

High-Speed Rail in the Sydney – Melbourne Corridor



Presentation to Rail Futures Inc. 24 February 2023

Dr Garry Glazebrook & Dr Ross Lowrey



Contents



HSR and Decentralisation

Achieving HSR in Australia

Why the Sydney – Melbourne Corridor?

A Staged Approach

Maximising the Benefits

Conclusions

Appendix: Canberra as a Stepping Stone

Five Key Propositions

Australia's population is over-concentrated in Sydney, Melbourne and Brisbane.

Decentralisation is needed to combat persistent problems like housing affordability, congestion, the high cost of infrastructure in our major cities, and the lack of opportunities in our regional areas.

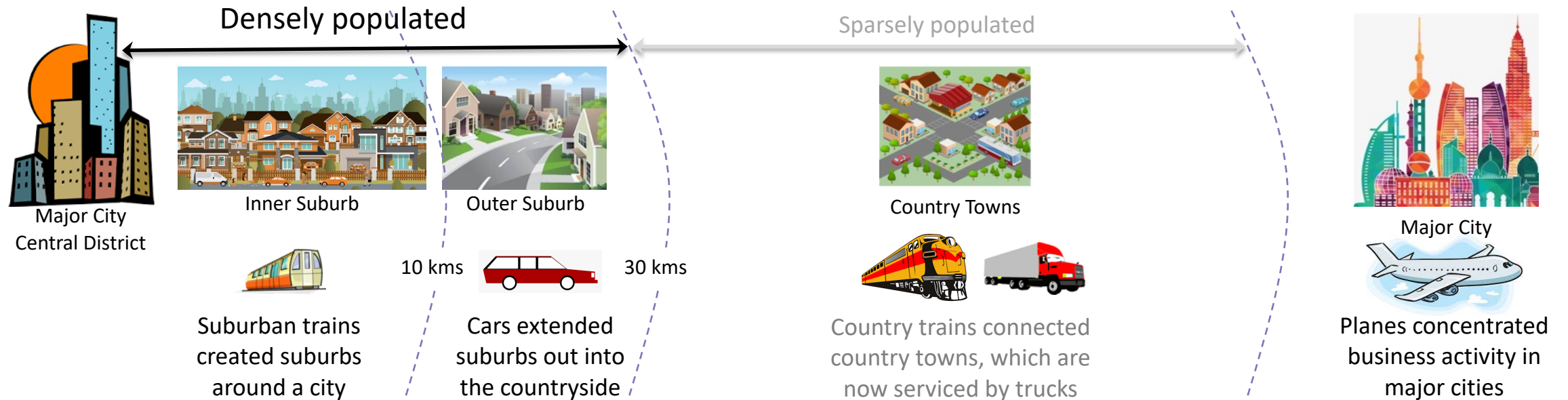
Our current transport options reinforce our current population distribution. Roads are too slow to change current accessibility patterns. And air travel further reinforces existing capital cities – it is faster to fly from Sydney to Melbourne than to drive from Sydney to Goulburn or Melbourne to Shepparton.

High-speed rail can put two thirds of Australians within two hours of our three major capitals, and can connect our regional communities. This is essential to any serious plan to decentralize. And investment in rail can improve energy efficiency and help decarbonize our transport system.

Continuing our current transport path is expensive. But high-speed rail will also require large scale investment. It must therefore be built in manageable stages, as part of a long-term plan, and integrated with our existing rail systems.

HSR and Decentralisation

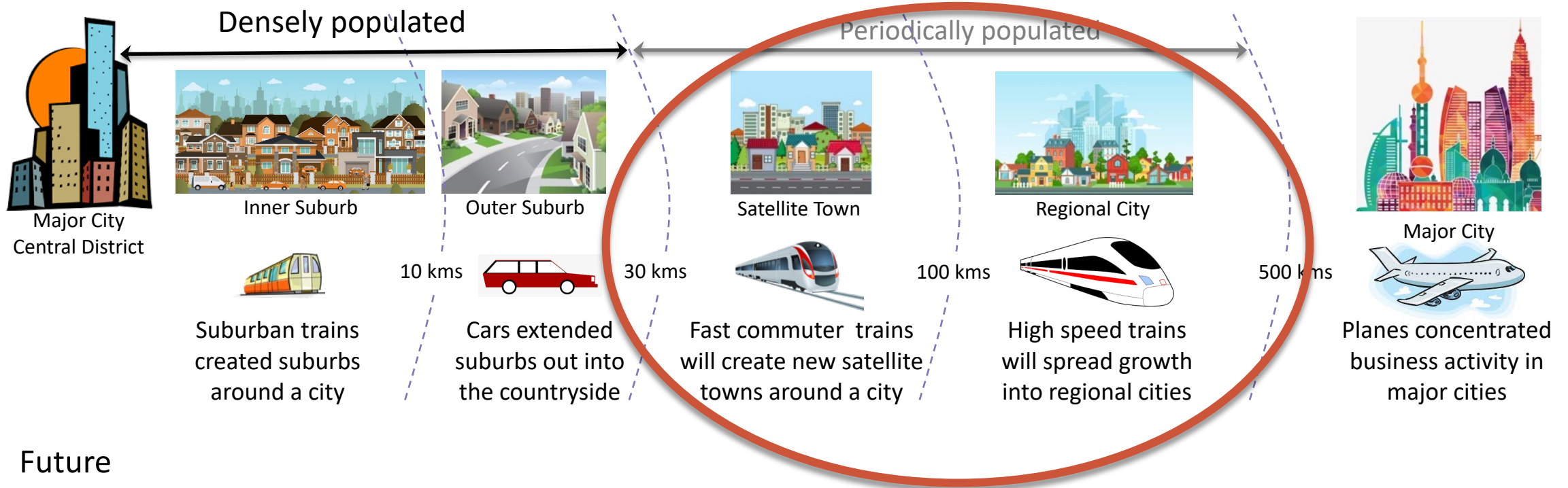
Australia is a highly-urbanised country dominated by its large cities



71% of Australians live in a few major cities, with sparse population in regional areas

- Originally towns were settled for access to natural resources, regardless of distance
- Manufacturing concentrated growth in capital cities for access to people and ports
- Suburban trains and cars extended suburban growth well out of the city
- Service industries have concentrated jobs in central city districts that are connected to other cities by planes

Faster rail connections will spread settlement out of our cities



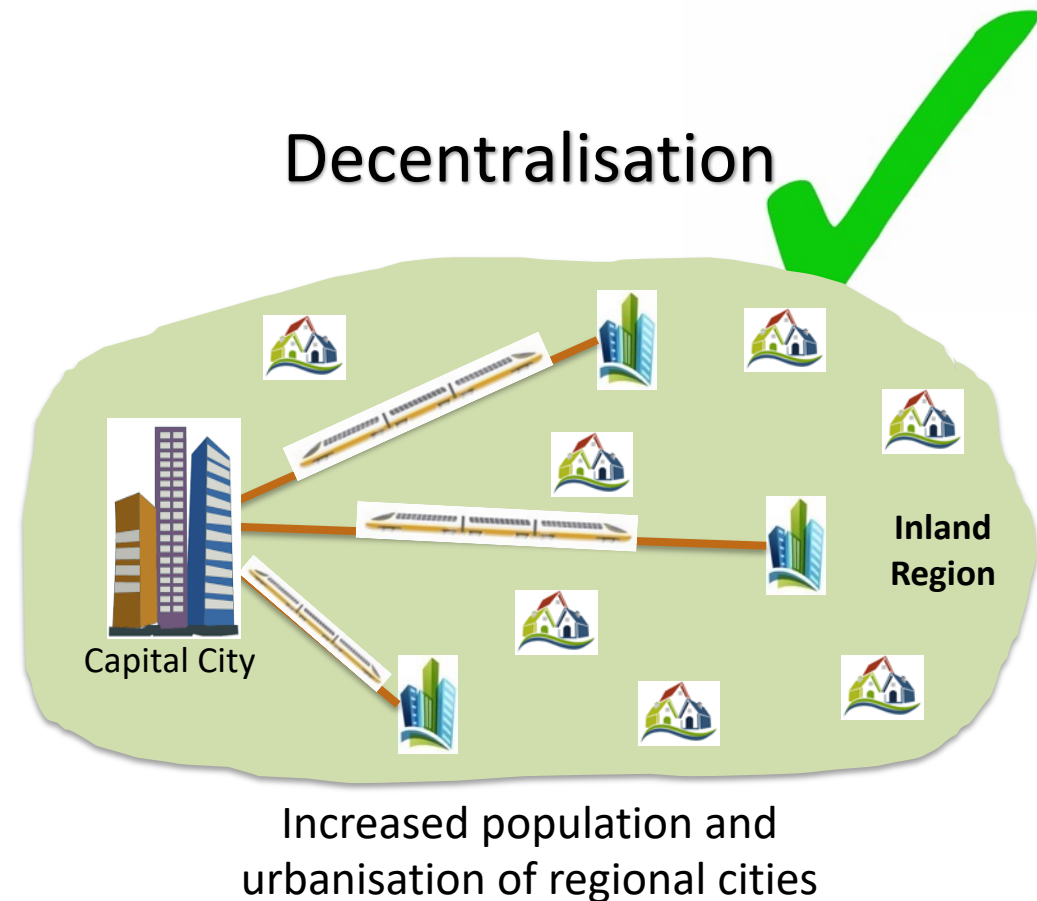
Future

- Fast regional commuter trains will allow people to move to new **satellite towns and cities** for a less-pressured lifestyle
- High speed rail will open **large regional cities** as alternative locations for businesses to operate, starting a natural cycle of growth that attracts more people and businesses into the city
- **HSR does not mean longer daily commutes, but rather makes it viable for occasional trips to the capital cities for work, education, specialist services or maintaining social connections with friends and family**

Decentralisation will deliver a stronger economy and higher liveability

Networks of cities drive greater growth

- People and goods can move efficiently to where they are needed most
 - congestion creates a drag on economic growth
- Businesses can relocate to secondary cities
 - to reduce high costs associated with labour, raw materials and land
- The network creates stronger value chains
 - The network effect opens more connections and opportunities for businesses in each city
- Networks have greater resilience
 - putting the “eggs in different baskets”



Achieving HSR in Australia

Japan's Shinkansen initiated high-speed rail in 1964

- Built as a stand-alone system as the existing railway was narrow gauge

France, Germany, Italy, Spain and other countries followed

- They built on existing rail networks, adding high-speed segments.
- Provides access to city centres and to cities beyond the HSR network.

There are advantages in a stand-alone HSR system

- Fewer integration issues and less complexity

But there are problems with this approach in Australia:

- The "all or nothing" approach limits short-term benefits
- Massive expenditure is required for the first complete line
- There are no benefits for faster freight

Budget and other constraints are likely to mean HSR will never get off the ground unless developed in manageable steps. This means integration with existing rail networks

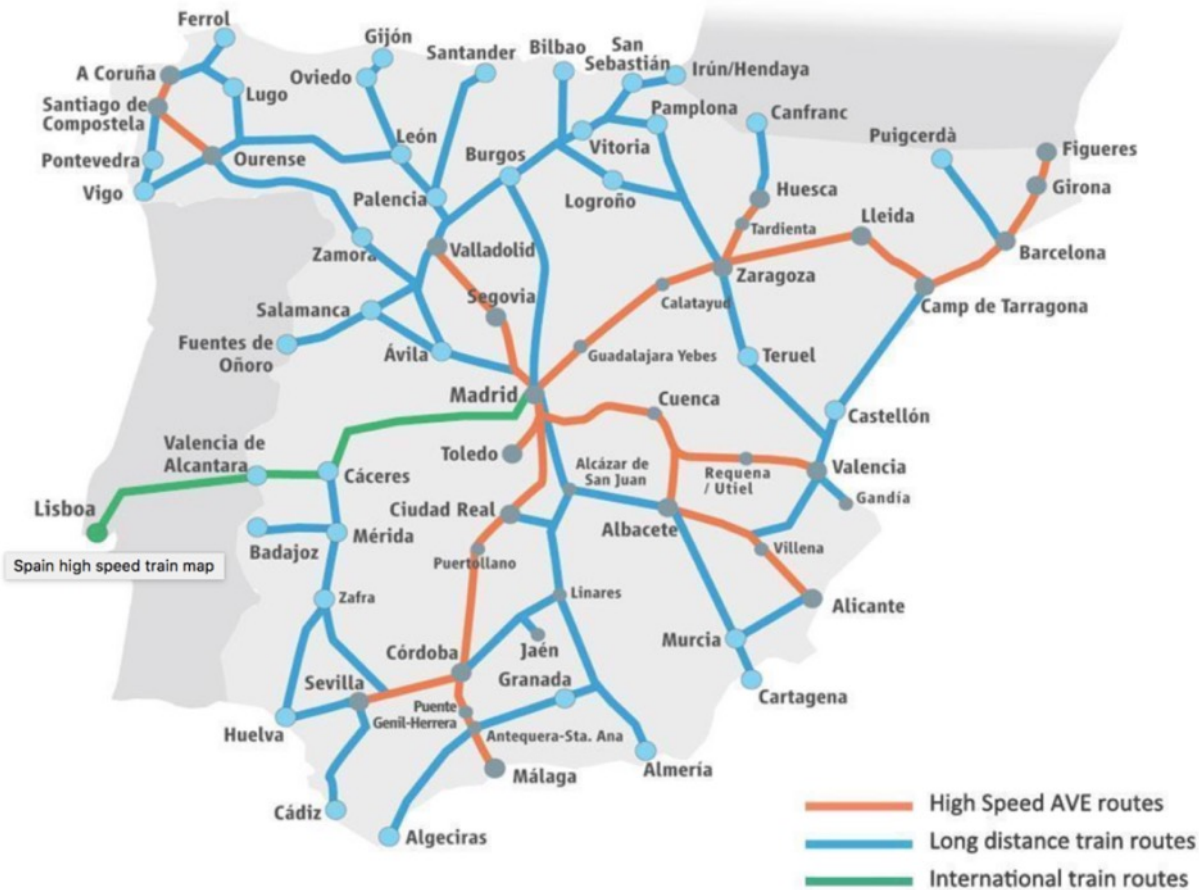


Shinkansen (Top) and Gare de Lyon station in Paris (below)



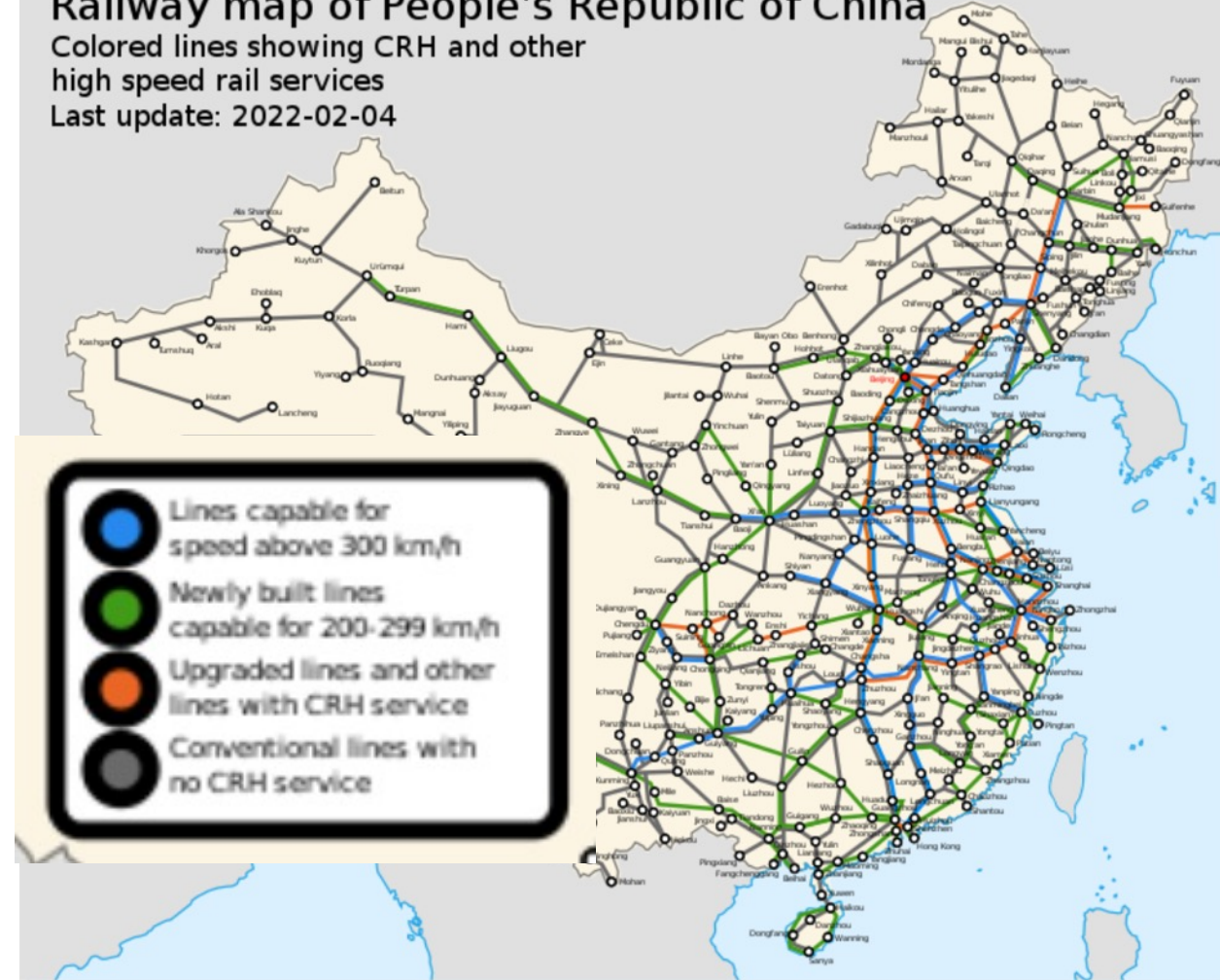
Mix of High Speed and Faster Rail adopted overseas

High Speed and Long Distance routes



Spain

Railway map of People's Republic of China Colored lines showing CRH and other high speed rail services Last update: 2022-02-04

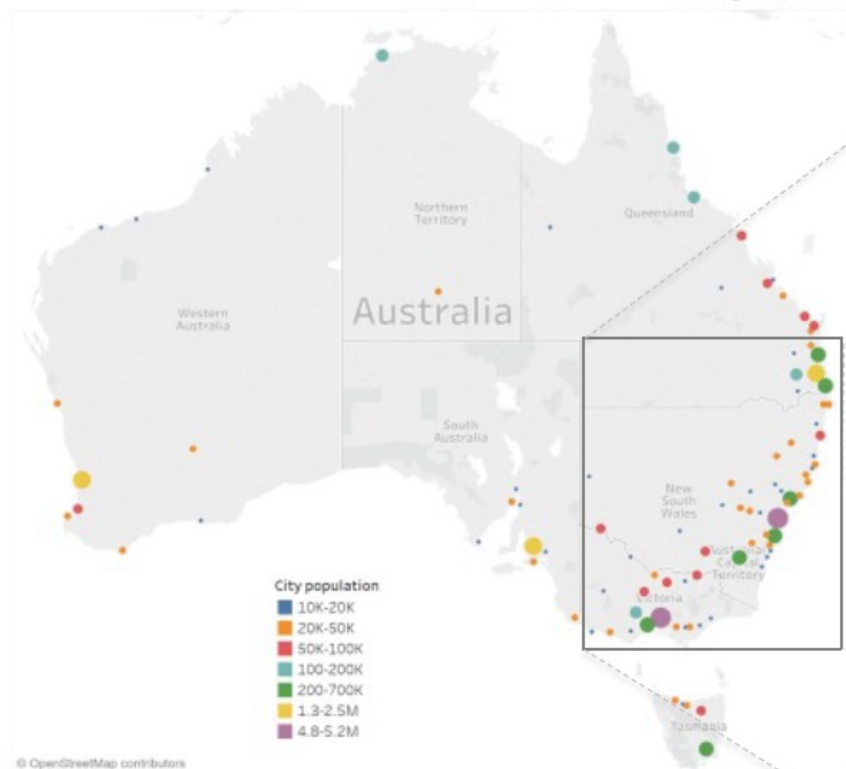


China

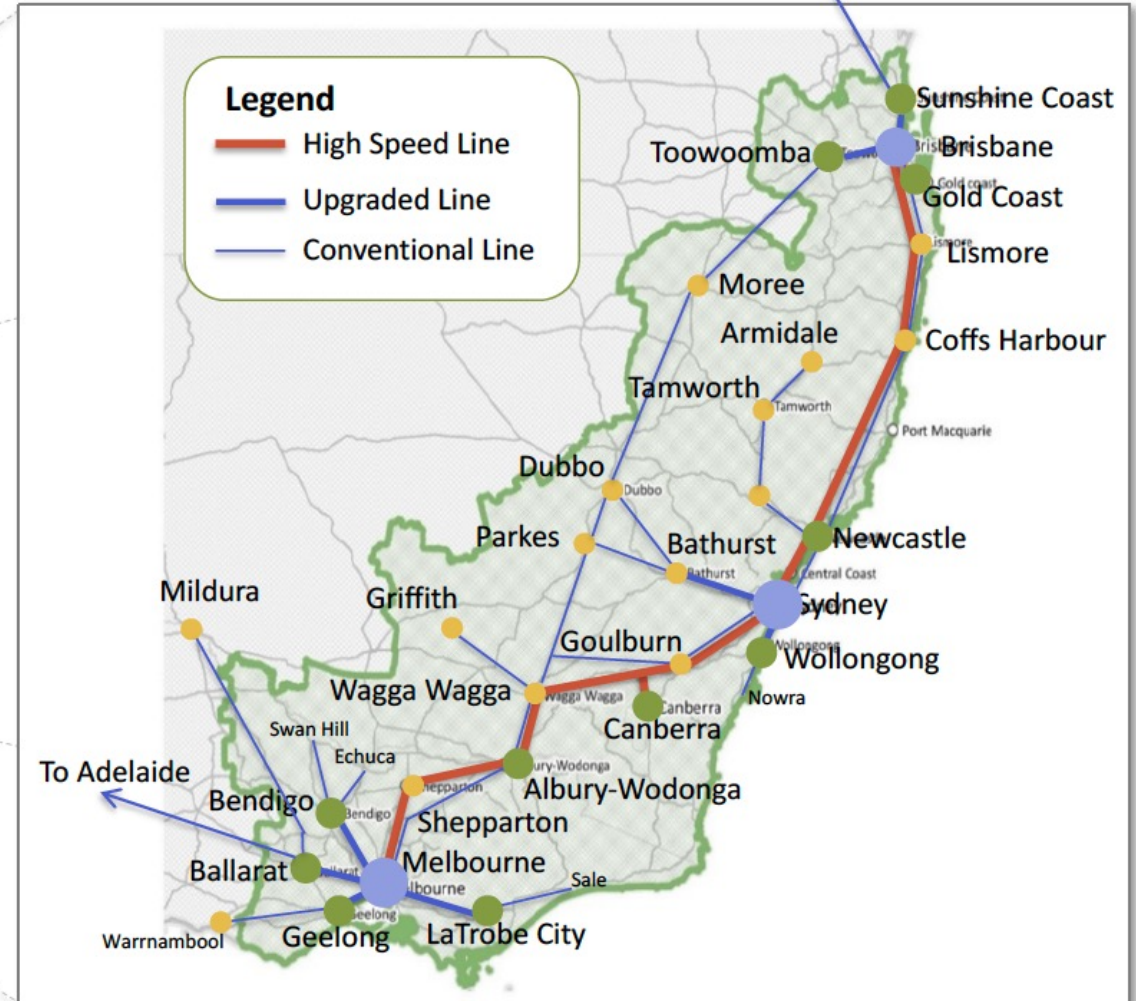
We need to build on the existing settlement pattern and rail network

Australian cities and larger towns by population, 2017

chartingtransport.com

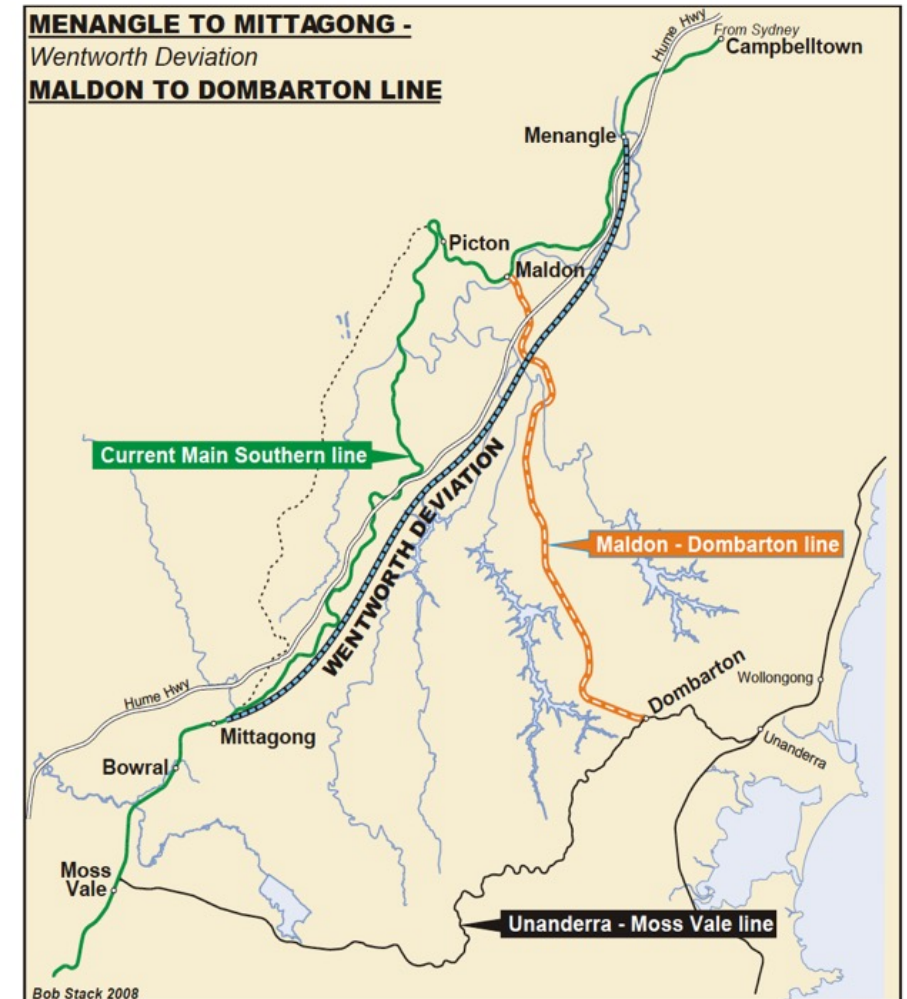


A national rail plan defines future regional settlement and economic growth



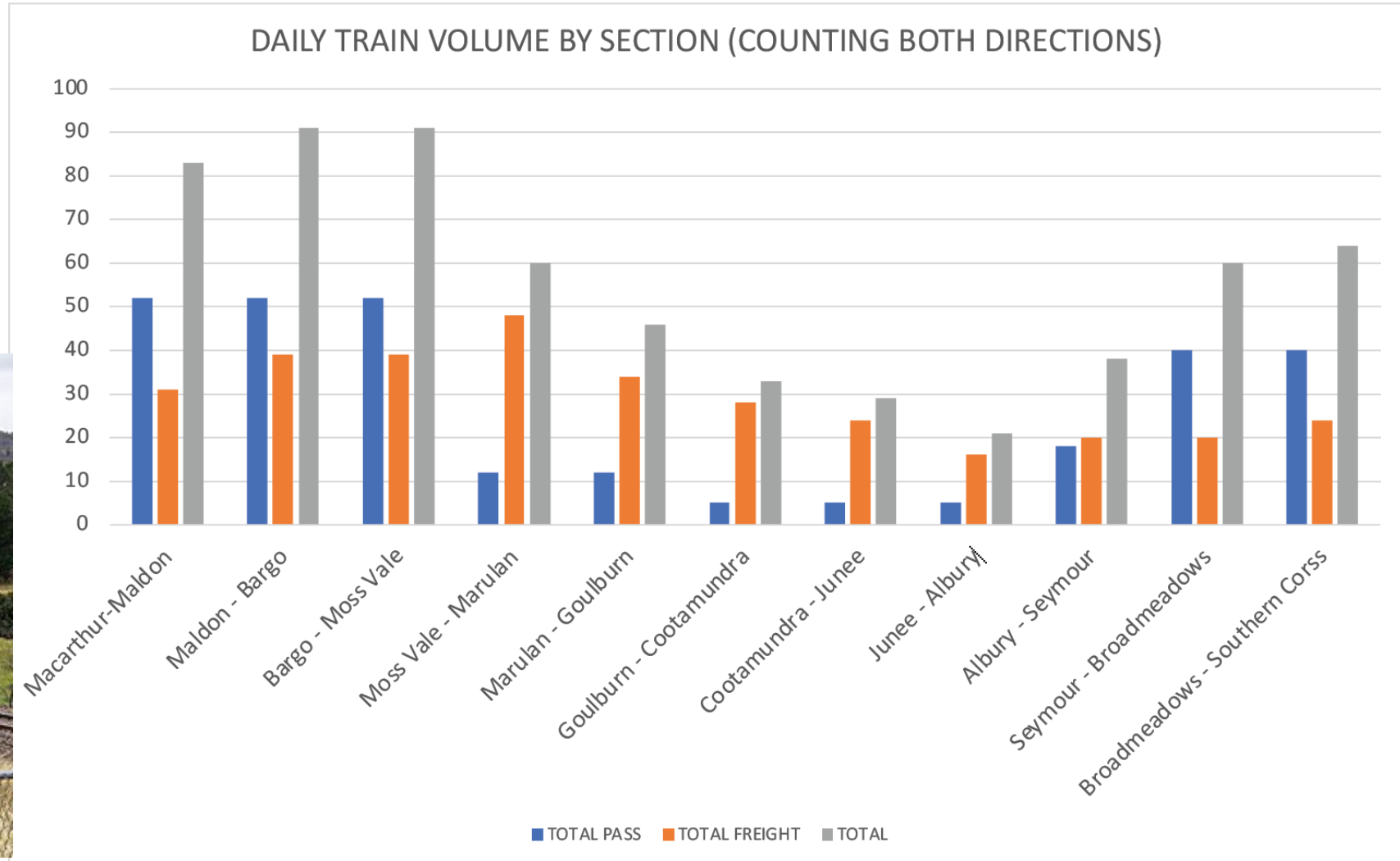
Why the Sydney – Melbourne Rail Corridor?

- Links Australia's two largest cities, the National Capital, and smaller – medium sized cities
- Current rail infrastructure based on 19th and early 20th century alignments, needs upgrading
- Carries substantial freight as well as passenger traffic
- Significant opportunities for decentralisation



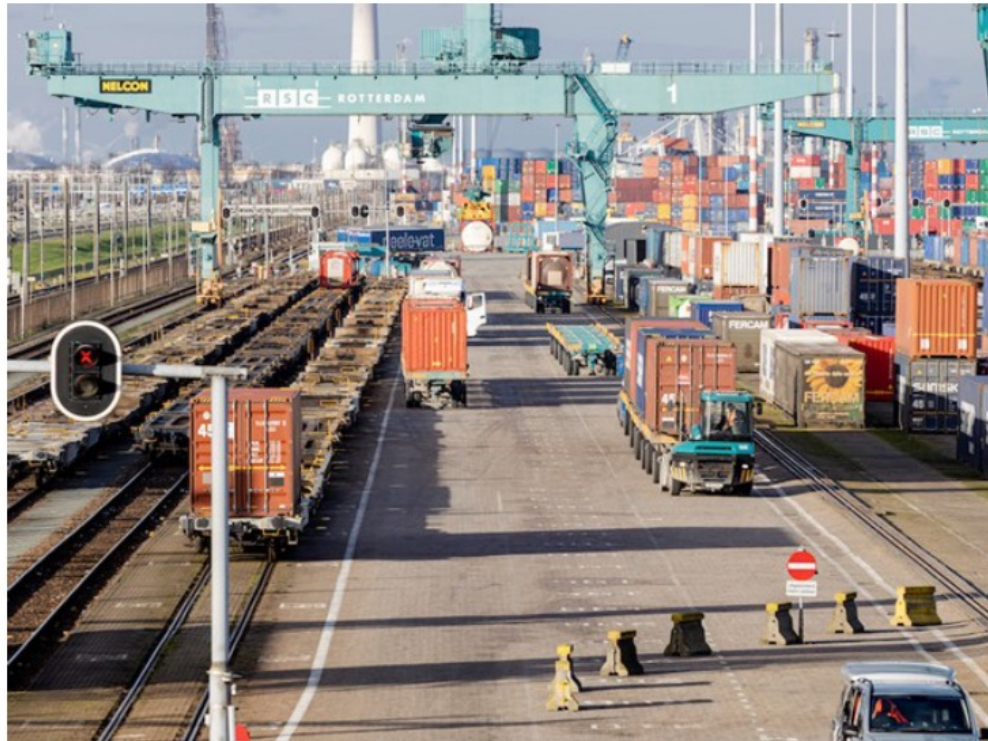
Current Rail Traffic in the Corridor

- Relatively few longer distance passenger trains in the Corridor
- However, significant freight and local passenger services in parts of the corridor
- Ninety trains a day between Maldon and Moss Vale.



Future of Rail Freight

- In addition, freight traffic may build up with major new investment at the Moorebank Intermodal Terminal, and recent announcements by Qube, Pacific National and Aurizon of purchases of new locomotives and rollingstock for intermodal freight trains.

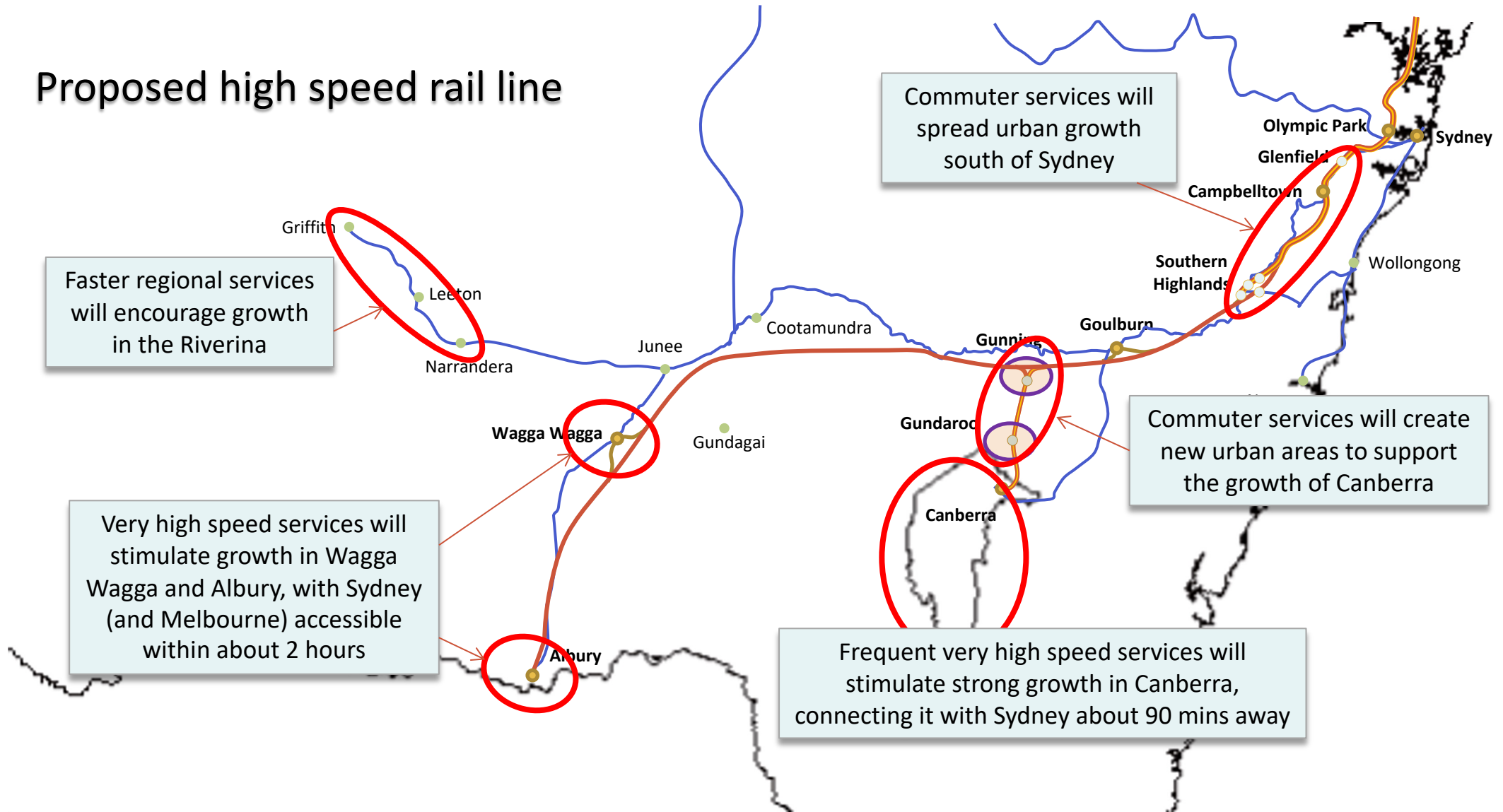


The Moorebank Logistics and Intermodal Terminal being built on 240 ha with strategic access to major rail and road corridors. It has a capacity 1.5 million domestic and international containers p.a., along with automated container transfer cranes^{xv}

Qube has ordered 12 new high-power locomotives to handle interstate intermodal container trains between Sydney and Melbourne

Unlocking growth potential along the corridor and beyond

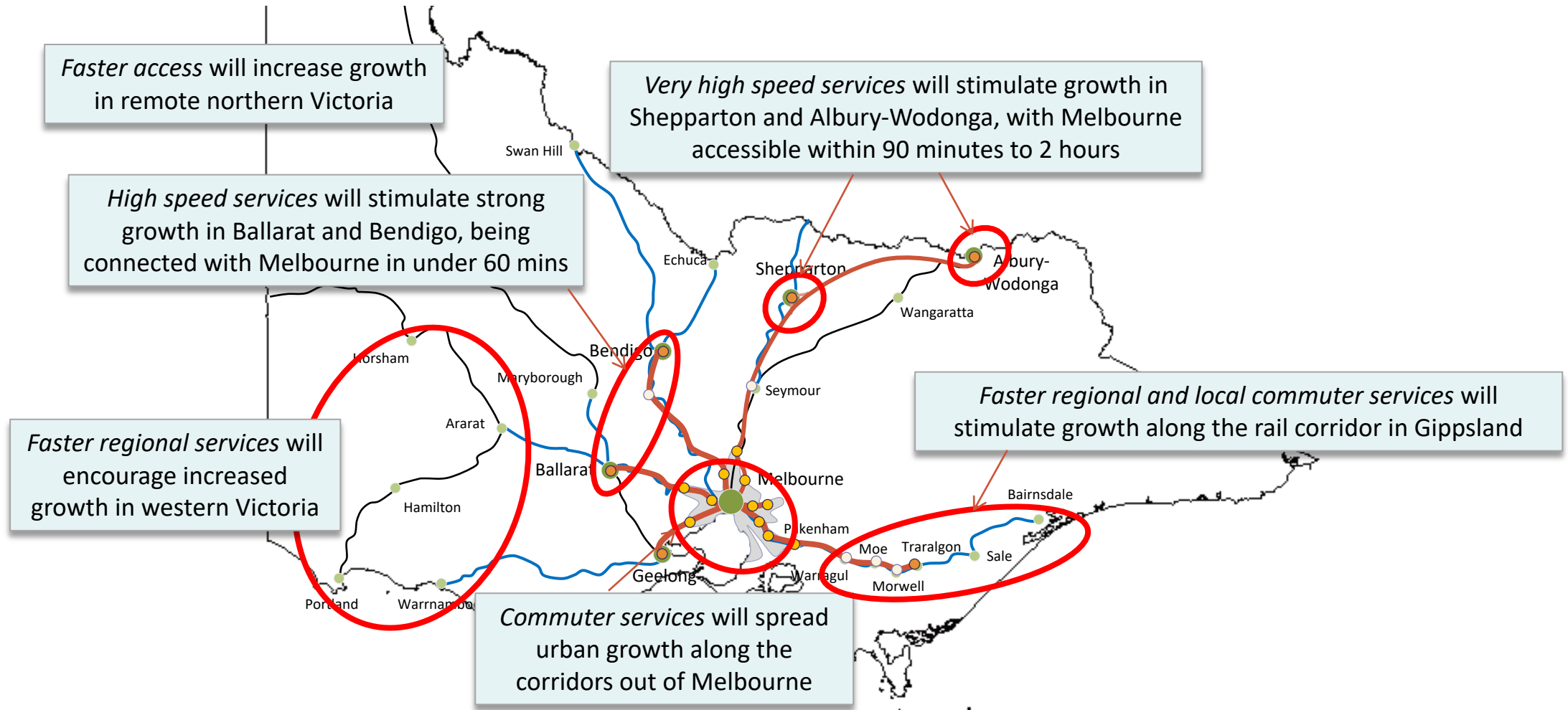
Proposed high speed rail line



High speed services will also unlock growth across Victoria

Upgrading or replacing the current broad gauge lines with higher speed standard gauge lines will allow passenger services to operate on all lines across Victoria

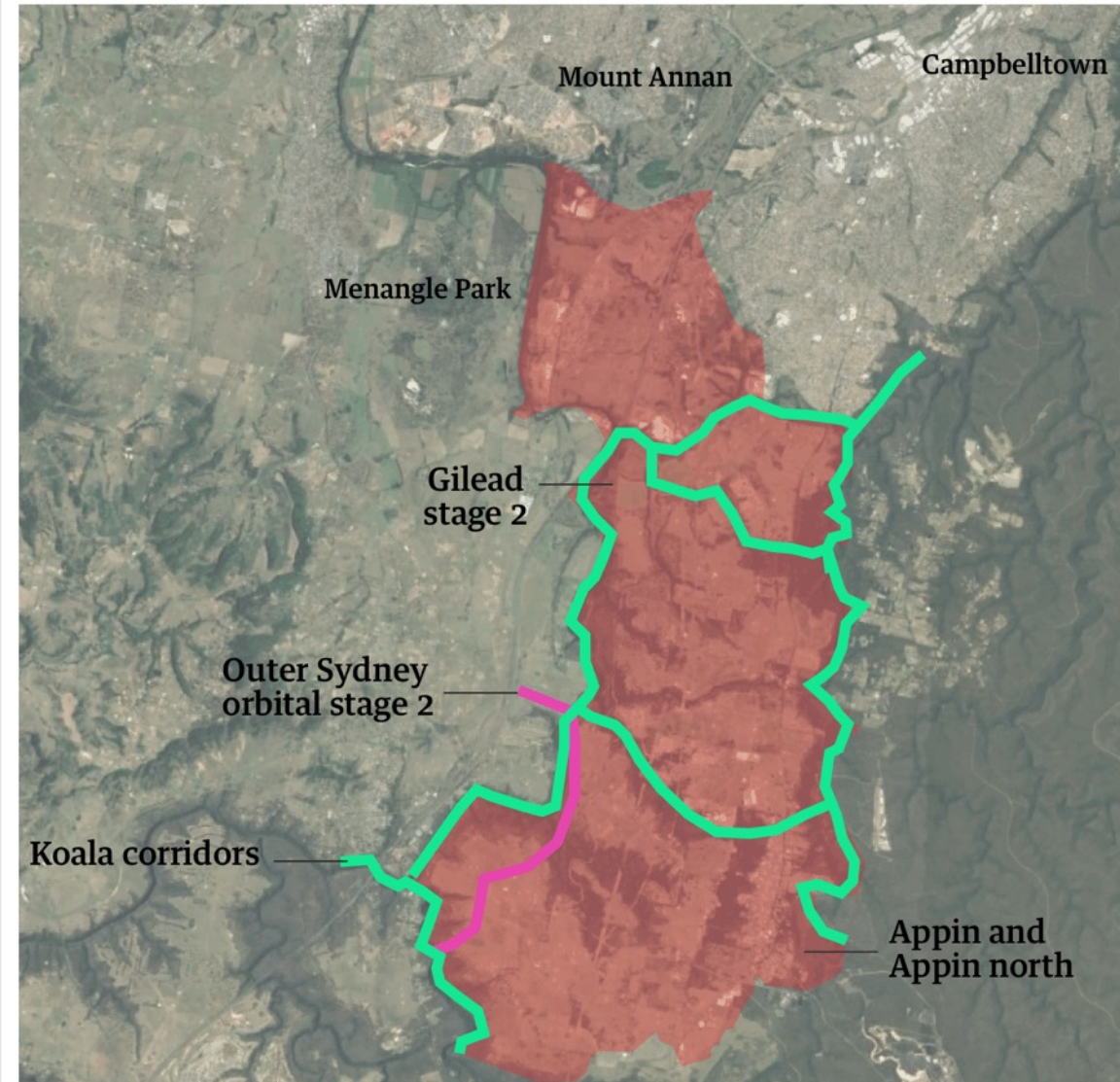
A NE HSR Line via Shepparton and Albury, with connecting services to Seymour, Wangaratta and other centres, will greatly increase access to a region with 200,000 people currently, and potential for significant growth



Corridors and Urban Development

- The NSW Government is fast-tracking development near Appin, south-west of Sydney
- It has potential for a population of at least 25,000 people.
- The area is directly on the proposed new HSR line, with a potential station at Wilton.
- But as yet there has been no commitment to build it, or indeed to protect the rail corridor
- There is an urgent need to do the integrated planning, including preservation of rail and koala corridors, and plans for the “Wentworth Deviation” as stage 1 of the HSR line to Canberra and Melbourne.

Greater Macarthur growth area



News Opinion Sport Culture Lifestyle More ▾

Environment ▶ Climate crisis Energy Wildlife Biodiversity Oceans Pollution Great Barrier Reef

New South Wales politics

Sydney's growing pains: land rezoning a potential billion-dollar deal for developers after local council sidelined

Exclusive: Questions over why NSW government is fast-tracking for possible housing an area with no public transport, inadequate water supplies and an endangered koala habitat

Proposed Sydney – Canberra – Melbourne HSR



Similar to 2013 HSR alignment, but:

- New routes through Sydney and Canberra
- More connections with existing rail corridor
- Slightly lower max speed (320 km/hr) and more realistic travel times
- Able to accommodate fast intermodal freights to provide real alternative to trucks
- Existing rail line retained for industrial and heavy freight, and local and connecting HSR services.
- Built in 5 stages.

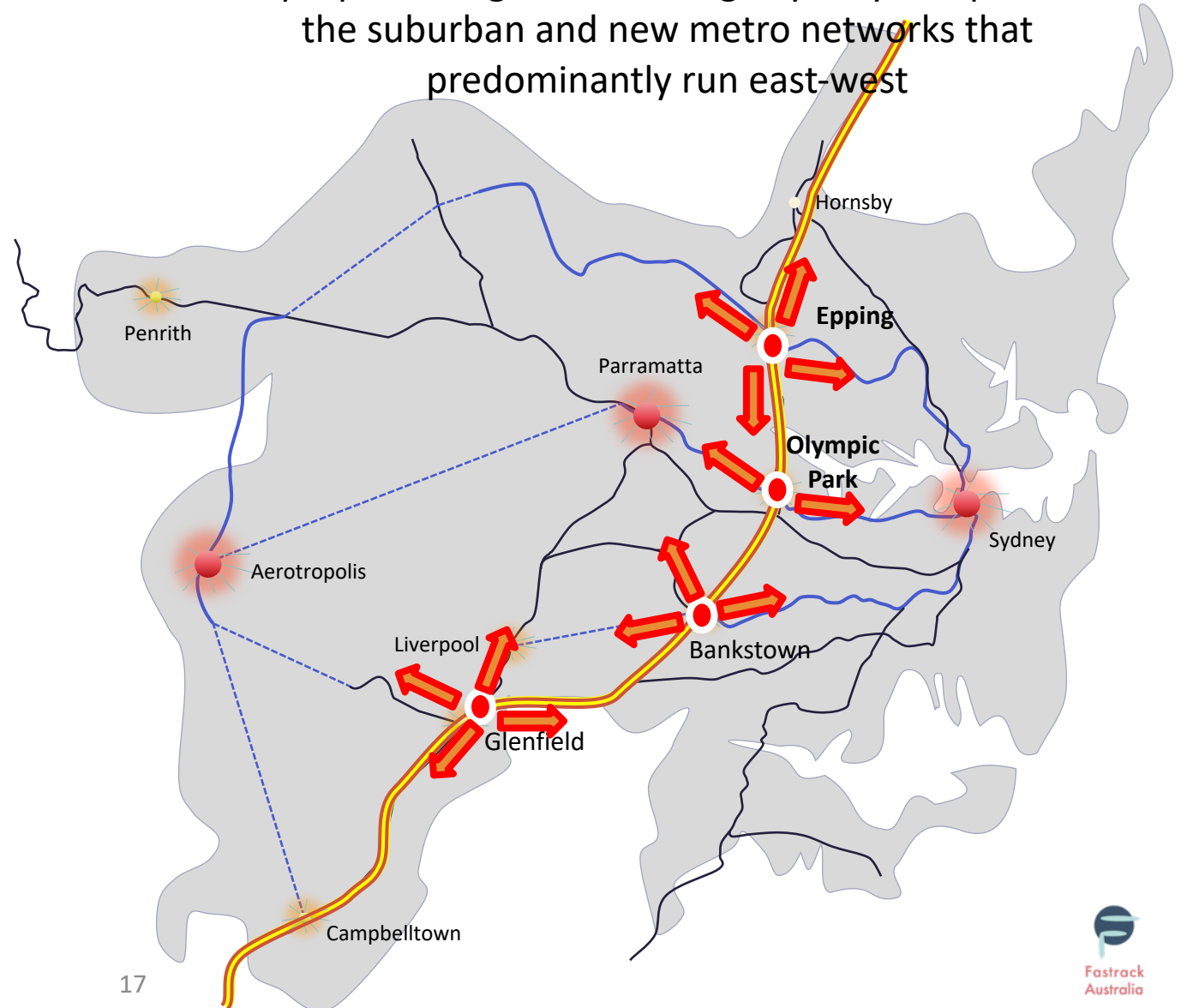
New Route and Connections in Sydney

The previously proposed alignment through Sydney involved a terminus at Central accessed by long tunnels

Figure 21 Preferred alignment to Central Station, Sydney



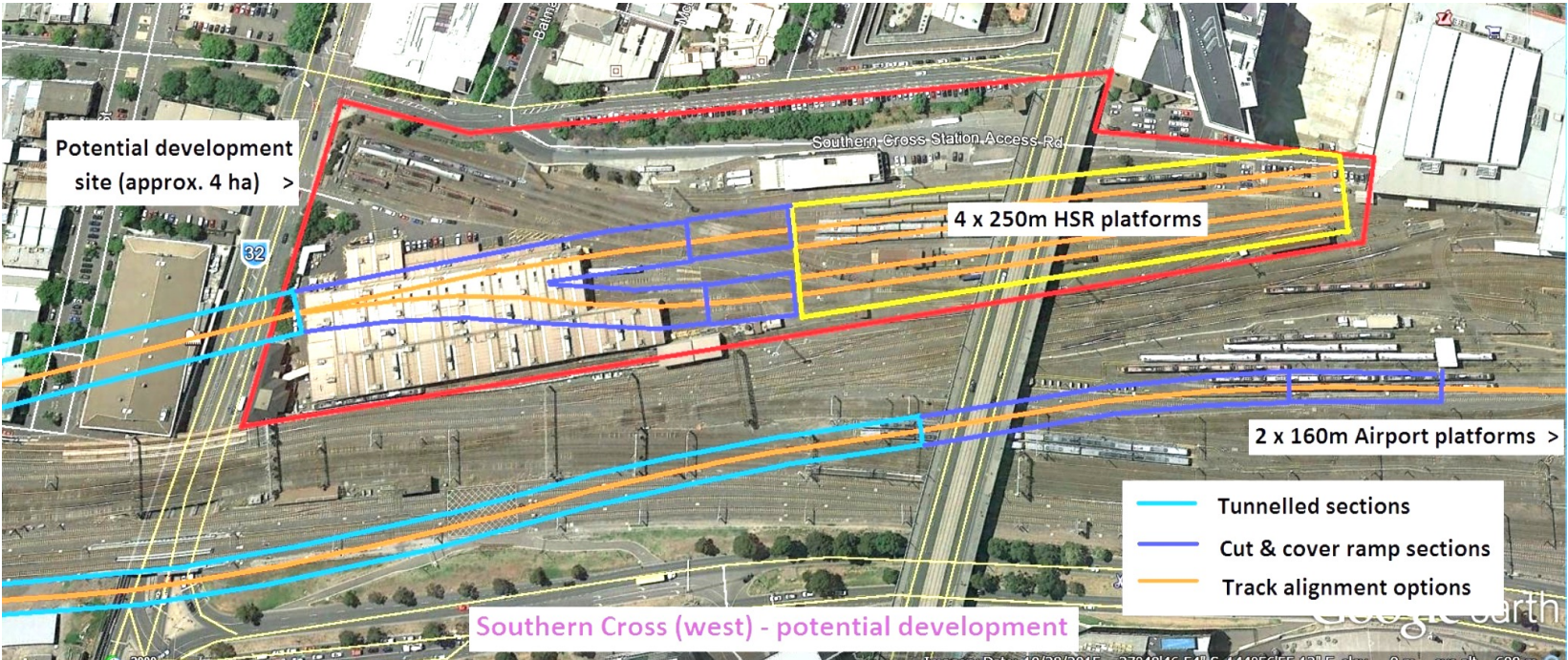
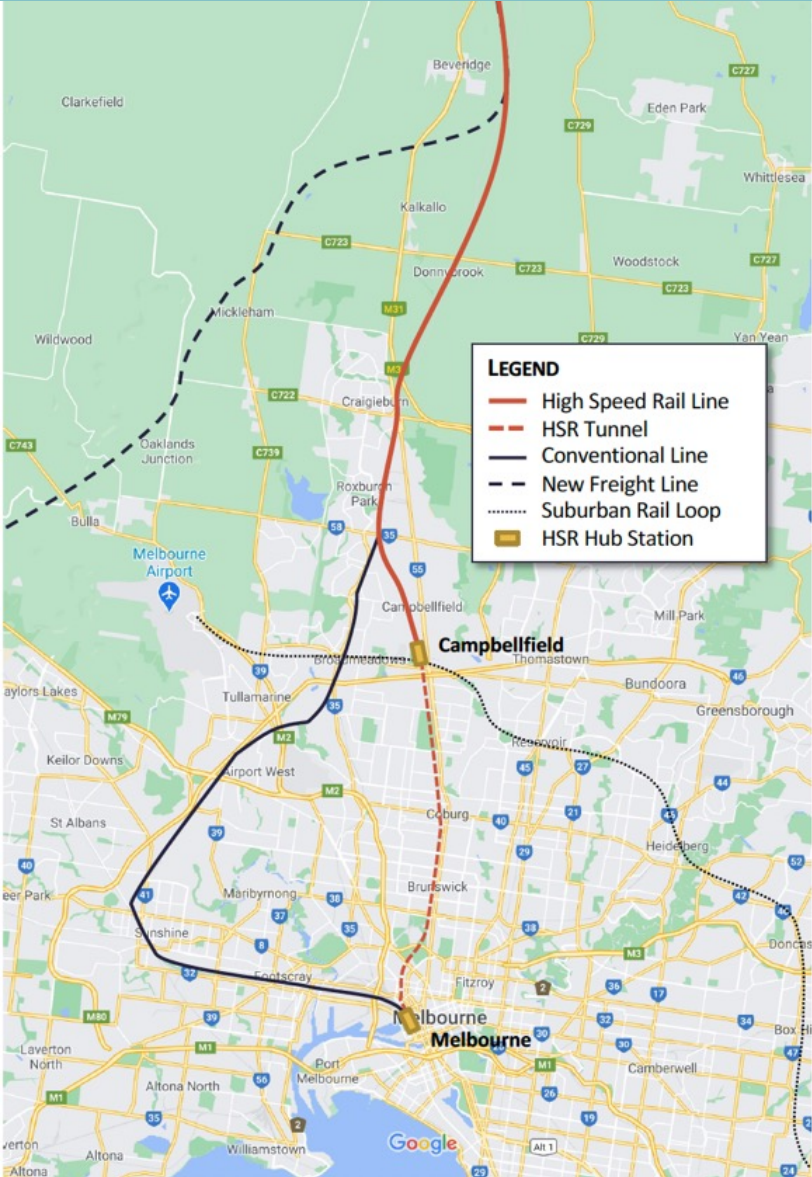
The proposed alignment through Sydney complements the suburban and new metro networks that predominantly run east-west



New Connections in Melbourne

In Melbourne (Left) the HSR line would eventually run direct into Southern Cross Station via a tunnel, as proposed in the 2013 HSR study, providing a considerable time saving compared to the current standard gauge route via Sunshine. Southern Cross would provide access to the CBD and also a key interchange with rail and tram lines to the East, South-East and West.

However, there would also be an interchange with the Suburban Rail Loop in the vicinity of Campbellfield, allowing east-west access to Melbourne Airport and the northern and north-eastern suburbs generally.



New Connections in Canberra

In the ACT (right) the alignment into Canberra is similar to the one identified in the 2013 HSR report, but with a station between the Airport and Duntroon, directly above the proposed Light Rail between Civic and the Airport (Stage 3).

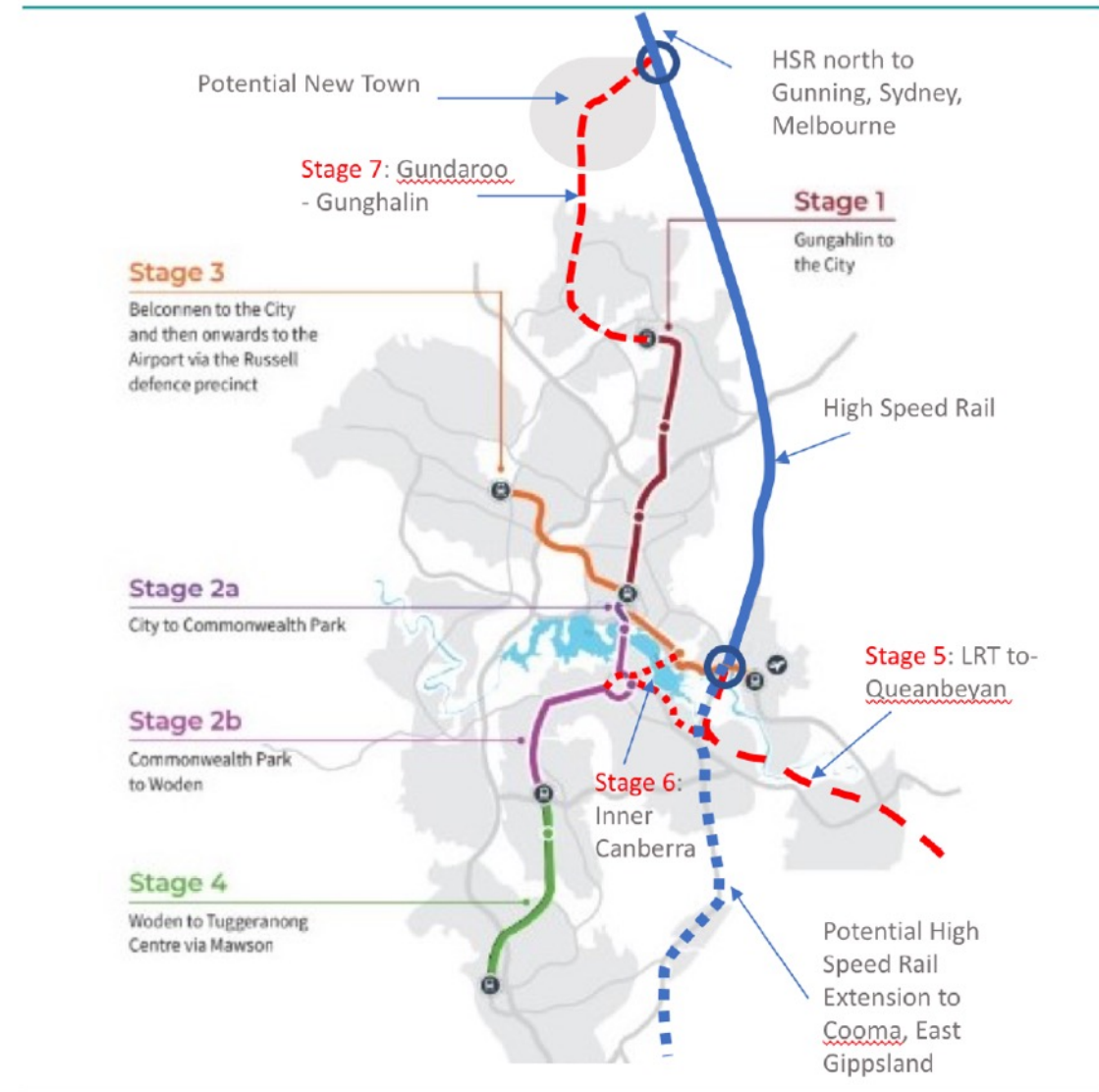
If the existing rail link via Kingston is closed, then it could be replaced by a light rail link from the Parliamentary Triangle (Stage 5 in the attached plan).

A stage 6 of the light rail could link Russell with the Parliamentary Triangle via Kings Avenue Bridge, providing a comprehensive LRT network in Central Canberra and serving all the other major town centres and employment zones.

There would also be a HSR station north of Gunghalin serving a new town, connected to an extension of the existing Light Rail Line between Civic and Gunghalin (Stage 7).

Finally, there is a long-term potential to extend the HSR line south to Cooma and beyond, eventually to Victoria via Cann River and the coast.

While this seems ambitious, Canberra and its surrounding region has the potential to grow to 1 million people in the long term, and a core public transport system, linked to HSR and the Airport, needs to be considered now.



Appropriate Speeds and Travel Times

The 2013 Report proposed a 400 kph alignment, with maximum operational speeds of 350 kph over most of the route. This was to achieve 3 hours or less between Sydney and Melbourne, driven by an assumed prime objective of competing with interstate airlines for business trips. However:

- Most countries have adopted 250 – 320 kph, for HSR services. China is the only country to operate commercial HSR services above 320 kph, and that only on limited lines.
- There are now many city pairs with HSR services of 4 - 6 hours or longer, and a significant move in Europe to shift from air travel to rail travel for environmental and other reasons, and a revival of overnight sleeper trains, utilizing HSR networks at night.
- Virtual meetings have reduced the need for interstate business trips. Trips for other purposes (education, recreation, tourism, visiting friends etc.) are less time sensitive.

Accordingly, a maximum operational speed of 320 kph, and maximum design speed of 350 kph is proposed (and only where there are no significant cost penalties from doing so). The Proposed HSR would have a target travel time for inter-capital express services of 4 hours between Sydney and Melbourne, and 90 minutes between Sydney and Canberra.

TRACTION & ROLLING STOCK

SJ orders 250 km/h trains as ‘the best travel product in Scandinavia’

6 April 2022

SWEDEN: SJ has signed a €650m contract for Alstom to supply 25 Zefiro Express 250 km/h trainsets, which the national passenger operator says will complement its refurbished X2000 fleet as ‘the best travel product in Sweden and Scandinavia’, meeting the demand for ‘climate-smart, comfortable and efficient’ travel.



Source: Railway Gazette.

Opportunity for Fast Intermodal Freight Trains

Current Intermodal Freight Trains take around 13 hours Sydney – Melbourne. This is slow compared with road transport which has grabbed most of the more lucrative overnight intercity freight market. But these could be accelerated by using sections of HSR lines if:

- They were operated at night or at times when passenger train frequencies were lower during the day
- They had sufficient power and tractive effort to climb any hills at high speeds
- Their axle loads were moderate
- Signalling and other systems were made compatible.



At Moorebank, automated cranes (left) can unload and reload a whole train in 2 hours, while automated stackers (right) move the containers direct to warehouses for unloading.



New generations of Bi-Mode (diesel plus electric) freight locomotives are emerging in Europe, e.g. the Euro 9000 (above), which generate extremely high power (9000 MW) when running on electrified track (as the HSR lines will be).

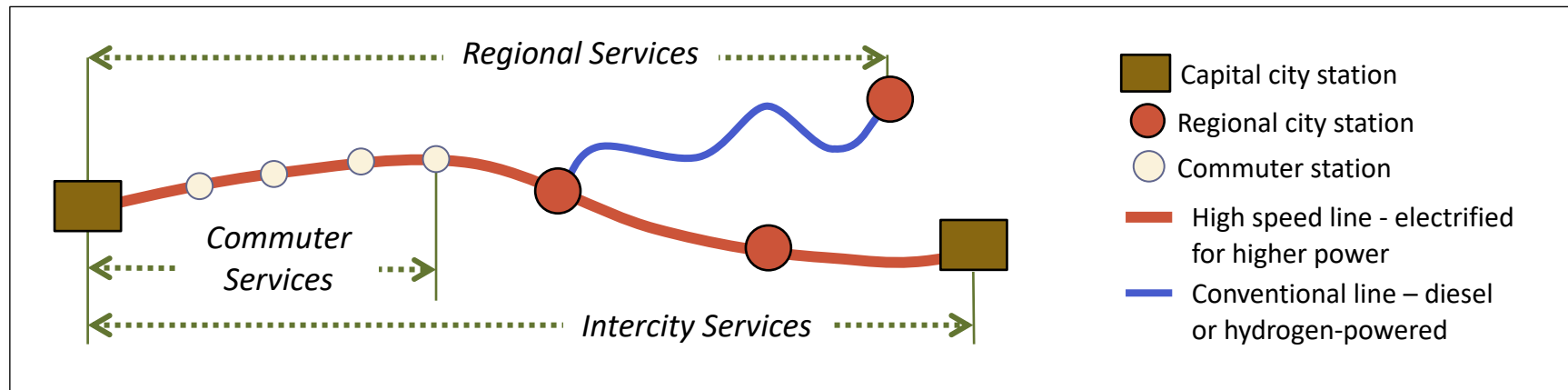
The opening of the automated Moorebank Intermodal Terminal (left) provides an opportunity to rethink intermodal rail freight as it will reduce load/unload times and improve supply chain efficiencies.

Retain the Existing Rail Corridor

The new HSR corridor will handle growing numbers of high-speed inter-capital, fast commuter, fast regional and fast freight trains.

But the existing corridor will still be needed for:

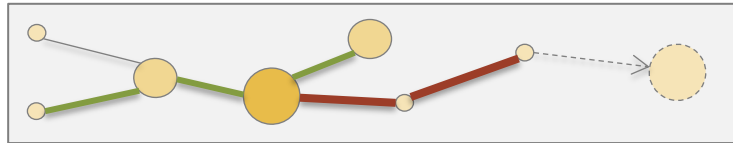
- slower freight trains, including steel, minerals, waste, cement and other industrial trains as well as seasonal grain trains
- local passenger services serving smaller centres
- fast regional passenger trains which can use both the high speed and the low-speed lines
- Maintaining services in the event of major disruptions or maintenance requirements on the high-speed lines



Building it in Stages

Building the network in stages focuses attention on the economic benefits from connecting each regional city

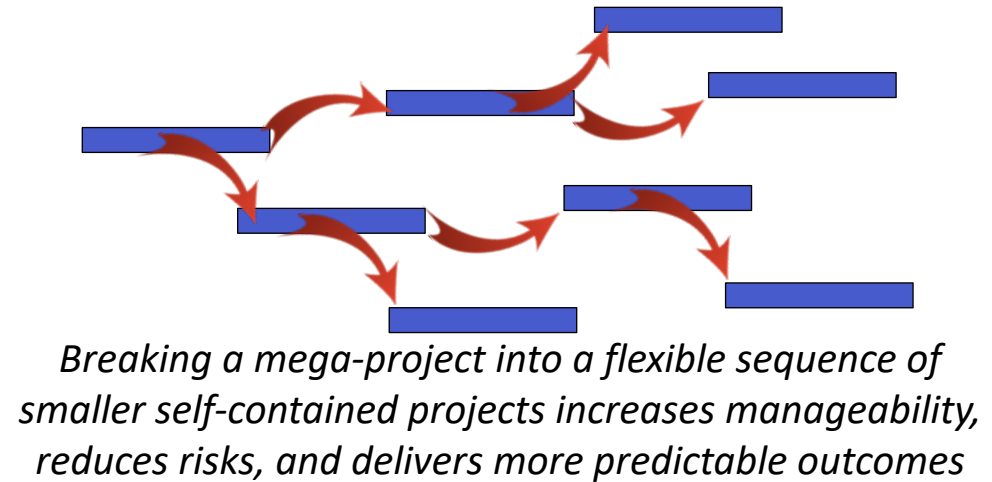
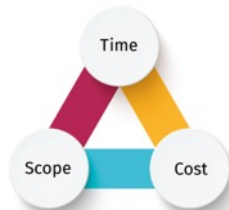
Progressively connect regional cities



With better, faster rail services



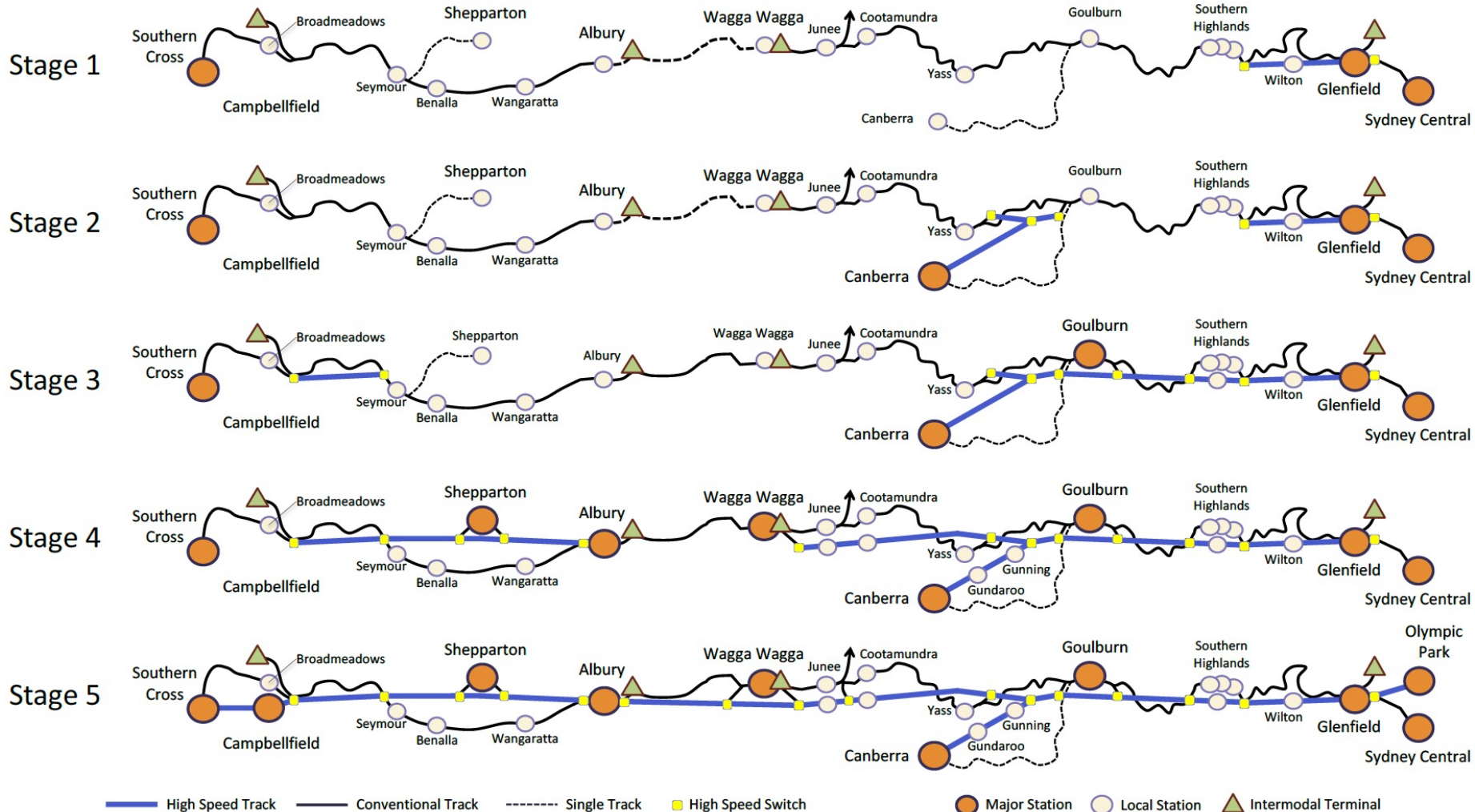
In a manageable, affordable way



- Smaller projects are more manageable
- Each stage opens a new regional city
- Each stage benefits cities along the corridor
- Benefits from each project help to pay for the network

Five stages are suggested for Sydney - Melbourne

Staging of upgrades in the Sydney-Melbourne corridor



- Start where the traffic is heaviest and the route is the most **circuitous**
- This maximises early benefits
- Stage 1 is therefore suggested as the Wentworth Deviation
- Subsequent stages complete Sydney – Canberra in Stage 3, and Sydney – Melbourne by Stage 5.

Progressively add New Trains and Services

Staged Infrastructure and Service Enhancements

Stage	Key Infrastructure Enhancements	Key Service Enhancements	Fastest Freight (hrs)*	Fastest Passenger Services (Hrs)		
				Sydney - Melbourne	Sydney - Melbourne	Melbourne - Canberra
Now			13	11	10.5	4.2
1	Glenfield – Mittagong (Wentworth Deviation)	New High Speed Tilt Trains New Fast Commuter Trains New Sleeper Trains Bi-mode locomotives	12	9	8.5	3.0
2	Goulburn – Yass Gunning – Canberra	First Hybrid Fast Freights Additional Tilt Trains Additional Commuter Trains	11	8	7	2.2
3	Wagga –Albury Duplication Mittagong – Goulburn Broadmeadows – Seymour	Additional Tilt Trains Additional Fast Freights	10	6	5	2.0
4	Seymour – Albury Yass – Junee	First High speed Non-Tilt Passenger Trains Additional Fast Freights	9	5	4	1.7
5	Albury – Junee Melbourne Entry Sydney Entry	Additional High speed Passenger Trains Additional Fast Freights	8	4	3	1.5

(*). Most of these would operate at night, when high speed passenger services are not operating

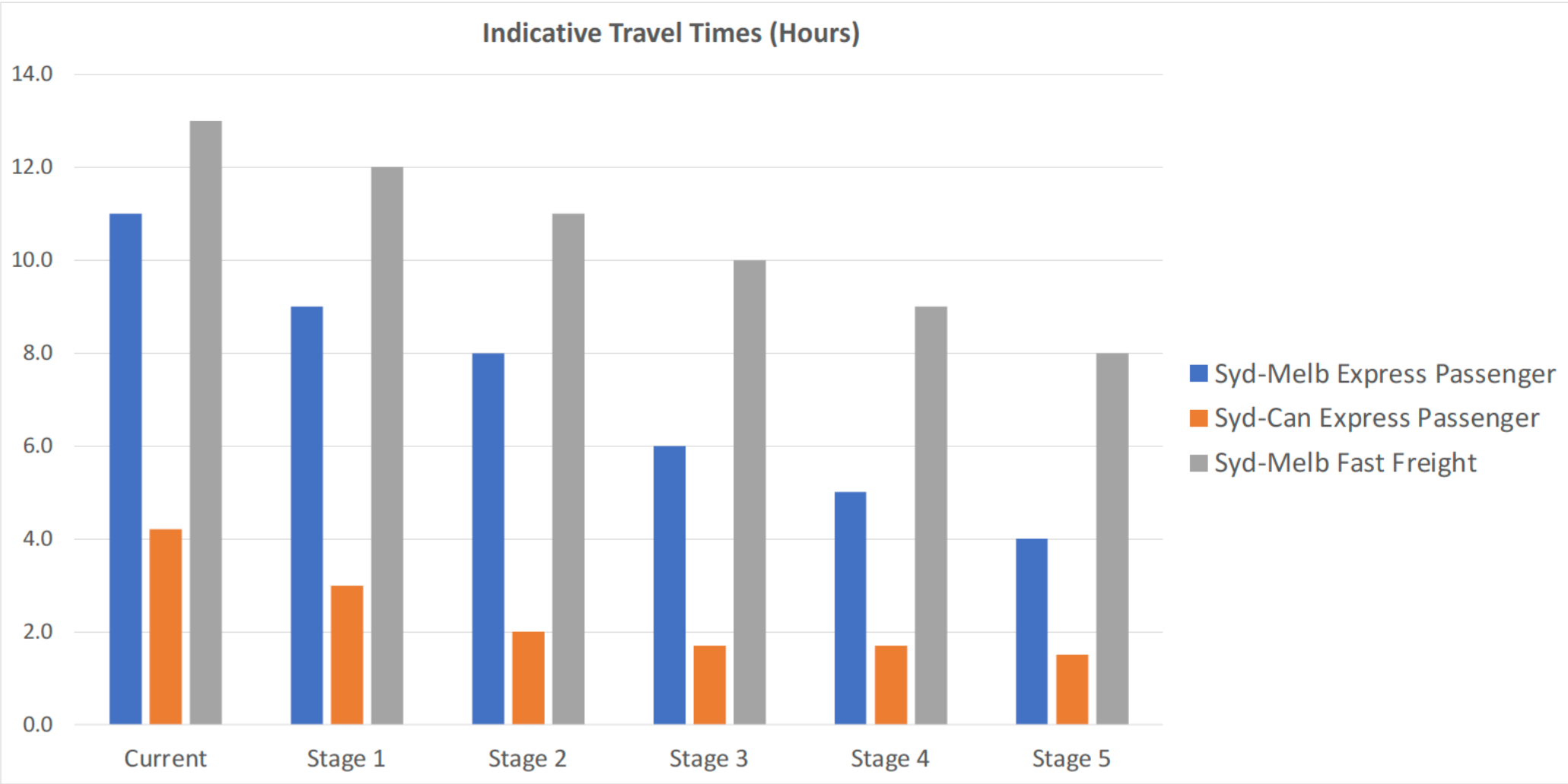
Right: Italy has two high-speed train operators running a variety of tilting and non-tilting trains, by different manufacturers, on the same tracks. Some are capable of up to 400 kph, though they are limited to 320 kph in normal service.



Above: Talgo 250 Dual has both diesel and electric power, has tilting capability and a top speed of 250 kph. . Talgo are working on a hydrogen / electric dual powered train.



Progressively Reduce Travel Times for Both Passenger and Freight



Indicative travel Times after completion of each stage

This provides the capacity, and the demand, for a massive increase in services

Daily Train Volume (counting both Directions) by Train Type at Different Stages

Daily Train Volume	Current	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Syd-Melb Express	0	4	8	12	18	24
Syd-Melb Regional	4	4	6	6	6	6
Syd-Can Regional	6	10	16	18	20	24
Syd-SH/Glbn Commuter	40	50	54	60	70	80
Can-Melb Regional	0	0	4	6	8	10
Can-Alb Regional	0	2	2	4	4	6
Can-Glbn/Yass Commuter	0	0	6	10	16	20
Shep-Melb Commuter	0	0	0	0	10	12
Alb-Wang-Melb Regional	8	8	10	6	8	10
Alb-Shep-Melb Regional	0	0	0	12	14	16
Shep-Melb Regional	8	10	14	18	20	24
TOTAL PASS	66	88	120	152	194	232
Fast Intermodal Freight	0	4	8	12	16	20
Other Intermodal Freight	10	12	14	16	18	20
Industrial Freight	38	40	44	48	52	52
Melb - Inland Rail Freight	0	8	12	16	20	24
TOTAL FREIGHT	48	64	78	92	106	116
TOTAL	114	152	198	244	300	348

Maximising the Benefits

New stations offer opportunities for development as a destination, a transport hub, and a catalyst for the growth of business precincts

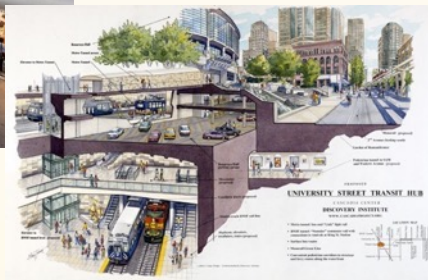
A Focal Point for the City



Open and inclusive community space



Shopping and business destination



Transport interchange

Hub for urban mobility

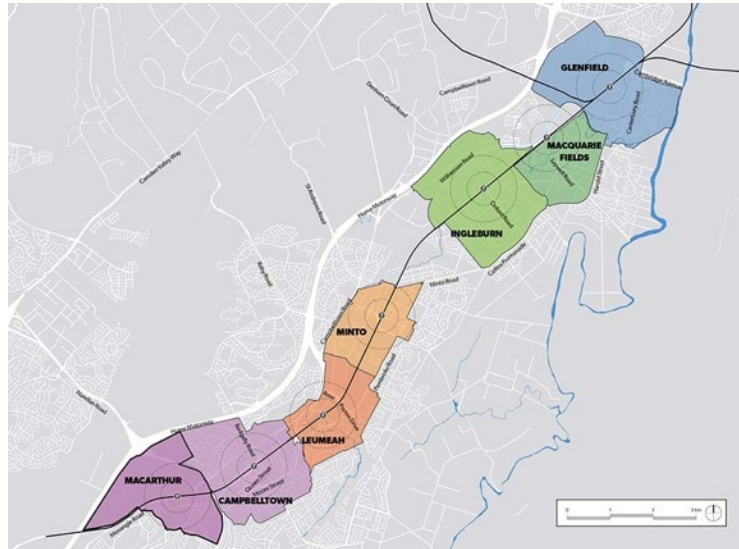


Catalyst for precinct development



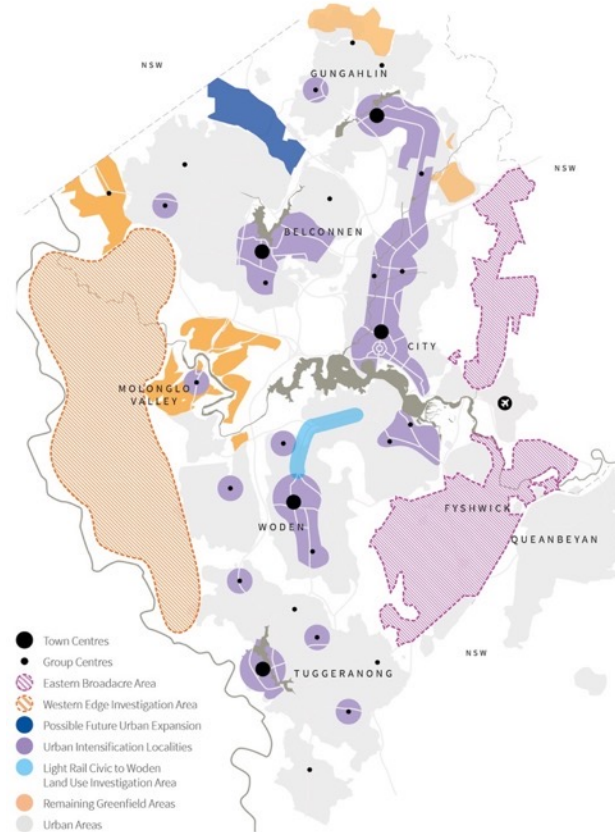
Connecting areas already targeted for growth in NSW

Greater Macarthur Area



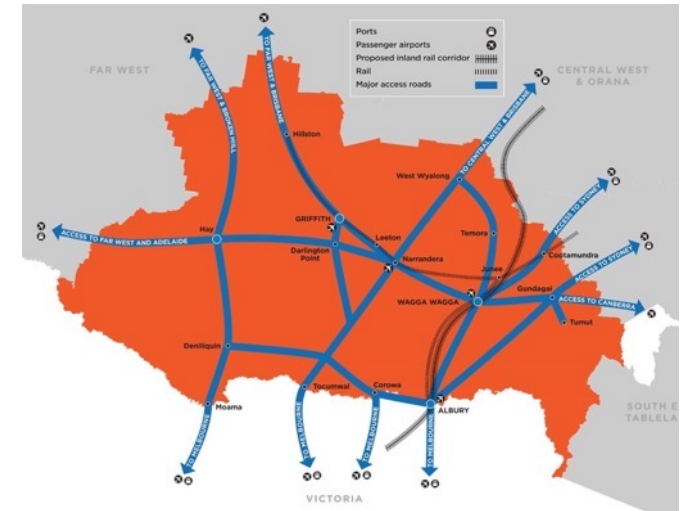
Greater Macarthur is a growth area with urban renewal precincts from Glenfield to Macarthur, and new land release precincts further south, including Gilead, North Appin and Appin

Canberra



Canberra can increase its rapid growth with further broadacre development and increased density around town centres connected by a light rail network

Regional Growth Centres



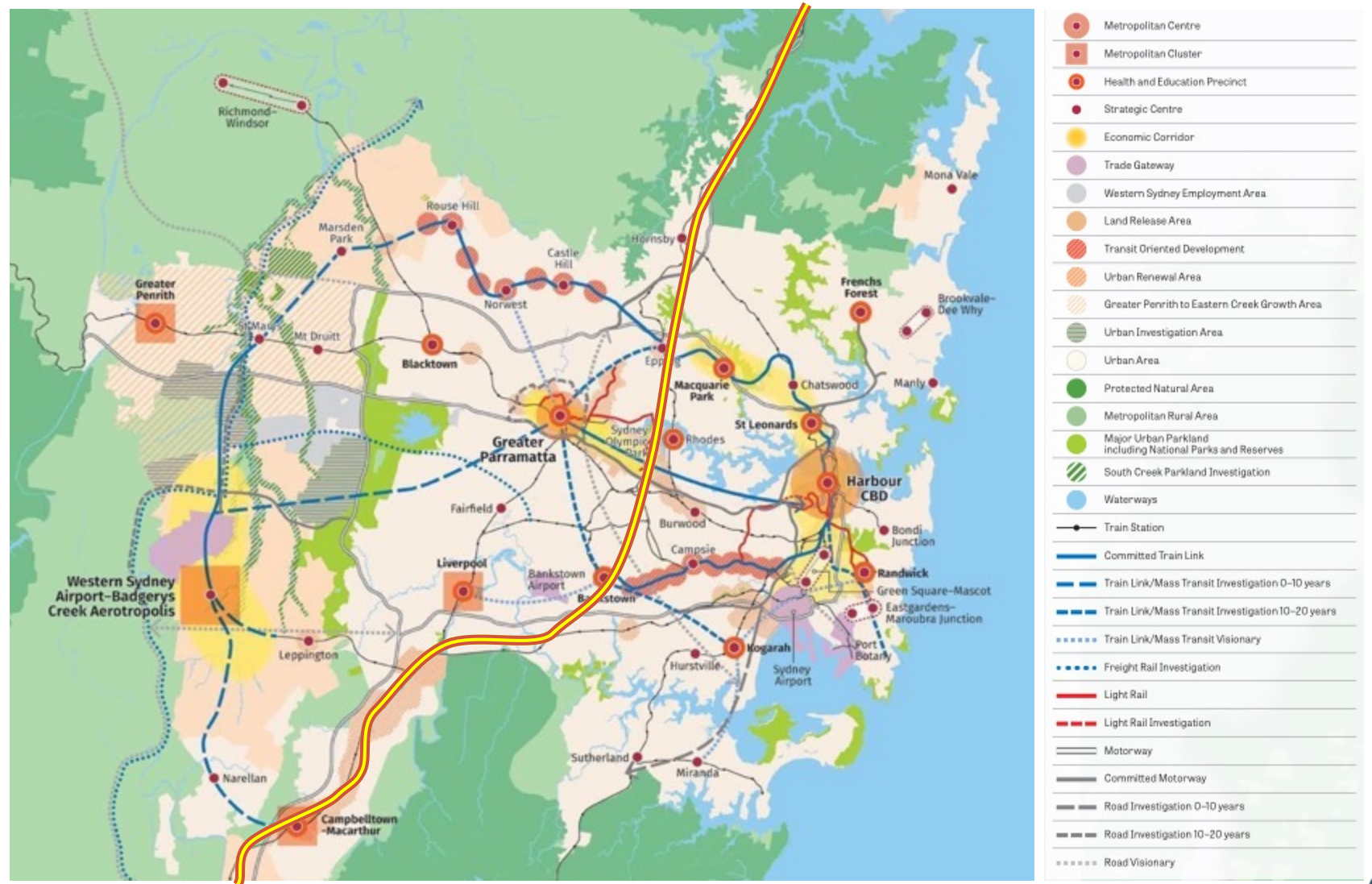
Wagga Wagga and Albury-Wodonga are targeted for high growth over the next 18 years, building on jobs provided from regional tertiary education campuses

HSR will also reinforce the strategic plan for Sydney

The HSR Route through Sydney will have good links to all three metropolitan centres (CBD, Parramatta and Aerotropolis).

It will also have good access to the whole of the metropolitan region via interchanges at Epping, Olympic Park, Lidcombe, Bankstown and Glenfield

This will allow the new HSR line to act as a key north-south link supplementing the new East West Metros and improving public transport connectivity generally



Rail can help Reduce Transport Emissions

- Freight Rail is three times more energy efficient than Road Freight. The plan allows for a major shift of interstate road freight to fast intermodal trains.
- Suburban Rail in Sydney is already using 100% green electricity, and the new rollingstock on order for regional NSW services are Bi-Mode, able to use overhead power where available.
- The first generation of high speed trains for Australia would enter service on completion of Stage 1 (The Wentworth Deviation) and be hybrid trains able to use 25 KvAC on the Stage 1 section, 1500V DC on other electrified lines, and green hydrogen for sections not yet electrified.
- The following Generation of high speed trains would enter service on completion of Stage 3. This would be electrified throughout. This generation would use 25KvAC or 1500V DC, and 100% green power.
- Future generations of freight locomotives are being developed to use combinations of battery and hydrogen power, or bi-mode which can also draw power from the overhead wires.



Hydrogen-powered fuel cells on the roof of an Alstom Coradia I-Lint train, already in service in Germany and elsewhere in Europe.

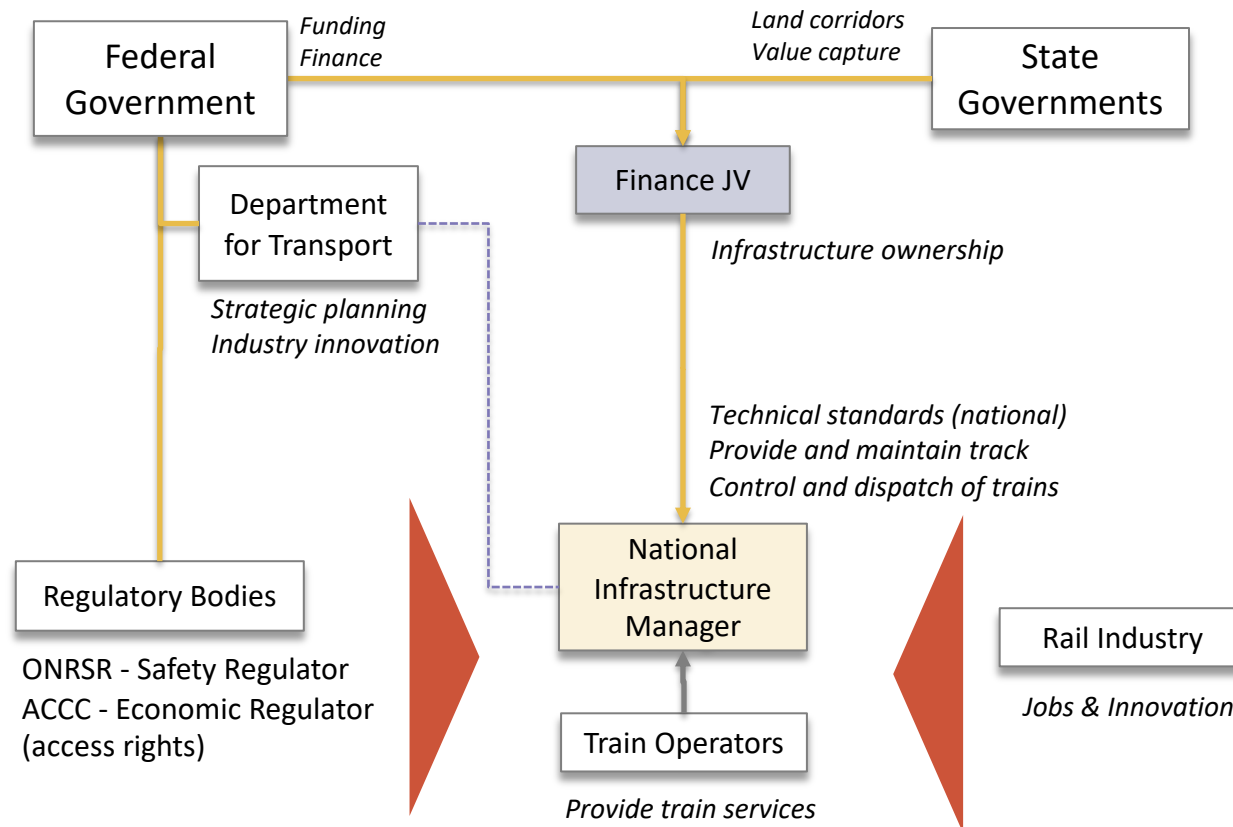


First H2-powered freight train developed by Alstom to transport H2O

Published on 24-11-2022 at 12:56

HSR can re-invigorate the Rail Industry Generally, including Manufacturing

National rail industry structure



Build on national rail freight industry structure

Add new ownership structure

- JV between state and federal governments
- States capture value uplift to help fund rail infrastructure

Establish new national infrastructure manager

- Bring in technical and operational expertise

Add passenger services to regulatory bodies

- e.g. national rail standards

Increase role of DoT

- Strategic planning, industry development

Build a stronger rail industry

- Seek private operators for passenger services
- Seek ways to develop the industry in Australia

Conclusions

There are now over fifteen countries with high-speed rail systems in operation (i.e. train services with top speeds of 250 kph or more), including:

- Japan, Korea, Taiwan and China in Asia
- France, Germany, Spain, Italy, the UK, Netherlands, Belgium, Turkey and Russia in Europe
- Morocco, Saudi Arabia and the UAE in the Middle East and Africa

Other countries currently building HSR include the USA, India, Indonesia, Laos and Egypt, while Poland, Finland, Portugal, Thailand and the Czech Republic are planning HSR.

Critics of HSR in Australia argue we lack the population to support it. But we now have nearly 18 million living in South-East Australia, who can be linked by an 1800 km HSR linear corridor, with connections to existing rail lines. Spain, with 47 million population, has already built 3,600km of high-speed rail linked to its wider rail network.

Our population meanwhile has resumed its upward trend post COVID and is expected to reach 30 million in the HSR Catchment area by 2061. Unless we embrace decentralisation, the additional 12 million people will end up overwhelmingly living in Sydney, Melbourne and Brisbane, exacerbating problems of housing affordability, congestion and inequality of services.

HSR is a necessary but not sufficient condition to change this trajectory. But we need to start with a concrete project which can target existing priorities and be the beginning of a longer term, integrated network solution.

And we need to start now. Unless we do the crucial corridors required will be built out and the opportunity will be lost.

The Federal Government has now passed legislation to establish a High Speed Rail Authority. Its time to turn planning into action.



Appendix: Canberra as a Stepping Stone

Where should High Speed Rail Start?

Currently the Federal and New South Governments have proposed that the first priority for high-speed rail should be north of Sydney to the Central Coast and Newcastle.

This makes sense from a population and current passenger volume perspective.

However, it requires some extensive tunnelling – around 50 km between Sydney and Gosford – which makes it an expensive and potentially risky first stage.

Although some investigations have been carried out on this corridor, a number of issues appear unresolved, such as to whether Gosford and / or Wyong should be bypassed by any High-Speed Line, and whether the line should go over or under the Hawkesbury River.

Furthermore, unless any HSR is properly integrated with the current railway, it involves some difficult interchange arrangements at Gosford, where the current station is space constrained.

In contrast, the route to Canberra offers many advantages as a place to start High Speed Rail, as suggested below. While this is recommended for early consideration, it need not and should not preclude development of detailed plans for other components of the ultimate HSR plan.

Advantages of Canberra as a Stepping Stone

- The first stage suggested here – the Wentworth Deviation – could be started within about 2-3 years, and completed within 5-6 years, for around \$6 billion.
- It will provide benefits for both freight and passenger traffic, and form the beginning of the route to Melbourne (and also potentially Wollongong)
- It also serves the potential Appin / Wilton development area already identified, which is likely to be developed in coming years.
- The second stage, from Goulburn and Yass to Canberra, similarly benefits not only Canberra, but also passenger and freight traffic on the main South Line, all the way to Melbourne, and could also be completed fairly quickly for a manageable cost (estimated at around \$6 billion)
- It would then open up a range of urban development and decentralization options with good connections to Canberra, a successfully planned city with a proven track record in handling major urban development, and a growing economic and service centre for the wider region.
- The HSR plan proposed also dovetails with and supports the light rail plan being developed for the ACT.
- Finally, this approach would involve three governments – The Federal, NSW and ACT Governments. It could pioneer arrangements which would later be extended to Victoria and Queensland as High-Speed Rail becomes a truly national project.