Fastrack Australia

FREIGHT AND HIGH-SPEED RAIL

Dr. Garry Glazebrook

June 2023

PREFACE

This report is one of a series of reports by Fastrack Australia, which develop a new strategy for introducing high-speed rail in Australia.

Whilst high-speed rail has been talked about for decades in Australia, the approach adopted by Fastrack Australia is different from earlier approaches, in particular:

- It focuses on how high-speed rail can encourage decentralisation.
- It shows how high-speed rail can improve freight as well as passenger transport; and
- It details how it can be progressively implemented in a series of well-defined stages.

Previous proposals in Australia envisaged high-speed rail as a stand-alone system. In contrast, Fastrack Australia believes it should be integrated both with existing rail networks and with urban development. This will provide confidence in the technology, achieve concrete results at an earlier stage, and maximise the benefits for key regional communities as well as the capital cities.

Fastrack Australia is a not-for profit organisation with no commercial links to high-speed rail manufacturers, land developers or any other organisations. It conducts its research on a purely voluntary basis, and receives no funding from government, the private sector or other stakeholders.

Reports issued or planned to date include:

Freight and High-Speed Rail	*Dr Garry Glazebrook*	*June 2023*
Implications of High-Speed Rail for the Canberra Region	*Dr Ross Lowrey*	*April 2023*
Implementation Plan for High-Speed Rail	*Dr Garry Glazebrook & Dr Ross Lowrey*	*January 2023*
High-Speed Rail for Regional Growth	*Dr Ross Lowrey*	*March 2021*
High-Speed Rail: A New Approach	*Dr Garry Glazebrook*	*January 2021*
Population Trends and Decentralisation Options	*Dr Garry Glazebrook*	*December 2020*

These reports, together with links to other relevant reports on high-speed rail, a database on high-speed rail developments and related topics world-wide, and a number of presentations, are available and may be downloaded from www.fastrackaustralia.net.

Future reports are planned to examine such topics such appropriate routes for high-speed rail through Sydney and the Implications of High-Speed Rail for the Australian Rail Industry.

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FOREWORD

This paper answers the question of whether freight can be carried on the high-speed rail line between Sydney and Melbourne. Drawing on recent developments both overseas and in Australia, it demonstrates the feasibility of using the high-speed line to operate fast freight trains, mostly running at night, together with a range of passenger services designed to meet expected future passenger demand.

This is good news for Australia for three reasons.

First, the high-speed line will be highly utilised, with up to 400 trains a day using part or all of the line. This negates the arguments of those who say that Australia's population is too small and its distances too long to justify the implementation of high-speed rail in Australia. Instead, the high utilisation of the high-speed line by both passenger and freight services means it will generate increased revenue to help pay back the significant infrastructure investment needed to build it.

Second, the high-speed line will create an economic boom in Australia. Not only will it help to spread population and economic growth into regional areas of Australia, reducing problems of housing affordability and congestion in our cities and boosting regional economies. But it will also make the distribution of goods quicker, more reliable and cheaper, by using high-speed rail as a fast and reliable 'conveyor belt' linking terminals with automated handling facilities.

Finally, shifting a significant part of future freight task from trucks to rail will also generate significant environmental, safety and other benefits, and make our transport systems more sustainable.

This paper sets out a vision and a detailed plan for meeting these objectives. Hopefully this can be incorporated into the proposals for high-speed rail in Australia which are about to be developed by the High Speed Rail Authority, and that they can be implemented as soon as possible.

EXECUTIVE SUMMARY

- The freight and logistics industry produced 8.6% of our GDP in 2014, and 19% of our carbon emissions in 2019. Freight matters both economically and to the environment. Rail is three times more energy efficient than road for freight. Shifting interstate freight to rail is therefore vital both economically and for reducing emissions.

- New technology is being adopted overseas for making rail more competitive with road freight. This includes new ways to rapidly load and unload trains, automated coupling systems and high-powered electric freight locomotives.

- While Australia has world class iron ore and coal railways, its interstate freight railways on the East Coast lag well behind, hampered by alignments which are well over a century old.

- Detailed surveys of truck movements estimated that trucks currently carry an estimated 42 million tonnes per annum on the Hume Highway, 88% in B-doubles and semi-trailers, with up to 10,000 trucks per day at the busiest point. Whilst rail handles a significant amount of shorter-distance bulk and industrial freight, it handles less than 10% of the estimated 100,000 tonnes / day of general merchandise freight between Sydney and Melbourne.

- Rail freight operators in Australia have recently begun investing in new locomotives, rollingstock and terminals, and increasing rail services. This will hopefully halt the shift of merchandise freight from rail to road. But it will need to be matched by improvements in rail freight travel times to be fully effective in achieving the potential which rail offers.

- High-Speed rail is often considered only in relation to passengers. However, the creation of high-speed rail in Eastern Australia could also enable fast freight trains to be introduced, especially at night when there are few passenger trains operating. Some track sharing on high-speed lines during daylight hours is also possible. Rail travel times between terminals can be cut from the current 13-15 hours to around 9 hours.

- Coupled with adoption of new technologies, and the development of modern logistics centres like Sydney's Moorebank terminal, a high-speed rail line could shift at least 50% of the future general merchandise freight between Sydney and Melbourne to rail, by adding 12-15 new fast freight trains in each direction per day.

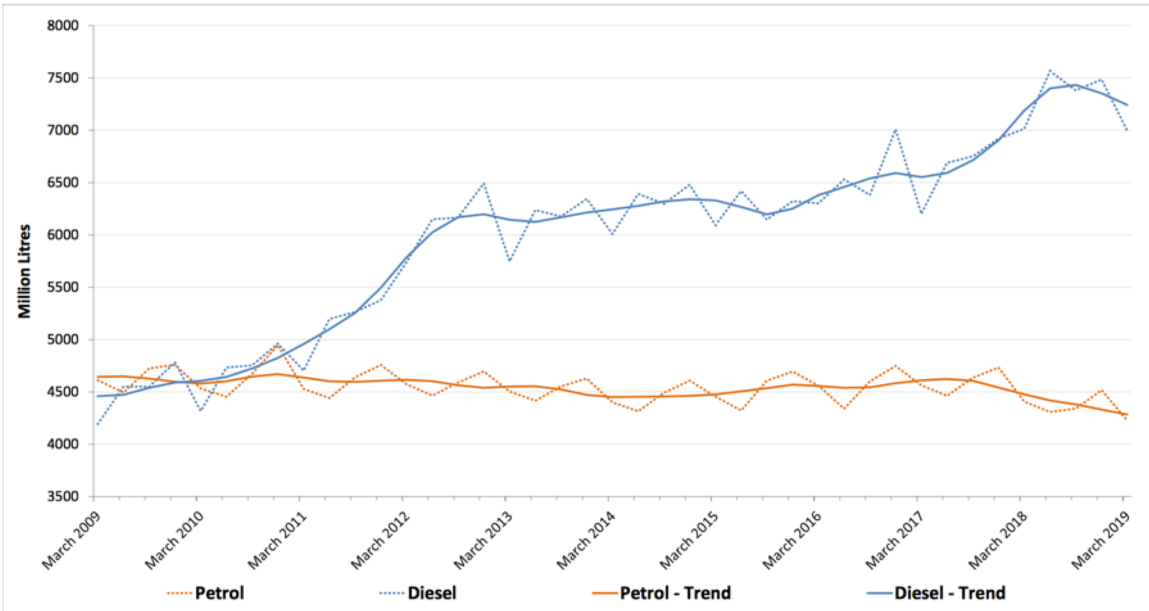
- The feasibility of this has been demonstrated by detailed analysis of notional timetables for the Sydney – Canberra - Melbourne corridor. This corridor can accommodate at least 200 trains per day in each direction on the high-speed line once complete, assumed to be between 2050 and 2060.

- The high-speed line can also carry 40% of future inter-city air passenger traffic, as well as regional and commuter movement in the Sydney-Melbourne corridor. The combined effect would produce major economic , social and environmental benefits for Australia.

1
INTRODUCTION

In 2014, the freight and logistics sector in Australia was estimated to be worth $132 billion, or 8.6% of GDP, and to employ 1.2 million people[i]. In 2019, transport accounted for 19% of Australia's greenhouse emissions, and most of its liquid fuel consumption. There was a particularly rapid increases in diesel use over the last decade, mainly by trucks.

Figure 1 Australia's Consumption of Diesel and Petrol, 2009-2019[ii]



Source: Department of the Environment and Energy

Furthermore, freight movement in Australia is growing faster than both population and the economy. This reflects Australia's role as a commodity exporter, the declining cost of freight movement with the shift to containers and pallets and sophisticated logistics for moving non-bulk freight, and the growth in world trade.

Improving the efficiency and sustainability of freight transport is therefore a key economic and environmental objective.

Rail is roughly three times more energy efficient than road for moving freight, and shifting freight transport to rail is an obvious strategy for improving both efficiency and emissions. In Australia, the rail freight industry has focused on moving iron ore, coal and other bulk commodities, with significant investment in rail infrastructure in some regions, especially in the Pilbara, Hunter Valley and Central Queensland. Rail operators, particularly those specialising in iron ore and coal, are world class at moving large volumes with high efficiency. Rail also continues to handle significant volumes of bulk and industrial products such as grains, limestone, cement and steel in many parts of Australia.

Merchandise Freight is a different story. Until recently, the movement of general merchandise freight has increasingly shifted to road transport. This reflects the speed, flexibility and reliability of the trucking industry. Rail has found it difficult to compete, especially on the north-south corridors between Melbourne, Sydney and Brisbane, given the substantial investment in major highways over the last four decades and the corresponding lack of investment in inter-city rail infrastructure. In addition, major warehouses and logistics facilities have in many cases been established alongside key highways and motorways, such as the M7 in Sydney, in locations without rail access.

Figure 2: Moving Freight In Australia

Australia's rail systems are world class for moving bulk commodities[iii], but we rely almost exclusively on trucks for moving general merchandise[iv].

However, in the last few years freight rail operators have begun investing in trains and terminals for intermodal and general freight. To make intermodal freight fully competitive with trucks however will require investment by governments in upgrade the current slow alignments, which in many cases date back to the 19th century.

Fastrack Australia's proposal for development of high-speed rail in South-East Australia is specifically aimed at producing benefits for both passengers and freight, by:

- The staged development of sections of high-speed rail in parallel with the main interstate corridor between Sydney, Melbourne and Brisbane, by using faster, much straighter alignments.
- The electrification of these new sections of high-speed line at 25 KvAC to provide the power necessary for high-speed passenger trains as well as fast intermodal freight trains.
- Progressive accelerations of passenger and intermodal freight trains as new sections of the high-speed line are commissioned.
- The retention of the existing non-electrified interstate lines in the long-term to accommodate mainly slow-speed bulk and industrial freight trains and local passenger services , as well as fast regional and commuter services and fast freight services when operating off the high-speed network.

Combined with the completion of the Inland Rail, the future investment in high-speed rail could lead to a substantially increased role for rail for moving freight in the East Coast Corridor between Melbourne, Sydney and Brisbane, with the potential to handle 50% of the freight task in the corridor by 2060.

This report therefore examines:

- ***Overseas Freight Rail Developments*** – what are the developments and overseas experience that would allow freight services to use higher speed lines?
- ***Recent Rail Freight Developments in Australia*** – what is the rail freight industry doing that would prepare it for faster freight services in Australia?
- ***Freight Demand in the Sydney-Melbourne Corridor*** –what is the current and future demand for freight movement in the Sydney-Melbourne corridor?
- ***Future Freight Options in the Sydney-Melbourne Corridor*** – what new freight services could be offered using the high-speed line, and how will they affect the freight industry?
- ***Proposed Scheduling for the Sydney-Melbourne High-Speed Line*** – can sufficient freight services can be scheduled without impacting the operation of passenger services on the high-speed line?
- ***Implications for Rail Freight*** – what actions are needed to enable freight on the high-speed line?

2
OVERSEAS FREIGHT RAIL DEVELOPMENTS

High-speed rail has already transformed inter-city passenger travel in many countries. It also has potential to make rail more competitive for specialised freight movement, including high-value cargoes (some of which currently go by air) and intermodal movements, especially when combined with other transport innovations.

Recent overseas developments in rail freight technologies and operations are making rail more competitive for handling merchandise freight. These include:

- Allowing fast freight trains on high-speed lines under suitable conditions
- Introducing high-powered electric and bi-mode locomotives, which can allow freight trains to operate at higher speeds and to operate on lines with a mix of electrified and non-electrified track.
- Use of double-stack container trains on long-hauls, and purpose-built rail corridors to avoid congestion.
- New rollingstock and terminals to allow rail to load and unload faster, and to combine with road transport for door-door flexibility. They also offer the prospect of reducing time delays in making up and breaking down trains, which has been a long-standing disadvantage of rail transport.

2.1 FREIGHT ON HIGH-SPEED LINES

Previous proposals for high-speed rail in Australia have focused exclusively on passengers, ignoring the movement of freight. This led to proposals for fully separated high-speed lines from the rest of the rail system.

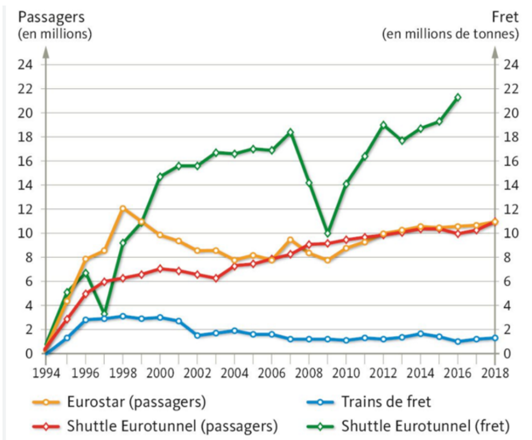
Yet in many countries, especially in Europe, high-speed passenger trains share tracks with slower speed passenger trains as well as fast freight trains, both on sections of the high-speed lines and on sections of traditional lines, as illustrated by the examples below:

UK – CHANNEL TUNNEL

The Channel Tunnel was designed from the outset to handle both high-speed passenger trains (with speeds up to 186 km/hr in the tunnel) and fast-moving freight trains.

Figure 3: Passengers and Freight in the Channel Tunnel

Eurostar emerging from the Channel Tunnel. These high-speed trains carry around 50% of passengers through the tunnel.



The Channel Tunnel also carried around 22 m tonnes of freight and 20 m passengers in 2018

The remaining 50% of passengers travel by car in fast double-deck shuttle trains

Freight moving through the Channel Tunnel in 2022 by fast freight shuttle trains.

ITALY – MERCITALIA FIRST

The Italian State-Owned rail operator has recently launched "MERCITALIA FAST", an overnight freight service using modified high-speed passenger trains running on high-speed lines. China has also announced an intention to operate dedicated high-speed freight services on its high-speed passenger network, to improve its overall logistical capability[v].

Figure 4: Case Study: High Speed Freight Trains in Italy

15 JANUARY 2019 ANALYSIS

Mercitalia Fast: the world's first high-speed rail freight service

SHARE

In November, Italian state-owned railway operator Ferrovie dello Stato Italiane inaugurated the world's first high-speed rail service dedicated to freight, which will run between the southern city of Caserta and Bologna. But despite initial appraisal, some are questioning its limits.

Its ability to run at 180km/h along Italy's High Speed/High Capacity network has made Mercitalia Fast the ideal transportation method for time-sensitive deliveries. As Gosso puts it, "the sector of time-sensitive cargo is the one we think has the biggest chances of growth, but it's also one that railway companies are always excluded from.

"We wanted to become part of this sector and have planned to focus on two factors: our ability to transport freight via train, and the use of one of the most important assets in Italy, the High Speed/High Capacity route."

And this will not only be convenient for Mercitalia, but also, according FLC's Marciani, it will help create more competition in the country: "In Italy, 65% of the international freight trains are operated by companies that are not Trenitalia, and this is signal of vitality. Traffic has always increased in Italy as a consequence of enhanced competition among intermodal operators," and this service could increase it even further, he says.

The last-mile problem

Mercitalia Fast was launched in compliance with the standards set by the EU in 2011 and to help move cargo off the road. Its environmental impact was largely welcomed during its launch earlier in 2018, with officials saying it will reduce traffic by taking 9,000 trucks off the motorway every year and cut CO_2 emissions by 80% compared to road transport.

However, despite acknowledging its good potential, Marciani says Mercitalia Fast could struggle to make a real difference. This is due to the fact that trains will run terminal-to-terminal instead of reaching different strategic points across the country.

Figure 5: Potential High-Speed Freight Operations

Italian High-Speed freight train capable of 180 km/hr, using modified high-speed passenger rollingstock operating on high-speed lines.

Eurodual Locomotive is capable of 160 km/hr and operates on both electrified and non-electrified tracks. It has equivalent power to three typical diesel locomotives when in electric mode

POLAND – RAIL BALTICA

Another example of the European approach to shifting freight from road to rail and sea is the Rail Baltica Project[vi], an ambitious project to link the Baltic States to Poland with high-speed rail passenger and freight services, which is now underway[vii viii]. The first trains are now operating as part of the Rail Baltica project, and the Lithuanian Rail operator has recently gained approval to operate in Poland[ix]. The project is designed to shift most of the current 5,000 trucks a day on this corridor from road to rail for the bulk of their journey.

Figure 6: Case Study: Rail Baltica Project

Everything interoperable

With the Rail Baltica project, this is all about to change. The key word is interoperability; everything should be aligned, from electrification standards to digitalisation to infrastructure capacity, the Latvian speaker explains. "We want to provide a one-stop shop for traffic from Poland all the way up to Lithuania."

On the Rail Baltica line, this means 25 tonne axle load and facilities for 1050-metre freight trains. High-speed trains will be able to pass on a railway line that is both for passnegers and freight. And it complies with ERTMS specifications. "As a greenfield company, we can accommodate that."

Timeframe

Although the objectives are high, there is still a lot of work to be done. First construction started this year, but it will not be for another seven to eight years until the full line is operative, Briskens said. When it comes to the connection to Poland, which runs up till Warsaw, the section is developed up till Bialystok. "Still to be developed is the connection from Elk till the Lithuanian border."

Once all infrastructure is there, there will be a much more efficient supply chain, he says, where trucks, which are a strategic partner to rail, are taking care of the first and last mile in a lower radius. "Rail Baltica will be taking care of the larger volumes of container loads, trailer loads, and also piggybacks.

Indeed, the Rail Baltica Operational Plan for 2026–2056 revealed that Rail Baltica would be a great stimulus for intermodal transport in the Baltic region. "80 per cent of freight trains to run on the route will carry containers and trucks on flatcars", the plan reads.

OTHER EXAMPLES

In many countries high-speed passenger trains share tracks with lower speed passenger trains as well as fast freight trains. Examples include:

- In France and most European countries, high-speed trains share tracks with slower trains to reach terminals in many cities.
- In Germany, Switzerland, Spain, Italy and other European countries, some main lines accommodate a mix of high-speed trains and fast freight trains, and even in some cases in Germany, with tram-trains.
- New base-tunnels under the Alps (Gotthard, Loschberg etc), are designed to accommodate freight trains, long-distance high-speed trains and in some cases regional passenger trains. These lines are fully electrified, with freight trains using high-powered electric locomotives to achieve high speeds.
- In Italy, Spain and many other European countries, many high-speed lines are designed to integrate with lower-speed lines, enabling some high-speed trains to divert off the high-speed line to conventional lines to reach cities not on the high-speed corridors.
- In almost all countries, high-speed lines were implemented and commissioned in stages, sometimes over decades, with progressive increases in train speeds and frequencies as new sections of high-speed line were implemented. Only in a few countries such as China were complete high-speed lines built as a single end-end project. Even in Japan, the Shinkansen network has evolved over many stages, with "mini-Shinkansen" trains operating on both high-speed and conventional lines.
- In China, while some lines are designed for top speeds in the 350-400 km/hr range exclusively for high-speed passenger trains, many other high-speed lines are built for top speeds of 250 km/hr or below and accommodate freight as well as passenger trains.
- Italy, Sweden, Japan, Switzerland, Spain, the UK and other countries operate tilt trains to enable higher speeds when using existing, more curved track, with many of these trains continuing on high-speed lines (which are generally built with larger-radius curves).

Figure 7: High-Speed Rail and Freight in Germany

Freight and High-Speed Trains in Germany | High-Speed line in Germany (on right) parallels the original line[x]

2.2 HIGH-POWERED LOCOMOTIVES

Figure 8: Modern High-Powered and Dual Powered Locomotives

CRRC's 28,800 KW Electric Locomotive, unveiled in July 2020[xi] | Russian Diesel-electric locomotive[xii], available in up to 12,200 KW versions

Very high-powered locomotives are now being built in China for handling very large (up to 30,000 tonne) as well as higher speed freight trains. These have up to 28,800 KW (40,000 HP), or the equivalent of six of the highest-powered diesel-electric locomotives used in Australia or the USA. High-powered diesel and electric locomotives are also now being deployed in Russia (on the non-electrified Trans-Siberian Routes) and in India.


Railways readies for WAG-12, India's most powerful locomotive

TNN | Aug 8, 2020, 04:15 IST

Vadodara: Indian Railways' crew readies to meet the challenges of WAG-12 — the country's most powerful indigenously developed locomotive. Manufactured by the Madhepura Electric Loco Factory, Bihar, WAG-12 is the first 'Made in India' high-power locomotive with 12,000 horse-power (HP).

These locomotives are state-of-the-art insulated gate bipolar transistors (IGBT) based three-phase drive. It is being developed in such a way that it can be deployed on dedicated freight corridors (DFCs) where they will be used to haul freight trains weighing more than 6,000 tonnes at speeds of 100 to 120 km per hour.

These locomotives are state-of-the-art insulated gate bipolar transistors (IGBT) based three-phase drive.

India's 8,500 KW freight locomotives[xiii]


DB Cargo awards Siemens 400 bi-mode locomotive framework contract

DB Cargo has awarded Siemens a framework contract worth more than €1bn for up to 400 bi-mode electro-diesel locomotives, including an initial order for 100 locomotives.

The agreement was signed by Mr Ralf Günter Kloß, DB Cargo head of production, and Siemens Rolling Stock CEO, Mr

Bi-Mode locomotives in Europe[xiv]

In Europe, dual-mode or bi-mode locomotives, which can operate under electric power when in electrified territory, or on their own diesel power when not, are becoming more popular, as shown above. Increasingly locomotive manufacturers are also introducing hydrogen powered as well as battery-powered locomotives, which will enable zero-emission options when operating on non- electrified lines.

Figure 9: High Power Bi-Mode Locomotives in Europe

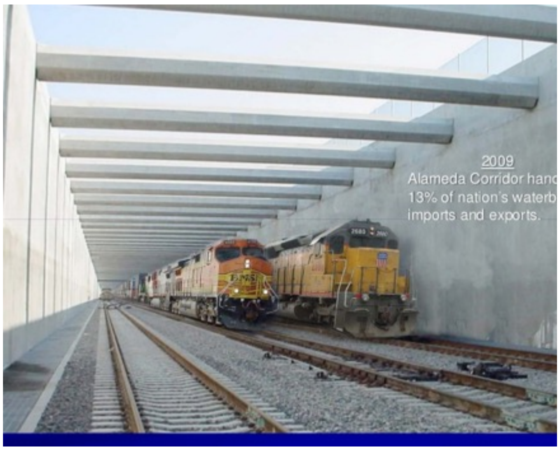
Euro Dual and Euro 9000 bi-mode locomotives handle both fast freight and passenger services in electrified or non-electrified territory.

2.3 LONG-HAUL INTERMODAL FREIGHT

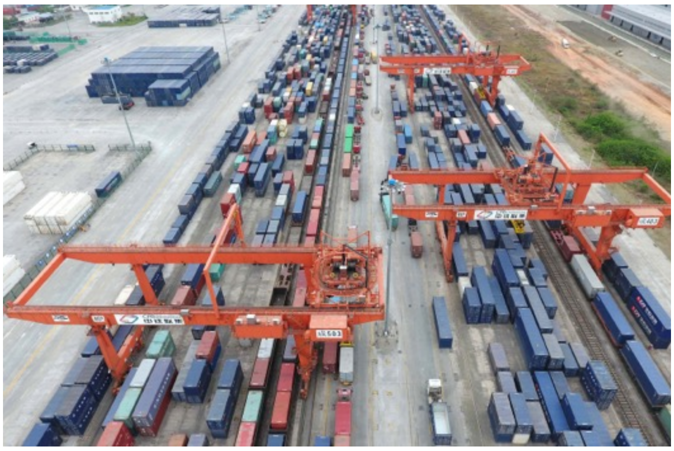
The United States has long been a pioneer in long-haul (1,000 km or greater) intermodal freight, with railroads such as the Pennsylvanian beginning "Truck-Train" services for carrying truck trailers on flat cars between Chicago and New York in the 1960's. This spread to many other railroads and now "Piggy-Back" and Container movement forms a large part of long-haul freight movement in that country. This business has expanded rapidly in the last two decades, particularly with double-stack container trains and the growth in international trade.

Prior to COVID, the growth in intermodal freight in the US was causing significant problems on both the road and rail networks, stimulating significant investment. For example, the $2.4 billion Alameda rail corridor was completed in 2002 to reduce the congestion caused by 20,000 trucks per day into and out of the Ports of Long Beach and Los Angeles, and to overcome the delays caused by trains at some 200 level crossings[xv].

Figure 10: Intermodal Traffic in the US and China



Alemeda Corridor in Los Angeles



A railway container centre in the Sichuan-Pilot Free Trade Zone in Chengdu. [Photo/Xinhua]

China continues to invest heavily in its rail network, from high-speed rail lines to rail freight facilities and lines. Chinese Railways handled 3.15 billion tons of freight in the first nine months of 2019, a 6% increase on the same period a year earlier, with plans to increase rail freight by 30% between 2017 and 2020[xvi].

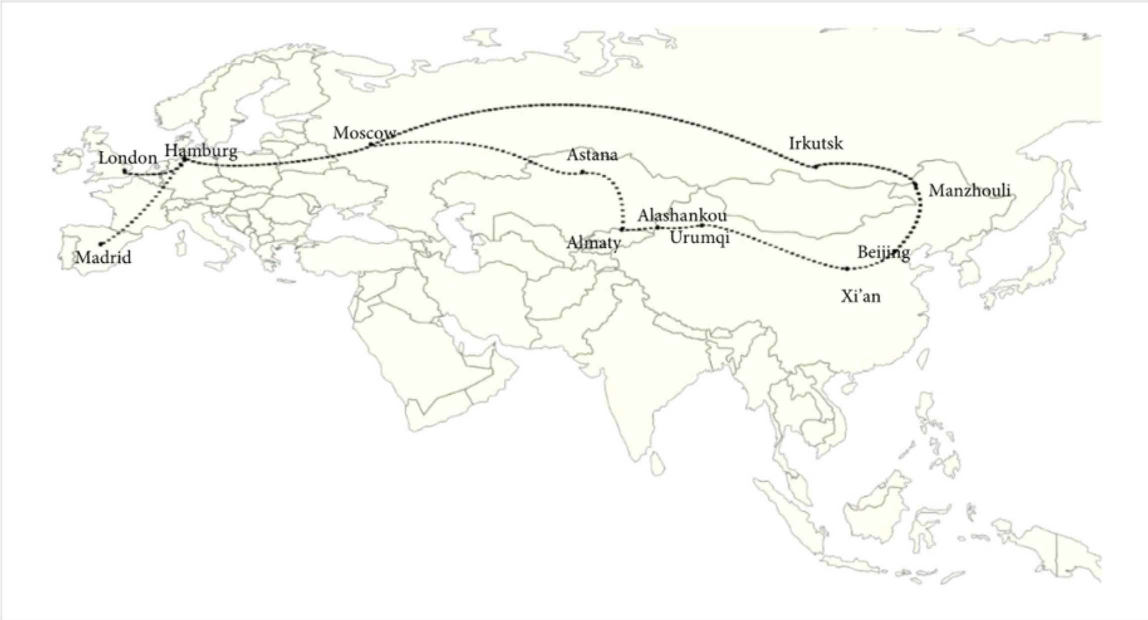
As part of its "Belt and Road" Initiative, China has also been rapidly expanding rail traffic between China and Europe under its "China Railway Express" Program. Rail travel times of 18-22 days are considerably faster than by sea, while freight rates are considerably less than airfreight, so rail has an advantage for certain types of cargoes.

Two main routes for the China Railway Express are used – the northern route via Irkutsk and the Trans-Siberian Railway in Russia, the other via Alashankou in Western China.

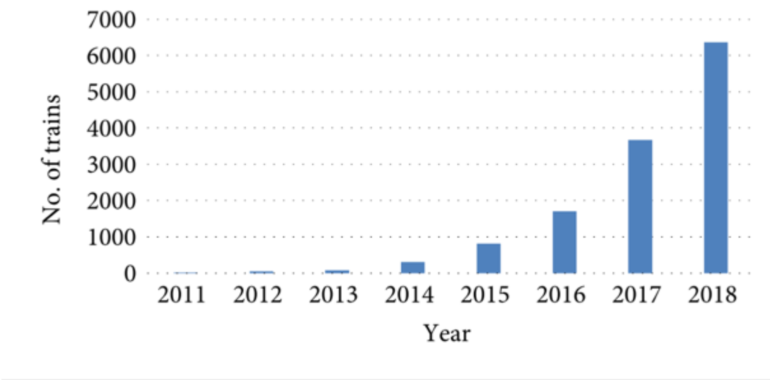
As a result of this initiative by China, the number of trains between China and Europe expanded from 17 in 2011 to almost 6,400 in 2018. By then there were 59 Chinese cities operating CRE terminals that had direct rail services to 49 cities in 15 European countries[xvii].

The CRE has continued to expand rapidly since then, more than doubling in the last two years despite the Corona Virus. For example, there were over 1,200 trains from China to Europe in July 2020, carrying 114,000 containers, a 73% increase on July 2019, with mode shift to rail occurring from both sea and air[xviii].

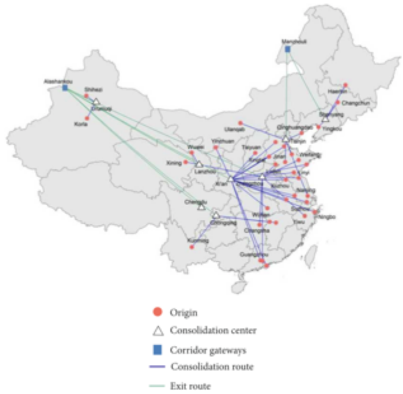
Figure 11: The China Railway Express



Main routes for the China Railway Express



Growth in China Railway Express Trains 2011-2018



Chinese cities linked to CRE

The early stages of this program involved dedicated trains between specific cities – such as Beijing and Madrid. However, the growth in this traffic is leading Chinese scholars to study optimal methods of consolidating traffic via various strategically located consolidation centres. The increasing volumes of traffic in both directions is also supporting significant new investment railways and terminal facilities within Europe itself, such as in the Rail Baltica corridor (see earlier discussion).

While the Ukraine war and political tensions between China and the West have affected trade flows, rail is likely to continue to gain market share in the future.

2.4 SHORT-HAUL INTERMODAL FREIGHT: NEW TECHNOLOGY

Europe tends to have shorter-haul distances than the USA or China. However, Europe is introducing innovations aimed at shifting more freight from road to rail, as part of a policy of improving the sustainability of their transport systems. These include specialised terminals and rollingstock for rapid loading / unloading of road trailers, and other new technologies, such as Digital Automated Coupling,

MODALOHR SYSTEM

Modalohr is a French-developed system of "Rolling Highways" developed by the LOHR company, using specialised wagons which can rotate in special terminals to allow rapid transfer of semi-trailers. These can allow up to 20 trailers to be loaded, and another 20 to be reloaded, in just over half an hour. See https://lohr.fr/lohr-railway-system/the-lohr-uic-wagons/ for detailed specifications. Special trains 850 metres in length, which is the limit for most European rail systems, then carry up to 36 semi-trailers (minus their prime movers) between terminals[xix].

Figure 12: Dedicated "Rolling Highway" Trains in France

Dedicated "Rolling Highway" Train

Alpine Rail Motorway

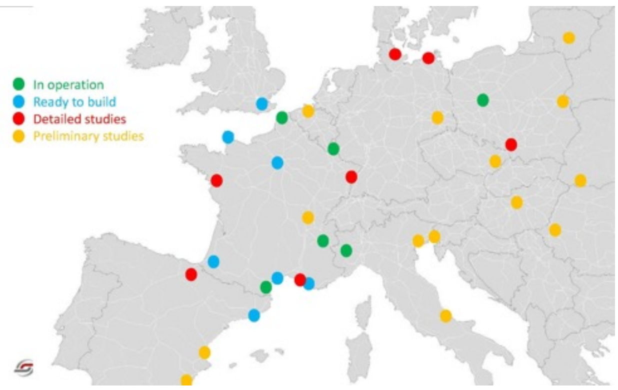
Modalohr articulated cars

Modalohr rotating trailer for transfer

The MODALOHR system has been in operation since 2003. There are now eight "Rolling Highway" routes operating in France or nearby countries (Luxembourg, Spain, Italy), ranging from 175km to 1200 km, with three more such routes and additional terminals under development[xx]. The most recently announced will be a 1,000 km route between Cherbourg on the English Channel and Spain[xxi]. The largest terminal is at Bettembourg-Dudelange in Luxembourg, which includes conventional container trans-shipment facilities as well as the specialised Modalohr terminal facilities, shown in the foreground of the illustration below[xxii]. The ultimate plan is for over 20 such terminals across Europe.

Figure 13: MODALOHR Terminals


Bettembourg-Dudelange Terminal in Luxembourg



Lohr's Plans for Terminals across Europe

CARGOBEAMER SYSTEM

An alternative, but similar system has been developed in Germany. Moveable "pallets" transfer semi-trailers (minus their prime movers) onto specially designed low loader wagons, utilising specialised terminals.

The CARGOBEAMER system allows even faster transfer of truck trailers between road and rail, with up to 36 trailers able to be unloaded and new trailers to be reloaded onto the wagons within 20 minutes. This compares with around 4 hours for conventional systems. However, the terminal and rollingstock facilities appear to be more complex than the LOHR system. As with the LOHR system, the pallets can also be lifted and transferred by overhead crane or stacking equipment[xxiii].

Figure 14: CargoBeamer system

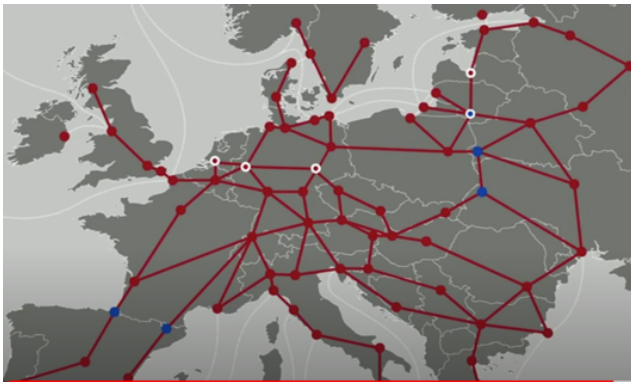
Lifting trailer in Cargobeamer pallet | Sideways transfer via Cargobeamer pallet

Another feature of the CARGOBEAMER system is that it allows trainloads of trailers to be transferred between different rail systems with different track gauges, which is a significant issue in Europe, where for example the Russian Rail system has a five-foot gauge. Specialised CargoBeamer trains have been operating for some time through Switzerland. CargoBeamer now has a network of 6 terminals and 80 freight trains per week between them, with plans for many more[xxiv]. The company has recently announced[xxv] it is increasing the production of its specialised rollingstock to 500 units p.a. and opening new routes.

Figure 15: CargoBeamer train in the Swiss Alps[xxvi]

Figure 16: CargoBeamer Plans for Terminals

CargoBeamer Terminal at Calais

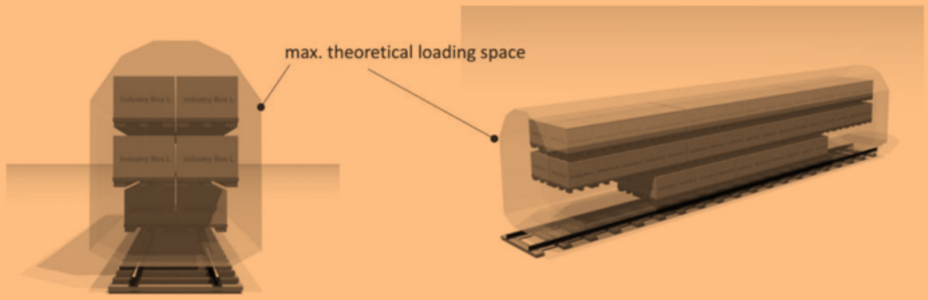


CargoBeamer Plans for a Network of Terminals

CARGOBEAMER is also developing new concepts for high-volume containers for rail, called CBoXX, which are optimised for rail rather than maritime transport, which uses the conventional 20-foot or 40-foot containers. This is in part driven by the growth in rail transport of freight between China and Europe using the "New Silk Road" – rail is not only faster than sea but connects directly to many inland cities in both continents. As the managing director for Cargobeamer notes below[xxvii]:

Approximately three quarters of the freight on European roads is transported by HGVs with semi-trailers, 90% of which ar not cranable, although, as frequently reported by *WorldCargo News*, CargoBeamer's transfer platform can also be used a lifting basket and TX Logistik and CFL Cargo use the NiKrasa lifting basket on some corridors.

"Now we offer our customers efficient and excellent climate-compatible logistics chains from ramp to ramp on the basis of their existing vehicle fleet," said Duisport CEO Erich Staake.



The CBoXX concept from CargoBeamer AG

Dr Hans-Jürgen Weidemann, CEO and co-founder of CargoBeamer AG is convinced that a game-changing transfer of freight from road to rail "can be achieved only with automation, parallelisation and digitization, and by addressing the huge market for tarp, reefer, silo and mega trailers of all types with innovative rail logistics products."

A CargoBeamer transshipment track can unload and load an entire train in 15 minutes, and within 20 minutes when the train has to be split on two tracks," claims Weidemann.

FLEXIWAGGON

Another company involved in developing innovative inter-modal solutions is the Swedish company Flexiwaggon[xxviii], which has recently established a subsidiary to develop markets in the US and overseas and has signed an MOU with Turkey to manufacture the wagons. Their technology involves:

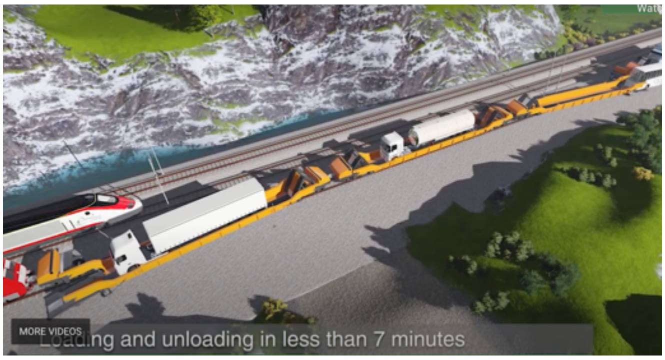
- Specialised wagons with swing-loading capabilities for loading trucks, with a payload of up to 52 tonnes per wagon.
- No need for specialised terminals, only level ground adjacent to the tracks

- Ability to load / unload each truck (or bus) within 7 minutes with the process controlled by the driver using radio controls.
- On-board independent battery storage of energy on the wagon, generated by regenerative brakes.
- Current top speed of 120 km/hr for the wagons, with plans to increase to 160 km/hr.
- Estimated reduction in energy and greenhouse emissions of 75% compared to road transport.

KIRUNA SIDE-OPENING WAGON

Another Swedish company has developed a special high-volume wagon on which the complete side can open, facilitating rapid loading / unloading of pallets[xxix].

Figure 17: Innovative Rollingstock Developments from Sweden



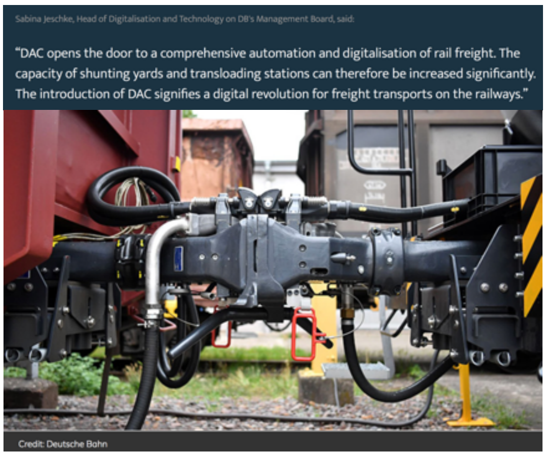
Flexiwaggon Promotional Video

Kiruna's side-opening wagon

DIGITAL AUTOMATIC COUPLING

A key reason why rail has become uncompetitive with road for moving other than bulk commodities is the time and cost of making up and breaking down trains. This causes long delays in marshalling yards, making rail freight travel times significantly longer than road freight for short-haul trips. A new initiative in Europe is aimed at reducing these delays through Digital Automated Coupling, or DAC. Other technological developments with impacts on rail freight include the use of double-stack container trains on electrified lines, the first example of which began operating in India recently[xxx].

Figure 18: Other Technological Developments in Rail



Digital Automated Coupling

Indian Railways runs world first double-stack container train under catenary

3
RAIL FREIGHT DEVELOPMENTS IN AUSTRALIA

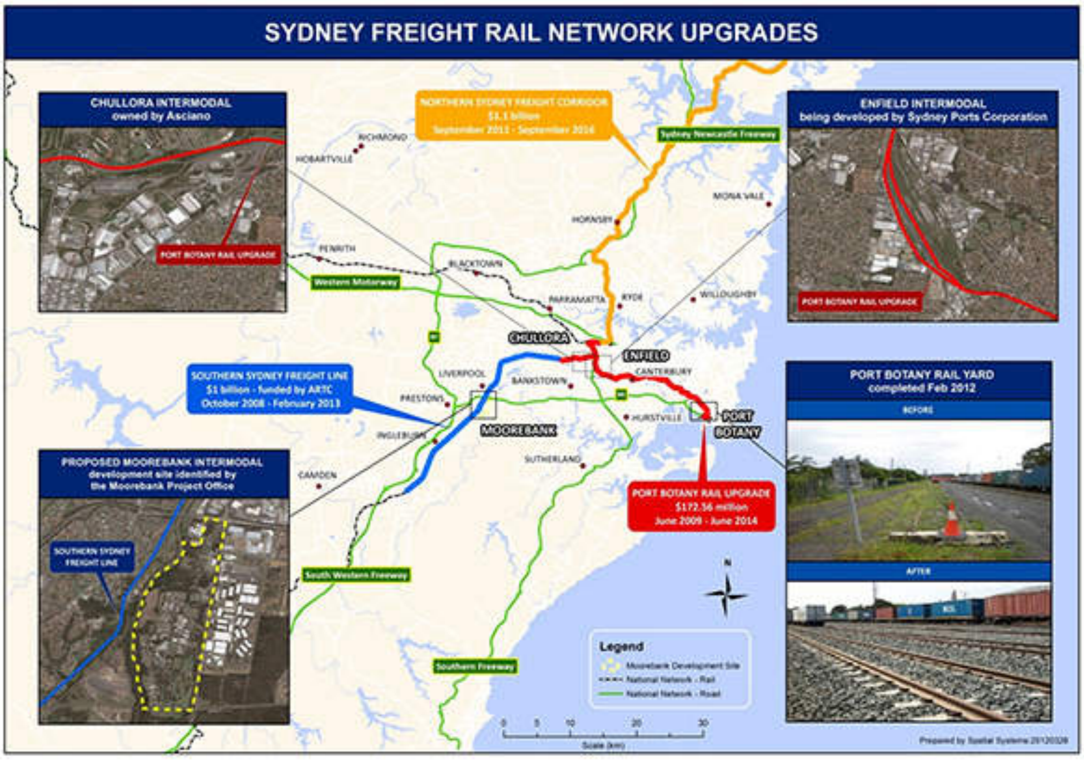
A 2017 study for the Department of Infrastructure and Regional Development[xxxi] highlighted the key trends in intermodal transport and the additional investment needs for handling future growth. The following outlines some of the key initiatives which have been completed recently, which are currently under construction, or which are planned for the next few years.

3.1 SYDNEY FREIGHT RAIL NETWORK

Sydney has long had a dedicated rail freight network connecting the major facilities at Enfield and Chullora with the Ports and other facilities within the Sydney region. However, the rail routes out of Sydney to the regions have become increasingly congested with passenger trains.

As a result, freight trains from the North, West and South have faced "curfews" which have restricted access to and from Sydney in peak hours, which have significantly increased rail transit times and reduced capacity and efficiency.

Figure 19: Sydney Rail Freight Network

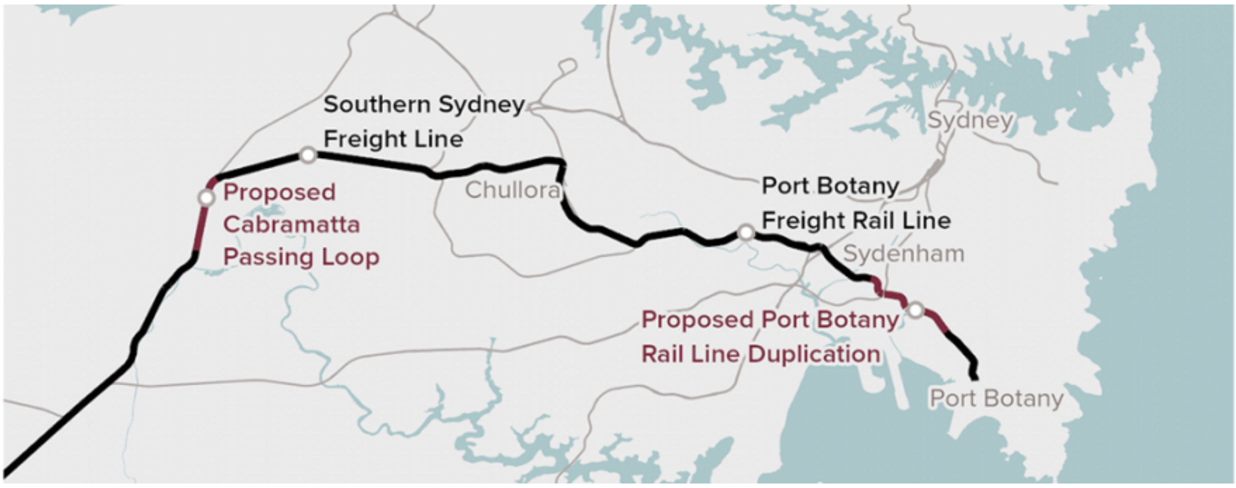


To overcome this a number of dedicated freight links have been built recently, including:

- Southern Sydney Freight line between Chullora and Macarthur in the south-west.
- Track improvements on the Northern corridor between Strathfield and Hornsby.

In addition, the Port Botany line is currently being duplicated to handle increased rail freight movement between the Port and various "Inland Ports" in Sydney, and further capacity enhancements are being made to the Southern Sydney Freight Line at Cabramatta[xxxii].

Figure 20: Upgrades to Port Botany Line and Southern Sydney Freight Line

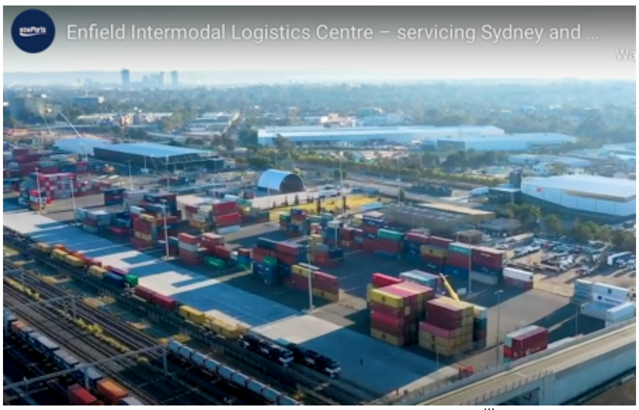


3.2 INTERMODAL TERMINALS

In addition, new intermodal terminals for handling overseas and interstate containers have been built or are planned in the major capital cities and selected regional centres, including:

- An "Inland Container Port" at Enfield, served by dedicated trains from Port Botany, opened in 2018.
- A second "Inland Port" and Logistics Centre at Moorebank in South-Western Sydney, which is currently being completed.
- An intermodal terminal at Bromelton, 75 km south of Brisbane, opened in 2017.
- Dedicated facilities for handling palletised cargoes built by SCT (Specialised Container Transport) at Bromelton near Brisbane and also in northern Melbourne.
- New Inland Ports planned for Melbourne at Truganinna and Beveridge, coupled with a $125m investment in rail at the Port of Melbourne.
- Additional intermodal capacity outside the major capitals, in locations such as Parkes in Western NSW, and at the Riverina Intermodal Hub at Bomen near Wagga Wagga, stage 1 of which was completed in 2017.

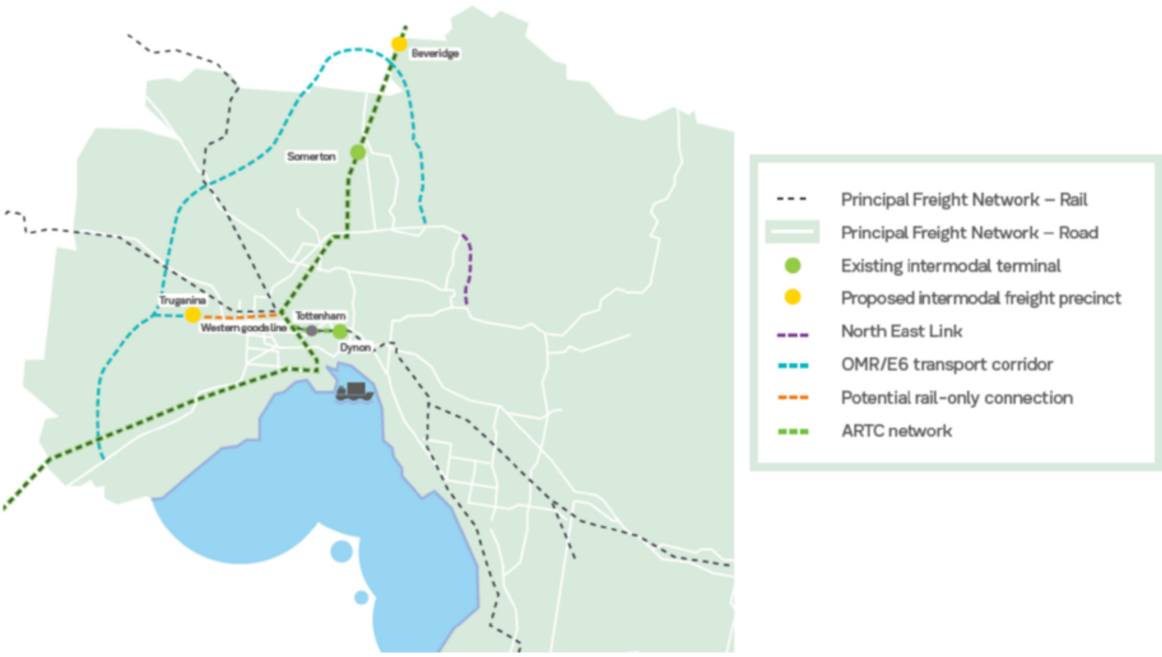
Figure 21: Enfield and Moorebank Intermodal Terminals



Enfield Intermodal Terminal, Sydney[xxxiii], has been in operation since 2018

Locomotive traverser at Moorebank Logistics Park in south west Sydney, currently being completed[xxxiv]

Figure 22: Other Intermodal Terminal Developments



Melbourne's plans for new Intermodal Terminals at Beveridge (in the North) and the Western Interstate Freight Terminal at Truganinna in Melbourne's West

Bromelton State Development Area and Intermodal Facility, south of Brisbane,

Proposed Riverina Intermodal Terminal[xxxv] near Wagga Wagga

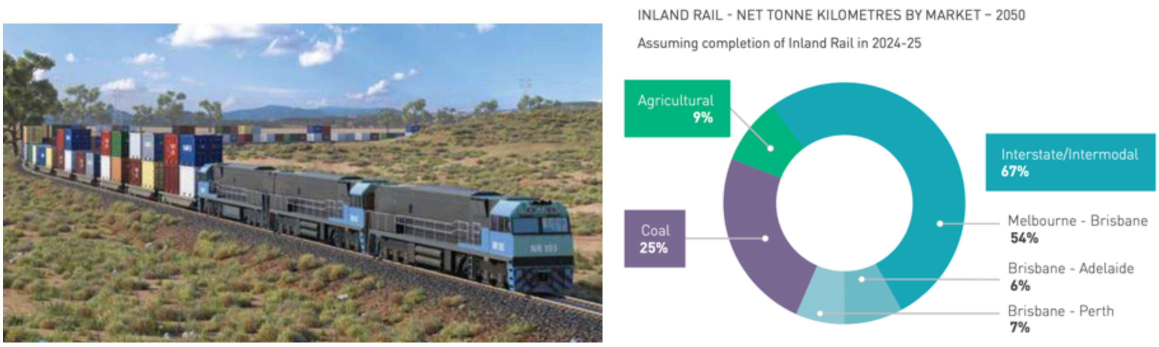
Future enhancements to the Freight Rail system in Sydney under consideration include the proposed Western Sydney Intermodal Terminal, which would be connected to the Southern Sydney Freight line near Cabramatta Junction. This could allow a further major intermodal logistics centre to be developed, similar to that at Chullora. This could serve the factories and warehouses in western Sydney with convenient connections, potentially including automated straddle carriers operating on dedicated roadways from the terminal.

3.3 INLAND RAIL

One of the most significant rail freight projects in Australia is the Inland Rail, a 1700 km standard gauge line from Melbourne to Brisbane via Parkes in Western NSW. Planning commenced in 2006 and the business case was concluded in 2018. The first section to be upgraded, from Parkes to Narromine, was completed in September 2020, and the project is expected to be completed by the late 2020's.

The plan assumes rail transit times between Melbourne and Brisbane will be reduced to 24 hours with 98% reliability, making rail competitive with road for this corridor. The mode share of Melbourne – Brisbane freight is expected to increase from 24% currently to 62% by 2050, with nearly 8 million tonnes of intermodal freight by then. In addition, Inland Rail is expected to handle significant grain, mineral and other traffic, some of which would also be the result of mode shift from road. This is anticipated to achieve safety and environmental benefits.

FIGURE 23: INLAND RAIL[xxxvi]



Inland Rail will allow double-stack container trains between Melbourne, Brisbane, Adelaide and Perth

HOW THE INLAND RAIL SERVICE OFFERING STACKS UP AGAINST THE EXISTING COASTAL RAIL LINE

SERVICE OFFERING	EXISTING COASTAL RAIL	INLAND RAIL	RAIL SERVICE COMPARISON
Transit time (linehaul)	32-34 hours	< 24 hours	10 hours
Reliability	83%	98%	15%
Availability	61%	95%	34%
Relative price (to road)	85%	57-65%	20-28%

Benefits from the Inland Rail

Unfortunately, the project has been running late and over budget, leading to significant criticism of its implementation[xxxvii]. A major review into Inland Rail has recently been released, indicating that construction of the northern link between Parks and Brisbane has been paused. However recent signs of improvement with Inland Rail include the letting of contracts in NSW[xxxviii], and new arrangements for agreements with rural landowners[xxxix].

3.4 INITIATIVES BY RAIL FREIGHT OPERATORS

Rail freight in Australia was privatised some decades ago and is now handled by private sector operators including Pacific Nation, QUBE, Aurizon, SCT, SSR and others.

Rail currently handles very large volumes of bulk mineral traffic in Australia, especially iron ore and coal, with some of the world's most advanced freight railway operations. Iron Ore trains in Western Australia weigh up to 30,000 tonnes, and the major iron ore producers (Rio, BHP and Fortescue) are automating their trains and also moving to hydrogen power in future to replace diesel. Coal trains in NSW and Queensland weigh up to 12,000 tones and are also some of the world's heaviest and most efficient.

However, with increasing concerns regarding climate change, coal traffic is expected to decline in the future, as export markets for both steaming and coking coal come under pressure from the closure of coal-fired power stations and the development of green steel production.

Pacific National and Aurizon, which are major coal haulers, are therefore seeking to diversify and to increase their intermodal operations. Others such as Qube and SCT have already focused on that market by moving containers or pallets in specialised trains, including trains direct to modern logistics centres as well as ports. For example:

- In September 2022, Pacific National announced over $500m worth of orders for 50 new freight locomotives, new container wagons and refurbishment of older NR class locomotives, to be used in intermodal operations. It also announced investments of over $250m in new and expanded intermodal terminals[xl]. PN has increased intermodal capacity by 12% in the last year and is planning a further 25% over the next four years.
- In December 2022, Qube announced orders for 12 new high-powered diesel-electric locomotives for additional intermodal services between Sydney and Melbourne[xli], with further orders since.
- In February 2023, Aurizon was awarded an 11-year contract by Team Global Express (TGE), formerly Toll Global Express, to operate intermodal services connecting Perth, Adelaide, Melbourne Sydney and Brisbane. It is allocating around $200m for new locomotives and $120m for new terminals to support this operation[xlii].

Figure 24: Recent Freight Rail Operator Initiatives

Pacific National is acquiring new locomotives and rollingstock for intermodal operations

Aurizon Intermodal Train

New Locomotives for Qube

4
FREIGHT DEMAND IN THE SYDNEY-MELBOURNE CORRIDOR

Rail currently handles an estimated 30% mode share of all freight in the Sydney – Melbourne corridor. However, its share of merchandise freight between the cities is less than 10%, with trucks handling over 90%. This requires an average of 6,300 trucks, mostly B-doubles and semi-trailers, every day on the Hume Highway, with 10,000 trucks per day in the approaches to Melbourne and Sydney. On past trends this could increase by at least 60% by 2060, which would mean one truck on average every 6 seconds.

4.1 CURRENT ROAD FREIGHT

Up-to-date and accurate data on road freight movement in the Sydney – Melbourne corridor is difficult to obtain given the number and variety of trucks using the Hume Highway and the number of freight forwarders and trucking operators.

Accordingly, a detailed survey was conducted in November – December 2020 (See Appendix 1 for more details). The survey counted a total of 1870 trucks in 57 fifteen-minute surveys, spread across 32 times and locations along the full length of the Hume Highway. The estimated average truck count was 6,300 trucks per day (3,150 in each direction) across the whole corridor.

The survey allowed estimates of total gross tonnages of truck traffic at different points in the corridor, and at different times of the day, based on estimates of typical loads for different types of trucks. It also allowed estimates of the amount of freight likely to be contestable by rail, by eliminating traffic which was likely to be short range or of a nature not suited to rail (such as road construction materials or specialised cargoes). The patterns of truck movement are summarised below.

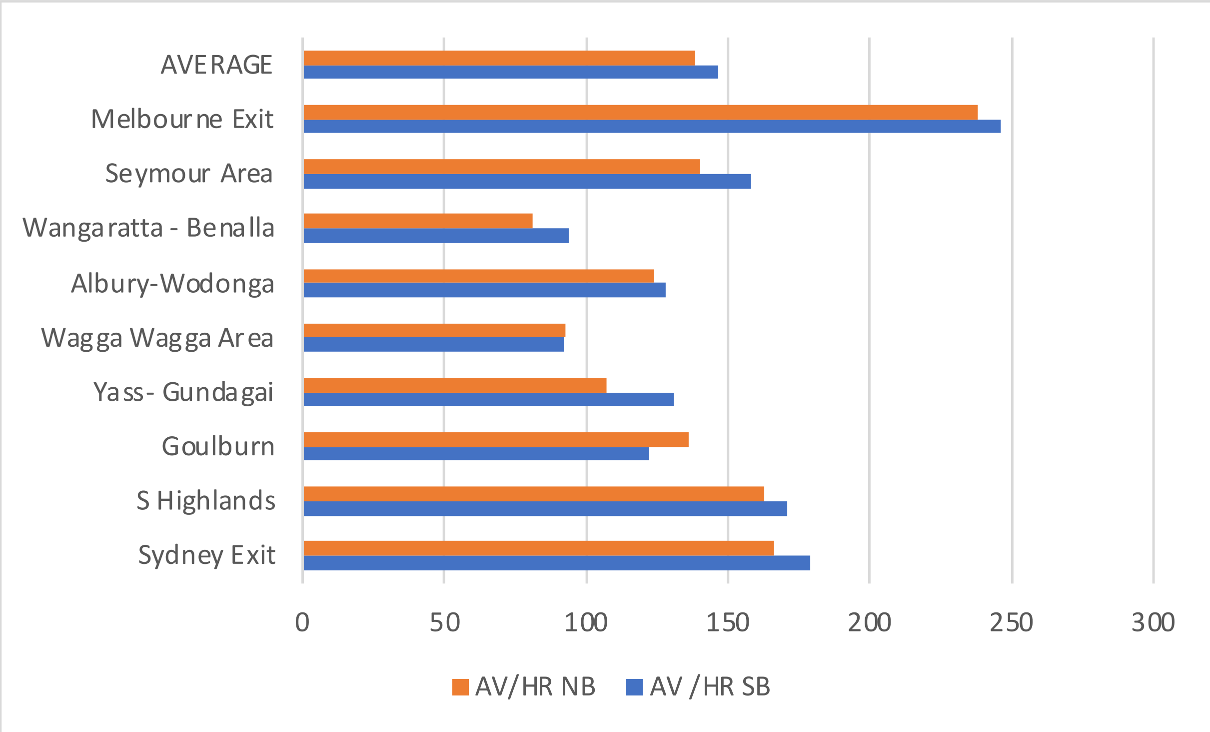
Figure 25: The Future of Road Freight?

B-triple trial for Coles: This may be the future unless rail can become more competitive.

VOLUME OF TRUCK MOVEMENTS

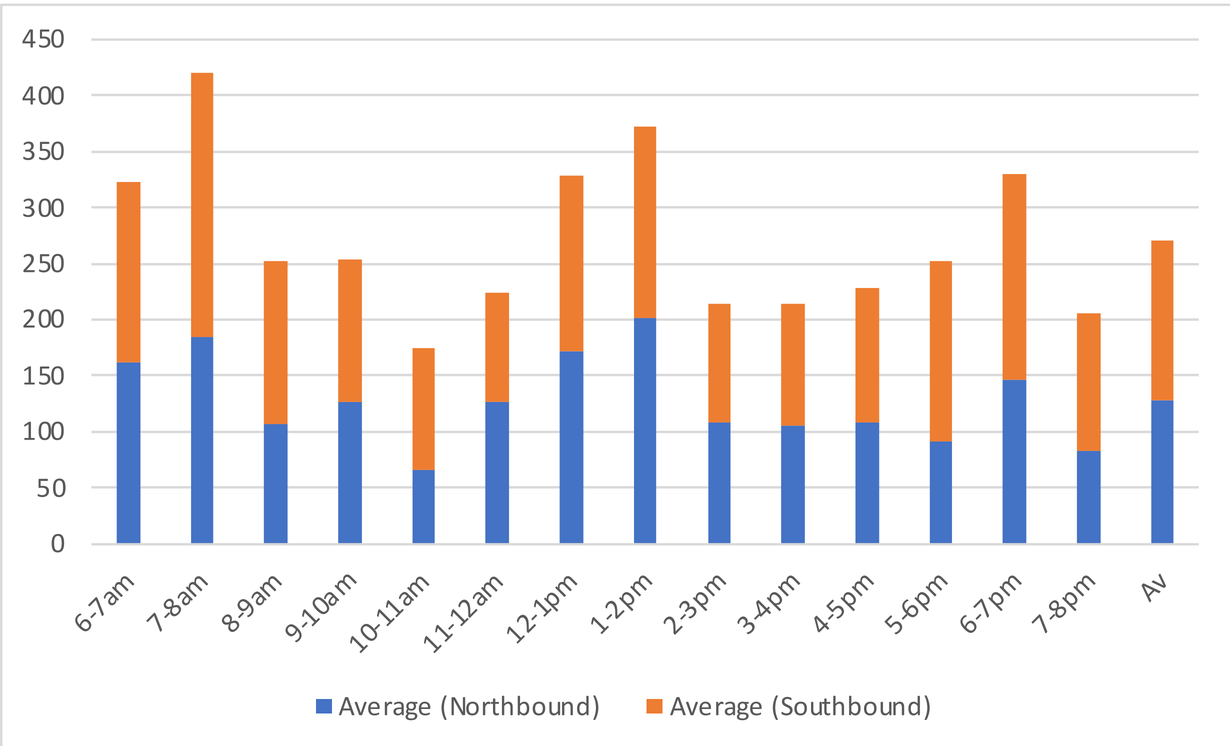
On average there were approximately 140 trucks per hour (of all types) in both the northbound and southbound directions. However, the volumes varied by location, being highest on the northern outskirts of Melbourne (240 trucks per hour in each direction, or an estimated 10,000 trucks per day counting both directions) and lowest between Wangaratta and Benalla, and near Wagga Wagga (around 80-90 trucks per hour, or 4000 trucks per day counting both directions). Volumes were slightly higher in the Albury-Wodonga area, because of the addition of local truck traffic.

Figure 26: Truck Volumes / Hour By Location



Truck Volumes also varied by time of day as shown below, being highest in the early morning, middle of the day and late evening (but with the exact pattern varying depending on the location). This reflects the significant volumes of longer distance freight movement (evidenced by high volumes of B-Doubles and Semi-Trailers with Curtain Sided or Refrigerated loads) leaving Sydney or Melbourne in the early evenings (6-8 pm) or arriving in the early mornings (6-8 am), or in the middle of the day.

Figure 27: Truck Volumes/ Hour by Time Of Day

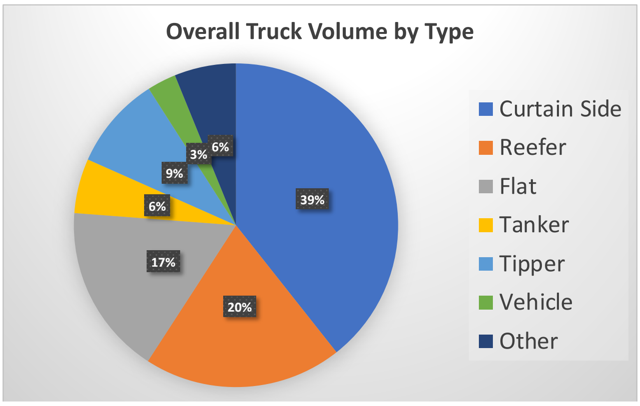


TRUCK TYPES AND SIZES

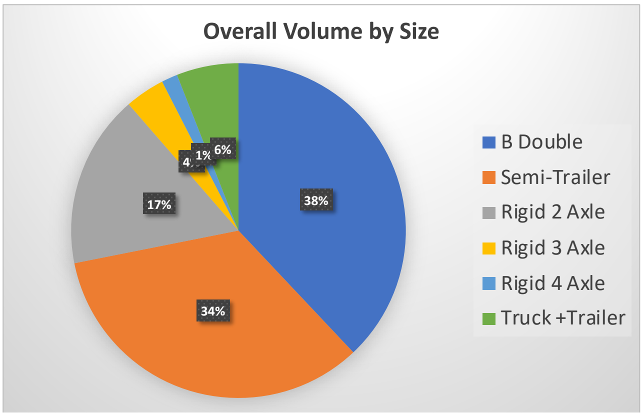
Figure 28: Truck Volumes on The Hume Highway By Type And Size

Curtain-sided and refrigerated trucks made up almost 60% of all trucks; these are more likely to be carrying cargoes suitable for intermodal trains.

B-Doubles are now the most common truck on the Hume Highway, accounting for 38% of the total volume, with a further 34% being Semi-trailers. This indicates the impact of the change in road regulations over the last decade in allowing larger vehicles.



Truck Volume by Type (above) and by Size (below)



The share of tonnage moved by B-doubles and Semi-trailers is even higher given their greater weight. Rigid trucks and truck- plus-trailer combinations account for a relatively low share of total tonnage moved, and an even lower share of tonne-kilometres given they are concentrated near the capital cities and generally move over shorter distances.

THE SYDNEY - MELBOURNE ROAD-BASED INTERMODAL MARKET

Using estimates of gross weights, tare weights and load factors, total net tonnage moved by road on the Hume Highway in late 2020 is estimated at 131,000 tonnes per day (counting both directions), or about 42 million tonnes pa, with 88% in B-doubles or Semi-Trailers. Of this around 90,000 tonnes per day (counting both directions) is considered contestable between rail and road.

Table 1: Current Estimated Road Freight On The Hume Highway

	B-Double	Semi	Rigid 2 Axle	Rigid 3 Axle	Rigid 4 Axle	Truck + Trailer	Total
Total Surveyed	710	634	313	72	29	112	1,870
Total Daily	2,392	2,136	1,054	243	98	377	6,299
Max Gross Tonnes*	63	43	14	23.5	27.5	60	
Typical Net Tonnes	20	14	6	8	10	15	
Av Load Factor	70%	70%	50%	50%	50%	50%	
Av Load (Tonnes)	30.1	20.3	4.0	7.8	8.8	22.5	20.8
Av Gross Tonnes	50.1	34.3	10	15.75	18.75	37.5	35.5
Total Gross ('000)	120	73	11	4	2	14	223
Total Net ('000)	72	43	4	2	1	8	131
Annual Net ('000)	23,036	13,873	1,350	601	274	2,716	41,849
Share	55%	33%	3%	1%	1%	6%	100%
% Contestable	80%	70%	10%	10%	10%	0%	
Contestable Net ('000)	58	30	0	0	0	0	89
* Based on Typical Axle and Wheel Arrangements for these classes of Vehicle, and the General Mass Limits under the NVHR							

4.2 CURRENT RAIL FREIGHT

As noted earlier, rail in Australia currently carries significant bulk and industrial cargoes but a relatively small share of general freight. For example, Table 2 below shows the typical weekday rail freight movements in the main south rail corridor at its busiest point at Moss Vale.

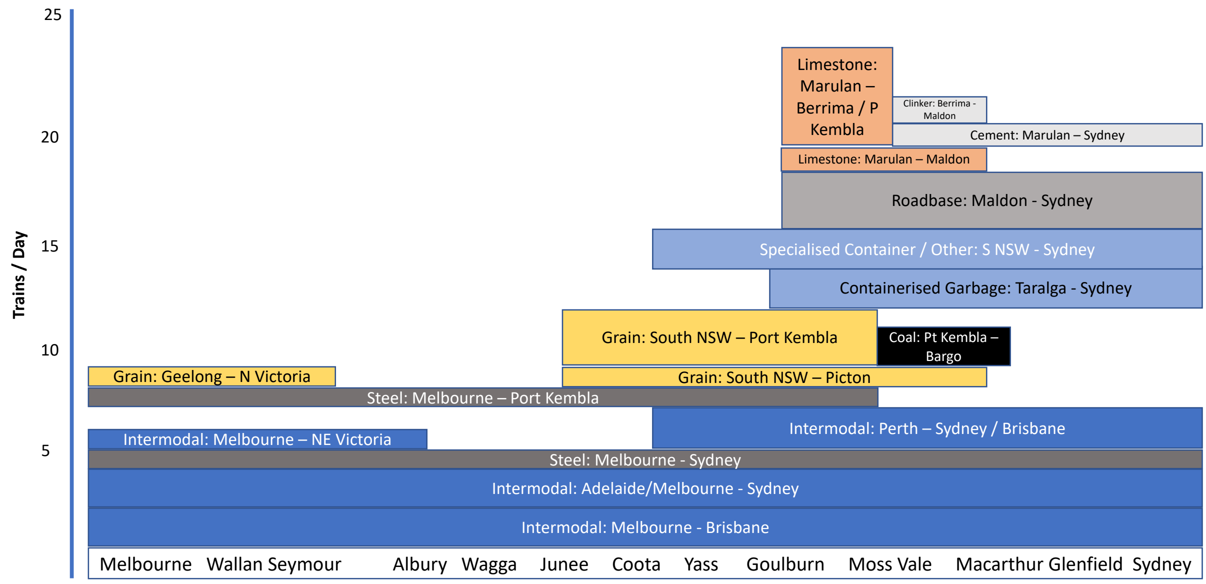
Table 2: Current Daily Rail Freight Traffic at Moss Vale

NORTHBOUND								
Commodity	**From**	**To**	**Operator**	**Approx Load**	**Approx Gross**	**Trains/ Day**	**Total Net**	**Total Gross**
Road Base Material	Marulan	Sydney	PN	2700	3600	3	8100	10800
Limestone	Marulan	Pt Kembla	PN	2200	2900	1	2200	2900
Limestone	Marulan	Berrima	PN	2200	2900	3	6600	8700
Limestone	Marulan	Maldon	PN	2200	2900	1	2200	2900
Merchandise/Cont	Melbourne	Sydney	SCT	1800	3200	1	1800	3200
Timber (Container)	Goulburn	Pt Botany	PN	1600	2400	0.2	320	480
Coal (Empty)	Moss Vale	Bargo	PN	0	1125	2	0	2250
Garbage (Empty)	Goulburn	Sydney	PN	0	1100	2	0	2200
Wheat	Cootamundra	Maldon	Qube	3000	4200	0.3	900	1260
Grain	Cootamundra	Berrima	PN	3000	4200	0.2	600	840
Barley (Cont)	Cootamundra	Minto	Qube	1500	2500	0.3	450	750
Steel	Melbourne	Sydney	PN	1000	3000	1	1000	3000
Containers	Melbourne	Sydney	PN	2100	3800	1	2100	3800
Containers	Melbourne	Brisbane	PN	2100	3800	1	2100	3800
Containers	Perth	Brisbane	PN	2100	3800	1	2100	3800
Cement	Berrima	Sydney	PN	1400	2000	1	1400	2000
Clinker	Berrima	Maldon	PN	1400	2000	1	1400	2000
Other	Melbourne	Sydney	varies	2000	3000	1	2000	3000
Grain	Cootamundra	Pt Kembla	varies	3000	4200	3	9000	12600
					2928	24	44,270	70,280
SOUTHBOUND								
Commodity	**From**	**To**	**Operator**	**Approx Load**	**Approx Gross**	**Trains/ Day**	**Total Net**	**Total Gross**
Road Base Material	Sydney	Marulan	PN	0	900	3	0	2700
Limestone	Pt Kembla	Marulan	PN	0	700	1	0	700
Limestone	Berrima	Marulan	PN	0	700	3	0	2100
Limestone	Maldon	Marulan	PN	0	700	1	0	700
Merchandise/Cont	Sydney	Melbourne	SCT	1800	3200	1	1800	3200
Timber (Container)	Pt Botany	Goulburn	PN	0	800	0.2	0	160
Coal (Loaded)	Bargo	Moss Vale	PN	3375	4500	2	6750	9000
Garbage (Loaded)	Sydney	Goulburn	PN	1400	3000	2	2800	6000
Wheat	Maldon	Cootamundra	Qube	0	1200	0.3	0	360
Grain	Berrima	Cootamundra	PN	0	1200	0.2	0	240
Barley (Cont)	Minto	Cootamundra	Qube	0	1000	0.3	0	300
Steel	Sydney	Melbourne	PN	1000	3500	1	1000	3500
Containers	Sydney	Melbourne	PN	2100	3800	1	2100	3800
Containers	Brisbane	Melbourne	PN	2100	3800	1	2100	3800
Containers	Brisbane	Perth	PN	2100	3800	1	2100	3800
Cement	Sydney	Berrima	PN	0	600	1	0	600
Clinker	Maldon	Berrima	PN	0	600	1	0	600
Other	Sydney	Melbourne	varies	2000	3000	1	2000	3000
Grain	Pt Kembla	Cootamundra	varies	0	1200	3	0	3600
		Note: Tare weights exclude locomoti			**2007**	24	20650	48160
TOTAL BOTH DIRECTIONS				1,353	2,468	48	64,920	118,440

Daily Freight train traffic at Moss Vale. Only a quarter of the trains are intermodal – others include grain, cement and minerals (shown on right) as well as steel, limestone, garbage, coal and other products.

Trains average around 2,450 tonnes gross weight excluding locomotives, with nearly 50 trains per day (more in peak grain season) passing through Moss Vale. Not all trains use the whole corridor between Melbourne and Sydney, with some joining at locations such as Marulan or destined for locations such as Port Kembla. Figure 26 below illustrates how the density of typical freight trains varies across the Sydney – Melbourne corridor.

Figure 29: Typical Northbound Freight Trains in the Sydney – Melbourne Corridor



Note that there are typically around 6 longer distance "Intermodal" freight trains each way in the corridor, which carry cargoes mostly in shipping or other containers. However, there is an increasing volume of bulk commodities also carried in containers, including garbage (from Sydney to Tarago outside of Goulburn); barley from Southern NSW to a Brewery in Minto; or timber from Goulburn to Port Botany. Thus, there can be 10 or more northbound container trains a day in the busiest part of the corridor, between Goulburn and Moss Vale.

MODE SHARE

Figure 30 and Table 3 below estimate the mode shares in the Melbourne -Sydney corridor for both rail and road. These are indicative only as full detail is not available. However, they suggest that rail has approximately a 21 - 35% mode share of the freight task, depending on the metric used. This reflects:

- The significant tonnages of bulk and industrial freight moved on rail, but the shorter haul lengths within the corridor for much of this freight.
- The relatively low share of non-bulk freight hauled by rail compared to road, especially general freight between Sydney and Melbourne.

Figure 30: Freight Mode Shares on the Sydney – Melbourne Corridor

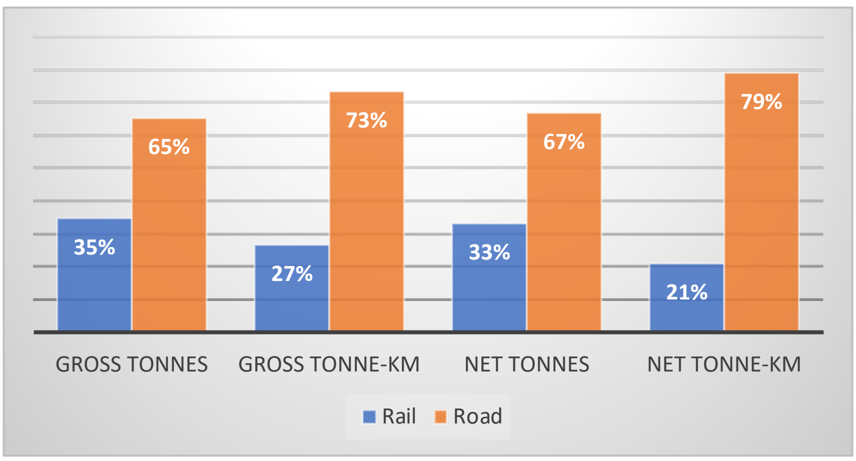


Table 3: Estimated Freight Mode Shares in the Sydney – Melbourne Corridor

Sydney - Melbourne Corridor	Rail	Road	Total
No / Day (counting both directions)	48	6,300	
Av Gross Tonnes	2,468	35.5	
Total Gross Tonnes / Day	118,440	223,448	341,888
Share of Gross Tonnes	35%	65%	100%
Av Km Travelled in the corridor. **	450	660	
Av Gross Tonne-Km	53,298,000	147,475,477	200,773,477
Share of GTK	27%	73%	100%
Av Net Tonnes	1,353	20.8	
Total Net Tonnes / Day	64,920	130,801	195,721
Share of Net Tonnes	33%	67%	100%
Av Km Travelled in the corridor. **	350	660	
Av Gross Tonne-km	22,722,000	86,328,418	109,050,418
Share of Net Tonne-Km	21%	79%	100%
* Excludes weight of locomotives	** Weighted average based on tonnages for different traffics.		

Estimates by the author. Based on data from late 2020. Note that certain freight tasks such as grain movements are seasonal and have been averaged over the year for the purposes of these estimates.

4.3 FUTURE TOTAL FREIGHT MOVEMENT

Figure 31: SCT Intermodal Freight Train

In addition to container trains, SCT operates intermodal freight trains between Sydney and Melbourne carrying palletised freight in specialised vans, which operate between SCT's dedicated freight terminals. This train is near Bundanoon,

Table 1 estimated that up to 90,000 tonnes per day of general merchandise cargo is moved between Sydney and Melbourne each weekday by road, the vast bulk in curtain-sided and refrigerated B-doubles and semi-trailers. Much of this would be strictly Sydney – Melbourne freight, since most Melbourne – Brisbane road-freight travels via the Newell highway.

In addition, a total of around 22,000 tonnes per day of general merchandise freight is moved by rail between Sydney and Melbourne, mostly in containers but also in specialised wagons. However much of this is freight is moving between Melbourne and Brisbane, which happens to use the Sydney to Melbourne rail corridor (until the Inland Rail is completed).

The total contestable merchandise freight market between Sydney and Melbourne is thus estimated at approximately 100,000 tonnes per weekday (counting both directions). It is not possible to be precise, but this suggests that the current rail mode share of such freight which is strictly between Sydney and Melbourne is therefore currently under 10%. By comparison rail achieves up to 30% on the longer haul Melbourne – Brisbane corridor, and around 70% or more for the East-West corridors, such as Perth to Sydney. This reflects:

- The longer transit times between Sydney and Melbourne by rail (typically 13 hours) compared to road (typically 9-10 hours).
- Lower reliability by rail given requirements for track maintenance shutdowns, as well as breakdowns, derailments and other incidents which tend to take longer to clear than incidents on the road network. The road network also tends to have more alternative route options.
- The longer time and cost of transhipment for rail to reach final destinations than road.

Three factors therefore need to be addressed if rail is to achieve a much more significant share of Sydney – Melbourne general freight:

- Transit times will need to be reduced by about 4 hours, ideally to around 9 hours. This would require average speeds in the order of 100 km/hr, which in turn will require higher maximum speeds (up to 130 km./hr) for much of the corridor.
- Reliability will need to be increased, and fast freight trains will need to be given appropriate priority.
- Times and costs for trans-shipment will need to be reduced, by use of modern logistics terminals, such as that being built at Moorebank in Sydney, and through the potential use of innovative rollingstock as utilised in Europe.

On this basis, and particularly if rail freight can be speeded up as well with appropriate investment in high-speed rail alignments, achieving a target of 50% mode share of the current contestable Sydney – Melbourne general freight market by 2050 for rail would seem feasible.

This would equate to approximately 75,000 net tonnes per weekday (counting both directions), assuming a 50% growth in the market by 2060. Since loads are roughly equal in both directions, this could be handled by 17 fast intermodal freight trains per day in each direction, each with about 2,200 tonnes net capacity (around 90 40-foot containers or equivalent, equal to the current 1800m train length). Assuming the current Melbourne – Brisbane trains will be routed via the Inland Rail in the future this would mean an additional 15 intermodal freights a day in each direction between Sydney and Melbourne compared to the current rail timetable.

4.4 FUTURE PASSENGER DEMAND

The likely demand, and hence capacity required to handle passenger services on the potential high-speed line between Sydney and Melbourne, has also been assessed using three key inputs:

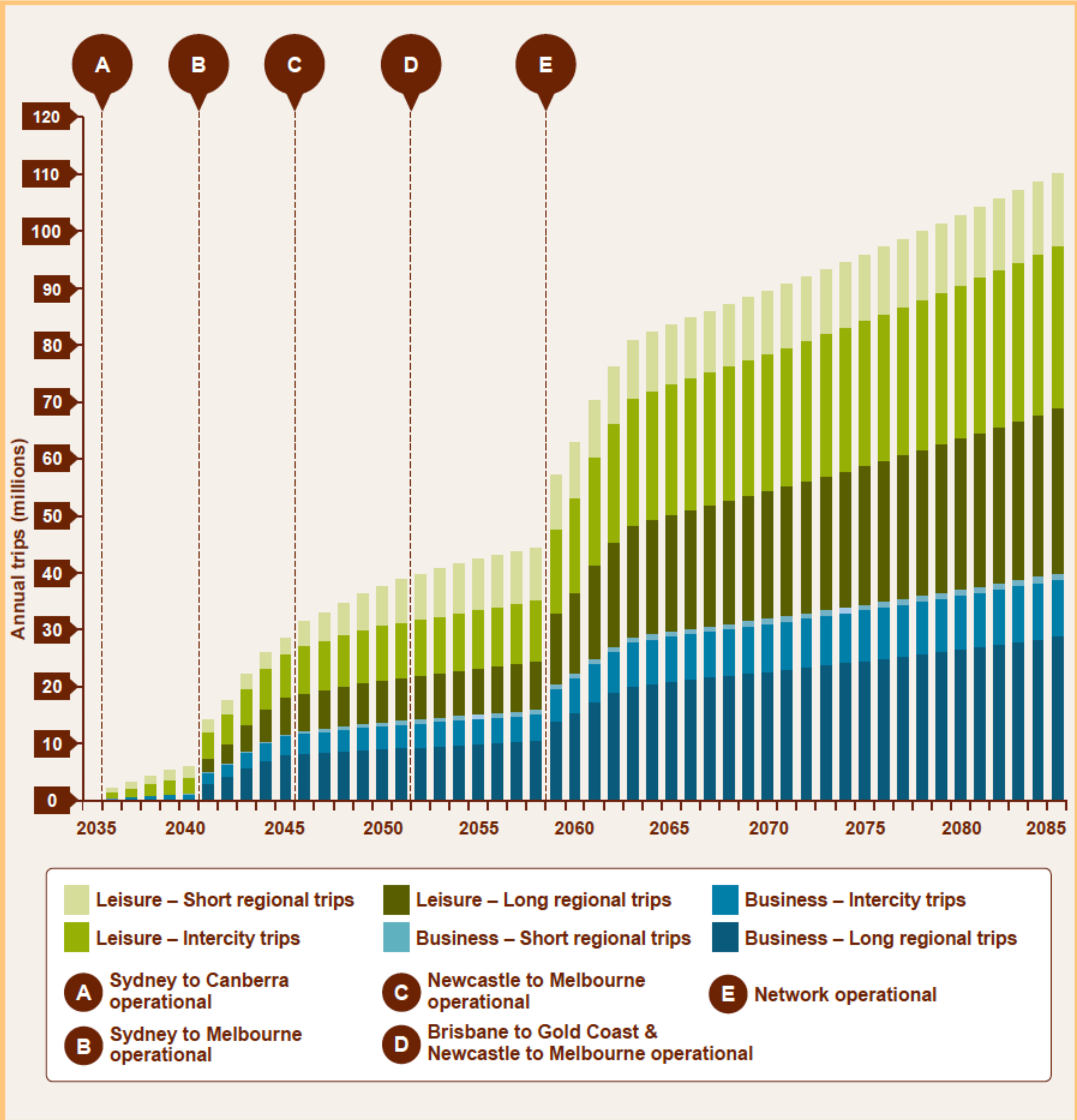
- Previous estimates, in particular the estimates in the 2013 High-Speed Rail Study
- Analysis of Overseas Experience
- Current estimates of Air Traffic in the Sydney-Melbourne corridor, together with estimates of potential further growth in the market and of rail's likely mode share.

The 2013 High-Speed Rail Study estimated passenger demand in the East Coast High Speed Rail corridor in 2055 (prior to opening of Newcastle – Gold Coast and Brisbane sections) at around 40 million passengers p.a. By 2065, with further population growth and completion of the network, the overall estimate of demand was 84 million passengers, including:

- 19 million inter-city passengers between Sydney and Melbourne
- 5 million passengers between Sydney and Canberra
- 11 million passengers between Sydney and Brisbane

- Most of the remainder would be shorter-distance passenger trips, between regional cities and the capital cities or other regional cities.

Figure 32: 2013 HSR Study Phase 2: Estimates of HSR Patronage



The assumed population growth between 2011 and 2050 was 39% for NSW, 49% for Victoria, 80% for Qld and 38% for the ACT. Other key assumptions in the forecasts included GDP / capita, relative fare structures, and travel times for high-speed trains of 3 hours between Sydney and Melbourne.

The 2013 HSR Report was an extremely detailed study and provides a solid base for future estimates. However, a few things have changed or potentially could change from the assumptions adopted in that study. These include:

- Actual population growth in Australia in the 2011-2019 period was higher than had been assumed, with higher levels of overseas migration. The relative growth rates between States were somewhat similar, but the ACT has grown more strongly than was assumed.

- COVID has had several key impacts, including a short-term collapse in population growth and changes in travel behaviour, such as the replacement of some business trips by virtual meetings. While the immediate impacts of COVID were dramatic over 2019 and 2020, they have begun to fade. Population growth is now surging and looks like it may cancel out the earlier fall. Car-based travel within the cities has now almost returned to pre-COVID levels, although public transport patronage remains below the levels before COVID. Air travel is still significantly below pre-pandemic levels (see discussion below.)
- Overseas there has been a surge in high-speed rail in many countries since 2013, with many additional countries investing in the technology, including Morocco, Saudi Arabia, Serbia, India and Indonesia.
- Recently there has been a trend for shorter and medium distance inter-city air travel to be replaced by high-speed rail where it is available; examples include Rome-Milan, Madrid-Barcelona, or London-Paris. HSR travel times in these corridors are generally in the range of 2.5-4 hours.
- There has also been an increase in longer distance rail travel including international HSR daylight travel up to 8 hours, and overnight sleeper trains. These changes reflect the comfort and convenience of rail travel and the declining convenience of air travel in many cases, partly due to COVID and other restrictions. They also reflect moves by governments and individuals to reduce the greenhouse emissions from travel.

In addition, HSR operators have begun offering low-fare travel options, in some cases as a reaction to competition on corridors with more than one HSR operator (such as Rome-Milan and Madrid-Barcelona). This is being achieved by rollingstock with higher seat densities, fewer amenities (such as restaurant cars) and slightly slower schedules, with more stops.

A key difference between the current proposal and the 2013 HSR proposal is that somewhat slower top speeds are now envisaged, with the fastest Sydney-Melbourne trip proposed as 4 hours rather than 3 hours. This could reduce the appeal for time-poor travellers, especially people making business trips. Accordingly, it is assumed that HSR as proposed is likely to capture around 40% of the Sydney – Melbourne air market, rather than 63% share assumed in the 2013 study.

In addition, it is assumed that by 2060 it is likely that at least some of the HSR market will be served by high seat-density trains, such as the latest Alstom double deck trains which offer 740 seats in a 200m train length.

Figure 33: Developments in High-Speed Passenger Trains

Alstom's Avelia high-capacity Horizon Duplex has 740 seats in 200m length

Talgo 250 Dual changes gauge, tilts, and can operate on non-electrified track

Stadler KISS regional commuter trains have high comfort, top speeds of 160 km/hr and can seat from 250 to 1000 passengers

Finally, the most recent estimates of air travel between Sydney and Melbourne are instructive, as they are recent, real data. They indicate that in January 2023, airlines provided 700,000 seats for travel between the two cities (predominantly Qantas, Jetstar and Virgin), indicating a potential annual figure of around 8.4 million, compared to a pre-pandemic level of 10 million in 2019.

On this basis the table below provides an indicative estimate of Sydney – Melbourne and Sydney - Canberra Travel demand in 2055 compared to that assumed in the 2013 report.

Table 4: Indicative Estimates of Passenger Demand

	Sydney - Melbourne			Sydney - Canberra		
	2013 Study	Adjustment	New Estimate	2013 Study	Adjustment	New Estimate
2065 Estimated Trips (million)	19.0			5.0		
2055 Estimated Trips (million)	16.0			4.5		
Impact of COVID on travel behaviour		-15%	13.6		-15%	3.8
Impact of HSR travel times		-25%	10.2		-10%	3.4
Impact of Population Growth estimates		-10%	9.2		20%	4.1
Impact of Environment / Fare assumptions		15%	10.6		15%	4.8
Final Estimate for Annual Trips (Million)	16		11	5		5
Av Daily One-Way Trips (thousand)	21.9		14.5	6.2		6.5
Average Train Capacity (seats)	450		900	450		450
Average Load Factor	90%		90%	90%		90%
No of Trains Required each Direction	54		18	15		16

As indicated above, the estimate of likely demand for the Sydney – Melbourne expresses is somewhat lower than that made in 2013, and the train capacity higher, so the number of services could be lower (of the order of 18 per day each way in 2055). On the other hand, the demand in the Canberra corridor and for other regional, commuter and fast suburban services is likely to be higher.

5
FUTURE FREIGHT OPTIONS IN THE SYDNEY-MELBOURNE CORRIDOR

As evidenced from around the world, there are many subtle variations in how high-speed rail has been implemented. Track alignments, power supply, signalling and operations need to be adapted to local conditions, including train density, topography, traffic patterns, existing infrastructure and financial constraints. For example, in Europe it is common for electrically powered trains to be able to operate seamlessly on both high voltage AC and lower voltage DC supply, and to cope with multiple signalling / train control systems.

Australia does not have the population density and hence train frequencies of countries like Japan, South Korea or China. The Tokyo-Osaka Shinkansen line operates up to 15 high-speed passenger trains per hour in each direction, but has over 50 million people in its 350 km corridor length. The Beijing-Shanghai high-speed line, despite being 1300km in length, carried 192 million passengers in 2018, generating a 9.5 billion Yuan profit in the first 9 months on a turnover of 25 billion yuan[xliii]. By 2010, the line was handling 52 high-speed trains per day each way between Shanghai and Beijing, with a further 28 shorter haul services each way. However, both Shanghai and Beijing have populations in excess of 23 million, with many other cities along the route.

Another example is the Madrid-Barcelona high-speed line, linking two cities with combined populations of over 12 million, some 506km apart, and with other medium sized cities on-route. This line is now carrying 42 high-speed trains per day in each direction, typically 3-4 per hour during the day.

These examples and the analysis in the previous section indicate Australia is likely to have between 3 and 6 high-speed passenger trains per hour (in each direction) on most lines, even thirty years from now, including long-distance expresses, fast regional and fast commuter services. However, in the entries to Sydney, Melbourne and Brisbane, up to 12 high-speed, fast commuter and fast outer-suburban trains per hour are likely to operate in the peak direction in the morning peak period.

Australia is therefore in a similar situation to countries such as Spain or Turkey, which have lower population densities than countries like Japan or China, but which have still developed extensive high-speed networks. Such train densities leave room for fast freight trains to utilise high-speed tracks at night (when few passenger trains are operating) and, with careful scheduling, in off-peak periods during the day as well.

This section therefore examines what new freight services could be operated with the introduction of the high-speed line in the Sydney-Melbourne corridor. These services will increase the capacity of freight to be carried in the corridor, with faster delivery times for specific types of types of freight (that benefits most from timely delivery) and increase the reliability for most non-bulk freight services as well.

In addition, it also explores the potential for freight trains to make same-day return trips between Sydney and Melbourne. This will allow the freight operators to better utilise their investment in rolling stock (freight engines and wagons), which will allow them to better compete with road freight in the corridor.

5.1 NEW FREIGHT SERVICES USING THE HIGH-SPEED LINE

Our proposal for development of high-speed rail in South-East Australia specifically aims to benefit both passenger and freight services by allowing them to interchangeably operate on either the high-speed line or the existing interstate line between Sydney and Melbourne, subject to a few technical limitations.

The table below contrasts the proposed approach with that previously assumed.

Table 5: Changes from Previous High-Speed Rail Assumptions

High-Speed Line Design Parameters	Previous Assumption		Proposed Model	
	High-Speed Line	Existing Line	High-Speed Line	Existing Line
Maximum Speed (Passenger trains)	350 km/hr	150 km/hr	320 km/hr	150 km/hr
Fastest Passenger Time Sydney - Melbourne	3 hours	11 hours	4 hours	11 hours
Fastest Speed (Freight trains)		115 km/hr	140 km/hr(d)	115 km/hr
Fastest Freight Time Sydney – Melbourne (between terminals)		13 hours	9 hours	13 hours
Trains Operated	**High-Speed Line**	**Existing Line**	**High-Speed Line**	**Existing Line**
High-Speed Long-Distance Passenger	Yes		Yes	
Fast Regional Passenger (a)			Yes	Yes
Fast Commuter Passenger	Yes		Yes	Yes
Local Passenger		Yes		Yes
Fast Intermodal Freight (b)			Yes	Yes
Bulk / Industrial Freight Trains		Yes		Yes
Other Trains (c)		Yes	Yes	Yes

(a) These trains can use the high-speed lines where available, but also slower speed lines as appropriate – for example: Newcastle – Hunter Valley and NW NSW; Seymour – Albury via Wangaratta; Sth Gunning – Wagga Wagga
(b) These trains will run mainly at night and need to be capable of 130-140 km/hr operation.
(c) Other trains may be able to use high-speed tracks in special circumstances, such as closure of low-speed lines for maintenance, subject to axle load, signalling, communications and other requirements. In addition, a fast suburban shuttle service is proposed between Epping HSR and Glenfield in Sydney to accommodate connections to the Bankstown and Main Western Lines and internal north-south movement within the Sydney Region
(d) Light-weight high speed trains (like Italy's modified high-speed passenger trains) could run at up to 180 km/hr.

The proposed strategy creates three new options for moving freight in the Sydney-Melbourne corridor:

i. Increased capacity for extra freight trains on the existing line, by shifting current passenger services to the high-speed line.
ii. Using High-speed lines for very-fast freight trains (up to 180-200 km/hr,) carried in modified high speed passenger trains, as is being done in Italy.
iii. Using High-speed lines for fast freight services (up to 130-140 km/hr), especially at nights and times when passenger traffic is low.

It is estimated that the combination of the existing Standard Gauge interstate lines, the Inland Rail and the High-Speed line from Melbourne to Brisbane could carry 50% of the estimated total freight task in the East Coast Corridor by 2060.

Details of how this could be achieved in the case of the Sydney – Melbourne corridor are set out below.

EXTRA FREIGHT TRAINS ON EXISTING LINES

As noted above, the busiest section of the Sydney- Melbourne main line for freight trains is between Moss Vale and Goulburn, which carries around 24 freight trains per day in each direction on weekdays (the exact number varies with seasonal traffic such as wheat and other grains). Currently there are seven longer distance passenger services each way per day on this section (three Canberra trains, two Melbourne trains, and two Goulburn trains).

The passenger trains currently travel faster than freight trains and so this equates to around 10 freight train paths in each direction in terms of capacity. Transfer of these passenger services to a new high-speed passenger line would therefore open up an additional 10 or more train paths daily in each direction for intermodal freight trains, trebling the number currently operating.

Similar benefits for freight train paths on the existing Sydney – Brisbane main line would also occur from construction of a high-speed line. The precise number of additional train paths would need to be determined from more detailed analysis given much of this line is single track with passing loops.

In addition, some of the intermodal trains currently operating in the Melbourne – Sydney – Brisbane corridor will be transferred to the Inland Rail line on its completion (including Melbourne – Brisbane; Perth – Brisbane; and Adelaide – Brisbane services).

HIGH-SPEED FREIGHT ON HIGH-SPEED LINES

It is also possible for specialised services to operate at close to passenger train speeds on high-speed lines, carrying palletised freight. Currently the Italians are doing this with modified passenger rollingstock operating at up to 180 km/hr on high-speed lines (see Section 2.1). The Chinese Railways are also aiming to do this, with planned speeds up to 250 km/hr, though this has not yet been implemented.

Clearly the maximum axle loads applicable at such speeds would be lower than generally applicable for conventional freight trains, (typically 23 – 30 tonnes), and specialised cargo handling arrangements more akin to those used for aircraft would be needed. While this is a possibility in the future, it is not considered sufficiently well developed to be further considered here.

FAST FREIGHT ON THE HIGH-SPEED LINE

Although the high-speed line would have significant gradients (in the order of 2.5% between Sydney and the Southern Highlands), the high power of modern electric and bi-mode locomotives would permit freight trains to operate at speeds up to 140 km/hr in level territory and to climb these gradients much faster than with conventional diesel-electric locomotives. They would nevertheless be slower than high speed passenger trains. Hence freight trains would be restricted to operating at nights, or when passenger services were operating at lower frequencies, such as between peak periods.

During those times, they could be operated at reasonably tight headways. Overseas, freight trains are operated in some cases at very high frequencies – for example in the Gotthard base Tunnel they operate on 3-minute headways. The number of freight trains which could be operated each night between Sydney and Melbourne, and between Sydney and Brisbane, will then depend on the length of the "window" available for their operation, their transit time while on the high-speed passenger network, and terminal capacity. It is assumed that such trains would be either:

- Conventional container trains, but with high-speed bogies; and/or
- Special Intermodal trains for carrying truck trailers, which would be swapped to prime movers at specialised terminals, for completion of the journey by road.

In either case a maximum speed of 140 km/hr, and an average speed of 100 km/hr, is assumed. They would operate between appropriate terminals in the Capitals as shown in Table 6.

5.2 PROPOSED SYDNEY-MELBOURNE FREIGHT OPERATIONS

Table 6: High-Speed Intermodal Train Assumptions

Service (Northbound)	Melbourne to Sydney	Sydney to Brisbane
Originating Terminal (s) (a)	Somerton, BIFT or WIFT (Melbourne)	Moorebank, Chullora, Western Sydney Logistics or Warnervale (c)
Destination Terminal (s) (a)	Moorebank, Chullora, Enfield or Western Sydney Logistics (Sydney)	Bromelton or Acacia Ridge (Brisbane)
Distance on High-Speed Line (b)	790 km	770 - 820 km
Average Speed on High-Speed Line	100 km/hr	100 km/hr
Transit time on High-Speed Line	8 hours	8 – 9 hours
Typical Transit time including access to Freight Terminals	9 hours	9 - 10 hours

(a) Note: Special terminals would be required in the general vicinity of the terminals indicated to handle Roll on – Roll off trailers.
(b) Note: Terminals are located on the outskirts of the capital cities, and hence the distance spent on the high-speed line is less than the distance between city centres
(c) Note: In addition to the terminals in Sydney, a further terminal could be located near Warnervale, being connected to both the existing Main line, the High-Speed Line and with good road connections to Sydney and the Hunter via the Pacific Highway.

It is estimated that a four-hour window would be available for operating these services. These would be essentially overnight services departing from one capital city and joining the high-speed line between 8 pm and midnight and leaving the high-speed line at the destination city between 4 am and 7 am next morning.

Assuming services departed every 15 minutes, at least 12 such services could be operated northbound each night between Melbourne and Sydney, with a similar number of services southbound, provided there was sufficient terminal capacity available.

It is assumed that these trains would be of similar maximum length (1,800m) and slightly lower average gross weight (3,300 tones) to the intermodal trains currently operating on the existing Melbourne – Brisbane main line, as they would handle mostly lighter containers. These would require three or four high-powered electric / dual locomotives (similar to the Stadler Eurodual or Euro 9000 locomotives used in Europe) when operating on the high-speed line.

RETURN SERVICES ON THE EXISTING LINE

In order to maximise the utilisation of the rollingstock, it is proposed that most fast freight trains would operate in the return direction during the daytime, using a combination of the existing (non-electrified) interstate lines between Melbourne, Sydney and Brisbane, the high-speed line, or in some cases, on the Inland Rail Line. Eurodual locomotives could be used for some of these services as they have independent diesel power in addition to electric power.

The precise way this can be accomplished would need further assessment and will emerge over time as additional sections of high-speed line are completed. Appendix 2 examines the timetabling issues of operating fast intermodal freight trains on the high-speed line in more detail.

In theory a single rake of wagons could thus complete a round trip, for example Melbourne – Sydney – Melbourne, within about 30 - 36 hours, given the fast turnaround for the specialised “Rolling Highways” type trains, or of trains utilising freight terminals such as that at Moorebank. Conventional container trains operating only on lower speed main lines would have cycle times closer to 48 hours.

Table 7: Cycle Times for High Speed and other Freight Trains

Time Taken (hrs)	**Type of Train / Service**		
	Special Intermodal (b)	**High Speed Container (c)**	**Current Intermodal**
Unload / Load time at Originating Terminal	2.0	4.0	6.0
Time to Start of High-Speed Line (a)	2.0	3.0	2.0
Transit Time on High Speed/ Main Line	8.0	8.0	14.0
Time to reach Terminal (a)	1.0	1.0	1.0
Unload / Reload Time in Terminal	2.0	4.0	6.0
Time to reach Main Line (a)	2.0	3.0	2.0
Transit Time on Existing Line	12.0	12.0	14.0
Time to reach Terminal (a)	1.0	1.0	1.0
TOTAL CYCLE TIME	**30.0**	**36.0**	**48.0**

(a) Note: This would depend on the specific terminal, and any delays in finding a suitable train path.
(b) Using specialised roll on / roll off rollingstock.
(c) Using automated overhead cranes and stackers

Achieving such cycle times would significantly improve productivity of locomotives and rollingstock and reduce costs per tonne-km for rail freight operators, making them more competitive with road freight.

6
PROPOSED SCHEDULING FOR THE SYD-MEL HIGH-SPEED LINE

This section examines whether sufficient freight services can be scheduled to significantly improve freight operations in the corridor, without impacting the operation of passenger services on the high-speed line.

6.1 ACCOMMODATING FREIGHT SERVICES ON HIGH-SPEED LINES

It is proposed that fast freight trains can, and indeed would need to, share the proposed high-speed rail corridor between Sydney and Melbourne with passenger trains, other than for the entries into the freight terminals in each city.

A significant share of these trains (perhaps 8 in each direction) would operate at night, when there were few passenger trains operating, and when the demand for fast intermodal traffic is highest.

The remaining trains could operate partly on the high-speed lines, with suitable scheduling arrangements to accommodate the mix of passenger and freight traffic. This flexibility has been the norm in Australian railways since they first operated and remains so in most of the world.

Mixing high-speed passenger services with freight poses significant challenges. However, these can be handled for higher speed freight trains with appropriate safety arrangement, timetables and track design.

To illustrate how this can be achieved, the figure below shows part of a weekday southbound timetable for the proposed high-speed line, for the period from about 6:00pm to about 11:00 pm.

Table 8: Part of Notional 2060 High-Speed Timetable (6pm – 11pm)

(Southbound Trains from Sydney and Canberra)

DEP SYDNEY	NO	SM5	SS6	CM4	SC6	SM6	FF1	SS7	SC7	SR2	SM7	FF2	FF3
		Syd-Mel	Syd-SH	Canb-Mel	Syd-Can	Syd-Mel	Syd-Mel	Syd-SH	Syd-Can	Syd-Glb	Syd-Mel	Syd-Mel	Syd-Mel
		HSE	F Comm	HSE	HSE	HSE	F Freight	F Comm	HSE	F Reg	HSE	F Freight	F Freight
Time		4 hr	1 hr 40m	3 hr 20m	1 hr 40 m	4 hr	10 hr 15m	1 hr 40m	1 hr 40 m	1hr 50m	4 hr	9 hr 45m	8 hr 20m
Kms		850	150	710	290	850	790	150	290	210	850	790	790
Av Speed	KM	213	90	213	183	213	77	90	183	115	213	81	95
OLYMPIC PARK	0	18:15	18:30		18:45	19:00		19:15	19:30	19:45	20:00		
MOOREBANK	30						17:05					18:15	20:10
GLENFIELD	32	19:30	18:45		19:00	19:15	17:15	19:30	19:45	20:00	20:15	18:25	20:20
MACARTHUR	45						via old					via old	
MITTAGONG JCN	100	18:55	19:10		19:25	19:40		19:55	20:10	20:25	20:40		20:40
STH HIGHLANDS	120		via MV		19:33			via MV	20:18	via MV			
EXETER JCN HSL)	140	19:05	19:35		19:40	19:50	20:00	20:20	20:25	20:42	20:50	21:10	21:25
BUNDANOON	150		19:48					20:33		20:55			
GOULBURN	210									21:45			
STH GUNNING	215	19:25		19:40	20:00	20:10	21:25		20:45		21:10	22:05	22:35
GUNDAROO	265			19:20	20:15				21:00				
CANBERRA	290			19:10	20:25				21:10				
YASS HSS	265	19:40		19:55		20:25	21:50				21:25	22:30	23:00
WAGGA W JCN	450	20:20		20:35		21:05	0:10				22:05	0:50	1:20
WAGGA WAGGA	460												
ALBURY	550	20:50		21:05		21:35	0:40				22:35	1:20	1:50
SHEPPARTON	670												
WANGARATTA	600												
SHEPPARTON JCN	680	21:20		21:35		22:05	1:45				23:05	2:25	2:55
SEYMOUR JCN	770	21:45		22:00		22:30	2:50				23:30	3:30	4:00
OMR JCN/BIFT	820						3:20					4:00	4:30
CAMBELLFIELD	834	22:05		22:20		22:50					23:50		
SOUTHERN CROSS	850	22:15		22:30		23:00					midn		

DEP SYDNEY	NO	SS8	SC8	SS9	FF3	FF4	FF5	FF6	FF7	SM8	FF8	SM9	FF9
		Syd-SH	Syd-Can	Syd-SH	Syd-Mel	Syd-Mel	Syd-Mel	Syd-Mel	Syd-Mel	S	Syd-Mel	S	Syd-Mel
		F Comm	HSE	F Comm	F Freight	F Freight	F Freight	F Freight	F Freight	Sleeper	F Freight	Sleeper	F Freight
Time		1 hr 40m	1 hr 40 m	1 hr 40m	9 hr	9 hr	8 hr	8 hr	8 hr	8 hr 30 m	8 hr	8 hr 30 m	8 hr
Kms		150	290	150	790	790	790	790	790	850	790	850	790
Av Speed	KM	90	183	90	88	88	99	99	99	100	99	100	99
OLYMPIC PARK	0	20:30	21:00	21:15						22:00		22:30	
MOOREBANK	30				19:45	20:00	21:25	21:40	21:55		22:20		22:50
GLENFIELD	32	20:30	21:15	21:30	19:55	20:10	21:35	21:50	22:05	22:20	22:35	22:50	23:00
MACARTHUR	45				via old	via old							
MITTAGONG JCN	100	20:55	21:40	21:55	22:00	22:15	22:15	22:30	22:45	23:00	23:15	23:30	23:40
STH HIGHLANDS	120	via MV	21:48	via MV						23:20	23:35	23:50	midn
EXETER JCN HSL)	140	21:20	21:55	22:20	22:30	22:45	23:00	23:15	23:30	23:45	midn	0:15	0:25
BUNDANOON	150	21:33		22:33									
GOULBURN	210												
STH GUNNING	215		22:15		23:15	23:30	23:45	midn	0:15	0:30	0:15	1:00	1:10
GUNDAROO	265		22:30										
CANBERRA	290		22:40										
YASS HSS	265				23:45	midn	0:15	0:30	0:45	1:00	0:45	1:30	1:40
WAGGA W JCN	450				1:05	1:20	1:35	1:50	2:05	2:20	2:05	2:50	3:00
WAGGA WAGGA	460												
ALBURY	550				2:35	2:50	3:05	3:20	3:35	3:50	4:05	4:20	4:30
SHEPPARTON	670												
WANGARATTA	600												
SHEPPARTON JCN	680				3:40	3:55	4:10	4:25	4:40	4:55	5:10	5:25	5:35
SEYMOUR JCN	770				4:45	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:40
OMR JCN/BIFT	820				5:15	5:30	5:45	6:00	6:15		6:45		7:20
CAMBELLFIELD	834									6:20	6:05	6:50	
SOUTHERN CROSS	850									6:30		7:00	

This illustrates the mix of passenger and freight trains as well as how this mix changes depending on the time of day. This segment of the timetable includes:

- 3xHigh-Speed Expresses from Sydney (Olympic Park) to Melbourne (Southern Cross)
- 2xOvernight Sleeper Trains from Sydney to Melbourne
- 3xHigh Speed Express from Sydney to Canberra and 1 from Canberra to Melbourne.
- 1xFast Regional service to Goulburn and 4xfast Commuter Services to the Southern Highlands
- 10xFast Freight Services from Moorebank and other Sydney Freight Terminals to Melbourne.

Note that:

- Most of the fast freights depart Sydney after about 8pm, by which time most high-speed passenger trains have already departed.

- Most of the southbound fast freights would be timetabled for run times of around 8 hours between Glenfield (where they join the high-speed line) and OMR Junction in Melbourne (where they leave the high-speed line).
- Fast freights are assumed to originate in a variety of terminals, including Moorebank, Chullora, Enfield and Western Sydney Intermodal Terminal (when built), and terminate in a variety of terminals in Melbourne, including Somerton, BIFT and WIFT.

Section 6.3 and Appendix 2 provide full details on the proposed operations on the Sydney – Canberra – Melbourne high-speed line once complete.

Figure 34: Sharing the Line between Freight and Passenger Traffic

Loaded limestone train passing the southbound XPT at Bundanoon. Freight and Passengers trains can share tracks if appropriately handled and have done so since railways begun.

6.2 PROPOSED SYDNEY TO MELBOURNE SCHEDULING

EXAMPLE – GOTTHARD BASE TUNNEL

To understand how fast freight can be combined with high-speed trains in practice, it is worth examining the Gotthard Base Tunnel as an example of where this is achieved, and how this could apply in Australia.

This 57 km tunnel under the Swiss Alps is currently the longest in the world. It connects Switzerland with Italy, and provides a faster, safer and higher-capacity route between the two countries than the original Gotthard tunnel, which however remains in use.

The tunnel consists of two single-track tunnels connected at a number of points for emergency evacuation, maintenance etc. In normal operation therefore trains follow each other. The tunnel has been designed to carry six fast freight and two high-speed passenger trains per hour in each direction, and operational requirements are as follows to achieve this capacity[xliv]:

- Passenger trains are usually operated at a maximum of 200 km/hr, taking around 20 minutes for the trip through the tunnel, though they can and do sometimes operate at up to 350 km/hr. Average speed for the 60km crossing is around 180 km/hr.
- Freight trains must operate at a minimum of 100 km/hr, taking around 35 minutes for the crossing. Average speed for the 60km crossing is around 103 km/hr.
- Freight trains are allocated six train paths per hour, and passenger trains are limited to a maximum of 2 per hour (to date the timetables usually require 3 trains every two hours).

- Tracks at either end of the tunnel allow trains to be held if necessary until their train path is available.

The table below shows how the two classes of train can be combined:

Table 9: Pathing Trains in the Gotthard Base Tunnel

Class	Pass	Freight	Freight	Freight	Pass	Freight	Freight	Freight	Pass
Depart	9:00	9:05	9:08	9:11	9:30	9:35	9:38	9:41	10:00
Arrive	9:20	9:40	9:43	9:46	9:50	10:10	10:13	10:16	10:20
Time (minutes)	20	35	35	35	20	35	35	35	20

Note that this requires highly efficient operation, high-powered freight locomotives and relatively short freight trains to maximise the number of train paths available. Swiss railways are renowned for their efficiency and timetable keeping. Freight trains in Europe are generally limited to around 900 metres, so the length restrictions fit with general practice.

PROPOSED SCHEDULE

As mentioned, the proposed high-speed line between Melbourne, Sydney and Brisbane (with branches to Canberra and the Gold Coast) is designed primarily for longer distance high-speed passenger trains, but also for fast commuter, regional and intermodal freight trains.

The table below indicates the expected timetable for the Sydney – Melbourne HSR line by completion, assumed to be in the 2050 – 2060 period when population in the corridor is expected to be 30%-50% higher than today.

Table 10: Indicative Southbound Services After Completion of High-Speed Line

(a) Southbound Sevices Departing Sydney and Canberra by Time of Day								
Type of Service	Origin and Destination	Departures between						
		4:00am 9:00am	9:00am midday	midday 5:00pm	5:00pm 8:00pm	8:00pm midnight	midnight 4:00am	TOTAL
High Speed Passenger	Sydney to Melbourne	4	2	5	3	1	0	15
High Speed Passenger	Sydney to Canberra	3	2	5	4	1	0	15
High Speed Passenger	Canberra to Melbourne	1	2	2	2	0	0	7
Fast Regional	Sydney to Melbourne	0	0	1	1	0	0	2
Fast Regional	Sydney to Goulburn, Wagga or Griffith	3	1	2	1	0	0	7
Fast Regional	Canberra to Melbourne	0	0	0	1	0	0	1
Fast Commuter	Syndey to Southern Highlands	2	3	5	3	2	0	15
Sleeper Trains	Sydney to Melbourne	0	0	0	0	2	0	2
Fast Freight	Sydney to Melbourne	2	1	0	2	12	0	17
SUB-TOTAL		**15**	**11**	**20**	**17**	**18**	**0**	**81**
Fast Suburban	Sydney to Glenfield/Wilton	10	12	20	12	10	0	64
SUB-TOTAL		**25**	**23**	**40**	**29**	**28**	**0**	**145**
Hours		5	3	5	3	4	4	24
Approx Train Frequency / Hr		5.0	7.7	8.0	9.7	7.0	0.0	6.0
(b) Additional Southbound Services departing Goulburn, Waggam, Albury and Shepparton								
Fast Suburban	Goulburn - Canberra	5	6	10	6	3	0	30
Fast Regional	Wagga Wagga - Melbourne	1	1	1	1	1	0	5
Fast Regional	Albury - Melbourne via Wangaratta	1	1	1	1	1	0	5
Fast Commuter	Shepparton to Melboune	3	3	5	3	1	0	15
SUB-TOTAL		**10**	**11**	**17**	**11**	**6**	**0**	**55**
GRAND TOTAL		**35**	**34**	**57**	**40**	**34**	**0**	**200**
Total Southbound Trains / Hr		7	11	11	13	9	0	8

(c) Description of Services		
TYPE	**DESCRIPTION**	**AV KM/HR**
High Speed Passenger	These are express and fast services travelling between the major capitals with limited stops	180-213
Fast Regional	Services between a Capital City and key Regional centres, typically 200 - 500 km	115-180
Fast Commuter	Fast regular links between capital city and nearby regional cities, up to 200 km	90
Fast Suburban	Fast, frequent links between capital cities and commuter belt, up to 100 km	80
Sleeper	Overnight Sleeper Trains between Sydney and Melbourne	100
Fast Freight	Fast Intermodal Freight linking major terminals in Sydney and Melbourne, approx 800-850 km	100

It is anticipated that there could be around 200 Southbound trains all up utilising the high-speed line (or parts thereof) after it is completed, and hence some 400 trains per day counting both directions. (Note that some of these trains will also utilise sections of the existing line). In particular, the timetable could accommodate (in the southbound direction):

- 15x High Speed Passenger, 2 Fast Regional and 2 Overnight Sleeper trains from Sydney to Melbourne, providing over 12 times more capacity than the current twice daily XPT service.
- 15x High-Speed Passenger trains between Sydney and Canberra, and 7 High-Speed Passenger and 1 Fast Regional service between Canberra and Melbourne. (All of the high-speed services would stop at the key outer suburban stops of Glenfield in Sydney and Cambellfield in Melbourne. They would all also stop at Albury, and many would stop at other stops including Gunning South and Shepparton).
- 7x Fast Regional services from Sydney to cities such as Goulburn, Yass, Cootamundra, Wagga and Griffith
- 5x Fast Regional Services from Wagga Wagga to Melbourne via Shepparton, and 5 Fast regional Services from Albury to Melbourne via Wangaratta, Benalla etc.
- 15x Fast Commuter services to the Southern Highlands centres of Mittagong, Bowral and Moss Vale from Sydney, with these services extending to Bundanoon. The proposed new city to be developed east of Bowral would be served by over 20 services to Canberra and Goulburn
- 15x Fast Commuter services to Melbourne from Shepparton.
- 30x Fast Suburban services to Canberra from Goulburn.
- 64x Fast Suburban services from Sydney to Appin. These would also provide fast connections between high-speed services and the Bankstown and Main Western Rail lines. Campbelltown would also have a frequent slower suburban service using the existing line to Parramatta and Central Station.
- 17x Fast Freight services per day.

6.3 TRAFFIC DENSITY BY TIME OF DAY

The busiest period of the day in terms of trains per hour is expected to be in the morning peak period, which could see up to 8 trains per hour approaching Melbourne (a similar situation would apply to the morning peak in the north-bound direction approaching Sydney).

However, it is not anticipated that fast intermodal freight trains will be operating on the high-speed line in this time window. Overnight fast freights from Sydney will have already arrived in Melbourne by 6:00 am, or if not would be routed via the existing line from Seymour south. This will include trains bound for the proposed intermodal terminals at BIFT, Somerton or WIFT. Note that Aurizon has recently acquired rights to develop the BIFT terminal.

During the day off-peak period, there would be a small number of fast intermodals operating between Sydney and Melbourne (and vice versa) on the high-speed line. These would be less time critical than the overnight fast freights, and so might have transit times of 10-11 hours (rather than 8-9 hours) and may be required to hold in sidings to let high-speed inter-capital trains past. Alternatively, they could utilise sections of the existing rail line if necessary, via the proposed crossovers between existing and high-speed lines near Mittagong, Goulburn, Yass, Albury and Seymour.

A similar analysis of northbound weekday traffic patterns would demonstrate a similar ability to operate some fast intermodals during daylight hours.

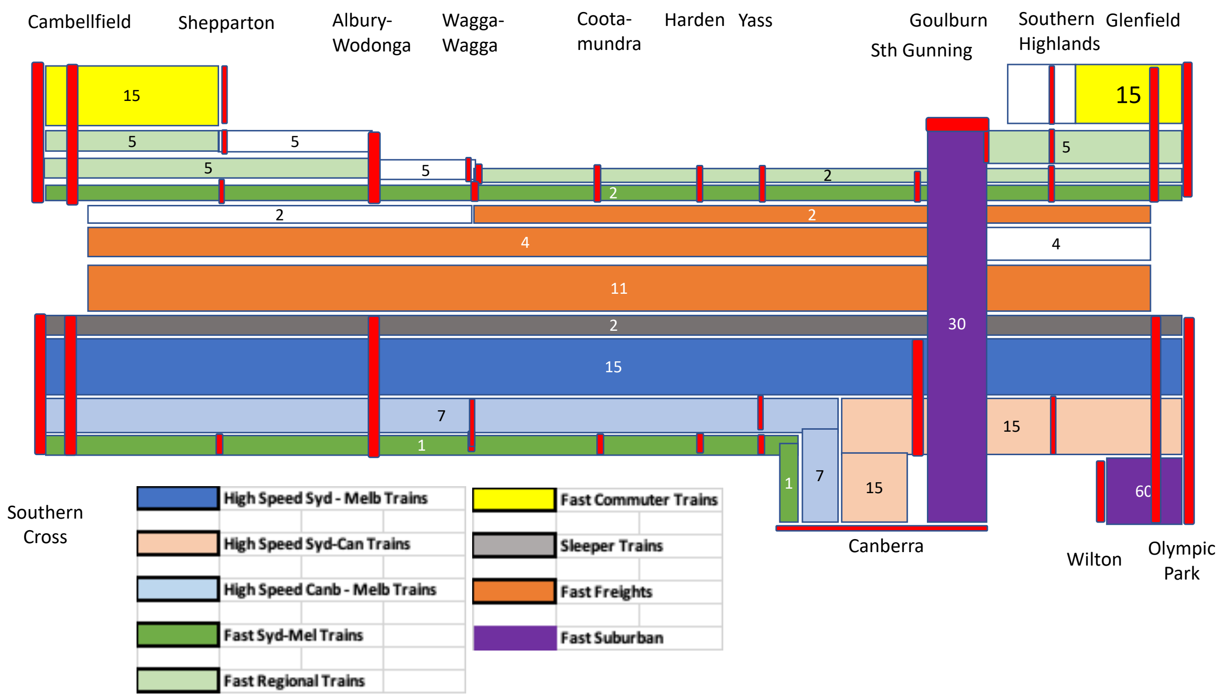
In the evenings and at night, very few high-speed or fast passenger trains would operate - the latest practical departure time for a Sydney – Melbourne Intercapital Express would be around 8:00pm, with arrival into

Melbourne at midnight, while the last Intercapital Express from Sydney to Canberra would likely depart around 9:00pm, with arrival at 10:40 pm. Thus, there would be very few conflicts between passenger and freight traffic using the high-speed line after 7:00 pm.

6.4 TRAFFIC DENSITY ACROSS THE CORRIDOR

The figure below highlights the traffic density across the corridor. The highest traffic density on the HSR network will occur at Glenfield, with around 133 trains per day in each direction.

Figure 35: Train Density (Southbound) along the corridor



A full timetable analysis of the approximately 80 southbound high-speed and fast passenger and freight trains departing Glenfield on the high-speed line on weekdays is included in Attachment 2. In addition to these there would be up to 60 fast suburban trains to Wilton, scheduled between the longer distance trains.

From the detailed analysis, it is concluded that fast intermodal freight trains, with competitive transit times to road freight, will be able to utilise the high-speed line. Indeed, this opportunity provides a key part of the overall economic benefit of high-speed rail infrastructure. A similar analysis can be undertaken for the Sydney – Brisbane corridor, where the development of a high-speed line can also produce significant economic benefits for freight movement.

7
IMPLICATIONS FOR RAIL FREIGHT

Combined with the completion of the Inland Rail and future investment in high-speed rail this could lead to a substantially increased role for rail in the future for moving freight in the East Coast Corridor between Melbourne, Sydney and Brisbane, with the potential to handle 50% of the freight task in the corridor by 2060.

7.1 DESIGN STANDARDS

The table below suggests how standards for different categories of rail infrastructure would vary according to their proposed utilisation. Note that a high-speed line can include sections of very high-speed, high-speed and medium-speed infrastructure.

Table 11: Standards for Different Classes of Infrastructure

Category of Infrastructure	**Design Speed Km/hr**	**Min Curve Radius (i)**	**Max Gradient**	**Axle Load (tonnes)**	**Electrified**	**Loading Gauge**	**Designed for:**				
							(a)	(b)	(c)	(d)	(e)
Very High Speed	Up to 320	5-6 km	3%	22	25 KvAC	Standard	green	beige	beige	red	red
High Speed	Up to 250	3-5 km	2.5%	22	Varies	Standard	green	green	beige	red	beige
Medium Speed	Up to180	1.5 km	2.5%	25	Varies	Standard	green	green	beige	green	beige
Double-Stack	Up to130	2 km	2%	25	No	High	red	beige	beige	green	green

(i) Smaller radius acceptable for tilting trains. (a) High Speed Passenger; (b) Fast Freight; (c) Other Passenger; (d) Other Freight; (e) Double-Stack Container Trains

- green: *Suitable*
- beige: *Suitable in some circumstances, depending on axle loads, speeds, power supply etc*
- red: *Not suitable*

The interaction between infrastructure and rollingstock design parameters is further illustrated in Table 12 below. For example:

- The maximum speeds of some types of trains can depend on the power supply as well as curvature.
- Double-stack container trains would be unsuitable for utilising the high-speed line for reasons of axle load, loading gauge and gradients.
- Very High-Speed Passenger Trains would be unable to use non-electrified lines.

These interactions need to be considered both in the design of infrastructure and in the selection of rollingstock.

Table 12: Allocation of Different Classes of Rollingstock

Type of Train	**Max Speeds**			**Infrastructure Requirements**		
Power Supply and other Characteristics	25 KV AC	1500V DC	Non-Electrified	Loading Gauge	Maximum Gradient	Maximum Axle Load
Very High-Speed Pass	320 km/hr	250 km/hr		Standard	3%	18 tonne
Fast Regional	250 km/hr	250 km/hr	180 km/hr	Standard	3%	18 tonne
Fast Commuter	250 km/hr	250 km/hr	180 km/hr	Standard	3%	18 tonne
Fast Freight	140 km/hr	140 km/hr	140 km/hr	Standard	2.5%	22 tonne
Double-Stack Container	n.a.	n.a.	115 km/hr	High	2%	25 tonne
Other Heavy Freight	115 km/hr	115 km/hr	115 km/hr	Standard	2.5%	25 tonne

7.2 LOGISTICS CENTRES AND TERMINALS

While the proposed high-speed line will have the required capacity to transform both passenger and freight movement between Sydney and Melbourne (and more generally in the East Coast between Brisbane and Melbourne), there will need to be sufficient terminal capacity as well as track capacity.

THE IMPACT OF LOGISTICS CENTRES

Moorebank Terminal is a massive facility designed to eliminate double-handling in the supply chain. Container shuttle trains from Port Botany arrive at the IMEX (Import-export) terminal and are unloaded by automated gantry cranes. The containers can then be moved using automated stackers to specific warehouses located in the facility, or to the Domestic Intermodal terminal for distribution to other cities by rail.

Similarly, cargoes arriving from interstate or regional areas by rail can be quickly handled at the Intermodal Terminal. Woolworths is currently building a $1.3 billion automated warehouse within the Logistics centre, which will be one of many such dedicated facilities. Similar terminals with integrated warehousing facilities have been established by SCT and are also being considered for Melbourne. These have the potential so significantly change the economics of rail transport and encourage a shift back to rail on the East Coast.

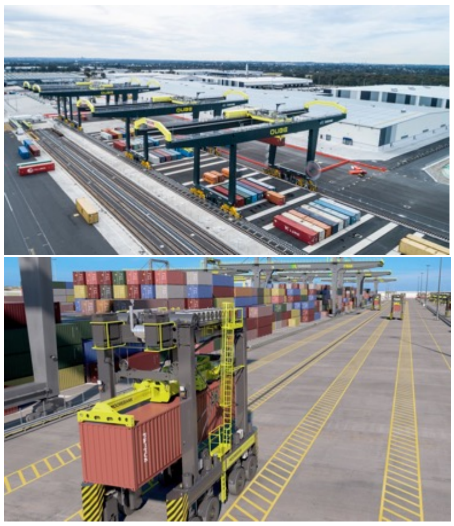
INCREASING THE MODE SHIFT FROM ROAD TO RAIL

Without access to confidential data it is not possible to estimate the cost differences between road and rail for intermodal transport. However, the latest moves by rail freight operators suggests that Rail is now becoming more cost-competitive:

- As mentioned, integrated terminals with rail access and automation can substantially reduce overall costs, as well as time for door-door service
- The costs of diesel fuel are now significant, and rail has a major cost advantage over road in this area.
- Road freight operators are reporting difficulties in getting enough drivers, and any increase in driver costs could be a significant incentive to shift to rail.

Figure 36: Moorebank Logistics Centre

General arrangement, showing the Import-Export (IMEX) Terminal and the Intermodal (Domestic) Terminal



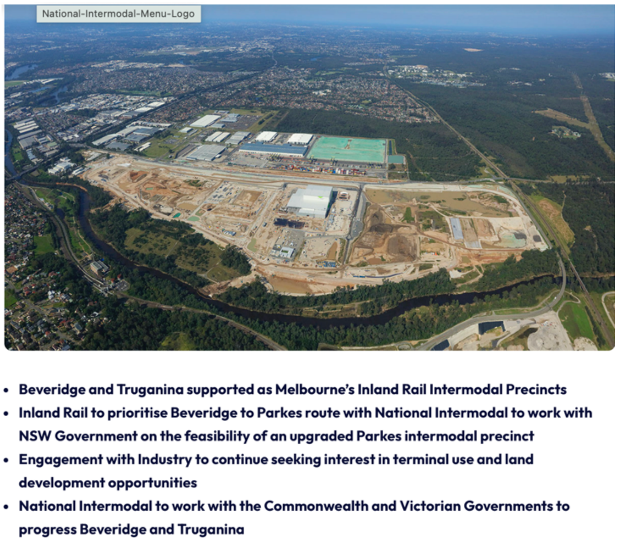
Automated Container cranes (top) unload containers from a three-track yard, which are then moved by automated straddle carriers (bottom) to adjacent warehouses

However, if rail is to achieve 50% mode share in the East Coast Freight market by 2050, including for intermodal freight, there will need to be additional intermodal capacity built over the next thirty years, including:

- The proposed Western Sydney Intermodal Terminal at Mamre Road Precinct, together with the proposed Western Sydney Freight Line to the terminal from Leightonfield[xlv].
- The proposed WIFT terminal at Truganina in Melbourne, together with associated rail links.
- A further major Facility at Brisbane, e.g. at Ebenezer.

Figure 37: Future Major Freight / Logistics Terminals

Proposed Mamre Road Intermodal Terminal in Western Sydney



Developments with Intermodal Terminals. Source: National Intermodal.

8
CONCLUSIONS

- Over the last few decades there have been major upgrades to road corridors in the East Coast, including the Hume Highway and Pacific Highway, as well as on projects such as the M7 and the North-Connex tunnel between Hornsby and the M2 in Sydney.
- Coupled with road rules allowing ever bigger and heavier trucks, these have enabled a large increase in longer distance truck traffic, with trucks taking an increasing share of intermodal / general freight in Interstate corridors particularly on Australia's East Coast (Melbourne – Sydney – Brisbane).
- Combined with the increase in the overall freight task, this has led to a substantial increase in truck volumes on our major Highways, with an average of 6,300 trucks per day using the Hume Highway, and up to 10,000 per day in the approaches to Sydney and Melbourne.
- In the last couple of years however there have begun to be significant investments in freight rail capacity in Sydney, as well as in intermodal terminals, while the Inland Rail between Melbourne and Brisbane is now also under construction.
- Rail freight operators are beginning to react to these initiatives by investing in more capacity for handling intermodal freight.
- Together with a suitably designed high-speed line and technological improvements on rail, these developments provide the potential to substantially increase rail's mode share of the overall freight task in the East Coast, from around 30% today to up to 50% by 2050. The share of intercity merchandise freight between Sydney and Melbourne could rise from below 10% now to 50% by 2050.
- A detailed analysis of the proposed high-speed rail line between Sydney, Canberra and Melbourne has demonstrated it has a capacity to handle at least 400 trains per day utilising some or all of the route. This could cater for at least an additional 30 fast intermodal freight trains, as well as 40% of future Sydney – Melbourne air traffic on high-speed trains, plus inter-regional, fast commuter and fast suburban passenger trains catering for shorter distance trips. This would make a significant improvement to both the efficiency and sustainability of freight movement in Australia.
- However, the failure to upgrade rail to handle the anticipated increase in freight movement in the East Coast Corridor will likely mean at least a 50-60% increase in road freight on the Hume and Pacific highways, with major implications for congestion, safety and the environment, and potentially large investments in further expansion of the road networks.

ATTACHMENT 1:
HUME HIGHWAY TRUCK SURVEY

A survey of truck movements at 32 locations on the Hume Highway was undertaken in October – December 2020. At each location three 5-minute samples of truck volumes were undertaken, in most cases for both directions. A total of 57 quarter-hour samples resulted. As can be seen from the example of raw data below, there is significant short-term fluctuations in traffic volumes between one 5-minute period and the next. However, the total of 171 five-minute samples allows confidence in the final estimates.

Each truck passing on the Hume highway was classified by type (Curtain Sided, Refrigerated, Flatbed, Tanker etc) and by size (B-Double, Semi-Trailer, 2,3 or 4-axle rigid truck, or truck plus trailer combination).

The surveys were carried out at 32 different time periods between 6:00 am and 8:00 pm. The spread of both locations and time periods allows extrapolation of total 24-hour volumes as well as the spatial and temporal patterns, and how the volume and composition of trucks varied by location and time of day.

Survey Locations on Hue Highway: Nov – Dec 2020

The extract below shows the raw data collected from southbound samples from the first four locations for southbound traffic.

SOUTHBOUND							TRUCK TYPE AND SIZE					
No	DAY	DATE	LOCATION	TIME	Curtain Side	Reefer	Flat	Tanker	Tipper	Vehicle	Other	TOTAL
1	Monday	2/10/2020	Illawarra HW	8:20-8:25	S,S,B,B,R2		R2,R3,R2,B	B	T,T,T,T			14
1	Monday	2/10/2011	Illawarra HW	8:25-8:30	R2,B,B,R2	S,S	R4,R2		T,T,T,T	S	R2	14
1	Monday	2/10/2011	Illawarra HW	8:30-8:35	B,S,B,R2	S,S,S			T,T,T,T	S	S (2)(cem)	13
1	Monday	2/10/2011	Illawarra HW	8:20-8:35	13	5	6	1	12	2	2	41
2	Tuesday	3/10/2011	Goulburn McD	11:20-11:25	R3,S,B,B,B,S		S	S			R4(cem)	9
2	Tuesday	3/10/2020	Goulburn McD	11:25-11:30	R2(2), S, B, R3		B,R2,S		T		S(cem),R4	11
2	Tuesday	3/10/2020	Goulburn McD	11:30-11:35	B,S,S,S	R2,B	R3,S	B			S(cem)	10
2	Tuesday	3/10/2020	Goulburn McD	11:20-11:35	15	2	6	2	1		4	30
3	Tuesday	3/10/2011	Marulan	12:10-12:15	R2,R2,S,S	B,R2	S,R2	S	T	B		11
3	Tuesday	3/10/2020	Marulan	12:15-12:20	R2(3),B,B,S	B,B,B,R2	S,R2		T,T,T			15
3	Tuesday	3/10/2020	Marulan	12:20-12:25	B,B,B,R2,R2,R3		R2,S,B	S	T,T		B(scrap)	13
3	Tuesday	3/10/2020	Marulan	12:10-12:25	16	6	7	2	6	1	1	39
4	Thursday	12/11/2020	Mittagong	12:55-13:00	S,S,R2,B,B,B		R3,S,S,R2,S,R3	R3	T,T,T	S		17
4	Thursday	12/11/2020	Mittagong	13:00-13:05	R2,B,B,S	S	S,S,S	B,B,S,B,B	B,T	S		16
4	Thursday	12/11/2020	Mittagong	13:05-13:10	B(4),R2(2),S	B,S,S			T	S,S,B	S	15
4	Thursday	12/11/2020	Mittagong	12:55-13:10	17	4	9	6	6	5	1	48

The total volume of trucks counted was 1870 vehicles across approximately 15 hours of counts. The following table summarises the total sample data at the 15-minute level. The key conclusions from the survey are included in the main report.

SUMMARY SURVEY DATA

SUMMARY FIFTEEN MINUTE DATA																			
SOUTHBOUND		SURVEY DETAILS					TRUCK TYPE					TRUCK SIZE							
No	DAY	DATE	LOCATION	TIME	Curtain Side	Reefer	Flat	Tanker	Tipper	Vehicle	Other	TOTAL	B Dbl	Semi	R2	R3	R4	TT	Tot
1	Monday	2/10/2011	Illawarra HW	8:20-8:35	13	5	6	1	12	2	2	41	8	11	8	1	1	12	41
2	Tuesday	3/10/2020	Goulburn McD	11:20-11:35	15	2	6	2	1	0	4	30	8	12	4	3	2	1	30
3	Tuesday	3/10/2020	Marulan	12:10-12:25	16	6	7	2	6	1	1	39	12	8	12	1	0	6	39
4	Thursday	12/11/2020	Mittagong	12:55-13:10	17	4	9	6	6	5	1	48	16	19	5	3	0	5	48
5	Thursday	12/11/2020	Mittagong	13:30-13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Thursday	3/10/2011	Picton Rd	13:50-14:05	13	11	8	3	4	1	1	41	14	12	6	1	4	4	41
7	Thursday	12/11/2020	Picton Rd	14:50-14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Thursday	12/11/2020	near Douglas Pk	18:40-18:55	35	11	3	3	5	5	0	62	33	19	8	0	1	1	62
9	Thursday	12/11/2020	near Picton Rd	19:05-19:20	21	6	2	2	2	1	0	34	21	11	2	0	0	0	34
10	Thursday	12/11/2020	near Yanderra	19:50-20:05	32	4	3	0	0	1	2	42	33	7	1	0	1	0	42
11	Thursday	12/11/2020	Canberra Turnoff	14:45-15:00	10	11	5	2	1	1	1	31	17	11	1	1	0	1	31
12	Thursday	12/11/2020	Yass & Gundagai	15:50-16:05	13	8	3	3	2	1	1	31	16	10	4	0	0	1	31
13	Thursday	12/11/2020	Yass & Gundagai	16:30-16:45	14	7	3	2	3	0	1	30	17	9	1	0	0	3	30
14	Thursday	12/11/2020	Gundagai	18:00-18:15	8	10	7	3	1	1	0	30	15	14	1	0	0	0	30
15	Thursday	12/11/2020	Near Wagga	19:10-19:25	9	8	2	0	0	3	1	23	11	10	2	0	0	0	23
16	Thursday	3/12/2020	Near Holbrook	19:50-20:05	13	8	2	0	0	0	1	24	10	13	0	1	0	0	24
17	Friday	4/12/2020	near Albury	6:00-6:15	18	5	1	1	3	0	1	29	15	7	6	0	0	1	29
18	Friday	4/12/2020	near Albury	6:20-6:35	11	5	4	0	2	0	6	28	13	4	7	1	2	1	28
19	Friday	4/12/2020	S of Wodonga	8:20-8:35	13	8	6	0	0	0	5	32	15	7	8	2	0	0	32
20	Friday	4/12/2020	near Wangaratta	9:10-9:25	5	6	8	1	0	1	0	21	5	9	6	1	0	0	21
21	Friday	4/12/2020	near Benalla	10:10-10:25	10	8	3	3	2	1	5	32	17	11	4	0	0	0	32
22	Tuesday	8/12/2020	S of Craigieburn	6:50-7:05	27	10	14	1	8	0	4	64	25	22	7	3	2	5	64
23	Tuesday	8/12/2020	N of Craigieburn	7:35-7:50	26	9	9	3	10	1	1	59	21	18	13	2	0	5	59
24	Tuesday	8/12/2020	Seymour Exit	8:40-8:55	10	3	11	3	8	0	1	36	10	11	5	3	0	7	36
25	Tuesday	8/12/2020	S of Shepparton Exit	9:05-9:20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	Tuesday	8/12/2020	S of Shepparton Exit	9:20-9:35	22	6	6	4	3	1	1	43	26	9	5	0	2	1	43
27	Tuesday	8/12/2020	20km S of Benalla	10:20-10:35	10	5	2	0	0	1	4	22	8	11	2	0	0	1	22
28	Tuesday	8/12/2020	10 km S of Wangaratta	11:30-11:45	6	3	3	2	2	1	2	19	6	7	4	0	0	2	19
29	Tuesday	8/12/2020	Wodonga	13:25-13:40	13	5	12	4	2	0	3	39	15	9	8	6	0	1	39
30	Tuesday	8/12/2020	Olympic H'way	14:00-14:15	11	4	3	1	0	0	3	22	13	5	2	0	1	1	22
31	Tuesday	8/12/2020	5k N of Snowy M HW	15:45-16:00	10	6	4	0	1	1	1	23	10	10	2	0	0	1	23
32	Tuesday	8/12/2020	Yass Jcn	17:10-17:25	14	15	5	1	0	2	4	41	22	15	3	0	1	0	41
NORTHBOUND		SURBEY DETAILS					TRUCK TYPE					TRUCK SIZE							
No	DAY	DATE	LOCATION	TIME	Curtain Side	Reefer	Flat	Tanker	Tipper	Vehicle	Other	TOTAL	B Dbl	Semi	R2	R3	R4	TT	Tot
1	Monday	2/10/2011	Illawarra HW	8:20-8:35	11	1	3	2	6	0	4	27	5	11	6	0	0	5	27
2	Tuesday	3/10/2020	Goulburn McD	11:20-11:35	13	7	8	2	3	1	0	34	9	20	2	0	2	1	34
3	Tuesday	3/10/2020	Marulan	12:10-12:25	21	6	7	5	1	3	0	43	18	20	4	0	0	1	43
4	Thursday	12/11/2020	Mittagong	12:55-13:10	20	8	13	1	8	1	1	52	11	21	6	6	0	8	52
5	Thursday	12/11/2020	Mittagong	13:30-13:45	18	11	10	2	9	0	0	50	12	9	22	5	0	2	50
6	Thursday	3/10/2011	Picton Rd	13:50-14:05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Thursday	12/11/2020	Picton Rd	14:50-14:30	17	5	8	2	15	3	1	51	12	21	10	0	1	7	51
8	Thursday	12/11/2020	near Douglas Pk	18:40-18:55	19	6	3	6	2	3	3	42	21	12	8	0	1	0	42
9	Thursday	12/11/2020	near Picton Rd	19:05-19:20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Thursday	12/11/2020	near Yanderra	19:50-20:05	8	7	2	5	0	1	0	23	12	9	2	0	0	0	23
11	Thursday	12/11/2020	Canberra Turnoff	14:45-15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Thursday	12/11/2020	Yass & Gundagai	15:50-16:05	9	2	4	1	4	0	6	26	10	5	8	2	0	1	26
13	Thursday	12/11/2020	Yass & Gundagai	16:30-16:45	9	9	6	1	2	0	0	27	6	12	8	0	0	1	27
14	Thursday	12/11/2020	Gundagai	18:00-18:15	16	5	3	3	0	2	2	31	15	12	4	0	0	0	31
15	Thursday	12/11/2020	Near Wagga	19:10-19:25	9	5	5	0	0	0	0	19	6	12	1	0	0	0	19
16	Thursday	3/12/2020	Near Holbrook	19:50-20:05	12	2	3	0	1	1	1	20	9	9	0	1	0	1	20
17	Friday	4/12/2020	near Albury	6:00-6:15	5	5	4	2	1	1	2	20	5	5	6	2	1	1	20
18	Friday	4/12/2020	near Albury	6:20-6:35	13	2	6	0	3	0	4	28	8	10	5	1	1	3	28
19	Friday	4/12/2020	S of Wodonga	8:20-8:35	9	8	5	0	1	1	3	27	8	8	8	2	0	1	27
20	Friday	4/12/2020	near Wangaratta	9:10-9:25	6	3	3	2	2	2	1	19	5	6	5	1	0	2	19
21	Friday	4/12/2020	near Benalla	10:10-10:25	9	2	4	1	0	0	1	17	7	7	3	0	0	0	17
22	Tuesday	8/12/2020	S of Craigieburn	6:50-7:05	8	11	21	2	22	1	8	73	9	20	17	15	2	10	73
23	Tuesday	8/12/2020	N of Craigieburn	7:35-7:50	11	10	10	4	10	0	1	46	16	7	13	2	1	7	46
24	Tuesday	8/12/2020	Seymour Exit	8:40-8:55	8	2	6	2	6	0	2	26	7	10	3	1	0	5	26
25	Tuesday	8/12/2020	S of Shepparton Exit	9:05-9:20	13	12	11	3	3	0	2	44	10	17	10	4	1	2	44
26	Tuesday	8/12/2020	S of Shepparton Exit	9:20-9:35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Tuesday	8/12/2020	20km S of Benalla	10:20-10:35	3	5	4	0	2	0	2	16	5	5	2	1	0	3	16
28	Tuesday	8/12/2020	10 km S of Wangaratta	11:30-11:45	4	7	7	3	1	0	7	29	9	12	5	1	1	1	29
29	Tuesday	8/12/2020	Wodonga	13:25-13:40	20	11	10	2	1	1	4	49	11	21	14	2	1	0	49
30	Tuesday	8/12/2020	Olympic H'way	14:00-14:15	9	8	6	1	0	0	3	27	8	13	5	0	0	1	27
31	Tuesday	8/12/2020	5k N of Snowy M HW	15:45-16:00	11	11	1	1	0	1	2	27	13	9	4	0	0	1	27
32	Tuesday	8/12/2020	Yass Jcn	17:10-17:25	8	5	6	1	1	1	1	23	8	11	3	1	0	0	23

ATTACHMENT 2:
DETAILED TIMETABLE

DEP SYDNEY	NO	SM1	SS1	SC1	CM1	SM2	SS2	SM3	SC2	SM3	SS3	SC3	CM2	SS4	SC4
		Syd-Mel	Syd-SH	Syd-Can	Canb-Mel	Syd-Mel	Syd-SH	Syd-Mel	Syd-Can	Syd-Mel	Syd-SH	Syd-Can	Canb-Mel	Syd-SH	Syd-Can
		HSE	F Comm	HSE	HSE	HS REG	F Comm	HSE	HSE	HSE	F Comm	HSE	HSE	F Comm	HSE
Time		4 hr	1 hr 40m	1 hr 40 m	3 hr 20m	4 hr 30m	1 hr 40m	4 hr	1 hr 40 m	4 hr	1 hr 40m	1 hr 40 m	3 hr 20m	1 hr 40m	1 hr 40 m
Kms		850	150	290	710	850	150	850	290	850	150	290	710	150	290
Av Speed	KM	213	90	183	213	182	90	213	183	213	90	183	213	90	183
OLYMPIC PARK	0	14:00	14:15	14:30		14:45	15:15	15:30	15:45	16:00	16:15	16:30		16:45	17:00
MOOREBANK	30														
GLENFIELD	32	14:15	14:30	14:45		15:00	15:30	15:45	16:00	16:15	16:30	16:45		17:00	17:15
MACARTHUR	45														
MITTAGONG JCN	100	15:10	14:55	15:10		15:30	15:55	16:10	16:25	16:40	16:55	17:10		17:25	17:40
STH HIGHLANDS	120		via MV	15:18			via MV		16:33		via MV	17:18		via MV	17:48
EXETER JCN HSL)	140	15:25	14:52	15:25		15:42	15:52	16:25	16:40	16:55	16:52	17:25		17:22	17:55
BUNDANOON	150		15:05				16:05				17:05			17:35	
GOULBURN	210														
STH GUNNING	215	16:25		15:45	16:10	16:05		16:45	17:00	17:15		17:45	17:40		18:15
GUNDAROO	265			16:00	15:50				17:20			18:00	17:20		18:30
CANBERRA	290			16:10	15:40				17:30			18:10	17:10		18:40
YASS HSS	265	16:40			16:25	16:22		17:00		17:30			17:55		
WAGGA W JCN	450	17:20			17:05			17:50		18:10			18:35		
WAGGA WAGGA	460					16:45									
ALBURY	550	17:50			17:35	17:35		18:10		18:40			19:05		
SHEPPARTON	670					18:05									
WANGARATTA	600														
SHEPPARTON JCN	680	18:20			18:05	18:20		18:50		19:10			19:35		
SEYMOUR JCN	770	18:50			18:30	18:45		19:05		19:35			20:00		
OMR JCN/BIFT	**820**														
CAMBELLFIELD	834	19:20			18:50	19:05		19:20		19:50			20:20		
SOUTHERN CROSS	**850**	19:30			19:00	19:15		19:30		20:00			20:30		

DEP SYDNEY	NO	SR1	SS5	SC5	CM3	SM5	SS6	CM4	SC6	SM6	FF1	SS7	SC7	SR2	SM7	FF2
		Syd-Glb	Syd-SH	Syd-Can	Canb-Mel	Syd-Mel	Syd-SH	Canb-Mel	Syd-Can	Syd-Mel	Syd-Mel	Syd-SH	Syd-Can	Syd-Glb	Syd-Mel	Syd-Mel
		F Reg	F Comm	HSE	F Reg	HSE	F Comm	HSE	HSE	HSE	F Freight	F Comm	HSE	F Reg	HSE	F Freight
Time		1hr 50m	1 hr 40m	1 hr 40 m	4 hr	4 hr	1 hr 40m	3 hr 20m	1 hr 40 m	4 hr	10 hr 15m	1 hr 40m	1 hr 40 m	1hr 50m	4 hr	9 hr 45m
Kms		210	150	290	710	850	150	710	290	850	790	150	290	210	850	790
Av Speed	KM	115	90	183	178	213	90	213	183	213	77	90	183	115	213	81
OLYMPIC PARK	0	17:30	17:45	18:00		18:15	18:30		18:45	19:00		19:15	19:30	19:45	20:00	
MOOREBANK	30										17:05					18:15
GLENFIELD	32	17:45	18:00	18:15		19:30	18:45		19:00	19:15	17:15	19:30	19:45	20:00	20:15	18:25
MACARTHUR	45										via old					via old
MITTAGONG JCN	100	18:10	18:25	18:40		18:55	19:10		19:25	19:40		19:55	20:10	20:25	20:40	
STH HIGHLANDS	120	via MV	via MV	18:48			via MV		19:33			via MV	20:18	via MV		
EXETER JCN HSL)	140	18:22	18:50	18:55		19:05	19:35		19:40	19:50	20:00	20:20	20:25	20:42	20:50	21:10
BUNDANOON	150	18:35	19:03				19:48					20:33		20:55		
GOULBURN	210	19:25												21:45		
STH GUNNING	215			19:15	18:25	19:25		19:40	20:00	20:10	21:25		20:45		21:10	22:05
GUNDAROO	265			19:30	18:10			19:20	20:15				21:00			
CANBERRA	290			19:40	18:00			19:10	20:25				21:10			
YASS HSS	265				18:42	19:40		19:55		20:25	21:50				21:25	22:30
WAGGA W JCN	450					20:20		20:35		21:05	0:10				22:05	0:50
WAGGA WAGGA	460				19:32											
ALBURY	550				20:10	20:50		21:05		21:35	0:40				22:35	1:20
SHEPPARTON	670				21:00											
WANGARATTA	600															
SHEPPARTON JCN	680				21:05	21:20		21:35		22:05	1:45				23:05	2:25
SEYMOUR JCN	770				21:30	21:45		22:00		22:30	2:50				23:30	3:30
OMR JCN/BIFT	**820**										3:20					4:00
CAMBELLFIELD	834				21:50	22:05		22:20		22:50					23:50	
SOUTHERN CROSS	**850**				22:00	22:15		22:30		23:00					midn	

DEP SYDNEY	NO	FF3	SS8	SC8	SS9	FF3	FF4	FF5	FF6	FF7	SM8	FF8	SM9	FF9	FF10	FF11
		Syd-Mel	Syd-SH	Syd-Can	Syd-SH	Syd-Mel	Syd-Mel	Syd-Mel	Syd-Mel	Syd-Mel	S	Syd-Mel	S	Syd-Mel	Syd-Mel	Syd-Mel
		F Freight	F Comm	HSE	F Comm	F Freight	F Freight	F Freight	F Freight	F Freight	Sleeper	F Freight	Sleeper	F Freight	F Freight	F Freight
Time		8 hr 20m	1 hr 40m	1 hr 40 m	1 hr 40m	9 hr	9 hr	8 hr	8 hr	8 hr	8 hr 30 m	8 hr	8 hr 30 m	8 hr	8 hr	8 hr
Kms		790	150	290	150	790	790	790	790	790	850	790	850	790	790	790
Av Speed	KM	95	90	183	90	88	88	99	99	99	100	99	100	99	99	99
OLYMPIC PARK	0		20:30	21:00	21:15						22:00		22:30			
MOOREBANK	30	20:10				19:45	20:00	21:25	21:40	21:55		22:20		22:50	23:05	23:20
GLENFIELD	32	20:20	20:30	21:15	21:30	19:55	20:10	21:35	21:50	22:05	22:20	22:35	22:50	23:00	23:15	23:30
MACARTHUR	45					via old	via old									
MITTAGONG JCN	100	20:40	20:55	21:40	21:55	22:00	22:15	22:15	22:30	22:45	23:00	23:15	23:30	23:40	23:55	0:10
STH HIGHLANDS	120		via MV	21:48	via MV						23:20	23:35	23:50	midn	0:15	0:25
EXETER JCN HSL)	140	21:25	21:20	21:55	22:20	22:30	22:45	23:00	23:15	23:30	23:45	midn	0:15	0:25	0:40	0:55
BUNDANOON	150		21:33		22:33											
GOULBURN	210															
STH GUNNING	215	22:35		22:15		23:15	23:30	23:45	midn	0:15	0:30	0:15	1:00	1:10	1:25	1:40
GUNDAROO	265			22:30												
CANBERRA	290			22:40												
YASS HSS	265	23:00				23:45	midn	0:15	0:30	0:45	1:00	0:45	1:30	1:40	1:55	2:10
WAGGA W JCN	450	1:20				1:05	1:20	1:35	1:50	2:05	2:20	2:05	2:50	3:00	3:15	3:30
WAGGA WAGGA	460															
ALBURY	550	1:50				2:35	2:50	3:05	3:20	3:35	3:50	4:05	4:20	4:30	4:45	5:00
SHEPPARTON	670															
WANGARATTA	600															
SHEPPARTON JCN	680	2:55				3:40	3:55	4:10	4:25	4:40	4:55	5:10	5:25	5:35	5:50	6:05
SEYMOUR JCN	770	4:00				4:45	5:00	5:15	5:30	5:45	6:00	6:15	6:30	6:40	6:55	7:10
OMR JCN/BIFT	**820**	4:30				5:15	5:30	5:45	6:00	6:15		6:45		7:20	7:30	7:45
CAMBELLFIELD	834										6:20	6:05	6:50			
SOUTHERN CROSS	**850**										6:30		7:00			

DEP SYDNEY	NO	FF12	FF13		FF14	FF15	SM10	SR2	SC9	SM11	CM5	SS10	SC10	SM12	SM13	SS11
		Syd-Mel	Syd-Mel		Syd-Mel	Syd-Mel	Syd-Mel	Syd-Glb	Syd-Can	Syd-Mel	Canb-Mel	Syd-SH	Syd-Can	Syd-Mel	Syd-Mel	Syd-SH
		F Freight	F Freight		F Freight	F Freight	HSE	F Reg	HSE	HSE	HSE	F Comm	HSE	HSE	HS REG	F Comm
Time		8 hr	8 hr		9 hr 45m	9 hr	4 hr	1hr 50m	1 hr 40 m	4 hr	3 hr 20m	1 hr 40m	1 hr 40 m	4 hr	4 hr 30m	1 hr 40m
Kms		790	790		790	790	850	210	290	850	710	150	290	850	850	150
Av Speed	KM	99	99		81	88	213	115	183	213	213	90	183	213	182	90
OLYMPIC PARK	0						5:45	6:15	6:30	6:45		7:00	7:15	7:30	7:45	8:00
MOOREBANK	30	23:35	23:50		4:00	5:00										
GLENFIELD	32	23:45	Midnt		4:10	5:10	6:00	6:30	6:45	7:00		7:15	7:30	7:45	8:00	8:15
MACARTHUR	45															
MITTAGONG JCN	100	0:25	0:40		5:10	6:05	6:25	6:55	7:10	7:25		7:40	7:55	8:10	8:30	8:40
STH HIGHLANDS	120	0:40						7:05	7:18			via MV	8:03			via MV
EXETER JCN HSL)	140	1:10	1:25		5:30	6:40	6:35	7:12	7:25	7:35		8:05	8:10	8:20	8:42	9:05
BUNDANOON	150							via old								
GOULBURN	210							8:15								
STH GUNNING	215	1:55	2:10		6:15	7:15	6:55		7:45	7:55	8:10		8:30	8:40	9:05	
GUNDAROO	265								8:00		7:50		8:45			
CANBERRA	290								8:10		7:40		8:55			
YASS HSS	265	2:25	2:40		7:15	7:50	7:10			8:10	8:25			8:55	9:22	
WAGGA W JCN	450	3:45	4:00				7:50			8:50	9:05			9:35		
WAGGA WAGGA	460				9:00	9:20									9:45	
ALBURY	550	5:15	5:30		10:25	10:40	8:20			9:20	9:35			10:05	10:35	
SHEPPARTON	670														11:05	
WANGARATTA	600				11:05	11:20										
SHEPPARTON JCN	680	6:20	6:35				8:50			9:50	10:05			10:35	11:20	
SEYMOUR JCN	770	7:25	7:40		13:05	13:20	9:15			10:15	10:30			11:00	11:45	
OMR JCN/BIFT	**820**	7:55	8:20		13:45	14:00										
CAMBELLFIELD	834						9:35			10:35	10:50			11:20	12:05	
SOUTHERN CROSS	850						9:45			10:45	11:00			11:30	12:15	

DEP SYDNEY	NO	CM6	SC11	SM14	SR3	SS12	SC12	CM7	FF16	SM15	SC12	SS13	SM16	SR4	CM8	SS14
		Canb-Mel	Syd-Can	Syd-Mel	Syd-Glb	Syd-SH	Syd-Can	Canb-Mel	Syd-Mel	Syd-Mel	Syd-Can	Syd-SH	Syd-Mel	Syd-Glb	Canb-Mel	Syd-SH
		HSE	HSE	HSE	F Reg	F Comm	HSE	HSE	F Freight	HSE	HSE	F Comm	HSE	F Reg	HSE	F Comm
Time		3 hr 20m	1 hr 40 m	4 hr	1hr 50m	1 hr 40m	1 hr 40 m	3 hr 20m	10 HR	4 hr	1 hr 40 m	1 hr 40m	4 hr	1hr 50m	3 hr 20m	1 hr 40m
Kms		710	290	850	210	150	290	710	790	850	290	150	850	210	710	150
Av Speed	KM	213	183	213	115	90	183	213	79	213	183	90	213	115	213	90
OLYMPIC PARK	0		8:15	8:30	8:45	9:00	9:15			10:00	10:15	10:30	11:00	11:15		11:30
MOOREBANK	30								9:25							
GLENFIELD	32		8:30	8:45	9:00	9:15	9:30		9:35	10:15	10:30	10:45	11:15	11:30		11:45
MACARTHUR	45															
MITTAGONG JCN	100		8:55	9:10	9:25	9:40	9:55		11:00	10:40	10:55	11:10	11:40	11:55		12:10
STH HIGHLANDS	120		9:03		9:35	via MV	10:03				11:03	via MV		12:05		via MV
EXETER JCN HSL)	140		9:10	9:20	9:42	10:05	10:10		11:20	10:50	11:10	11:35	11:50	12:42		12:35
BUNDANOON	150				9:52							11:48		12:52		12:48
GOULBURN	210				10:45									13:15		
STH GUNNING	215	9:20	9:30	9:40			10:30	10:40	12:15	11:10	11:30		12:10		12:25	
GUNDAROO	265	9:00	9:45				10:45	10:20			11:45				12:05	
CANBERRA	290	8:50	9:55				10:55	10:10			11:55				11:55	
YASS HSS	265			9:55				10:55	12:50	11:25			12:25		12:40	
WAGGA W JCN	450	10:20		10:35				11:35		12:05			13:05		13:20	
WAGGA WAGGA	460								14:10							
ALBURY	550	10:40		11:05				12:05	15:10	12:35			13:35		13:50	
SHEPPARTON	670															
WANGARATTA	600								15:50							
SHEPPARTON JCN	680	11:25		11:35				12:50		13:05			14:05		14:20	
SEYMOUR JCN	770	11:50		12:00				13:15		13:30			14:30		14:45	
OMR JCN/BIFT	**820**								17:25							
CAMBELLFIELD	834	12:10		12:20				13:35		13:50			14:50		15:05	
SOUTHERN CROSS	850	12:20		12:30				13:45		14:00			15:00		15:15	

DEP SYDNEY	NO	SR5	SC13	SM17	SS15	CM9	SM18	SR6	SC14
		Syd-Wag	Syd-Can	Syd-Mel	Syd-SH	Canb-Mel	Syd-Mel	Syd-Glb	Syd-Can
		F Reg	HSE	HSE	F Comm	HSE	HSE	F Reg	HSE
Time		4 hr 15m	1 hr 40 m	4 hr	1 hr 40m	3 hr 20m	4 hr	1hr 50m	1 hr 40 m
Kms		460	290	850	150	710	850	210	290
Av Speed	KM	108	183	213	90	213	213	115	183
OLYMPIC PARK	0	11:45	12:00	12:15	12:30		13:00	13:15	13:30
MOOREBANK	30								
GLENFIELD	32	12:00	12:15	12:15	12:45		13:15	13:30	13:45
MACARTHUR	45								
MITTAGONG JCN	100	12:25	12:40	12:55	13:10		13:40	13:55	14:25
STH HIGHLANDS	120		12:48		via MV			14:05	14:33
EXETER JCN HSL)	140	12:50	12:55	13:05	13:35		13:50	14:42	14:40
BUNDANOON	150				13:48			14:52	
GOULBURN	210							15:15	
STH GUNNING	215	13:10	13:30	13:25		13:55	14:10		15:00
GUNDAROO	265		13:45			13:35			15:15
CANBERRA	290		13:55			13:25			15:25
YASS HSS	265			13:40		14:10	14:25		
WAGGA W JCN	450			14:20		14:50	15:05		
WAGGA WAGGA	460	16:00							
ALBURY	550			14:50		15:20	15:35		
SHEPPARTON	670								
WANGARATTA	600								
SHEPPARTON JCN	680			15:20		15:50	16:05		
SEYMOUR JCN	770			15:45		16:15	16:30		
OMR JCN/BIFT	**820**								
CAMBELLFIELD	834			16:05		16:35	16:50		
SOUTHERN CROSS	850			16:15		16:45	17:00		

CODE

STH GUNNING	Station on High Speeed Line
WANGARATTA	Other Station / Junction
16:45 Train Stops	17:00 Train does not Stop
(blue)	High Speed Syd - Melb Trains
(peach)	High Speed Syd-Can Trains
(light blue)	High Speed Canb - Melb Trains
(green)	Fast Syd-Mel Trains
(light green)	Fast Regional Trains
(yellow)	Fast Commuter Trains
(grey)	Sleeper Trains
(orange)	Fast Freights
(purple)	Fast Suburban
(red)	Trains Terminate Here
(dark red)	Maintenance Window

REFERENCES

i ACIL Allen Consulting, The Economic Significance of the Australian Logistics Industry, 2014

ii https://www.environment.gov.au/system/files/resources/6686d48f-3f9c-448d-a1b7-7e410fe4f376/files/nggi-quarterly-update-mar-2019.pdf

iii https://www.projectusinfrastructure.com.au/wp-content/uploads/2018/10/123.png

iv https://media.apnarm.net.au/media/images/2017/06/12/trucksmain-zcm75r2f27tg7aq9e02_ct300x225.jpeg

v https://www.scmp.com/news/china/politics/article/3098444/china-planning-high-speed-rail-freight-network-help-e-commerce

vi https://www.railwaygazette.com/freight/road-trailers-carried-from-germany-to-lithuania-by-rail/56529.article

vii https://www.railfreight.com/interoperability/2020/07/21/rail-baltica-could-lift-5000-trucks-of-the-road-per-day/

viii https://www.railfreight.com/interoperability/2020/07/21/rail-baltica-could-lift-5000-trucks-of-the-road-per-day/

ix https://www.railwaygazette.com/freight/lithuanian-freight-operator-launches-polish-business/56913.article

x See Hughes, Murray (2020): "The Second Age of Rail: A History of High-Speed Trains". P 189.

xi https://www.youtube.com/watch?v=AN1eqwBR-Pk

xii https://www.railwaygazette.com/traction-and-rolling-stock/russian-railways-puts-93-mw-diesel-locomotives-into-service/55622.article

xiii https://timesofindia.indiatimes.com/city/vadodara/railways-readies-for-wag-12-indias-most-powerful-locomotive/articleshow/77420404.cms

xiv https://www.railjournal.com/locomotives/db-cargo-awards-siemens-400-bi-mode-locomotive-framework-contract/

xv https://www.railway-technology.com/projects/alameda/

xvi https://www.chinadaily.com.cn/a/201910/28/WS5db65b34a310cf3e35573f68.html

xvii https://www.hindawi.com/journals/jat/2019/9536273/

xviii https://www.scmp.com/economy/china-economy/article/3097719/chinas-rail-shipments-europe-set-records-demand-surges

xix See https://lohr.fr/lohr-railway-system/ for explanation of Modalohr system

xx https://www.railfreight.com/intermodal/2020/07/30/three-new-rolling-highways-in-france/

xxi https://www.railwaygazette.com/freight/brittany-ferries-to-launch-cherbourg-spain-rail-motorway-service/55843.article

xxii See https://www.youtube.com/watch?v=iZ4nshHnplo for full description of the terminal

xxiii https://www.youtube.com/watch?v=l9RflYoNWBI

xxiv https://www.railjournal.com/technology/construction-begins-on-calais-intermodal-terminal/

xxv https://www.railwaygazette.com/business/cargobeamer-to-open-erfurt-wagon-factory/61340.article

xxvi See https://www.railjournal.com/freight/bls-cargo-launches-gotthard-cargobeamer-intermodal-service/

xxvii https://www.worldcargonews.com/news/news/duisport-and-cargobeamer-to-deploy-cboxx-63531

xxviii https://www.flexiwaggon.se

xxix https://www.railwaygazette.com/57868.article?utm_source=RGInewsletter&utm_medium=email&utm_content=Story%205&utm_campaign=RGInewsletter-%2020201127

xxx https://www.railjournal.com/freight/indian-railways-launches-electric-double-stack-container-operation/

xxxi https://investment.infrastructure.gov.au/files/reports_and_key_studies/Future_of_Intermodal_Terminals.pdf

xxxii https://www.railexpress.com.au/divergent-future-intermodal-australia/

xxxiii https://www.nswports.com.au/enfield-intermodal-logistics-centre

xxxiv https://www.railexpress.com.au/wp-content/uploads/2019/11/Photo-Qube-1.jpg

xxxv https://committee4wagga.com.au/riverina-intermodal-freight-and-logistics-hub

xxxvi https://1worpv3xudfc4dl4ol1hi7fz-wpengine.netdna-ssl.com/wp-content/uploads/2020/06/IR_897_The_Case_for_Inland_Rail.pdf

xxxvii https://thenewdaily.com.au/news/2023/03/01/inland-rail-over-budget-behind-schedule/

xxxviii https://www.thedcn.com.au/news/logistics-and-supply-chain/nsw-government-approves-inland-rail-projects/

xxxix https://www.graincentral.com/news/artc-nsw-farmers-issue-guide-for-those-on-inland-rail-route/

xl https://pacificnational.com.au/pacific-national-investing-heavily-in-critical-rail-freight-infrastructure-and-rollingstock/

xli https://qube.com.au/wp-content/uploads/2022/12/Loco-annoucement-201222.pdf
xlii https://www.railjournal.com/freight/aurizon-re-enters-inter-state-intermodal-market-with-tge-contract/
xliii https://www.etegl.org/understanding-european-trains/sharing-the-railroad-passenger-and-freight-trains-in-europe
xliv https://company.sbb.ch/en/media/background-information/gotthard-base-tunnel.html
xlv https://www.planning.nsw.gov.au/-/media/58FE84EAD2EE4669AEA198E7F7BF0AF2.ashx