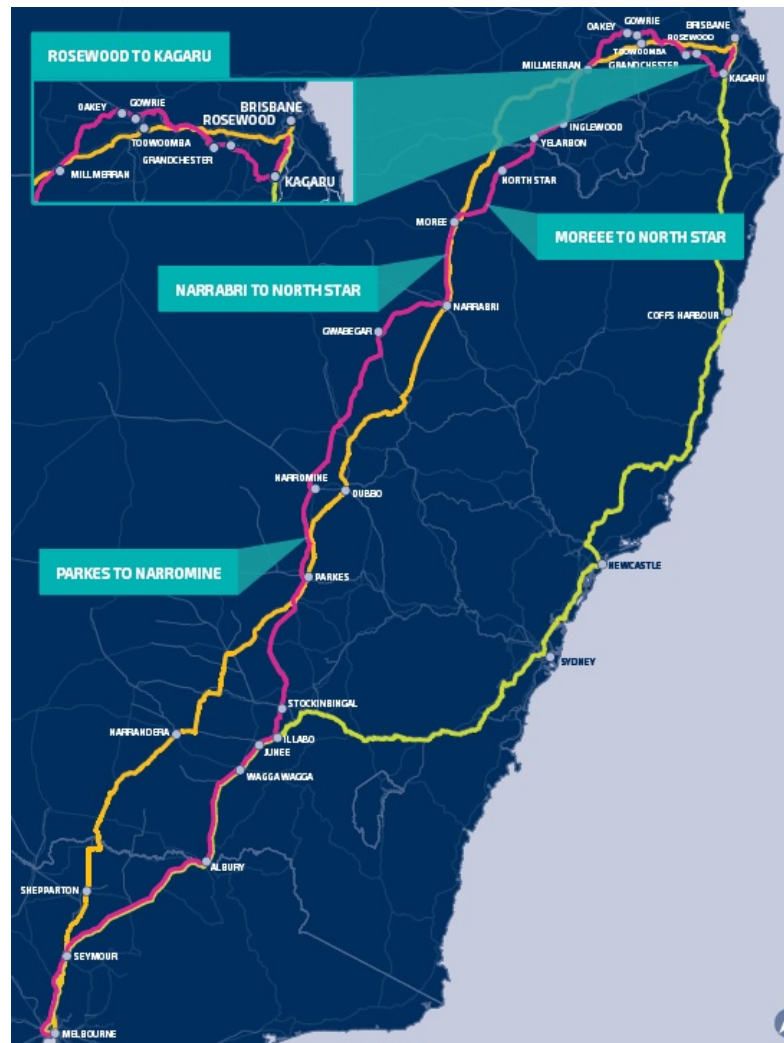
“Procurement models and commercial risk management differ from government to government and even between agencies within the same government. This results in confusion for tenderers seeking consistency of approach, adds to cost and time pressures and does not support the capacity for a project to receive financing at best market rates available”.

The complexity and costs of bidding for major projects including Public Private Partnerships, has become a major barrier to entry into the Australian infrastructure market.

The Productivity Commission, the House of Representatives Standing Committee on Infrastructure and Communications, and others have advanced a number of solutions. These include:

1. A more streamlined information requirement for bidders. Detailed, non-design management plans only to be required of the preferred tenderer;
2. Governments to invest more time and resources in the initial concept design specifications to help reduce bid costs (centralising common elements);
3. Governments should consider contributing to the design costs by co-funding design or purchasing IP rights or owning design outright;
4. Past contract performance by tenderers be considered as a means of shortlisting high-performing tenderers;
5. Concept designs using Building Information Modelling (BIM) should be prescribed to help lower bid costs;
6. For complex projects, government clients should pre-test the market to gain insights into possible savings from de-bundling projects into smaller components; and
7. More time and funding should be invested in understanding and minimising site risks.

INLAND RAIL – A TRANSFORMATIONAL PROJECT



- Melbourne to Brisbane, bypassing congested Sydney
- 1,700 km route
- \$10 billion project cost
- 22 hours of transit time
- Removing thousands of trucks from the road
- Boosting regional development

The Inland Rail project is crucial to our nation's economy; it is expected to take seven hours off transit times between Melbourne and Brisbane, while removing trucks from the Pacific, Newell and Hume Highways, and further boosting regional development along the entire 1,700 km route.

The Inland Rail project has the potential to unblock an infrastructure bottleneck that currently sees Brisbane to Melbourne freight unnecessarily travelling through Sydney, congesting road and rail networks alike. The efficient movement of freight in Australia is crucial for our domestic economy and our ability to compete internationally.

Achieving competitive neutrality between road and rail costs is an important pre-requisite.

NEUTRALISING THE TRANSPORT MARKETS: ROAD - RAIL PRICING REFORM

THE PRINCIPLES OF ROAD PRICING REFORM

- The cost-reflective road infrastructure access charge should apply to heavy vehicles (over 4.5 tonnes).
- The charge should be applied to heavy vehicles operating on State arterial networks and national highways (which carry 75% of freight volumes). This will include links to intermodal facilities, ports and other significant freight infrastructure.
- It should be a mass-distance-location (MDL) pricing regime – trucks would pay little or no registration or fuel excise but would pay for road access according to their mass, where they are and how far they travel.
- Prices for access to the road freight network should be based on a building block regulatory model as applied in other price regulated infrastructure utilities (electricity, gas, water and rail freight). Pricing would be subject to approval by an independent economic regulator.
- Pricing will be facilitated by the use of in-vehicle telematics systems
- The reforms should include both pricing reform and investment reform where state road agencies road infrastructure plans and service standards are transparent, consistent with commercial principles, and responsive to the current and future requirements of heavy vehicle users. Heavy vehicle operators must be given the opportunity to provide input into plans and be able to negotiate improved access provided safety and performance standards are met.
- While the rail industry supports on-going consultation on this matter, actions to address this issue are required as a matter of urgency.

HIGH SPEED RAIL – A QUESTION OF PRIORITIES



High Speed Rail is more than a transport project. It is a transformative project about the future landscape of Australia and it should be funded from a special allocation of funds that does not affect the funding of existing freight and passenger rail systems and their forecast requirements.

CAREERS IN RAIL: A EXCITING NETWORK OF OPPORTUNITIES



Rail is a strong, exciting and diverse industry with a prosperous future.

This industry employs around 200,000 people in a wide range of occupations, disciplines and professions. There are more than 500 companies comprising private and public operators involved in passenger and freight operations, track owners and managers, manufacturers and suppliers operating in urban and regional areas of Australia and infrastructure contractors and consultants.

A career in rail provides a wide range of local and international opportunities - not just train drivers but great variety for tradespeople to engineers and in customer services. There are great career opportunities in logistics, marketing, sales, human resources, training and development, work health and safety, finance, administration, legal, and information technology.

A career in rail offers employees great scope for advancement, a variety of career paths and great job prospects in Australia and overseas.

DELOITTE ACCESS ECONOMICS: NEXT STEPS

The Deloitte Study outlines a number of steps into the future. These steps remain relevant today.

- Prepare integrated long term rolling stock strategies;
- Develop a national rolling stock pipeline database;
- Initiate a Coordinated Rollingstock Planning Program;
- Establish a pilot to prove partial harmonisation benefits;
- Develop harmonisation principles and harmonised rollingstock standards; and
- Explore feasibility of cross-state procurement arrangements.

These were insightful steps proposed by the Deloitte Access Economics study in 2013. There is an intensifying urgency to act on them.

CONCLUSION

The Australian rail industry is on the verge of a new era. Rail is coming to the fore – as means of relieving city congestion, addressing environmental concerns, delivering patrons safely to their destinations and transporting our raw materials, products and general freight to markets. There is a massive pipeline of opportunities to exploit in a manner that is not at risk in each political cycle.

Cohesion between the Australian states, acting in unison in satisfying demand and in planning for the future is essential - harmonisation in standards and procurement is a top priority.

Big picture projects like the Inland Rail must become part of the committed landscape for government. There should be competitive neutrality in road-rail pricing.

Australia, like in Defence must understand the benefit which will flow to the national economy, to growth and employment should an internationally competitive locally oriented rail industry work cohesively to that objective.

^[i] Australasian Railway Association (2016)

^[ii] Industry Capability Network (2016)

^[iii] DIISR, A Profile of the Railway Manufacturing Industry in Australia (2011)

RAIL FOR A

BETTER FUTURE

Join our network

The Australasian Railway Association (ARA) is the peak body for the rail industry in Australia and New Zealand. Join us in our journey to a better rail future.

Stay informed

Stay connected

Contribute

Australasian Railway Association

We are the peak body for rail throughout Australia and New Zealand representing all sectors of the rail industry.

We provide a coordinated and unified voice on relevant issues of national importance. The ARA engages political leaders at both the state and federal levels in forward-looking discussions around industry potential. We bring about key policy reform to effectively enhance Australia's productivity, economic and social prosperity, as well as its international competitiveness.

The ARA creates an avenue for industry to connect, knowledge-share and work together to achieve greater results for rail. We work to create an environment for the rail industry to prosper; we want to ensure a better rail future for all.

What we do

The ARA is the rail industry's

Leader – influencing key decision makers and policy direction

Facilitator – Creating business opportunities through ongoing networking, establishing professional partnerships and knowledge sharing

Communicator – listening and responding to member needs, sharing updates, ideas and industry insight

Developer – building world-class credentials and competencies of industry workers through professional development

Collaborator – forming cooperative partnerships between industry stakeholders/ state and federal governments

Promoter – advocacy for the people and projects within rail, promoting Australian rail expertise internationally

Contributor – navigating rail issues and identifying rail solutions through our working groups and executive committees

Works to achieve

A pipeline of freight and passenger projects to benefit all sectors of the rail industry

A coordinated and unified voice on relevant issues of national importance

Career opportunities for highly capable rail industry employees in all facets of a high-tech and innovative rail system

Improved public policy and procurement processes, greater investment in rail







Harmonised rail regulations, regulatory reform, reducing of red tape

Wider recognition of economic, environmental and social benefits of rail

Our vision

A world-class rail industry in Australia and New Zealand that contributes to a liveable and sustainable society that benefits all.


Stay informed

-  Access to member-only communications on key industry issues as they unfold.
-  Invitations to members to participate in regular industry briefings covering such areas as: freight and passenger project opportunities, logistics, customer service, revenue protection and benchmarking for passenger rail.
-  Access to the latest industry data, global benchmarking and relevant research through advocacy publications and submissions.
-  Access to rail guidelines, industry standards and codes of practice.
-  Participation at discounted member rates for conferences and courses ranging from specialised engineering courses to events targeting key issues facing industry.
-  Access information pertaining to government assistance programs that support local suppliers.

Stay connected

-  The opportunity to connect with key stakeholders and decision makers through networking events, government roundtables, collaborative forums and leaders' lunches.
-  Member rates to attend large scale networking and information sharing opportunities at AusRAIL - the largest rail conference in the Southern Hemisphere.
-  The ability to form connections and cultivate professional relationships to help you grow your business and advance the rail industry overall.
-  The opportunity to become part of our advocacy – the ARA meets regularly with with senior government ministers and opposition shadow portfolio holders to advocate on your behalf.
-  The ARA maintains a strong relationship with senior departmental representatives and independent bodies such as the Rail Industry Safety & Standards Board, Infrastructure Australia, the Australian Communication & Media Authority and the Office of the National Rail Safety Regulator.

Contribute

-  The opportunity to participate (either actively or just by being informed) in any of our working groups. Through collaboration with industry players, ARA's groups provide ways to work together to help your business run efficiently and cost effectively.
 -  Key focus areas include infrastructure planning, safety (including Signals Passed At Danger), telecommunications (including Spectrum), disability access, workforce development and asset inventory management.
-  Opportunity to work with us in forming a position on industry matters and influencing key industry regulations and policies.
-  The opportunity to participate in 'Rail Careers Week' held annually to provide the community with insight into the rail industry and all it has to offer.
-  Become involved in shaping the future direction of our nation's infrastructure, from financing and streamlined procurement processes, through to the delivery and ongoing maintenance of rail projects.

Join now and become part of our local and international network
www.ara.net.au/become-member

Follow us on social media



Deloitte Access Economics

The True Value of Rail Report



ara.net.au

The True Value of Rail **Report**

October 2011



Deloitte Access Economics

The true value of rail

The Australasian Railway Association

31 August 2011

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26 October 2011

Dear Bryan

The true value of rail

I am pleased to attach our report examining the true value of rail in Australia. The analysis identifies and quantifies, where possible, the benefits from rail transport that are not captured in prices and which accrue to the community at large. The level and type of investments needed to help rail achieve its potential are also considered and compared to the benefits that could flow from increased rail use.

We hope this report will add to the policy debate around where and how to invest in Australia's transport infrastructure.

Some revisions have been made to the report since the original version was released in August 2011. There have been a number of minor corrections, updating of some infrastructure options to reflect changes to government policy and a change in the treatment of emissions from road transport.

Yours sincerely,

Ric Simes
Partner
Deloitte Access Economics

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Glossary

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACF	Australian Conservation Foundation
ACG	Applebaum Consulting Group
ARA	Australasian Railway Association
ARTC	Australian Rail Track Corporation
ATC	Australian Transport Council
ATSB	Australian Transport Safety Bureau
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BTE	Bureau of Transport Economics
BTRE	Bureau of Transport and Regional Economics
CNG	Compressed natural gas
COAG	Council of Australian Governments
CPI	Consumer price index
CPRS	Carbon pollution reduction scheme
CRAI	Charles River Associates International
CRC	Cooperative Research Centre
CRRP	COAG Road Reform Plan
DFAT	Department of Foreign Affairs and Trade
DRET	Department of Resources, Energy and Tourism
FIRS	Federal Interstate Registration Scheme
IPART	Independent Pricing and Regulatory Tribunal
ITLS	Institute of Transport and Logistics Studies
NSW	New South Wales
NTC	National Transport Commission
OECD	Organisation for Economic Cooperation and Development
PWC	PricewaterhouseCoopers
QR	Queensland Rail
RIS	Regulatory Impact Statement
RTA	Roads and Traffic Authority

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SPC	Sydney Ports Corporation
TRESIS	Transport and Environmental Strategy Impact Simulator
USA	United States of America
VFT	Very fast train
VSL	Value of statistical life

Executive Summary

Understanding the true value of rail in Australia requires that the benefits from rail transport which are not captured in prices and which accrue to the community at large are identified and quantified. In this report some of these social, environment and economic impacts of rail transport are identified and quantified.

The analysis indicates that, for passenger journeys, every trip made on rail rather than road can reduce costs to society by between \$3 and \$8.50, depending on the city. For freight the savings are estimated to be around 80 cents for every tonne kilometre (this translates to around \$124 for a normal container transported between Melbourne and Brisbane).

These estimates are based on congestion, accident and carbon emission costs and so benefits from social inclusion, reduced infrastructure maintenance costs and fuel security could also be added.

The situation today

Australia's approach to the planning of cities, land use and transport has changed dramatically over the last half century as a result of population growth. Our major cities have expanded and their centres have grown denser. Demand for passenger and freight transport services have steadily grown, both within and between urban centres. The pressure on transport infrastructure is set to progressively intensify over the coming years as Australia's population increases to a forecast 30.5 million by 2030 (ABS 2008). In this environment, decisions must be made about how much and where to invest in transport infrastructure. These decisions must be informed by the true value of rail or the wrong investments will be made.

Historically, much of the increased demand for transport services has been met by road. For example, the share of interstate, non-bulk freight met by road transport has risen from around 22% in 1970 to around 70% today, while that met by rail has fallen from around 45% to under 30% over the same period (BTE 1999 and Port Jackson Partners 2005). Similar trends can be observed in passenger services within cities.

Indeed, Australia is now the most intensive user of road freight in the world¹ and has the least energy efficient road passenger transport among members of the International Energy Association (DFAT 2008 and Prime Minister's task group on energy efficiency 2010).

These trends cannot continue if our freight systems are to be managed efficiently and our passenger networks are to not be overburdened by congestion as populations grow.

In order to meet the land transport challenges confronting the nation, a suite of complementary measures will be needed; involving:

¹ When measured on a tonne-kilometre per person basis.

- effectively integrating investment in transport infrastructure in all metropolitan strategies;
- reforming pricing to encourage efficient choices between different transport modes; and
- taking a long-term view of the benefits that accrue from investment in core transport infrastructure.

Policy-makers have been engaged in developing elements in each of these three areas for action but progress has been slow. Congestion, carbon emissions and inefficiencies in supply chains have continued to worsen. A greater sense of urgency is required.

As is evident from international experience, an increased use of rail will be vital to meeting these challenges as the population, and population densities, increase. Rail provides many benefits over road transport which are not incorporated into costs and prices. These benefits include:

- improved land use and urban densification;
- lower carbon emissions;
- reduced congestion;
- fewer accidents;
- removing barriers to social inclusion;
- improving land values; and
- enhanced energy security.

Rail is already price competitive with road in some areas of the transport network, particularly freight, and would become more competitive with improved infrastructure and/or suitable pricing signals. These benefits should grow as the population increases and rail infrastructure can be more fully utilised allowing the infrastructure costs to be spread between more users.

Benefits of rail

A key part of ensuring correct investment decisions are made is to recognise the true value of rail. This report provides evidence on the level of the benefits not captured in prices or costs that arise from shifting passengers or freight from road to rail. The benefits identified are:

- Passenger transport:
 - Road travel produces more than 40% more carbon pollution than rail travel per passenger kilometre.
 - Road transport generates almost eight times the amount of accident costs as rail transport does.
 - In the longer term, high speed rail provides the potential to alleviate pressures that will emerge to move people between major cities and along east coast corridors as Australia's population grows.
- Urban passenger transport:
 - An additional commuter journey by rail reduces congestion costs alone by between around \$2 and \$7.

- For every passenger journey made on rail rather than road in Australia's four largest cities, between \$3 and \$8.50 can be saved in congestion, safety and carbon emission costs.
- In Sydney, for example, if rail absorbed 30% of the forecast increase in urban travel then congestion, safety and carbon emission costs could be reduced by around \$1 billion a year by 2025.
- Interstate freight transport:
 - Heavy vehicle road freight users do not face the full maintenance costs that they cause. Under-recovery of these costs has been estimated at between \$7,000 and \$10,500 per truck each year (Productivity Commission 2006 and NTC 2006). The National Transport Commission (NTC) has recommended changes which seek to address this issue.
 - Freight moved between Melbourne and Brisbane by rail instead of road reduces carbon costs by around \$32 per container and reduces accident costs by around \$92 per container.
 - Along the North-South freight corridor, for example, if rail was to achieve a 40% share of the market then savings, in terms of carbon pollution and accidents, would currently be around \$250m a year or \$530m a year by 2030.
- Freight transport within urban centres:
 - Along with the use of the mass transit of people, a greater use of rail for freight within, especially, Sydney and Melbourne will be needed to alleviate the increasing congestion on road networks. Environmental and safety benefits would also accrue.
 - The NSW and Victorian Governments have recognised the need to develop more effective rail freight services within their cities and have set targets accordingly. These goals aim to ease congestion on arterial roads and improve use of existing rail infrastructure and port land.

These costs have tangible effects on the lives of all Australian's and the economy. Congestion eats away at leisure time and reduces economic productivity as workers and goods take longer to reach their destination and cost more to transport. Carbon pollution creates social costs to be borne by future generations who will face the dual costs of a changed climate and the need to reduce emissions. In addition to deaths caused by vehicle accidents, injuries create ongoing effects in terms of pain, reduced ability to work and the need for care.

Investing in infrastructure

The costs in terms of congestion, carbon emissions and safety that have been outlined above will increase in coming years. Increases in congestion costs are set to outpace the increase in either the size of the economy, the size of our cities or the size of our population. Policy makers are, therefore, faced with difficult decisions. Investment which recognises the value of rail could lead to significant benefits for Australia but these investments are large and can be administratively difficult.

For example, to meet the needs of this growing population, there is a choice between investing in mass transit now or building road or rail networks through already developed urban areas in the future. The high cost of retro-fitting road networks is already reflected

in Sydney's M4 East expansion, which is expected to amount to more than \$500 million per km (NRMA 2011). In contrast, Brisbane is looking to invest in Cross River Rail to prepare for a denser population.

There are currently some key bottlenecks holding back the efficient use of rail in Australia. Freight movements between Melbourne and Brisbane are constrained by congestion in northern Sydney. The North Sydney Freight Corridor would go a long way to addressing this issue. Fixing this key point of infrastructure is estimated to cost around \$4.4 billion today. A number of other projects on this route such as modern intermodal facilities in Sydney and Melbourne and many minor adjustments to the track might also be needed.

These investments are costly but will help drive a modal shift towards rail freight which creates benefits from reduced carbon pollution and accidents. If rail was to achieve a 40% market share then by 2030 the savings from accidents and carbon pollution could be worth well over \$500 million a year.

The key choke point for freight is intimately linked with Sydney's metropolitan network. The metropolitan network is currently constrained by capacity through the city. Expanding capacity in the city would lead to large savings in carbon pollution, accident and congestion costs which work to offset the initial infrastructure investment. If a congestion charge and carbon tax were introduced, this could result in around 150 million extra rail journeys a year. All these extra passengers would reduce carbon pollution, congestion and accident costs on the roads by around \$1.2 billion a year.

Projects to relieve current bottlenecks should be put through a rigorous cost benefit analysis before being committed to and the full benefits of rail should be included in this analysis.

The policy challenge

Rail has a central role to play in meeting this transport challenge; it can provide mass transport and links across cities, reducing congestion, accidents and pollution. It can also play a key role in transporting freight efficiently between and through population centres. Rail, therefore, should be a focus of policymakers when considering how best to support and accommodate future transport and economic growth.

Investment in rail should be made through a mix of public, private and public-private partnership (PPP) funding. No matter which method of funding is used investment should be made in a coordinated manner with reference to longer term transportation goals and incorporating the full costs of different modes of transport.

The most prominent involvement of State governments has been in metropolitan rail. State governments, through their metropolitan plans, therefore have an essential role to play in ensuring investments in rail infrastructure are made which keep pace with their growing cities and capture the full range of benefits that rail offers (including social inclusion, reduced congestion, reduced road accidents and reduced pollution). Rail will play a key role under any reasonable transport plan.

In addition to making investments in rail, state governments can also focus on addressing existing inefficiencies in the pricing of road transport. First through ensuring that heavy

freight vehicles cover the costs they impose and then by moving towards mass-distance pricing.

The Australian Government, by being less focused on the operation and maintenance of rail networks themselves, can take on a coordination and leadership role as well as their central funding role. Leadership can be made through continued investigation of new rail developments and planning strategies which place an emphasis on rail.

In terms of funding, ideally, the benefits of rail (such as reducing congestion, carbon emissions and accidents) would be directly internalised using policy options such as carbon pricing, congestion charges and accurate vehicle registration fees. This is a long term goal, however, and, in the shorter term, a second best approach is for the Australian Government to take into account the full benefits of rail when considering which investments to support.

Funding from the Australian Government is also important in overcoming myopic investments. Given the past pattern of transport investment in Australia it is often the case that an incremental investment in road seems more appealing than an investment in rail. Following along this path will only lock Australia in more closely with road transport and will miss the opportunities presented by making use rail transport.

A series of bold and innovative policy options should be considered. Over the very short term, the CRRP process should be strongly pursued and supported with a goal of more closely tying truck operating costs to the actual costs they create.

In the medium term, allocating some of the funds from a carbon tax to the development of public transport networks could present a particularly appealing policy.

In the longer term, introducing congestion charging in Australia's capital cities and levying a per tonne charge on road freight transport within cities should be seen as overall policy goals.

Effective action along these lines would result in very large gains to the national economy. Indeed, the potential gains would result in improvements in national productivity of a scale that would compare favourably with some of the major microeconomic reforms delivered over the past few decades.

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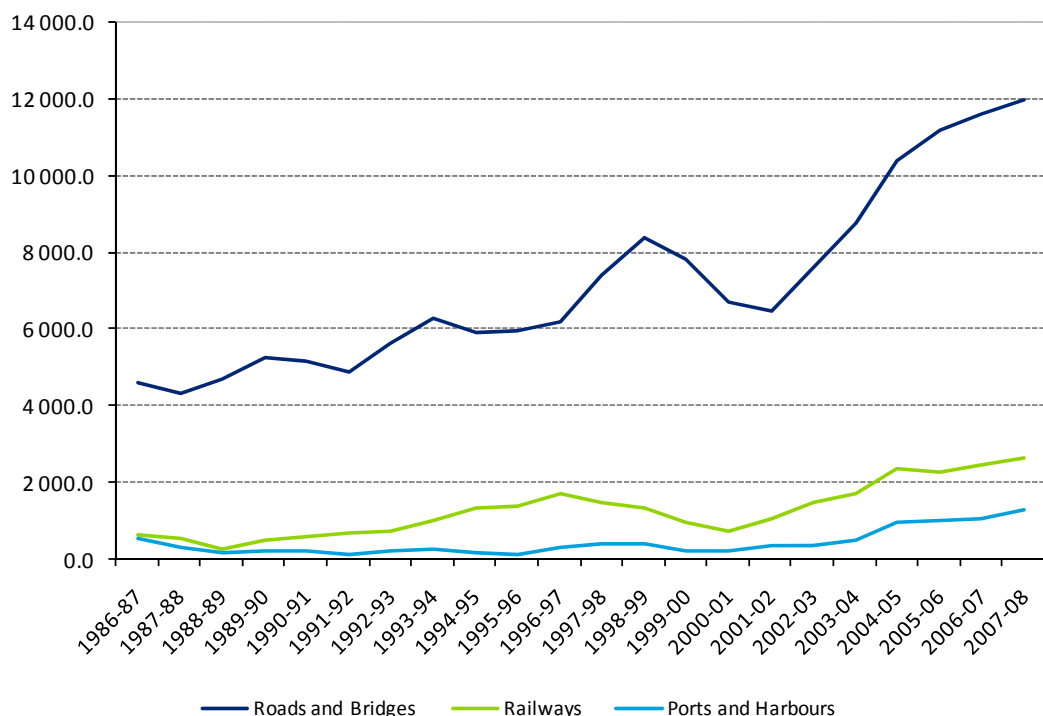
1 The policy setting

The increasing demand for transport associated with the expansion of our major cities has been predominantly met by building roads. Governments have played a key role in guiding these investment choices. With a movement towards integrated planning of transport investments across modes and jurisdictions supported by a number of key policy documents, there is an opportunity for a fresh approach to investment planning.

To make appropriate policy decisions, decision makers must take into account all the costs for each different transport mode.

Australia's approach to the planning of cities, land use and transport has changed dramatically over the last half century as a result of population growth. Our major cities have expanded, leading to greater demand for the transport of both passengers and freight, within and between cities. The expansion of our cities reflects a change in land use, from a relatively dense hub-and-spoke configuration, to a low density suburban sprawl, supported by an expanding road network (BTRE 2007). Over the last few decades, this increasing transport need has typically been met by investment in roads, with little relative investment in rail (see Chart 1.1 below).

Chart 1.1: Value of major transport infrastructure engineering construction, \$ million



Source: BTRE (2009c)

Government policy plays a significant role in guiding investment choices in Australia's transport infrastructure. Looking ahead, it will continue to play a coordinating role for infrastructure development because, while many transport operators are private entities or government corporations, the planning of cities and major infrastructure investments remain, largely, the purview of government, as does control of transport's regulatory environment.

A program of microeconomic reform in the 1990s, as part of the National Competition Policy Review, led to changes in the operating environment of the transport industry. For example, restructuring occurred in the rail industry, where below and above rail infrastructure was vertically separated and a number of rail access regimes were created (Everett 2006). It is arguable that in the decades since, however, reform and investment in infrastructure have stagnated. That attention is now shifting back, with freight and transport policy both firmly in the spotlight (BCA 2009).

In the freight sector, government policy towards freight transport has recently shifted towards an integrated planning model, in contrast to the previous parallel planning model where transport modes were planned separately and state and territory regulations did not align. The Australian Government and the Council of Australian Governments (COAG)'s reform agenda has been a driving force behind this shift. Several steps have already been taken towards an approach to transport policy that is integrated across jurisdictions and across modes, some recent highlights include:

- The release of a draft National Land Freight Strategy (Infrastructure Australia 2011)
- The National Ports Strategy (Infrastructure Australia 2010a)
- The Road Reform Plan (ATC 2009)
- A report commissioned by the National Transport Commission (NTC) looking at the development of an inter-modal supply chain (Booz & Company 2009)
- A Regulatory Impact Statement (RIS) recommending the implementation of a national framework for the regulation, registration and licensing of heavy vehicles (Department of Infrastructure, Transport, Regional Development and Local Government 2009)
- A RIS recommending the creation of a national safety investigator across all transport modes (NTC 2009)
- Dedicated transport infrastructure spending, with the creation of Building Australian Fund and the Nation Building Program, both under the jurisdiction of Infrastructure Australia

The role of rail freight within Australia's cities has also been recognised with, for example, renewed efforts for the integration of rail into the Port of Melbourne and Port Botany and planning for investments into intermodal terminals.

Similarly, there has been increased attention on urban transport planning at both a Federal and State level. Recent examples include:

- Initial Federal movement into urban infrastructure planning, with the development of a Major Cities Unit within Infrastructure Australia.
- A Discussion Paper looking at Sydney's Metropolitan Strategy for 2036 (NSW Planning 2009)

- A call for submissions regarding Sydney's proposed M5 corridor expansion (RTA 2009a)
- The Victorian Transport Plan (Department of Transport 2008)
- A draft Integrated Transport Plan for South East Queensland (Department of Transport and Main Roads 2010)
- An Infrastructure Plan and Program for South East Queensland (Department of Infrastructure and Planning 2010)
- A research report into 'Population growth, jobs growth and commuting flows in Perth' (BITRE 2010b).

Australia's population is forecast to increase to 30.5 million by 2030 (ABS 2008). As such, both the population and freight task are likewise forecast to continue growing in the decades to come. The policy shift towards an integrated planning model bodes well for the task ahead, as it has been found that multiple regulatory systems are inherently unstable (BTRE 2006). A more populous Australia will inevitably further change the landscape of our cities and infrastructure requirements. This will require significant investment in transport infrastructure for the efficient movement of more people and more goods. A focus on improving Australia's transport infrastructure is integral to continuing to build on the productivity gains that began with economic reform and competition policy in earlier decades (BCA 2009). Efficient transport is a key input to the production of goods and services in Australia and, as such, designing the right transport policy for both freight and passengers is integral to achieving future productivity growth. Without addressing efficiency and capacity constraints, there will be significant negative implications for the national economy (IPA and PWC 2009).

This begs the question; how best to grow as a nation? To sufficiently answer this question, it is important to understand the full implications of different investment choices. The question then becomes what is the best approach to the provision of funding of infrastructure, services and pricing to ensure that the most efficient modal mix is achieved.

Policy architecture that lends itself to the efficient development of the transport sector must ensure that stakeholders take into account all the costs for each different transport mode. Hence, one important consideration for transport planning decisions is an appreciation of the externalities associated with each mode. It is not the only consideration, but a failure to include it in the decision making process will likely lead to an outcome with a distortionary effect.

This report seeks to outline the potential advantages of investment in rail and its potential to best meet the challenges of a growing population and freight task. Issues affecting the policy decision making process are discussed further in this report. Background is given in Section 2, the current state of road and rail in Australia, including their economic characteristics, is discussed in Section 3, transportation costs are addressed in Section 4 and other considerations are discussed in Section 6. Finally, implications for public policy are addressed in Section 7.

2 Transport background

Rail is well suited to meeting the needs of Australia's future population growth whether this be as mass transit in Australia's increasingly large and dense cities, interstate passenger transport or freight transport (both within and between cities).

Rail presents benefits of enabling increased density, reducing congestion and accidents, being less fossil fuel dependent and negating the need for investment in airport and road expansions.

Rail has been held back by historical underinvestment, especially when compared to other modes of transport, which has led to an unnecessary reputation of poor performance. With sufficient infrastructure rail could significantly increase its share of the transport task.

As Australia's population grows over the coming decades, the potential value of rail will likewise grow. A more populous country is better able to tap into the efficiencies and benefits of rail, as its advantages lie in mass transportation, whether that be of people or of goods.

For the transport of passengers, rail has particular advantages at an intra-city, or metro, level. Australia has, for a long time, had a highly urbanised population and a growing population is likely to result in larger, denser cities. Investment in passenger rail networks offers one way of addressing how Australia's cities will be organised.

The ability of our major cities' footprints to expand is limited by geographic barriers to what are already sprawling suburbs. As a result, cities accommodating larger populations will inevitably become denser. This increased density and increased numbers of people make investment in rail an attractive option. Rail is able to move people in mass, resulting in a more efficient use of capital and transport corridors, and a reduction in congestion. Other notable benefits accrue from increased safety, partly as a result of reduced congestion. Environmental benefits are also derived from the economies of scale achieved through the mass transit of people and because rail is a less fossil fuel-dependent mode of transport than road.

Rail also potentially offers advantages for the transport of passengers at an inter-city level. In addition to the population growth of major cities, regional centres are also growing and sizeable population corridors are beginning to take shape. This trend is particularly strong along the East coast of Australia between Sydney and Brisbane, but is also becoming apparent to the South of Perth and around Melbourne.

With sufficient population density and with more nodes along potential routes in the future, the option of a very fast train (VFT) for passenger transport along the east coast of Australia may be increasingly attractive. The BITRE reports that, as a general rule, a viable high speed train line should connect cities with over one million residents that are at around three hours apart, and requires 6 to 12 million passengers a year (BITRE 2010c). In

a similar manner to intra-city metro services, inter-city rail has potential advantages for addressing congestion and environmental issues.

The most important transport mode in this space is currently air. However, in the future, a reliance on air transport among a larger population may lead to congestion problems at airports. Air travel also has higher negative environmental costs than both rail and road (BITRE 2010), as well as fuel security concerns, both of which may reduce its relative appeal over time. Research in this area asserts that an east coast high speed rail corridor achieving speeds of 350km/h could compete with air travel (IPA and AECOM 2010).

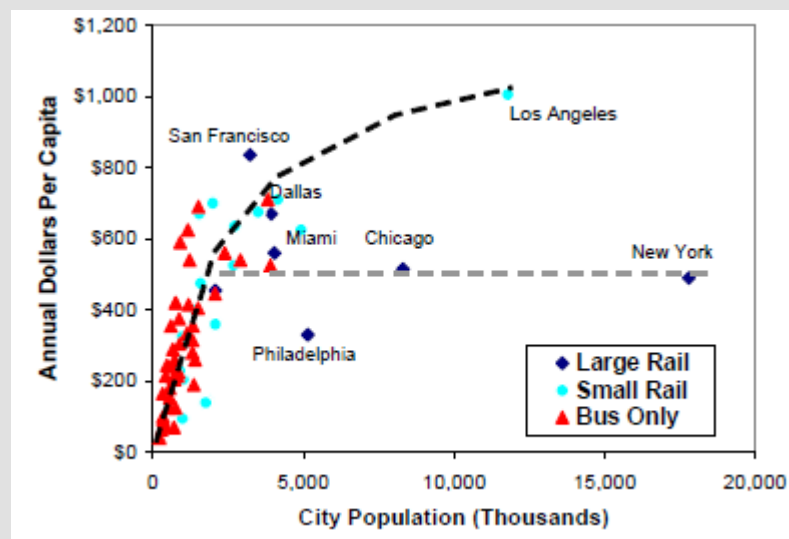
Case study: Rail passenger transport in America

Those American cities with 'large rail' systems are found to receive economic, social and environmental benefits from their public transport system relative to cities with 'small rail' or a 'bus only' public transport system.

A large, well-established rail public transport system is found to significantly increase per capita public transport use through two mechanisms. First, with access to rail transportation, more people choose to commute by public transport rather than by car (also called 'discretionary riders'), reducing total vehicle mileage. Secondly, people change their car ownership patterns, thereby reducing levels of car ownership.

Through a higher per capita use of public transport, these large rail systems are found to achieve expected benefits, relative to comparably sized 'small rail' and 'bus only' cities. These include less traffic congestion and lower traffic death rates, as well as lower consumer expenditure on transport and higher public transport service cost recovery. Chart Box.1 below shows that American cities with large rail transport systems have far lower congestion costs than cities of comparable size with a small rail or bus only transport system.

Chart Box.1: Estimated congestion cost in American cities



Source: Litman (201)

New York, Boston, San Francisco and Chicago are examples of American cities with successful established rail transport systems. However, Portland has a relatively new rail system and has achieved similar outcomes in neighbourhoods with access to rail transport, such as increasing public transport patronage and a reduction of private car use. This suggests that new rail systems can affect transport and land use patterns at a fast enough rate to be considered worthwhile investments.

Source: Litman (2010)

By 2020, Australia's freight task is forecast to double in size (PWC and IPA 2009). Like for the movement of passengers, rail has advantages for the movement of large quantities of goods. Rail has a particular advantage over very long distances moving from point to point where economies of scale can be achieved (BITRE 2009d) but can also play a key role over shorter distances, particularly within cities where rail offers ways to manage congestion and staffing concerns. For example, rail already performs very well in the movement of freight between the West and East coasts of Australia. As Australia's population grows and the freight task between major population centres also grows, rail may be the most efficient transport mode for the movement of goods between cities. Like in the case of metro passenger transport, it offers benefits in terms of congestion, safety, health and environmental costs.

It is arguable that historical under-investment in capital along rail corridors in east coast hubs and along the North-South corridor between Melbourne and Brisbane has affected line haul performance and limited the demand for rail services along these tracks. With increased capital investment, it is estimated that rail could increase its modal share. Some estimates place the potential for rail share to be between 30 and 40% for freight movements between Melbourne and Sydney, and up to 80% for freight movements between Melbourne and Brisbane (Booz & Co 2009).

The US, particularly along the West coast with the Alameda Corridor and in the mid-West, provides a best practice example for the use of rail for the movement of freight. Figure 2.1 shows the main rail corridors in the US and the average daily patronage of each route. Long-distance routes along East-West corridors receive the highest number of trains per day, while the populous West coast supports high-speed rail corridors.

An OECD (2006) study finds that the US has a fairly balanced modal share for freight, with rail taking on the highest share at 39%, followed by road at 31% and pipelines/inland navigation/short-sea shipping at between 7 and 8%. This is relative to both Europe and Japan, where rail does not hold a significant modal share and road and short-sea shipping dominate. In Japan 41% of the freight task is undertaken by short-sea shipping and 55% by road. In the EU-15 countries 44% is done by road and 39% by short-sea shipping. Given its geographic similarities and similar requirement to navigate a federal system, this bodes well for the potential of rail to take on a similar role for the movement of freight in Australia.

Figure 2.1: Freight Rail Movements in the United States of America

Source: The Economist (2010)

Moving forward, rail may also play a greater role in connecting regional and metro areas to Australia's major ports. Rail already facilitates the transport of many bulk commodities to Australia's ports for export. Furthermore, several significant Australian ports have flagged a goal to improve rail's modal share of their respective port trades, particularly in containerised exports (Sydney Ports Corporation 2008; Port of Melbourne Corporation 2009a; Port of Hastings Corporation 2009). An increase in rail's modal share of this task would aim to relieve road congestion, improve port land use and improve linkages with the interstate rail freight network (BITRE 2009d). Booz & Co (2009) predict that in the absence of landside logistics reform to better favour rail, an additional 1.3 million truck trips will occur each year adding to the congestion problems for ports.

A better understanding of the potential benefits of rail is important when considering Australia's future transport infrastructure planning. The development of rail infrastructure in the certain areas of the transport network where its benefits are clearest has the potential to efficiently and productively meet Australia's growing passenger and freight transport tasks.

3 The state of transport in Australia

The potential role for rail in Australia should be compared to its current state. There are extensive road and rail networks both within and between Australia's major cities. There is, however, a clear difference in outcomes. The share of interstate non-bulk freight met by road transportation has risen from around 22% in 1970 to around 70% today, while the share met by rail has fallen from around 45% to under 30% over the same period (BTE 1999 and Port Jackson Partners 2005). In an environment where the total transport task has been growing, rail, although showing recent gains, has been largely confined to areas such as the transport of bulk minerals, very long freight hauls and for mass transit in Australia's largest cities.

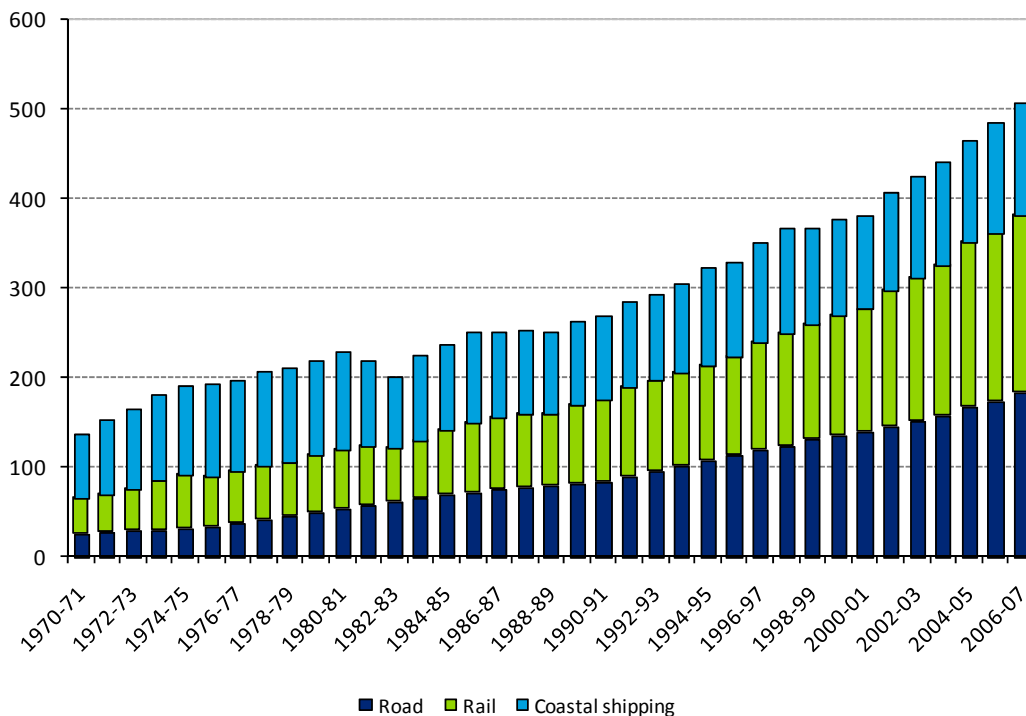
Part of the explanation for this outcome is the different infrastructure investments made in both networks. Historical trends have shown greater investment by government in road than rail infrastructure. Given the economics of infrastructure networks, such as the increasing returns to scale due to network effects and high fixed costs, these past supply decisions have driven current demand outcomes.

3.1 Road in Australia

Transport in Australia is highly reliant on its road network, which is vast. In 2007 Australia had a total 815,074 kms of roads (BITRE 2009c). Australia is the most intensive user of road freight in the world on a tonne-kilometre per person basis (DFAT 2008) while a survey of members of the international energy association has also shown that Australia has the least energy efficient road passenger transport and one of the lowest levels of new passenger vehicle fuel efficiency (Prime Minister's task group on energy efficiency 2010).

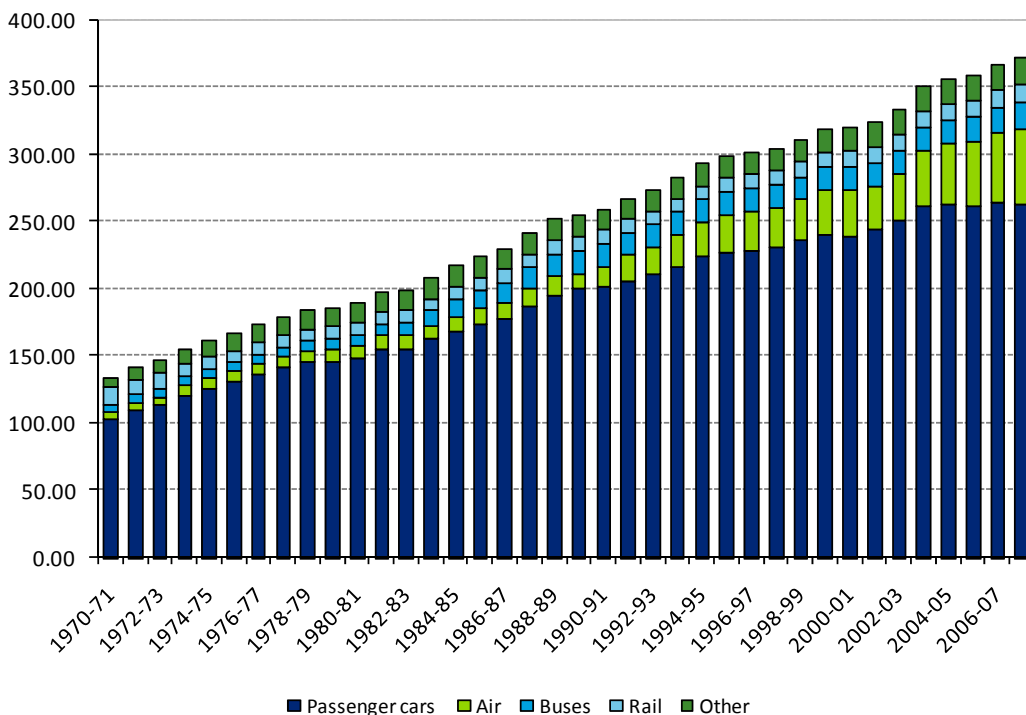
Australia's reliance on its road network has been increasing over recent decades; both for the movement of passengers and of freight (see Chart 3.1 and Chart 3.2). In terms of the freight task, in 1970-71 road moved 19% of goods, measured in tonne-kms and by 2006-07 this had increased to 36%. Total passenger-kms travelled by passenger cars increased by 256% over the same timeframe; however passenger cars' share of total passenger travel did not increase. The steady role of passenger road travel, as a proportion of total passenger travel, is due to the rise of air passenger travel, which has increased its passenger kms almost ten-fold over this time and is the only transport mode to have increased its share of passenger travel from 1970-71 to 2006-07.

Chart 3.1: Total domestic freight task by transport mode, billion tonne-kms



Source: BITRE (2009c)

Chart 3.2: Total passenger travel by transport mode, billion passenger-kms



Source: BITRE (2009c)

Most road infrastructure in Australia is provided by government, with all three levels of government contributing in different ways. State, territory and local governments have ownership and control over Australia's road networks, with the former responsible for major roads and the latter responsible for smaller local roads. The Australian government is responsible for funding of the interstate highway network (formerly known as Auslink), shown in Figure 3.1. The Australian government also has some influence over the governance of roads, through its distribution of funding and through its role in negotiating COAG reforms.

At a state and territory level, each jurisdiction's respective transport department is responsible for distributing funding for roads, registration and licensing of vehicles, managing road networks and for transport safety. Local councils are responsible for managing local roads.

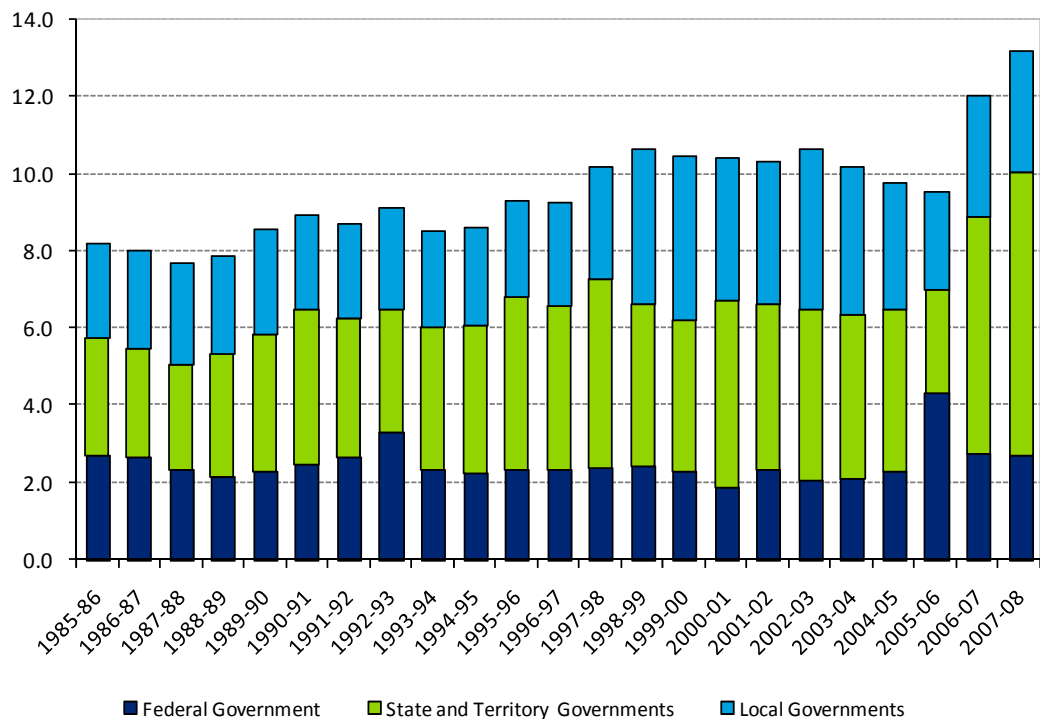
Figure 3.1: Auslink national road network



Source: BITRE (2009c)

Generally speaking, state and territory government make the largest funding contributions to Australian roads, followed by local governments and the Australian government, respectively (see Chart 3.3). A limited proportion of road infrastructure is also provided by private sector transfers. Private sector transfers refer to roads that are constructed by the private sector and are then transferred to local government, for example, roads in new housing developments (BITRE 2009d). According to the BITRE's most recent figures, road related expenditure by all levels of Australian governments totalled \$13.9 billion in 2007-08, including transfers from the private sector.

Chart 3.3: Road-related expenditure by jurisdiction, \$billion (2006-07 prices)



Source: BITRE (2009c)

However, since 2008 the Australian Government has taken on a greater role in the funding of roads. Major new programs for funding road infrastructure by the Australian government include:

- The Nation Building Program, which distributes Australian Government funding for roads. Funding under this program will average of \$4.6 billion per year between 2008-09 and 2013-14. This is a significant increase in funding compared to the previous total federal spending level of \$2.7 million in 2007-08 (BITRE 2009d).
- The Building Australia Fund contributes to critical infrastructure projects, including road projects. Funding is distributed based on an Infrastructure Priority List (Department of Infrastructure and Transport 2010a).
- The Roads to Recovery program contributes federal funding to local councils and to state and territory government for local roads in unincorporated areas. \$1.75 billion will be distributed between 2009-10 and 2013-14 (Department of Infrastructure and Transport 2010b).
- The Black Spots Program provides funding to high-risk road locations around Australia. It will provide \$59.5 million per year until 2013-14.

The pricing of road use is generally managed by state and territory governments. For passenger road transport, the price of road use consists of a vehicle registration fee, a license fee and toll charges for the use of privately constructed roadways. In the first two cases, these are fixed cost compulsory fees where vehicle registration is an annual charge and the term of vehicle licenses varies. Toll charges are marginal costs to road users, but are discretionary to the extent that they can be avoided.

For freight road transport, road use prices consist of charges to heavy vehicles, which in turn include a diesel fuel excise and heavy vehicle registration fees. The diesel fuel excise is a marginal cost for heavy vehicle users and varies with the amount of fuel consumed and, therefore, with distance travelled. It is charged at 38.14 cents per litre. However, most heavy vehicles (those over 4.5 tonnes) are eligible for a fuel tax credit if they meet a minimum one of four environmental criteria under the *Fuel Tax Act 2006*. Heavy vehicles meeting this condition receive a fuel tax credit of 18.51 cents per litre, leaving a net diesel fuel excise of 19.63 cents per litre (Productivity Commission 2006).

The interstate registration of heavy vehicles is called the Federal Interstate Registration Scheme (FIRS) and provides national registration for heavy vehicles over 4.5 tonnes operating solely in interstate transport. The National Transport Commission (NTC) recommends the level of interstate heavy vehicle registration charges. These recommendations are then taken into account by the Australian Transport Council (ATC), an element of COAG, when it forms its decisions. Over the past few years there has been a tendency for the ATC to not implement recommendations from the NTC, this was noted in a 2009 review of the NTC which found that its "impact on transport outcomes has fallen short of what should be expected" (NTC Review Steering Committee 2009). The relevant State and Territory transport authorities administer these charges on behalf of the Australian government. Each jurisdiction also administers registration of heavy vehicles that are registered to that State or Territory. Both systems, individual State and Territory, and FIRS, have registration fees that vary by vehicle type.

There has been debate in Australia recently about whether road freight has been subsidised relative to rail. In 2006 the Productivity Commission released a report into *Road and Rail Freight Infrastructure Pricing* which found that there was no compelling case that heavy vehicles are subsidised relative to rail, there was some indication that there may be cross-subsidisation within vehicle classes (Productivity Commission 2006). The conclusions of this report should be tempered by the persistent data problems identified by the Productivity commission. At various points in the report the lack of data for both road and rail infrastructure is highlighted as a problem which restricted the commission's ability to fully analyse the issues:

- "A lack of reliable data in relation to some issues has affected both the emphasis and approach [to the terms of reference]."
- "Data on the expenditure within each jurisdiction that is attributable to heavy vehicles is needed to test this claim [of under-compensation to local government], but these data are not available."
- "Data on State and Territory rail expenditure do not identify expenditure on capital works or new assets, nor are they comparable across jurisdictions due to significant differences in accounting policies."
- "there is considerable uncertainty about the accuracy of the road capital stock data"

In addition, advocates of rail have argued that because heavy vehicle road user charges have been capped at CPI since 2002, and steep increases in road infrastructure investment have been made over this time, that road freight operators have been subsidised (CRC for Rail Innovation 2009). The outcome of this debate is, as yet, unclear.

Following on from the Productivity Commission report, over the past few years COAG has been proceeding along its road reform plan. The COAG road reform plan (CRRP) has focussed on the finding that prices for larger road vehicles were highly averaged and did

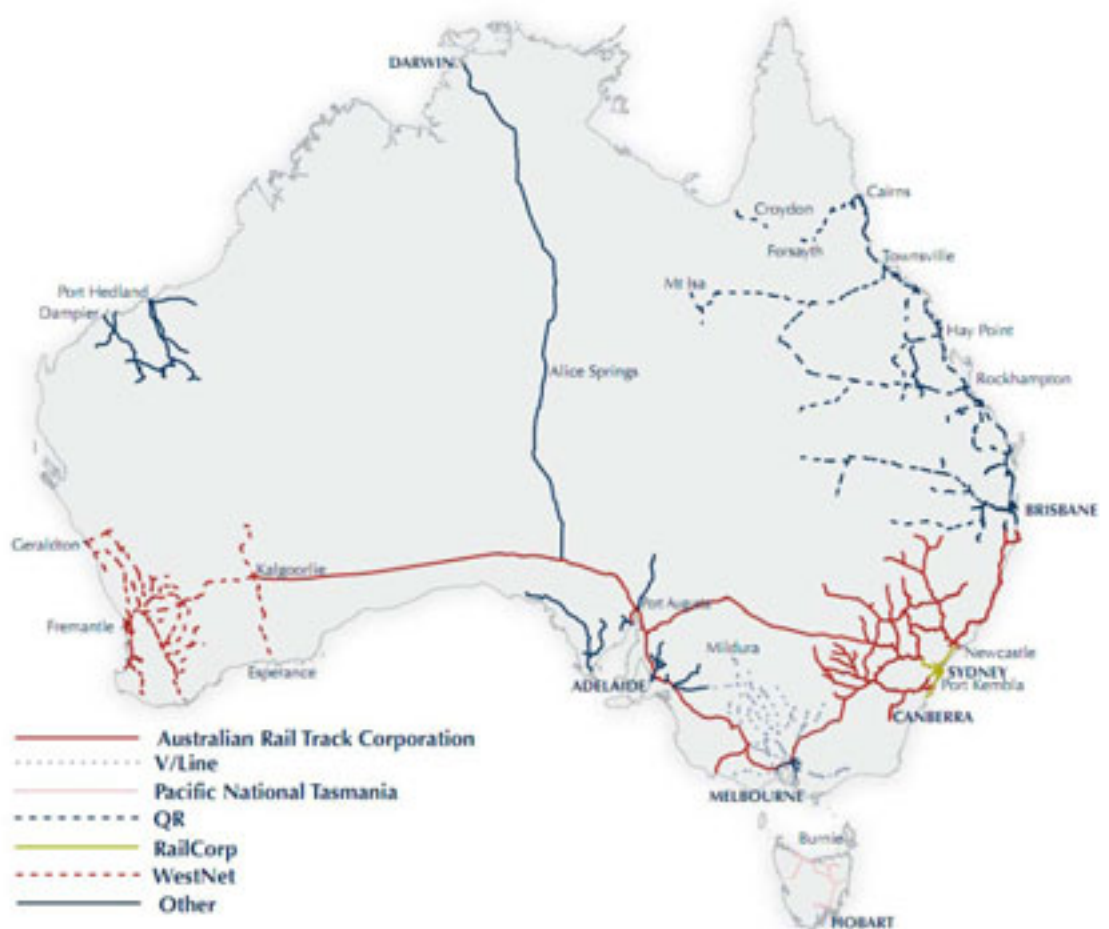
not always reflect the distance travelled, vehicle mass and the maintenance costs of different road types. This is a somewhat narrow target for reform and CRRP has explicitly stated that it does not intend to include social costs such as congestion, air pollution, greenhouse gas emissions and accidents in the pricing reform process (CRRP 2010).

COAG is therefore interested in implementing a pricing structure which more closely reflects mass, distance and location. One likely element of this would be to increase registration charges for larger heavy vehicles making long journeys (such as road trains or b-doubles) when compared to smaller heavy vehicles making shorter journeys. These changes are currently expected to be implemented no earlier than 2014. This variety of externality, cross subsidisation between road users, is further investigated later in this report.

3.2 Rail in Australia

Australia has an extensive, complex, rail network covering the major capital cities. Australia's rail infrastructure can broadly be broken down into interstate railways, intrastate railways and metropolitan passenger networks, some of the major links are shown in Figure 3.2 below.

Figure 3.2: Major rail links in Australia



Source: BITRE 2009c

Interstate railways join Perth to Adelaide; Adelaide to Melbourne, Sydney and Darwin and Sydney, Melbourne and Brisbane along the east coast. These interstate connections, all standard gauge, carry passengers and freight.

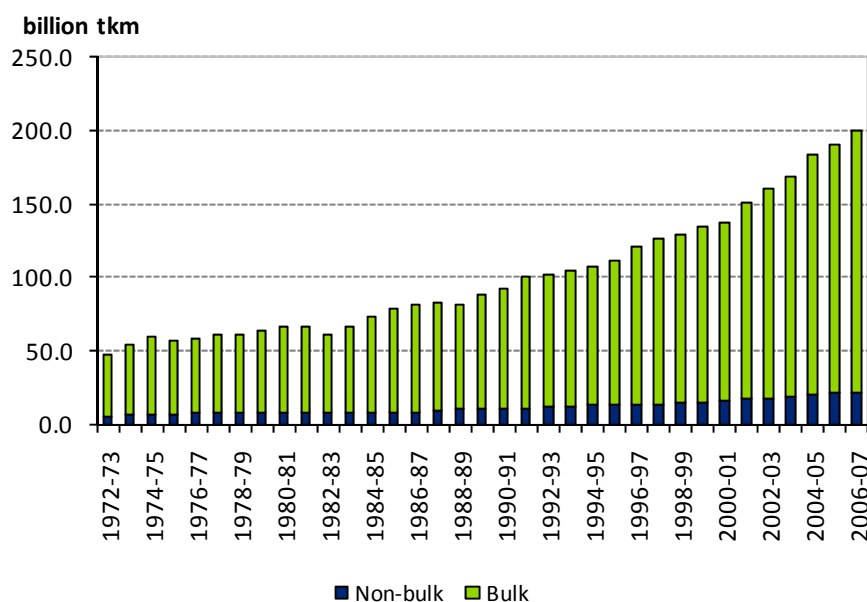
Within states there are many different types of rail infrastructure including:

- networks such as the Goonyella system in Queensland or the Hunter Valley Coal network in NSW which primarily connect mines to the port;
- intercity rail networks such as that operated North of Brisbane by Queensland Rail (QR);
- regional freight networks, often used to transport grain; and
- private railways used to transport cane, timber and ore.

Looking to metropolitan passenger networks, there are electrified heavy rail networks in Sydney, Melbourne, Brisbane and Perth and a non-electrified network in Adelaide.

The volume of freight moved by rail, measured in billion tonne kilometres has been growing strongly over recent years from around 136.9 billion tonne kilometres in 2000-01 to around 198.7 billion tonne kilometres in 2006-07, accounting for around 39% of total freight transported in 2006-07. This is an average growth rate of around 5.8% a year. Bulk transport has been growing faster than non-bulk transport, around 5.9% a year for bulk freight compared to 5.5% a year for non-bulk freight. This compares to a growth rate in total road freight of around 4.5% a year over the same period and in coastal shipping of around 3.1% a year (BITRE 2009c).

Chart 3.4: Estimated rail freight task



Source: BITRE 2009c, Access Economics calculations

Rail has not performed quite as well when measurements are made in millions of tonnes. Rail has grown at an average rate of 3.4% a year between 2003-04 and 2006-07 as

compared to road's 8.4% a year average growth. By this measurement, rail transport makes up around 23% of the freight task. The better performance of rail when measured in tonne kilometres, rather than just kilometres, indicates that rail has performed well in long haul markets (BITRE 2009c).

As Chart 3.4 shows, bulk commodity transport currently makes up the majority of net tonne kilometres transported by rail. In 2006-07, the latest year for which there are comprehensive statistics available, bulk transport made up around 87% of freight net tonne kilometres transported by rail (BITRE 2009c, BITRE 2010a). The major bulk commodities transported by rail in terms of tonnage are iron ore and coal which together make up around 75% of net tonne kilometres of bulk goods transported by rail (ACG 2008). Bulk goods transported by rail are predominantly moved within, not between states (BITRE 2010a).

In terms of passenger transport, rail makes up a very small portion of passenger kilometres, around 3.8% in 2007-08 but has been growing at an average rate of around 3.8% a year since 2000-01, this is a faster growth rate than either road (1.1% a year) or bus transport (1.2% a year) since 2000-01 (BITRE 2009c).

In the past, many of the above rail networks were provided by government in an integrated fashion, having a single entity operate both the above rail services and below rail infrastructure. With the focus on microeconomic reform throughout the last few decades there has been a consistent trend towards corporatisation and structural separation.

Corporatisation involves the transformation of ownership structures to put greater emphasis on profitability and response to market signals rather than political factors. An example of corporatisation has been the transformation of Victorian Railways, originally chaired by government commissioners, into V/Line.

Structural separation involved splitting ownership of rail infrastructure from ownership of rail services. The most prominent example of this was the establishment of the Australian Rail Track Corporation (ARTC) which now controls the interstate rail infrastructure (through either ownership, leasing or having the right to sell access) in Western Australia, South Australia, Victoria and NSW. ARTC also operates the Hunter Valley network and will soon assume responsibility for the freight network within Sydney. ARTC then provides open access to rail operators, such as Great Southern Rail or Pacific National, to operate rail services. Access to rail infrastructure is normally covered by access arrangements overseen by competition regulators in order to prevent the infrastructure operator from misusing its monopoly position.

The structural separation of rail operators and infrastructure providers has also encouraged specialisation among rail operators. There are very few rail operators servicing multiple markets with specialisation clearly apparent between freight and passenger operators and even within these categories between luxury and budget passenger journeys and even somewhat between operators transporting intermodal and bulk freight.

This specialisation has highlighted areas where rail has a comparative advantage over other forms of transport. Rail has a clear cost advantage in high volume passenger markets, such as metropolitan areas, in transportation of bulk minerals and along longer

hauls for freight. For example, rail is frequently used in transporting intermodal freight between Perth, Adelaide and Melbourne but is less frequently used to transport similar freight along the shorter routes between Melbourne, Sydney and Brisbane. This is mirrored in the transport of bulk grain where rail is generally preferred to road in Western Australia while road transport dominates in Victoria.

Corporatisation and structural separation have significantly reduced the direct role of government in the provision of rail infrastructure. A corporatised rail infrastructure provider, such as ARTC, must operate in a commercially viable manner and recover infrastructure costs from the users of its network.

Government's role in the provision of rail services has therefore shifted from operational concerns to strategic concerns. Governments have taken on the role of long term planning and vision setting for rail, such as the NSW government's goal of 40% of freight from Port Botany being transported by rail. Long term planning and strategy requires a focus by government on factors such as:

- planning zoning and city growth in a way which makes efficient use of transport options;
- securing rights-of-way for future rail developments;
- ensuring coordination in investments by different infrastructure providers; and
- managing the interaction of parties along rail supply chains.

Some of the areas where government still makes more direct interventions into rail including funding for large investments of national significance, overseen by Infrastructure Australia, and through competition policy. Competition policy is normally enforced by regulation which aims to ensure open access to rail infrastructure at fair prices, an example of this is the regulation of ARTC by the Australian Competition and Consumer Commission (ACCC).

There are also cases of ongoing subsidies from government, for example Sydney's metropolitan network received \$1.9 billion in subsidies from the state government in 2007-08 (IPART 2008). A substantial portion of this, however, is used to subsidise concession fares such as seniors' concessions and student concessions (Transport NSW 2003). These subsidies may be justified in terms of the benefits generated by rail transport, which are analysed in section 4 of this report.

Overall, rail currently plays a specialised role in servicing Australia's transport task. It currently excels over long hauls, in the transport of bulk minerals and for mass passenger transport. Rail transport has been growing steadily and at a higher rate than other forms of transport over the past ten years. This strong growth may reflect benefits coming from more commercially focussed, corporatised organisations. The corporatisation of rail organisations in Australia presents an opportunity for government to focus on broader strategic goals of transport in Australia and to take into account the true value of rail when considering infrastructure investments.

3.3 Economic characteristics of road and rail transport and infrastructure

Turning from the state of transport as it currently stands in Australia and towards conceptual issues; there are a number of economic concepts which should be considered by decision makers when weighing up transport investments. Primary among these are network effects, economies of scale and supply led demand.

Transport networks

Road and rail infrastructure can both be thought of as networks which connect geographic locations. These networks connect the nodes of cities, homes and workplaces with the links of roads or railway track.

There is a balance between competition and complementarity of rail and road networks. In some cases the two networks are in direct competition with each other, an example is when a commuter deciding whether to drive to work or catch the train. Another area of direct competition is in the movement of grain and other minor mineral commodities to Port (BITRE 2009d).

However, even in cases where it appears as if the networks are in competition with each other, interstate transport for example, there is a degree of complementarity as containers moved between cities using rail must still be delivered to its final destination by road (BITRE 2009d). Even in metro areas road and rail can act as complements with bus transport and train transport providing redundancy and resilience to failure of a single mode of transport on critical routes (Munger 2008).

There are, of course, differences in the infrastructure for road and rail networks. One key difference is that the interdependence of technology between road and rail infrastructure and the vehicles that operate on them is quite different. For rail infrastructure, choices of gauge width, axle load and electrification have a significant influence on the types of locomotives and wagons run on track. The choice of above-rail technology in turn has an influence on the performance and availability of infrastructure, poorly maintained wheels, for example, can cause serious damage to rails. In contrast to rail, road infrastructure and vehicles are not so intimately linked.

Increasing returns to scale

Road and rail both show increasing returns to scale from network effects and from reduced average costs.

As with other networks, the value of a transport network increases at an increasing pace with the number of nodes that are connected. An additional train station not only increases the value to people near the station but also increases the value to consumers near all the other train stations, as they can now more easily travel to a new location.

Transport also incurs large fixed costs. For both road and rail there are extremely large fixed costs in the initial construction, or subsequent expansion, of infrastructure and then there are additional fixed costs for trucks, trailers, locomotives and rollingstock. These

fixed costs must be incurred before the first tonne of freight or the first passenger can be transported.

As the volume of freight or number of passenger journeys increase, these large fixed costs can be shared between more users. This causes the average cost per tonne or per passenger to decrease as volumes increase. In this case rail transport is likely to have greater returns to scale than road transport as not only can the fixed infrastructure be used more efficiently at higher volumes but train lengths can also be increased. This is in contrast to road transport where the number of trailers or seats per vehicles is essentially fixed.

These two effects are also cumulative, a new connection in a rail or road network will raise the value of that network to all its users which will lead to more use of the network which will lead to reduced costs for all users.

Supply-led demand and path dependence

Both the network effects and the increasing returns to scale felt by transport users mean that current decisions about which mode of transport to select are strongly led by past decisions about the supply of infrastructure.

A good example of supply led demand is comparing port infrastructure in Sydney and Melbourne. In Melbourne some trains are loaded at a facility separate from the Port itself while in Sydney rail is fully integrated into port activities. This means that, in Melbourne, an intermediate step is often made where trucks move containers from the dock to the train. This supply decision, about where to locate train tracks, has influenced different outcomes for rail transport in the two cities. In Sydney around 20% of all containers are moved by rail while in Melbourne this is around 14% (SPC 2010, Port of Melbourne Corporation 2009b)

In this case rail infrastructure is somewhat at a disadvantage to road infrastructure. Investments in road infrastructure can often be made in smaller increments than rail infrastructure. Road infrastructure has the advantage of servicing smaller, more spread out units (cars and trucks) rather than larger, more concentrated users (rail operators) which require special additional infrastructure (such as intermodal terminals and or passenger stations) to actually make use of the infrastructure. This makes organising and planning extensions of road infrastructure easier and less risky.

Over time, decisions which select between relatively easy expansions of road infrastructure and relatively difficult and costly expansions of rail infrastructure may lead to over investment in roads. Given the supply led demand situation that exists in transport, this may lead to overconsumption of road transport at the expense of rail transport.

Capacity, congestion and network expansion

Investment in transport infrastructure is not all about connecting new nodes but is often about ensuring capacity for existing connections. This is particularly the case when congestion begins to arise.

Road and rail transport experience congestion in different ways. When trains consume rail infrastructure they consume a train path, a location and time pair which secures unencumbered movement through the rail network. To ensure movement through the network, this train path must be mutually exclusive; no other train can consume that portion of track infrastructure. Train paths are allocated by a central network planner.

In contrast, planning for paths through the road network is completely decentralised. Each vehicle operator decides when they are going to leave and how they are going to pass through the network. This creates the possibility that certain roads will reach capacity and become congested.

Trains, therefore, experience a different kind of congestion than road users. Congestion for road users is experienced through increased travel times. On rail networks congestion is experienced through planning problems for network coordinators. In Australia it is most common for this planning problem to be managed by giving passenger rail priority, and sometimes excluding freight at certain times of the day. Congestion for passengers is then managed by the network planner ensuring that sufficient infrastructure is available and creating a timetable which best achieves the transport task. For freight services this congestion, caused by passenger transit during peak times, most often manifests as delays in entering the network or being held on a loop to allow a passenger train to pass.

In Australia, in various geographic locations, rail and road are experiencing congestion – bottlenecks and pinch points for rail and peak hour congestion on roads in metro areas. In deciding how to best respond to this congestion, governments who still play the role of strategic planners in rail and road, must weigh up the factors outlined above (network effects, economies of scale and supply led demand) to arrive at a vision for how they want Australian cities to function in the future.

The following chapters of the report discuss and analyse specific phenomena that policy decision makers ought to consider when planning and facilitating investment.

4 Transport costs to society

Both road and rail transport generate costs that are not taken into account in prices. These costs, known as externalities, must be borne by society. These costs should be taken into account in order to make correct investment decisions.

Importantly, rail transport creates less of these external costs than does road transport.

Modelling indicates that a passenger journey made by rail and not road transport can reduce costs relating to congestion, carbon pollution and accidents by around \$3.11 in Brisbane or up to around \$8.41 in Sydney. On the freight side, moving from road to rail can decrease these costs by around \$0.80 for every tonne kilometre; this translates to around \$124 for a single container transported between Melbourne and Brisbane.

Road freight transport also creates costs for other road users as larger trucks tend to under-pay for access compared to the costs that they create. Rail also generates benefits by allowing for greater social inclusion.

These costs have tangible effects on the lives of all Australian's and the economy. Congestion eats away at leisure time and reduces economic productivity as workers and goods take longer to reach their destination and cost more to transport. Carbon pollution creates social costs to be borne by future generations who will face the dual costs of a changed climate and the need to reduce emissions. In addition to deaths caused by vehicle accidents, injuries create ongoing effects in terms of pain, reduced ability to work and the need for care.

Rail transport is used to move passengers and various types of freight. In a number of markets rail has a strong comparative advantage. Rail is the preferred transport mode for many bulk commodities and long distance haulage tasks (in some instances, rail networks are used almost solely for the transportation of minerals). For other tasks such as passenger transport (e.g. metropolitan public transport and intra state services) and other freight tasks (e.g. containerised freight, intra-city freight and grain) rail faces strong competition from transport by road.

Current decisions about choosing between road and rail transport are distorted because the price users' face does not reflect the true costs they create. There are two reasons for this:

- the existence of a number of costs that are not captured in prices which disproportionately advantage road transport (i.e. road transport is underpriced); and
- the existence of pricing distortions because of cross subsidisation between different classes of road users.

The true value of rail includes the benefit of avoiding incurring these costs and must be considered when determining pricing and investment decisions if the right decision is going to be made. In addition, investment decisions should consider the long term ability to expand road and rail networks in terms of resource availability in order to ensure that the transport system evolves to suit both short term and long term needs. For example, land and development constraints may prevent future expansions of important roads.

4.1 Passenger

The largest difference in costs imposed by road and rail that are not included in prices is through congestion. Other major costs investigated in this paper are carbon emissions and costs related to accidents.

4.1.1 Passenger - carbon emissions

Carbon emitted from burning fuel to power road vehicles and trains imposes a cost on society through its impact on the atmosphere and climate. Both road and rail generate costs from the emission of carbon but the true value of rail is in its relatively lower emissions per passenger journey than road.

In Australia, passenger transport is mostly made by road. In 2010, passengers travelled 182.0 billion kilometres (km) by road compared to 13.6 billion km by rail (BITRE, 2009a). BITRE (2009a) estimated that 48.3 million tonnes of CO₂ equivalent was emitted due to road vehicles transporting passengers. Emissions from rail were less; only 14.8 million tonnes of CO₂ equivalent.

Adjusting for distance travelled and passengers carried, emissions from road users were 0.16 kilograms of CO₂ equivalent per passenger kilometre travelled. In comparison, rail emissions were 0.11 kilograms of CO₂ equivalent per passenger kilometre. This means that every kilometre travelled by a passenger in a road vehicle rather than by rail resulted in an additional 0.05 kg of CO₂ equivalent being emitted. These calculations are set out in Table 4.1.

Table 4.1: Carbon emissions from passenger transport, 2006

	Total emissions	Total distance travelled	Emissions/km travelled
	Million tonnes of CO ₂ equivalent	Billions of passenger km	kilograms of CO ₂ equivalent per passenger km
Road			
Cars	46.6	287.5	0.16
Buses	1.4	21.9	0.06
Motorcycles	0.3	2.1	0.13
Total	48.3	311.5	0.16
Rail^(a)			
Total	1.5 ^(b)	13.6 ^(c)	0.11
Difference			0.05

Notes: (a) Estimate includes emission from power generation for electric rail. (b) Sum of electric and non-electric. (c) Sum of passenger km for urban heavy, non-urban and urban light.
Source: BITRE (2009a) and Access Economics calculations.

Road travel produces more than 40% more carbon pollution than rail travel for each kilometre travelled by a passenger.

Converting carbon emissions into a dollar savings is difficult because there is currently no price on carbon emissions. Since the cost imposed on society will occur in the future and is highly uncertain it is difficult to determine the potential size of the cost. In this report a price of \$26.70 per tonne of CO₂ equivalent is used. This price is based on the price that was proposed for the beginning of the CPRS-5 in 2010 (converted from 2005 dollars to 2010 dollars using consumer price inflation) (Treasury, 2008). This price reflects the expected cost of carbon required to induce a certain reduction in emissions rather than the expected net present value of future social costs.

At a carbon cost of \$26.70 per tonne, every kilometre of transport moved from road to rail transport results in a reduction in negative carbon pollution costs of 0.12 cents.

This reduction can be put in context by looking at average commute distances in some of Australia's major cities. Data on actual average commute lengths is difficult to find and so information from a number of sources has been drawn together to give estimates of average travel distances. Table 4.2, below, shows the potential reduction in carbon costs if the average trip being made by car was moved onto rail.

Table 4.2: Carbon pollution costs per commuter trip

City	Average trip (km)	Potential cost saving (cents)
Sydney	16.8	2.1
Melbourne	17.8	2.2
Brisbane	15.3	1.9
Perth	17.0	2.1

Note: average trip distances were available for Sydney and Brisbane (Sanderson 2010; Xu and Milthorpe 2010) while average straight line distances were available for Sydney, Melbourne and Perth (BITRE 2010b). The ratio between the two measures for Sydney was used to estimate actual travel distances in Melbourne and Perth.

Every additional rail journey reduces carbon emission costs by around 2 cents.

These results are based on the current energy mix used to power road and rail transport. In Australia rail transport is predominantly powered by diesel fuel and electricity. The electricity is most often generated from coal fired power plants. The emissions from rail transport could therefore be reduced significantly by increased electrification of rail networks and substitution into less emissions intensive sources of electricity.

These results indicate that if 1000 commuters switched the mode of transport for their daily commute from road to rail, this would reduce costs from carbon emissions by roughly between \$10,000 and \$11,000 a year (depending on the city).

The assumed carbon price of \$26.70 a tonne is not necessarily representative of the price that would emerge under a carbon trading scheme. As there are currently ongoing negotiations over the mechanics of an emissions reduction scheme, it is difficult to accurately estimate the carbon price that may emerge. A range of other carbon prices are considered in Table 4.3.

Table 4.3: Carbon emissions costs at different carbon prices

Carbon price (\$/tonne)	Emissions cost (c/passenger km)
10	0.05
26.7	0.12
50	0.23
75	0.35
100	0.46

4.1.2 Passenger - congestion

As Australia's cities continue to grow and the pressure on arterial roads mounts, avoiding congestion is likely to be the largest benefit to be gained from transporting passengers by rail rather than road.

Congestion occurs when infrastructure is being used above capacity — the amount of use that allows free flow of traffic. This tends to be more of an issue on roads rather than rail and is more likely to occur in densely populated areas.

Once roads reach their capacity, each additional user imposes a cost on existing road users in terms of increasing their travel time, uncertainty about travel time, fuel usage, and reducing the amenity of driving. Congestion also increases fuel consumption, air pollution and green house gas emissions, all of which impose a cost on society. Congestion is, at its heart, caused by a combination of an underpricing of access to roads at peak times and places and an undersupply of the infrastructure necessary to accommodate demand. A direct approach to managing congestion could be to introduce peak period pricing; this would force road users to face the true cost of their decisions.

Rail is much less subject to congestion. While increased numbers of rail users can cause over-crowding on trains, which reduces the amenity of the trip for the passenger, this does not impose the other costs that occur as a result of road congestion. The centralised scheduling of train services makes it easier to avoid congestion on the train lines — although increasing the number of services operating will make this coordination more difficult and could increase the risk or severity of a delay.

Determining the value of congestion costs is challenging. This is because the level of congestions depends on features such as:

- the origin and destination of commuter journeys;
- the time of day that journeys are made;
- the capacity and layout of the road network;

- the placement of railway stations;
- the frequency of rail services; and
- available alternatives such as buses, walking or cycling.

These factors differ from city to city and over time. As such, congestion costs are best dealt with using a model which simulates the transport network and its use in a particular area (such as a city).

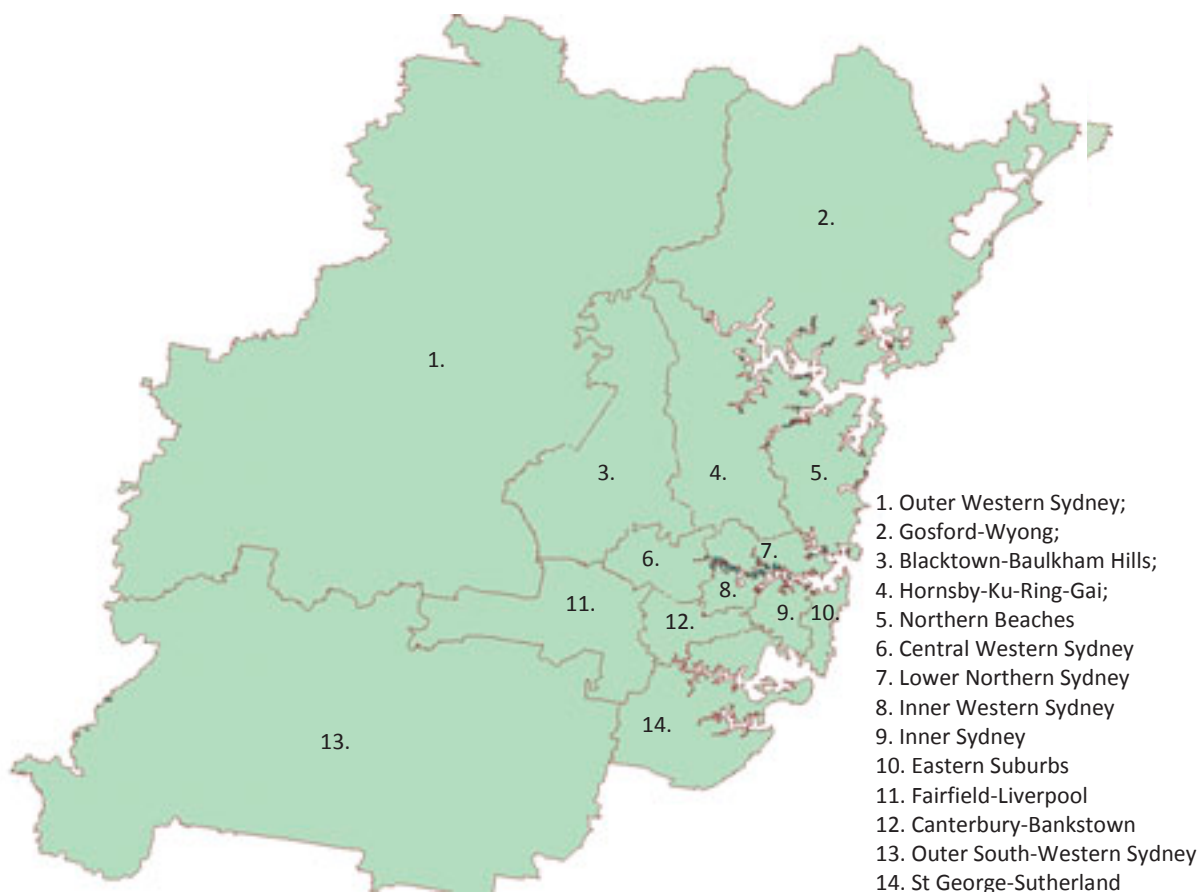
This report relies on a model, the Transport and Environmental Strategy Impact Simulator (TRESIS), developed at the Institute of Transport and Logistics Studies at the University of Sydney. TRESIS combines information on the behavioural responses of individuals (gathered through experiments, surveys and data), road networks, public transport options and demographic information. It contains a set of choice models for:

- commuting — includes choice of working hours, departure time, mode of transport and workplace location;
- automobile choice — type of vehicle and number of vehicles per household;
- residential — location and dwelling type; and
- automobile use — annual vehicle and kilometres travelled by the household and the spatial composition of this travel.

This input is combined to create a model where households select their home and work locations as well as their transport decisions, including whether to own a car or not. The model is more fully described in Appendix A. TRESIS has been used to analyse diverse situations including the benefits that could flow from increased bus use in Melbourne (Stanley 2007), an improved road connection in north east Sydney (Hensher *et al* 2004) and from congestion pricing on Sydney's roads (Hensher 2008).

One key advantage of TRESIS is that it allows modelling to be targeted to each major Australian city. This report focuses on congestion costs for Sydney, Melbourne, Perth and Brisbane. Each city is represented by a number of regions with each region having road, rail and bus links to other regions. Sydney, for example, is made up of 14 regions, as is shown in Figure 4.1.

Figure 4.1: TRESIS regions in Sydney



Source: TRESIS

The key outputs from TRESIS that will be used to estimate the congestion costs are the total travel time and the number of journeys by bus, car and train. TRESIS also provides information on carbon emissions.

Following an approach used in papers developed for the NSW government (CRAI 2008, LECG 2009) congestion costs will be measured in terms of the increase in minutes of travel time and carbon emissions that an extra road user adds to all the existing road users.

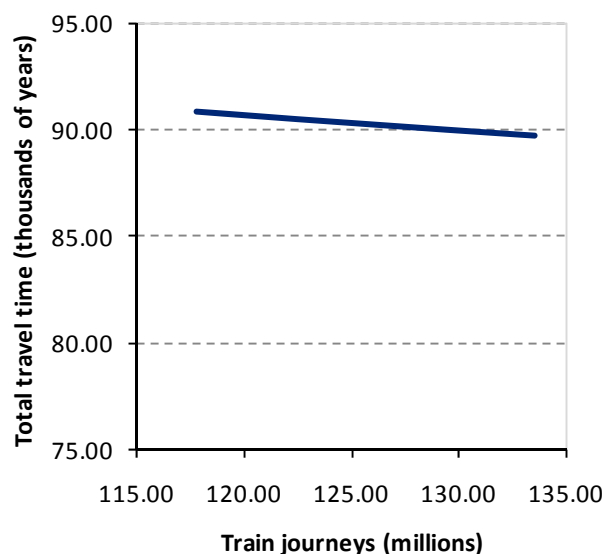
To take a stylised example, consider a situation where 100 road users currently make the same commute which takes them each 45 minutes. If another road user is added the commute time might increase to 50 minutes each. In this case the congestion cost created is the additional 5 minutes added to each existing road user’s journey but does not include any of the travel time of the 101st road user. The 101st user’s own travel time is excluded as it is a cost taken into account and borne by that user. The same basic approach can be used to look at the effect of congestion on carbon emissions (just replace minutes of travel time with kilograms of carbon emitted).

As TRESIS models the behavioural response of individuals to factors such as travel time and cost, the effect of moving a person from road transport to rail transport can be mimicked by varying the cost of a train fare. An increase in the train fare will drive some

people away from rail and towards road transport. This will increase congestion on the roads and lead to an increase in total travel time and carbon emissions.²

The output from this stage of the modelling was to establish a relationship between the number of train journeys and travel time.³ An example of this relationship is shown in Chart 4.1 below. This figure shows a negative relationship between total travel time and the number of train journeys in Sydney in 2011, that is, each additional passenger journey that is moved from road to rail decreases total travel time by reducing the effect of congestion on other road users.

Chart 4.1: Modelled relationship between rail journeys and total travel time in Sydney 2011



Source: TRESIS, Access Economics

The next step in the modelling is to extract the effect of moving a single person from road to rail transport. As the impact of increasing (or decreasing) train fares by 10% moves a large number of commuters between modes, the effect of moving a single commuter must be drawn out. This was done using regression analysis, described in detail in Appendix B.

Making the necessary calculations for each of the cities we are considering gives the following results for average congestion externalities in the city:

² This approach was used to establish a high level relationship between number of rail journeys and total travel time, not to identify the characteristics of specific users who would change travel decisions based on fare changes.

³ Total travel time includes travel time for ride-share for each person in car and all components of time of public transport users (Bain and Hensher 2008).

Table 4.4: Congestion costs, travel time

City	Change in travel time for existing road users (minutes)
Sydney	-22.5
Melbourne	-17.1
Brisbane	-5.9
Perth	-9.2

Source: TRESIS, Access Economics estimates

Every additional rail journey reduces time spent waiting in traffic by between around 6 and 23 minutes.

These results mean that, for example, in Sydney, a single journey moved from road transport to rail transport reduces total travel time for existing road users by 22.5 minutes; each individual road user therefore only benefits by a fraction of a second.

More intuitive comparisons could be made by considering actual real world passenger volumes. For example, if a Melbournian's daily commute for a normal working year was moved from road to rail that would result in a time saving of 5 days and 17 hours for other road users. If this was extended to 1000 people, the time saving would be in the order of 15 years and 8 months.

These changes in travel time can also be used to calculate the effect on CO₂ emissions. The NSW Roads and Traffic Authority (RTA) estimate that idling engines emit around 1.15 kilograms of CO₂ per hour (RTA 2009). This rate of emissions can be applied to the amount of extra time spent in congested traffic to give the results are in Table 4.5.

Table 4.5: Congestion costs, carbon emissions

City	Change in CO ₂ emissions for existing road users (kg)
Sydney	-0.4
Melbourne	-0.3
Brisbane	-0.1
Perth	-0.2

The next step in estimating the costs of congestion is to bring the measurements from disparate figures of minutes and kilograms of CO₂ into a comparable dollar value.

For travel time, a certain percentage of the wage is normally used to calculate a dollar value for time spent travelling. A paper reviewing a wide range of research indicates a range of percentages have been used in various papers (BTE 1982). Although now rather old, the estimates established in this paper have been frequently used and have formed the basis of previous, recent studies of transport externalities in Australia such as CRAI (2008) and LECG (2009). Drawing on the 98 references in the paper which are not assumed values, the following results are obtained:

Table 4.6: Ranges for value of travel time as percent of wage

	Mean	Median	Standard deviation
Business	83.8%	76%	62.7%
Commuter	43.5%	35%	25.8%
Average	63.65%	55.5%	

Source: BTE 1982

The average of the above medians is then applied to the wage to obtain dollar values for the cost of congestion. This approach has been used in previous studies of transport externalities in Australia such as CRAI (2008) and LECG (2009).

Data from the ABS indicates the average weekly earnings in each Australian state; this is set out in Table 4.7. Earnings in Western Australia are higher than in other cities due to the influence of mining on the local economy. It is reasonable to use this higher than average figure as it remains a genuine reflection of the opportunity cost of time, and hence congestion, in Western Australia.

Table 4.7: Average weekly earnings around Australia, August 2010

City	Average weekly earnings	Average hourly earnings	Value of travel time (per hour)
Sydney	1347.10	33.68	18.69
Melbourne	1305.00	32.63	18.11
Brisbane	1335.30	33.38	18.53
Perth	1503.70	37.59	20.86

For carbon emissions, as described above, a cost per tonne of CO₂ of \$26.70 can be attributed based on modelling by Treasury (2008).

This then allows the conversion of travel time from minutes to dollars and carbon emissions from kilograms to dollars. The different components of the congestion costs can then be added together to give an estimate of the total congestion costs, this is set out in Table 4.8 below.

Table 4.8: Congestion costs per journey, dollars (2010)

City	Travel time (\$)	Carbon emissions (cents)	Total (\$)
Sydney	7.00	1.15	7.01
Melbourne	5.17	0.88	5.18
Brisbane	1.83	0.30	1.84
Perth	3.19	0.47	3.20

Every additional rail journey reduces congestion costs by between \$1.80 and \$7.01.

These results indicate that if 1000 commuters switched their mode of transport from road to rail, this would reduce costs from congestion by between around \$959,000 and \$3,700,000 a year (depending on the city).

There are other options for the value of time that could be used to calculate a dollar value for congestion costs. Table 4.9 sets out a sensitivity analysis for the value of time, in the above analysis 55% of average hourly earnings was used, but this percentage can be varied.

Table 4.9: Congestion cost sensitivity analysis, dollars (2010)

City	Value of time, percentage of average hourly wage					
	25%	33%	55%	66%	75%	100%
Sydney	3.16	4.17	7.01	8.33	9.47	12.62
Melbourne	2.34	3.08	5.18	6.16	7.00	9.33
Brisbane	0.83	1.09	1.84	2.18	2.48	3.31
Perth	1.44	1.90	3.20	3.80	4.32	5.76

4.1.3 Passenger - accidents

Accidents impose a significant cost on society in terms of Medical care, disability care, support services and the cost of emergency services. These costs are predominantly publically provided and so accidents create costs borne by the community at large. There are also losses in productivity from death or disablement, quality of life and damage to property. Some of these costs are included in costs faced by those making transport decisions. This is done through insurance and road user charges. However, much of the cost of an accident is borne by society and the people involved in the accident.

Many costs associated with accidents are similar for road and rail (such as the cost of a loss of life) while others, such as property costs, differ substantially. The costs of rail and road accidents are taken from estimates made by the BITRE (formally the BTRE) for 1999 and 2006 respectively. The methodologies differ because less detailed data is available on rail accidents.⁴

It is assumed in this report that the cost of road and rail accidents have grown in line with the CPI between 1999 and 2010. This has been done because of the lack of publicly available data on accident cost changes.⁵ Although many of the accident costs for road and rail transport are similar, there are many more road accidents each year than there are rail accidents. In 2006, there were 1,602 fatalities, 31,204 injuries and 438,700 accidents

⁴ The BITRE may have developed its methodology in the period between these reports. Changes made between the costing of road accidents in 1996 and 2006 account for around 1% of total 2006 costs (BITRE, 2009b).

⁵ This is unlikely to be a problematic assumption as it is the relative accident costs between road and rail which are of most interest and, as similar treatments are required for both road and rail accidents, it is unlikely that the cost relativity has changed significantly.

involving property damage on roads (BITRE, 2009b). In 2006, there were only 38 rail fatalities and 135 injuries Australia wide (ATSB, 2010).

Table 4.10: Number of accidents by severity for road and rail

	Road (2006)	Rail (1999)	Rail (2006)
Fatalities ^(a) (number of people)	1,602	48	38
Injuries ^(a) (number of people)	31,204	170 ^(b)	135
Property damage only (number of crashes)	438,700	214	NA

Note: (a) Suicides are excluded for road (2006) and rail (1999), unknown for rail (2006) injury (b) This number is atypical due to 57 minor injuries that occurred in the Glenbrook accident in 1999.

Source: Access Economics calculations and ATSB (2010).

The total social cost of road accidents in 2006 was \$17.85 billion (BITRE, 2009b). Rail accidents cost \$143 million in 1999 (BTRE, 2003). Of the road accidents, passenger vehicle crashes made up around \$17.2 billion. Rail costs were not split by passenger and freight. Laird (2005) suggests a 30% share for freight, which would imply an accident cost of around \$100.1 million for rail passenger transport.

The cost per passenger km travelled in 2006 was 8.4 cents for road and in 1999 was 0.87 cents for rail (Table 4.11). Converted to 2010 dollars using CPI inflation the cost per km for road was 9.38 cents and for rail was 1.20 cents. Road transport therefore generates 8.19 cents extra in accident costs per km than rail.

Table 4.11: Accident costs from passenger travel

Unit	Road	Rail
Total cost (\$ million)	17,249	100
km travelled (billion)	205.7	11.51
Cost per km (cents)	8.4	0.87
Cost per km (cents) in 2010	9.38	1.20
Difference (cents per km)		8.19

Note: These figures are based on 2006 for road and 1999 for rail.

Source: Access Economics calculations.

Road transport generates almost eight times more accident costs than rail transport.

The reduction in accident costs can be highlighted by looking at average commute distances in some of Australia's major cities. Table 4.2, below, shows the potential reduction in accident costs if the average commuter trip being made by car was moved onto rail.

Table 4.12: Accident costs per trip

City	Average trip (km)	Potential cost saving (\$)
Sydney	16.8	1.38
Melbourne	17.8	1.46
Brisbane	15.3	1.25
Perth	17.0	1.39

Every additional rail journey reduces accident costs by between \$1.25 and \$1.46.

These results indicate that if 1000 commuters switched their mode of transport road to rail, this would reduce costs from accidents by between around \$650,000 and \$760,000 a year (depending on the city).

A recent study (Tooth 2011) makes use of a similar approach to estimating accident costs to that used by BITRE but updates the value of statistical life (VSL). The VSL used reflects recent research which identified a VSL in Australia of around \$6 million (Hensher *et al* 2009). This estimate is far higher than the \$2.4 million used by BITRE in its analysis. Incorporating this estimate of VSL into BITRE's framework results in an estimate of road accident costs of around \$28 billion in 2006.

Unfortunately these updated calculations do not provide enough detailed information to update the BITRE estimates for the purposes of this paper. Rough calculations indicate that the revised difference in passenger accident costs based on these updated figures would be around 12.8 cents per kilometer; a 56% increase above the BITRE based estimates. This gives an indication of the sensitivity of the above results to the VSL.

4.1.4 Passenger - social inclusion

Social inclusion involves the lowering of barriers which make it difficult for people to participate fully in society. Social exclusion is usually measured from five different angles:

- Employment status: whether a person is or is not in a job
- Political activity: whether a person is engaged in any committees or groups
- Social support: whether a person can access help from friends, family or neighbours
- Participation: whether a person can participate in any hobbies, events, or organised recreational activities

Mobility is a key aspect of social inclusion as, without it, individuals are likely to have difficulty finding work, travelling to places of education, accessing health services, buying affordable groceries or even participating in social activities. That is, without mobility a person will have difficulty doing well on any of the measures of social exclusion.

More extensive rail networks that provide more frequent services have the ability to enhance social inclusion. For an individual, travel by rail does not require the large fixed costs of vehicle ownership, registration, insurance and licensing that travel by road does.

The availability of rail transport options may therefore increase the mobility of those unable to afford the large fixed costs of cars.

The role for rail here is further enhanced by its ability to move relatively quickly over long distances. The recent Infrastructure Australia report, *State of Australian Cities 2010*, found social inequality to be most significant in large metropolitan areas. The role for rail is further illustrated by a joint study funded by the University of Western Sydney and the Western Sydney Community Forum (2006) which found that widening the diversity of rail network coverage, improving accessibility and network effects was seen as a means of improving social benefit and productivity.

Until recently, there has been little focus on quantifying the value of social inclusion in Australia. This has reflected the difficulty in estimating the value from significantly expanded transport services. A forthcoming paper has attempted to address this lack of research by estimating the willingness to pay for additional trips that enhance mobility and improve social inclusion (Stanley *et al* 2011).

The approach is based on a series of face-to-face interviews across Melbourne with 443 adults. Selection of participants was designed to ensure representative geographic coverage and variability in access to transport, income and age. The results of the survey indicated that those at higher risk of social exclusion made fewer journeys per day. The results of the survey can be used to calculate willingness to pay for trips; this depends on the household's income.

At the average level of household income, the willingness to pay for an additional journey, among those included in the survey, is up to \$19.30. This valuation declines as income increases. This is because higher income individuals tend to already make a large number of trips while lower income individuals make a small number of trips and so stand to benefit significantly from increased mobility.

This estimate, based on willingness to pay, can be compared to other sources, based on costs of transport, which indicate an implied value of \$7.07 for an additional car trip and \$9.56 for a public transport journey (Department of Infrastructure 2005; Australian Transport Council 2006), a difference of \$2.49 between private and public transport.

4.1.5 Passenger - other

An important issue to consider is that in major cities it is difficult to expand the road network due to land constraints. These constraints apply both when attempting to retrofit existing roads to higher volumes and when expanding the road network into new areas (as there are natural constraints to the footprint of many of Australia's cities).

As such, rail is potentially more valuable on a transport per land area used basis. This aspect of rail transport could be looked at in two ways:

- For a given amount of land, the number of people or volume of freight that can be carried by rail transport is likely to be higher than what could be carried by road transport.
- For a given transport task, the amount of land required when using rail transport is smaller than the amount of land required when using road transport.

Some attempts have been made in past papers to estimate this value. A rail transport system, operating efficiently, may use around 1.25m² of land per person per kilometre travelled while a highway may use up to 20m² per person per kilometre travelled (ARA 2000 in ACF 2009).

This potential land use benefit arising from the use of rail transport is often taken into account in current prices, as the land must be paid for. However, additional benefits arise from other potential uses of the land. Land that could be freed up by relying more heavily on rail transport could be put to other uses such as housing, industry, warehouses, or for community and recreation areas. All of these uses may create additional benefits.

4.1.6 Summary on passenger transport

Costs created by passenger travel but not included in prices come from a number of different areas including: carbon emissions, congestion, accidents, social inclusion, land use and from funding arrangements.

Some of these are amenable to quantification in dollar terms and some are even comparable to one another, this allows for the calculation of a total costs, shown in Table 4.13.

Table 4.13: Total costs per average commuter trip (2010\$)

City	Carbon emissions	Congestion	Accidents	Total
Sydney	0.02	7.01	1.38	8.41
Melbourne	0.02	5.18	1.46	6.66
Brisbane	0.02	1.84	1.25	3.11
Perth	0.02	3.20	1.39	4.61

Each passenger journey made by rail instead of road reduces congestion, accident and carbon costs by around \$6.45 in total.⁶

4.2 Freight

The focus of this report, and the calculations below, is on interstate freight transport, particularly the North-South corridor. This is a key, and growing, market for freight transport in Australia. Having said this, the role of intra-city and inter-regional rail transport should not be overlooked. Inter-regional transport shows the same benefits outlined below, but simply on a smaller scale. Intra-city rail transport is somewhat different, offering opportunities to relieve congestion, as was analysed above, in addition to the carbon and accident benefits estimated below.

The largest cost associated with freight that is not covered in prices is the difference in infrastructure maintenance costs. Rail lines used for freight are required to earn a return, while roads are publically owned and can operate at a loss. The public ownership of roads makes it difficult to accurately price the share of the damage inflicted and the share

⁶ Using a weighted average based on population

of common costs (construction and services such as street lights) that should be attributed to each vehicle.

Similar to passenger services, there are also differences in carbon emissions and accident costs. However, congestion is less of a problem as freight routes tend to bypass city centres.

4.2.1 Freight - carbon emissions

Rail plays a larger role in freight transport than it does in passenger transport, accounting for over half of land based freight, when measured in tonne kilometres. In 2010, 249 billion tonne kilometres were transported by freight trains and 207.4 billion by road vehicles. Despite the similarity in total distance travelled, road transport emits ten times as much CO₂ equivalent as rail transport (30.4 million tonnes of CO₂ equivalent for road compared with 3.1 for rail). The difference in road and rail carbon emissions from freight transport per tonne km travelled is 0.13 kilograms of CO₂ equivalent per tonne kilometre (see Table 4.14).

Table 4.14: Carbon emissions from freight, 2010

	Total emissions	Total vehicle distance travelled	Emissions/tonne km travelled
	Million tonnes of CO ₂ equivalent	Billion tonne km	kilograms of CO ₂ equivalent per tonne km
Road			
Rigid trucks	7.1	36.9	0.19
Articulated trucks	10.8	162.3	0.07
Total	17.9	199.2	0.09
Rail^(a)			
Total	0.6	48.9	0.01
Difference			0.08

Notes: (a) Estimate includes emission from power generation for electric rail. (b) Sum of electric and non-electric. (c) Sum of tonne billion km for ancillary freight, hire and reward bulk and hire and reward non-bulk. Source: BITRE (2009a) and Access Economics calculations.

Road freight produces more than seven times as much carbon pollution as rail freight per tonne kilometre.

As with the analysis of carbon emissions for passenger transport, these emission figures can be converted to dollar figures by applying a carbon price. A price of \$26.70 per tonne of CO₂ equivalent is chosen based on the price that was proposed for the beginning of the CPRS-5 in 2010 (converted from 2005 dollars to 2010 dollars using consumer price inflation) (Treasury, 2008).

Every tonne kilometre of freight moved from road to rail results in a reduction in carbon pollution costs of around 0.21 cents.

These results are based on the current energy mix used to power road and rail transport. In Australia rail transport is predominantly powered by diesel fuel and electricity, freight transport relying heavily on diesel. The emissions from rail transport could therefore be reduced by increased electrification of rail networks and substitution into less emissions intensive sources of electricity.

To put this figure into context we can look at the overall effect if a single container, weighing around 9 tonnes and being transported between some Australian cities, was moved by rail transport instead of road transport. The total costs saved for various city combinations are given in Table 4.15.

Table 4.15: Modal Shift: Example carbon cost savings for intercity freight (\$)

	Sydney	Melbourne	Brisbane
Sydney			
Melbourne	16.05		
Brisbane	17.35	32.18	
Perth	73.72	63.57	82.01

Note: distances are taken from BITRE (2009c) and using an assumed 9 tonne container of freight.

The assumed carbon price of \$26.70 a tonne is not necessarily representative of the price that would emerge under a carbon trading scheme. As there are currently ongoing negotiations over the mechanics of an emissions reduction scheme, it is difficult to accurately estimate the carbon price that may emerge. A range of other carbon prices are considered in Table 4.16.

Table 4.16: Carbon emissions costs at different carbon prices

Carbon price (\$/tonne)	cost (c/tkm)
10	0.08
26.7	0.21
50	0.39
75	0.58
100	0.77

4.2.2 Freight - accidents

Following the same approach as set out for passenger transport related accidents (see section 4.1.3) the accident cost for freight transport was 0.58 cents per tonne km in 2006 for road and 0.04 cents per tonne km for rail in 1999. In 2010 prices this would be 0.65 cents for road and 0.06 cents for rail. This means that the accident cost associated with road freight transport is ten times that for rail freight transport on a per tonne km basis. These calculations are set out in Table 4.17.

Table 4.17: Accident costs from freight transport

Unit	Road	Rail
Total cost (\$ million)	999.2	100.1
Tonnes km (billion)	173.30	106.2
Cost per tonne km (cents)	0.58	0.04
Cost per tonne km (cents) in 2010	0.65	0.06
Externality (cents per tonne km)		0.59

Note: These figures are based on 2006 for road and 1999

Every tonne kilometre of freight moved from road to rail results in a reduction in accident costs of around 0.59 cents.

To put this figure into context we can look at the overall effect if a single container, weighing around 9 tonnes and being transported between some Australian cities, was moved by rail transport instead of road transport. The total accident cost saved for various city combinations is given in Table 4.18.

Table 4.18: Example accident costs for intercity freight (\$)

	Sydney	Melbourne	Brisbane
Sydney			
Melbourne	45.83		
Brisbane	49.54	91.92	
Perth	210.54	181.55	234.22

Note: distances are taken from BITRE (2009c)

As discussed above, a recent study (Tooth 2011) makes use of new estimates of the value of statistical life in Australia to update BITRE's total accident cost estimates. Unfortunately these updated calculations do not provide enough detailed information to update the BITRE estimates for the purposes of this paper. Rough calculations indicate that the revised difference in freight accident costs based on these updated figures would be around 0.82 cents per kilometer; a 39% increase above the BITRE based estimates. This gives an indication of the sensitivity of the above results to the VSL.

4.2.3 Freight - infrastructure maintenance

Heavy vehicles, the transporters of freight, are required to pay both a registration fee and a fuel excise to help recover the cost of damages made to the road, if this fee accurately reflected the costs created by each vehicle type then prices would reflect costs and there would be no advantage for road or rail transport. When prices depart from costs, this can distort transport decisions.

In practice prices faced by individual users do not necessarily reflect their actual damage. For example, the Productivity Commission (2006) found that B-Doubles under recover the costs that they generate when compared to other classes of trucks. This cost is being borne by the smaller rigid and articulated trucks. As such, the price signal sent to

operators may not be correct, distorting the choice between using rail or road to transport freight.

The fact that it is the largest road vehicles which receive the cross subsidisation from smaller vehicles is critical as it is these larger vehicles which are the closest substitutes for rail transport.

The current basis for calculating heavy vehicle charges is to apportion the expected expenditure on roads. This is based on the average of seven years of budget data and is updated annually. This total cost is then apportioned across vehicle classes based on average:

- vehicle kilometres travelled;
- Equivalent Standard Axle kilometres travelled, which is a measure of deep pavement wear;
- Passenger Car Unit kilometres travelled, which is a measure of relative road space requirements based on the size of the vehicle;
- Average Gross Mass kilometres travelled, which is a measure of the mass impacts on the road pavement in general; and
- Heavy vehicle kilometres travelled, which is a measure of the relative amount of heavy vehicle travel.

The principle of this pricing system is that, on average, each class of heavy vehicle pays its own share of allocated road expenditure, minimising under and over-recovery. This only ensures that costs are recovered on average in each vehicle class and so the pricing structure might not be the most efficient possible.

Another difficulty with the current pricing structure is that it is based on current expenditure needs, not future needs. Heavy vehicles today are paying for road damage that occurred in the past rather than paying to repair the damage they are causing today. Since heavy vehicle use has been growing steadily, road charges today are not sufficiently high to recover the actual cost of today's road use.

There are different estimates of the precise level of this cross subsidisation. The Productivity Commission estimated that on a per truck basis, under-recovery was in the order of \$7000 a year (Productivity Commission 2006) while the NTC has estimated a value of around \$10,500 (NTC 2006). The NTC has made recommendations for pricing reforms which would address some of these issues, but this is an ongoing issue as the COAG Road Reform Plan is currently conducting a review process which will identify ways to address the current cross-subsidisation but have not, as yet, calculated a dollar figure for its level.

4.2.4 Summary on freight transport

The carbon pollution and accident costs quantified above lend themselves to adding together to give a total cost, Table 4.19.

Table 4.19: Total freight costs

Type	Cost (c/tkm)
Carbon emissions	0.21
Accidents	0.59
Total	0.80

This per tonne kilometre measure can be put into context by considering some of Australia's intercity freight journeys

Table 4.20: Example total costs for intercity freight (\$)

	Sydney	Melbourne	Brisbane
Sydney			
Melbourne	61.87		
Brisbane	66.89	124.10	
Perth	284.26	245.12	316.24

Note: distances are taken from BITRE (2009c)

5 Impact of modal shift and investment in rail

To achieve the potential benefits of rail identified above, investment will be needed. Two good examples of current bottlenecks can be found in Sydney. For freight transport along the North-South corridor, there is currently a bottleneck in Northern Sydney while for passenger transport within Sydney there is a bottleneck at key city stations.

If rail was to take a 40% share in North-South freight movements there would, today, be a reduction in accident and carbon costs of around \$250m a year. This is expected to grow to around \$530m by 2030.

On the passenger side, if rail was to absorb 30% of the forecast increase in transport demand in Sydney, this could create benefits of over \$1 billion a year by 2025.

This section will consider two main case studies where infrastructure investment is required to achieve the true value of rail:

- Freight transport on the north-south corridor; and
- Passenger transport in Sydney.

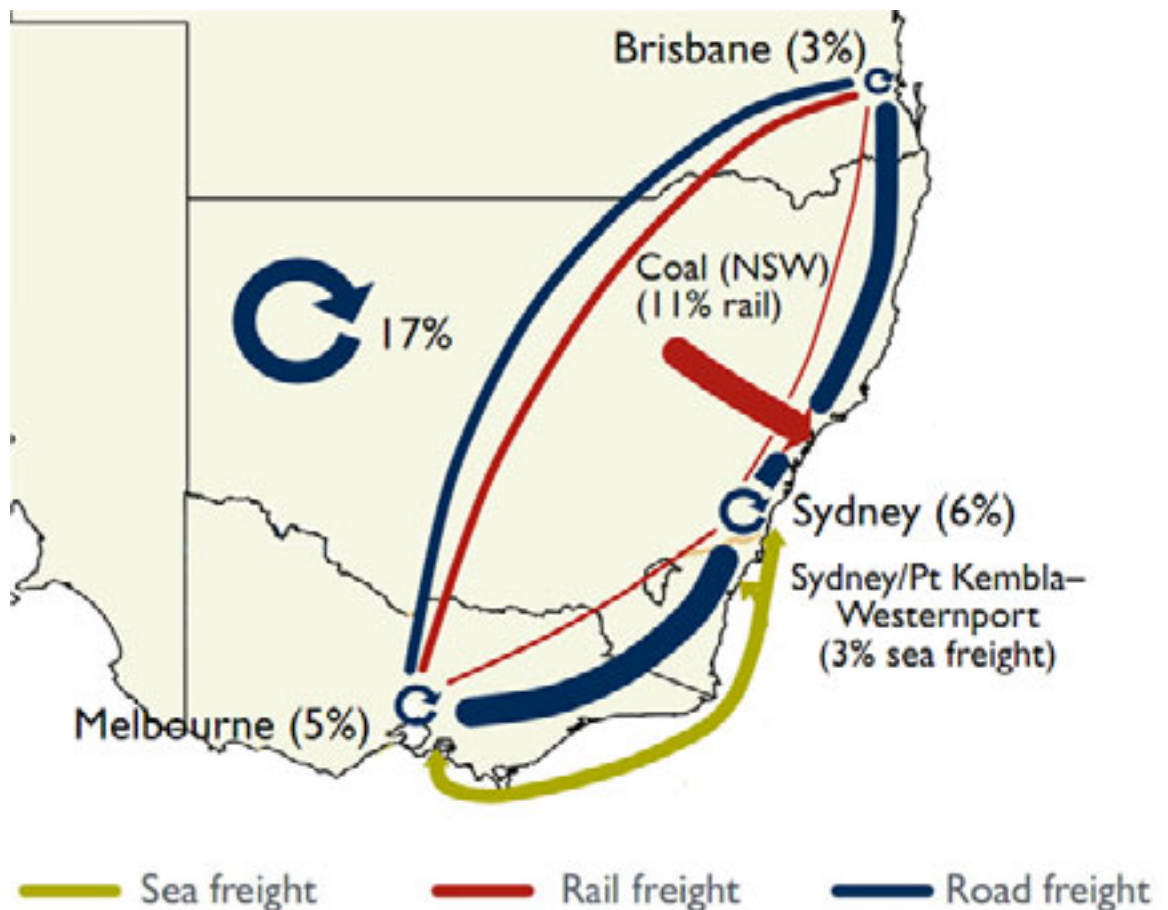
These case studies have been selected as there are clear gains to be made, even in the short term, from specific infrastructure investments. However, these are not the only investment options in Australia, Cross River Rail in Brisbane, an inland freight route and a very fast passenger train are other possibilities each with different investments and timeframes.

5.1 The north-south corridor

5.1.1 The corridor today

The north-south transport corridor connects Melbourne to Brisbane via Sydney. It is one of Australia's key transport corridors. In 2006-07, trade along this corridor in goods originating from these states accounted for around 30% of the total domestic non-bulk freight task (BITRE 2010a). Of this, rail made up well under 15% and likely in the region of 9-12% (BITRE 2009c and BTRE 2006). As a percentage of the market, rail tended to perform best on the northbound NSW to Brisbane leg of the journey (BITRE 2010a).

Figure 5.1: The north-south corridor



Note: Percentages are the share of total modal freight task, measured in tonne kilometres.

Source: BITRE 2009d

In terms of the infrastructure used by road along this journey, trucks will take alternative routes if they are travelling between Melbourne or Brisbane and Sydney or if they are travelling between Melbourne and Brisbane. The Melbourne to Brisbane route runs inland along the Hume, Goulburn Valley, Newell, Cunningham, Leichhardt, Gore and Warrego Highways. The Sydney to Melbourne corridor runs via the Hume Highway, more toward the coast, while the Sydney to Brisbane corridor runs mainly along the Pacific or New England Highways (Department of Infrastructure and Transport 2007a, 2007b, 2007c). Of course, there are variations possible. The road infrastructure is able to accommodate B-Doubles along its entirety and road trains along sections of the Newell Highway (Department of Infrastructure and Transport 2007c).

The inland corridor is generally not affected by capacity constraints at the moment, excepting congestion when passing through population centres and areas where speeds are affected due to steep climbs (Department of Infrastructure and Transport 2007c). The more coastal routes, servicing Sydney, are more heavily affected by congestion than the inland route. This is mostly in areas of population such as around Albury/Wadonga, between Sydney and Newcastle and between the Gold Coast and Brisbane but also includes infrastructure constraints such as bridges around Scone and Maitland (Department of Infrastructure and Transport 2007a, 2007b).

The heavy use of road transport along this corridor leads to heavy vehicles making up a high proportion of total traffic on many legs of the journey. The proportion often exceeds 30 per cent for lengths of the corridor between Jerilderie and Forbes as well as between Narrabri and Toowoomba (Department of Infrastructure and Transport 2007c).

In terms of rail infrastructure, a single line runs between Melbourne and Sydney and another between Sydney and Brisbane, the Sydney metropolitan network links these two interstate lines.

Between Melbourne and Sydney, the track generally runs in parallel with the Hume highway but deviates through Wagga Wagga. On the Sydney to Brisbane leg the track generally follows the Pacific Highway but deviates inland via Maitland, Taree, Grafton and Casino (Department of Infrastructure and Transport 2007c). The interstate track is owned (or leased) by the ARTC while the Sydney metropolitan network is owned and operated by RailCorp.

Some sections of the track still maintain the original alignment set out for steam trains. These sections include tight curves and steep grades (particularly between Macarthur and Goulburn and between the Hunter Valley and Grafton) as well as being only a single track in places. This legacy infrastructure can be compared to the highways servicing the same routes which have seen significant re-alignment to reduce curves and climbs as well as the introduction of multiple lanes.

At the moment, the critical constraint on the North-South rail corridor is the Sydney metropolitan network. This arises from the fact that interstate freight trains must share the metropolitan network with passenger trains. Passenger and freight trains move at different speeds and have different stopping patterns. Passenger trains are given preference over freight trains on the network; this effect is most clear during peak periods in the Sydney network, roughly from 6:00 to 9:30 in the morning and from 4:00 to 6:00 in the evening, where there are virtually no freight train movements on the network.⁷

A freight train journeying from Melbourne to Brisbane via Sydney must enter the RailCorp network, pass through the southern part of the network to arrive at an intermodal terminal then navigate through the northern section of the metropolitan network. An example of a typical run from Melbourne to Sydney would be a train that leaves Dynon in Melbourne at around 3pm to arrive in Sydney at around 3am the following morning. The train then enters an intermodal terminal to exchange containers, before heading off at around 5:30am. This train can pass northward through the passenger network as it is heading against the flow of the peak traffic.

5.1.2 The need for and benefits of investment in rail

Investment in rail infrastructure could, generally, be motivated by two factors: increasing capacity or improving service standards. In the case where capacity is currently constrained, investment becomes a pressing issue which requires addressing if volumes are to be allowed to grow.

⁷ Some counter-peak movements are possible such as moving north from Hornsby.

On the north-south rail corridor, capacity is generally constrained by the need to mix passenger and freight trains which move at different speeds and have different stopping patterns. Issues raised by the presence of passenger trains can either be managed by segregation of freight from passenger traffic or by enabling more flexible management of traffic by incorporating loops which allow for holding and passing. Loops to allow holding and passing help manage the different speeds at which passenger and freight trains move.

The Southern Sydney Freight Line (SSFL), running between Macarthur and Sefton, is due to be completed sometime in the next two years and will effectively allow for complete separation of freight and passenger trains in Sydney's south.

The presence of the SSFL leaves Sydney's north as the key bottleneck for trains looking to traverse the metropolitan network. The main north line currently has capacity for around 16 freight trains each day in each direction. Of these there is capacity for seven in the period from 5:00am to 10pm. This period is a key time as it allows trains to arrive in Brisbane at a time which end customers' desire. There is currently only space for one extra train in either direction during this core period. Demand forecasting by Transport NSW indicates that this single remaining path will probably be consumed by 2013 (Department of Transport 2010a). For example, if a single large customer, such as Woolworths, was to shift its interstate transport from road to rail (a distinct possibility), it would be difficult to meet the extra demand given the current network constraint in north Sydney. The Melbourne to Sydney leg of the journey could be accommodated with current infrastructure but the Sydney to Brisbane leg could not be accommodated in an efficient manner leading to undesirable arrival and departure times from the major cities.

The problems with the line heading north out of Sydney are partially related to the lack of places where freight trains can be held to allow passenger trains to pass. The different speeds at which the two train types travel make this a necessity. The lack of these facilities has been driven by increases in train length (ARTC 2008). Increases in the length of trains in recent years have grown ahead of increases in the number of long loops in the RailCorp network which can accommodate these trains. For example, there is a long loop available at Cowan but nothing further until Broadmeadow, much further north.

In addition to the need to invest to maintain capacity for natural growth in transport volumes, there are also large benefits to investing in rail. As identified earlier in the report, moving a single tkm of freight from road to rail transport reduces negative carbon and accident costs by around one cent. Given that the Melbourne to Sydney journey is around 863km and Sydney to Brisbane is around 933km, this implies that a single tonne of freight moved by rail instead of road could reduce carbon emission and accident costs by around \$16.50-\$17, depending on the route taken.

Using BITRE estimates of current freight volumes on the corridor, rail is already contributing around \$77m of benefits each year. Looking at forecast freight volumes, which only see modest increases in rail's modal share, by 2030 rail is forecast to contribute around \$190m in today's dollars. Some more scenarios are provided in the table below.

Table 5.1: Potential yearly rail benefits on the north-south corridor (\$m)

Year	Base case	20% rail modal share	30% rail modal share	40% rail modal share
2011	77.3	125.1	187.6	250.1
2020	133.8	196.1	294.2	392.2
2030	190.4	264.3	396.5	528.6

However, the realisation of these potential benefits cannot be achieved with today's infrastructure. Today's north-south corridor infrastructure faces an immediate capacity constrain in the north of Sydney and ongoing constraints in the years beyond. The investments required to allow growth in rail, both natural and in the event of a modal shift, are outlined below.

These investments are large in both scale and dollars but should be compared to investments which attempt to expand the existing road network in populated areas. It is these urban areas which constrain road capacity along the same route. Retrofitting a major urban highway is an extremely costly exercise, as exemplified by the M5 and M4 expansions in Sydney. These major investments could also start Australia down a path towards more reliance on rail and break away from the current situation where past investment in road infrastructure has determined current preferences for road transport.

5.1.3 Required investments

The initial investment required to free up capacity on the north-south corridor is to establish the northern Sydney freight corridor (NSFC). A project outline for the NSFC has recently been made by Transport NSW (2010a). The proposed NSFC is not a separate freight line but is, instead, a series of augmentations to the existing shared network which would allow passenger and freight trains to interoperate more freely and would therefore create additional freight train paths. The proposed NSFC would operate in three stages, initially increasing the daily number of train paths from 16 to 26 in both directions while stage two would increase this to at least 33 paths in both directions. Stage three would transition towards a dedicated freight line

The NSFC is forecast to cost around \$1.2bn for stage one, \$3.4bn for stage two and \$3.2bn for stage three, for a total of around \$7.8bn. This expenditure would be spread over the next 12 years and so, in present value terms the capital cost is around \$5.2bn. Of this, \$0.8bn has already been allocated under the Nation Building program. This leaves an unfunded capital cost of around \$4.4bn in present value terms.

Another infrastructure investment likely to be required is that of intermodal terminals in Sydney and Melbourne. In Sydney, the most likely candidate is for a terminal at Moorebank (ARTC 2008). This terminal has recently been estimated to have a capital cost of around \$700m but would likely be privately funded. In Melbourne, a new intermodal terminal would likely be located to the west of the city. Both of these new terminals would be located closer to the current industrial centres of the cities, as compared to the older terminals at Chullora and Dynon which are now not at the industrial heart of the city, and could also be configured to allow for double stacking.

The introduction of double stacking on the north-south corridor would likely follow on from the introduction of double stacking on the east-west corridor. Allowing double stacking on the east-west corridor would require significant works on the stretch of track from Cootamundra to Sydney, estimated to be around \$214m. Introduction of double stacking on the north-south corridor could, potentially, follow on from this initial investment by making incremental investments to the track between Cootamundra and Melbourne, estimated at around \$107m (ARTC 2008).

A number of other projects including deviations, passing lanes and duplications are also considered necessary by ARTC in order to meet demand growth that would occur in the presence of a modal shift to rail. These other projects could amount to around \$2.4bn in the period to 2020 (ARTC 2008).

A somewhat separate, but interconnected, issue is the treatment of freight within Sydney. These two issues are interconnected as internal freight takes up train paths which could be dedicated to interstate freight. Key issues here are the potential expansion of Port Kembla, which could lead to more trains travelling into Sydney. This could be offset by improvements to the Illawarra line, or potentially by re-construction of the Maldon-Dombarton line. The Maldon-Dombarton line was partially completed in the 1980s and would currently cost around \$0.55bn to complete (Connell Hatch 2009). Other potential future freight issues within the Sydney network are the movement of coal from a new coal mine at Warnervale to Port Waratah, possibly costing around \$150m, and the movement of thermal coal to the power stations at Lake Macquarie.

5.2 Sydney's passenger network

5.2.1 The network today

Sydney's metropolitan network extends from the Hunter south to the Southern Highlands and west to the Blue Mountains. The Sydney metropolitan network is highly complex, connecting 307 stations and averaging around one million passenger trips each weekday. Some of the complexity of the Sydney network arises from the fact that it combines a metro-style system, which serves underground stations at frequencies up to 20 trains per hour in the city, with a suburban rail system. This means that the same trains and track must fulfill dual purposes. This complexity is increased as trains serving different routes share common infrastructure and so delays on one route can easily spread across the network.

During the one hour peak of morning travel around 100,000 people are transported by train in Sydney, a single train operating on the RailCorp network moves around 875 people on average (on some routes an average train can move up to 1280 people).

5.2.2 The need for and benefits of investment in rail

The Sydney passenger network is a radial network, spreading out from the key city stations of Central, Town Hall, Wynyard and North Sydney. It is these stations, and the flow of passengers towards the city, which currently constrains capacity. Capacity through the CBD theoretically allows for the passage of 20 trains an hour. Currently the number of paths used ranges from 14 to 19 and is constrained by factors such as the mix of stopping patterns, congestion at key junctions and rollingstock availability. There is an

additional line which terminates at Central Station, theoretically capable of carrying 24 trains an hour, but which does not enter the city itself and so currently only carries up to 14 trains an hour.

The rail clearways program seeks to obtain the full 20 trains per hour capacity through the six lines at Town Hall station. This program is essentially aimed at getting the most out of the existing available infrastructure. The extra capacity delivered by the rail clearways program will require extra rollingstock. Although there is currently a program to acquire extra carriages, which will also allow all suburban trains to be built up to eight cars long, there will not be sufficient rollingstock to fully utilise the available capacity.

The city stations themselves are also constrained by their ability to physically accommodate passengers and move passengers into and out of trains. The mix of suburban style carriages and multiple destinations being serviced from single platforms do not allow for the complete clearing of platforms or the efficient unloading and reloading of trains. This constraint reflects the fact that the major city stations were designed and constructed in the 1920s and 30s and that redevelopment is difficult due to the need to also redevelop surrounding areas of the city to accommodate larger stations.

Putting these two effects together, the Sydney metropolitan network is currently constrained by capacity, both in terms of rail paths and platform space, in the city itself.

Even though the network is currently approaching capacity, there would be large benefits to be gained from inducing a further shift towards rail. Modelling using TRESIS, further discussed in Appendix A, indicates that if a congestion charge and a carbon tax were introduced the number of passengers travelling via rail could immediately increase by around 146 million journeys a year or by up to 212 million journeys a year by 2025. This would represent an almost doubling of passenger journeys compared to the base case for 2025.

Using the costs estimated earlier, this modal shift would lead to around a \$1.2 billion a year reduction in costs in 2011 or almost \$25bn in the period to 2025. These savings in accidents, carbon emissions and congestion costs would also have to be added to the revenue raised for government from a carbon tax and a congestion charge.

Using the current average number of passengers per train, this modal shift caused by policies that align prices and costs, would require an extra 95 trains to be running per hour of the peak, on average. This number of trains would not be able to be accommodated given the current available infrastructure.

Instead of looking at the effect on modal choice that would result from a radical policy shift, we could also consider how the Sydney metropolitan network might expand under natural growth conditions. Considering the increase in population and other key variables that might occur within Sydney by 2015, in the absence of any policy interventions, TRESIS provides the following estimates:

Table 5.2: Change in key transport indicators in Sydney from 2010 to 2025

Indicator	Change by 2025
Population	767,240
Annual rail passenger journeys	27,417,000
Annual road vehicle journeys	491,525,000
Vehicle Kilometres	5,343,500,000
CO ₂ emissions (tonnes)	105,930
Average car journey length (metres)	140

In this base case, it is clear that road transport plays a dominant role in accommodating the increased number of journeys demanded. If rail was to play a larger role in accommodating this increase then there would be significant benefits. Estimates of these benefits are given in Table 5.3. This table gives scenarios where the base case of only 5% of additional trips being serviced by rail increases to 10%, 20% and 30%.

Table 5.3: Cost savings from increased rail usage in Sydney in 2025 (\$2010 million)

	Base Case	Scenario 1	Scenario 2	Scenario 3
Road/rail share of extra journeys	95/5	90/10	80/20	70/30
Accident costs saved	0	25.6	77.4	129.1
Congestion costs saved	0	179.8	542.7	905.5
CO ₂ emissions costs saved	0	0.6	1.9	3.1
Total	0	206.1	622.0	1,037.8

Different infrastructure investments would be required by these different levels of rail modal share. The precise cost of the investments would depend on how intensely different parts of Sydney experience the modal shift. However, as the average journey length for cars is forecast to increase by 2025 this indicates that there is likely to be strong growth in outer lying areas of Sydney (such as the north-west and south-west growth regions). This indicates the potential need for extensions of motorways into these new areas. Extensions of train networks into these areas are considered in the following section.

5.2.3 Required investments

Planning for investment in commuter rail should be made in an integrated way. That is, rail planning should align with bus and light rail planning. Bus and light rail can work as complements to rail travel by providing a feed in mechanism or by providing redundancy and overflow ability. Having said this, there are a number of stand-alone infrastructure investments that need to be made in rail in order to accommodate natural growth in passenger numbers and any modal shift that could be induced.

The most immediate infrastructure investment planned is the northwest rail link. The northwest rail link would involve the construction of 23km of rail and 6 new stations in

Sydney's northwest; this would bring passengers onto the existing RailCorp network at Epping. This link would serve one of Sydney's key current growth areas. Transport NSW estimates that currently only 7% of trips made by travelers who live in the northwest of Sydney are made public transport and that by 2021 road congestion in the area is expected to increase travel times by 50-70% (Transport NSW 2010b). To be fully effective, and to avoid the capacity choke point of the Harbour Bridge, an integrated approach to planning the northwest link will need to be implemented.

The northwest rail link is estimated to cost around \$3.8bn, excluding the second harbor crossing, and would allow for around 23.6 million passenger journeys per year (Transport NSW 2010b). This level of patronage would generate around \$200m a year in benefits, this equates to 5% of the construction costs each year.

To accommodate the natural growth in Sydney, and rail transport, by 2030 it is envisioned that the RailCorp network would also include the South West Rail Link and the Parramatta to Epping Link. However, in order to accommodate a modal shift leading to the doubling of rail volumes there would also likely have to be additional investments, these could include projects such as:

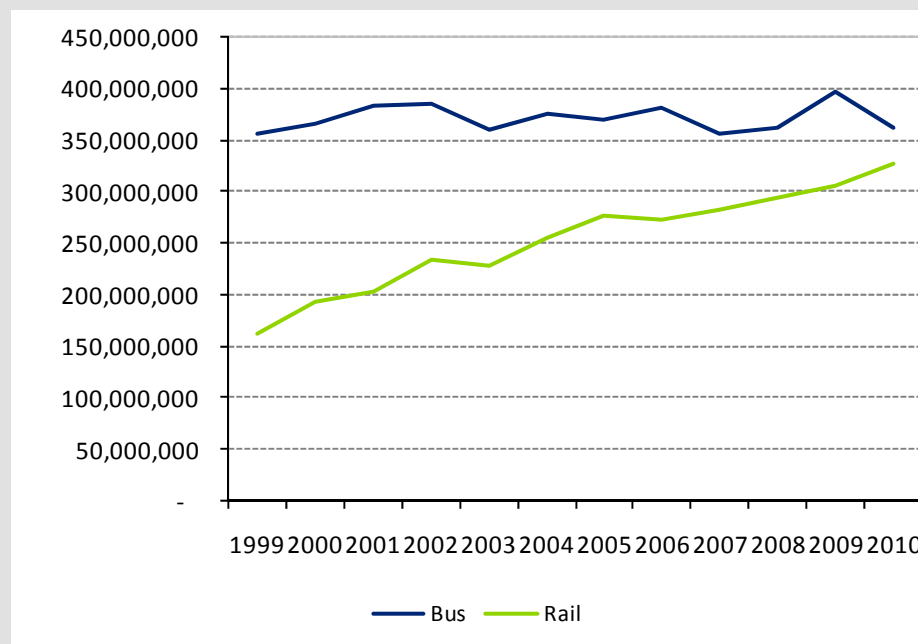
- track amplifications throughout the network:
 - north to Chatswood; and
 - west to Strathfield, Granville and Parramatta.
- Upgrading of Town Hall and Wynyard stations;
- two additional rail lines into the city; and
- grade separation at remaining flat junctions;

In addition to these expansions there would also, likely, need to be increases in other public transport facilities, such as bus and light rail, consideration of the introduction of more metro style trains, improved interchange locations, adequate maintenance and stabling facilities and altered land use policy to employments centres in areas such as Parramatta, Penrith and Liverpool.

Case study: Light rail in Portland, Oregon

The city of Portland, Oregon in the US is largely viewed to have implemented a successful light rail system, coupled with 'transit oriented neighbourhoods'. The investment in light rail has successfully led to the take-up of rail transport by commuters, as rail ridership in Portland over the last decade has grown much more strongly than has bus ridership (shown in 0 below). Residents living in these neighbourhoods have been found to own fewer cars, drive less and use public transport more than they otherwise would (Litman 2010). Specifically, 30% of residents moving into these neighbourhoods reduce their vehicle ownership, while 69% increase their use of public transport. This trend may explain Portland's success in curbing congestion delays. Between 1998 and 2003, Portland's population grew by 14%, however per capita congestion delays did not increase (Litman 2010).

Chart Box.2: Passenger kms travelled in Portland by bus and train, kms



Source: Trimet (2010), Access Economics calculations

The introduction of metro style trains could be achieved on the existing RailCorp infrastructure, by the addition of new metro only lines or, most likely, by some combination of the two. Metro trains may help to overcome problems of boarding and alighting trains as metro trains have more and larger doors but introduce other problems relating to increased rolling stock requirements, signalling needs and stabling facilities.

5.3 Elsewhere in Australia

Although these two case studies have been selected, there are critical bottleneck and infrastructure projects all around Australia.

At the top of the list is likely to be the Cross River Rail project in Brisbane. This project would provide an alternate path for trains to cross the Brisbane River, currently trains running on the Gold Coast, Beenleigh, Cleveland, Ferny Grove, Airport and Doomben lines must travel across the Merivale Bridge. This bottleneck presents a capacity constraint to the Brisbane network. There is currently a detailed feasibility report being prepared but the recent natural disasters in Queensland have led to a delay in the project timeline.

Other significant infrastructure projects, with longer time horizons for investment, would include:

- An inland rail route between Melbourne and Brisbane. This route would allow for faster movement of freight by creating a modern infrastructure and allowing for the problems raised by the Sydney network to be avoided.
- A high speed rail network in Australia's southeast. This network could potentially connect Brisbane, Melbourne, Sydney and Canberra as well as some regional cities in the area. This network would reduce air and road congestion, allow for regional development, defer the construction of a second airport in Sydney and reduce costs arising from carbon pollution and accidents.

6 Other considerations

Rail transport also has other benefits, not identified above.

Rail transport can be powered by electricity generated by many different sources. The use of electricity is a key advantage for rail as both domestic fossil fuels, such as natural gas and coal, or even renewable energy sources can be used to generate electricity

This should be compared to Australia's current oil intensive approach to fuelling transport. Unleaded gasoline and diesel oil contributed 94% of road transport's energy consumption in 2008-09. Investment in rail transport would therefore provide some insurance against an increased scarcity, and price, of oil.

An effective rail based passenger transport system can improve economic productivity and create wider benefits for the economy. This is created through more efficient land use patterns (such as higher density and clustering) as well as enhanced land values.

Future investment in the rail network has the potential to play a wider role in achieving long term government objectives. It has the capacity to contribute towards social benefit, through society-level outcomes associated with a rail network, such as moving the economy towards a less oil-reliant logistics chain and through an increase in the value of land in proximity to future rail network investments. These broader benefits should be additional considerations for government policy in decisions affecting modal choice and planning.

6.1 Fuel security

Planning for a less oil-dependent economy and future is a visible concern of the Australian Government. This goes back to 2007 when the Senate Rural and Regional Affairs and Transport Committee Inquiry stated that 'corridor strategy planning [should] take into account the goal of reducing oil dependence' (quoted in Laird 2007). The Department of Resources, Energy and Tourism (DRET) is currently working on producing an Energy White Paper in order to set policy directions for Australia's long term energy security, with the aim of reducing reliance on fossil fuel related greenhouse gas emissions. DRET has also released a report into Australia's liquid fuel vulnerability (ACIL Tasman 2008) and a National Energy Security Assessment (DRET 2009), noting that energy security is a priority of the government.

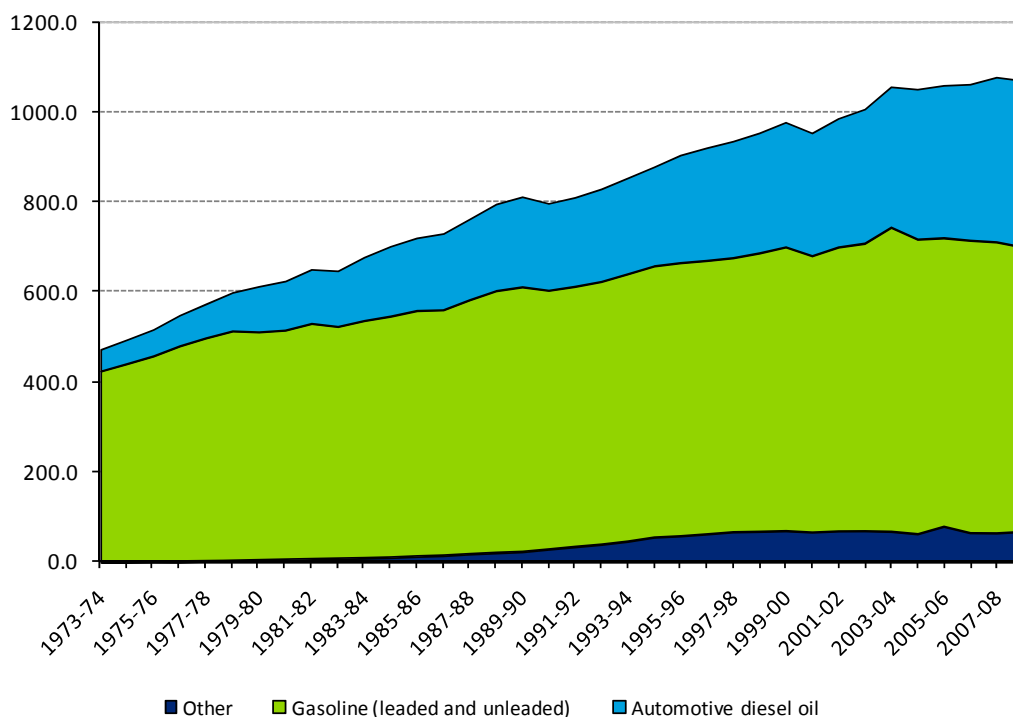
A member of the board of Infrastructure Australia, Professor Peter Newman, has brought attention to the symbiotic relationship between urban planning and oil dependency, with a strong focus on the role of transport. He has recently contributed to a Planning Institute of Australia study that recommends an overhaul of transport and urban policies to limit urban sprawl in the face of increased reliance on oil imports. Professor Newman is also

reported to have recommended that every State should duplicate a Queensland law requiring an 'oil dependence test' for new developments (West 2010).

The current transport task in Australia is oil intensive as most of the energy consumed in this industry is by road transport, which is dependent on fossil fuels for its energy. Chart 6.1 shows that in Australia, road's total energy consumption has more than doubled over the last three decades. It is also highly reliant on fossil fuels, with unleaded gasoline and diesel oil contributing 94% of road transport's energy consumption in 2008-09. In addition, there are next to no renewable energy sources available to power energy consumption for vehicles; in 2008-09 bio-fuels contributed a meagre 0.005% of total energy consumption for road transport.

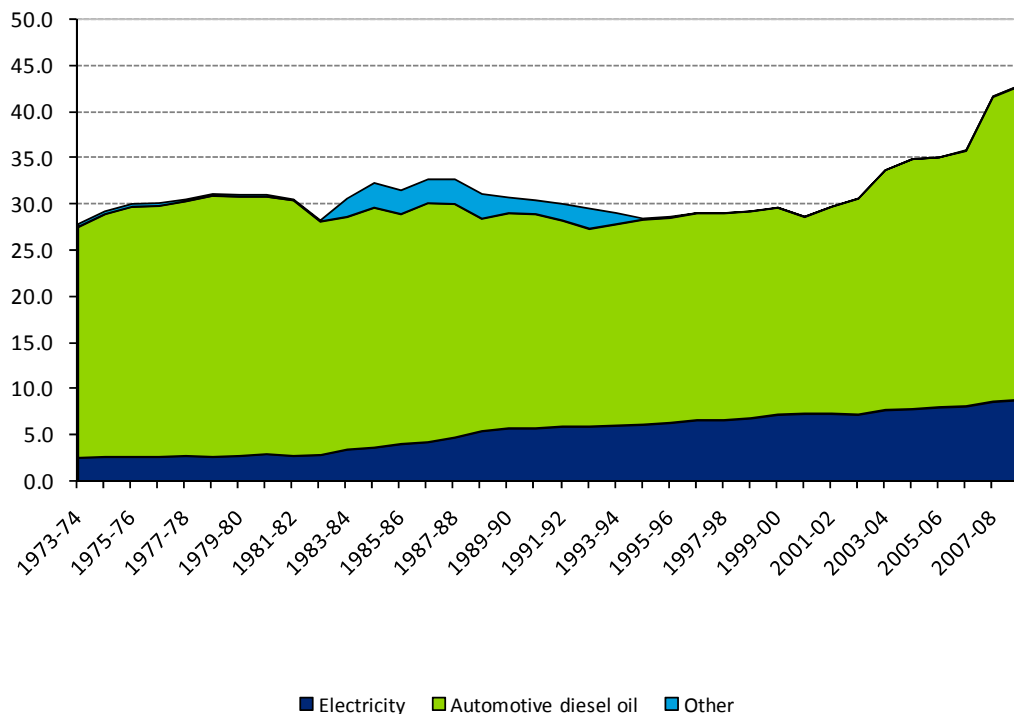
Rail's total energy consumption has remained fairly steady over the same three decades and its total energy consumption is on a much smaller scale than that of road. In 2008-09, rail transport consumed only 4% of the amount of energy consumed by road. Rail is also reliant on a more diverse range of fuels for its power, including electricity which contributed 20% of rail energy consumption in 2008-09. The use of electricity is a key advantage for rail as both domestic fossil fuels, such as natural gas and coal, or even renewable energy sources can be used to generate electricity. The use of electricity therefore makes rail transport far more resilient to fuel security concerns than road transport.

Chart 6.1: Total road transport energy consumption by fuel type, energy units



Source: ABARE (2009)

Chart 6.2: Total rail transport energy consumption by fuel type, energy units



Source: ABARE (2009)

The OECD sees a potential role for rail transport in decoupling economic growth from greenhouse gas emissions and for meeting future growth in freight transport. In relation to the transport of passengers, they suggest that measures involving low investment costs and short implementation periods, such as improving rail service quality or the accessibility of rail and public transport, are an important first step in any effort to decouple economic growth from transport-related CO₂ emissions (OECD 2006). Rail is also viewed favourably as an option for freight transport. The OECD (2010) finds that there is considerable scope for improved rail efficiency through shorter transit times and reduced costs, in the face of expanding global demand for the transport of freight. This is in contrast to other modes of transport that have limited scope for improved transit times and are unlikely to curtail their levels of CO₂ emissions.

The Prime Minister's task group on energy efficiency has also found that Australian energy efficiency strategies have not dealt with the improvements that could be achieved by greater use of public transport. The task group has found that the result of this has been to lock in high emissions, high energy transport networks for decades to come. It recommends explicit linking of Australian Government transport infrastructure funding to energy efficiency outcomes (2010).

Given that rail has less reliance on oil than road and that it currently has greater potential to diversify away from fossil fuel consumption, investment in a rail network would provide some insurance against a future scarcity of oil supply. Such a change in both urban and inter-state transport and freight planning would help to address the concerns raised by DRET and the Planning Institute of Australia.

6.2 Broader economic benefits

An effective rail based passenger transport system can improve economic productivity and create wider benefits for the economy. Essentially, having a rail network, whether it is a metropolitan system or an inter-state system, increases the value of being in proximity to that network.

There is evidence that both households and firms change their behaviour in response to a change in transport infrastructure (OECD 2008) and this can lead to a changing approach to land use, with wider flow-on economic benefits. Examples of such benefits include increased productivity, agglomeration, competition and the thickening of the labour market (OECD 2008), as well as increases to the value of land proximate to a public transport network (Litman 2010).

Litman (2010) finds that rail passenger transport systems encourage more efficient land use patterns, where multiple metropolitan areas of business activity arise, centred on important stations. Improved land use through increased density and clustering then provide agglomeration benefits, which increase productivity through improved accessibility and network effects.

Similarly, the improved accessibility and inter-connectedness provided by a rail network may create increases in property values. A summary review of various studies into the effect of proximity to rail lines in European and American cities finds that properties located near railway stations can have up to a 50% increase in property values (Hass-Klau et al 2004 referenced in Litman 2010).

These effects are possible as a result of investments in metropolitan and regional rail networks. At the metropolitan level, investments in passenger rail infrastructure will be beneficial for Australia's major cities as populations become denser and the need for mass transit increases. These benefits would also be expected to increase over time due to the increasing returns to scale and network effects that should arise as rail networks expand. Benefits would also increase through a system based on optimising the complementarities between bus and rail passenger transport, whereby rail lines form the backbone of the network but may work with bus networks to increase the reach of the public transport system (Kenworthy 2008).

At the regional level, if a very fast train (VFT) network eventuates, similar benefits would be derived from regional centres that are nodes along this network. For example, high speed rail has been associated with the economic and social recovery of regional centres in Europe (Infrastructure Partnerships Australia and AECOM 2010). There is, however, a trade off in the planning for a VFT route whereby more stops will lead to more areas where land values increase, but more stops also reduce the speed of the train, limiting the benefits of the service.

Case study: High speed rail in China

China already has the world's largest network of dedicated high speed railways and is currently investing to expand this further. This comprises 3,400km of track that was built between 2003 and 2010, and an additional 6,700km that was under construction in 2010 (BITRE 2010). By 2012, 42 high speed lines in China are scheduled to be operational (Bradsher 2010). 0 below shows China's high speed rail network, including routes under construction or planned for the future.

Chart Box.3: China's high-speed railways

Source: BITRE 2010

The use of high speed rail suits China's geographical spread, dense population centres, system of central planning and ability to gain from economies of scale. As such, it has pioneered advances in high speed rail technology. For example, certain routes, such as that between Beijing and Tianjin, achieve the highest possible speeds, travelling at 350km/hour (BITRE 2010). The Chinese bullet train, travelling from the coastal industrial centre in Guangzhou to the inland city of Wuhan covers just over 1,000km in little more than three hours (Bradsher 2010). The line being built between Shanghai and Beijing will cover 1,318kms and is the most expensive engineering project in Chinese history (Forsythe 2009). The Chinese experience demonstrates that, as high speed rail becomes more common, the technology becomes easier to access, cheaper and less risky (IPA and AECOM 2010).

From 1990 to 2008, the average distance travelled by passengers on China's national railway system doubled from 275km to 534km, demonstrating the increased mobility of the population (Amos et al 2010). China also aims to achieve long-term benefits from its substantial investment in its high speed railways. This includes a slowing of China's dependence on private vehicles and imported oil, a reduction in air pollution and relief for annual shortages of seats during Chinese New Year (Bradsher 2009). It is also part of an asserted effort to free up existing track for the transport of freight (Schulz 2007).

It is difficult for rail infrastructure providers to capture these broader economic benefits. That is, these positive property value and city planning benefits are a positive externality which accrues to society at large. As such, private investment alone in rail infrastructure is unlikely to result in an efficient network size being achieved. There is a key role for government to play in ensuring that the broader economic benefits that rail provides for city planning are captured and the necessary infrastructure investment is made.

7 Implications for public policy

Australia is currently in a situation where the most desirable mix of transportation modes may be changing and if the right investments in infrastructure are to be made then decision makers must consider the true value of rail.

Considering a future with larger, denser cities the benefits associated with moving passengers from road to rail transport are likely to grow. This indicates that the benefits of rail calculated in this report, which are based on current levels of emissions, accidents and transport choices, may be conservative when thinking over longer time horizons.

For freight, when the benefits for each container shipped by rail and not road are multiplied up by the distances freight moves within Australia then the benefits are sizable.

There is a need for policy action to overcome current network constraints and realise the true value of rail to the Australian economy. Bold policy decisions, such as redirecting funds from a carbon tax towards public transport, should be considered. Failure to act will tie Australia further in to road based transport and would not allow the realisation of increasing returns to scale, environmental, productivity and social gains that could be seen if rail networks were encouraged to grow.

The main role for public policy in transportation is for making decisions related to infrastructure investments. These decisions include both the amount of funding to be delivered from government sources as well as other issues such as zoning and density decisions and protection of right-of-way for future rail and road corridors. In this sense, the role of government is forward looking. It must envision a likely and socially acceptable future and plan for the according infrastructure investments.

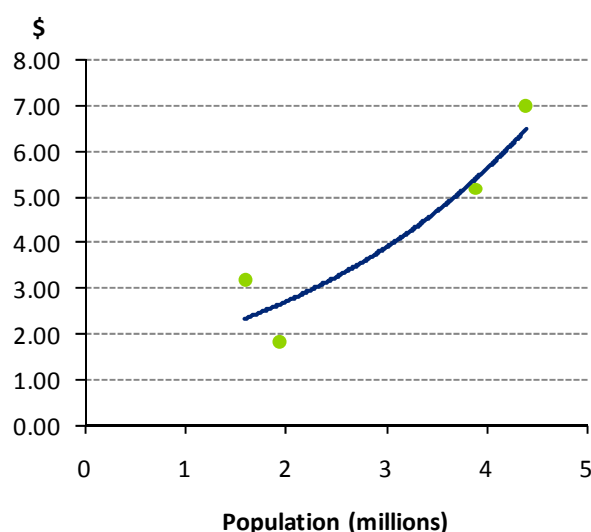
Australia is currently in a situation where the most desirable mix of transportation modes may be changing. If the right investments in infrastructure are to be made then decision makers must consider the true value of rail. The true value of rail includes issues identified in this report such as:

- Improved land use and urban densification;
- reduced carbon emissions;
- reduced congestion;
- reduced accidents;
- removing barriers to social inclusion;
- improving land values; and
- enhanced energy security.

Many of these factors flow from decisions about how we want our cities to function. Over time, increasing populations mean that there will either be a continued spread of our cities or increased densification (or likely some combination of both). Under both scenarios there is a key role for rail to play, either through mass transport within dense metro areas or by connecting far flung suburbs. The costs of investment in rail must also be compared to the costs of retrofitting road networks to meet population growth. Consider, for example, the recent estimate that the M4 east expansion in Sydney could amount to around \$4.7-5.6 billion; this is well above \$500m per km (NRMA 2011).

Considering a future with larger, denser cities the benefits associated with moving passengers from road to rail transport are likely to grow. It was shown earlier that congestion costs are currently the largest components investigated in this report. When comparing different Australian cities we find a strong and ever increasing relationship between a city's population and the congestion cost that was identified, this is shown in Chart 7.1.

Chart 7.1: Relationship of congestion costs (\$) to city population



This indicates that the externality calculations made in this report, which are based on current levels of emissions, accidents and transport choices, may be conservative when thinking over longer time horizons.

For policy decision makers, thought must be put towards how rail infrastructure will be integrated into a transportation system which can adapt and respond to changes in urban sprawl and density over time. The transport system must be both able to cope with moving large numbers of people to a few areas during peaks and moving smaller numbers of people across a large city.

A similar story applies for regional and interstate passenger transport. Australia is in a somewhat unique international situation with a relatively small number of quite large cities separated by long distances. This is, however, changing. There is a growing belt of regional centres arising along the eastern coast and, over the next 30 to 50 years, the prospects for rail passenger transport along Australia's eastern coast will improve. For the

benefits of rail in connecting these regional centres to Australia's main cities, high level planning must commence soon.

For freight, the true value of rail far exceeds its nominal value. When the benefits for each container shipped by rail and not road are multiplied up by the distances freight moves within Australia then the benefits are sizable and compare to the internal costs of transport itself.

On the north-south corridor, where there is significant room for rail to grow its market share, it is currently being held back by inefficient network infrastructure which leads to reliability issues. The main constraint on the north-south corridor is currently in the Sydney metropolitan network. Trains attempting to move through the network must avoid peak passenger periods. This is complicated by a lack of necessary infrastructure in the north of Sydney. There is currently only a single extra freight train path available each day heading north out of Sydney and this path is likely to be used up within the next year or two. The north-south corridor is therefore facing imminent capacity constraints which will hamper any growth in rail freight along the east coast. This constraint could be alleviated with investment in the north Sydney rail freight corridor, which has been proposed to Infrastructure Australia but is currently only partially funded.

The Sydney metropolitan network itself is also facing constraints; this is caused by the radial nature of network, where capacity in the CBD limits capacity throughout the entire network. The rail clearways program is attempting to extract as much as can be from the existing infrastructure but is quickly approaching the limits of what is possible. Investment will soon be needed, and is planned, to add a new rail line through the CBD and to increase capacity on the western line. Looking further out, there is also a need to supply rail to Sydney's growth areas in the north and south west regions.

Overall, there is a need for policy action. Rail is a sector where today's policy decisions will seriously affect the future. The long lived nature of transport assets effectively locks consumers' choices into whatever infrastructure has been provided to them. In the face of increasing population, more congestion, climate concerns, the need to retrofit existing arterial roads and energy supply issues, there is a key role for rail.

There is a place for multiple approaches to achieving investment and development of rail in Australia. This could be through public, private or PPP funding and at either a state government or Australian Government level. No matter what the investment approach taken is, coordination is highly desirable and a national approach to rail is warranted.

The most prominent involvement of State governments has been in metropolitan rail. Metropolitan rail networks play a vital role in moving people and goods through Australia's largest cities and are the point where most Australian's directly feel the benefits of rail transport. State governments, through their metropolitan plans, therefore have an essential role to play in ensuring investments in rail infrastructure are made which keep pace with their growing cities and capture the full range of benefits that rail offers (including social inclusion, reduced congestion, reduced road accidents and reduced pollution).

In addition to making investments in rail, state governments can also focus on addressing existing inefficiencies in the pricing of road transport. This process is beginning with the CRRP and attempts to ensure that heavy road freight vehicles are covering the costs they

create. Following on from this, further reforms could be made to charge a per container levy on freight movements, to reflect the external costs such as congestion, created by road transport. This could then transition towards charging freight movements based on the use of arterial roads and finally towards mass-distance charging. Analogously in passenger transport would be movements towards congestion charging by initially having time of day tolls on arterial roads.

The Australian Government has a critical role to play in determining the future of rail in Australia. Being less focused on the operation and maintenance of rail networks themselves frees the Australian Government to take on a coordination and leadership role as well as their central funding role.

In terms of leadership, the Australian government can focus its own policies on rail and drive states towards a focus on rail through, for example, continued investigation of new rail developments and planning strategies, such as the national urban policy, which give rail a central role in meeting transport demand. The Australian Government is already playing a strong role here, with recent support for rail voiced in the national port strategy and a forthcoming land freight strategy as well as work being undertaken by CRRP. A greater sense of urgency is, however, required as Australia is currently at a point where well selected policy decisions could lead to rail playing a far larger role in meeting Australia's transport task.

In terms of funding, ideally, the benefits of rail (such as reducing congestion, carbon emissions and accidents) would be directly internalised using policy options such as carbon pricing, congestion charges and accurate vehicle registration fees. This approach is unlikely to be fully implemented in the short term and so a second best approach is for the Australian Government to take into account the full benefits of rail when considering which investments to support. This would involve fully accounting for all the benefits of rail when comparing investments in different modes of transport. This is, to a certain extent, already done but could be made more central to government considerations and more rigorous. A more straightforward version of this is to ensure that transport infrastructure investments are compared on a consistent basis. That is, the full costs of one investment should be weighed against the full costs of the alternative. For example, an investment in road based transport, such as buses, should account for ongoing road infrastructure and maintenance costs.

Funding from the Australian Government is also important in overcoming myopic investments. Given the past pattern of transport investment in Australia it is often the case that an incremental investment in road seems more appealing than an investment in rail. Following along this path will only lock Australia in more closely with road transport and will miss the opportunities presented by making use rail transport.

A series of bold and innovative policy options should be considered. Over the very short term, the CRRP process should be strongly pursued and supported with a goal of more closely tying truck operating costs to the actual costs they create (including damage to road infrastructure, emissions, accidents and noise).

In the coming years, allocating some of the funds from a carbon tax to the development of public transport networks could present a particularly appealing policy. Using funds from a carbon tax to invest in sustainable transport infrastructure would not only help to reduce the carbon emissions from transport, and hence reduce its costs, but, by creating

more useful public transport options, would also help to reduce congestion and accident costs. Funds raised through a carbon tax also create fewer economic distortions than funds raised through other taxes. This is because a carbon tax affects economic activity by reducing a damaging behaviour (polluting) while other taxes tend to affect the economy by reducing a beneficial behaviour (production, employment, consumption). It has been proposed that a 'double dividend' could be achieved by using the funds raised from a carbon tax to reduce other, less efficient, taxes. However, a 'double dividend' could also be achieved by investing in rail infrastructure which reduces costs related to accidents and congestion.

In the longer term, introducing congestion charging in Australia's capital cities and levying a per tonne charge on road freight transport within cities should be seen as overall policy goals. A congestion charge has similar goals to a carbon tax, making those who create costs bear them. Congestion charging would work by having a charge for the use of a road which varies based on how congested the road is. Ideally the price would be set to equal the additional time costs that each driver entering the road creates for other drivers using the road. Although a large departure from how roads are currently priced in Australia, much of the infrastructure required for congestion pricing is already established. Many cars are already equipped for electronic tolling and many arterial roads already being toll roads. There is also rudimentary congestion pricing in effect with time of day tolling on the Harbour Bridge. Implementation of congestion charging is therefore more likely to be a question of political will and whether the benefits outweigh the costs of implementation rather than technical feasibility.

Levying a per tonne charge on road transport within cities is a move towards a long term goal of mass-distance pricing for road freight. Mass-distance pricing is the most desirable method to more closely tie truck operating costs to the true costs they create. A per tonne charge would account for mass while confining the charge to arterial toll roads would allow for distances to be estimated. Implementation of mass-distance pricing is hampered by a lack of data (and data gathering methods) for both road freight distance and weight. If implemented, a per tonne charge on road transport could be used to both internalise the damage that heavy road vehicles cause to the road as well as other externalities associated with road transport, such as carbon pollution, accidents and noise.

Overall, there is a key role for rail to play in the future of Australia's transport system. This role will be growing over time as the size and density of our cities as well as the amount of freight moved around the country increases. Policy makers will have a decisive role in determining the success of rail transport due to decisions about the future of our cities' density and sprawl, reserving right-of-way and providing funding for infrastructure investment. Policy makers must focus on the true value of rail. If the true value of rail is not taken into consideration then there will be underinvestment in Australia's rail infrastructure and underdevelopment of the rail network. This would tie Australia further in to road based transport and would not allow the realisation of increasing returns to scale, environmental, productivity and social gains that could be seen if rail networks were encouraged to grow.

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Appendix A: Overview of TRESIS

This appendix is derived from Hensher (2004).

The Transport and Environmental Strategic Impact Simulator (TRESIS) is a microsimulation package, developed at the Institute of Transport and Logistics Studies (ITLS), part of the University of Sydney. It is designed as a policy advisory tool to evaluate, at a strategic level, the affect of policy instruments on urban passenger travel behaviour and the environment. Versions of TRESIS have been developed which can be applied to Canberra, Sydney, Melbourne, Brisbane, Adelaide, and Perth.

As an integrated model of many aspects of household decision making such as location of home and work as well as vehicle stock, TRESIS offers users the ability to analyse and evaluate a variety of land use, transport, and environmental policy strategies or scenarios for urban areas.

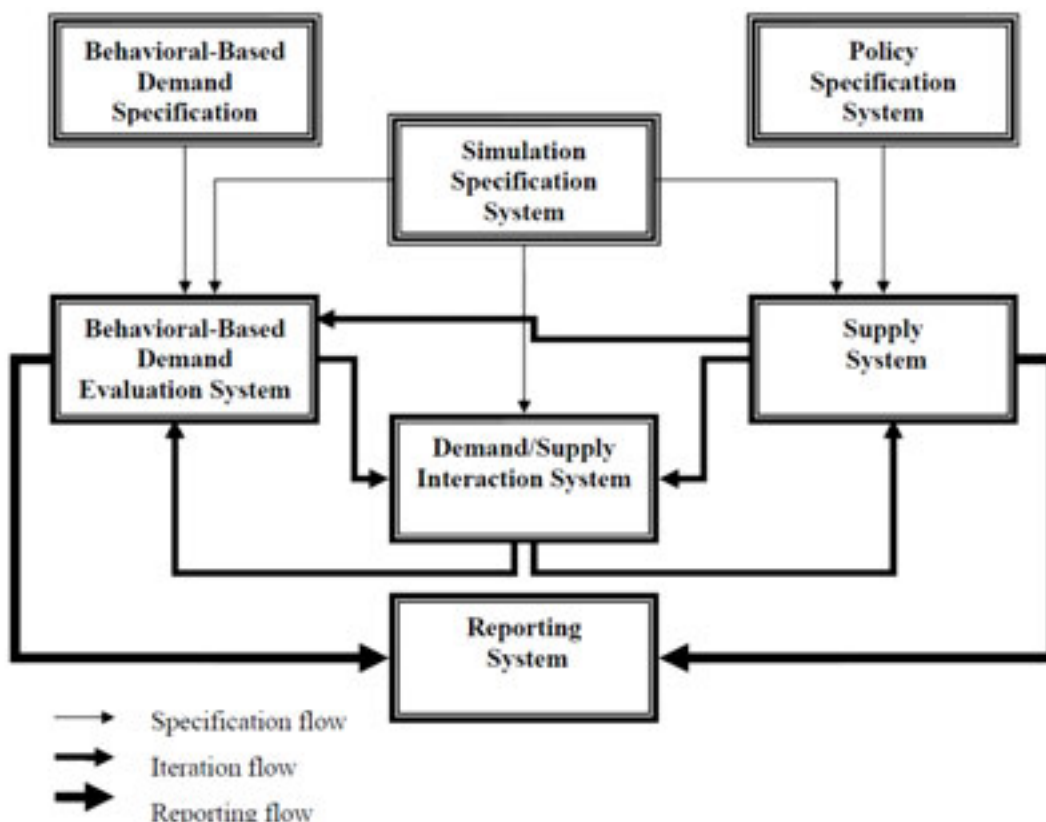
The behavioural engine of TRESIS encompasses key household, individual, and vehicle-related decisions; in particular:

- where a household chooses to locate;
- the type of dwelling to live in;
- where the workers from that household will work;
- the household's number and type of vehicles;
- the means of travel; and
- the time of travel.

From this a range of economic and environmental impacts are estimated on a year by year basis. The results of a base case scenario are used as references to compare with those of the policies and projects to be tested. The system generates a number of performance indicators to evaluate these effects in terms of economic, social, environmental and energy impacts.

TRESIS is structured around seven key systems, set out in the diagram below.

Figure A.1: TRESIS' component systems



Source: Hensher (2004)

Simulation specification system

This system provides a means for users of TRESIS to control factors such as:

- the types, sources, and locations of input and output from TRESIS;
- the heuristic rule for accommodating the temporal adjustment process;
- the number of future years to be simulated from the present year; and
- the specification to control the calibration and iteration process of TRESIS run.

The heuristic rule for accommodating the temporal adjustment process needs to be clarified. The model system in TRESIS is static and hence produces an instantaneous fully adjusted response to a policy application. In reality, choice responses take time to fully adjust, with the amount of time varying by specific decision. We expect that it would take longer for the full effect of the change in residential location to occur and much less time for departure time and even choice of transport mode. TRESIS allows users to impose a discount factor that establishes the amount of a change in choice probability that is likely to be taken up in the first year of a policy. It removes the rest of the change and uses the new one-year adjustment as the starting position for the next year.

Behavioural demand specification system

This system provides the household characteristics data and model formulation for the behavioural demand evaluation system of TRESIS. It contains a module for constructing a

synthetic household database as well as a suite of utility expressions representing the behavioural system of choice models for individuals and households. These models are based on mixtures of revealed and stated preference data. Each synthetic household carries a weight that represents its contribution to the total population of households. Through time TRESIS carries forward the base year weights or, alternatively, modifies the weights to represent the changing composition of households in the population.

Households adjust their residential location in response to changes in the transport system and for other reasons. Consequently any one of a number of strategies can influence the probability of a household both living in a particular location and the type of dwelling they choose to occupy. At any point in time there will be a total demand for dwelling types in each residential location. Excess demand will result in an increase in location rents and dwelling prices; excess supply will result in a reduction in the respective rents and prices. In TRESIS, dwelling prices are used to clear both the market for dwelling types and location.

Disequilibrium is allowed for when an injection of new dwellings creates excess supply given the number of households. Any additional dwellings will be left vacant in the particular year as an indication that property developers may have created too much stock at that time. In future years as households grow the take up rate increases without creating increases in dwelling prices until the market is cleared.

Supply system

This system contains four key databases:

- the transport network database (with different levels of service for each time of day for each of six main modes of transport including drive alone, ride share, train, bus, light rail and busway)
- the land-use zone database (with attributes such as number of different dwelling types and associated prices, number of jobs, etc.);
- automobile technology or vehicle database (number of different vehicle types and associated performance and energy indicators); and
- the policy and environment parameters database (carbon contents in petrol, diesel, CNG and electric vehicles and others).

Key attributes (such as travel times for different times of the day, demand level and associated prices of housing) of transport network and zone databases are updated dynamically at run time during the calibration process to reflect the impact of the demand system on the supply system. In return, the newly updated attributes of the supply system will have an impact on the behavioural demand evaluation system. The iterative control process is handled by the demand/supply interaction system.

Policy specification system

A rich array of policy instruments is supported in TRESIS, such as new public transport, new toll roads, congestion pricing, gas guzzler or greenhouse gas taxes, changing residential densities, introducing designated bus lanes, implementing fare changes, altering parking policy, introducing more flexible work practices, and the introduction of more fuel efficient vehicles.

The policy specification system employs a graphical and map-based (Map Objects) user interface to translate a single or mixture of policy instruments into changes in the supply system.

Behavioural demand evaluation system

Given the input from the behavioural demand specification system and the supply system, the characteristics of each synthetic household are used to derive the full set of behavioural choice probabilities for the set of travel, location and vehicle choices and predictions of vehicle use.

Demand/Supply interaction system

This system contains three key procedures to control or equilibrate the three different types of interactions between demand and supply. The key mechanism for driving these three procedures is the level of interaction between demand and supply.

The three procedures are:

- Equilibration in the residential location and dwelling type market involves establishing total demand for different dwelling types in each residential location calculated at any point in time. Excess demand will result in an increase in location rents and dwelling prices. In TRESIS, prices for different dwelling types are used to clear the markets for dwelling types and locations, in the absence of data on location rents.
- For equilibration in the automobile market: a vehicle price relative model is used to determine the demand for new vehicles each year. This model controls the relativities of vehicle prices by vintage via given exogenous new vehicle prices. A vehicle scrappage model is used only to identify the loss of used vehicles consequent on vintage and used vehicle prices, where the latter are fixed by new vehicle prices in a given year. The supply of new vehicles is determined as the difference between the total household demand for vehicles and the supply of used vehicles after application of the scrappage model based on used vehicle prices.
- For equilibration in the travel market: households might adjust their route choices between origin and destination, or trip timing and/or mode choice in response to changes in the transport system, particularly the travel time and cost values between different origins and destinations. In other words, different households can have different choices in responding to changes in different levels of service at different times of day.

Output

TRESIS provides a comprehensive set of outputs representing performance indicators such as impacts on greenhouse gas emissions, accessibility, equity, air quality and household consumer surplus. The output is in the format of summary tables cross-tabulated by household types, household incomes and residential zones and in more detailed format by origin and destination, by different times of day and by different simulation years.

Appendix B: Approach to identifying congestion externalities

The most useful data available from TRESIS for attempting to estimate rail transport externalities is:

- total travel time; and
- annual number of journeys by each mode.

Generally we can say that travel time is an increasing function of journeys by both road and rail. Considering congestion, there should be a quadratic relationship between the number of journeys and total travel time; this is because each additional road user will generate congestion externalities which increase the average travel time for all other road users. In contrast, the relationship between total travel time and the number of train journeys should be linear as the central organisation of the train system should be able to manage additional journeys.

This leads to the following functional form for a relationship between the number of journeys and total travel time:

$$\text{Total travel time} = \beta_1 * (\text{rail journeys}) + \beta_2 * (\text{road journeys}) + \beta_3 * (\text{road journeys})^2$$

This parameterisation allows the identification of average journey time for the different modes of transport. For rail, the average journey time is given by β_1 while for road the average journey time is:

$$(\beta_2 * (\text{road journeys}) + \beta_3 * (\text{road journeys})^2) / (\text{road journeys})$$

Here, average road travel time depends on the number of road journeys, this reflects the congestion externality.

Using output from TRESIS on how people change their transportation decisions when the train fare is increased or decreased, the parameters (β_1 , β_2 and β_3) can be extracted using ordinary least squares regression.

Once these parameters have been extracted, we can then carry out the thought experiment of moving one person from road to rail transport

$$\text{Total travel time}_{\text{base}} = \beta_1 * (\text{rail journeys}) + \beta_2 * (\text{road journeys}) + \beta_3 * (\text{road journeys})^2$$

$$\text{Total travel time}_{\text{experiment}} = \beta_1 * (\text{rail journeys} + 1) + \beta_2 * (\text{road journeys} - 1) + \beta_3 * (\text{road journeys} - 1)^2$$

We can then find the different in total travel time

$$\text{Total travel time}_{\text{experiment}} - \text{Total travel time}_{\text{base}}$$

This difference is made up of three components, the increase in rail travel time for the passenger that has been shifted, the decrease in their road travel time and the decrease in other people's road travel times. We can identify these three components as:

$$\text{Average increase due to own shift to rail} = \beta_3$$

$$\text{Average decrease due to own shift from road} = -(\beta_1 * x + \beta_2 * x^2) / x$$

This leaves an amount which is unaccounted for, the externality on other road users.

This approach gives the following results

Table B.1: Congestion externality modelling results

City	β_1	β_2	β_3
Sydney	56.56	54.26	4.27×10^{-8}
Melbourne	71.69	32.59	3.68×10^{-8}
Brisbane	67.22	26.53	2.89×10^{-8}
Perth	57.94	21.94	4.59×10^{-8}

Note: All β s are statistically significant at the 1% level of significance

Limitation of our work

General use restriction

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PIPELINE OF OPPORTUNITIES

RAIL'S LONG-TERM PLAN FOR

A BETTER FUTURE

Rail has a crucial role to play in building a better future for Australia and New Zealand. It can help make both countries more productive, more competitive, more liveable and more sustainable.

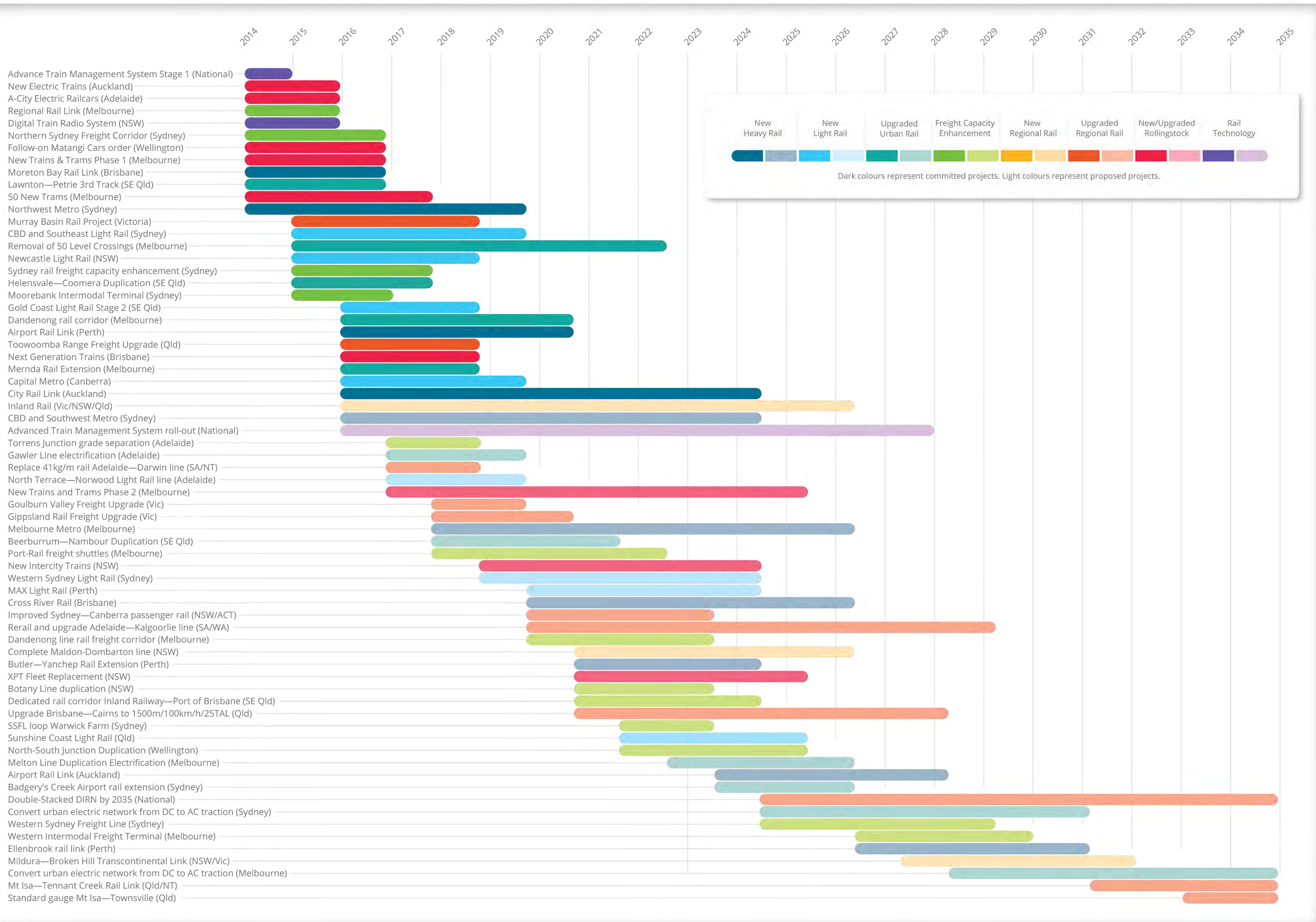
The development of this 'Pipeline of Opportunities' document provides political leaders and key decision makers with a visual representation of the rail industry's pipeline of projects from today out to the mid-2030s. The 'Pipeline of Opportunities' can better inform political leaders and other key decision makers on planning the future directions for infrastructure investment beyond the short-term electoral cycle. This long-term vision means, however, that some projects, while committed, are not fully funded by governments, while some planned projects remain largely conceptual.

The rail industry already makes a significant contribution to our economies and societies. In Australia alone, the rail industry generates annual revenues of over \$4.2 billion and directly or indirectly supports over 110,000 jobs — mostly locally-owned small and medium enterprises. Rail's extensive local industry network is engaged in producing advanced manufactured goods and professional services.

Rail provides an efficient and sustainable alternative to car-based transport in Australian and New Zealand cities. It provides the lowest cost land transport mode for long-distance freight movements and, increasingly lower cost transport for short-haul freight movements to and from our major ports.

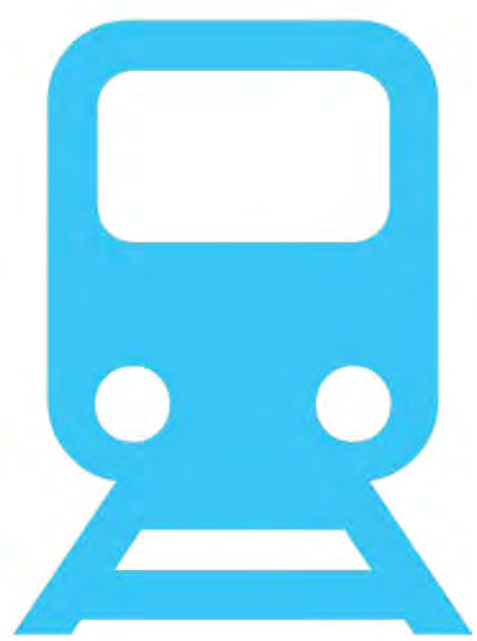
Making major public policy decisions and building rail infrastructure are both long-term projects that will shape our two countries' futures for decades to come. This is why the ARA has developed this strategy through consultation with its board and its members and a deep analysis of the long-term issues critically affecting the industry.

For many years, the rail industry has been rightly or wrongly criticised as not having 'plans in the drawer'. In developing the 'Pipeline of Opportunities' document, the ARA and its members are determined to show the rail industry is progressive, forward thinking and prepared to chart a course for the rail industry's future, rather than let it be shaped by external forces.

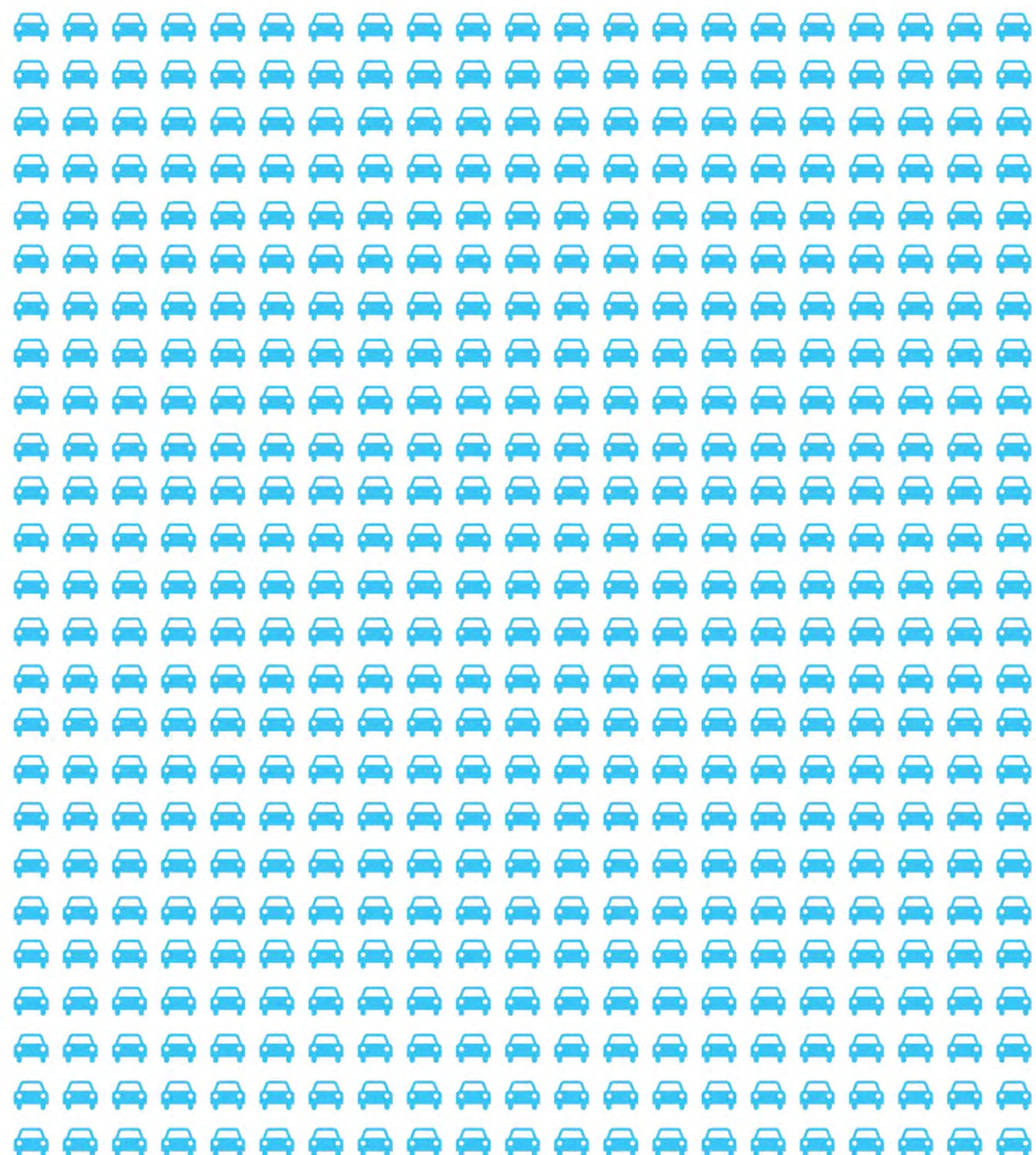


DID YOU KNOW?

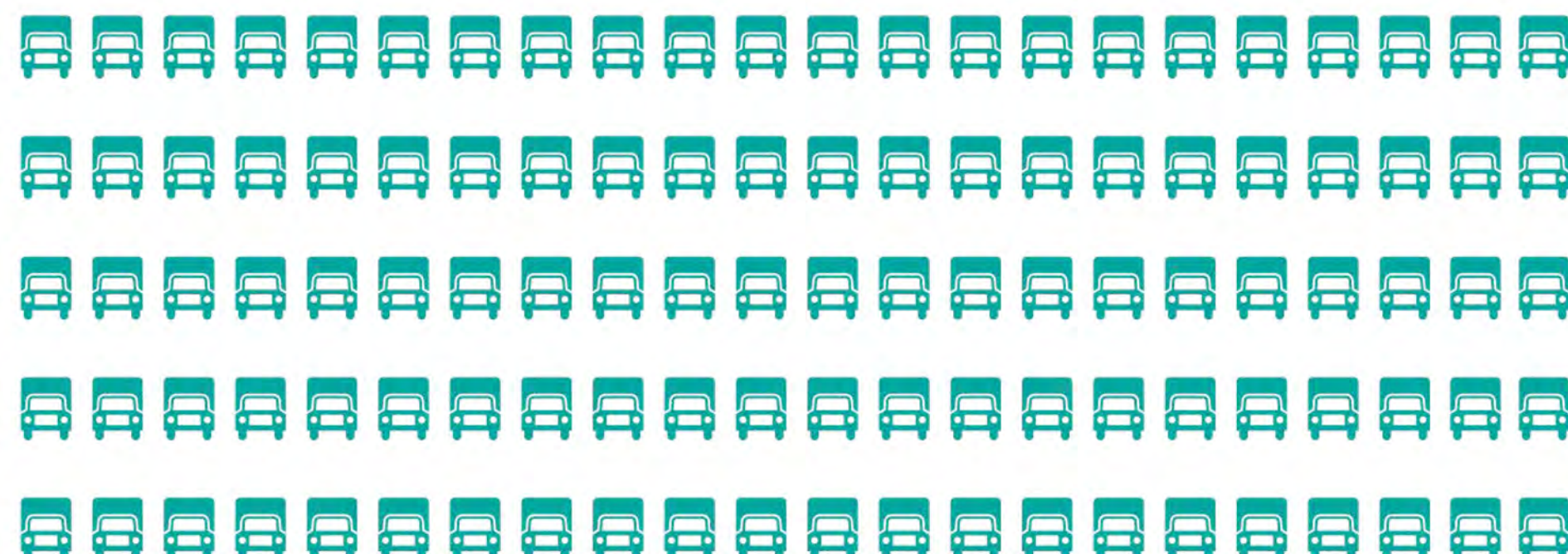
1 FREIGHT TRAIN TRAVELLING BETWEEN MELBOURNE AND BRISBANE **REDUCES CARBON EMISSIONS** BY THE SAME AMOUNT AS PLANTING **600 HECTARES OF TREES.**



1 PASSENGER TRAIN TAKES THE EQUIVALENT OF **525 CARS** OFF THE ROAD



THE **AVERAGE FREIGHT TRAIN** TAKES **110 TRUCKS** OFF THE ROAD



THERE ARE OVER **770 MILLION PASSENGER JOURNEYS** PER ANNUM GROWING AT **60K EVERY WEEK.**

Australian Infrastructure Plan

The Infrastructure
Priority List

Project and Initiative Summaries
February 2016



Infrastructure Australia is an independent statutory body that is the key source of research and advice for governments, industry and the community on nationally significant infrastructure needs.

It leads reform on key issues including means of financing, delivering and operating infrastructure and how to better plan and utilise infrastructure networks.

Infrastructure Australia has responsibility to strategically audit Australia's nationally significant infrastructure, and develop 15 year rolling infrastructure plans that specify national and state level priorities.

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The Infrastructure Priority List

Better infrastructure planning supports better decision making, and better decisions support better outcomes. The Infrastructure Priority List is a platform for better infrastructure decisions. It provides rigorous, independent advice to governments and industry on the infrastructure investments Australia needs over the next 15 years.

Since its establishment in 2008, Infrastructure Australia has undertaken robust, independent assessments of infrastructure proposals and provided clear advice to governments on priorities for investment. This process has supported an improvement in the quality of infrastructure planning and proposal development across Australia.

Establishing visibility of Australia's infrastructure priorities is important for governments, investors, industry and the community. It can promote confidence in the economy, guide decisions on how to allocate resources, reduce the cost of infrastructure provision and help to retain specialist skills by providing industry with a clear forward program of works.

The Infrastructure Priority List is not static. It will evolve over time to meet new challenges, to respond to changing needs, and to take advantage of emerging opportunities.

Alongside the Australian Infrastructure Plan, the Infrastructure Priority List represents a clear strategic direction and guidance to decision makers on the reforms and investments that will underpin Australia's continued prosperity.

How the Infrastructure Priority List has been developed

The *Australian Infrastructure Audit* and the *Northern Australia Audit*, both released in May 2015, provided the first ever national, independent review of the infrastructure we have, and the infrastructure we will need over the coming decades. The Audits helped to identify the nationally significant challenges and opportunities we must address and embrace to remain an efficient, competitive and agile economy.

Using the *Australian Infrastructure Audit* and *Northern Australia Audit* as the primary evidence base, Infrastructure Australia has undertaken a 'top-down' assessment of our infrastructure gaps and requirements. Extensive consultations with all states and territories, industry and the community have also provided a 'bottom-up' view of both the challenges and the potential solutions. Where a nationally significant problem has been identified, but a proposal to address it has not yet been developed, this is acknowledged in the List. Infrastructure Australia will continue to work with jurisdictions and proponents to evaluate these problems and develop solutions. This approach acknowledges that



everyone has a role to play in shaping our infrastructure future, and collaboration will be fundamental to shaping our response to the challenges of growth.

Through early engagement, Infrastructure Australia aims to stimulate and support high quality proposal development and decision making – from problem identification, to option and business case development, project funding, delivery and operation.

All inclusions on the Infrastructure Priority List have been assessed by the Infrastructure Australia Board, through a transparent Assessment Framework. The Assessment Framework, which is published on the Infrastructure Australia website, allows the Board to evaluate a proposal's strategic fit, economic viability and deliverability.

In preparing the Infrastructure Priority List, Infrastructure Australia has emphasised the need for robust, evidence-based analysis. The List has been developed in collaboration with governments and industry wherever possible, while retaining Infrastructure Australia's objectivity and independence.

Decisions about funding infrastructure investments are ultimately made by governments and private sector proponents. The Infrastructure Priority List does not provide specific funding recommendations to infrastructure providers, nor does it endorse particular investments by a particular government. Rather it sets out a detailed, independent and transparently-evaluated view of opportunities to deliver a better infrastructure future.

How to read the Infrastructure Priority List

The Infrastructure Priority List is designed to give structured guidance to decision makers, visibility to industry and transparency for the community. It is a 'rolling' list which will be updated periodically as proposals move through stages of development and delivery and to respond to emerging challenges and opportunities.

Inclusions on the Infrastructure Priority List range from the description of a problem through to fully developed solutions. This breadth of content requires classifications to differentiate between ideas which are in their infancy and address a problem or opportunity of national significance, through to those which are more developed. The List also needs to reflect the scale of the challenge or opportunity being addressed. For instance, an idea may be in its infancy, but the challenge it addresses is substantial – decision makers need this information to determine how and when funding is allocated.

To meet this challenge, the Infrastructure Priority List contains two broad groupings:

- **Initiatives:** priorities that have been identified to address a nationally significant need, but require further development and rigorous assessment to determine and evaluate the most appropriate option for delivery; and
- **Projects:** priorities that have undergone a full business case assessment by Infrastructure Australia and that will address a nationally significant problem and deliver robust economic, social or environmental outcomes.

Initiatives or projects that address major problems or opportunities of national significance are highlighted as *High Priority*, to focus decision makers' attention on the most significant problems, where delivery of an effective solution will be critical.

High Priority projects and initiatives appear at the top of their respective categories. Within these two categories, initiatives and projects are not ranked. Instead they are ordered by the category of problem they address, then by location and by timeframe. Initiatives are further classified by their current stage of development.

Each project and initiative on the Infrastructure Priority List includes a broad indication of timeframe.

For projects, the timeframe provides the proponent's indication of when the project is likely to be delivered.

For initiatives, the timeframe indicates when the problem is likely to have a material impact on national productivity. In both instance, these timeframes are defined as:

- Within 5 years (near-term);
- Within 10 years (medium-term);
- Within 15 years (longer-term); and
- Expected to be more than 15 years (future).

To reflect those initiatives and projects which have progressed through the Infrastructure Priority List, Infrastructure Australia publishes a separate list of projects that were previously on the List, and are now being delivered or have been completed. Projects will normally remain on the List until construction or delivery is underway.

Infrastructure Priority List:

High Priority Projects

Problem category	Location	Proponent's proposed delivery timescale ¹	Problem description	Proposed project
Urban Congestion	Vic	Near term	Connectivity between Melbourne Airport and CBD	CityLink-Tullamarine Widening ²
National Connectivity	WA	Near term	Perth freight network capacity	Perth Freight Link

Priority Projects

Problem category	Location	Proponent's proposed delivery timescale ¹	Problem description	Proposed project
None currently*				

*Infrastructure Australia is currently assessing a number of proposed projects submitted by states and territories. These are listed in Appendix B. Projects which are positively assessed by Infrastructure Australia will be added to subsequent updates of the IPL.

¹ Proponent's Proposed Delivery Timescale refers to the timescale in which the proponent is proposing to deliver the project:

Near term: within 5 years | Medium term: within 10 years | Longer term: within 15 years

² Construction of Stage 2 was yet to commence at the time of assessment

Infrastructure Priority List:

High Priority Initiatives

Problem category	Location	Problem timescale ³	Initiative development stage	Problem description	Proposed initiative
Urban Congestion	NSW	Near term	Business case development	Sydney rail network capacity	Sydney Metro (high frequency rail connection from Chatswood to Bankstown via Sydney CBD)
Urban Congestion	NSW	Near term	Business case development	Sydney corridor congestion: Northern Beaches, Parramatta Road, Victoria Road	Bus Rapid Transport: Northern Beaches, Parramatta Road, and Victoria Road
Urban Congestion	NSW	Near term	Business case development	Sydney inner west road congestion	WestConnex Stage 3 road connection from M4 to M5
Urban Congestion	NSW	Near term	Business case development	Connectivity in outer western Sydney	M4 motorway upgrade (Parramatta to Lapstone)
Urban Congestion	NSW	Medium term	Business case development	Connection between inner south urban growth area and Sydney CBD	Southern Sydney to CBD public transport enhancement
Urban Congestion	Qld	Near term	Business case development	Brisbane CBD public transport capacity	Cross River Rail (passenger rail connection to and through Brisbane CBD)
Urban Congestion	Qld	Near term	Business case development	Southern Brisbane-Ipswich road network capacity	Ipswich Motorway Rocklea-Darra
Urban Congestion	SA	Near term	Business case development	Adelaide outer north east suburbs access to CBD	Gawler Line rail upgrade*
Urban Congestion	Vic	Near term	Business case development	Connectivity between Eastern Freeway and Melbourne CBD	Hoddle Street capacity upgrade*
Urban Congestion	Vic	Near term	Business case development	Melbourne outer south east suburbs access to CBD	Cranbourne-Pakenham rail line upgrade*
Urban Congestion	Vic	Near term	Business case development	Melbourne rail network capacity	Melbourne Metro Rail (Melbourne CBD rail simplification and capacity upgrade)
Urban Congestion	Vic	Near term	Business case development	Connectivity between West Gate Freeway and Port of Melbourne and CBD North	Road connection between West Gate Freeway and Port of Melbourne and CBD North
Urban Congestion	Vic	Near term	Business case development	Melbourne M80 Western Ring Road congestion	M80 Western Ring Road upgrade
Urban Congestion	Vic	Near term	Business case development	Melbourne south east road network congestion	Cranbourne-Pakenham level crossings removal

³ Problem Timescale refers to the timescale in which a problem is likely to have a material impact on national productivity: Near term: within 5 years | Medium term: within 10 years | Longer term: within 15 years

* Initiative includes a significant 'better use' component

‡ Infrastructure Australia Audit identified gap

Problem category	Location	Problem timescale ³	Initiative development stage	Problem description	Proposed initiative
Urban Congestion	Vic	Near term	Initiative development	Connectivity between Melbourne's Eastern Freeway and CityLink	Improve the connection between Eastern Freeway and CityLink [‡]
Urban Congestion	WA	Near term	Options assessment	Perth northern corridor capacity	Perth CBD-north corridor capacity [‡]
Urban Congestion	National	Near term	Initiative development	National urban road network congestion	Network Optimisation Portfolio ^{* ‡}
National Connectivity	NSW	Near term	Business case development	Sydney Port Botany Rail freight capacity	Port Botany freight rail duplication
National Connectivity	NSW	Near term	Business case development	Sydney freight rail network capacity	Chullora Junction upgrade
National Connectivity	NSW	Near term	Business case development	Sydney road network capacity: Port Botany and Airport to WestConnex	Connection from Port Botany and Sydney Airport to WestConnex at St Peters
National Connectivity	NSW	Longer term	Business case development	Sydney aviation capacity	Western Sydney Airport
National Connectivity	Qld	Near term	Options assessment	Freight rail access to Port of Brisbane	Port of Brisbane dedicated freight rail connection [‡]
National Connectivity	National	Near term	Initiative development	National strategic planning for future freight initiatives	National Freight and Supply Chain Strategy [‡]
Corridor Preservation	NSW	Near term	Options assessment	Future connectivity between Western Sydney and Central Coast/Illawarra	Preserve corridor for Outer Sydney Orbital road and rail / M9
Corridor Preservation	NSW	Near term	Options assessment	Future fuel connection to Western Sydney Airport	Preserve corridor for Western Sydney Airport fuel pipeline
Corridor Preservation	NSW	Near term	Options assessment	Future rail connection to Western Sydney Airport	Preserve corridor for Western Sydney Airport rail connection
Corridor Preservation	NSW	Near term	Options assessment	Future freight rail bypass of Newcastle urban area	Preserve corridor for Lower Hunter freight rail realignment
Corridor Preservation	NSW	Near term	Options assessment	Future freight rail capacity to Eastern Creek intermodal and Sydney Main West Line	Preserve corridor for Western Sydney Freight Line and Intermodal Terminal access
Corridor Preservation	Vic	Near term	Business case development	Future connectivity between Melbourne outer south west and outer north	Preserve corridor for Melbourne Outer Metropolitan Ring Road/E6 [‡]
Corridor Preservation	National	Near term	Business case development	Future connectivity between east coast capital cities	Preserve corridor for East Coast High Speed Rail [‡]

³ Problem Timescale refers to the timescale in which a problem is likely to have a material impact on national productivity:

Near term: within 5 years | Medium term: within 10 years | Longer term: within 15 years

* Initiative includes a significant 'better use' component

‡ Infrastructure Australia Audit identified gap

Infrastructure Priority List:

Priority Initiatives

Problem category	Location	Problem timescale ³	Initiative development stage	Problem description	Proposed initiative
Urban Congestion	NSW	Near term	Business case development	Inner city access to Sydney CBD	Active transport (walking and cycling) access to Sydney CBD
Urban Congestion	NSW	Near term	Initiative development	Connectivity between Parramatta - Sydney CBD	Western line CBD to Parramatta upgrade [‡]
Urban Congestion	NSW	Medium term	Options assessment	Public transport access to Parramatta CBD	Public transport access to Parramatta CBD
Urban Congestion	NSW	Medium term	Options assessment	Connectivity between Wollongong – Sydney CBD	Extend M1 from Waterfall to Sydney motorway network
Urban Congestion	NSW	Longer term	Options assessment	Sydney road network cross-harbour and Northern Beaches connectivity	WestConnex Stages 4a and 4b: Western Harbour Tunnel and Beaches Link
Urban Congestion	Qld	Near term	Business case development	Gold Coast transport capacity	Gold Coast Light Rail – Stage 2 (connecting existing Gold Coast light rail to Brisbane heavy rail at Helensvale)
Urban Congestion	Qld	Near term	Business case development	Road network capacity Brisbane – Gold Coast	M1 Pacific Motorway - Gateway Motorway merge upgrade
Urban Congestion	Qld	Near term	Business case development	M1 Pacific Motorway capacity	M1 Pacific Motorway upgrade – Mudgeeraba to Varsity Lakes
Urban Congestion	SA	Near term	Business case development	Adelaide north-south urban road network capacity	Adelaide north-south corridor upgrade (remaining sections)
Urban Congestion	SA	Medium term	Options assessment	Adelaide public transport capacity	AdeLINK Tram Network (Adelaide tram network expansion)
Urban Congestion	Vic	Near term	Business case development	Melbourne urban road network congestion	Melbourne level crossings removal
Urban Congestion	Vic	Medium term	Initiative development	Access to Melbourne airport	Melbourne Airport to CBD public transport capacity [‡]
Urban Congestion	Vic	Medium term	Initiative development	Melbourne outer western suburbs access to CBD	Melton Rail Line upgrade ^{**}
Urban Congestion	Vic	Medium term	Initiative development	Connectivity between M80 and Eastlink in outer NE Melbourne	Complete Metro Ring Road from Greensborough to the Eastern Freeway [‡]
Urban Congestion	Vic	Longer term	Initiative development	Melbourne outer northern suburbs access to CBD	Melbourne outer northern suburbs to CBD capacity upgrade [‡]

³ Problem Timescale refers to the timescale in which a problem is likely to have a material impact on national productivity:

Near term: within 5 years | Medium term: within 10 years | Longer term: within 15 years

* Initiative includes a significant 'better use' component

‡ Infrastructure Australia Audit identified gap

Problem category	Location	Problem timescale ³	Initiative development stage	Problem description	Proposed initiative
Urban Congestion	WA	Near term	Business case development	Public transport access to Perth airport	Perth – Forresterfield Airport Rail Link
Urban Congestion	WA	Medium term	Initiative development	Perth urban road network capacity	Perth major east-west and southern corridor capacity upgrades ‡
Urban Congestion	ACT	Medium term	Options assessment	Canberra CBD to north transport corridor congestion	Canberra CBD to north corridor
Urban Congestion	ACT	Medium term	Options assessment	Canberra public transport capacity	Canberra public transport improvements
National Connectivity	NSW	Near term	Business case development	Melbourne – Brisbane connectivity	Newell Highway upgrade
National Connectivity	NSW	Medium term	Business case development	Sydney – Brisbane connectivity	New England Highway upgrade
National Connectivity	NSW	Near term	Business case development	Sydney – Brisbane connectivity	Pacific Highway (A1) - Coffs Harbour Bypass Stage 1
National Connectivity	NSW	Near term	Business case development	Sydney – Brisbane connectivity	Pacific Highway (M1) – extension to Raymond Terrace Stage 1
National Connectivity	NSW	Near term	Business case development	Access to Western Sydney and Western Sydney Airport	Western Sydney roads upgrade ‡
National Connectivity	NSW	Near term	Business case development	Freight rail access to Port Kembla	Freight rail access to Port Kembla
National Connectivity	NSW	Near term	Options assessment	Road network connectivity to Moorebank Intermodal Terminal	Moorebank Intermodal Terminal road connection upgrade
National Connectivity	NSW	Longer term	Business case development	Sydney freight rail network capacity	Northern Sydney Freight Corridor Stage 2 (additional track West Ryde to Rhodes and Thornleigh to Hornsby)
National Connectivity	NSW	Longer term	Business case development	Sydney South to Moorebank rail freight capacity	Southern Sydney Freight Line upgrade
National Connectivity	NSW	Longer term	Options assessment	Freight rail capacity constraint in suburban Newcastle	Lower Hunter freight corridor construction
National Connectivity	NSW	Longer term	Options assessment	Connectivity between Newcastle, Wollongong and Sydney CBD	Newcastle – Sydney and Wollongong – Sydney rail line upgrades
National Connectivity	NSW	Longer term	Options assessment	Access to Western Sydney Airport	Western Sydney Airport public transport connection
National Connectivity	Qld	Near term	Various stages	Queensland coastal cities connectivity	Bruce Highway upgrade
National Connectivity	Qld	Near term	Business case development	Queensland north coast rail congestion	Beerburrum to Nambour rail upgrade

³ Problem Timescale refers to the timescale in which a problem is likely to have a material impact on national productivity:

Near term: within 5 years | Medium term: within 10 years | Longer term: within 15 years

* Initiative includes a significant 'better use' component

‡ Infrastructure Australia Audit identified gap

Problem category	Location	Problem timescale ³	Initiative development stage	Problem description	Proposed initiative
National Connectivity	Qld	Medium term	Options assessment	Land and sea access to Port of Gladstone	Gladstone Port land and sea access upgrade
National Connectivity	Qld	Medium term	Business case development	Mt Isa – Townsville rail capacity	Mount Isa – Townsville rail corridor upgrade
National Connectivity	Qld	Near term	Business case development	Cunningham Highway – Yamanto to Ebenezer/ Amberley congestion	Cunningham Highway – Yamanto to Ebenezer/ Amberley upgrade
National Connectivity	SA	Near term	Business case development	Access to Cooper Basin (South Australia)	Strzelecki Track sealing and mobile coverage
National Connectivity	SA	Medium term	Business case development	South Australia bulk port capacity	South Australian regional mineral port development
National Connectivity	SA	Medium term	Options assessment	South Australia road freight network capacity	Sturt Highway High Productivity Vehicle capacity enhancement, including Truro bypass
National Connectivity	SA	Medium term	Options assessment	Freight rail connection to Gawler Craton mineral province	Gawler Craton rail access
National Connectivity	SA	Longer term	Options assessment	Freight connectivity Melbourne – Perth	Melbourne – Adelaide – Perth rail upgrade
National Connectivity	Tas	Medium term	Options assessment	Tasmania Derwent River crossing capacity	Derwent River crossing capacity
National Connectivity	Tas	Medium term	Options assessment	Tasmania freight network planning	Burnie to Hobart freight corridor strategy
National Connectivity	Vic	Near term	Business case development	Freight rail connection Murray Basin to Ports of Geelong and Portland	Murray Basin rail upgrade
National Connectivity	Vic	Near term	Initiative development	Melbourne aviation capacity	Melbourne Airport third runway [‡]
National Connectivity	Vic	Longer term	Initiative development	Melbourne container terminal capacity	Melbourne container terminal capacity enhancement [‡]
National Connectivity	WA	Medium term	Initiative development	Perth airport capacity	Perth Airport third runway [‡]
National Connectivity	WA	Longer term	Initiative development	Perth container terminal capacity	Perth container terminal capacity enhancement [‡]
National Connectivity	National	Longer term	Business case development	Freight connectivity Melbourne-Brisbane	Inland Rail (Melbourne to Brisbane via inland NSW)
National Connectivity	National	Near term	Business case development	Rail freight capacity constraint on ARTC network	Advanced Train Management System implementation on ARTC network*
Remote infrastructure	WA	Near term	Options assessment	Constrained road access to remote WA communities	Improve road access to remote WA communities [‡]

³ Problem Timescale refers to the timescale in which a problem is likely to have a material impact on national productivity:

Near term: within 5 years | Medium term: within 10 years | Longer term: within 15 years

* Initiative includes a significant ‘better use’ component

‡ Infrastructure Australia Audit identified gap

Problem category	Location	Problem timescale ³	Initiative development stage	Problem description	Proposed initiative
Remote infrastructure	NT	Near term	Business case development	Infrastructure services for remote NT communities	Provision of enabling infrastructure and essential services to remote NT communities (Wadeye, Tiwi Islands, Jabiru)
Remote infrastructure	NT	Near term	Business case development	Constrained access to the Tanami region	Upgrade Tanami Road
Opportunity for Growth	Qld	Medium term	Options assessment	Opportunity to develop industry and agriculture in Fitzroy region	Lower Fitzroy River water infrastructure development [‡]
Opportunity for Growth	SA	Near term	Options assessment	Opportunity to develop industry and agriculture in Northern Adelaide region	Northern Adelaide Plains water infrastructure development
Opportunity for Growth	Tas	Near term	Business case development	Opportunity for improved agricultural water supply in Tasmania	Tasmanian irrigation schemes (Tranche 2)
Opportunity for Growth	Tas	Near term	Business case development	Opportunity to stimulate economic growth and productivity in Tasmania	Relocation of University of Tasmania STEM facilities to Hobart CBD
Water Security	NT	Medium term	Options assessment	Darwin water supply security	Darwin region water supply infrastructure upgrades
Waste water treatment	Tas	Near term	Options assessment	Tasmanian waste water treatment environmental compliance	Tasmanian sewerage infrastructure upgrades
Resilience	NSW	Near term	Business case development	Flood mitigation in Hawkesbury-Nepean Valley	Hawkesbury-Nepean Valley flood management
Efficient Markets	National	Near term	Options assessment	Constrained East Coast gas supply	Connect gas suppliers to eastern gas markets

³ Problem Timescale refers to the timescale in which a problem is likely to have a material impact on national productivity:

Near term: within 5 years | Medium term: within 10 years | Longer term: within 15 years

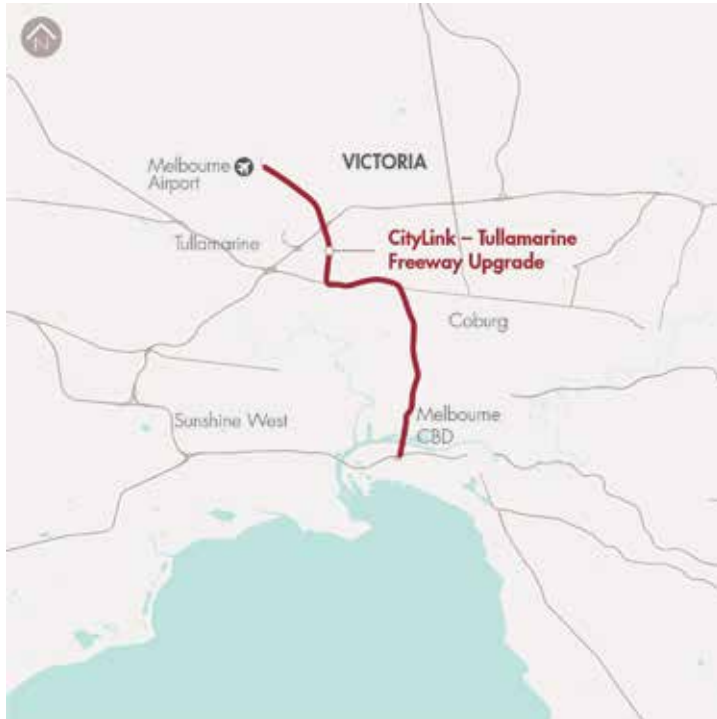
* Initiative includes a significant 'better use' component

‡ Infrastructure Australia Audit identified gap

Project and Initiative Summaries



CityLink-Tullamarine Widening



Infrastructure Priority List classification

High Priority Project

Location

Melbourne, Victoria

Indicative delivery timeframe

Near term (0-5 years)

Proponent

Victorian Government

Problem addressed

The proposal addresses longer and less reliable travel times to Melbourne Airport and the Port of Melbourne, and high accident rates because of congestion on the M2 corridor (covering the Tullamarine Freeway and a part of CityLink).

The root causes of these problems are the strong growth in passenger and freight movements to and from Melbourne Airport and the rapid development of areas that are catchments for the Tullamarine Freeway and CityLink. Over the past decade, Melbourne Airport passenger throughput has grown by 5.4 per cent per year. From 2002 to 2012, population in relevant local government areas grew by 28 per cent. The high demand growth is anticipated to continue.

Modelling by the proponent indicates that growth in demand will lead to relatively severe impacts on travel times. On average, travel times deteriorate by 20 to 25 per cent along the CityLink-Tullamarine Freeway and 45 per cent for the Tullamarine Freeway component from 2011 to 2031. The Australian Infrastructure Audit (April 2015) assessed the Tullamarine Freeway (Airport) Corridor as the 8th most congested corridor in Melbourne in 2011 and the 3rd most congested in 2031.

Project description

The project proposes to widen and introduce managed motorways on the M2 road corridor from Melbourne Airport through to the M1. The proposed solution includes:

- a widening of the Tullamarine Freeway and CityLink (to the M1), by at least one additional lane in each direction
- the implementation of a Motorway Management System
- various other works such as grade separation and ramp metering, including priority access for buses (Sky Bus) on the ramp from the Airport onto the Tullamarine Freeway.

Economic, social and environmental value

Additional capacity on the CityLink-Tullamarine corridor would deliver economic and social gains through reducing delays for airport traffic and general traffic in the north-west of Melbourne. The benefit cost ratio stated by the proponent is 2.4:1.

Capital cost of initiative stated by nominator \$1,229 million (\$2015) and \$1,282 million (undiscounted)

Australian Government contribution \$200 million | **Victorian Government contribution** \$51 million | **Private sector contribution** \$1,031 million

Perth Freight Link



Infrastructure Priority List classification

High Priority Project

Location

Perth, WA

Indicative delivery timeframe

Near term (0-5 years)

Proponent

WA Government

Problem addressed

Perth Freight Link seeks to address the following problems:

- Growth in freight traffic on mixed use routes
- Sub-optimal access to Fremantle port and key strategic industrial areas.

There is currently heavy congestion and significant delays to freight journeys for many sections of the route. Impacts of this include inefficient freight movement which limits productivity and economic growth, higher than average crash rates involving heavy vehicles and diminished amenity for the nearby community.

Project description

The Perth Freight Link project seeks to remove the ‘missing link’ to Fremantle Port by the provision of a high standard road freight link which includes the extension of Roe Highway west of the Kwinana Freeway to become the principal east-west freight link, and a high standard freight connection between Roe Highway and Fremantle Port via Stock Road, Leach Highway and Stirling Highway.

Note: This project summary, including the map above, is based on the business case submitted to Infrastructure Australia in 2015. Subsequent to Infrastructure Australia’s assessment, the WA Government has advised it is considering alternative route options between the end of the Roe Highway at Stock Road and Fremantle Port.

Economic, social and environmental value

The Perth Freight Link would deliver economic and social benefits, through reducing delays for port-related traffic and general traffic. The benefit cost ratio stated by the proponent is 2.5:1.

Capital cost of initiative stated by proponent \$1,575 million (undiscounted, P50) \$1,742 million (nominal, P90)

Federal Government contribution \$925 million (P50) | **State Government contribution** \$275.5 million (P50)

Private sector contribution \$374.5 million (P50)

Sydney Metro

High frequency rail connection from Chatswood to Bankstown via Sydney CBD



Infrastructure Priority List classification

High Priority Initiative

Location

Northern, central and south-western Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

Sydney's key employment and economic areas are clustered along the 'Global Economic Corridor' which extends from the Airport to the CBD, and north to Macquarie Park. The corridor is home to high-value service industries such as finance, insurance, technology, health, education and tourism, and contributes around 50 per cent of NSW Gross State Product. High levels of transport connectivity are an essential input to support growth in these industries, providing access to a deep labour market and connectivity to suppliers, knowledge-based institutions, and customers.

Driven by population growth, employment in Sydney is expected to increase from its current level of 2.1 million workers to 2.8 million by 2031, of which about two-thirds are expected to work within the Global Economic Corridor.

Transport access to the Global Economic Corridor is reaching capacity. An analysis of transport capacity and employment growth indicates that, without additional transport capacity, some 42,000 potential jobs in the Global Economic Corridor would be unrealised by 2036.

A significant increase in transport capacity in key parts of the network, especially to the CBD and the Global Economic Corridor, will assist in realising employment growth and increased productivity.

Proposed initiative

The Sydney Metro (City and Southwest) would provide single deck, fully-automated metro rail services connecting the Sydney Metro Northwest operations from Chatswood through Sydney's North Shore, under Sydney Harbour to the CBD and beyond to Sydenham Station. The proposed rail line would connect to the existing Bankstown Line, converting that line (13.5km from Sydenham to Bankstown) to Sydney Metro operations.

Next Steps

Business case development

Bus Rapid Transport

Northern Beaches, Parramatta Road and Victoria Road



Infrastructure Priority List classification

High Priority Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

In 2012, the NSW Government identified the need to redesign Sydney's bus system as part of the Long Term Transport Master Plan. The three most important corridors requiring significant improvements in connectivity and efficiency are: the Mona Vale to Sydney CBD corridor; the Burwood to Sydney CBD via Parramatta Road corridor; and the Parramatta/Ryde/Sydney CBD via Victoria Road corridor.

Each of these corridors is vital from a broader urban transport network perspective, with buses being used by a large number of commuters to travel into the Sydney CBD and other commercial centres. While parts of the Parramatta and Victoria Road Corridors are served by rail, part of these corridors, and all of the Northern Beaches Corridor, are only practically served by road. For these corridors, bus travel is the most practical form of public transport.

Efficient management of the transport network along the three corridors is a priority issue. The Australian Infrastructure Audit (April 2015) identified that some of Sydney's highest congestion delay costs are along these

routes, including the harbour crossing approaching the CBD from the north, and along Victoria Road (which feeds onto the Anzac Bridge). The cost of congestion in the greater Sydney region is projected to rise from \$5.6 billion in 2011 to \$14.8 billion in 2031. Inadequate investment in bus systems along the three corridors will result in greater reliance and use of private passenger vehicles, in turn leading to further road congestion and delays at the expense of economic efficiency.

Proposed initiative

The provision of high-capacity, on-road bus transport infrastructure is potentially an effective method of improving connectivity along priority corridors and alleviating congestion on Sydney's urban transport network.

Next Steps

Business case development

WestConnex Stage 3 road connection from M4 to M5



Infrastructure Priority List classification

High Priority Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The Australian Infrastructure Audit (April 2015)(the Audit) noted a number of corridors in Sydney’s inner west are severely congested now, and that this will get worse in the future:

- King Georges Rd Corridor from the Princes Hwy to the M4 was ranked the 2nd most congested in Greater Sydney in 2011
- The corridor from Parramatta to the City West Link includes the 7th, 8th and 9th most congested corridors in 2011
- The M5 was the 11th most congested corridor in 2011.

WestConnex Stage 3 complements Stages 1 and 2 (currently being delivered) and is important in realising the benefits of the WestConnex project as a whole. Modelling conducted as part of the Audit indicates that in the absence of improvements in the corridor, the delay cost of the Parramatta Rd (A31) City West Link Corridor Sydney – Ashfield, Gore Hill/Warringah Freeway/SHB/Eastern Distributor, and Airport to CBD corridors would increase from \$141 million in 2011 to \$665 million in 2031.

Proposed initiative

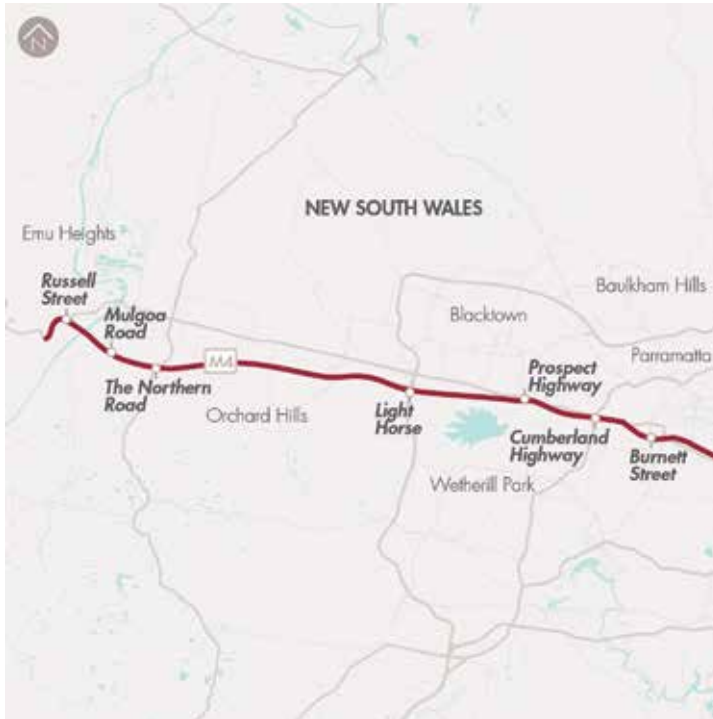
WestConnex is a program of around 33 km of interconnected road projects that will extend the M4 motorway towards Sydney city, widen the M5 East motorway (including duplicating the existing tunnels) and then join the two motorways with a new tunnel running under the inner western suburbs of Sydney. Stage 3 relates to the connection between the M4 and M5 corridors.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

M4 motorway upgrade

Parramatta to Lapstone



Infrastructure Priority List classification

High Priority Initiative

Location

Western Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The problem being addressed by the initiative is congestion on the M4, which constrains productivity growth. The absence of management of the motorway prevents it from achieving its maximum productivity.

Demand for the corridor is currently exceeding capacity. Transport modelling undertaken as part of the Australian Infrastructure Audit (April 2015) noted that this corridor currently has a volume to capacity ratio of 1.1 (for 2011 AM and PM peaks) and is projected to have a delay cost of \$209 million in 2031.

The M4 motorway is an important part of Sydney's urban transport system for freight and passenger travel. It serves 170,000 vehicles per day, providing a key access route between and within Western Sydney. Growing travel demand will be driven by population and employment growth in Western Sydney.

Proposed initiative

The initiative would introduce motorway management systems on the M4. This 'smart motorways' approach allows for better use of existing infrastructure, by managing the point at which traffic flow breaks down, to improve the throughput and travel times on the motorway.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

Southern Sydney to CBD public transport enhancement



Infrastructure Priority List classification

High Priority Initiative

Location

Central southern Sydney corridor

Problem Timescale

Medium term (5-10 years)

Nominator

NSW Government

Problem

The transport network between the Sydney CBD and the area south towards Kingsford Smith Airport lacks the capacity to effectively handle prospective population growth (a projected increase of 30,000 residents by 2036). While Green Square has a railway station on its western side, the north and east of Green Square make up a fast growing inner residential area that is not directly served by rapid public transport. Green Square forms part of the nation's largest bus transport task (Eastern Suburbs – South to Sydney Inner City), as identified in the Australian Infrastructure Audit (April 2015). Due to road congestion, bus transport to the Sydney CBD is slow and unreliable. Potential growth in bus transport, to service a larger population, will add to congestion close to the centre of Sydney.

With Green Square abutting the Sydney Airport precinct and close to the Port Botany precinct (which together generate more than \$10 billion per year in economic activity), there is also an opportunity to grow commercial activity, facilitated by reliable, rapid public transport.

Proposed initiative

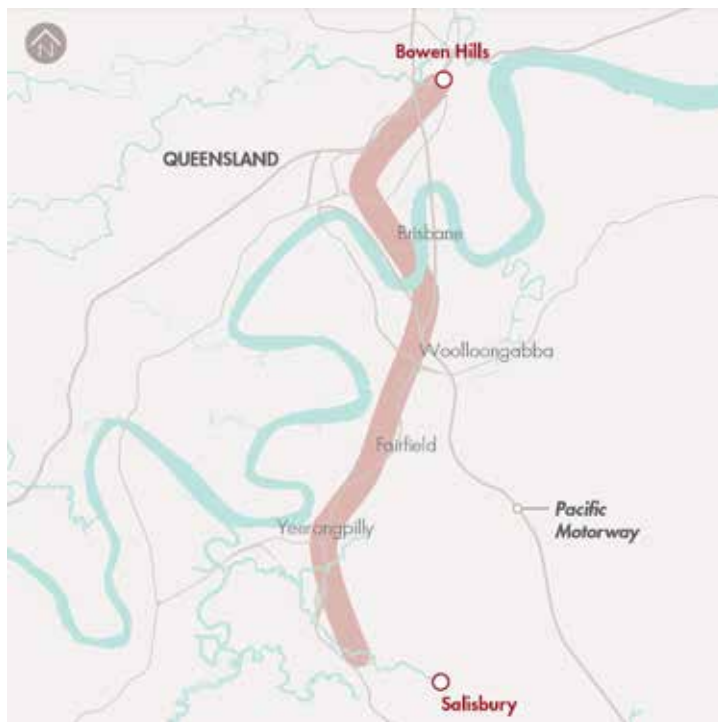
Provide a high capacity, rapid transport link, which could be bus or light rail, between the Sydney central business district and the unserved parts of the area. Subject to further investigation, this could be extended in future to Mascot, Rosebery, Sydney Airport and Port Botany.

Next Steps

Business case development

Cross River Rail

Passenger rail connection to and through Brisbane CBD



Infrastructure Priority List classification

High Priority Initiative

Location

Brisbane, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

The problem relates to capacity constraints in the existing transport system for trips to and from the Brisbane CBD, and strong population and employment growth in South East Queensland.

The current rail connection into Brisbane's CBD is expected to reach capacity by the early to mid 2020s, while parts of the road and bus network are close to or at capacity. The population of South East Queensland is forecast to continue to grow at about 3 per cent per annum through to at least 2041, which together with strong jobs growth in the CBD will drive additional demand for trips to and from the CBD.

The Australian Infrastructure Audit (April 2015) identified crossings of the Brisbane River as a critical bottleneck for trains and buses.

Proposed initiative

The initiative would provide a north-south passenger rail line in Brisbane's inner city from Bowen Hills (north of the CBD) to Salisbury, travelling via Roma Street, the southern CBD and Woolloongabba. This would provide a second rail crossing of the Brisbane River, and reduce demand for buses to enter the CBD by providing bus connections to the rail network.

Next Steps

Business case development

Ipswich Motorway Rocklea-Darra



Infrastructure Priority List classification

High Priority Initiative

Location

Western Brisbane, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

The initiative seeks to address congestion and extensive delays in the Ipswich Motorway corridor. Modelling undertaken for the Australian Infrastructure Audit (April 2015) estimates the direct cost of congestion along the corridor at around \$30 million to \$40 million in 2011, which is likely to increase considerably over time.

The problem results in inefficient freight movement. The Ipswich Motorway is one of the three busiest freight corridors in Queensland. The section between Rocklea and Darra is used by 10,000-12,000 heavy vehicles a day, representing 15-18 per cent of all traffic.

Proposed initiative

The initiative proposes a suite of road upgrades, including between Rocklea and Darra. This submission relates to Package 1 of the project, which consists of:

- widening to three lanes between Oxley Road and Suscatand Street
- a northern service road across Oxley Creek
- ramp rationalisation and smart motorway treatments for the entire seven kilometre Rocklea to Darra section length.

Subsequent works will be required to complete the full upgrade between Rocklea and Darra.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

Gawler Line rail upgrade



Infrastructure Priority

List classification

High Priority Initiative

Location

Gawler to Adelaide City, SA

Problem Timescale

Near term (0-5 years)

Nominator

SA Government

Problem

The Australian Infrastructure Audit (April 2015) (the Audit) identified that demand on the northern line between Gawler and Adelaide is expected to almost double by 2031. Salisbury (serviced by the Gawler rail line) has been identified by the Audit as the second most frequented destination in greater Adelaide for rail trips. The current load factor during the morning peak reaches 75 per cent along the busiest sections of the rail line and network capacity is expected to be reached within 5 to 10 years.

Increased patronage is driven by high population growth in areas that are serviced by the Gawler line, including Gawler-Two Wells, Playford and Salisbury. An additional 116,000 residents are expected to live in these suburbs by 2031.

The Gawler rail line is currently serviced by diesel rail cars as the line has not been fully electrified. As 22 electric railcars are currently serviced at the maintenance facility at Dry Creek on the Gawler line, diesel rail cars are required to haul the electric fleet, resulting in inefficient use of the diesel fleet and unnecessary dead running.

The diesel fleet and the signalling system on the line are reaching the end of their reliable service life, presenting an opportunity to invest in sustainable, reliable and efficient transport solutions.

Proposed initiative

The upgrade and electrification of the Gawler rail line, including installation of a new signalling system.

Next Steps

Business case development

Hoddle Street capacity upgrade



Infrastructure Priority List classification

High Priority Initiative

Location

Inner Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

Hoddle Street is a major arterial road in inner Melbourne that provides a link between the Eastern and Monash Freeways. The Victorian Government estimates that over 300,000 people travel along or across Hoddle Street each day either by car, tram, bus, bike or on foot. Hoddle Street is often heavily congested, and as a result, is unsafe and inefficient. Average travel speeds during the morning and evening peaks are generally around 20 km/hour but can drop below 10 km/hour in some sections. The Australian Infrastructure Audit (April 2015) found that the cost of congestion on Melbourne's major roads could reach \$9 billion a year by 2031 if nothing is done to reduce congestion. Congestion on Hoddle Street increases travel time costs, vehicle operating costs, vehicle emissions and the chance of accidents.

A study conducted by the Victorian Government found that Hoddle Street is in the 'very high' risk group for accidents – higher than similar arterial roads.

Proposed initiative

A number of options are being considered to alleviate congestion on Hoddle Street. Options being considered include, but are not limited to:

- Enhancing computerised traffic management systems
- Implementing best practice Intelligent Transport Systems
- Revising operations at intersections
- Prioritising public transport
- Increasing service levels
- Exploring the use of continuous flow intersections, which are designed to improve traffic flow through intersections by reducing delays caused by right-turning traffic.

Next Steps

Business case development

Cranbourne-Pakenham rail line upgrade



Infrastructure Priority List classification

High Priority Initiative

Location

Melbourne – Dandenong Rail Corridor

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

The Cranbourne-Pakenham rail lines are part of the Dandenong Rail Corridor (DRC). Reliability and punctuality on the DRC is an issue. The DRC performs poorly in terms of customer satisfaction, and is the worst performing line in the Melbourne metropolitan network in terms of punctuality. Unless reliability and punctuality can be improved, existing users will be discouraged from continuing to use rail and may seek other modes of transport – placing additional pressure on the already congested road network.

Peak passenger demand, which drives levels of service and affects punctuality and reliability, is forecast to remain strong over the medium to long term. The Australian Infrastructure Audit (April 2015) estimated that the DRC will exceed crush capacity by 2031 – causing further train delays.

The DRC is already operating above its practical capacity (i.e. operating over the accepted threshold passenger load in peak periods). As population along the corridor and peak demand continues to increase, there is no spare capacity to service additional passengers.

Proposed initiative

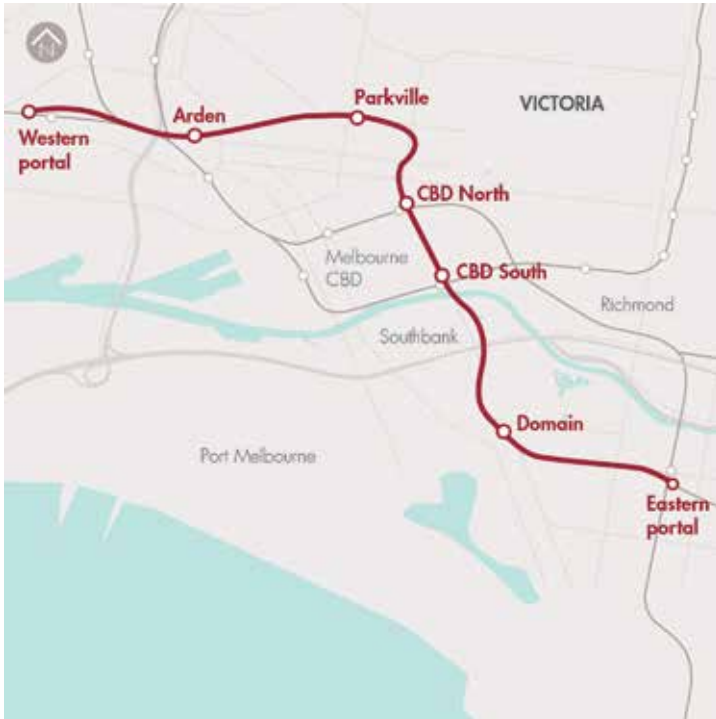
The Cranbourne-Pakenham Line Upgrade Program includes rolling stock and supporting infrastructure upgrades (e.g. procuring high capacity trains and improving signalling to increase train frequency). Complementary corridor initiatives including a proposal to remove nine level crossings between Caulfield and Dandenong are also being considered.

Next Steps

Business case development

Melbourne Metro Rail

Melbourne CBD rail simplification and capacity upgrade



Infrastructure Priority List classification

High Priority Initiative

Location

Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

The underlying problem is capacity constraints in Melbourne's rail transport network. This is a particular problem for the connections between the Melbourne CBD and Melbourne's north, west and south-east growth corridors.

The rail network is currently operating at or close to capacity during the morning peak, and is likely to exceed capacity as travel demand is expected to continue to grow faster than population growth.

Public Transport Victoria forecasts that passengers on metropolitan trains entering the city in the morning peak will continue to grow by an average of 3.8 per cent per annum to 2021, and by an average of 3.2 per cent per annum between 2021 and 2031. The Cranbourne/Pakenham, Sunbury and Werribee lines, which service a number of Melbourne's growth corridors, are predicted to be the most overloaded.

Capacity on Melbourne's metropolitan rail network was identified as a key challenge in the Australian Infrastructure Audit (April 2015).

Proposed initiative

The initiative proposes to construct twin nine kilometre tunnels, from South Kensington to South Yarra, linking the Sunbury and Cranbourne Pakenham rail lines.

Next Steps

Business case development

Road connection between West Gate Freeway and Port of Melbourne and CBD North



Infrastructure Priority List classification

High Priority Initiative

Location

Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

The key problem is the absence of an east-west connection between West Gate Freeway and Port of Melbourne and CBD North. A lack of connectivity results in road transport congestion and the reliance on the West Gate Bridge for travel from Melbourne's west towards the CBD.

The initiative relates to an area which suffers from significant congestion. According to the Australian Infrastructure Audit (April 2015), the delay cost on the West Gate Freeway/Princes Freeway corridor is around \$105 million in 2011. This is projected to increase to \$355 million in 2031. The network-wide cost, including the cost for arterial roads that are used to access the Port of Melbourne, would be higher than this.

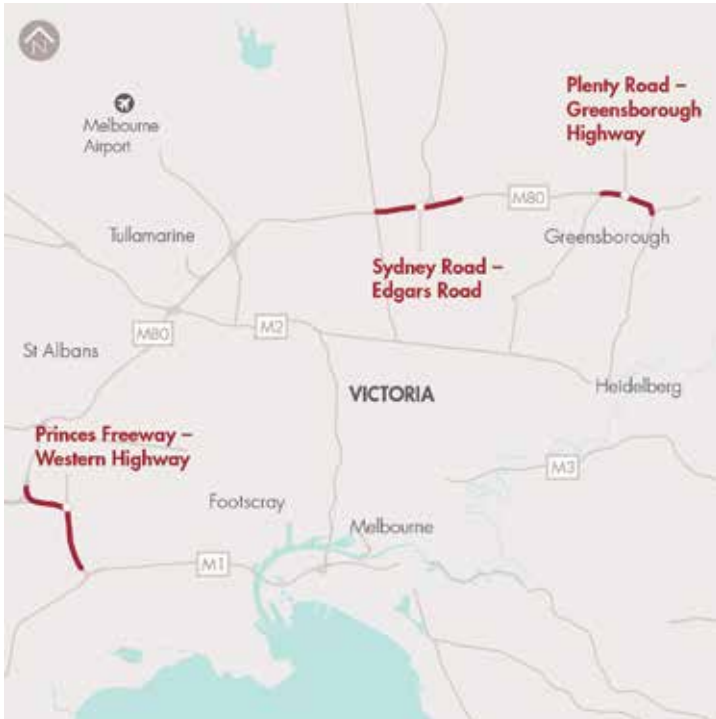
Proposed initiative

The initiative proposes to develop a connection between the West Gate Freeway, Citylink and Port of Melbourne.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

M80 Western Ring Road upgrade



Infrastructure Priority List classification

High Priority Initiative

Location

Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

The M80 was identified as a significant problem in the Australian Infrastructure Audit (April 2015); growth in demand is causing the M80 corridor to operate beyond capacity, especially during peak periods.

The M80 is used by 160,000 vehicles per day, connecting major population centres in Melbourne's north and west to the CBD and elsewhere, and facilitating access to Melbourne's port, airports and other major road corridors including the M1, M8, M31 and M79.

Congestion on the M80 is increasing travel times along the corridor, which is imposing significant costs on businesses. Congestion is also producing negative social and environmental impacts as a result of increased travel time and fuel consumption, and higher vehicle crash rates.

Projected population and economic growth in centres to the west and north of Melbourne are likely to contribute to congestion along the corridor, amplifying these problems.

Proposed initiative

The M80 Upgrade is a 38 kilometre freeway upgrade project that extends from the West Gate Freeway to the Greensborough Highway. The upgrade of the entire corridor has been occurring in multiple stages due to the size and complexity of the initiative. Completed sections have been opening since 2012. The following sections remain to be upgraded:

- Plenty Road to Greensborough Highway (2.4 km)
- Princes Freeway to Western Highway (7.9 km)
- Sydney Road to Edgars Road (4.0 km).

The upgrade will involve widening to a minimum three through-lanes in each direction and one or two auxiliary lanes between interchanges where required. The initiative also includes the implementation of Managed Motorway infrastructure along the corridor. The full M80 upgrade is expected to allow additional throughput of 66 per cent, or 41,000 vehicles, in comparison to the road's capacity in 2008.

Next Steps

Business case development

Cranbourne-Pakenham level crossings removal



Infrastructure Priority List classification

High Priority Initiative

Location

Melbourne - Dandenong Rail Corridor

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

Traffic at level crossings in Melbourne is managed by boom gates that give priority to trains. When closed, these level crossings interrupt the flow of road traffic and cause congestion and delays on Melbourne's roads, including for road based public transport users. Level crossings also introduce a 'conflict point' between rail and road traffic. This can create safety issues. Incidents at level crossings, including collisions and signal faults, impact the efficiency and reliability of the rail network.

If, as is proposed under the complementary Cranbourne-Pakenham Line Upgrade initiative, the capacity of the Cranbourne-Pakenham line is increased with longer and more frequent trains, the interruption to the road network will increase as level crossings are closed more frequently. Modelling suggests that the introduction of additional and longer trains will lead to boom gate closures for up to 95 per cent of the peak period, effectively closing roads during busy times.

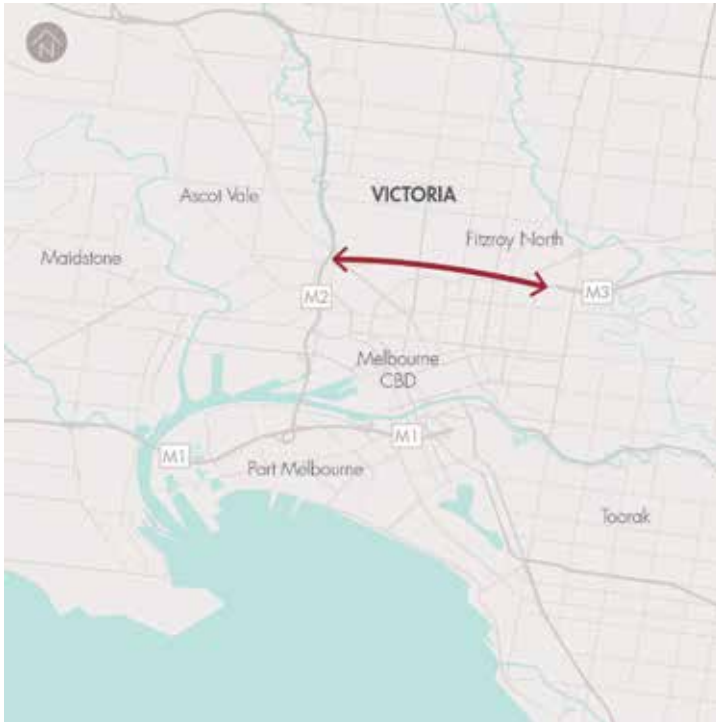
Proposed initiative

The initiative is a proposal to remove nine level crossings between Caulfield and Dandenong.

Next Steps

Business case development

Improve the connection between Eastern Freeway and CityLink



Infrastructure Priority List classification

High Priority Initiative

Location

Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

The Australian Infrastructure Audit (April 2015) (the Audit) identified the east-west corridor to the north of Melbourne CBD as one of Melbourne's major congestion challenges. Vehicles travelling east-west between the Eastern Freeway and CityLink are forced to navigate the congested inner city road network, or the heavily utilised M1 corridor to the south of the city. This results in congestion and delays on Melbourne's urban road network for both passenger and freight vehicles. The Audit found that this corridor had the highest 2011 road congestion delay cost in Melbourne, with a delay cost of \$73 million. This is expected to worsen by 2031, with delay cost increasing to \$144 million.

The Eastern Freeway only extends as far as Hoddle Street on the edge of the CBD, channelling the large volume of vehicles heading into and out of the city onto residential streets in the inner north.

Proposed initiative

The initiative is to improve the connection between the Eastern Freeway and CityLink.

Next Steps

Initiative development

Perth CBD-north corridor capacity



Infrastructure Priority

List classification

High Priority Initiative

Location

Perth, WA

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

Traffic congestion in the Perth metropolitan region is impacting on the efficiency of the transport network.

The Australian Infrastructure Audit (April 2015) (the Audit) found that transport delay costs in Perth are expected to grow at an average annual rate of around 11 per cent over the next 20 years, from \$2 billion in 2031 to \$16 billion in 2031.

The northern corridor is projected, in the absence of additional capacity, to become the most congested corridor in Perth, with demand expected to exceed capacity well before 2031. The Audit estimates that delay cost on the corridor, including the Mitchell Freeway, Marmion Ave/West Coast Highway and Wanneroo Road, will be \$2 billion (\$2011) in 2031. Congestion is expected to be driven by strong population growth in the North West sub-region (averaging around 5.2 per cent per annum).

The increase in road demand, and road congestion, is expected to be matched by strong growth in demand for public transport. An additional 123,000 daily trips are expected to occur on the Joondalup rail line by 2031, resulting in demand exceeding capacity by over 2.5 times during the morning peak.

Proposed initiative

A number of approaches could be adopted to increase supply and to manage demand, including additional road capacity, mode shift to public transport or better use of existing roads. The WA Government is currently developing a transport plan addressing this corridor.

Next Steps

Options assessment

Network Optimisation Portfolio



Infrastructure Priority

List classification

High Priority Initiative

Location

National

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

The Australian Infrastructure Audit (April 2015) found that, in the absence of demand management and suitable investment, the total cost of urban congestion could increase from \$13.7 billion in 2011 to \$53.3 billion (\$2011) in 2031. Although its root causes vary, it is a widespread problem across multiple corridors in Australian cities.

Addressing these problems will require multiple investments that are focused on productivity-enhancing network optimisation as well as continued investment in new capacity.

Proposed initiative

The initiative would involve a portfolio of works focused on addressing congestion on urban road networks with comparatively high public transport and freight use. These works could use data and technology to improve network operations by, for example, optimising traffic flow through intersection treatments, traffic light sequencing, clearways and incident management.

The initiative would build on existing work being undertaken in this field. It would focus on urban motorways, major urban arterials, and access to central business districts.

Next Steps

Initiative development

Port Botany freight rail duplication



Infrastructure Priority List classification

High Priority Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

Port Botany is one of Australia's most significant import/export terminals for containerised freight, and a backbone asset for economic productivity within Sydney and NSW. The Australian Infrastructure Audit (April 2015) found the Direct Economic Contribution of Port Botany is projected to grow from \$5 billion in 2011 to \$8 billion in 2031, a 63 per cent increase.

The Port Botany freight line is currently operating close to capacity. Additional demand arising from growth in interstate, intrastate and import/export freight has the potential to create a bottleneck along this line, impacting on reliability and restricting the efficient movement of freight across the broader Sydney rail network.

As Sydney's primary container port, it is vital that Port Botany maintains throughput capacity to meet demand over the long term. Currently, only a small portion of freight is moved using the freight rail network, which imposes additional demands on the road network. Truck traffic at Port Botany is estimated to increase by 400 per cent by 2030, driven largely by expected growth in throughput at Port Botany.

Proposed initiative

The proposed initiative aims to upgrade the capacity of the Port Botany Rail Line by completing a duplication of 2.8 kilometres of the line. The proposed initiative will form part of a broader strategy designed to drive growth in rail mode share.

Next Steps

Business case development

Chullora Junction upgrade



Infrastructure Priority List classification

High Priority Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The current configuration of Chullora Junction creates a significant operational constraint for Sydney’s Metropolitan Freight Rail Network. Given the forecast growth in freight movements as a result of significant developments (e.g. the Moorebank Intermodal Terminal) and population growth, the junction will become a major bottleneck in the absence of any improvements. This will negatively impact on the efficient movement of freight across the network.

If the capacity and resilience of Sydney’s rail freight network is not addressed, congestion on both the rail and road networks will substantially increase, impacting productivity and increasing delays for freight and passengers.

In order to reduce reliance on Sydney’s road network, the rail network and intermodal terminals must provide an efficient and cost competitive alternative to road distribution. Removing identified bottlenecks on the network is critical to increasing the competitiveness of rail.

Proposed initiative

The proposed initiative involves improvements to the current low speed at-grade junctions at Chullora, including possible duplication of the Chullora North/Chullora West connection and a holding road between Chullora Junction and Flemington Junction. The proposed initiative would form part of a broader strategy designed to drive growth in rail mode share.

Next Steps

Business case development

Connection from Port Botany and Sydney Airport to WestConnex at St Peters



Infrastructure Priority List classification

High Priority Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The initiative addresses the problem of connectivity between Sydney Airport, Port Botany and the Sydney Motorway network. Road congestion on the arterial road network in and around Port Botany and Sydney Airport causes significant delays.

Congestion is a problem throughout the day, rather than just at peak times, with the major road links congested for over half the day. Part of this congestion is generated by road freight in and around Port Botany. Truck traffic at Port Botany is estimated to increase by 400 per cent by 2029/30, if the mode share of rail does not increase. Congestion will be exacerbated by:

- Growing imports and exports through Port Botany. The 2011 throughput of two million Twenty Foot Equivalent Units (TEU) per annum at Port Botany is projected to increase to seven million TEU by 2031, an annual growth rate of approximately 7 per cent
- High growth rates for passenger air travel, estimated by Sydney Airport at 4.2 per cent per year and 2.9 per cent per year for international and domestic travel respectively.

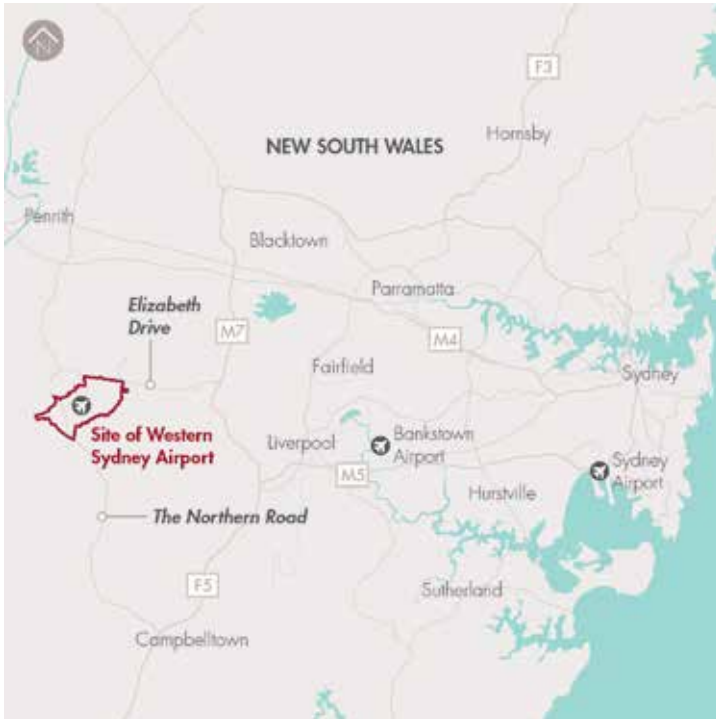
Proposed initiative

The initiative aims to provide a connection from Sydney Airport and Port Botany to WestConnex. It will provide an integrated high capacity road connection from the WestConnex – St Peters Interchange to the Sydney Airport and Port Botany precinct, allowing airport and port traffic to avoid local arterial roads when accessing WestConnex.

Next Steps

Business case development

Western Sydney Airport



Infrastructure Priority List classification

High Priority Initiative

Location

Badgerys Creek, Western Sydney, NSW

Problem Timescale

Longer term (10-15 years)

Nominator

Department of Infrastructure
and Regional Development

Problem

The limited capacity of the existing Sydney airport is a significant constraint to aviation growth in the Sydney basin.

The Australian Infrastructure Audit (April 2015) found that demand for aviation capacity in the Sydney basin, driven by population growth and increases in air travel, is projected to exceed the airport's current capacity. Without major additional capacity, economic growth in Sydney, and Australia more generally, will be constrained.

Proposed initiative

The initiative is to develop a second airport in the Sydney basin on Government-owned land at Badgerys Creek in Western Sydney. The site is away from major population centres and the airport would operate without a curfew. The Stage 1 development will cater for the predicted demand of up to 10 million annual passengers as well as freight traffic for five years following opening in 2025. Further development stages would follow in line with the normal investment decisions by the airport operator. A single runway airport would provide a capacity of around 36 million annual passengers, while further development including a second runway would provide long term capacity of about 82 million annual passengers.

Next Steps

Business case development

Port of Brisbane dedicated freight rail connection



Infrastructure Priority List classification

High Priority Initiative

Location

Brisbane, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

Freight volumes at the Port of Brisbane are forecast to increase by 76 per cent, representing an increase of 4.8 per cent per annum to 2045. The Australian Infrastructure Audit (April 2015) identified that growth at the Port of Brisbane is likely to become constrained by the lack of a dedicated rail freight connection.

Rapid population growth in South East Queensland is creating significant congestion on both the road and rail networks, negatively impacting the productivity of greater Brisbane and the Queensland Economy as a whole.

The preservation and, ultimately, construction of a dedicated freight rail corridor will allow more freight movements to be removed from the road network, which would help alleviate congestion.

Proposed initiative

The proposed initiative is to improve connectivity between the Port of Brisbane and freight terminals in the Brisbane region through preserving and, ultimately, constructing a dedicated freight rail corridor. The initiative should aim to meet the projected increase in freight volumes and capitalise on economic opportunities, while encouraging a modal shift from road to rail.

Next Steps

Options assessment

National Freight and Supply Chain Strategy



Infrastructure Priority

List classification

High Priority Initiative

Location

National

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

The Australian Infrastructure Audit (April 2015) found that population and economic growth will increase demand for freight transport, with the national land freight task expected to increase by 86 per cent to 2031.

While there has been significant work undertaken on national strategies for land transport and ports, there is a need to further progress this work, taking a whole-of-supply chain perspective. National-level long-term freight master planning will facilitate more effective infrastructure planning, and more robust investment decisions in the freight and supply chain sector. Failure to adequately cater for the expected increase in freight transport will increase freight network congestion around Australia, and ultimately harm national productivity.

Proposed initiative

The Strategy would build on existing work, adopting a holistic approach to the planning and performance of the national freight and supply chain networks. The Strategy, which will be developed through a collaborative approach with all levels government and industry, will provide appropriate frameworks to support end to end planning of key freight and supply chains. It will:

- Guide future investment
- Support better use from existing infrastructure assets
- Recommend a program of regulatory reforms and capital initiatives.

Next Steps

Initiative development

Preserve corridor for Outer Sydney Orbital road and rail / M9



Infrastructure Priority

List classification

High Priority Initiative

Location

Western Sydney, Illawarra, Central Coast

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

Western Sydney, and areas north and south of Sydney, will need to accommodate large travel demand increases due to significant population and employment growth.

An additional 65,000 people are expected to live in the Illawarra and Central Coast, and an additional one million people in Western Sydney by 2031. The broader Western Sydney Employment Area is expected to provide 212,000 new jobs in the long term.

Traffic modelling undertaken in the Australian Infrastructure Audit (April 2015) indicates that in 2031 parts of the existing outer Sydney road network will be at or above capacity, which is expected to result in congestion and long travel times.

In the absence of long term planning and corridor protection, future infrastructure provision would be complex and costly.

Proposed initiative

This initiative proposes to conduct a planning study to identify a preferred alignment for a multi-modal transport corridor comprising a motorway, a north-south freight rail line, and where practical, passenger rail, and to preserve the preferred corridor.

Next Steps

Options assessment

Preserve corridor for Western Sydney Airport fuel pipeline



Infrastructure Priority List classification

High Priority Initiative

Location

Badgerys Creek, Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

Western Sydney Airport is projected to commence operation by 2025. When operation reaches full capacity, the airport could potentially require 50-65 B-double fuel tanker deliveries per day, which would add to congestion on Sydney's urban road network. The reliance on fuel transportation by heavy vehicles could also generate congestion problems at the airport site, and contribute to delay costs along key freight corridors.

While a dedicated fuel pipeline is unlikely to be required upon the commencement of operations at Western Sydney Airport, the identification and preservation of a corridor will ensure a route for the pipeline is available when required.

Developing a fuel pipeline connection would enable efficient, safe and cost effective transportation of jet fuels in significant volumes.

Proposed initiative

Identify and preserve a corridor for a fuel pipeline connection between the Sydney fuel pipeline network and Western Sydney Airport.

Next Steps

Options assessment

Preserve corridor for Western Sydney Airport rail connection



Infrastructure Priority List classification

High Priority Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

Over the next two decades, Western Sydney will be home to an additional 900,000 people, with more than half of all Sydneysiders expected to be living in this region within 25 years. Preliminary analysis indicates that within five years from operation commencement in 2025, total passenger demand at Western Sydney Airport could reach 10 million per annum.

Provision of efficient transport options connecting the Western Sydney Airport to other key hubs such as the CBD, Parramatta, Western Sydney Employment Area, and North West and South West Growth Centres is critical to avoid unnecessary travel delays and enable sustained economic growth.

Proposed initiative

Identify and preserve a rail corridor connecting the Western Sydney Airport to the Sydney rail network.

Next Steps

Options assessment

Preserve corridor for Lower Hunter freight rail realignment



Infrastructure Priority List classification

High Priority Initiative

Location

Fassifern – Hexham, Hunter Region, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The existing Main North railway line services coal freight travelling to the Port of Newcastle, interstate freight travelling from Sydney and Melbourne to Brisbane, as well as intrastate freight and passenger trains.

Line congestion, and the priority given to passenger trains on shared parts of the rail network, mean that the efficiency and cost effectiveness of freight movement is reduced in the Lower Hunter region in and around Newcastle. This affects bulk freight destined for the Port of Newcastle as well as containerised and general freight being transported on the east coast freight rail network linking Melbourne, Sydney and Brisbane. Rail freight inefficiency increases costs, and makes rail less competitive than road. This in turn creates an incentive for more trucks to be on the road, which increases congestion, vehicle emissions and noise, and affects amenity.

Proposed initiative

This initiative is to identify and protect the relevant rail corridor alignment in the lower Hunter Region to provide an opportunity to construct a dedicated freight rail network that will allow passenger services and freight trains to run concurrently on separate lines.

Next Steps

Options assessment

Preserve corridor for Western Sydney Freight Line and Intermodal Terminal access



Infrastructure Priority List classification

High Priority Initiative

Location

Western Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The national land freight task is expected to grow by 86 per cent between 2011 and 2031. The Australian Infrastructure Audit (April 2015) found that freight rail will need to play a growing role in the movement of goods between ports and inland freight terminals. The role of freight rail will be particularly important for containerised freight with demand for container terminal port infrastructure projected to grow faster than Gross Domestic Product.

Currently, only 14 per cent of container freight handled at Port Botany is transported by rail. If this trend continues, congestion on Sydney's road network will increase as the number of trucks required to meet the growing freight task increases.

In order to facilitate a shift from road to rail for containerised freight movement in Sydney, additional capacity and higher levels of service are required on Sydney's rail freight network.

Proposed initiative

The Western Sydney Freight Line is a proposed dedicated rail freight line connecting Western Sydney to the Sydney Metropolitan Freight Network, with connections to intermodal terminals to service freight moving through Western Sydney from across NSW. The core objective of the initiative is to reduce growth in truck movements on the Sydney road network and reduce delays to freight trains on the main Western Line, where passenger trains have priority. Preservation of the corridor is the first step to achieving this objective.

Next Steps

Options assessment

Preserve corridor for Melbourne Outer Metropolitan Ring Road/E6



Infrastructure Priority List classification

High Priority Initiative

Location

Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

There is a need to preserve transport corridors to ensure cost effective transport infrastructure is able to be provided in the future. Preserving transport corridors is a multi-step process which includes defining the corridor, applying land use controls, and acquiring the land required for the corridor.

The Victorian Government has undertaken planning for the Outer Metropolitan Ring Road and E6 corridor, and defined the corridor through application of a Public Acquisition Overlay in 2010. This allows for compulsory acquisition of property when required. It also gives VicRoads rights to request refusal of development applications.

The early protection and staged purchase of land in the corridor is aligned with Infrastructure Australia's previous recommendations to the Council of Australian Governments, and consistent with the 2016 Australian Infrastructure Plan.

Proposed initiative

The initiative is corridor preservation for the Outer Metropolitan Ring Road and E6 in Melbourne. The corridor has provision for a freeway (four to six lanes in each direction) and four rail tracks. The land required for the corridor was defined and preserved in 2010 through a Public Acquisition Overlay. The next step in preserving the corridor is acquisition of land in the corridor as it becomes available.

Next Steps

Business case development

Preserve corridor for East Coast High Speed Rail



Infrastructure Priority List classification

High Priority Initiative

Location

Eastern seaboard: Melbourne to Brisbane

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

By 2075, the population of Melbourne, Sydney and Brisbane is projected to exceed 30 million people. The future demand for efficient, high-capacity transport services between major centres on the east coast will likely exceed the capacity of existing and planned rail, road and aviation services.

Protecting a corridor would significantly increase options for future development of high speed rail infrastructure to meet future demand for inter-city and regional travel.

Proposed initiative

Confirm and begin the preservation of a corridor, based on the corridor set out in the Australian Government's High Speed Rail Study Phase 2, for a high speed rail link between Melbourne, Sydney and Brisbane.

Next Steps

Business case development

Active transport (walking and cycling) access to Sydney CBD



Infrastructure Priority List classification

Initiative

Location

Inner Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

City of Sydney

Problem

The cost of congestion in Sydney is estimated to increase from around \$6 billion in 2011 to \$15 billion in 2031. With a growing population and an increasingly centralised workforce, Inner Sydney is forecast to have the highest number of trips for any region in NSW.

Five of Sydney's most congested urban roads are located within a 10 kilometre radius of Sydney's Central Business District. The public transport network in Inner Sydney is also projected to reach or exceed current capacity by 2031.

There are more than one million daily short distance trips (i.e. less than five kilometres) undertaken by private motor vehicles and taxis within 10 kilometres of the CBD. Safety concerns, along with disparate travel routes, are current barriers to other forms of short distance or active transport.

A two to five per cent shift of short distance car trips within 10 kilometres of the CBD to active transport may result in a reduction of between 20,000 and 50,000 motor vehicles per day on inner Sydney's congested corridors.

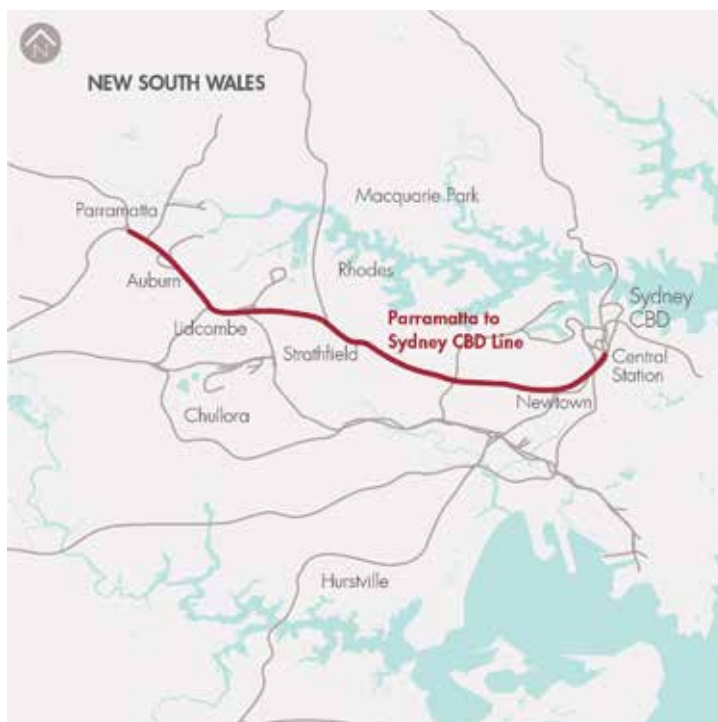
Proposed initiative

Upgrade a network of 284 kilometres of dedicated cycling and shared cycling/walking paths, on existing radial and cross regional corridors within a 10 kilometre radius of the CBD.

Next Steps

Business case development

Western line CBD to Parramatta upgrade



Infrastructure Priority List classification

Initiative

Location

Parramatta to Sydney CBD, NSW

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

The Western line on Sydney's suburban rail network is one of Sydney's busiest passenger corridors. The Australian Infrastructure Audit (April 2015) (the Audit) identified the areas of Parramatta and Strathfield-Burwood-Ashfield as having the highest rail patronage of any Sydney region outside of the CBD.

The Audit projects passenger demand on the line to increase strongly by 2031 (by around 50 per cent on current levels), supported by above average population growth around and to the west of Parramatta (around 1.9 per cent on average) and employment growth (around 2 per cent on average) in economic centres along the line.

By 2031, the Audit identifies that passenger loadings during peak periods are projected to reach or exceed capacity on most sections of the line. This will likely lead to a reduction in reliability and quality of service, and an increase in travel times. It will also reduce connectivity between Western Sydney and the Global Economic Corridor, including the Sydney CBD and other economic centres to Sydney's North and North-West. The absence of an appropriate response could potentially encourage mode shift to road, increasing demand on the M4 and adding to road congestion.

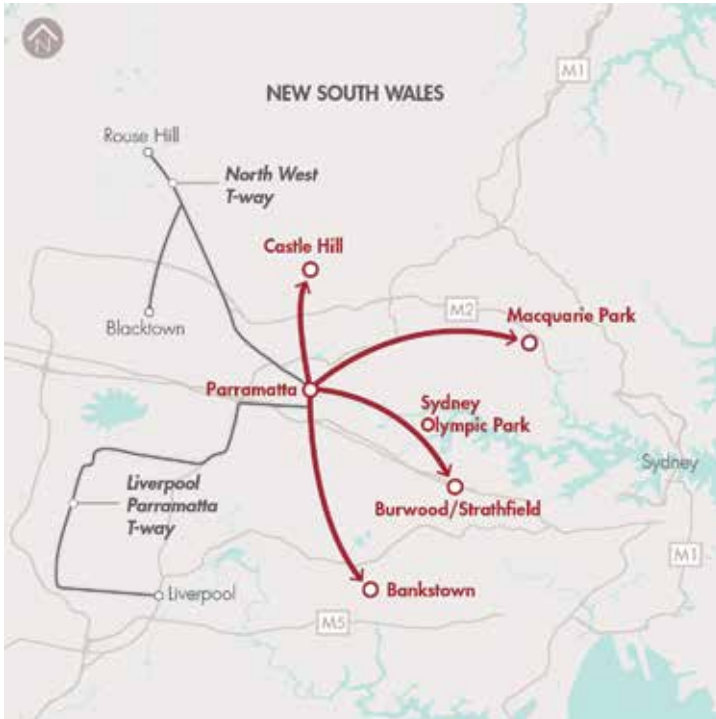
Proposed initiative

There are several options, subject to further investigation, to increase speed and capacity on the Western Line rail corridor. This could range from measures that increase utilisation of the existing track through further track works, signalling and power supply upgrades, combined with investment in new rolling stock, to the construction of a metro line that accommodates higher frequency trains on or parallel to the Western line.

Next Steps

Initiative development

Public transport access to Parramatta CBD



Infrastructure Priority List classification

Initiative

Location

Western Sydney, NSW

Problem Timescale

Medium term (5-10 years)

Nominator

NSW Government

Problem

The Australian Infrastructure Audit (April 2015) identified significant future congestion and capacity constraints on both the road and rail network operating in western Sydney.

Over the next 20 years, Sydney's population is estimated to increase by 1.6 million people. The majority of this growth (900,000 people) is forecast to occur in western Sydney. As a stand-alone region, western Sydney is now the nation's fourth largest city and third largest economy.

The Parramatta CBD and several other precincts including the Westmead health precinct, the Western Sydney University, Rydalmere, North Parramatta, and Camellia have been identified for urban renewal and residential and commercial redevelopment. This redevelopment is expected to accelerate Parramatta's growth and bring more jobs, businesses and residents into the Parramatta CBD and surrounding areas. Employment in the Parramatta Local Government Area is expected to grow by 30 per cent by 2031 (from 114,000 people at present). This growth will create significant transport-related challenges which are expected to exacerbate an existing problem of limited public transport accessibility to Parramatta and western Sydney.

Without investment in public transport, population growth and people coming in to the area is expected to increase congestion on the road and train networks.

Proposed initiative

Additional public transport, which could include bus or light rail, is required in western Sydney to alleviate congestion on the road and public transport networks. Some public transport solutions can also facilitate urban renewal in western Sydney.

Next Steps

Options assessment

Extend M1 from Waterfall to Sydney motorway network



Infrastructure Priority List classification

Initiative

Location

Sydney, NSW

Problem Timescale

Medium term (5-10 years)

Nominator

NSW Government

Problem

There is no motorway standard route southwards between the Sydney motorway network and the M1 at Waterfall. Demand for road travel along this corridor is high and the arterial network is at capacity during peak periods. The three crossings of the Georges River, which together accommodate almost 200,000 trips per day, are at or close to capacity. These problems lead to long travel times, both because of slower speeds and intersections on arterial roads and congestion.

The Australian Infrastructure Audit (April 2015) identified the Sutherland-Ryde/Parramatta Corridor as being the 5th most congested in the greater Sydney area in 2011, and the 6th most congested in 2031. The King Georges Road Corridor, from Princes Highway to the M4, was ranked as the 2nd most congested in 2011 and 3rd most congested in 2031.

Proposed initiative

The initiative is a motorway connection from the M1 at Waterfall to the Sydney motorway network. The connection is anticipated to be 3 lanes each way. The route and point of connection has not been developed at this stage, although parts of the corridor have been preserved.

Next Steps

Options assessment

WestConnex Stages 4a & 4b

Western Harbour Tunnel and Beaches Link



Infrastructure Priority List classification

Initiative

Location

Sydney, NSW

Problem Timescale

Longer term (10-15 years)

Nominator

NSW Government

Problem

The initiative is aimed at addressing projected travel demand across Sydney Harbour and onto the Northern Beaches. Congestion on these corridors impacts on bus and private vehicle travel, with bus travel particularly impacted by congestion on the Spit Bridge/Military Road. The high levels of demand for existing infrastructure reflects the channelling of traffic into harbour crossings Sydney Harbour Bridge and Tunnel (across Sydney Harbour) and Spit Bridge (across Middle Harbour).

The Australian Infrastructure Audit (April 2015) ranked the North Sydney – Northern Beaches corridor as the 10th most congested corridor in the wider Sydney region in 2011, and 11th in 2031. The Gore Hill/Warringah Freeway/Sydney Harbour Bridge/Eastern Distributor was ranked 12th in 2011, and is projected to be the most congested corridor in NSW in 2031.

Proposed initiative

The initiative proposes a motorway crossing underneath Sydney Harbour (Stage 4a), connecting WestConnex Stage 3 with the Warringah Freeway, and a motorway connection from the Warringah Freeway to Seaforth/Balgowlah (Stage 4b).

Next Steps

Options assessment

Gold Coast Light Rail – Stage 2

Connecting existing Gold Coast light rail to Brisbane heavy rail at Helensvale



Infrastructure Priority List classification

Initiative

Location

Gold Coast, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

The problems addressed by the initiative are: increasing levels of congestion on motorways providing access between Brisbane and the Gold Coast; a lack of public transport connectivity between major regional centres, and poor access and high delay costs within the Gold Coast urban transport network.

The Australian Infrastructure Audit (April 2015) projects that the main road route from Brisbane to the Gold Coast will encompass four of the top 10 road corridors in the South East Queensland region in terms of delay costs in 2031. Moreover, the Southport-Burleigh Heads road corridor, of which the Gold Coast urban transport network is a part, is projected to have the 10th highest delay cost by 2031.

Growth in delay cost is expected to be driven by moderate population growth in the Gold Coast and more rapid population growth in South Brisbane, combined with capacity constraints on key connections.

Proposed initiative

The initiative is a 7.3 kilometre extension of the Gold Coast light rail to connect with the Brisbane heavy rail system. The extension would be from the current light rail terminus at Gold Coast University Hospital, northwards to Helensvale. This would include two new stations and potential for two further stations.

Next Steps

Business case development

M1 Pacific Motorway – Gateway Motorway merge upgrade



Infrastructure Priority List classification

Initiative

Location

Brisbane - Gold Coast, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

The Pacific Motorway between Tugun and Brisbane is the busiest road corridor in South East Queensland, carrying an average of 145,000 vehicles a day, of which 40 per cent are commercial vehicles. The corridor is a key freight route and part of the National Land Transport Network. Congestion on the corridor is noted in the Australian Infrastructure Audit (April 2015).

The most significant congestion and delays occur at the southbound merge of the Gateway Motorway onto the Pacific Motorway. At this junction, seven lanes of traffic (four from the Pacific Motorway, two from the Gateway Motorway and one from the South East Busway) merge into a three-lane carriageway, resulting in significant congestion.

Alleviating congestion on this section of the motorway will improve the overall efficiency of the National Land Transport Network in South East Queensland, with significant economic benefits likely to be delivered through reduced travel time savings for freight movements, as well as business and commuter travel.

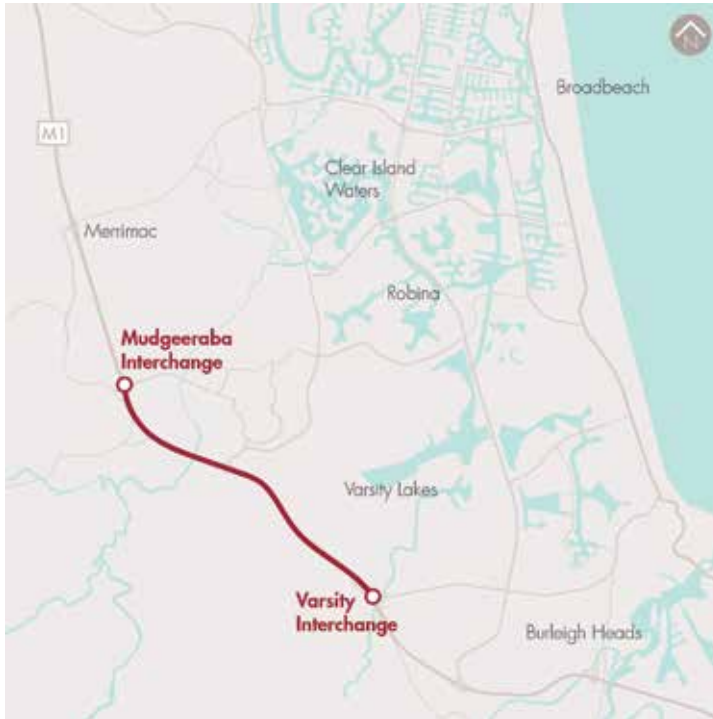
Proposed initiative

The proposed initiative seeks to upgrade a 4.2 kilometre section on the M3 between Eight Mile Plains and Springwood, specifically where the M3 merges with the southbound lanes of the Gateway Motorway (M1).

Next Steps

Business case development

M1 Pacific Motorway upgrade – Mudgeeraba to Varsity Lakes



Infrastructure Priority List classification

Initiative

Location

Gold Coast, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

The M1 Pacific Motorway between Mudgeeraba and Varsity Lakes is capacity constrained.

The Australian Infrastructure Audit (April 2015) indicates that the corridor (Pacific Motorway Helensvale - Varsity Lakes) had a delay cost of \$26 million in 2011, and the parallel Southport - Burleigh Heads corridor had a delay cost of \$37 million.

The problem is expected to result in:

- Unreliable travel times
- Higher risk of accidents (the initiative is expected to reduce the crash rate by 50 per cent)
- Heavy congestion during peak periods, increasing vehicle operating costs and air pollution
- Accelerated deterioration of the road asset due to overuse.

Proposed initiative

The initiative proposes to widen 5 kilometres of the M1 Pacific Motorway from four to six lanes between Mudgeeraba Road/Robina Town Centre Drive (Mudgeeraba) and Reedy Creek Road (Varsity Lakes). The upgrade will include Managed Motorways systems.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

Adelaide north-south corridor upgrade (remaining sections)



Infrastructure Priority List classification

Initiative

Location

Adelaide, SA

Problem Timescale

Near term (0-5 years)

Nominator

SA Government

Problem

The underlying problem is congestion on the road network, specifically for north-south traffic in the corridor and east-west traffic which crosses the corridor.

Sections of the north-south corridor which have not been upgraded experience slow travel times and reduced travel time reliability. The Australian Infrastructure Audit (April 2015) found that South Road, which is part of the north-south corridor, is expected to have a delay cost of \$164 million in 2031. North-south traffic congestion is not limited to South Road; it is also evident along parallel routes, such as Marion Road (with a delay cost of \$97 million in 2031) and Goodwood Road (with a delay cost of \$60 million in 2031).

South Road is currently optimised for north-south travel in Adelaide, given its role as part of the National Land Transport Network and as a prioritised freight corridor. As such, it can impede east-west traffic movements, potentially increasing travel times in those directions.

Proposed initiative

This initiative focuses on the remaining unfunded sections of the north-south corridor and involves 15 km of grade separated motorway along the existing corridor alignment. When completed, the north-south corridor will be the major transport spine for Adelaide's north-south traffic over a total distance of 78 kilometres.

Next Steps

Business case development

AdeLINK Tram Network

Adelaide tram network expansion



Infrastructure Priority List classification

Initiative

Location

Adelaide, SA

Problem Timescale

Medium term (5-10 years)

Nominator

SA Government

Problem

The Australian Infrastructure Audit (April 2015) (the Audit) found that the performance of urban roads and urban public transport in Adelaide is a key challenge for South Australia.

The Audit estimated that the cost of delay on Adelaide's urban transport network was \$1 billion in 2011 and would grow to \$4 billion in 2031, in the absence of investments or other changes beyond those already funded.

The major public transport destination in Adelaide is the CBD, with most public transport use being on buses. Public transport use in Adelaide is significantly lower than in Sydney, Melbourne and Brisbane. In Adelaide, the proportion of passengers using public transport for journeys to work is just over 8 per cent, whereas in Melbourne and Brisbane it is 11.5 per cent, and in Sydney it is 17.6 per cent.

Proposed initiative

The initiative is a major expansion of the tram network in Adelaide, creating a tram network around the CBD and inner suburbs. The proposed link to Port Adelaide would entail conversion of existing diesel heavy rail to a modern electric light rail service which would integrate with land use changes and facilitate increased densification.

Next Steps

Options assessment

Melbourne level crossings removal



Infrastructure Priority List classification

Initiative

Location

Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

Melbourne's transport network includes approximately 180 road/rail level crossings. Road traffic at these level crossings is managed by boom gates which give priority to trains. Level crossings interrupt the flow of road traffic and contribute to congestion and delays on Melbourne's roads. The Australian Infrastructure Audit (April 2015) forecasts that the cost of road congestion in the Melbourne/Geelong area is expected to reach approximately \$9 billion by 2031 (\$2011).

As Melbourne's train network is modernised, longer and more frequent trains are expected to be introduced to the network to cater for increased demand. Longer and more frequent trains at level crossings will translate into additional delays for road users.

Level crossings also introduce a 'conflict point' between rail and road traffic which creates safety issues. Incidents at level crossings, including collisions and signal faults, impact the efficiency and reliability of Melbourne's transport network.

Proposed initiative

This initiative proposes to remove priority level crossings in Melbourne. The objective of the initiative is to deliver a more reliable, convenient, productive and safer transport system in Melbourne.

Next Steps

Business case development

Melbourne Airport to the CBD public transport capacity



Infrastructure Priority List classification

Initiative

Location

Melbourne, Victoria

Problem Timescale

Medium term (5-10 years)

Nominator

Audit identified gap

Problem

The Australian Infrastructure Audit (April 2015) (the Audit) noted that the corridor between the Melbourne CBD and Melbourne Airport is already one of the most heavily congested roads in Melbourne. The Tullamarine Freeway was already operating at, or close to capacity in 2011. Congestion affects traffic in both directions, particularly close to the airport terminal. Analysis completed as part of the Audit estimated that travel times to the airport during peak periods will increase substantially between 2011 and 2031. Travel time by car in the morning peak from the CBD to the airport is forecast to increase by nine minutes from 33 minutes to 42 minutes, a 27 per cent increase; while travel times by car from Werribee and Doncaster are forecast to increase from an average 61 minutes to 90 and 74 minutes respectively (a 48 per cent and 21 per cent increase respectively).

Melbourne's population growth, combined with expected growth in passenger numbers at Melbourne Airport will be key drivers of future congestion on the Melbourne CBD – Melbourne Airport corridor.

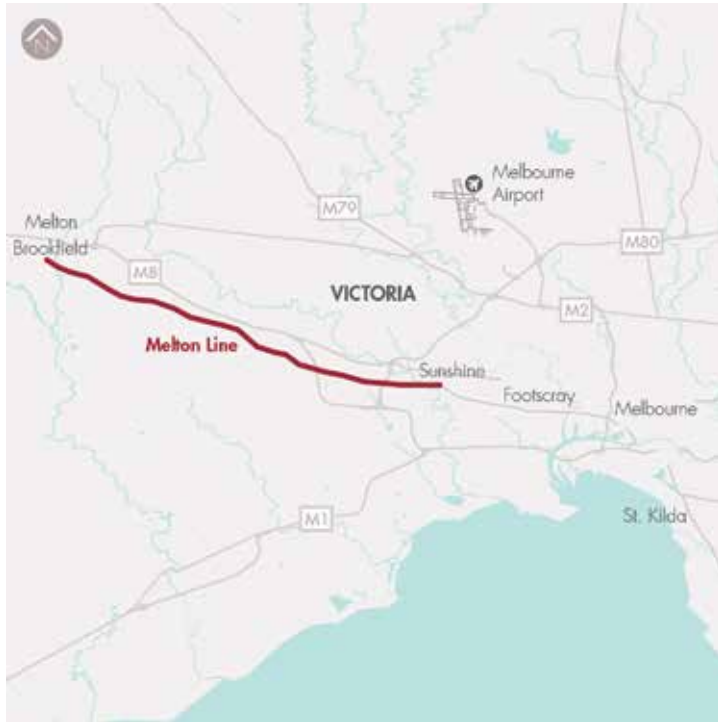
Proposed initiative

Develop options for increasing public transport capacity to Melbourne Airport.

Next Steps

Initiative development

Melton Rail Line upgrade



Infrastructure Priority List classification

Initiative

Location

Northwest Melbourne, Victoria

Problem Timescale

Medium term (5-10 years)

Nominator

Audit identified gap

Problem

Melbourne's long term growth strategy identifies Melton-Bacchus Marsh as a key growth area. The Australian Infrastructure Audit (April 2015) (the Audit) estimates that population growth in the Melton-Bacchus Marsh region will grow at an average annual rate of 3.9 per cent per annum between 2011 and 2031. This is the second highest growth rate in Greater Melbourne.

The Audit identified the Melton-Bacchus Marsh region as an area in which high levels of additional transport activity is expected out to 2031. For example, the Direct Economic Contribution of road and public transport journeys that commence or finish in Melton-Bacchus Marsh is forecast to increase from \$0.6 billion in 2011 to \$1.8 billion in 2031. Audit data shows that demand on the Melton line is projected to grow to around three times current capacity by 2031.

Currently, the line between Melton station and Sunshine station is operated by V/Line and is not part of the metropolitan network. This section of the line is not electrified, which limits higher capacity trains being introduced on the line. The Melton line currently lacks the capacity to service future population growth.

Proposed initiative

The proposed initiative would involve upgrading the Melton line to expand capacity to service additional demand associated with population growth. Options that may be considered as part of the upgrade include, but are not limited to:

- Preservation of corridors for extensions and/or duplication of the Melton line
- Duplication of the Melton line
- Electrification of the existing Melton line
- Capacity upgrades where the Melton line meets the metro line at Sunshine station (part of the Sunbury line).

Next Steps

Initiative development

Complete Metro Ring Road from Greensborough to the Eastern Freeway



Infrastructure Priority List classification

Priority Initiative

Location

Melbourne, Victoria

Problem Timescale

Medium term (5-10 years)

Nominator

Audit identified gap

Problem

The option for freeway travel between Melbourne's north and south east is currently limited, and requires passing through Melbourne CBD which is regularly congested with inner city commuter traffic, and freight traffic from the Port of Melbourne.

There is currently a 'missing link' between the M80 Metropolitan Ring Road in Melbourne's north and the M3 Eastern Freeway – EastLink in Melbourne's east and south east. The current route – which is to use Greensborough Highway, Rosanna Road, Banksia Road and Bulleen Road – spanning approximately 9.5 kilometres, is congested and operating close to capacity during peak periods, making it inadequate for supporting commercial and freight transport activities.

The Australian Infrastructure Audit (April 2015) estimates the total cost of delay on Melbourne-Geelong's urban transport network in 2011 at around \$3 billion. In the absence of additional capacity, this cost of delay is projected to grow to around \$9 billion by 2031.

Proposed initiative

Development of a new motorway-standard connection between the Metropolitan Ring Road and Eastern Freeway ('North East Melbourne Corridor') to reduce congestion and capacity constraints.

Next Steps

Initiative development

Melbourne outer northern suburbs to CBD capacity upgrade



Infrastructure Priority List classification

Initiative

Location

Melbourne, Victoria

Problem Timescale

Longer term (10-15 years)

Nominator

Audit identified gap

Problem

The Australian Infrastructure Audit (April 2015) (the Audit) noted that the Hume Freeway would become the most congested corridor in Victoria, on a delay per lane kilometre basis, with a total delay cost of around \$172 million per year. The Audit also projects that demand for rail transit in the corridor, on the Craigieburn line, will exceed capacity by a factor of four. In the absence of transport capacity improvements, the Audit indicates that daily vehicle movements on the Hume Freeway would grow from 43,100 in 2011 to 107,400 by 2031, and the rail system in the corridor would be the most crowded in Melbourne by 2031.

Traffic demand growth along the corridor is expected to be driven by population and employment growth in Melbourne's northern growth corridor. The Victorian Government projections indicate that population in the corridor is expected to almost double between 2015 and 2031, while the northern growth corridor plan has the capacity to provide between 83,000 and 105,000 new jobs.

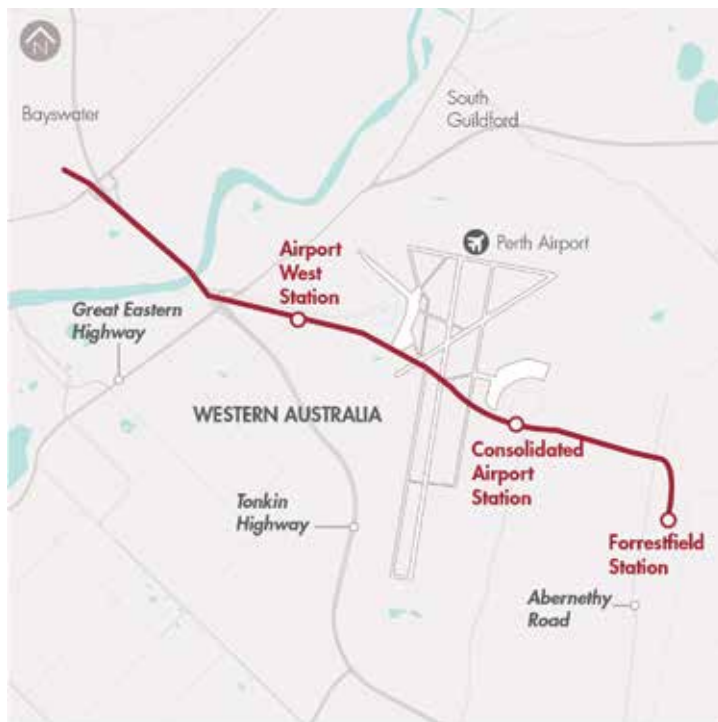
Proposed initiative

The initiative is to investigate options to ensure that transport demand from development in the northern growth corridor is accommodated.

Next Steps

Initiative development

Perth – Forreestfield Airport Rail Link



Infrastructure Priority List classification

Initiative

Location

Perth, WA

Problem Timescale

Near term (0-5 years)

Nominator

WA Government

Problem

The problems addressed by the initiative are public transport connectivity to Perth Airport and suburbs to the east of the Airport, and road congestion in Perth's east.

Perth Airport is Australia's fourth busiest airport and is a nationally significant asset. The Australian Infrastructure Audit (April 2015) (the Audit) found that the airport had a Direct Economic Contribution of \$1.89 billion in 2011, which is projected to grow to \$5.08 billion by 2031.

The airport operator's master plan forecasts passenger numbers will more than double from 13.7 million in 2013 to 28.5 million in 2034.

Modelling undertaken as part of the Audit projects the time for a car trip from Perth Airport to the CBD to increase from 15 - 20 minutes in 2011 to 25 - 30 minutes in the AM peak in 2031. Based on passenger numbers from the airport operator's master plan, and assuming that around half of this travel would be impacted by this additional travel time, the additional congestion cost would be around \$60 million per year by 2031.

Proposed initiative

The initiative proposes a rail link from Perth's eastern suburbs, under the airport (either by tunnel or cutting), linking to the existing Perth rail system. By providing a rail link to the airport and eastern suburbs/foothills, the rail link will improve public transport options and help drive urban development in the city's eastern corridor.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

Perth major east-west and southern corridor capacity upgrades



Infrastructure Priority List classification

Initiative

Location

Perth, WA

Problem Timescale

Medium term (5-10 years)

Nominator

Audit identified gap

Problem

The Australian Infrastructure Audit (April 2015) identified that the road and rail corridors linking the southern suburbs with Perth central business district, and the east-west road and rail links across Perth, include four of the top ten most congested corridors in Australia.

The Kwinana and Rockingham areas south of Perth are expected to experience population growth of 162 per cent and 141 per cent respectively between 2011 and 2031. Without additional capacity, the increase in demand for transport in the southern part of Perth will lead to significant delays on both road and rail infrastructure.

The southern and eastern areas of Perth are serviced by three main rail corridors: the Mandurah line, the Armadale line and the Midland line. Passenger loadings on Perth's rail corridors are projected to increase over time, reaching or exceeding crush capacity on the Mandurah line by 2031.

East-west connections within Perth have a number of at-grade intersections and level crossings that contribute to congestion and increase the likelihood of accidents on these high volume freight routes. In the absence of additional capacity, the Tonkin Highway is projected to

be the second most congested corridor in Australia by 2031. Congestion has a direct impact on productivity by increasing freight and passenger transport travel times and impacting on the efficiency of the transport network. The cost of delay on Perth's road network in 2011 was around \$2 billion. Without intervention, this is expected to grow to around \$16 billion by 2031.

The WA Government is currently developing transport plans addressing these corridors.

Proposed initiative

Reduce congestion on the southern transport corridors and the east-west links within Perth metropolitan area.

Next Steps

Initiative development

Canberra CBD to north corridor



Infrastructure Priority List classification

Initiative

Location

Canberra, ACT (Civic to Gungahlin)

Problem Timescale

Medium term (5-10 years)

Nominator

ACT Government

Problem

The underlying problem is growing congestion on the Canberra CBD to north corridor. This congestion is being caused by limited road and public transport capacity and increasing travel demand as a result of major population growth in the corridor.

The Australian Infrastructure Audit (April 2015) (the Audit) shows the cost of delay on greater Canberra's urban transport network was \$0.2 billion in 2011, and is projected to increase to \$0.7 billion in 2031. Further, the Audit shows that in the absence of additional public transport capacity, significant projected population growth in the CBD to north corridor will lead to demand for public transport outstripping available supply.

Proposed initiative

The initiative proposes several measures to alleviate congestion in the Canberra CBD to north corridor, including the construction of light rail between Gungahlin and Canberra CBD, improvements to bus connectivity and reliability and capacity improvements for a number of arterial roads.

Next Steps

Options assessment

Canberra public transport improvements



Infrastructure Priority List classification

Initiative

Location

Belconnen, Queanbeyan to central Canberra

Problem Timescale

Medium term (5-10 years)

Nominator

ACT Government

Problem

Canberra's limited public transport network capacity, coupled with high rates of private vehicle reliance, is causing the transport network to suffer from increasing congestion. Congestion is likely to be exacerbated by projected significant population growth.

This congestion results in adverse economic impacts through increased travel times and higher vehicle operating costs.

Proposed initiative

The initiative proposes to develop two bus transit ways connecting Belconnen and Queanbeyan to Central Canberra. The bus transit ways will provide an integrated transport solution, reducing traffic congestion and providing transport network capacity for future economic development in the region.

Next Steps

Options assessment

Newell Highway upgrade



Infrastructure Priority List classification

Initiative

Location

Corridor between Tocumwal
and Boggabilla, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The Newell Highway is part of the National Land Transport Network. It is the principal inter-capital freight route between Melbourne and Brisbane, and is a critical link for regional producers in central and western NSW. Freight on the corridor is expected to grow strongly, supported by robust population growth in both Melbourne and Brisbane.

The efficiency of the route is constrained by localised congestion, deteriorating pavement and a lack of overtaking opportunities. Road alignment and geometry in several sections are also unsuitable for some High Productivity Vehicles (HPVs).

These factors constrain freight productivity by increasing travel times and the number of vehicle journeys required, as well as reducing freight reliability.

Proposed initiative

The initiative seeks to improve several sections of the highway to support safe HPV access, and improve safety and reliability. The initiative will also consider first/last mile issues faced by HPV operators in the corridor.

Next Steps

Business case development

New England Highway upgrade



Infrastructure Priority List classification

Initiative

Location

South of Singleton to Muswellbrook, NSW

Problem Timescale

Medium term (5-10 years)

Nominator

NSW Government

Problem

The New England Highway is part of the National Land Transport Network and is a major freight and passenger route forming part of the inland Sydney-Brisbane corridor. The corridor services a high proportion of heavy freight vehicles and is the main freight route from the Hunter Valley coalfields to the Port of Newcastle.

Under the existing alignment, the New England Highway passes through the centre of towns such as Singleton and Muswellbrook. Traffic congestion, reduced land freight transport productivity, safety (due to the mix of heavy vehicles and residential traffic in the town centres) and amenity issues are the principal problems. The current alignment also limits the extent to which Higher Productivity Vehicles can be mobilised.

Proposed initiative

The initiative includes a number of potential projects, including bypasses of the towns of Singleton and Muswellbrook, and intersection upgrades.

The initiative is designed to contribute to the efficient movement of freight from regional exporters to the Port of Newcastle which is essential to supporting economic growth and productivity in New South Wales.

Next Steps

Business case development

Pacific Highway (A1) – Coffs Harbour Bypass Stage 1



Infrastructure Priority List classification

Initiative

Location

Coffs Harbour, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

Connecting Sydney and Brisbane, the Pacific Highway is an important passenger and freight corridor, and is part of the National Land Transport Network. Currently, vehicles on the Pacific Highway must travel through the Coffs Harbour Central Business District. This increases freight and passenger vehicle travel times and increases the potential for conflict between heavy vehicles, passenger vehicles and pedestrians in this built-up area. The Australian Infrastructure Audit (April 2015) identified improving freight network efficiency as a key challenge for New South Wales.

Preliminary economic analysis estimates that the annual cost of the problem is in the order of \$55 million per annum.

Proposed initiative

Construct a bypass around Coffs Harbour. This would also include an upgrade to an existing section of highway to deliver a total of 13.2 kilometres of motorway standard dual carriageway on the Pacific Highway.

Next Steps

Business case development

Pacific Highway (M1) – extension to Raymond Terrace Stage 1



Infrastructure Priority List classification

Initiative

Location

Beresfield to Raymond Terrace, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The Pacific Highway is one of the most heavily used road corridors for freight in NSW. The highway is critical to the transport of freight between Sydney and Brisbane.

Between John Renshaw Drive and Raymond Terrace, the highway is at arterial road standard with at-grade intersections, hindering the free-flow of traffic.

Traffic speed during the morning peak is estimated to be 60 km/hour by 2021 and to drop to 23-39 km/hour by 2031. Current traffic volumes are 21,835 vehicles during the afternoon peak. This is expected to increase by 36 per cent by 2031. The major growth drivers are the planned industrial developments at Black Hill, Tomago Road and Weakleys Drive. It is estimated that road network improvements could increase travel speed by around 20 km/hour.

The current road network does not adequately cater for High Productivity Vehicles (HPVs). Heavy vehicles travelling to-and-from Tomago industrial area and the Port of Newcastle are required to undertake contra-flow movements during the night. The use of HPVs is estimated to generate significant productivity benefits. It is estimated that HPVs could perform the freight task with up to 37 per cent fewer trucks and 37 per cent fewer vehicle kilometres travelled.

Proposed initiative

Upgrade of the Pacific Highway between John Renshaw Drive and Raymond Terrace to motorway standard. This would lead to productivity benefits from faster freight movements in the Sydney to Brisbane corridor.

Next Steps

Business case development

Western Sydney roads upgrade



Infrastructure Priority List classification

Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

Over the next two decades, Western Sydney will be home to an additional 900,000 people, with more than half of all Sydneysiders expected to be living in this region within 25 years. Preliminary analysis indicates that the initial demand at the Western Sydney Airport from opening will be around three million passengers per year.

Future development in Western Sydney, and at the Western Sydney Airport, is expected to generate additional travel demand which would eventually exceed the capacity of the existing road network.

A separate initiative proposes the preservation of a rail corridor to the Western Sydney Airport.

Proposed initiative

The initiative proposes a suite of road projects including:

- Upgrading The Northern Road to a minimum of four lanes
- Building a new M12 Motorway with up to six lanes
- Upgrading Bringelly Road to a minimum of four lanes
- A package for local roads upgrades.

Next Steps

Business case development

Freight rail access to Port Kembla



Infrastructure Priority List classification

Initiative

Location

Illawarra/Southern Highlands region, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The Australian Infrastructure Audit (April 2015) identified that Port Kembla would face capacity constraints in the absence of any additional rail network improvements. Port Kembla is a significant economic asset. Maintaining efficient movement of freight to and from the port is a key challenge.

Currently, 60-65 per cent of freight travelling to and from Port Kembla is transported by rail on either the Illawarra Line or the Moss Vale to Unanderra Line. Operations on both lines are limited by passenger rail services in the region, resulting in disruptions to freight scheduling. Queuing of up to 11 hours is common as passenger services are given priority.

Port Kembla's Outer Harbour development is expected to attract overflow container traffic from Port Botany. The NSW Government has stipulated that Port Kembla should generally not accept more than 120,000 TEUs per annum by road. This is around 10 per cent of Outer Harbour container capacity. This is likely to lead to a significant increase in demand for rail services.

Inadequate rail freight capacity may lead to a substantial increase in road freight, further constraining the Illawarra region's road network.

Proposed initiative

Develop additional rail freight capacity to Port Kembla via:

- Moss Vale – Unanderra capacity enhancements
- Unanderra to Dapto duplication
- Macarthur to Moss Vale capacity enhancements.

Consider whether additional capacity, such as that which could be provided through development of the proposed link between Maldon and Dombarton, is warranted in the longer term.

Next Steps

Business case development. Infrastructure Australia has received a business case for the proposed link between Maldon and Dombarton.

Moorebank Intermodal Terminal road connection upgrade



Infrastructure Priority List classification

Initiative

Location

Sydney, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The Australian Infrastructure Audit (April 2015) identified the M5 corridor – the key corridor linking the Moorebank Intermodal Terminal (MIT) and Port Botany – as highly economically significant. The delay cost per km is projected to be the tenth highest of any corridor in NSW in 2031, even after accounting for the duplication of the M5 as part of WestConnex Stage 2.

The development of the MIT presents an opportunity to moderate growth in freight traffic on the M5 corridor; however, it will generate additional freight traffic in the vicinity of the terminal. The current road network provides a single point of access to the freight precinct. This constraint could create significant ‘last mile’ congestion affecting the efficiency of freight movements, and ultimately the effectiveness of the MIT itself.

The broader road network surrounding the MIT is currently highly congested, particularly sections of the M5, which has a poor safety record due to significant ‘weaving’ conflicts (where vehicles are weaving in and out of lanes).

In the absence of any network improvements, the additional freight demand will adversely affect travel times and reliability to the precinct, and ultimately harm freight productivity.

Proposed initiative

The initiative proposes a package of inter related road infrastructure improvements to increase network efficiency and improve access to the Moorebank Intermodal Terminal. The major components of the Program include:

- Upgrades to the M5 interchanges at the Hume Highway and Moorebank Avenue
- Connection improvements between the Moorebank Intermodal Terminal and the M7 Motorway and M31 Hume Motorway
- Upgrades to key intersections.

Next Steps

Options assessment

Northern Sydney Freight Corridor Stage 2

Additional track West Ryde to Rhodes and Thornleigh to Hornsby



Infrastructure Priority List classification

Initiative

Location

Sydney, NSW

Problem Timescale

Longer term (10-15 years)

Nominator

NSW Government

Problem

Demand for East Coast rail freight is projected to grow rapidly. Interstate container freight in the Newcastle to Sydney corridor is projected to grow four-fold from 2012 to 2028. The rapid near term growth expected is driven by improvements to freight transport availability and reliability due to the Northern Sydney Freight Strategy Stage 1 project.

Once Stage 1 is completed in 2016, the corridor's capacity will increase by 50 per cent, from 29 to 44 freight trains each day, and will accommodate growth in demand for rail freight up until 2028. In the longer term, the Sydney metropolitan rail network may again become a point of bottleneck for the rail freight network, mainly because of priority given to passenger rail services.

The Australian Infrastructure Audit (April 2015) found that freight rail in NSW had a Direct Economic Contribution of \$862 million in 2011, which is expected to grow to \$1,274 million in 2031.

Proposed initiative

The initiative comprises additional tracks from West Ryde to Rhodes and from Thornleigh to Hornsby.

Next Steps

Business case development

Southern Sydney Freight Line upgrade



Infrastructure Priority List classification

Initiative

Location

Sydney, NSW

Problem Timescale

Longer term (10-15 years)

Nominator

NSW Government

Problem

The forecast growth in interstate, intrastate and import/export freight, particularly with the development of the Moorebank Intermodal Terminal, will place significant pressure on Sydney's rail freight network and the Southern Sydney Freight Line (SSFL) in particular. The SSFL forms a key connection between the proposed terminal and other logistics hubs. Without additional capacity once Moorebank Intermodal Terminal is fully operational, the SSFL could become increasingly unreliable and face capacity constraints.

Currently, only 14 per cent of freight handled at Port Botany is transported by rail with the remainder transported by road. On average, Port Botany produces around 3,900 truck movements daily, contributing to significant congestion on key arterial roads including the M4 and M5, both of which were identified in the Australian Infrastructure Audit (April 2015) (the Audit) as highly congested corridors.

In order to incentivise a shift from road to rail for containerised freight movement in Sydney (consistent with both NSW government policies and findings from the Audit), further capacity and higher levels of service

are required on Sydney's freight rail network. Investment in the rail freight network will be crucial to ensuring the competitiveness of landside freight infrastructure such as the Moorebank Intermodal Precinct.

Proposed initiative

The Southern Sydney Freight Line is a 36 kilometre single line from Macarthur to Sefton. The proposed initiative involves track duplications and additional passing loops on the line. The initiative aims to support the movement of freight by rail through the city, particularly between Port Botany and the Moorebank Intermodal Precinct. It forms part of a broader strategy designed to drive growth in rail mode share.

Next Steps

Business case development

Lower Hunter freight corridor construction



Infrastructure Priority List classification

Initiative

Location

Lower Hunter region, NSW

Problem Timescale

Longer term (10-15 years)

Nominator

NSW Government

Problem

The existing Main North railway line services coal freight travelling to the Port of Newcastle, interstate freight travelling from Sydney and Melbourne to Brisbane, as well as intrastate freight and passenger trains.

Line congestion, and the priority given to passenger trains on shared parts of the rail network, mean that the efficiency and cost effectiveness of freight movement is reduced in the Lower Hunter region in and around Newcastle. This affects bulk freight destined for the Port of Newcastle as well as containerised and general freight being transported on the east coast freight rail network linking Melbourne, Sydney and Brisbane. Rail freight inefficiency increases costs, and makes rail less competitive than road. This in turn creates an incentive for more trucks to be on the road, which increases congestion, vehicle emissions and noise, and affects amenity.

Proposed initiative

Develop a new rail freight alignment from Fassifern to Hexham bypassing suburban Newcastle.

Next Steps

Options assessment

Newcastle – Sydney and Wollongong – Sydney rail line upgrades



Infrastructure Priority List classification

Initiative

Location

Newcastle – Sydney – Wollongong, NSW

Problem Timescale

Longer term (10-15 years)

Nominator

NSW Government

Problem

Slow regional passenger rail speeds (average 56 kilometres per hour) result in lengthy travel times of two hours 37 minutes (Newcastle – Sydney) and one hour 27 minutes (Wollongong – Sydney), that are generally longer than car travel. This service level reduces accessibility to the Sydney employment market from regions with above average unemployment. It also limits the opportunities to develop greater economic synergies between Australia's largest, seventh largest and ninth largest cities, which would benefit productivity and relieve metropolitan housing market pressure.

Uncompetitive rail services also add to road congestion on key roads linking Sydney with Newcastle and Wollongong. The current level of rail capacity and quality of service reflect a range of operational and infrastructure constraints, including winding alignments across the Hawkesbury River (Newcastle – Sydney) and the Illawarra Escarpment (Wollongong – Sydney).

Proposed initiative

The proposed initiative is expected to include but is not limited to the following improvements:

- An initial set of operational and fleet improvements
- Targeted fixed infrastructure improvements (for example, new deviations to eliminate curvatures and flatten grades)
- New rail crossing of the Hawkesbury River and Illawarra Escarpment.

Next Steps

Options assessment

Western Sydney Airport public transport connection



Infrastructure Priority List classification

Initiative

Location

Sydney, NSW

Problem Timescale

Longer term (10-15 years)

Nominator

NSW Government

Problem

As identified in the Australian Infrastructure Audit (April 2015), meeting the Sydney region's future air passenger demand will require expansion of airport capacity beyond Sydney Airport. Much of this demand is expected to be absorbed by the proposed Western Sydney Airport at Badgerys Creek.

Upon opening, Western Sydney Airport would require reliable public transport connectivity, appropriate to the level of demand, to service arriving and departing air passengers, as well as employees and airport, aviation, freight and related businesses. Fast and reliable bus connections using dedicated infrastructure, integrated with the broader Sydney rail and public transport network, can help minimise road congestion in Sydney's growing South West Growth Centre.

Proposed initiative

Provide infrastructure to support bus connections between the proposed Western Sydney Airport and the nearby centres of Liverpool and Penrith, and connecting the airport to the broader Sydney rail and public transport network. This proposed initiative does not preclude direct rail access to the proposed Western Sydney Airport in the long term, and should be viewed as a potential complimentary investment to preserving a rail corridor.

Next Steps

Options assessment

Bruce Highway upgrade



Infrastructure Priority List classification

Initiative

Location

Brisbane to Cairns, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

The Bruce Highway is part of Queensland's Priority Freight Network and forms part of the National Land Transport Network. The highway plays an important role in connecting regional centres as well as facilitating significant freight movement. Both roles were identified as key regional priorities for Queensland in the Australian Infrastructure Audit (April 2015).

The Bruce Highway is Queensland's major north-south corridor, connecting coastal population centres from Brisbane to Cairns. With Queensland's freight task expected to double over the next 20 years, the highway is expected to experience a significant increase in freight volumes.

The problems identified along the Bruce Highway include: safety concerns, poor flooding immunity, poor connectivity to regional centres and capacity constraints around key economic clusters.

The root cause of the problems identified along the highway are largely driven by increased traffic volumes associated with population and economic growth, resulting in congestion around key economic hubs, ultimately harming Queensland's freight productivity.

Proposed initiative

Progressive priority upgrades to the Bruce Highway to address specific capacity constraints, flood resilience and safety concerns.

Next Steps

Individual upgrade projects are at various stages of development

Beerburrum to Nambour rail upgrade



Infrastructure Priority List classification

Initiative

Location

Sunshine Coast to Brisbane, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

Capacity issues on the rail line between Beerburrum and Nambour were identified as a priority in the Queensland Government's Moving Freight strategy, and in the Northern Australia Audit.

The existing rail line is operating above capacity, and failing to support current levels of passenger and freight demand. The configuration of the route as a single track with limited passing loops severely limits capacity of the line. Modelling undertaken suggests that passenger demand on this route could grow by between 5 and 8 per cent per annum out to 2031.

In the absence of any rail network enhancements, a significant increase in traffic on the already constrained Bruce Highway is likely to occur, to cater for increased commuter movements from the Sunshine Coast to Brisbane. Economic modelling suggests that improvements to this line to increase capacity and efficiency could yield \$150 million and \$300 million in passenger and freight benefits respectively.

Proposed initiative

The proposed initiative is located on the North Coast Line between Beerburrum and Nambour stations. The proposed initiative involves the duplication of the track, extensions of existing passing loops and improvements to stations along the route. All the proposed improvements will facilitate greater flexibility and passing opportunities, improving the efficiency of both passenger and freight services, and taking pressure off the Bruce Highway.

Next Steps

Business case development

Gladstone Port land and sea access upgrade



Infrastructure Priority List classification

Initiative

Location

Gladstone and surrounding area

Problem Timescale

Medium term (5-10 years)

Nominator

Gladstone Ports Corporation

Problem

The Australian Infrastructure Audit (April 2015) (the Audit) found that growth in mineral and gas exports will lead to significant growth in demand for regional highway, rail and port infrastructure. Improving connections to ports will be essential to supporting these industries.

The Audit noted that Gladstone Port handled around 7.5 per cent of Australia's bulk imports and exports (measured in gross mass tonnes) in 2012-13. The Audit estimated the Direct Economic Contribution of Gladstone Port at \$615 million in 2011, rising to \$1.1 billion by 2031 (2011 dollars).

Gladstone Ports Corporation has referred to a recent study which identified a number of opportunities to invest in infrastructure to underpin growth in Central Queensland's mining, export and agricultural sector. These opportunities relate to land and sea access infrastructure designed to support productive supply chains to Gladstone Port.

Proposed initiative

The proposal covers a range of potential projects including:

- Channel management to increase export capacity through the port
- Upgrades to road and bridge infrastructure that service the port
- New rail infrastructure to provide direct connections from the Surat Basin to the port.

Next Steps

Options assessment

Mount Isa – Townsville rail corridor upgrade



Infrastructure Priority List classification

Initiative

Location

Far North Queensland

Problem Timescale

Medium term (5-10 years)

Nominator

Queensland Government

Problem

The current rail line between Townsville and Mount Isa is experiencing capacity constraints with inefficient rail and terminal operations. These constraints include access to the Port of Townsville, short passing loop lengths, and limited passing opportunities.

In its current form, the rail line does not have capacity to cater for the projected increase in demand for rail haulage from mines in the Mount Isa region to the Port of Townsville. Future demand on the line is, under the moderate scenario, estimated to be 20 million tonnes per annum (mtpa). In 2011, the line carried 6 mtpa and had a theoretical capacity of 7.5 mtpa.

Proposed initiative

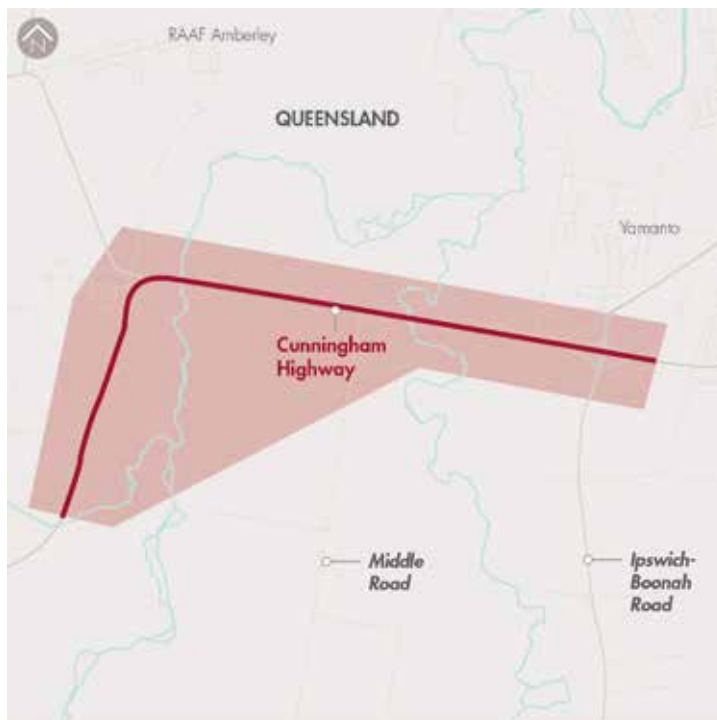
The initiative proposes the following works:

- Enhancements to western sections of the Mount Isa to Townsville Rail Corridor
- Construction of a new 6.5 kilometre Townsville Eastern Access Rail Corridor to provide direct access to export facilities at the Port of Townsville for longer trains.

Next Steps

Business case development

Cunningham Highway – Yamanto to Ebenezer/ Amberley upgrade



Infrastructure Priority List classification

Initiative

Location

Yamanto to Ebenezer, Queensland

Problem Timescale

Near term (0-5 years)

Nominator

Queensland Government

Problem

The Cunningham Highway is a key interstate freight corridor that forms part of the Sydney to Brisbane inland corridor. It is part of the National Land Transport Network, and plays a significant role in transporting people and freight (recording 2,700 heavy vehicle movements per day) to and from Brisbane and the Port of Brisbane from the west.

With the construction of the Port of Brisbane Motorway, and the recent upgrading of the Gateway Motorway South and the western Ipswich Motorway, the Cunningham Highway at Amberley is one of the few remaining 'pinch-points' for interstate freight along the western Corridor.

The identified 'pinch point' is the intersection of the Cunningham Highway and the Ipswich Rosewood Road. It results in high levels of congestion particularly during the morning peak. Preliminary modelling suggests that the current direct cost of congestion is approximately \$45 million per year.

The material impacts of the problem include declining levels of service which reduces freight efficiency and through-traffic movements, as well as potentially limiting major developments planned for the area.

The intersection does not comply with current design standards resulting in significantly higher than average crash rates. These problems are likely to worsen in the face of the significant population and freight growth expected in the region.

Proposed initiative

The initiative involves upgrades to a 4.75 kilometre section of the Cunningham Highway between Warwick Road at Yamanto and Ebenezer Creek, including the Amberley Interchange. Specific capital works include a major off-line deviation with grade-separation for the Amberley Interchange, additional capacity at the Amberley Interchange off-ramp, and a new service road between Coopers Road and Yamanto.

Next Steps

Business case development

Strzelecki Track sealing and mobile coverage



Infrastructure Priority List classification

Initiative

Location

Corridor: Lyndhurst – Innamincka

Problem Timescale

Near term (0-5 years)

Nominator

SA Government

Problem

The Strzelecki Track was identified in the Australian Infrastructure Audit (April 2015) as a key freight route. It is the only viable land route between Adelaide and the Cooper Basin, and will be increasingly important to service the expanding oil and gas industry in the Cooper and Eromanga Basins, and the pastoral industry in the north east of South Australia.

The Strzelecki Track is currently unsealed and suffers from potholes, corrugation and a lack of drainage. It is not sufficiently wide for triple road trains.

The road's condition and alignment reduce travel speed, damage vehicles, cause unpredictable closures due to flooding, and result in road safety risks. The road is not currently suitable for the most productive heavy road vehicles.

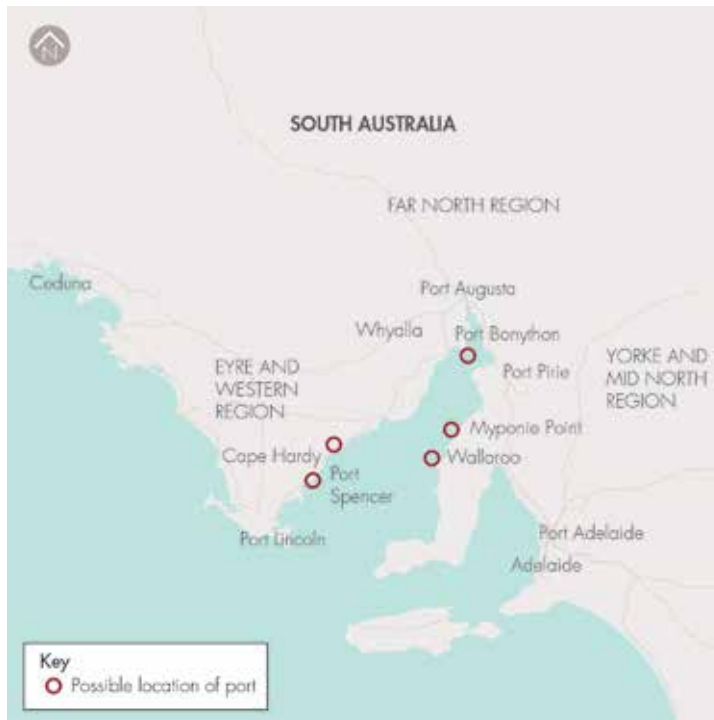
Proposed initiative

Upgrade and seal 426 kilometres of the (currently unsealed) Strzelecki Track between Lyndhurst and Innamincka, and 26 kilometres of the Nappa Merrie Access Road. This will provide a sealed connection between SA and Queensland. Improvements to mobile phone coverage along the route are also proposed.

Next Steps

Business case development

South Australian regional mineral port development



Infrastructure Priority List classification

Initiative

Location

Spencer Gulf region

Problem Timescale

Medium term (5-10 years)

Nominator

SA Government

Problem

The mining and resources sector in South Australia is continuing to grow. South Australia now has 10 fully operating mines; four approved or under construction; and more than 20 projects at various stages ranging from exploration to pre-feasibility.

To date, operations have been accommodated within existing ports and landside transport infrastructure. The Australian Infrastructure Audit (April 2015) noted that expansion of a number of regional ports, as well as development of new high-capacity ports, could support further increases in exports, especially of minerals and resources. There is a particular requirement to develop deep ports with the capacity to accommodate the 'capesize' vessels which are essential to compete in global iron ore markets.

The lack of a clear path to market (including high capacity, deep ports) can be a barrier to attracting capital to new mining projects. However, it is difficult to attract capital for new port projects without financial and contractual commitments from miners. Recent downturns in commodity markets, including for iron ore, are also a barrier to expanding South Australia's mining sector.

Proposed initiative

Considers options for the development of bulk commodity port capacity in the Spencer Gulf region. A business case completed in September 2015 identified three sites that could meet potential demand. These are:

- the existing Whyalla Port in the northern Spencer Gulf
- the planned Cape Hardy Port on the central eastern Eyre Peninsula
- the planned Myponie Point Bulk Commodity export facility on the northern Yorke Peninsula.

Next Steps

Business case development

Sturt Highway High Productivity Vehicle capacity enhancement, including Truro bypass



Infrastructure Priority List classification

Initiative

Location

Truro, SA

Problem Timescale

Medium term (5-10 years)

Nominator

SA Government

Problem

The road transport system is the only means of transporting goods in most regional areas of South Australia. However, the existing road network does not allow for the use of high productivity vehicles (HPVs), and the absence of a fully developed HPV network is constraining productivity and the realisation of opportunities in the South Australian economy.

The Sturt Highway is part of the National Land Transport Network, providing a strategic route between Adelaide and Sydney, as well as Perth and Sydney. Freight growth on the Sturt Highway is expected to increase at 1.6 per cent per annum. Increases in freight vehicle numbers will reduce the capacity of the Sturt Highway, resulting in increased travel time and costs. This negatively affects business competitiveness and productivity.

HPVs have the potential to carry over 30 per cent more freight per vehicle, resulting in fewer vehicles required to move the same freight task. This reduces the costs to transport operators and end users, and reduces the number of heavy vehicles on the road, improving safety, capacity and efficiency of transport services.

The Australian Infrastructure Audit (April 2015) estimated that the Direct Economic Contribution of all national highways in South Australia was \$511 million in 2011. This is projected to increase to \$722 million in 2031, an increase of 41 per cent.

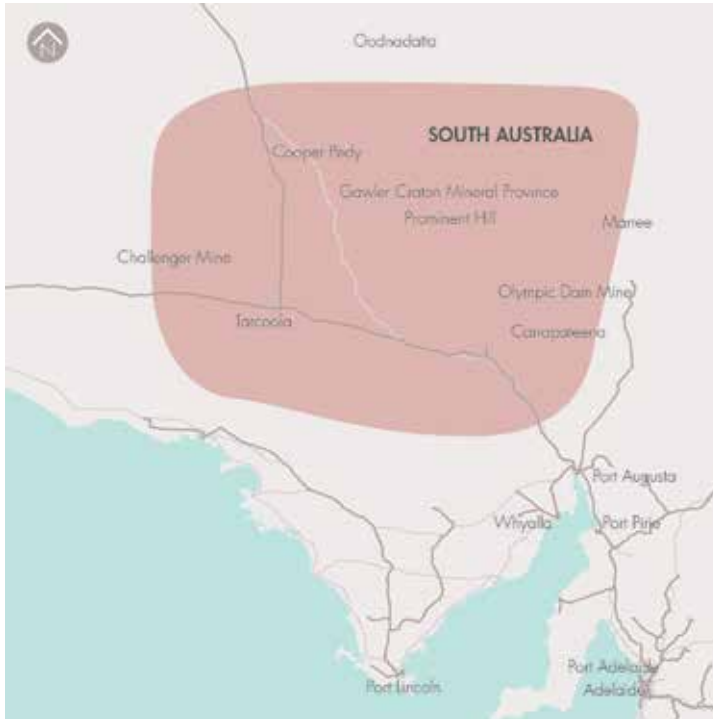
Proposed initiative

This initiative proposes the realignment of the Sturt Highway through the Truro Hills, including a bypass of the town of Truro, to improve safety and allow use of HPVs on the highway.

Next Steps

Options assessment

Gawler Craton rail access



Infrastructure Priority List classification

Initiative

Location

Gawler Craton minerals region

Problem Timescale

Medium term (5-10 years)

Nominator

SA Government

Problem

The Gawler Craton is a remote mineral region north west of the Eyre Peninsula in South Australia. The province, which extends into the Woomera Prohibited Area, contains extensive copper, gold, silver and iron ore deposits.

The remoteness of the mineral deposits within the northern part of South Australia is a challenge for exploration and development. Development of a railway could provide a significant transport connection to the Prominent Hill, Olympic Dam and Carrapateena mines, and open up other potential reserves in the area, including Wirrda Well, Acropolis, Vulcan, Titan and Millers Creek.

Geological surveys have indicated that potential deposits in the Woomera Prohibited Area are valued at up to \$35 billion, indicating that a significant uplift in the region's mineral exports could be attainable.

Proposed initiative

The initiative proposes that a third party builds, owns and operates a 350km railway in the Gawler Craton province, linking to the existing interstate rail network. Future connections to other potential mining projects will be possible.

Next Steps

Options assessment

Melbourne – Adelaide – Perth rail upgrade



Infrastructure Priority List classification

Initiative

Location

Corridor between Melbourne and Tarcoola

Problem Timescale

Longer term (10-15 years)

Nominator

SA Government

Problem

The interstate rail freight network in South Australia comprises links between Melbourne, Adelaide, Perth, Sydney and Darwin and was identified in the Australian Infrastructure Audit (April 2015) as a key part of the National Land Transport Network. The track handles 80 per cent of the land-based east-west intercapital freight market and is also utilised by regional mineral and agricultural producers in South Australia.

The track is expected to become capacity constrained over the next 10-15 years by a combination of steady growth in the east-west non-bulk freight task (expected to double by 2030) and future mining and agricultural production. Some sections of track are approaching the end of asset life and have alignments that impose speed and axle load restrictions.

The combination of congestion, poor alignment, and asset age is expected to impact travel times and the reliability and productivity of the interstate freight network. The viability of future mining projects may also be affected.

Proposed initiative

The initiative proposes upgrades on the Port Augusta – Tarcoola section of the network to accommodate higher axle loads, capacity and speed, and improve train management systems. Future development of the Melbourne – Port Augusta sections of the network will need to be considered as part of the development of the National Freight and Supply Chain Strategy, which is being recommended in the Australian Infrastructure Plan.

Next Steps

Options assessment

Derwent River crossing capacity



Infrastructure Priority List classification

Initiative

Location

Bridgewater, Tasmania

Problem Timescale

Medium term (5-10 years)

Nominator

Tasmanian Government

Problem

The Bridgewater Bridge does not meet contemporary loading and design standards as part of the National Land Transport Network. The bridge provides one lane in each direction, and has a posted speed limit of 60 km/h.

The existing bridge and causeway are reaching the end of their serviceable lives and future refurbishments will be increasingly costly.

The bridge has high maintenance costs due to its age and current operation as a vertical lift bridge.

Proposed initiative

The initiative involves the development of options to enhance Derwent River crossing capacity. These could include:

- Rehabilitation of the existing bridge, possibly without the vertical lift capability
- Construction of a new high-level or low-level bridge adjacent to the existing Bridgewater Bridge and causeway.

Next Steps

Options assessment

Burnie to Hobart freight corridor strategy



Infrastructure Priority List classification

Initiative

Location

Burnie to Hobart, Tasmania

Problem Timescale

Medium term (5-10 years)

Nominator

Tasmanian Government

Problem

The road and rail corridor connecting Burnie and Hobart is identified in the Australian Infrastructure Audit (April 2015) as a corridor of national significance.

The total Tasmanian freight network connects regional producers to Tasmania's ports, meaning producers are reliant on the corridor to bring goods to market at competitive prices. The Direct Economic Contribution of the corridor was estimated to be \$288 million in 2011, which is projected to increase to \$415 million in 2031.

Given the corridor's importance to Tasmania's transport network, there is a need for an integrated strategy to ensure its future efficiency and reliability. This strategy would facilitate the development of the corridor as a key freight route, supporting the economic productivity of regional producers and businesses.

Proposed initiative

The initiative seeks to develop a Burnie to Hobart Freight Corridor Strategy, which will prioritise areas for investment along the corridor, with a focus on improving intermodal freight productivity. The key elements of the strategy are to:

- Identify a single, integrated package of investment priorities for road and rail based on freight demand, corridor and system outcomes
- Confirm required road and rail infrastructure standards and service levels
- Plan for appropriate road freight infrastructure standards across the state road network, including in the use of high productivity vehicles.

The strategy would be considered in conjunction with the development of the National Freight and Supply Chain Strategy, which is being recommended in the Australian Infrastructure Plan.

Next Steps

Options Assessment

Murray Basin rail upgrade



Infrastructure Priority List classification

Initiative

Location

North West Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Victorian Government

Problem

Victoria's broad gauge regional rail network is capacity constrained owing to limited axle loadings and short passing loops. Trains on the broad gauge network are unable to access the Port of Portland which is now served by standard gauge track.

The broad gauge rail network only has access to the ports of Melbourne and Geelong, which reduces the potential for competition with other ports such as Portland. The constraints of Victoria's mixed gauge network also create disincentives for new entrants or existing operators to invest in rail infrastructure.

Capacity constraints in the network result in declining rail service levels, longer and less reliable transit times for rail freight, and increasing costs for business. Higher rail freight costs have resulted in an increase in road freight in the Murray Basin region, which has a detrimental impact on regional roads and amenity.

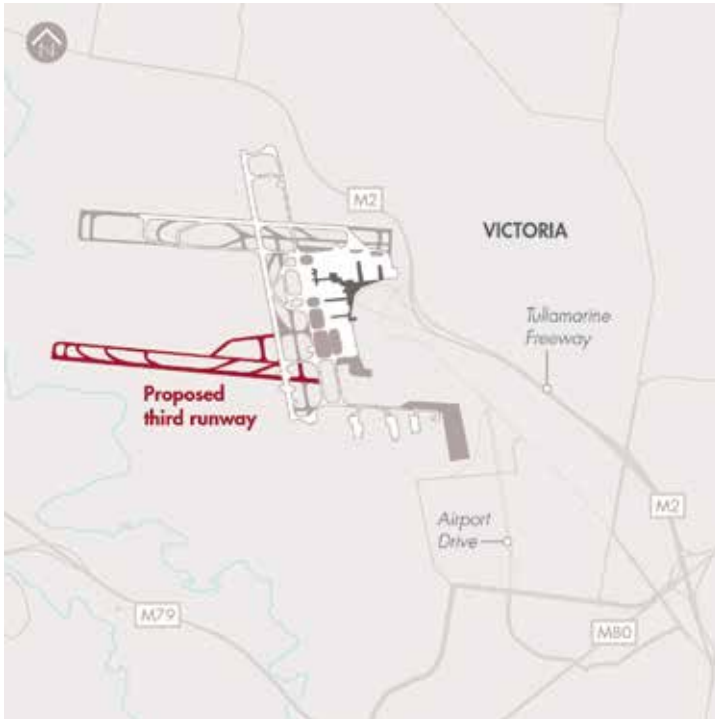
Proposed initiative

The initiative proposes a package of rail network improvements including axle load upgrades and standardisation of the existing broad gauge rail network in North West Victoria. The initiative would also see the reopening of the standard gauge connection from Maryborough to Ararat.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

Melbourne Airport third runway



Infrastructure Priority List classification

Initiative

Location

Melbourne Airport, Melbourne, Victoria

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

Melbourne Airport is Australia's second-busiest airport, handling 29.1 million passengers and 210,000 aircraft movements in 2013. In 2013, the airport's contribution to Gross State Product (GSP) across all industries was estimated to be approximately \$1.47 billion, including 14,300 jobs. The airport's contribution to GSP is forecast to increase to \$3.21 billion by 2033, including 23,000 jobs.

Demand for the airport is increasing, and by 2033 the airport anticipates facilitating 64 million passengers and 348,000 aircraft movements.

With its existing two-runway system, Melbourne Airport is expected to reach capacity during peak periods between 2018 and 2022.

This capacity constraint will inhibit the efficient functioning of the airport, leading to significant delays for passengers and freight, increasing fuel costs for airlines, and increasing emissions.

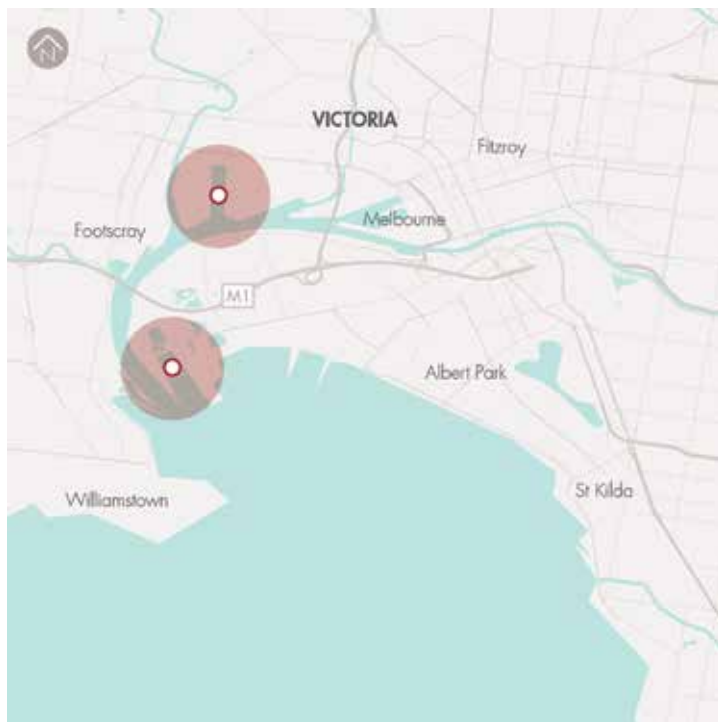
Proposed initiative

The initiative proposes a third runway to meet increased demand at Melbourne Airport. The three-runway system could facilitate at least 380,000 total aircraft movements at the airport per year, providing sufficient capacity to accommodate projected aircraft movements until around 2040.

Next Steps

Initiative development

Melbourne container terminal capacity enhancement



Infrastructure Priority List classification

Initiative

Location

Melbourne, Victoria

Problem Timescale

Longer term (10-15 years)

Nominator

Audit identified gap

Problem

The Port of Melbourne is Victoria's busiest port and the largest container and general cargo port in Australia. Traffic at the port has grown at six per cent per year over the last two decades. The Australian Infrastructure Audit (April 2015) identified that, even with planned expansions, additional container terminal capacity will be required before 2031.

The development of additional container terminal capacity in Melbourne, with dedicated rail links connected to the national rail system, will help to alleviate congestion caused by road freight movements.

Given Melbourne's central role in Australia's freight supply chain, inadequate port capacity in Melbourne could have broader national consequences.

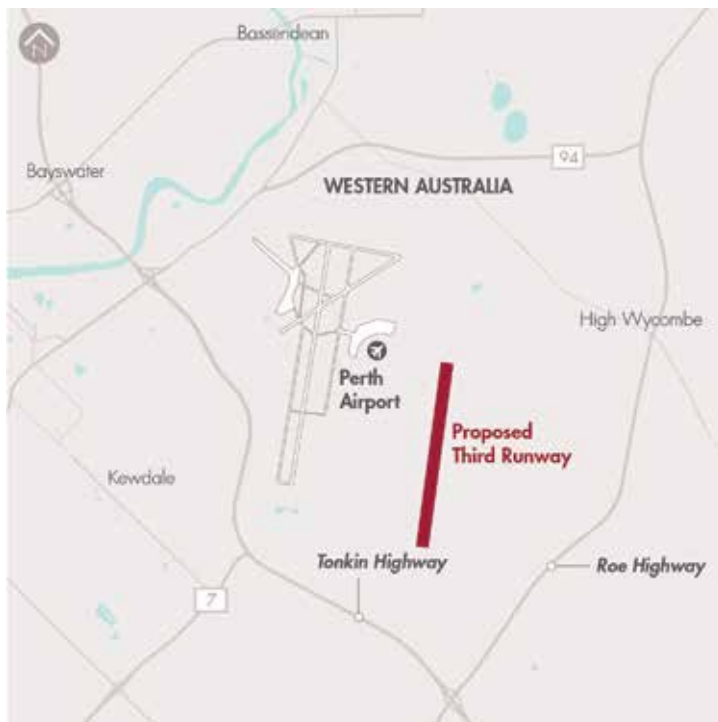
Proposed initiative

Planning and construction of additional container terminal capacity in Melbourne to cater for projected increases in containerised freight volumes.

Next Steps

Initiative development

Perth Airport third runway



Infrastructure Priority List classification

Initiative

Location

Perth, WA

Problem Timescale

Medium term (5-10 years)

Nominator

Audit identified gap

Problem

Perth Airport is the fourth busiest in the country. The Australian Infrastructure Audit (April 2015) found Perth Airport's Direct Economic Contribution is projected to increase by 169 per cent from \$1.9 billion in 2011 to \$5.1 billion in 2031. Passenger throughput is projected to double from 13.7 million in 2013 to 28.5 million in 2034, and total aircraft movements are predicted to grow from 151,300 annually in 2013 to 242,400 in 2034.

This growth is partly driven by the airport's role as a critical fly-in-fly-out (FIFO) transport hub for shift workers travelling to Western Australia's regional mining operations.

Due to the nature of the resource sector's deployment of a FIFO workforce, passenger movements in and out of Perth Airport are concentrated around peak periods. Runway capacity is currently insufficient to meet demand during peak periods, which can lead to higher operating costs for companies relying on FIFO workers, reducing Australia's international competitiveness.

Proposed initiative

Construction of an additional runway at Perth Airport to provide capacity needed to meet increasing demand.

Next Steps

Initiative development

Perth container terminal capacity enhancement



Infrastructure Priority List classification

Initiative

Location

Perth, WA

Problem Timescale

Longer term (10-15 years)

Nominator

Audit identified gap

Problem

Capacity at the current container terminal at Fremantle Port is limited. The Australian Infrastructure Audit (April 2015) (the Audit) indicates that with improvements in productivity and some development, the capacity of the terminal would be 1.2 to 1.4 million containers per year.

In 2014-15, Fremantle Port handled 743,503 containers. Assuming port container traffic grows at 5.6 per cent (in line with the average annual growth rate between 2005/06 and 2010/11), and based on current port and landside access capacity, the current facility could reach capacity in around ten years.

According to the Audit, Fremantle Port accounted for 9.4 per cent of Australia's containerised trade in 2012/13 and has a Direct Economic Contribution of \$2.7 billion in 2011.

The Audit found that significant investment will be required in order to ensure that port capacity can meet the forecast growth in demand by 2031.

Proposed initiative

The initiative involves investigation, planning, and potentially corridor and site preservation for additional container terminal capacity to accommodate future demand in Perth.

Next Steps

Initiative development

Inland Rail

Melbourne to Brisbane via inland NSW



Infrastructure Priority List classification

Initiative

Location

Melbourne to Brisbane, through inland Victoria, New South Wales and Queensland

Problem Timescale

Longer term (10-15 years)

Nominator

Department of Infrastructure and Regional Development

Problem

The existing north-south rail corridor between Melbourne and Brisbane does not provide a service offering that is competitive with road transport. This is largely the result of 19th century alignments leading to low travel speeds and reliability, and major bottlenecks, most notably in transiting the Sydney metropolitan area.

The Melbourne to Brisbane corridor is one of the most important general freight routes in Australia, supporting key population and employment precincts along the east coast. The non bulk and complementary volumes moving within the corridor are currently estimated at 21 million tonnes per annum. This is expected to grow to over 40 million tonnes per annum by 2050.

Without increased use of rail, the growth in freight demand may see increasing pressure on road networks, increased freight costs and a loss of economic opportunity. The long lead times for a project of this nature means that decisions on the further development or delivery of this project will be required in the near term.

Proposed initiative

Construction and operation of 1,700 kilometres of freight railway from Melbourne to Brisbane via inland NSW and South East Queensland. Construction would take 8 to 10 years.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

Advanced Train Management System implementation on ARTC network



Infrastructure Priority List classification

Initiative

Location

Australian interstate rail network

Problem Timescale

Near term (0-5 years)

Nominator

Australian Rail Track Corporation

Problem

The Australian Infrastructure Audit (April 2015) indicated the combined Direct Economic Contribution (DEC) of the national port and freight rail network was \$22 billion in 2011 (12 per cent of the national infrastructure DEC).

The interstate freight rail network is constrained over many long sections of single track. This restricts the number of train paths, reducing rail's competitiveness with road, and hindering rail's ability to meet growing freight movement demand.

Proposed initiative

Advanced Train Management System (ATMS) is a wireless satellite communications-based train control system, that will replace line-side signalling, allowing:

- More train paths on single tracks
- Improved line capacities
- Reduced transit times and improve competition with road
- Improved rail safety
- Improved system reliability.

ATMS will improve the safety and efficiency of train operation between metropolitan centres and between national ports.

Next Steps

Business case development

Improve road access to remote WA communities



Infrastructure Priority List classification

Initiative

Location

Remote areas of WA

Problem Timescale

Near term (0-5 years)

Nominator

Audit identified gap

Problem

There are approximately 270 remote communities in Western Australia, many of which are in the Kimberley region, 2,000 kilometres from Perth. According to the Australian Bureau of Statistics, approximately 35,000 people live in remote areas of Western Australia. Many of these areas have limited transport access, and poor freight connectivity. Existing roads are generally of low quality, and some freight routes are unsealed. This:

- Constrains access to employment, health and education services
- Presents safety issues
- Increases the costs of transporting goods
- Reduces resilience to flooding, particularly during the wet season.

The Australian Infrastructure Audit (April 2015) noted that lower levels of infrastructure service in remote areas can reinforce social and economic inequalities.

Proposed initiative

The initiative is a program of works to improve road access to remote WA areas. This would consider:

- Providing higher standard gravel roads
- Sealing gravel roads
- Floodway improvements
- Improvements to remote and regional airstrips.

Next Steps

Options assessment

Provision of enabling infrastructure and essential services to remote NT communities

Wadeye, Tiwi Islands, Jabiru



Infrastructure Priority List classification

Initiative

Location

Remote locations in the Northern Territory:
Jabiru region/Arnhem Highway, Wadeye region/Port Keats Road, Tiwi Islands

Problem Timescale

Near term (0-5 years)

Nominator

NT Government

Problem

This initiative addresses infrastructure problems in three remote regions of the Northern Territory:

- Jabiru, and the Arnhem Highway, which connects Jabiru to Darwin
- Wadeye (Port Keats) and other nearby remote communities, and the Port Keats Road, which connects Wadeye to Darwin
- The Tiwi Islands.

These remote communities lack the infrastructure required for sustainable economic and social development.

For example:

- Key road corridors, such as the Arnhem Highway and the Daly River Road, can be severely impacted by floods during the wet season, severing land transport access for remote communities for extended periods of time
- Essential services infrastructure, such as water storage and sewerage management, is not always adequate for the population it supports
- Demand for community infrastructure, such as youth centres and public housing, can often outstrip the available supply.

These infrastructure deficiencies constrain the economic development of these remote regions and can impose significant social costs on the local populations.

Proposed initiative

This initiative proposes a portfolio of upgrades to road infrastructure, as well as a range of essential services and community infrastructure upgrades to support economic and social development:

- Road upgrades to improve the accessibility and flood resilience of key road networks
- Upgrades to provide new or improved water storage facilities and wastewater management facilities in a number of remote population centres
- Upgrades to provide additional public housing and upgrades to social infrastructure, such as community centres and youth centres.

Next Steps

Business case development

Upgrade Tanami Road



Infrastructure Priority List classification

Initiative

Location

Tanami Road links Stuart Highway in the NT to Great Northern Highway in WA

Problem Timescale

Near term (0-5 years)

Nominator

NT Government

Problem

The key problems identified in the region include:

- limited economic opportunities for Indigenous and non-Indigenous people in the region
- limitations to development in mining, tourism and pastoral operations
- high vehicle operating costs
- poor flood immunity resulting in lengthy road closures
- reduced opportunities for employment in remote areas
- reduced access to essential services for the Indigenous population
- broader risks to the health and safety for road users arising from poor road geometry, excessive corrugations and poor visibility.

A key cause of these problems is the poor quality of the road. Over two thirds of Tanami Road is unsealed with substantial sections being unformed. This surface has led to the development of significant ruts and corrugations from heavy vehicles.

This initiative aligns with the findings from the Australian Infrastructure Audit (April 2015), as well as with other government priorities, such as ‘closing the gap’ policies. Further, the initiative was identified as an infrastructure gap in the Northern Australia Audit 2015.

Proposed initiative

The scope of the initiative is to build a two lane sealed road from the Stuart Highway just north of Alice Springs to Newmont’s Granites operations, a distance of 527 kilometres, and from there upgrade a further 176 kilometres of the road to a good gravel road standard to the WA border.

Next Steps

Business case development. Infrastructure Australia has received a draft business case.

Lower Fitzroy River water infrastructure development



Infrastructure Priority List classification

Initiative

Location

Fitzroy River, Central Queensland

Problem Timescale

Medium term (5-10 years)

Nominator

Audit identified gap

Problem

Demand for water resources is predicted to rise as a result of continued industrial and urban growth in the Lower Fitzroy and Gladstone areas and potentially some agricultural development within the Fitzroy Agricultural Corridor.

Water demand projections indicate a total shortfall of high priority water for urban and industrial needs in the Central Queensland region in the order of 41,000 megalitres per annum by 2020.

Without secure access to water, further development in this high growth region is expected to be constrained beyond this period.

Proposed initiative

The initiative comprises raising Eden Bann Weir and constructing a new weir at Rookwood on the Fitzroy River.

The primary benefit of the initiative will be to make available 76,000 megalitres of high priority water per annum. The water will be used primarily for industrial and urban purposes and potentially underpin further agricultural development.

The Lower Fitzroy River water infrastructure development initiative should be considered as part of the National Water Reform Plan recommended in the Australian Infrastructure Plan. It is indicative of the requirement to ensure secure water supply to support further urban, industrial or agricultural development in some parts of the country – including in response to increasing water demand associated with population and economic growth, and increasing variability in water supply.

Next Steps

Options assessment

Northern Adelaide Plains water infrastructure development



Infrastructure Priority List classification

Initiative

Location

Northern Adelaide Plains, SA

Opportunity Timescale

Near term (0-5 years)

Nominator

SA Government

Opportunity

By 2028, SA Water will have to significantly reduce nitrogen discharge into the marine environment from the Bolivar Wastewater Treatment Plant (in Northern Adelaide) to satisfy increasing environmental standards. SA Water wants to deliver environmental compliance at the lowest possible cost for their sewerage customers, which would involve a land-based disposal option and avoid the need to invest in additional treatment technology to remove nitrogen.

At the same time, the Northern Adelaide Plains has a limited availability of natural water resources. Groundwater is the major natural resource supporting the existing irrigation area. This groundwater is considered to be over allocated and it is likely that future allocations will decrease.

Proposed initiative

The initiative proposes to expand the Bolivar Wastewater Treatment Plant to achieve least cost compliance for the treatment and disposal of waste water, and make an additional 20 gigalitres of recycled water available for high value agricultural production.

Investing in infrastructure to expand the Bolivar plant presents the opportunity to bring forward the lowest cost wastewater compliance option while providing water to support high value agriculture in the region. Without the 20 gigalitres of water that the expansion of Bolivar would deliver, there are limited opportunities to further expand agricultural activity and build the regional economy.

This is expected to significantly extend the current irrigation scheme in the Northern Adelaide Plains, increasing the value of primary production in the region.

Next Steps

Options assessment

Tasmanian irrigation schemes

Tranche 2



Infrastructure Priority List classification

Initiative

Location

Various locations, Tasmania

Opportunity Timescale

Near term (0-5 years)

Nominator

Tasmania Irrigation Pty Ltd
and Tasmanian Government

Opportunity

The gross value of Tasmanian agricultural production for 2011-12 was over \$1.17 billion. Research has shown that Tasmanian agriculture could generate a further \$5 billion per annum with additional irrigation water.

In 2014, the Tasmanian Government allocated \$30 million towards the development of new irrigation schemes as part of its plan to grow the value of the agricultural sector in Tasmania tenfold to \$10 billion per year by 2050.

The Australian Government announced \$60 million in funding towards Tranche 2 schemes in February 2015.

Proposed initiative

The initiative is to invest in rural water storage and delivery infrastructure to enable large-scale, multi-user irrigation schemes in rural areas in Tasmania. The five Tranche 2 irrigation schemes are at various stages of development:

- Circular Head
- North Esk
- Scottsdale
- Southern Highlands
- Swan Valley.

In combination, these schemes are estimated to deliver approximately 40,000 megalitres of new irrigation water entitlements with 95 per cent reliability.

Next Steps

Business case development

Relocation of University of Tasmania STEM facilities to Hobart CBD



Infrastructure Priority List classification

Initiative

Location

Hobart, Tasmania

Problem Timescale

Near term (0-5 years)

Nominator

University of Tasmania

Problem

The Tasmanian economy is growing at a significantly slower rate than the Australian average. Over the period 2004-05 to 2013-14, the Tasmanian economy grew on average by 1.4 per cent per year compared to a national average of 2.8 per cent. Economic output per capita (measured in Gross State Product) in Tasmania fell between 2009-10 and 2013-14 with an average decline of -0.1 per cent per annum. Tasmania is almost 20 per cent less productive on average, per hour worked compared to the rest of Australia.

Hobart's CBD lacks the scale and diversity necessary to support strong population and economic development in high value industries. Increased densification and urban development in Hobart's CBD, coupled with development of science, technology, engineering and mathematics related industries, may help attract new industries to locate in Hobart. This could, in turn, help increase economic and population growth.

Proposed initiative

Development of University of Tasmania tertiary science, technology, engineering and mathematics (STEM) research and training facilities in the Hobart CBD.

Next Steps

Business case development

Darwin region water supply infrastructure upgrades



Infrastructure Priority List classification

Initiative

Location

Darwin, NT

Problem Timescale

Medium term (5-10 years)

Nominator

NT Government.

Problem

Population growth and industrial development is driving increases in demand for water in the Darwin region.

The Northern Australia Audit (April 2015) found that an additional water source for Darwin is essential to support further growth of the city. At the same time, climate change is forecast to impact on supply by increasing evaporation and transpiration, which will lead to reduced inflows to reservoirs and decreasing yields.

Failure to expand Darwin’s water supply will increasingly constrain population and economic growth. It is also likely to impact on business and investor confidence.

Proposed initiative

The Darwin Region Water Supply Strategy details the options currently being investigated for expanding supply in the region by 2025. While the preferred option has not yet been identified, the Northern Territory Government is continuing to investigate options for developing new surface water sources.

The Darwin region water supply infrastructure upgrades initiative should be considered as part of the National Water Reform Plan recommended in the Australian Infrastructure Plan. It is indicative of the requirement to ensure secure water supply to support further urban, industrial and/or agricultural development in some parts of the country – including in response to increasing water demand associated with population and economic growth, and increasing variability in water supply.

Next Steps

Options assessment

Tasmanian sewerage infrastructure upgrades



Infrastructure Priority List classification

Initiative

Location

Hobart, Launceston and Devonport

Problem Timescale

Near term (0-5 years)

Nominator

Tasmanian Government

Problem

The Australian Infrastructure Audit (April 2015) noted problems in Tasmania’s sewerage infrastructure. The major population centres of Hobart, Launceston and Devonport are serviced by a large number of poorly performing sewage treatment plants (STPs), a legacy of previous ownership and delivery arrangements.

Non-compliant and ageing infrastructure is contributing to public health and environmental outcomes that do not meet contemporary standards. These outcomes present a threat to Tasmania’s status as a ‘clean green state’ renowned for its natural values and a preferred tourist destination. Furthermore, a number of STPs are located on prime waterfront land in densely populated areas.

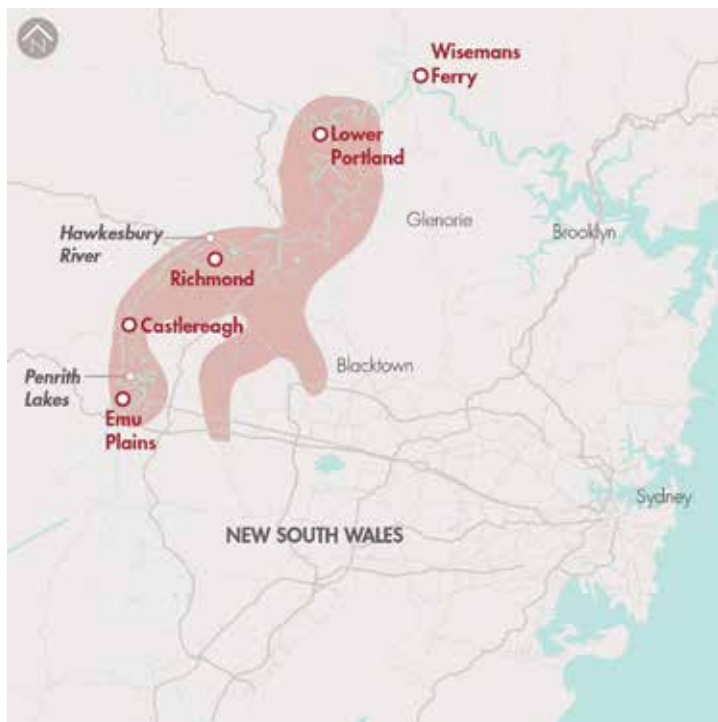
Proposed initiative

The initiative is to rationalise existing STPs and upgrade and operate a reduced number of STPs in Hobart, Launceston and Devonport. The completion of these projects will provide adequate treatment capacity for future growth, minimise environmental regulatory breaches, increase levels of service and improve operational efficiencies.

Next Steps

Options assessment

Hawkesbury-Nepean Valley flood management



Infrastructure Priority List classification

Initiative

Location

Hawkesbury-Nepean Valley, NSW

Problem Timescale

Near term (0-5 years)

Nominator

NSW Government

Problem

The problem is the increasing flood risk in the highly populated and major growth region of the Hawkesbury-Nepean Valley. The annual average damage of flooding in the Hawkesbury-Nepean Valley is expected to be in the order of \$70 million.

Hawkesbury-Nepean Valley flood management represents a long term infrastructure resilience challenge. Increasing frequency of extreme weather events, combined with the impacts of population growth into new and more densely populated areas, will likely require an increase in the level of resilience of some of our infrastructure networks. Infrastructure should be able to continue operating through minor disruptions, and recover quickly from major disruptions.

The largest flood on record in the Hawkesbury-Nepean Valley occurred in 1867 when the river level at Windsor reached 19.2 metres above mean sea level, compared to the normal river level which is less than 0.5 metres above mean sea level. If the 1867 flood levels were to occur today, it is estimated that the total tangible damages could exceed \$3 billion. If a more extreme event were to occur, the total damages could approach \$8 billion.

Proposed initiative

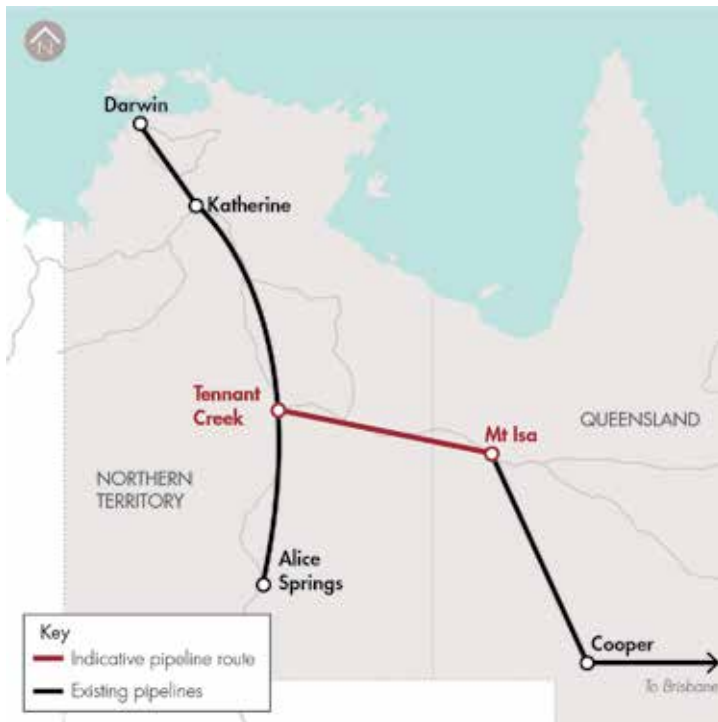
The Hawkesbury-Nepean Valley Integrated Flood Management Strategy presents a series of initiatives and investments to reduce flood risk in the valley. Elements of the strategy being investigated include:

- Flood mitigation infrastructure (including raising Warragamba Dam)
- Road infrastructure upgrades to improve flood evacuation capacity
- A community engagement strategy
- Improved governance and accountability to reduce flood risk through the integration of emergency, road and land use planning.

Next Steps

Business case development

Connect gas suppliers to eastern gas markets



Infrastructure Priority List classification
Initiative

Location
National

Problem Timescale
Near term (0-5 years)

Nominator
NT Government

Problem

The Australian Infrastructure Audit (April 2015) identified a potential gas supply shortfall in the eastern gas market as a result of increased domestic and export demand. This increased demand is expected to lead to higher prices. The Northern Territory has price-competitive gas available, as well as further on-shore reserves.

Providing a connected national energy market with sufficient capacity to supply domestic and foreign markets, withstand supply shocks and market forces, and sustainably contribute to Australia’s broader environmental goals will be essential to supporting the resilience of the national economy.

Proposed initiative

Develop infrastructure to connect northern Australian gas reserves to the eastern gas markets. This will provide additional supply, support economic growth in the Northern Territory, and maintain cost effective gas supply for both markets.

Next Steps

Options assessment

Appendices



Appendix A: Project assessments completed in 2015

Location	Project
New South Wales	Moorebank Intermodal Terminal
	Bringelly Road Upgrade Stage 1
	NorthConnex
Victoria	St Albans Level Crossing Removal
	Princes Highway West Duplication
	CityLink-Tullamarine Widening Project
Queensland	Gateway Motorway North
Western Australia	Perth Freight Link
South Australia	Strzelecki Track

Appendix B:

Project business cases under assessment

Location	Proposed Project
National	Inland Rail
New South Wales	M4 motorway
	WestConnex
	Maldon to Dombarton Rail Link
Victoria	Western Distributor
	Murray Basin Rail Project
Queensland	M1 Pacific Motorway – Mudgeeraba to Varsity Lakes
	Ipswich Motorway Rocklea-Darra
Western Australia	Forrestfield-Airport Rail Link
Northern Territory	Upgrade Tanami Road

*Note this list is limited to proposed projects which are listed as Initiatives in the Infrastructure Priority List.

Australian Infrastructure Plan
The Infrastructure Priority List

February 2016

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DRAFT ONLY – FOR DISCUSSION

SECURING THE PIPELINE AND CREATING OPPORTUNITIES

PROPOSALS FOR A DETENTE

RATIONALE

ARA has established a Pipeline of rail projects which extends over the next two decades or so. The Pipeline records the announced rail projects by federal and state Australian governments and those in New Zealand. Many can be regarded as committed projects and others as being announced but some uncertainty about them proceeding, for whatever reason, remains.

The details of the Pipeline were launched at AusRAIL Plus 2015 and there was widespread support for the concept. A copy of the Pipeline Document is attached.

However the challenge is to secure the pipeline so it endures the various political cycles, provides some degree of certainty to the rail industry and maximises the opportunities for growth, innovation and employment.

Importantly, Infrastructure Australia has now released its Australian Infrastructure Plan, including priorities and reforms. Rail features strongly in these reports. There has been strong support for the IA Reports from all quarters and it is important to keep the momentum going – particularly identifying and securing the pipeline of projects. In rail, this can't be done without the cooperation of the state jurisdictions.

Accordingly, it is proposed that a mechanism be established to generate support and commitment to major rail infrastructure projects, led by the Commonwealth but with the support of state jurisdictions, the federal and state infrastructure bodies and the rail industry companies (operators, suppliers and contractors).

For this purpose it is proposed that there be a “Détente”, bringing together interested parties, to plan the next steps and commitments.

Proposed “Détente” Concept

- 1. This be a combined initiative led by Infrastructure Australia and the Australasian Railway Association with the support of Commonwealth and State jurisdictions and senior industry representatives*

Note that Infrastructure Australia (through Mssrs Birrell and Davies) has supported the concept as has the Infrastructure bodies in Victoria, NSW and Queensland.

2. *The “Détente” be hosted by the Commonwealth in Parliament House Canberra with costs being met by the Government / IA and by the participants with in-kind contributions and administrative support from ARA. It may require two days to be committed to it. The main costs would relate to the venue and catering (coffees and light lunches)*
3. *The Détente be opened by the Government, ideally the Minister responsible for Infrastructure Australia, the Hon Paul Fletcher MP, Minister for Major Projects, Territories and Local Government.*
4. *Participants to be invited, ideally through personal invitations from Minister Fletcher and would include:*
 - *Infrastructure Australia and Australasian Railway Association*
 - *CEO from each State Infrastructure body*
 - *Very senior representatives from federal and state government departments responsible for rail and associated infrastructure*
 - *CEOs from ARA members (at least a strong representation from each of the four sectors: freight; passenger; suppliers; & contractors) – the target being say 30 to 50 participating companies*
 - *Industry Capability Network*
 - *Deloitte / Access Economics (Author of Report: Opportunities for Greater Passenger Rolling Stock Procurement Efficiency Sept’13)*
5. *Session 1: The Pipeline, how to secure it and why*
 - *Opening presentation / scene setting by Minister Fletcher*
 - *Presentations from IA and ARA*
 - *Identification of the major barriers to securing a beneficial, secure pipeline – lumpy demand flows from the states; product specifications and their harmonisation; procurement policies; skilling and capability issues; etc*
 - *Supply chain issues -- what is the current position and how should it be going forward*
 - *Benefits to Australia – growth, employment, etc*

Session 2: How governments would secure the pipeline

 - *A presentation from State & federal jurisdictions adding meaning and definition to the pipeline as to certainty, timelines, funding approach, tender requirements, etc*

- *Labour market requirements*
- *Opportunities for harmonisation, smoothing the demand curve*
- *Capability requirements, showcasing capability, skilling needs, etc*

Session 3: Working toward solutions

- *The gathering of constructive ideas -- presentations of proposals from*
 - * *Infrastructure Australia & State Infrastructure bodies*
 - * *State governments*
 - * *ARA / Industry*
 - * *Industry Capability Network*
 - * *Funding institutions*

6. Workshop

- *Structured workshop to develop action plans*

7. Follow-up

- *Set program for report back on actions*
- *Other*

25/2/16

Deloitte Access Economics

Opportunities for
Greater Passenger
Rolling Stock
Procurement
Efficiency

Australasian Railway Association

27 SEPTEMBER 2013

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Opportunities for Greater Passenger Rolling Stock Procurement Efficiency

Joint Foreword

The Australian rail industry has long been a crucial part of our manufacturing sector but it is facing a crossroad.

With growing populations and ageing rail fleets, it is clear there will be higher demand for rail in the future. We need to ensure that Australian industry is well prepared and ready to meet this growing demand. Understanding the future plans for rail in Australia is essential in achieving this.

Over the next 30 years, state governments could spend approximately \$30 billion on procuring rolling stock. This report demonstrates that by undertaking some necessary actions to achieve more efficient planning around these purchases, not only will Australian businesses have the foresight to help them win more work but that governments can save nearly \$6 billion on their upcoming rail projects.

This is a significant opportunity. Crucial savings are there to be made and through providing rail businesses with more consistent work, they are projected to be able to retain nearly \$15.5 billion in economic activity over the next 30 years. It is our aim to help governments and industry work together to realise these benefits and secure the future of our industry through a more national, consistent and holistic approach to procuring rolling stock.

The benefits of this work cannot be overstated. It will support Australian jobs, regional development, higher productivity, result in a more functional and well-coordinated supply chain and increased innovation for the industry.

This work is essential for the future growth and sustainability of the Australian rail industry. We will be working hard to ensure that government and industry take these important actions forward.

Bryan Nye

CEO, Australasian Railway Association

Bruce A Griffiths OAM

Rail Supplier Advocate

Executive Summary

A time for change

Over the next 30 years, approximately \$30 billion will be spent by state governments on the procurement of heavy rail passenger rolling stock to meet the increasing demands of public transport and replace ageing fleets.

Improved coordination and planning across government would provide considerable opportunity for efficiencies, offering governments the ability to generate direct procurement savings in the region of nearly \$6 billion over the next 30 years. These savings would accrue from avoiding small orders and increasing commonality in rolling stock platforms and componentry.

Failing to address existing inefficiencies may serve to diminish the Australian rolling stock manufacturing base. There is increasing pressure on domestic rolling stock manufacturing and there exists a risk that all production could be sourced internationally. Based on industry consultation, smoother demand could assist in relieving some of this pressure and in turn, assist in retaining some production domestically. If domestic production could be maintained at 30% of the value of future rolling stock orders, this would equate to approximately \$15.5 billion in economic activity that could be retained over the next 30 years.

This activity would be concentrated in specific areas including regional towns including Newcastle and Maryborough and in metropolitan areas including Auburn and Dandenong.

This *Opportunities for Greater Passenger Rolling Stock Procurement Efficiency Report* was prepared by Deloitte Access Economics for the Australasian Railway Association (ARA) and partly funded by the Department of Industry. It draws on national and international research, consultations with transport operators and manufacturers and sets out the existing limitations of passenger rolling stock procurement, outlines strategies to address these limitations, the impact on economic activity of improving procurement and presents a staged series of actions to realise savings and to support key regional economies.

The need for action

Three factors are driving an urgent need for action:

- An estimated 1,900 cars will need to be replaced while an additional 1,100 cars will be required within the next 10 years to support anticipated patronage growth, expected to cost around \$9 billion
- Projected public transport patronage growth requires an increase in the fleet from around 4,000 cars today to almost 11,000 cars by 2043
- Increasing pressure to achieve greater efficiencies in rail, given low current cost recovery levels for public transport, which average 25% nationally.

These pressures mean that new rolling stock will need to be added over the next decade. A failure to act quickly to refine procurement processes could mean a considerable portion of potential savings will be foregone.

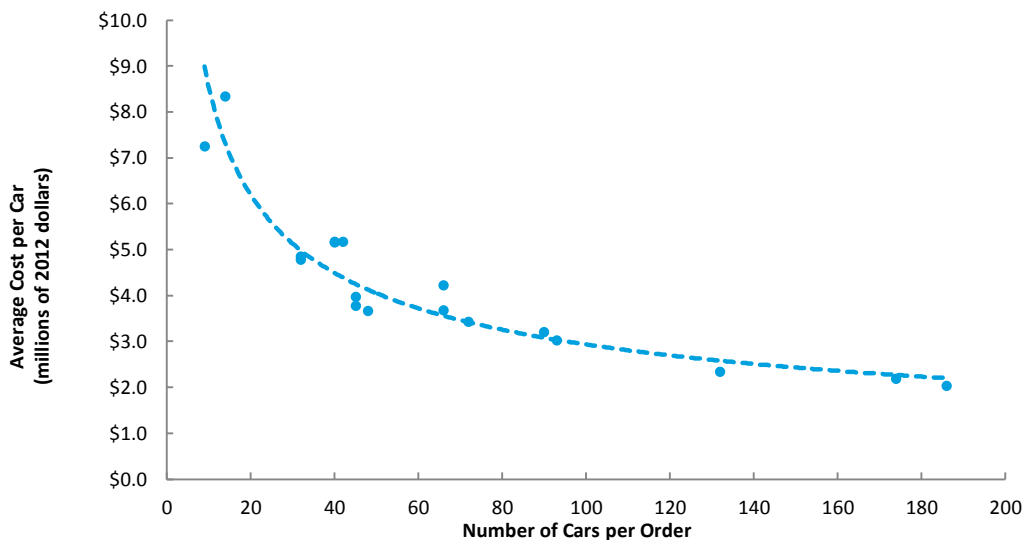
Delivering sustainable efficiencies

Small order sizes, sporadic ordering and resultant production volatility, variations in rolling stock standards and the administrative effort required to move from previous practice all contribute to procurement inefficiencies.

Decisions made early in the rolling stock life cycle substantially influence committed whole of life costs. Whilst only accounting for 20% of costs incurred, the early stages of procurement (before primary build) lock in approximately 80% of whole of life rolling stock costs. Effective interventions in the form of greater transparency for planning and increased harmonisation in design and components are therefore essential.

Simply increasing order sizes to achieve economies of scale, as illustrated in **Figure E.1**, could contribute to savings over the 30 year estimate period of \$2.3 billion.

Figure E.1: Impact of Order Size on Average Cost per Car (Single Deck Trains)



Source: Deloitte Access Economics. The cost of historical orders have been adjusted using the ABS' Producer Price Index: Other transport equipment manufacturing series

Better planning of production encourages investment in more efficient technology and reduces the need for retraining and retooling. It also assists in avoiding very large orders in short timeframes that typically need to be met offshore, given local production capacity.

Rolling stock standards are complicated by legacy development of Australia's passenger networks including differing track gauges, loading gauges and traction arrangements, even before operational and customer requirements are taken into account. Political considerations can also influence the design, timing and funding arrangements for new rolling stock. Whilst this may make it challenging to achieve a single platform, clear opportunities exist to at least reduce Australia's 36 different passenger rolling stock classes.

Eight key responses have been identified to tackle these limitations. All responses are beneficial in their own right yet become progressively more difficult to achieve as greater levels of coordination between states and harmonisation are required.

Improved planning and coordination of rolling stock procurement has the potential to offer the greatest impact. Coordinated long term rolling stock planning combined with the use of

financing arrangements that smooth the upfront financing requirements have the potential to deliver \$2.3 billion in savings from improved order scale. Approximately \$15.5 billion in economic activity could be maintained should coordinated planning result in the demand for rolling stock being smoothed.

Planning to realise greater harmonisation in rolling stock platforms and componentry could also deliver further benefits. It is estimated that \$2.5 billion in planning and design cost savings and \$1.1 billion in component cost savings could be realised if rolling stock platforms and componentry were harmonised across the nation.

Table E.1 outlines how each of the responses contributes to the realisation of each identified benefit.

Table E.1: Key Responses and their Impacts

Potential Responses	Savings from Improved Scale	Benefits to Industry from Smoother Demand	Savings in Planning and Design Costs	Savings due to Componentry Harmonisation
Long term rolling stock planning	●	●		
Long term train procurement programs	●	●	○	○
Coordinated rolling stock planning	●	●		
Alternative financing arrangements		●		
Reduce number of train classes			●	○
Joint procurement of rolling stock	○	○		
Harmonised componentry	○	○		●
Harmonised rolling stock platforms	○			●

Increasing difficulty ↓

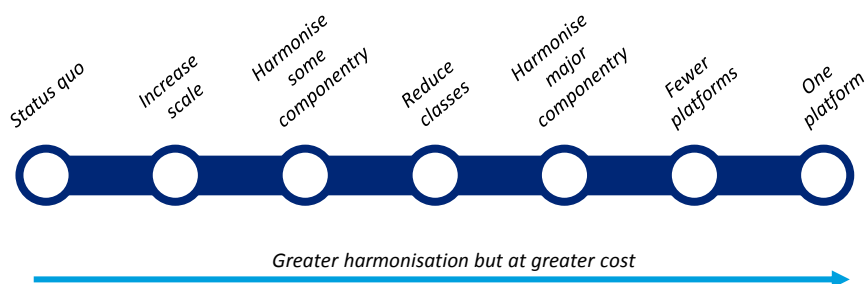
Impact of Coordinated Planning (encompasses: Long term rolling stock planning, Long term train procurement programs, Coordinated rolling stock planning, Alternative financing arrangements)

Impact of Harmonised Design (encompasses: Reduce number of train classes, Joint procurement of rolling stock, Harmonised componentry, Harmonised rolling stock platforms)

● This response provides a major contribution to realising this saving/impact
○ This response provides a minor contribution to realising this saving/impact

Harmonisation has the potential to deliver savings in its own right. However, harmonisation entails costs, whether it is in the form of retrofitting infrastructure, changing operating practices or changing rolling stock designs and build practices. An optimal level along the harmonisation spectrum set out in **Figure E.2** will be needed to balance standardisation and resultant procurement efficiencies against the cost of retrofitting infrastructure and operator/market requirements.

Figure E.2: Rolling Stock Harmonisation Spectrum



The responses have therefore been grouped into a series of sequential actions that can be used to progress along the harmonisation spectrum at a measured pace. Both government and industry stakeholders have a key role to play in progressing identified actions and identifying the optimal level of harmonisation.

The first three actions, as shown in **Table E.2**, are designed to realise \$2.3 billion in cost savings from improved scale and potentially maintain up to \$15.5 billion in economic activity with relatively low effort.

Table E.2: Short Term Actions

Action	Key Elements	Status / options to progress
Action 1: <i>Prepare integrated long term rolling stock strategies</i>	20 to 30 year plans of expected rolling stock demand including: <ul style="list-style-type: none"> • Potential network expansions • Levels of future patronage by year and market segment • Whole of life costs • Ancillary infrastructure • Current and future infrastructure standards • Current and future operating requirements • Current and future customer requirements • Potential financing arrangements. 	Development already commenced
Action 2: <i>Develop a national rolling stock pipeline database</i>	Develop a publicly available database of anticipated rolling stock demand by: <ul style="list-style-type: none"> • Jurisdiction • Expected year of procurement • Type of train • Number of cars 	The National Infrastructure Construction Schedule may provide a potential platform
Action 3: <i>Initiate a Coordinated Rolling Stock Planning Program</i>	A Coordinated Rolling Stock Planning Program enabling jurisdictions to put forward their own individual rolling stock programs, and potentially identify opportunities to: <ul style="list-style-type: none"> • Match potential orders with lulls in demand • Smooth out rolling stock orders • Identify funding requirements • Identify opportunities for joint procurements • Identify opportunities to harmonise rolling stock platforms and infrastructure standards. 	

Actions 4, 5 and 6 represent the ability to capture significant additional harmonisation savings over time, whilst ensuring that the impacts and quantified infrastructure effects of extensive platform harmonisation are progressively understood.

Table E.3: Longer Term Actions

Action	Key Elements	Status / options to progress
<p>Action 4: <i>Establish a pilot to prove partial harmonisation benefits</i></p>	<p>A pilot program aimed at developing harmonisation principles and standards for one class of train may provide the basis for establishing key operating and infrastructure constraints limiting harmonisation and the level of appetite for harmonisation.</p> <p>The development of a harmonised platform for regional rail may provide an ideal test case to prove the harmonisation concept. A harmonised platform for regional rail would serve to consolidate a market segment whereby the number of cars per class is typically small. Furthermore, a regional rail initiative could highlight design elements that are most amenable to harmonisation, taking into account variations in operating and infrastructure parameters between different rail networks.</p> <p>Such a pilot could require involvement from a range of transport agencies as well as industry participation to identify a rollingstock platform/market that would be most amenable to harmonisation.</p>	<p>Potential regional rail rolling stock projects</p>
<p>Action 5: <i>Develop harmonisation principles and harmonised rolling stock standards</i></p>	<p>Should it be considered desirable by industry, the formalisation of principles and standards to guide the greater harmonisation of rolling stock design and where necessary, infrastructure would be developed. An engineering assessment of the following elements should be undertaken to assess the potential for a reduction of train classes and a harmonisation of rolling stock platforms:</p> <ul style="list-style-type: none"> • Current and emerging platforms and standards • Current fleet designs and standards • Key elements and “non-negotiable” standards • Operating arrangements impacting on train design • Infrastructure constraints impacting on train design. <p>Should it be considered desirable by industry, the formalisation of principles and standards to guide the greater harmonisation of rolling stock design and where necessary, infrastructure could be developed. This action would be largely informed by the findings from Action 4.</p>	<p>Could draw on assessments undertaken by bodies including Rail Industry Safety and Standards Board (RISSB) and transport agencies</p>
<p>Action 6: <i>Develop cross-state procurement arrangements</i></p>	<p>To further progress the potential for joint procurement, the feasibility of such arrangements should first be assessed. The assessment should consider:</p> <ul style="list-style-type: none"> • Potential obstacles that may impede joint procurements • Regulatory and legislative issues • Competition issues. 	<p>Models for joint procurement could be based on whole of Australian government procurement arrangements developed by the Department of Finance</p>

Acting now will enhance the sustainability of the Australian rolling stock manufacturing industry. Growing demand for rolling stock and the fragility of the domestic manufacturing industry provides a setting whereby considerable savings of \$5.9 billion and economic activity of \$15.5 billion over the next 30 years are at stake for both government and

industry respectively. With better planning and changes to procurement practices, these benefits are realisable without the need to resort to interventionist policy.

1 Introduction

1.1 Purpose

The **Opportunities for Greater Passenger Rolling Stock Procurement Efficiency Report** (the Report) was prepared by Deloitte Access Economics for the Australasian Railway Association (ARA) and partly funded by the Department of Industry.

The Report considers the potential benefits from improving the procurement of heavy rail passenger rolling stock networks operated by:

- New South Wales: Sydney Trains and NSW Trainlink¹
- Victoria: Metro Trains Melbourne and V/Line
- Queensland: Queensland Rail
- Western Australia: Transperth and Transwa
- South Australia: Adelaide Metro.

Improving procurement processes have the potential to generate significant benefits for governments including greater value for money. The sustainability of the industry is likely to be enhanced from a better understanding of future demands from government for rolling stock.

Although there are benefits to be gained from improving procurement nationally, such improvements will only result in greater value for money if the specific needs of individual passenger rail owners, operators and their respective markets are considered. This Report draws on national and international analysis, supported by consultations with a wide range of government agencies and rolling stock manufacturers across Australia to validate assumptions and findings. It provides economic and market evidence and an approach to stimulate planning and policy deliberations at the state and national levels, in order to assist government, operators and industry in moving towards improved procurement of passenger rolling stock. This Report is focused on passenger rail and therefore specifically excludes freight and light rail rolling stock procurement².

¹ Formerly RailCorp and CountryLink

² Light rail rolling stock demand was forecast to remain a relatively small proportion of the Australian rail rolling stock fleet. Preliminary investigations suggested that potential procurement savings for light rail were relatively limited compared to heavy rail rolling stock given the small size of the light rail fleet and existing levels of homogeneity in light rail platforms.

1.2 Policy Context

In May 2009, the Council for the Australian Federation noted the potential benefits of a coordinated approach to procuring rolling stock. The Council agreed to establish a taskforce to examine the opportunities that might exist from improving the coordination of rolling stock procurement and to deliver better value for money for rolling stock purchasers.

The Australian Rail Industry Development Strategy was subsequently developed by key rail industry stakeholders including the ARA and the former Department of Innovation. The Strategy outlines the need to prepare a clear, long term demand profile; and harmonised national product specifications, policy and standards.

“Coordinated national demand is worth proceeding with as a core objective of national rail industry policy”

Orion Advisory (2012)

The need for improving coordination of passenger rolling stock was further reinforced in the rail industry's roadmap, *On Track to 2040*³, which was funded by the Commonwealth Government, the state governments of NSW, Victoria and Queensland and the ARA on behalf of industry. Over 110 different organisations were involved in the development of the roadmap.

To provide a view on the potential industry order book, *The Future of Australian Passenger Rolling stock*⁴ report was commissioned by the ARA and partly funded by the former Department of Innovation. The report outlined anticipated fleet requirements and the need for a more coordinated approach to procurement.

This Report builds on the database of current rolling stock fleet developed by Orion Advisory and adjusts demand forecasts to reflect:

- Retirements and additions to the national fleet
- The use of city specific task growth rates
- A separation of single and double deck car demand
- The potential reintroduction of single deck cars in Sydney.

The database provides a more current and state-specific perspective of rolling stock demand over the next 30 years that has been used to determine potential procurement efficiencies.

This Report reflects on the challenges the rail industry faces in delivering the predicted level of new rolling stock, what measures might be available to remedy these challenges and the benefits of doing so.

³ ANU Edge (2012)

⁴ Orion Advisory (2012)

Although the primary motivation for this Report is to deliver better value for money in the procurement of passenger rolling stock, it also evidences the risks to the long run longevity of the rail manufacturing industry of not taking action. As with other manufacturing sectors in Australia, rail manufacturing faces considerable challenges in remaining competitive in a global environment. Whilst rail manufacturers are likely to retain a local role in repair, maintenance and refurbishment, the future of the Australian rail manufacturing industry is heavily dependent on its ability to remain relevant to its key customers, state government asset owners, for new rolling stock.

This Report does not seek to set out a detailed implementation strategy. Rather, it identifies the opportunities and the steps for the industry and government to pursue to increase the efficiency, agility and sustainability of the industry whilst delivering value for money to government procurers.

1.3 Approach

To provide an assessment of the opportunities from improving the procurement of passenger rolling stock, this Report has been structured as follows:

Chapter 2 – Current procurement arrangements: sets out the current procurement process to identify the components of costs within procurement processes.

Chapter 3 – Identification of barriers to efficiency: identifies key shortfalls within current rolling stock procurement arrangements which restrict more efficient procurement arrangements.

Chapter 4 – Demand for rolling stock: reassesses passenger rolling stock projections, to highlight opportunities for change.

Chapter 5 – Formation of policy responses: sets out a range of potential policy responses which address the barriers identified in Chapter 3 and enable the industry to accommodate the forecasted demand opportunities in Chapter 4.

Chapter 6 – Determination of benefits: estimates potential savings and changes in the level of economic activity from improving procurement through the identified policy responses.

Chapter 7 – Next steps: establishes a way forward to achieve opportunities for more efficient procurement of rolling stock.

This Report has drawn upon an extensive desktop review of domestic and international literature on the efficiency of rolling stock procurement to identify potential issues, their impacts and possible actions. This analysis has been informed and validated through consultation with government rolling stock owners and operators in each state, manufacturers and industry stakeholders.

2 Current Procurement Arrangements

This chapter outlines the process of procuring a new passenger train to provide some background on the issues that need to be faced when procuring rolling stock.

2.1 Overview of the Procurement Process

The procurement of passenger rolling stock is frequently a complex, costly and time consuming process. Depending on the size and complexity of the order, procuring a train generally takes around 5 to 7 years, and in some instances up to a decade, from the point where a decision to purchase a new train is made to actual delivery of the first car.

There are four key steps in the lifecycle of a new train. The first three steps are perhaps most critical for the purposes of this Report but all four steps may have procurement implications, depending on how a train is maintained, owned and operated. Each step is outlined as follows:

Table 2.1: Key Procurement Steps

Step	Key processes
Step 1: Needs assessment	<p>Long term network transport planning and demand modelling often precedes planning for rolling stock as it provides the basis for forecasting the number of cars required. Transport planning and demand modelling take into account anticipated peak period patronage growth and planned network expansions, key variables influencing the demand for rolling stock.</p> <p>In this step, the performance and operating parameters of new rolling stock are considered at a high level. Ancillary needs including stabling, maintenance and traction supply may also be considered at this point.</p>
Step 2: Approvals, Tendering and Design	<p>The procurement task is generally preceded by an approvals process. As a reflection of public ownership, formal procurement and Cabinet processes would need to be followed prior to approval for the procurement of new trains. This may include a value for money assessment, detailed design, establishing tendering and evaluation procedures, and increasingly an assessment of potential financial arrangements including the use of public-private partnerships.</p> <p>Potential prime rolling stock suppliers would then be invited to submit expressions of interest and ultimately detailed proposals, with tenders being filtered until a preferred supplier is identified. Negotiations are then organised to refine contractual arrangements, culminating in financial close. At this point in time, a final detailed design would be developed and confirmed.</p>
Step 3: Primary Build, Testing and Acceptance	<p>The primary build phase may be preceded by a ramp-up phase whereby the prime manufacturer secures the necessary materials, component suppliers, staff, training and production lines to undertake the primary build.</p> <p>The 'primary build' phase involves the physical construction of the train chassis, development of various sub-systems including the electrical, communications, motor systems and all other</p>

components. Fit out, systems integration and testing follow.

As each new train set comes off the production line, it is tested by the end customer to ensure that each set conforms to pre-agreed standards and performance measures. Where testing identifies issues that may impact on operating performance, compatibility, safety, reliability and amenity, train sets may be sent back to the production line for rework.

Once each set has passed testing, it is generally transferred to the rail operator for use.

For many train orders, the procurement lifecycle concludes after train acceptance.

Step 4: Operations & Decommissioning

Once the fleet is accepted by the rail operator, rolling stock would be maintained and repaired at routine intervals by either the manufacturer, the rail operator or a third party. Componentry is often replaced during routine maintenance or component change out. Where a particular train type is being manufactured on a long term basis, 'real-world' learnings may be used to inform and evolve the design and production of future train sets contributing to ongoing planning and design costs.

Mid-life, rolling stock is generally refurbished with updated or new systems installed to improve amenity, extend component life, optimise operating and maintenance costs or comply with new standards. Where a secondary market exists, rolling stock may be disposed of and used elsewhere.

Generally, passenger rolling stock becomes age-expired after 30 years although depending on the level of use and maintenance, rolling stock may be divested prior to 30 years or refurbished again to further extend life. Depending on condition, useful lives of 35, 40, 45 years may be achievable.

Ultimately, rolling stock will be divested based on its physical condition but other factors including ongoing costs, technical obsolescence, prevailing standards, level of passenger demand, amenity and availability of replacements may impact on the exact timing of disposal.

2.2 Costs of Procurement

“It rarely costs less than £10 million even for repeat orders of trains, and as much as £100 million for completely new train specifications”

*UK Railway Industry Association*⁵

The cost of planning, procuring, designing and building new trains can be substantial.

A significant proportion of the cost of procuring a new train lies in the planning and design stage, even for trains based on proven platforms. For rolling stock based on new specifications, the design costs can be considerable. In a UK context, the design costs associated with the development of a new rolling stock platform can be as high as £100m⁵ (A\$224m⁶).

Invariably, the level of costs incurred will depend on the nature of the order, the nature of the rolling stock being purchased and the practices of the manufacturer.

Desktop research and consultation suggests, broadly speaking, that approximately half of whole of life costs is spent prior to operations. A significant proportion of costs are spent on planning and design. Consultation suggests that prior to the commencement of primary

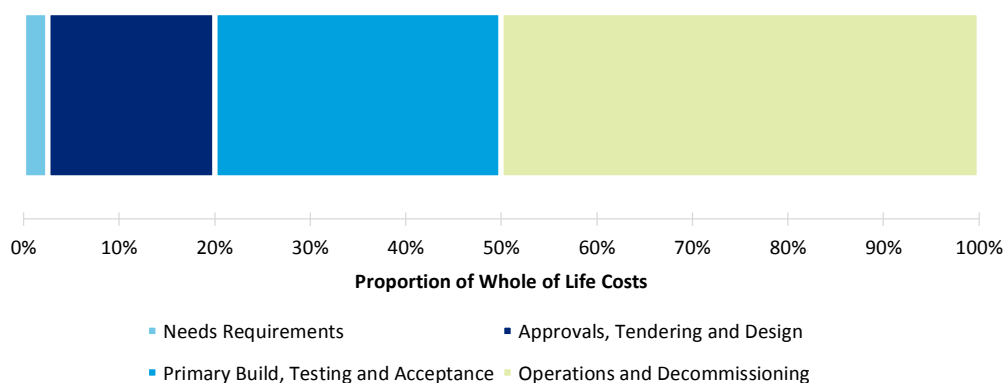
⁵ Network Rail (2011)

⁶ Based on purchasing power parity exchange rate of £1 = \$2.24. Sourced from OECD.Stat

build, the cost incurred due to planning and design typically accounts for up to 20% of whole of life costs. This is consistent with UK research⁷. This level of cost is not surprising given the relatively high levels of customisation typically applied to Australian trains. Approximately 30% of whole of life costs are incurred during primary build. The remaining 50% of whole of life costs are incurred during operations. Even during operations, capital costs can account for over 50% of ongoing costs, incurred through changes in componentry, refurbishments and disposal.

Figure 2.1 provides an indicative outline of the level of costs incurred through each step of the procurement lifecycle.

Figure 2.1: Breakdown of Whole of Life Costs by Procurement Stage



Source: Deloitte Access Economics

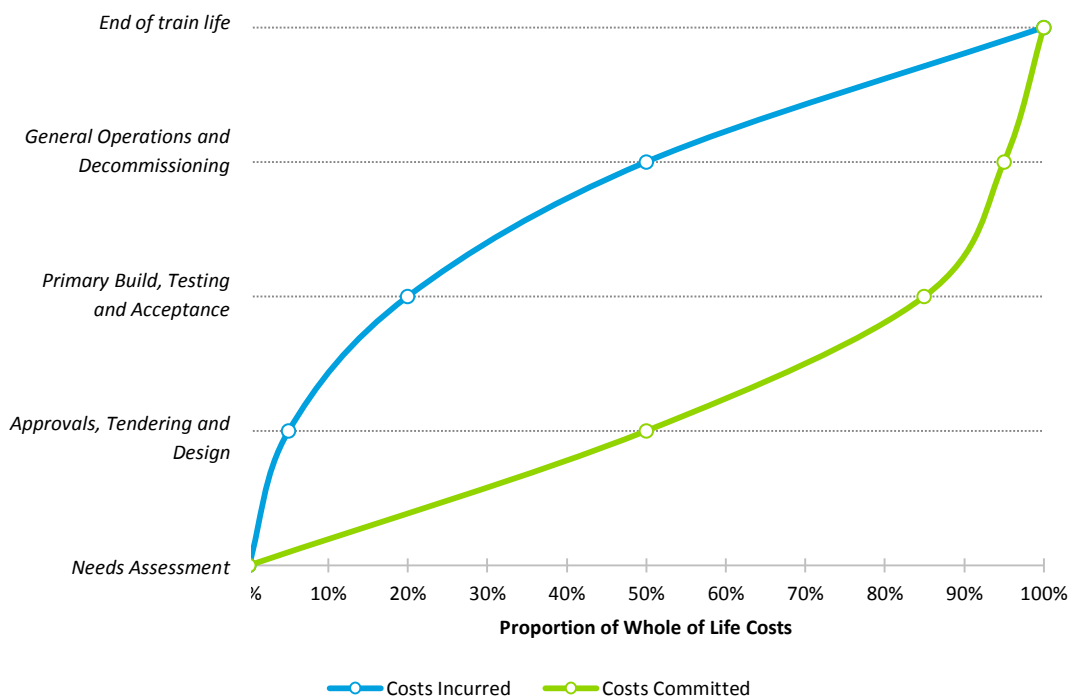
The decisions made prior to primary build are critical in influencing the capital costs of rolling stock. These decisions impact on the:

- Train design
- Number of cars built
- Speed at which the cars are built
- Ongoing maintenance and operating practices.

As **Figure 2.2** illustrates, even before the first train of an order is built, a high proportion of the eventual cost of the train is “locked in” by the decisions made during planning and design. Ensuring the right decisions are made prior to build is critical in achieving cost savings.

⁷ ARUP (2011)

Figure 2.2: Whole of Life Cost Committed and Incurred by Procurement Stage



Source: Deloitte Access Economics

2.3 Key Findings

This chapter highlights the key steps that need to be undertaken during any procurement of rolling stock. Decisions made during the early stages of procurement have a disproportional and irrevocable impact on rolling stock whole of life costs. The key barriers that impede the cost efficient procurement of rolling stock can be directly attributed to the decisions made during the planning and design of a train. The following chapter outlines what these barriers are and how they contribute to cost inefficiencies.

3 Barriers to Efficiency

The achievement of more effective rolling stock procurement has to date been elusive. This chapter outlines the key barriers that are continuing to reduce the efficiency of passenger rolling stock procurement.

“[We] urge that a broader and longer-term framework be made available and examined in the procurement of transport infrastructure”

NSW Auditor General (2003)

3.1 Introduction

Many of the challenges faced by the rail industry and governments, as their key customers in delivering passenger trains cost effectively are not unique to Australia. Other jurisdictions, such as the UK and across Europe, have grappled with how best to pursue the purchase of passenger trains in a cost effective manner. Of particular note are the McNulty Report⁸ and Network Rail⁹, which identified a number of opportunities to improve the procurement of rolling stock to deliver cost savings. This Report provides some perspective on these opportunities within an Australian context.

In Australia, the Bureau of Transport and Regional Economics¹⁰ assessed the need for optimised harmonisation of technical standards. The NSW Auditor General¹¹ has also noted the need for a long term strategy to deliver standardisation, account for industry capacity, infrastructure requirements and lifecycle costs.

3.2 Key Barriers

Four key barriers exist that impede the realisation of lower cost rolling stock:

- **Barrier 1: Lack of scale**
- **Barrier 2: Volatile production**
- **Barrier 3: Variation in standards**
- **Barrier 4: Political and financial considerations.**

These barriers are interrelated and can serve to feedback and reinforce each other. Each of these barriers is discussed in turn.

⁸ McNulty (2011)

⁹ Network Rail (2011)

¹⁰ BTRE (2006)

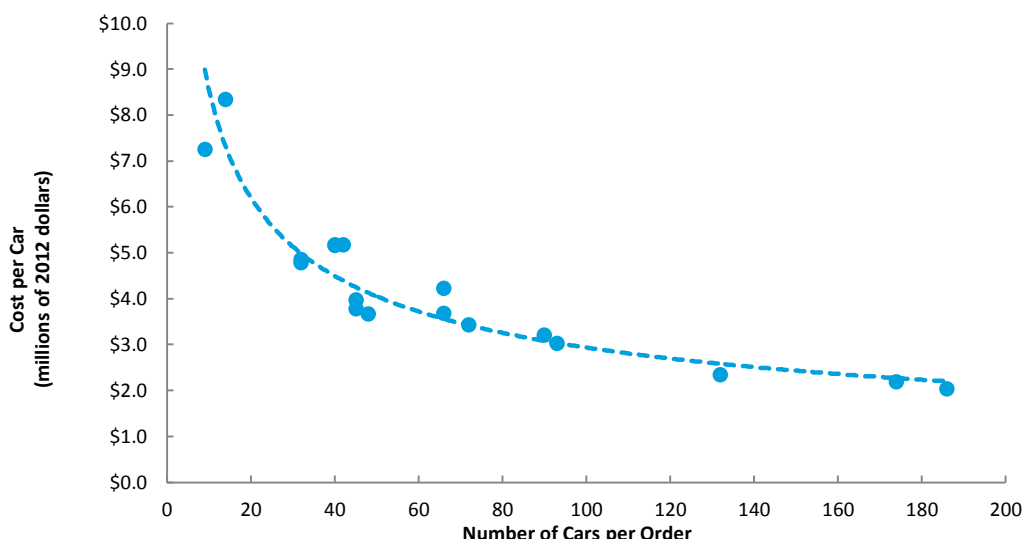
¹¹ NSW Auditor General (2003)

Barrier 1: Lack of Scale

There are significant fixed costs associated with the procurement and development of new trains. In addition to overheads in the form of factories and the production lines and tooling housed within, a significant level of upfront effort is expended in planning and designing. If recouped over a large number of cars, and potentially a large number of orders, the impact of these overheads is less significant.

Based on a desktop analysis of publicly available information of Australian train orders over the past 10 years, there appears to be a discernible impact on cost per car based on order size. **Figure 3.1** illustrates, for single deck trains, how smaller orders have resulted in higher average costs per car.

Figure 3.1: Cost per Single Deck Car Based on Australian Orders



Source: Deloitte Access Economics. The cost of historical orders have been adjusted using the Producer Price Index: Other transport equipment manufacturing series

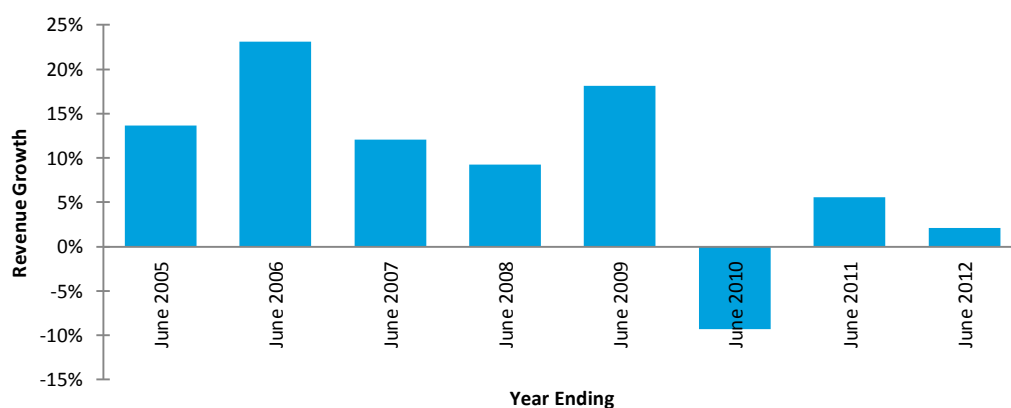
The cost of lack of scale can be significant. Based on previous orders, average costs per car for a 50 car order relative to a 150 car order would be two thirds (equivalent to \$0.7 million) higher.

It should be noted that the point at which economies of scale can be achieved, and at what cost, does vary between manufacturers. Consultation suggests that for some firms, economies of scale could be reached with as few as 60 cars but for other firms orders of over 150 cars are required to achieve scale. Nevertheless in many cases, orders sizes have been too small for any rolling stock manufacturer to offer rolling stock cost effectively to government.

Barrier 2: Volatile Production

Although all industries face a degree of variability in production from time-to-time, rolling stock manufacturers and their suppliers face considerable uncertainty around new orders, given long life spans for rolling stock and the limited number of purchasers. Due to volatile production levels, rolling stock manufacturers experience high levels of profit volatility as shown in **Figure 3.2**. Reliability of cash flow is also a concern with expenses often preceding income flows¹².

Figure 3.2: Growth in Australian Rail Manufacturing Revenues

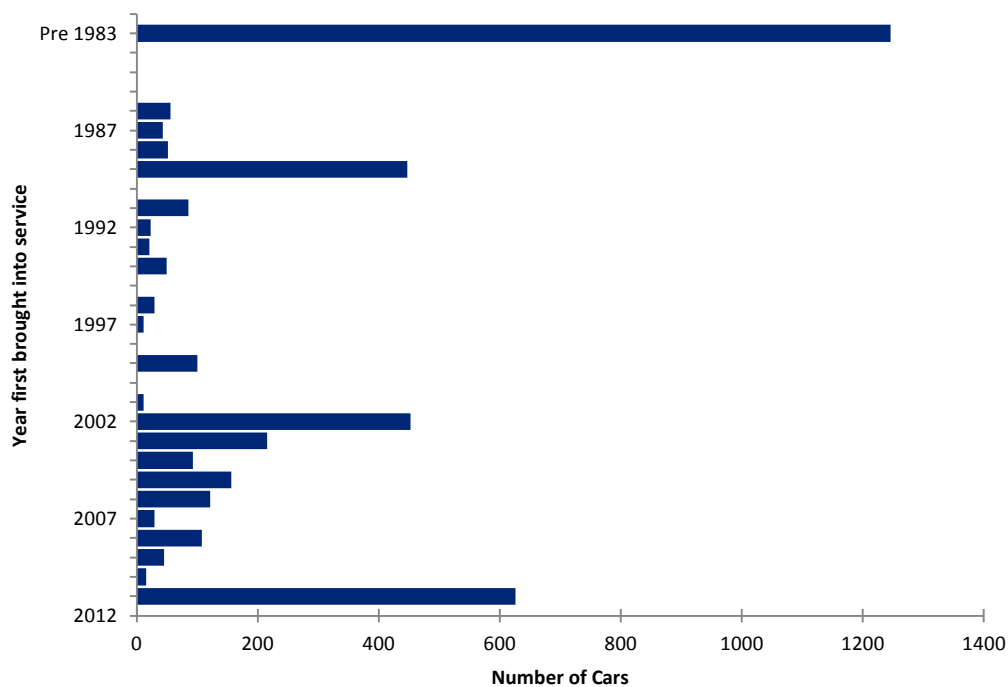


Source: IBISWorld (2012)

Although historical production figures were not available, the fleet database prepared by Orion Advisory provides a useful proxy for how production has varied over time. **Figure 3.3** illustrates the number of new cars brought into service over the past 30 years.

¹² IBISWorld (2012)

Figure 3.3: Introduction of Cars in Current Fleet



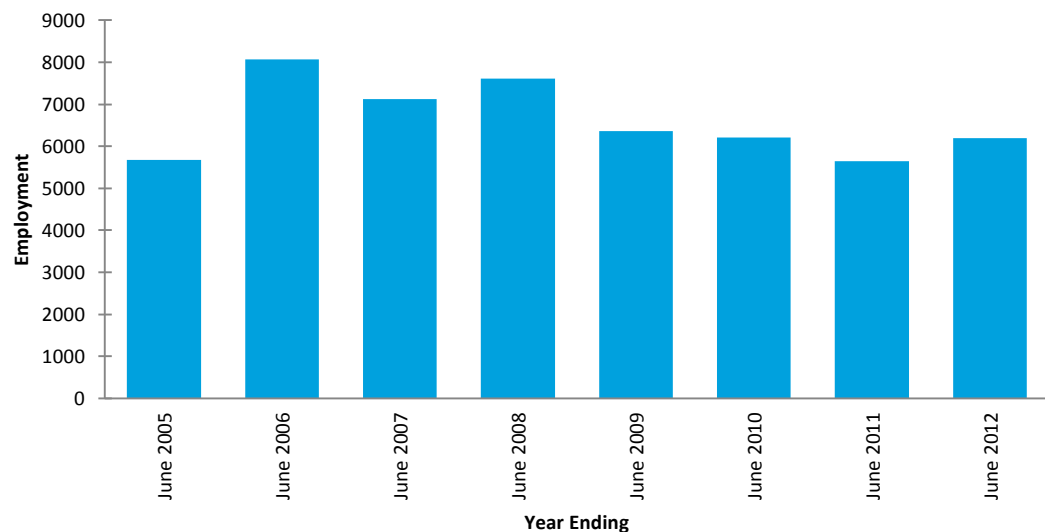
Source: Deloitte Access Economics

“We don’t know when the next order will be or for what sort of train...so how can we invest?”

Manufacturer comment

Uncertainty associated with when, what type and how many new cars will be required does little to promote efficiency within the rolling stock supply chain. Although primary rolling stock manufacturers undertake some forecasting, these efforts are not replicated through the supply chain. Furthermore, lack of certainty over funding limits the reliability of such forecasting exercises.

As such, limited visibility of the production pipeline limits the ability of manufacturers and their suppliers to make appropriate decisions regarding staffing and training. As **Figure 3.4** shows, the industry has struggled to maintain and grow its workforce with the number of jobs within the industry fluctuating in recent years.

Figure 3.4: Employment in the Australian Rail Manufacturing Industry

Source: IBISWorld (2012)

Limited visibility of work also does little to facilitate investments and innovation that may provide opportunities to improve efficiency. The lack of visibility creates a significant investment risk for manufacturers, and accordingly may defer or reduce:

- Investments in research, equipment and technologies to increase efficiency
- Improving processes to further increase efficiency
- Opportunities to develop new markets.

“Volatile production levels make sustaining local facilities and workforce skills very difficult. Innovation is discouraged.”

Manufacturer comment

Any investment that does occur feeds back into the rolling stock cost base. These upfront costs, which need to be recovered, are impacted by the volatility of production. Manufacturers may not be able to rely upon spreading the costs of research and development and new equipment over longer periods of time. The boom-bust cycle limits the ability of the supply chain to plan investments and to optimise production costs over a long period of time and accordingly increases mobilisation and depreciation costs, costs that would need to be passed on to the government purchaser in the next train order.

These costs can be considerable. As an example, the UK Railway Industry Association suggests that the lack of continuity of production added up to 20% to the cost of UK rolling stock between 1988 and 2010¹³. Rail suppliers in the UK also noted that uncertainty regarding future work has led to a number of suppliers being unwilling to invest in more efficient

¹³ Ibid 5

“Opportunities do exist to improve manufacturing efficiencies...but we need visibility [of future demand]”

Manufacturer comment

manufacturing equipment. Where investments are made, suppliers plan to recoup the cost of these investments over a relatively short period of seven to ten years given this uncertainty¹⁴.

Consequently, production volatility has encouraged practices that may not be efficient. For example, volatile production has encouraged the establishment of smaller sized entities, which have greater flexibility in switching between different rail markets as demand patterns change. Although smaller firms may be more resilient to changes in rolling stock demand, they can lack scale to deliver products and services at lowest cost.

In the context whereby international supply chains are increasingly becoming an option, volatile production may well have more profound implications for domestic rail manufacturers and suppliers. Combined with limited visibility, volatility in production levels limits the extent to which the industry can ‘right size’ capacity. In turn, this creates a significant risk that future capacity may not be able to meet spikes in rolling stock demand. Based on consultations with industry, without smoothing, these spikes in demand are more likely to be better met by greater sourcing of rolling stock from overseas. The economic implications of the displacement of local industry are significant and are discussed further in Chapter 6.

Volatile production may also work against encouraging greater competitive tension for rolling stock tenders. Gaps between orders require new potential suppliers to commit significant time and resources in developing a local presence before the next order, a significant impost. Alternatively, in lieu of such an investment, potential suppliers may accept that they cannot afford to be fully informed on the local market and may choose to incorporate a risk premium on any bids they submit, accept higher design, testing and acceptance risks or abstain from bidding. This effect can reduce the competitive tension that government may be seeking from potential new rolling stock providers.

Barrier 3: Variation in Standards

The variety of passenger rolling stock in the current fleet is diverse with at least 36 different classes of trains across the nation. As part of the Taig Review¹⁵, one Australian based rail manufacturer noted that they needed to cater for 27 different loading gauges for Australian customers.

Whilst many are similar in style and specifications, there exist many differences between different classes, for example in terms of gauge, power supply, speed, acceleration, braking and fit out.

¹⁴ Ibid 8

¹⁵ Taig (2012)

“Standardisation of trains [to a single platform] isn’t an option”

Operator comment

These differences arise due to:

- Differences in infrastructure
- Differences in operations
- Differences in passenger expectations and requirements
- Continual changes in standards and technology.

“We need trains that suit our customers, operations and infrastructure”

Operator comment

The state by state development of Australia’s passenger railway networks has not been conducive to the development of harmonised train designs across the country. Obvious differences lie in the use of different gauges, power systems and in the case of Sydney, the use of double-deck trains. As a result, differences in infrastructure design and operating practices creates a need for different train designs.

In many cases, there may be good reason for rail operators to create variations in train design to respond to passenger expectations. For instance, the social and economic benefits of providing seating for long distance passengers is likely to outweigh the design costs and the fit out costs of installing the seats.

“...there may be some similarities between train classes”

Operator comment

Variations in rolling stock standards also arise over time as rolling stock standards are altered and new technologies emerge. Over time, train designs need to change to ensure compliance with current standards and to reduce the risk of technical obsolescence. Issues including the broader application of accessibility standards, automatic train protection and associated signalling technology, digital radio technology and train-platform interfaces (e.g. platform screen doors) were identified by stakeholders as potential areas needing harmonisation to better manage obsolescence risk.

“There appear to be ‘vested’ interests in maintaining differences in standards”

Manufacturer comment

However, procurement arrangements can contribute to variations in train standards. Lengthy procurement processes, some of which may last up to 7 years from conception to acceptance, may result in the build of “new trains” with componentry that may be technically obsolete by the time a train order has been fulfilled. Long lead times between train orders serve to encourage revolutions rather than evolutions in train standards.

The cost of implementing new standards on an ad-hoc basis through a new platform can be considerable. For instance, it was estimated that heterogeneous specifications added between 5% and 10% onto the cost base for rolling stock in the UK¹⁶. This is consistent with Network Rail’s¹⁷ view that approximately 8% of the average procurement cost is spent on non-recurring costs including research and development of bespoke rolling stock. As noted

¹⁶ Ibid 8

¹⁷ Ibid 9

previously, these costs can run into the hundreds of millions of dollars for bespoke platforms.

In the Australian context, the impact of heterogeneous standards is most evident with the cost of double deck trains. Using historical Australian train order cost data, the projected average cost of a double deck car is estimated to be \$4.1 million per car based on a 150 car order. Using the same order size, the projected average cost of a single deck car is estimated to be \$2.4 million per car, or 40% less than the double deck cost. The costs of heterogeneous trains are reflected in part through higher planning, design, testing and acceptance costs, which are discussed further in Chapter 6.

“Platforms are becoming increasingly globalised”

Manufacturer comment

Variations in train standards have broader implications for the ability of the Australian rail manufacturing industry to compete in global markets. The limited compatibility of many components, developed specifically for Australian trains, for use in trains overseas presents a barrier for export opportunities. This in turn, limits the use of exports as an instrument to smooth out local production and to develop specialisation to further improve the viability of local rail manufacturing.

Variations in train standards, particularly standards which deviate significantly from world practice also serve to discourage entry by potential international providers.

Barrier 4: Political and Funding Considerations

State governments have played an important role in the instigation and growth of Australia’s railways. Historically, Australia’s railways, owned and operated by various state governments, played an important role in the development of its cities and opening up the hinterland.

More recently, the low levels of cost recovery on Australia’s passenger networks (discussed further in Chapter 4), invariably requires some form of financial support from government to ensure ongoing operation and expansion. As such, as the ultimate owners of rail passenger operations, governments are the rail manufacturing industry’s customers.

Political imperatives and funding availability are both major impacts on procurement timing and cannot be ignored

The link between government ownership and rolling stock demand is inextricable, with a variety of factors influencing the nature and size of rolling stock purchases. For instance, passenger concerns with respect to crowding may require the expedient delivery of new cars. The timing of elections can also influence the timing of rolling stock purchases.

The high level of involvement from government within the rail sector often means that government agencies are involved in both what needs to be delivered and how it is to be delivered. Accordingly, rolling stock procurement tends to be volatile, high profile, complex and influenced by political as well as operating considerations.

Funding

A critical issue where political factors come into play is the availability of funding. Traditionally, rolling stock has been funded through the use of consolidated revenue or government debt. Given the many competing demands (e.g. schools and hospitals) for such revenue and the high levels of expenditure required for rolling stock, the purchase of rolling stock can often be linked to the availability of funding or the propensity to use debt facilities. This can be further compounded by the link between new rail links and new rolling stock, with the latter only being funded once the former has committed funding. Recent turbulence in the economy has served to impact adversely on the availability of funding and the willingness to use debt.

“Tendering is increasingly complex and time-consuming”

Manufacturer comment

In lieu of government financing, public private partnerships (PPPs) have emerged as a potential tool to spread the cost of rolling stock over a longer period of time. Rather than funding rolling stock upfront, PPPs generally requires a manufacturer to finance, build and maintain rolling stock. In return, governments make a periodical payment based on the availability of rolling stock available for revenue service. In addition to smoothing out costs of assets, PPPs offer the potential benefits of greater budget certainty and timelier delivery¹⁸.

“Engineers + bankers + lawyers = high cost”

Stakeholder comment

One key challenge with PPPs is their potential complexity. The specification, build, financing and maintenance of trains and the demarcation of responsibilities need to be well defined and anticipated prior to financial close and often leads to the compilation of complex documentation. Accordingly, PPP arrangements can be time consuming and costly for industry participants to interpret and depending on how the PPP is structured, may constrain the innovations and improvements that can be made to the rolling stock once the contract has been struck.

Probity Concerns

Current procurement arrangements require government agencies to conduct open, competitive tendering processes. These processes require government agencies to approach suppliers in such a way that there can be no actual or perceived discrimination against potential suppliers. This constrains how and when agencies can engage with industry to discuss potential rolling stock purchases, with first consultations often occurring once funding has been obtained, when some key decisions have already been made.

Some rail manufacturers expressed concerns that the arms-length approach to engaging industry was leading to opportunities to optimise procurement being missed. One manufacturer noted that closer engagement between government and manufacturers occurs overseas to identify production gaps. Although there may be competition issues that may arise from such practices, consultation undertaken earlier in the planning process can provide opportunities to reduce delivery costs.

¹⁸ NSW Treasury (2010)

3.3 Key Findings

Four key barriers have been identified as significantly reducing the efficiency of rolling stock procurement in Australia. Small orders, variable lead times between orders and variations in standards which continue to change frequently result in unique fleets that are expensive to design, procure and ultimately operate and maintain. Governments may also play a role in perpetuating some barriers.

These barriers are interrelated and can be self-reinforcing. For instance, small orders and volatile production have the potential to promote bespoke train specifications. In turn, these specifications may limit export opportunities and exposure to overseas markets which may further exacerbate the volatility in production. Uncertainty regarding the availability of government funding contributes to volatility in production and variations in train specifications.

The next chapter shows that there is an urgency to remove these barriers as the cost of the barriers is significant. If left unresolved, the cost of these barriers is likely to increase with time.

4 The Need for Change

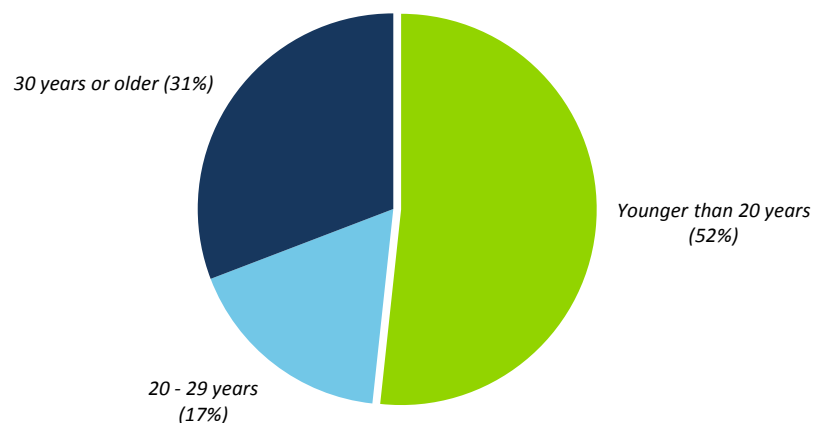
There are clear issues associated with the cost effective procurement of passenger rolling stock. The magnitude of the implications is considerable and likely to grow over time with higher demand for rolling stock. This chapter outlines drivers that collectively contribute to a need to change the way rolling stock is procured. The drivers of change extend from an increased pressure to demonstrate greater value for money, an imminent need to replace age-expired rolling stock and a requirement to deliver growth capacity to address increasing patronage and proposed network extensions. In addition, there is increasing industry discussion of the need for greater coordination around rail standards.

4.1 Imminent Need to Replace Age-Expired Rolling stock

On average, passenger rolling stock has a commercial life of around 30 years although this may vary depending on factors including the level of use, asset condition, cost of maintenance and operation, technical obsolescence and customer expectations. Although the life of rolling stock can be extended with intensive maintenance and refurbishment, a decision to replace (or refurbish) rolling stock will need to be made once the age of a car passes 30 years.

As **Figure 4.1** illustrates, there exists a need to consider replacing about 30% of Australia's current fleet. Almost half of Australia's current rolling stock fleet will need to be replaced in the next 10 years, equating to more than 1,900 cars.

Figure 4.1: Breakdown of Australia's Rolling Stock Age



Source: Deloitte Access Economics

Over the next 10 years, the replacement of age-expired rolling stock will cost approximately \$6 billion

The replacement of close to half of Australia's passenger fleet would require large numbers of rolling stock at considerable investment. Based on our assessment and the average cost of acquisition over the past decade, the replacement of the fleet over the next decade is projected to cost around \$6 billion to fulfil. This does not include the need to procure growth trains, which will add another \$3 billion in costs over the next decade. Regardless of whether rolling stock is replaced or refurbished, decisions that will require significant levels of capital expenditure will be required to maintain the passenger fleet at current levels.

4.2 Need to Deliver Growth in Fleet

Over the long run, the demand for rolling stock is anticipated to increase, not only to replace age-expired rolling stock but also to provide additional rolling stock to meet the growing transport task. The size of the rolling stock task is expected to be underpinned by the desire for rail to handle a greater proportion of passenger trips, driven by a range of factors including:

- Growth in population
- Growing levels of road congestion
- Planned network expansions.

Population

Table 4.1 sets out median projected population levels for Sydney, Melbourne, Brisbane, Adelaide and Perth, and illustrates that population levels are anticipated to continue to grow near or above 1% per annum, with the exception of Adelaide. Continued population growth will continue to underpin rail patronage and network expansion will provide new markets for rail to serve.

Table 4.1: Projected Population Levels

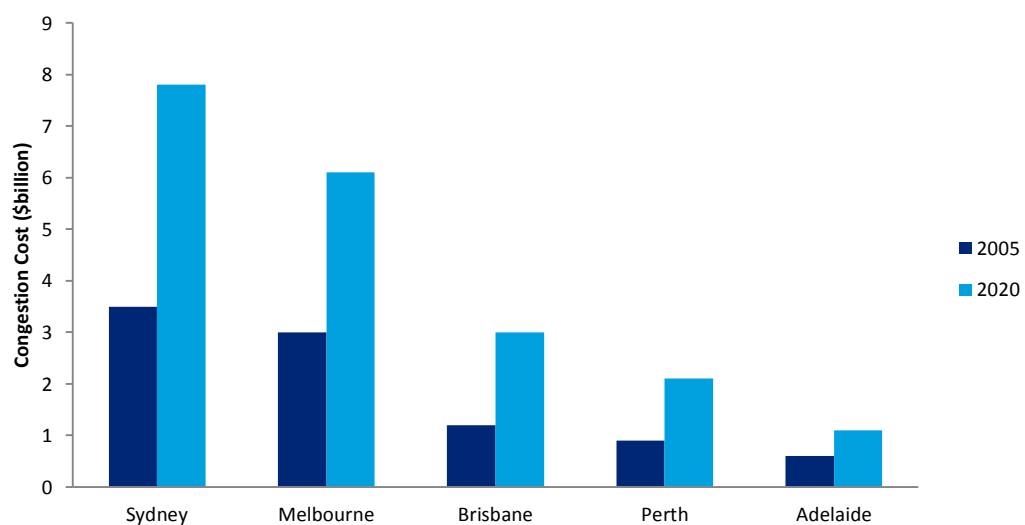
City	2011	2031	Average Annual Growth Rate
Sydney	4,672,433	6,017,088	1.3%
Melbourne	4,137,432	5,411,938	1.4%
Brisbane	2,076,817	2,627,511	1.2%
Perth	1,522,500	2,276,900*	2.7%*
Adelaide	1,222,495	1,470,680	0.9%

Sources: BTS (2012a), Victorian Department of Planning and Community Development (2012), Queensland Office of Economic and Statistical Research (2011), PlanningWA (2012), Government of South Australia (2010). * Population forecasts for Perth are available up to 2026.

Road Congestion

With challenges in increasing the supply of road space, a by-product of population growth and economic growth will be road congestion. The Bureau of Transport and Regional Economics (2007) forecasted that the cost of road congestion would at least double in most Australian cities by 2020 as shown in **Figure 4.2**.

Figure 4.2: Projected Road Congestion Costs



Source: Bureau of Transport and Regional Economics (2007)

The resultant longer travel times, lower travel time reliability and higher vehicle operating costs on the urban road network will increase the relative cost of travel by car and bus compared to train. This factor, combined with network enhancements (discussed below) will increase the attractiveness of rail as a mode of transport.

Network Enhancements

To service anticipated patronage growth, major rail passenger infrastructure works are being proposed by various governments to increase service levels on existing corridors and to expand the coverage of rail. Network enhancements either under construction or being planned over the next 20 years include:

- South West Rail Link (NSW)
- North West Rail Link (NSW)
- Second Harbour Crossing (NSW)
- Melbourne Metro Tunnel (VIC)

- Rowville Line (VIC)
- Melbourne Airport Line (VIC)
- Cross River Rail (QLD)
- Butler Extension (WA).

Many of these projects are either being driven by a desire to service populations in new greenfield development areas or to augment existing lines with capacity limitations. For example, levels of spare capacity on rail services approaching central business districts during morning peaks is rapidly being exhausted with increasing levels of on-board crowding, particularly in Sydney, Melbourne and Brisbane.

Projected Fleet

The impacts of the above-mentioned factors are projected to lead to a significant increase in demand for rolling stock. Projected demand for rolling stock has been based on the fleet database that underpinned the preparation of the *Future of Australian Passenger Rolling stock Report*. Adjustments to the database were then made to reflect recent additions to the fleet and retirements.

Future demand for rolling stock was projected using city specific task growth rates, based on rolling stock forecasts where available, although in most cases forecast changes in peak patronage or train service kilometres were used as proxies. **Table 4.2** outlines the growth rate in rolling stock assumed for each network and the basis for each growth rate.

Table 4.2: Projected Growth in the Fleet Task by Network

Network	Assumed Task Growth per Annum	Basis
NSW	2.4%	Train service km
VIC	4.3%	Morning peak capacity
QLD	4.3%	Morning peak patronage
WA	2.4%	Rolling stock forecast
SA	3.6%	Weekday patronage

Sources: BTS (2012b), PTV (2012), BCC (2011), WA DOT (2011), Williams (2011)

The national fleet is projected to grow from 4,000 cars to above 11,000 cars over the next 30 years

It is projected that the national rolling stock fleet would more than double in size. The current fleet of 4,044 cars is projected to increase to 10,930 cars by 2043, at an average growth rate of 3.2% per annum nationwide. The cost of replacing the existing fleet and procuring additional trains is projected to be approximately \$30 billion over the next 30 years.

4.3 Low Cost Recovery

Passenger rail systems in Australia play a vital role in shaping the economic development of our cities by providing critical links between skilled workforces in the suburbs to highly specialised central business districts. By enabling lower levels of road travel, rail contributes to reduced road congestion, lower greenhouse gases, improved amenity and improved social inclusion.

However, the economic benefits of passenger rail do not match the financial outlay required to sustain existing operations or expand rail operations. For instance, on the CityRail network, costs exceeded revenues by \$2.5 billion with an implied cost recovery ratio of 22% in 2011/12¹⁹. Cost recovery rates on other rail systems in Australia are similarly challenged with the level of cost recovery in each of Australia's five largest cities ranging from 25-45% on average across all transport modes with lower cost recovery rates for rail²⁰.

Invariably, these gaps between costs and farebox revenues need to be covered by governments. Opportunities that reduce costs and improve cost recovery such as improving the way in which rolling stock is procured would be highly valued.

4.4 Key Findings

The limited level of cost recovery achievable from rail services requires governments to approve funding for major capital expenses such as rolling stock. The tight fiscal environment further reinforces the need for rolling stock to be procured cost-effectively to ensure that cost recovery can be enhanced.

With a need to replace close to half the fleet over the course of the next decade at an expected cost of around \$6 billion, governments must consider urgently how they could lock in procurement savings.

However, the issue of how to procure new trains cost efficiently will continue to be an issue over the long run. With the current fleet expected to grow from 4,000 cars to almost 11,000 cars by 2043, without intervention Australian governments could be expected to spend approximately \$30 billion over the next 30 years. Given the level of capital expenditure, even small savings could result in a tangible reduction in capital spend. Measures that may assist in substantially reducing costs are discussed in **Chapter 5**.

¹⁹ NSW Independent Pricing and Regulatory Tribunal (2012)

²⁰ Transport and Tourism Forum (2011)

5 Proposed Policy Responses

There exists a range of short, medium and longer term responses to stimulate action to resolve the key barriers precluding more cost efficient procurement. This chapter identifies potential measures that could address the barriers that currently prevent more efficient procurement of rolling stock.

5.1 Introduction

Chapter 3 identified four key barriers limiting the efficient procurement of rolling stock. Accordingly, a series of policy responses are required to:

- **Optimise the number of trains per order** to better ensure that economies of scale can be achieved by manufacturers
- **Smooth the level of production** to further assist in achieving economies of scale and to provide better signals to industry as to the appropriate level of investment in plant, people and training
- **Reduce the variations in train standards** to reduce the need for one-off designs, the avoidance of which would remove significant design costs during the procurement process
- **Smooth out funding** to reduce the significant one-off financial burden that rolling stock purchases can impose that can affect timing and the political will for procurement
- **Encourage greater engagement** between government and industry to assist in smoothing out production and encouraging harmonisation of train platforms.

The recent purchase of 171 cars by Auckland Transport provides anecdotal evidence of what can be achieved with the right planning:

“The purchase of the 19 extra trains, 50% more than originally planned, resulted from a positive business case showing the savings involved in operating a homogenous fleet, additional central and local government funding and the intensity of competition providing a very good price”²¹

²¹ Auckland Transport (2011)

In this chapter, eight areas have been identified as potential policy responses to addressing the barriers identified in **Chapter 3**. These solutions include:

- Undertake long term rolling stock planning
- Introduce long term train procurement programs
- Coordinate the planning of rolling stock purchases
- Apply alternative funding arrangements
- Reduce the number of train classes
- Procure rolling stock jointly with other jurisdictions
- Harmonise componentry
- Harmonise rolling stock platforms.

Table 5.1 illustrates how these responses could be applied to each of the identified barriers:

Table 5.1: Potential Responses

Potential Responses	Barrier 1 <i>Lack of Scale</i>	Barrier 2 <i>Volatile Production</i>	Barrier 3 <i>Variation in Standards</i>	Barrier 4 <i>Political and Funding Constraints</i>
Long term rolling stock planning	●	●		●
Long term train procurement programs	●	●	●	●
Coordinated rolling stock planning	●	●		●
Alternative funding arrangements				●
Reduce number of train classes	●	●	●	
Joint procurement of rolling stock		●	●	
Harmonised componentry	●	●	●	
Harmonised rolling stock platforms within fleets and between fleets	●	●	●	

As **Table 5.1** suggests, there is no single ‘silver bullet’ that will address the barriers in their entirety. The proposed responses will require rolling stock owners to commit to a higher

and comprehensive level of planning. Some of these responses may need to be executed together to maximise the chance that each barrier can be overcome. Each is discussed below.

5.2 Potential Responses

5.2.1 State by State Long Term Rolling Stock Planning

The longer term planning of rolling stock purchases on a state by state basis is the first step towards improving the planning and procurement of trains. The development of long term passenger rolling stock procurement plans is important as rolling stock and the infrastructure they operate on are long life assets. The procurement of trains has the best chance of being optimised if considered with the design and constraints of other longer life railway assets, avoiding train designs that meet short term requirements without consideration of longer term needs and opportunities.

Industry participants consulted in this study identified that ideally, such plans would span a 20 to 30 year period to cover the anticipated life of a typical car and assess the following aspects:

- Potential network expansions
- Levels of future patronage by year and market segment
- Whole of life costs
- Industry capacity and capabilities
- Ancillary infrastructure (e.g. traction, maintenance and stabling)
- Current and future infrastructure standards
- Current and future operating requirements
- Current and future customer requirements.

Public Transport Victoria's *Network Development Plan*²² and Network Rail's *Rollingstock RUS*²³ serves as useful templates, providing a comprehensive assessment of future patronage, future service levels and infrastructure parameters to inform its rolling stock strategy. The development of similar long term plans by all jurisdictions would provide a useful basis for:

- Informing industry of government's intentions regarding procurement
- Assessing the feasibility of consolidating rolling stock platforms

²² Public Transport Victoria (2012)

²³ Ibid 5

The Taig Review note that where the local norm is not standard gauge, rail investments are designed and developed to be made 'standard gauge ready'.

In Adelaide, new investments in broad gauge passenger transport in the city are being designed with the possibility of future conversion to standard gauge in mind

- Assessing the feasibility of altering and harmonising train design standards
- Assessing the feasibility of altering fixed infrastructure to remove or reduce the need for train variants
- Providing input into longer term train procurements and the coordination of planning across jurisdictions.

Rolling stock planning could be undertaken to involve other stakeholders including passenger rail operators, other government agencies, rolling stock manufacturers and industry associations. The plan would require periodic updates to provide greater predictability of orders and potential specifications.

Ideally, the plan would then translate into a rolling stock program aligned to the following documents:

- Relevant corporate plans
- State government strategies and objectives
- State government asset management plans
- Potentially, Commonwealth Government strategies and objectives.

This would reinforce the reliability of the plan, as part of a whole of rail system program to fund future rolling stock purchases and ancillary infrastructure.

5.2.2 Longer Term Train Procurement Programs

Typical train orders require the build, testing and delivery of trains over relative short periods of anywhere between one and three years.

Longer term train procurements provide opportunities for production to occur over a longer period of time, with the primary aim of smoothing out production. Longer term procurement programs offer both manufacturers and government procurers a range of other, but no less important, benefits including:

- Allow new technologies to be integrated during the production phase for trains waiting to be built
- Opportunities for 'continuous' learning - learnings from stock that has already been brought into service which can then be used to improve production of trains waiting to be built
- Promote a continuous evolution of train designs
- Provide opportunities for alliance style cooperative working arrangements whereby manufacturers, operators and owners are incentivised to improve train designs
- Facilitate smoother testing and acceptance

- Better match demand against industry capacity
- Moderate the level of political pressure on the procurement of rolling stock.

5.2.3 Coordinated Rolling Stock Planning

At present, jurisdictions have limited visibility of potential rolling stock purchases being considered by other jurisdictions. This can serve to limit the extent to which a given jurisdiction can plan to procure new trains during times when rolling stock demand could be low.

Coordinated rolling stock planning would see jurisdictions put forward their own individual rolling stock programs and potentially identify opportunities to:

- Reallocate the timing of potential orders to align with lulls in production
- Smooth out the volume of rolling stock orders in each period
- Identify funding requirements early
- Identify opportunities for joint procurement or specification of common platforms
- Identify opportunities to harmonise rolling stock platforms and infrastructure standards.

Similar databases that record and publish details of future capital projects exist, which could serve as examples for a future rolling stock procurement database. For instance, the National Infrastructure Construction Schedule (NICS)²⁴ developed by the Department of Infrastructure and Regional Development, outlines the timing and expenditure of potential and confirmed infrastructure projects.

As an alternative to developing a standalone rolling stock database, the NICS could be expanded to encompass rolling stock projects. A database similar to the NICS was developed by Infrastructure UK and included both rail infrastructure and rolling stock projects. Extending the NICS to include rolling stock projects would require some amendments to the NICS, additional resourcing and approval of the Council of Australian Governments' Infrastructure Working Group. However, given the links between new below-rail infrastructure and rolling stock, linking the two appears to have merit.

Contact between transport agencies would also be desirable to facilitate discussion of strategic issues including joint procurement and harmonisation.

The NICS provides the infrastructure sector with a database of all known and forecast infrastructure investment by all three levels of Government.

Within one year of its inception, the NICS received nearly 2 million hits²⁰.

²⁴ Former Minister for Infrastructure and Transport (2013)

Longer term pipelining would allow jurisdictions to combine replacement trains with growth trains to increase scale, identify funding constraints earlier and identify ancillary infrastructure requirements.

Subject to addressing probity and procurement concerns, this provides industry with some form of visibility of a future pipeline and could serve to facilitate planning within the industry with respect to investments, supply chain arrangements and required capacity.

5.2.4 Alternative Funding Arrangements

More often than not, rolling stock purchases have been financed through large upfront payments. As the size of these payments can be considerable, they can act as a significant constraint in the purchase of new rolling stock. However, there exists a range of financing techniques to spread purchasing costs to increase the ease of purchase, which are outlined as follows:

Public Private Partnerships

As mentioned in Chapter 3, the use of PPPs is emerging in Australia to fund rolling stock purchases. The Waratah PPP Program is perhaps the most notable example of PPP rolling stock procurement in Australia. The Queensland Government is currently in the process of procuring new suburban train sets through a PPP arrangement.

The use of PPP arrangements have been advocated for their ability to better manage the cost of delivery, ensure better timely delivery, ease the burden of financing over a longer period and to wrap up procurement and maintenance into one package²⁵.

PPP arrangements for rolling stock require a manufacturer to secure the initial capital costs to procure, produce and maintain rolling stock in return for a periodic payment, often linked to the availability of rolling stock for revenue service. A PPP arrangement could be extended to cover operations as well. Financing is often sourced from third parties rather than from the manufacturer.

The periodic payment is conditional on the manufacturer meeting the service requirements set out in the contract, including availability of the rolling stock and upkeep of the assets (cleaning/routine maintenance/major overhauls). If these conditions are not met, each performance failure incurs a deduction against the periodic payment. At the end of the contract, ownership of the rolling stock reverts to the public sector.

However, these agreements can be complicated and often require manufacturers to comply with strict and comprehensive standards and requirements although it is possible for these specifications to be defined on performance terms.

PPP arrangements, which create a direct contractual arrangement between government and manufacturer, offer real opportunities to lower the upfront costs for rolling stock

²⁵ See NSW Treasury (2010)

procurement, despite being complex financial instruments. Simplifying PPP documentation would be of considerable value in helping to reduce the cost of tendering and increase the viability of using PPPs for rolling stock procurement.

Vendor Financing

Financing from manufacturers rather than from third parties may provide another source of funding available to government to fund rolling stock purchases. Similar to a car lease, funding is secured directly from the manufacturer with government paying the manufacturer a periodic payment to cover the capital and financing costs.

Under this model, government takes ownership of the rolling stock and is responsible for its maintenance and operations.

Vendor financing may be practical for smaller, longer term procurements whereby lease payments could be used by the manufacturer to fund both financing costs and future production costs. However, the viability of this approach is reliant on the manufacturer's cost of capital which may be higher than the government's cost of capital, the financial strength of the manufacturer, the availability of free cash and its borrowing capacity.

Sale and Leaseback

This model is often used in the property industry where businesses are seeking to unlock the value tied up in existing assets to fund new growth. In this model, rolling stock currently owned can be sold to an external party (e.g. superannuation fund, a specialist rolling stock company) who then lease it back to the previous owner, freeing up finances for use on other investments, such as new rolling stock construction for growth.

The key advantage of this method is that it can make available finance that could be used to purchase new rolling stock without drawing from contested government funding. This approach can also include maintenance or refurbishment requirements that may present opportunities to better manage whole of life costs.

However, this method can only be used once. The value of the return on rolling stock will be subject to the condition of current rolling stock. There may also be issues regarding who and how rolling stock may need to be maintained.

Sale and leaseback arrangements have been used in the UK and in Europe for passenger fleets. Domestically, sale and leaseback arrangements are perhaps more common for freight rolling stock although as part of the 1999 Victorian passenger franchising agreements, franchisees were required to acquire all rolling stock and make arrangements for lease back²⁶.

²⁶ Productivity Commission (2009)

Rolling Stock Leasing Companies

Rolling stock leasing companies (ROSCOs) may provide an indirect means of procuring rolling stock. With the privatisation of mainline railway operations in the UK in 1993, the ownership and purchase of rolling stock was vested to specialist financing companies who purchased and financed existing and new rolling stock. Private sector train operators then leased rolling stock from these ROSCOs. Government takes the role of planning, defining train specifications, providing the necessary ancillary infrastructure and guaranteeing lease payments through the use of a tripartite agreement between itself, the train operator and the ROSCO.

ROSCOs can provide benefits by buying rolling stock in bulk and providing a means of off-balance sheet financing. With a relatively low level of rail franchising, low fleet numbers and heterogeneity in rolling stock, the ROSCO financing option may not deliver efficient procurement and financing outcomes over the short to medium term. However, should private sector involvement in train operations and harmonisation in rolling stock and infrastructure increase, ROSCOs may provide an alternative means to PPPs to financing new rolling stock.

5.2.5 Reduce the Number of Train Classes

There appear to be opportunities to rationalise the number of different types of cars. Across Australia's passenger fleet, there exist 36 different train classes. Whilst some train classes are similar in design, there exists significant difference between others. Contributing to the wide variety of trains is the small size of many classes. Of the 36 different train types of trains within the current fleet, 23 classes have less than 100 cars.

There may be good reason for a rolling stock operator to procure different types of trains. For instance a metro train may be built on a different platform to a long distance train. It is recognised that on some networks, such as the Transperth rail network, there exists a high degree of similarities between different rolling stock classes. However, there is considerable scope for the consolidation of train classes within other fleets.

The impending retirement of RailCorp's XPT, Xplorer and Endeavour fleet may provide the first opportunity to consolidate train classes. Relatively small in terms of fleet numbers compared to fleet used for urban operations, there is likely to be value in consolidating the design of regional rail trains. Already, trains used by V/Line and Transwa are similar in design (as shown in **Figure 5.1** and **Figure 5.2** respectively).

Figure 5.1: VLocity Train**Figure 5.2: Transwa Train**

Consolidating the number of train classes as rolling stock is renewed would allow rolling stock owners to develop economies of scale at the tendering, design and primary build stage. Larger, more homogenous fleets may also provide opportunities to save on ongoing maintenance and operating costs.

5.2.6 Joint Procurement

Where two or more jurisdictions have orders that may otherwise struggle to achieve economies of scale, a potential option may be to combine the orders into one single approach to market.

This has the potential to deliver rolling stock owners two major benefits in the form of improved economies of scale as well as greater interest from the market.

The trains that are ordered may not necessarily need to have the same specifications. For instance, different train designs could be put to market jointly, although there would be significant benefits from having a high level of commonality between the different trains.

To facilitate joint procurement, long term rolling stock planning as well as coordinated planning of rolling stock procurement would provide potential channels to firstly identify potential train classes that have high degrees of commonality and are likely to become age-expired simultaneously.

It is likely that joint procurement would be undertaken on an ad-hoc basis initially. For instance, the procurement of long distance trains and regional trains, could provide an opportunity to jointly procure rolling stock in a market which would otherwise be piecemeal. Also, the design of long distance trains and regional trains would need to

Four narrow gauge rail operators in Western Switzerland, having reached the same point in their fleet renewal cycles, issued a joint invitation to tender.

The operators jointly selected Stadler to supply a total of 17 two and three-car electric multiple-units worth a total of Fr150 million (A\$160.7 million²⁷).

Stadler note joint procurement saved Fr28 million (A\$30 million) compared to separate contracts and should offer long-term savings through maintenance synergies²⁸.

²⁷ Based on purchasing power parity exchange rate of Fr1 = \$1.071. Sourced from OECD.Stat

account for freight train design and operations in addition to urban passenger train design and operations.

5.2.7 Harmonised componentry

A key element towards greater harmonisation of rolling stock platforms will be the harmonisation of componentry.

Over time as new operating practices and technologies emerge, new standards will be required in order to cater for new applications. For instance, the emerging demand for automatic train control systems and train-platform interfaces (e.g. platform screen doors) would require new types of componentry to deliver these systems and interfaces. Harmonised standards could play a useful role in streamlining and reducing the compliance costs associated with the roll out of these systems should they be developed upfront.

New regulations could also drive a need for harmonised componentry. For instance, all Australian passenger rail operators are required to comply with the *Disability Standards for Accessible Public Transport 2002* (DSAPT). The ARA is currently proposing a legal recognition of a Code of Conduct that translates the DSAPT requirements in a way that reflects the rail industry's constraints. If this process is successful, this could influence the manner in which componentry such as doors, ramps, seats and rails are designed.

Harmonisation of componentry may drive some cost savings through the rail manufacturing supply chain by improving scale, reducing inventory requirements and reducing the costs of sub-assembly. In the UK, it has been suggested that changing design standards by providing best practice guidance on specification, procurement and design to support greater innovation and cost-effectiveness could save between £10m - £20m per year (A\$22.4m - A\$44.8m), and if followed up with mandatory reviews, deliver a further £10m - £20m per year²⁸. It is important to note however that these savings may largely overlap the savings from moving to a more common platform and depend on the extent to which componentry is harmonised. Harmonisation with overseas good practice would also offer opportunities for domestic suppliers to service both domestic and international customers and in turn expand their markets.

Ideally, harmonisation principles and standards can be undertaken in such a way that they incorporate overseas good practice, encourage innovation and evolve over time to account for emerging technologies, market practices and regulations.

5.2.8 Harmonised rolling stock platforms

Over time, the harmonisation of rolling stock platforms may be possible within individual fleets and potentially across the national fleet. Over the longer term, common platforms may emerge for the following market segments:

- Metro style services

²⁸ Little (2011)

- Suburban/commuter services
- Intercity services
- Regional services and long distance services.

In some cases, it may be possible to use the same platform for a variety of market segments.

Regulators are already playing active roles both domestically and internationally in promoting harmonisation. Greater interoperability is currently being sought within the European Union, with a proposal for the European Railway Agency²⁹ to take the central role

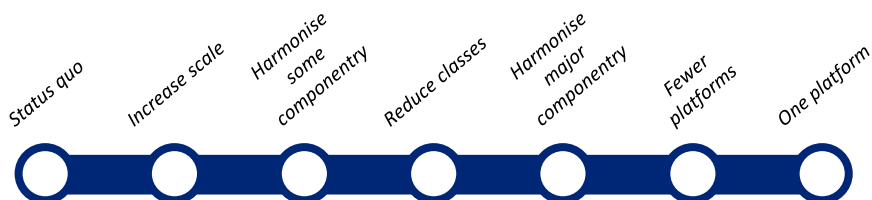
in the acceptance of new rolling stock. In light rail, UK Tram has been tasked with the responsibility of preparing guidance with respect to the design of both light rail rolling stock and infrastructure to assist in delivering greater value for money for future UK light rail projects.

Over the short to medium term, a number of steps could be taken to facilitate a harmonisation of platforms. All of the responses above contribute to some degree to greater harmonisation yet become progressively more difficult to achieve as greater coordination between states and between requirements (in the form of platform harmonisation) is required. An optimal level position along the harmonisation spectrum (see **Figure 5.3**) will be needed to balance standardisation and resultant procurement efficiencies against the cost of retrofitting infrastructure (for example, changing power supplies, station platform designs or bridge clearances) and operator/market requirements.

“Where industry has procured trains without a detailed specification being imposed, there has already been a strong move towards common platform trains”

Angel Trains, a UK based rolling stock provider

Figure 5.3: Steps towards a Harmonised Platform



The role of the market in promoting harmonisation of train platforms will be important. There is an inherent incentive for manufacturers to promote global platforms. The use of common platforms has the potential for rolling stock manufacturers to offer rolling stock

²⁹ International Railway Journal (2013)

more cost effectively, with the research, design and development costs spread over a greater number of orders. The use of common platforms is increasingly becoming market driven and is already evident in the use of platforms like the Siemens Desiro on commuter services as well as regional and intercity services in the UK and across Europe.



Siemens Desiro on the Graz S-bahn
Source: Wikipedia



Siemens Desiro on the Transpennine Express
Source: Wikipedia

It is important to emphasise that common platforms do not necessarily mean standardisation. Forcing standardisation has the potential to stifle innovation. Platforms require innovation to cost effectively maintain rolling stock on an ongoing basis, to replace obsolete componentry, to retrofit new/emerging technologies and to enhance the reliability of the fleet over time.

5.3 Key Findings

To overcome the four identified barriers limiting the cost-efficient procurement of trains, it is imperative that potential responses:

- Optimise the number of trains per order to better ensure that economies of scale can be achieved
- Smooth the level of production to further assist in achieving economies of scale and to provide better signals to industry
- Reduce the variations in train standards to reduce the need for one-off designs, the avoidance of which would remove significant design costs during the procurement process
- Smooth the upfront financial burden of rolling stock purchases to increase the ability to procure based on need rather than on when funding is available
- Encourage greater coordination of production and procurement between industry and government to improve visibility and encourage production efficiencies.

Eight potential policy responses have been identified to assist in delivering the above outcomes:

- Long term rolling stock planning
- Long term train procurement programs
- Coordinated rolling stock planning
- Use of alternative financing arrangements
- Reduce number of train classes
- Joint procurement of rolling stock
- Harmonised componentry
- Harmonised rolling stock platforms.

Specific actions will be required to deliver these policy responses. These actions are outlined in **Chapter 7**.

6 Potential Benefits

A range of responses have been identified which could smooth production, reduce variation and improve the scale of train orders. This chapter outlines the potential economic benefits and changes in the level of economic activity associated with the Policy case, which reflects improved procurement practices, against a Business as Usual case. This chapter outlines how the Business as Usual and the Policy case have been defined, how each economic benefit stream has been measured and the projected costs to government and to industry of not taking action to address the current barriers.

6.1 Evaluation Parameters

The key parameters underpinning the economic assessment reflect recommended parameters used by various agencies including the Standing Committee on Transport and Infrastructure, Infrastructure Australia and various state government treasuries. The following key parameters have been used to monetise benefits:

- **Real discount rate:** 7% per annum
- **Evaluation period:** 30 years
- **Price year:** 2012 prices.

6.2 Project Cases

Future Demand for Rolling Stock

As a prelude to defining the Business as Usual and Policy cases, establishing the size and the timing of rolling stock demand is key in establishing the absolute size of the potential economic benefits. As mentioned in Chapter 4.2, this assessment updates the rolling stock forecasts prepared by Orion Advisory³⁰ to improve the precision of the forecasts. The following adjustments to the forecasts have been made:

- Removal of recent train retirements
- Additions for new trains
- Removal of light rail vehicles
- Separation of single and double deck trains
- Additions to reflect the proposed development of a rapid transit network in Sydney
- Variations in task growth by network.

³⁰ Ibid 4

Based on these adjustments, the current heavy rail passenger fleet is estimated to increase in size from 4,044 cars to 10,930 cars by 2043. **Table 6.1** provides a breakdown of the current fleet and the 2043 fleet by network and deck type:

Table 6.1: Forecast Task Growth Rates

Network	Current Fleet			Annual Task Growth Rate	Projected 2043 Fleet		
	Single Deck	Double Deck	All		Single Deck	Double Deck	All
NSW ³¹	130	1,792	1,922	2.4%	966	2,949	3,915
VIC	1,037		1,037	4.3%	3,615		3,615
QLD	737		737	4.3%	2,604		2,604
WA	248		248	2.4%	510		510
SA	100		100	3.6%	286		286
Sub-total	2,252	1,792	4,044		7,981	2,949	10,930

By 2043, close to 11,000 cars are projected to be demanded across Australia's passenger railways

It should be noted that internal network planning analysis within individual transport agencies may provide for additional capacity to cater for unexpected patronage growth. Therefore, actual rolling stock requirements may be higher than our projections and accordingly, the economic benefits may be higher. However, a conservative approach based on publicly available data validated in each state has been adopted for this analysis.

Business as Usual Case

The Business as Usual case assumes a current practice of each state continuing to procure rolling stock separately without consideration of the timing and size of orders from other states. Within the demand model, the following assumptions have been applied to reflect these practices:

- Train orders are not combined on a nationwide basis
- A new train order is prepared when a train class reaches 30 years of age
- No reduction or harmonisation of train platforms.

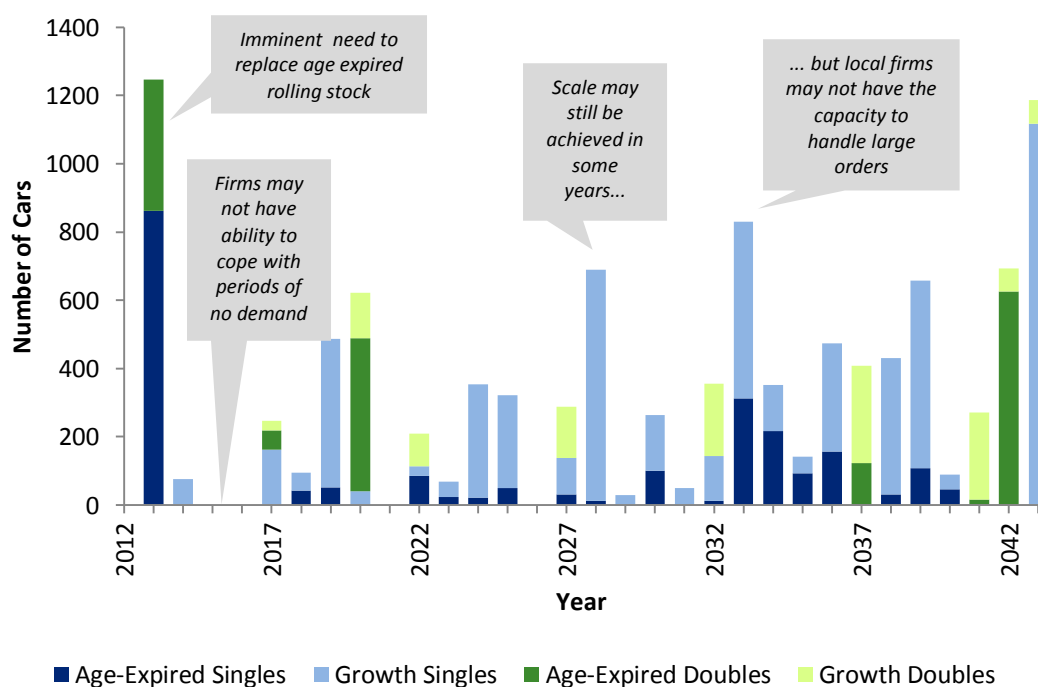
³¹ Rolling stock projections for NSW have been adjusted to reflect the potential development of a separate rapid transit tier, which would see the reintroduction of single deck operations on the suburban network. Based on high level cycle time analysis, it has been assumed that 150 single deck cars would be required for Stage 3 of Sydney's Rail Future (North West Rail Link) and 300 single deck cars for Stage 5 of Sydney's Rail Future (conversion of the Bankstown Line and local Illawarra Lines to rapid transit). Assuming a sequential rollout of Sydney's Rail Future, it was assumed that the 141 of the 300 single deck cars would replace the Millennium train set around 2033, when the Millennium trains would be due for retirement.

In the midst of replacing age-expired trains, new growth trains will also need to be procured in order to meet future patronage growth. It has been assumed that growth trains would generally be combined with an order for replacement trains. The following assumptions were made with regards to the purchase of growth trains:

- Growth trains are purchased at the same time as replacement trains
- If no replacement trains are purchased for 5 years, a growth train order is assumed to be put to market
- A growth train order is put to market in the last year of evaluation to ensure that the cost of all growth trains up to 2043 is included.

Based on these assumptions, **Figure 6.1** outlines the timing and size of orders by deck type under the Business as Usual case.

Figure 6.1: Rolling Stock Orders under the Business as Usual Case



The above figure illustrates the high level of projected volatility associated with no coordination or smoothing. Of the 30 years evaluated, there are 11 years where annual orders will be less than 200 cars and 9 years where annual orders exceed 400 cars. Of particular note is the immediate need to procure more than 1,200 cars. The significant variation in order size under the Business as Usual case is likely to test the agility and capacity of the rolling stock supply chain to deliver to these variable volumes.

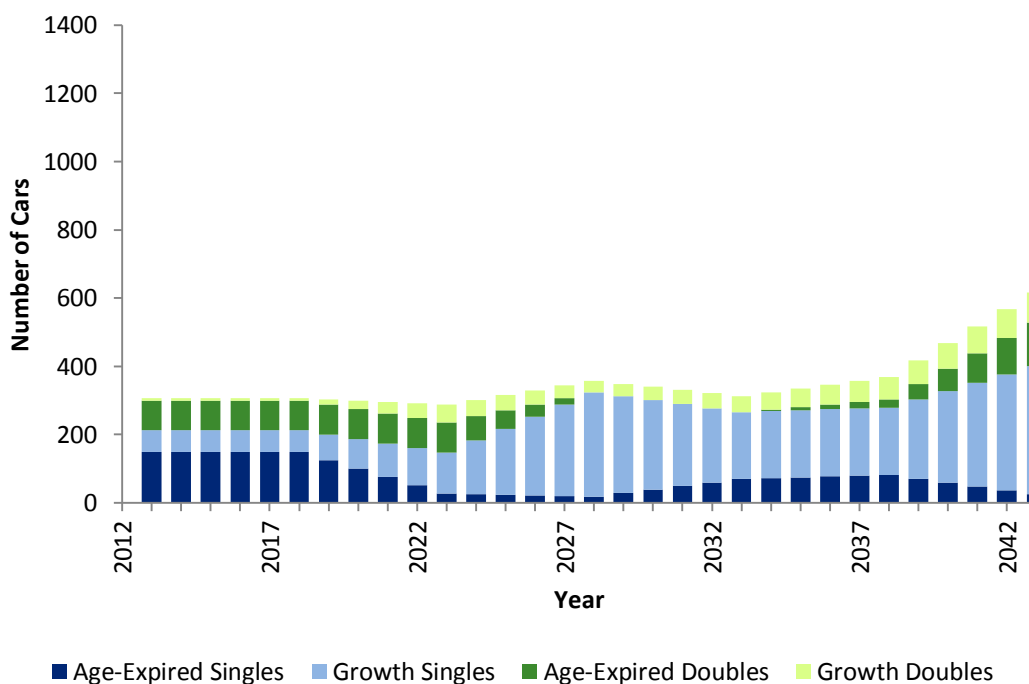
Policy Case

The Policy case assumes a “perfect” level of coordination between the states. The policy case assumes that:

- Train orders are procured collaboratively for all states
- Long term procurement programs are in place
- Two harmonised train platforms, one each for single deck and double deck trains.
- Train orders are smoothed across time.

Within the demand model, train orders by year in the base case have been continuously smoothed using a 5 year moving average to produce estimates of rolling stock demand under the Policy case. **Figure 6.2** outlines the timing and size of orders by deck type under the Policy case.

Figure 6.2: Rolling Stock Orders under the Policy Case



Under the improved case of continual smoothing, the procurement profile for new trains illustrates a fairly constant demand of around 300 cars per year with a ramp up in demand towards the end of the 30 year forecast period. Based on industry consultations, consistent production of approximately 300 cars per annum could be sufficient for two or three domestic rolling stock manufacturers to operate sustainably.

6.3 Benefits to Government

Chapter 5 noted eight potential policy responses that could be enacted to overcome the barriers impacting on the efficient procurement of rolling stock. Should all identified policy responses be implemented, this would give rise to the following savings:

- Savings from improved scale
- Savings in planning and design costs
- Savings from componentry harmonisation.

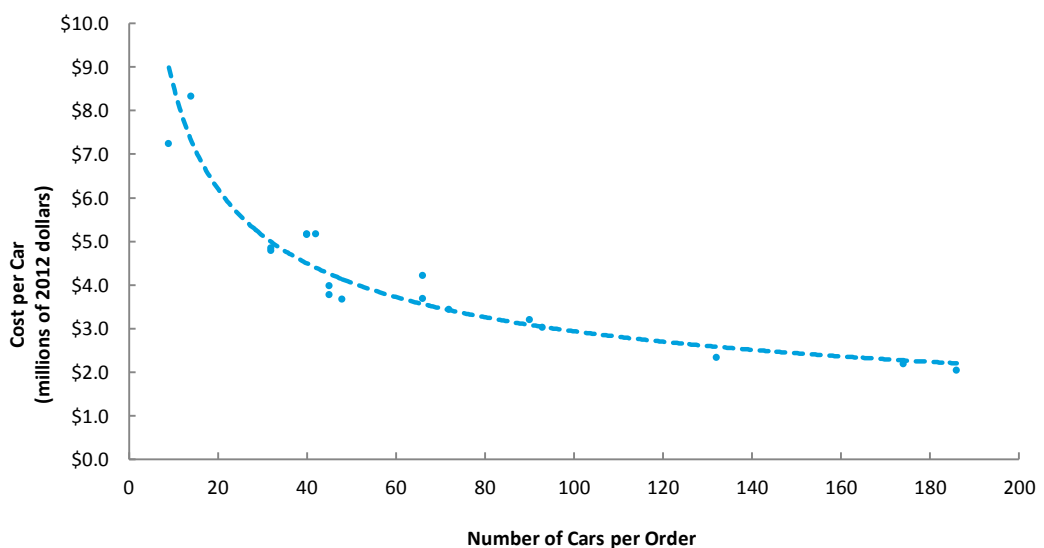
The approach used to monetise each saving stream is discussed below.

6.3.1 Savings from Improved Scale

As mentioned previously in Chapter 3, the first barrier that inhibits the cost-efficient delivery of rolling stock is the lack of scale of many rolling stock orders. An analysis of previous single and double deck orders in Australia indicates that many orders are below 150-200 cars, a level at which economies of scale are achieved by manufacturers.

Figure 6.3 and **Figure 6.4** outline the cost curves for single and double deck cars based on order data.

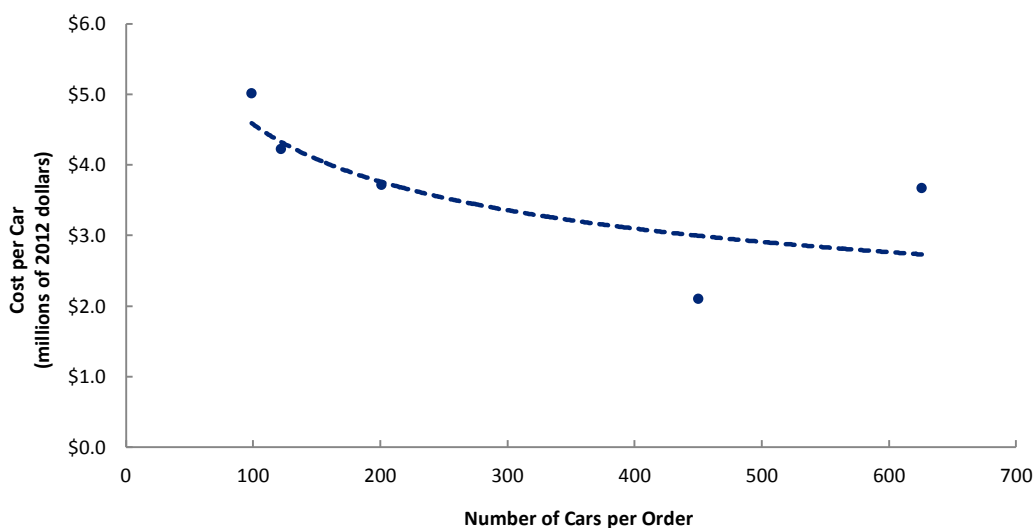
Figure 6.3: Australian Cost Curve for Single Deck Cars



Source: Deloitte Access Economics

To illustrate the impact of scale, for single deck cars, an increase in order size from 50 cars to 150 cars, based on empirical data, would reduce the average cost per car from \$4.0 million to \$2.4 million, a reduction of 40%.

Figure 6.4: Australian Cost Curve for Double Deck Cars



Source: Deloitte Access Economics

For double deck cars, an increase in order size from 50 cars to 150 cars, based on empirical data, would reduce the average cost per car from \$5.6 million to \$4.1 million, a reduction of 37%.

For the purposes of the economic assessment, the empirical cost curves have been used to estimate the cost per order. For train orders beyond 200 cars, a further assumption has been made whereby economies of scale are assumed to be exhausted where orders exceed 200 cars.

6.3.2 Savings in Planning and Design Costs

Procurement costs incurred by government and manufacturers can be quite significant. As mentioned in Chapter 2, a number of time consuming and costly steps are taken prior to primary build. These steps include:

- Transport planning and modelling
- Engineering design and standards
- Business cases and approvals
- Tendering and evaluation.

Research undertaken by the UK Department for Transport indicates that the typical planning and design costs associated with the procurement of trains ranges between 9% and 12% of total capital costs. However, for the development of bespoke rolling stock, this proportion can be as high as 20%. Based on a historical average cost of \$3.3 million per car, average procurement costs in Australia could range between \$0.3 million per car and \$0.7 million per car. Given the high proportion of relatively bespoke trains, small numbers of cars for many train classes and multiple platforms, the costs of planning may be towards the upper end of the range.

Under the Policy case, whereby a common platform would be used across the nation, considerable savings in design, planning and tendering could be made. For instance, a common platform could:

- Deliver gradual iterations in train specifications rather than step changes, avoiding the need to undertake new rounds of research, development and testing
- Improve the viability of joint procurements and harmonisation efforts, which in turn would result in reduced tendering costs through fewer tenders and greater standardisation in tendering processes.

According to research undertaken by ARUP³², approximately 75% of the pre-build costs are “locked in” after tendering, evaluation and detailed design. Under the Policy case, harmonisation and joint procurement have the potential to significantly reduce costs during this stage. Based on the outcomes of industry consultation, an assumption was made that it would be possible to reduce planning and design costs by half should harmonisation and joint procurement initiatives be pursued. Some allowance for ongoing planning and design costs is required - this still allows for costs to be incurred for a simplified tendering and evaluation process and gradual iterations in detailed design.

For the purposes of the assessment, it has been assumed that the average cost of procurement under the Business as Usual case is \$0.60 million per car and under the Policy case, this reduces to \$0.38 million per car, or a saving of \$0.22 million per car.

6.3.3 Savings due to Componentry Harmonisation

Harmonisation of componentry may drive some cost savings through the rail manufacturing supply chain by improving scale, reducing inventory requirements and reducing the cost of sub-assembly. The level of benefit from componentry harmonisation will depend on the ultimate level of harmonisation achieved, a function of the benefits of harmonisation but also the costs and market appetite for harmonisation. It is important to note some of these savings may overlap the savings from moving to a more common platform and increasing order scale.

³² Ibid 7

To gauge what the level of benefit that could be attributed to the harmonisation of componentry, estimates developed for the UK have been drawn upon. Based on a fleet that is currently three times as large as the Australian passenger fleet, it has been estimated that changing design standards by providing best practice guidance on specification, procurement and design to support greater innovation and cost-effectiveness could deliver savings of between £20m - £40m per year³³ (A\$44m - A\$90m³⁴). Taking the midpoint of this range and prorating, harmonisation of componentry could deliver benefits of about \$22 million³⁵ in the first year, growing in size in line with growth in the fleet size.

6.3.4 Headline Savings

Table 6.2 outlines the value of each savings stream. Relative to the Business as Usual case, the Policy case is projected to deliver \$5.9 billion in core capital expenditure benefits, directly attributable to government, in undiscounted terms over the next 30 years (assuming that cost savings are passed onto government in the form of lower prices). This level of savings represents a 19% decrease in rolling stock costs relative to the base case.

Table 6.2: Estimated Savings (\$m)

Benefit Stream	Undiscounted	Discounted
<i>Savings from Improved Scale</i>	\$2,323	\$490
<i>Savings in Planning and Design Costs</i>	\$2,459	\$898
<i>Savings due to Componentry Harmonisation</i>	\$1,126	\$407
Total savings	\$5,908	\$1,794

Where values have been discounted, a 7% real discount rate has been applied

6.4 Benefits to Industry

There is considerable concern amongst domestic rolling stock supply chain participants that continued volatility in production levels is likely to contribute to a decline in domestically based rolling stock manufacturing. Reflecting consultation with industry, in the absence of local content rules under a Business as Usual case, primary build is not expected to continue to occur onshore.

Volatility in production increases the risk for rolling stock manufacturers to develop their supply chain to scale up for large orders as this capacity could well be underutilised for long periods of time. This in turn can lead to situations where orders are in excess of the local industry's capacity, and are in turn filled through the use of international supply chains. This

³³ Little (2011)

³⁴ Ibid 7

³⁵ A mid-point of A€30m p.a. was adopted which was divided by 3 to account for the relative difference in size between the UK and Australian passenger fleet. The £10m was converted to local currency using the above noted PPP exchange rate.

trend was recently evidenced through the use of an international rolling stock manufacturer partner to fulfil the Waratah train order.

Coordinated planning, order smoothing and joint procurements have the potential to limit the erosion of domestic market share. Greater pipeline visibility would provide a range of benefits including:

- Better foresight on the appropriate level of investment in plant, people and training
- A more stable environment from which to encourage investment in innovation and better production practices
- Flow-on potential opportunities for regional specialisation and clustering of rail supply chain participants
- The potential for greater competitive tension by encouraging rolling stock manufacturers to consider entering the domestic market.

Industry consultation suggests that with the greater use of global rolling stock platforms and higher relative labour costs, the proportion of rolling stock production occurring domestically is expected to decline with time.

However, industry participants have suggested that with greater visibility of future production, certain aspects of rolling stock production can be retained on shore such as detailed design, production of some rolling stock componentry, localised fit-out, testing and acceptance. Consultation suggests that should future production levels be smoothed, the value of rolling stock production undertaken domestically may only decline from current levels of around 50% to approximately 30% of the upfront capital cost of rolling stock. This represents a considerable improvement compared with industry's view that no domestic production may occur under the base case.

Using industry's perspective that 30% of production value occurs domestically, this is projected to generate \$8.6 billion of rolling stock production being undertaken on shore over the next 30 years.

Smoothing in production may assist in maintaining up to \$15.5b of domestic economic activity

In turn, domestic production can be expected to have broader impacts beyond the rolling stock manufacturers. Domestic expenditure of \$8.6 billion would flow through other sectors of the rail supply chain and the broader economy. ABS Input-Output data was used to impute a multiplier – a value of 1.8³⁶ was derived. Hence, the initial \$8.6 billion expenditure is projected to equate to a \$15.5 billion impact in undiscounted terms (or \$6.5 billion in discounted terms) over the next 30 years - \$8.6 billion direct and \$6.9 billion indirect.

Conversely should no action be taken, industry stakeholders have suggested that it is conceivable that no rolling stock manufacturing would occur domestically, with all primary build undertaken overseas.

³⁶ Deloitte Access Economics assessment based on ABS (2012)

Without change, this means that economic activity of up to \$15.5 billion could be at risk and lost to domestic industry.

6.4.1 Industry Impacts by Region

The manufacture of rolling stock is highly specialised and is a significant employer in many regional economies. The 2011 Census indicates that about 6,000 people were directly employed by entities involved in rolling stock manufacturing and repair across Australia.

Workers within the rolling stock manufacturing sector are concentrated in specific hubs. The top ten regions account for over 60% of employment with the sector with concentrations of workers in both metropolitan areas, including Auburn and Dandenong, as well as in regional areas including Newcastle, Maryborough and Bendigo. With respect to the latter, rail often plays a disproportionate role in underpinning the local manufacturing base. The benefits of retaining a domestic rolling stock manufacturing base would likely be concentrated in these locations. A breakdown of major rolling stock manufacturing and repair locations are shown in **Table 6.3**.

Table 6.3: Major Locations for Rolling Stock Manufacturing and Repair in Australia

Region	Key Rail Manufacturing and Repair Centres	Workers	Share of Industry Employment	Share of Manufacturing Jobs in Region
Newcastle/Lake Macquarie (NSW)	Cardiff, Waratah, Broadmeadow	1072	18.1%	7.7%
Sydney – Parramatta (NSW)	Clyde-Auburn	769	13.0%	2.8%
Wide Bay (Qld)	Maryborough	490	8.3%	6.3%
Adelaide – North (SA)	Dry Creek	239	4.0%	1.3%
Melbourne – South East (VIC)	Dandenong	200	3.4%	0.4%
Melbourne – West (VIC)	Spotswood	191	3.2%	0.7%
Melbourne – Inner (VIC)	West Melbourne	171	2.9%	0.7%
Fitzroy (Qld)	Rockhampton	157	2.7%	1.8%
Brisbane – Inner City (Qld)	Bowen Hills	154	2.6%	1.9%
South Australia – Outback (SA)	Whyalla	149	2.5%	4.9%
Sydney - Inner South West (NSW)	Eveleigh (Redfern)	139	2.3%	0.8%
Mid North Coast (NSW)	Port Macquarie	134	2.3%	3.2%
Ballarat (VIC)	Ballarat, Bendigo, Castlemaine	124	2.1%	2.1%
Australia		5,923	100%	0.7%

Source: ABS 2011 Census

Table 6.4 illustrates the potential distribution of economic activity under the Policy case if it were to be spread based on the breakdown of employment. Under the Policy case, economic activity could be enhanced by over a \$1 billion in Maryborough and over \$2 billion in Auburn and Newcastle over a 30 year period.

Table 6.4: Projected Difference in Economic Activity under the Policy Case by Key Rolling Stock Manufacturing and Repair Regions in Australia

Region	Key Rail Manufacturing and Repair Centres	Direct Benefits (\$m)	Indirect Benefits (\$m)	Total Benefits (\$m)
Newcastle/Lake Macquarie (NSW)	Cardiff, Waratah, Broadmeadow,	\$1,557	\$1,241	\$2,799
Sydney – Parramatta (NSW)	Clyde-Auburn	\$1,117	\$891	\$2,008
Wide Bay (Qld)	Maryborough	\$712	\$567	\$1,279
Adelaide – North (SA)	Dry Creek	\$347	\$277	\$624
Melbourne – South East (VIC)	Dandenong	\$291	\$232	\$522
Melbourne – West (VIC)	Spotswood	\$277	\$221	\$499
Melbourne – Inner (VIC)	West Melbourne	\$248	\$198	\$446
Fitzroy (Qld)	Rockhampton	\$228	\$182	\$410
Brisbane – Inner City (Qld)	Bowen Hills	\$224	\$178	\$402
South Australia – Outback (SA)	Whyalla	\$216	\$173	\$389
Sydney - Inner South West (NSW)	Eveleigh (Redfern)	\$202	\$161	\$363
Mid North Coast (NSW)	Port Macquarie	\$195	\$155	\$350
Ballarat (VIC)	Ballarat, Bendigo, Castlemaine	\$180	\$144	\$324

Australian governments have gone to great lengths to promote employment and regional economic activity, particularly within manufacturing, in the past. In this case, a sustainable domestic manufacturing presence could be achieved by simply changing approaches to procurement and better planning.

Better planning and procurement would go a long way in complementing other government initiatives currently being developed to increase domestic involvement in rolling stock manufacturing. Recently, there was an announcement on Industry Innovation Precincts that aims to help businesses and researchers collaborate, share knowledge, create products and services and take advantage of business opportunities. Manufacturing Taskforce Excellence Australia (META) is one of the first Industry Innovation Precincts to be established. META will build a critical mass of Australian manufacturers and researchers

with the capability to take full advantage of domestic and international opportunities including integration into global supply chains and opportunities arising out of Asia. Organisations across all manufacturing sectors are encouraged to engage with META. META will enable firms to collaborate and build scale with each other and researchers both at home and abroad to improve knowledge and skills and develop a cohort of growth-oriented businesses.

In addition, where government procurement is involved, local industry participation plans may be required by state government agencies. These plans promote involvement and the consideration of competitive local small to medium sized business in major projects. Project proponents may be required to develop and implement a plan that sets out how full, fair and reasonable opportunity will be provided to local industry to participate.

6.5 Key Findings

The economic assessment, which considered the economic benefits and impact of improved procurement practices, relative to a Business as Usual situation, suggests that savings and changes in economic activity could be significant.

Over the next 30 years, these savings are projected to be \$5.9 billion, accruable from improved scale, reduced planning and design costs and harmonised componentry.

Smoother demand also provides the chance for domestic rolling stock manufacturing to be sustained without resorting to interventionist policy. Assuming that domestic production reduces from the present levels to 30%, as assumed under the Policy case, smoother demand has the potential to maintain \$15.5 billion in economic activity. Much of this activity could be concentrated in existing rail manufacturing hubs located in both regional and metropolitan areas. This activity requires changing approaches to procurement only, without the need for interventionist policy.

7 Next Steps

The potential benefits from improving how passenger rolling stock is procured are significant. This chapter sets out a high level plan of key actions required to drive the realisation of these benefits.

7.1 Realising the Benefits

Chapter 6 outlined that with better planning and harmonised platforms, the procurement of passenger rolling stock could realise significant savings and influence the level of economic activity. Table 7.1 outlines how these savings and impacts align with each recommended response.

Savings from improved scale and the industry impact from smoother demand rely on responses that require better coordinated planning. These savings, if realised in full, could deliver cost savings of \$2.3 billion and maintain up to \$15.5 billion in economic activity domestically over the next 30 years.

Savings from planning and design and harmonised componentry rely on responses that deliver greater commonality in design. The collective benefits associated with these responses are projected to be around \$3.6 billion over the next 30 years, although these benefits may be more difficult to realise.

Table 7.1: Impact of Key Responses by Benefit Type

Potential Responses	Savings from Improved Scale	Industry Impact from Smoother Demand	Savings in Planning and Design Costs	Savings due to Componentry Harmonisation
Long term rolling stock planning	●	●		
Long term train procurement programs	●	●	○	○
Coordinated rolling stock planning	●	●		
Alternative financing arrangements		●		
Reduce number of train classes			●	○
Joint procurement of rolling stock	○	○		
Harmonised componentry	○	○	●	●
Harmonised rolling stock platforms	○		●	●

Impact of Coordinated Planning (encompasses: Long term rolling stock planning, Long term train procurement programs, Coordinated rolling stock planning, Alternative financing arrangements)

Impact of Harmonised Design (encompasses: Reduce number of train classes, Joint procurement of rolling stock, Harmonised componentry, Harmonised rolling stock platforms)

● This response provides a major contribution to realising this saving/impact
○ This response provides a minor contribution to realising this saving/impact

Some responses are considered to contribute significantly or are necessary to the realisation of a particular benefit; these responses are highlighted with a bold circle (●). Other responses may make a minor contribution to the realisation of a particular benefit; these responses are highlighted with a hollow circle (○).

A considerable proportion of the projected savings and changes in economic activity can be attributed to better coordinated planning. However, the effort associated with greater harmonisation could be higher than the efforts required for better coordinated planning. In general, more effort will be required to realise benefits that require greater coordination between states and greater harmonisation.

The responses have therefore been grouped into a series of sequential actions that can be used to progress along the harmonisation spectrum at a measured pace.

Six key actions have been identified to assist in the realisation of the eight policy responses identified in **Chapter 5**. These key actions are:

- **Action 1:** Prepare integrated long term rolling stock strategies
- **Action 2:** Develop a national rolling stock pipeline database
- **Action 3:** Initiate a Coordinated Rolling Stock Planning Program
- **Action 4:** Establish a pilot to prove partial harmonisation benefits
- **Action 5:** Develop harmonisation principles and harmonised rolling stock standards
- **Action 6:** Develop cross-state procurement arrangements.

Table 7.2 outlines how these actions seek to address each policy response.

Table 7.2: Alignment of Key Actions against Potential Policy Response

		Key Actions					
		Action 1: Prepare integrated long term rolling stock strategies	Action 2: Develop a national rolling stock pipeline database	Action 3: Initiate a Coordinated Rolling Stock Planning Program	Action 4: Establish a pilot to prove partial harmonisation benefits	Action 5: Develop harmonisation principles and harmonised rolling stock standards	Action 6: Develop cross-state procurement arrangements
Key Responses	Long term rolling stock planning	●		●	●		
	Long term train procurement programs	●		●	●		
	Coordinated rolling stock planning	●	●	●	●		
	Alternative funding arrangements	●					
	Reduce number of train classes	●			●	●	
	Joint procurement of rolling stock	●			●	●	●
	Harmonised componentry				●	●	
	Harmonised rolling stock platforms within fleets and between fleets	●		●	●	●	

These actions are aimed at promoting a culture of planning to address the barriers impeding the cost efficient procurement of rolling stock. In the first instance, the actions are designed to encourage rather than mandate involvement from key stakeholders. If undertaken sequentially, learnings from previous actions may then inform subsequent actions.

There is great potential in the form of cost savings and broader economic benefits to pursue greater harmonisation. Further planning and assessment is considered vital in order to establish what harmonisation opportunities exist, particularly interstate opportunities, and provide the basis for whether further measures are required to improve the procurement of rolling stock.

7.2 Key Actions

Table 7.3 outlines the recommended actions to access these procurement efficiencies. Any and all of these activities would assist in moving the Australian rolling stock sector further along the harmonisation spectrum which will realise ongoing benefits.

Table 7.3: Key Recommended Actions

Action	Key Elements
<p>Action 1: <i>Prepare integrated long term rolling stock strategies</i></p>	<p>Develop plans spanning a 20 to 30 year period to project anticipated level of rolling stock demand accounting for:</p> <ul style="list-style-type: none"> • Potential network expansions • Levels of future patronage by year and market segment • Whole of life costs • Ancillary infrastructure • Current and future infrastructure standards • Current and future operating requirements • Current and future customer requirements • Alternative financing options that could be used. <p>These plans could:</p> <ul style="list-style-type: none"> • Consider input from rolling stock manufacturers to identify industry's potential offerings and capabilities • Identify opportunities for rolling stock to be procured over longer term contracts / under different financing models • Balance the need for new train classes to better meet customer/operating needs against the benefits of rationalising the number of train classes.
<p>Action 2: <i>Develop a national rolling stock pipeline database</i></p>	<p>Develop a database that sets out anticipated rolling stock demand by:</p> <ul style="list-style-type: none"> • Jurisdiction • Expected year of procurement • Type of train • Number of cars. <p>The aim of the database would be to develop a profile of committed, planned and projected rolling stock requirements, informed by long term rolling stock planning undertaken by individual agencies. This would provide visibility to each State, to manufacturers and to industry suppliers.</p>
<p>Action 3: <i>Initiate a Coordinated Rolling Stock Planning Program</i></p>	<p>A Coordinated Rolling Stock Planning Program would see jurisdictions put forward their own individual rolling stock programs, and potentially identify opportunities for agencies to:</p> <ul style="list-style-type: none"> • Reallocate potential orders to match up with lulls in demand • Smooth out rolling stock orders • Identify funding requirements • Identify opportunities for joint procurements • Identify opportunities to harmonise rolling stock platforms and infrastructure standards.
<p>Action 4: <i>Establish a pilot to prove partial harmonisation benefits</i></p>	<p>A pilot program aimed at developing harmonisation principles and standards for one class of train. This pilot could provide the basis for establishing key operating and infrastructure harmonisation principles, issues that may limit the level of harmonisation and the appetite for harmonisation.</p> <p>The development of a harmonised platform for regional rail may provide an ideal</p>

Action	Key Elements
	<p>test case to prove the harmonisation concept. A harmonised platform for regional rail would serve to consolidate a market segment whereby the number of cars per class is typically small. Furthermore, a regional rail initiative could highlight design elements that are most amenable to harmonisation, taking into account variations in operating and infrastructure parameters between different rail networks.</p> <p>Such a pilot could require involvement from a range of transport agencies as well as industry participation to identify a rollingstock platform/market that would be most amenable to harmonisation to demonstrate benefits of harmonisation.</p>
<p>Action 5: <i>Develop harmonisation principles and harmonised rolling stock standards</i></p>	<p>Should it be considered desirable by industry, the formalisation of principles and standards to guide the greater harmonisation of rolling stock design and where necessary, infrastructure would be developed. An engineering assessment of the following elements could be undertaken to assess the potential for a reduction of train classes and harmonisation of rolling stock platforms:</p> <ul style="list-style-type: none"> • Current and emerging platforms and standards • Current fleet designs and standards • Key elements and “non-negotiable” standards • Operating arrangements impacting on train design • Infrastructure constraints impacting on train design.
<p>Action 6: <i>Explore feasibility of cross-state procurement arrangements</i></p>	<p>To further progress the potential for joint procurement, the feasibility of such arrangements could first be assessed. The assessment could consider:</p> <ul style="list-style-type: none"> • Potential obstacles that may impede joint procurements • Regulatory and legislative issues • Competition issues.

7.3 Key Findings

As identified in **Chapter 5**, eight policy responses have been identified to improve economies of scale, smooth production and reduce variations in standards. These responses are:

- Long term rolling stock planning
- Long term train procurement programs
- Coordinated rolling stock planning
- Alternative funding arrangements
- Reduce number of train classes
- Joint procurement of rolling stock
- Harmonised componentry
- Harmonised rolling stock platforms.

In order to deliver these responses, the following actions should be carried out:

- **Action 1:** Prepare integrated long term rolling stock strategies
- **Action 2:** Develop a national rolling stock pipeline database
- **Action 3:** Initiate a Coordinated Rolling Stock Planning Program

- **Action 4:** Establish a pilot to prove partial harmonisation benefits
- **Action 5:** Develop harmonisation principles and harmonised rolling stock standards
- **Action 6:** Develop cross-state procurement arrangements.

These actions are aimed at promoting a culture that delivers sustainable cost efficiencies.

To realise the estimated benefits, buy-in from a range of key government and industry stakeholders would be required to achieve the potential policy responses outlined in **Chapter 5**. Both government and industry stakeholders have key roles to play in progression identified actions.

There are considerable economic benefits at stake for all stakeholders. For governments, these amount to cost savings of \$5.9 billion over the next 30 years. For the rolling stock manufacturing industry, economic activity worth \$15.5 billion may not be maintained without action. There is now a clear imperative to take action. This requires primarily better planning rather than major government intervention, to deliver benefits for all stakeholders, improve efficiencies and provide a platform for a more sustainable domestic rolling stock manufacturing industry.

8 Limitation of our work

This report is prepared solely for the use of the ARA. This report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. The report has been prepared for the purpose set out in our engagement letter dated 7 February 2013. You should not refer to or use our name or the advice for any other purpose.

9 References

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