RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD
ABN: 58 105 001 465

Rail Industry Safety and Standards Board (RISSB)

Interoperability Impact Plan

addressing issues from the proposed introduction of new train control systems

v1.0, February 2021

palazzirail

Why is RISSB undertaking this work?

New systems present an interoperability issue that must be addressed, for the good of the industry and the nation

The issue

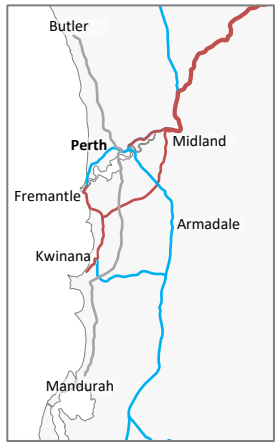
- A number of railways are moving to adopt new network control systems in order to maximise the value (capacity, efficiency, safety) of their rail asset. A key characteristic of these new systems is the need for both trackside and onboard components.
- Ideally, these systems would be implemented in a way that would ensure that all trains can operate with maximum safety and efficiency across networks, whilst minimising the need for trains to carry multiple sets of onboard equipment for different networks.
- Because of the integrated nature of rail operations across Australia, greatest efficiency of the network will be achieved with cooperation and integration between rail operators and rail network owners/managers, and between adjacent rail networks.
- An integrated approach to network control systems across Australia has the potential to provide many benefits to the rail industry generally, to individual businesses involved in the rail industry, and to the economy. Conversely, a disjointed approach will have consequences that will last for many years, including higher costs and lower competitiveness for rail transport.

Why is RISSB undertaking this work?

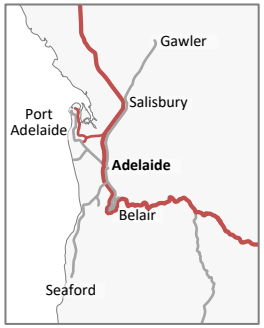
- RISSB has produced AS 7666 Train Protection and Control Interoperability to assist network managers in the adoption of new technology whilst not creating inefficiencies and costs for operators who use the networks. AS 7666 calls for the proponents who seek to introduce new systems to undertake an assessment on whether there will be operating impacts on users of the network or on adjoining networks. It requires definition of the geographic and operating impact and the development of a plan to minimise the impact.
- Recognising the interconnectedness of the national rail system, Action 5B in the National Rail Action Plan tasked RISSB to develop a strategy to roll out an interoperable control system based on an investigation of technological options.
- In response to this action, RISSB has undertaken two pieces of work:
  - An Interoperability Assessment, completed in September 2019, to ensure the complete impact of new systems is understood, and
  - This Interoperability Impact Plan, to identify a way forward to manage emerging interoperability issues.
- This assessment focuses on the connected elements of the national rail network.

The network requiring a national approach to interoperability

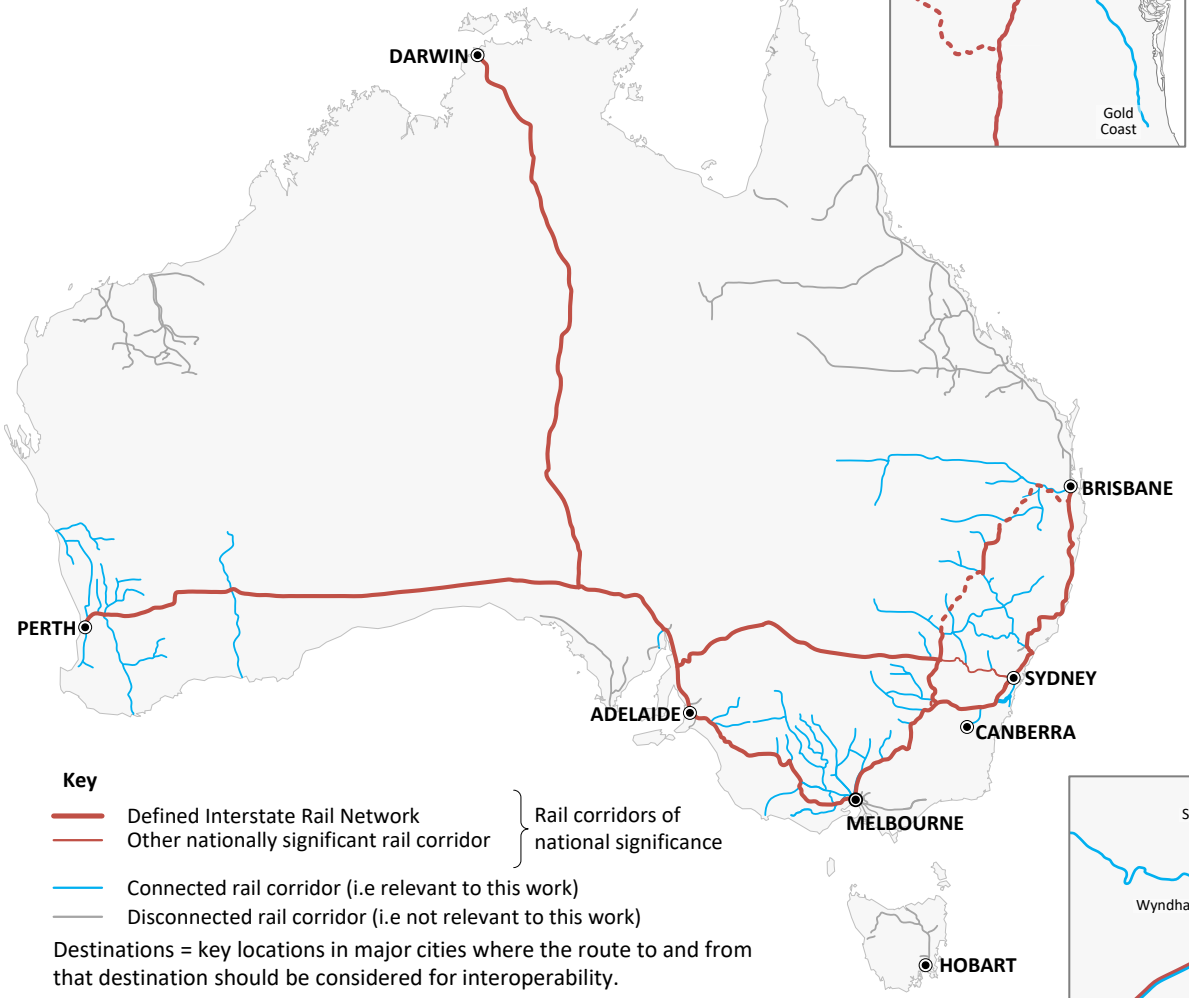
(see notes on the next slide)

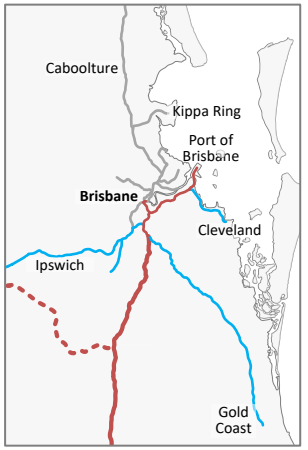


Perth destinations:
- Forrestfield terminal
- Port of Fremantle
- Port of Kwinana
- East Perth station



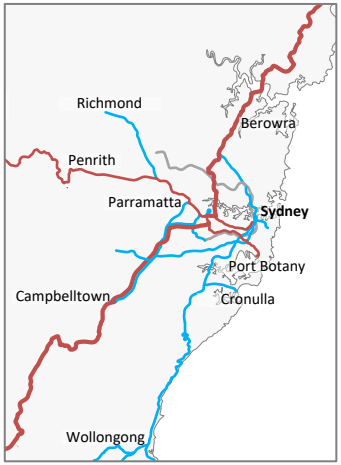
Adelaide destinations:
- Adelaide Freight Terminal
- Port Adelaide
- Keswick station



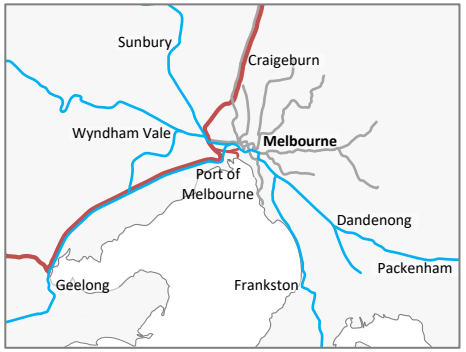


Brisbane destinations:
- Acacia Ridge terminal
- Port of Brisbane
- Roma Street station

Sydney destinations:
- Chullora and Enfield terminals
- Port Botany
- Sydney Terminal station



Melbourne destinations:
- Tottenham terminal
- Port of Melbourne
- Southern Cross station



RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD

palazzirail

Notes regarding the identification of corridors

A national approach to interoperability is required across the **Rail Corridors of National Significance**, which includes:

- The **Defined Interstate Rail Network** – the primary (standard gauge) corridors used for the passage of interstate freight between capital cities, extending to the major freight terminals in each capital city. This includes Inland Rail (currently under construction).
- Additional **corridors of national significance**, including
  - Corridors used by interstate passenger trains, extending to the major passenger terminals in each capital city.
  - Corridors connecting to major ports.

Ideally, systems deployed across the Rail Corridors of National Significance should be fully interoperable, with an objective of achieving a 'good' outcome as outlined on the next slide.

Connected rail corridors include corridors where train operations are inextricably mixed with those on the Rail Corridors of National Significance. Connected rail corridors include standard gauge networks, plus broad and narrow gauge corridors where sufficient dual gauge operations exists to create an operational connection. Decisions regarding systems deployed on these corridors can generally be left to the individual authorities / RIMs, noting that a SFAIRP approach would require consideration of the interaction between these corridors and the Rail Corridors of National Significance, and hence interoperability will be desirable,

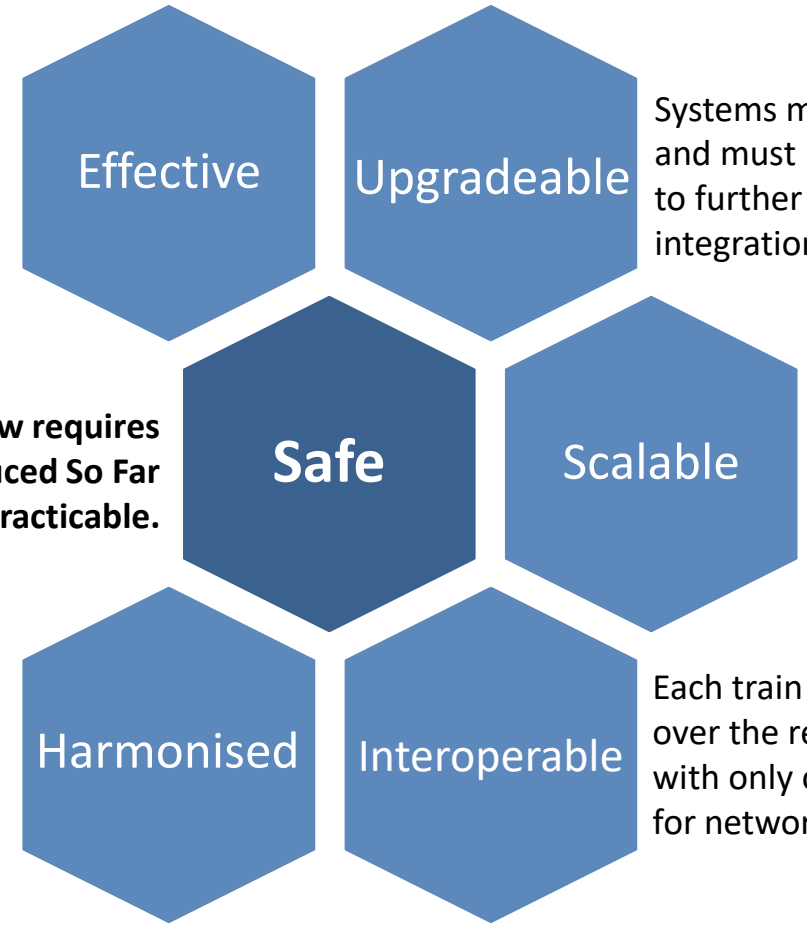
This analysis is primary concerned with establishing an interoperability impact plan for the **Rail Corridors of National Significance,** plus the **Connected rail corridors.**

Disconnected rail corridors are those either physically or operationally separated from the Rail Corridors of National Significance. Decisions regarding systems deployed on these corridors can be left to the individual authorities / RIMs. However, development of a common approach to system deployment, and development of interoperability solutions, may provide useful options for these corridors.

Destinations identified are those locations in major cities where trains using the Rail Corridors of National Significance originate and terminate. Hence, the route to and from that destination should be considered as part of the Rail Corridors of National Significance and is relevant for interoperability.

What does a good outcome look like?

A good outcome allows each rail business (above- and below-rail) to meet their needs within a coherent national framework



Provides the required functionality for efficient rail operations

Systems must be supported, and must provides a pathway to further enhancements / integration with other systems .

Rail Safety National Law requires safety risks to be reduced So Far As Is Reasonably Practicable.

One or multiple systems that can be cost-effectively applied across all types of railways in a seamless way, i.e. suburban, coal, interstate and regional.

Harmonising of safeworking systems across state boundaries, wherever one signalling and control system is used, the same safeworking rules are applied.

Each train fleet can operate over the required network(s) with only one onboard system for network control purposes.

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD palazzirail

Planned network control systems

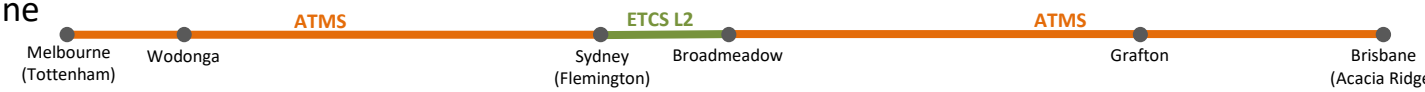
State	Network	Authority	RIM	Planned systems
Interstate	ARTC network (NSW, Qld, SA, Vic, WA)	ARTC	ARTC	Policy to implement Advanced Train Management System (ATMS) over the entire network.
New South Wakes	Sydney suburban railway	Transport for NSW	Sydney Trains	Policy to implement European Train Control System (ETCS) Level 2 over the entire network.
	Country Regional Network	Transport for NSW	John Holland Rail	Continuing to use TMACS Train Order Working, with data transmission and electronic track worker authorities.
Northern Territory	Tarcoola to Darwin	1Rail	1Rail	Exploring GPS based electronic train control systems which will interface with the ICE radios installed in the standard gauge locomotive fleet. Part of the FORG ATMS submission to the Commonwealth Government.
Queensland	Brisbane suburban railway	Transport and Main Roads	Queensland Rail	Implementing ETCS Level 2 on Cross River Rail and central Brisbane area. Further deployment may follow.
	Queensland regional network	Transport and Main Roads	Queensland Rail	Implementing ETCS Level 1 on North Coast Line. No committed program for other areas of the Queensland regional network.
	Central Queensland coal network	Aurizon	Aurizon	Implementing ETCS Level 2 as an above-rail initiative, to improve efficiency and safety of Aurizon trains.
South Australia	Adelaide suburban railway	Department of Planning, Transport and Infrastructure	DPTI	Implementing ETCS Level 1. The Adelaide suburban rail network is disconnected from the Rail Corridors of National Significance and hence this network is not considered further in this analysis.
Victoria	Melbourne suburban railway	Transport for Victoria	Metro Trains Melbourne (MTM)	Communications Based Train Control (CBTC) being implemented on the Sunbury to Dandenong corridor. No committed program for other corridors, although contemplating ETCS L2 in some areas at least.
	Victoria regional network	Transport for Victoria	VicTrack	Implementing an enhanced TOW solution on selected corridors as part of the Regional Rail Revival program. No network-wide strategy.
Western Australia	Perth suburban railway	Public Transport Authority	Public Transport Authority	Planning underway for Communications Based Train Control (CBTC) across the Perth suburban network.
	Western Australia regional network	Arc Infrastructure	Arc Infrastructure	Currently implementing a new Train Control System, planned next step is to implement a suitable cab signalling solution. Part of the FORG ATMS submission to the Commonwealth Government.

Planned control systems on some example routes

Interstate freight

Perth to Sydney

Melbourne to Brisbane (via coast)



Adelaide to Darwin

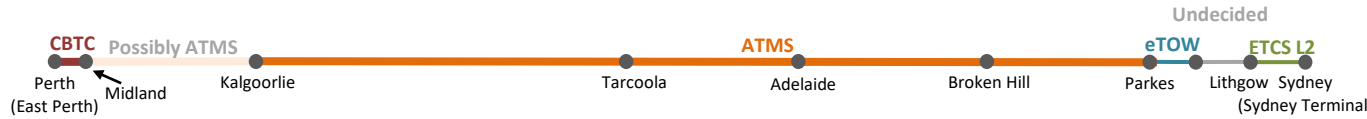
Intra-state freight

West Wyalong to Port Kembla (NSW)

Mildura to Geelong (Vic)

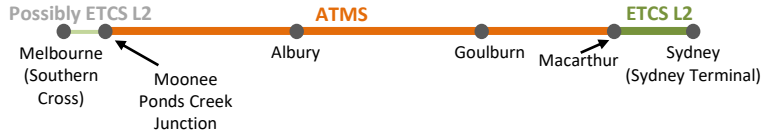
Passenger

Perth to Sydney (Indian Pacific)



Sydney to Brisbane

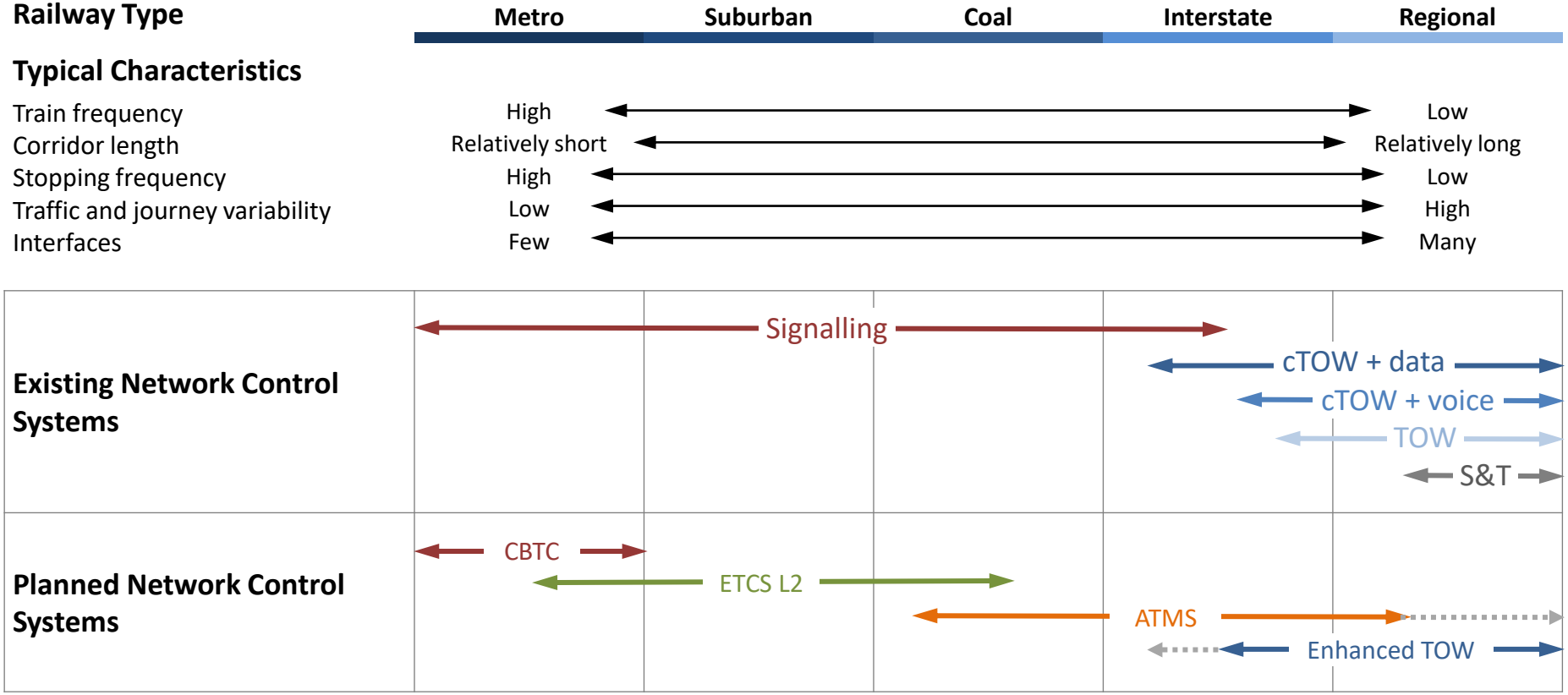
Melbourne to Sydney



Key:
Colour indicates proposed future control system where known, possible systems (pending decision), or 'undecided' where no plan has been announced.
Thick line indicates interstate network
Thin line indicates regional / intrastate network

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD palazzirail

Summary of current and planned network control systems



Notes:

For planned systems – solid line indicates breadth of currently planned scope. Grey dotted line indicates potential wider application with enhancement.

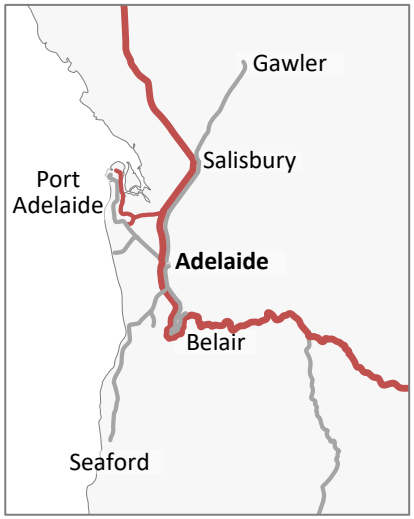
Refer to the Interoperability Assessment for a discussion on the above systems.

Separation of rail operations

Separate corridors with different use cases, to avoid interoperability issues caused by different system choices.

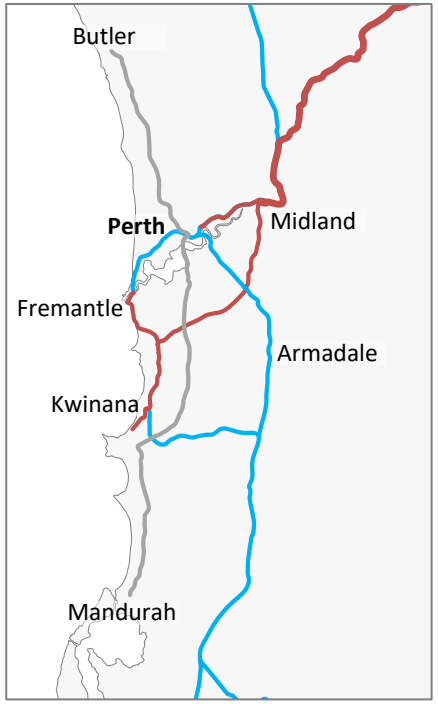
Achieved in: **Adelaide**

Completion of the grade separation of Goodwood and Torrens Junctions in 2018 meant that the Adelaide suburban rail network is separate from the ARTC network. No interoperability issues exist.



Partially the case in: **Melbourne**

Many lines in the Melbourne suburban network can operate as independent corridors, and the network plan aims to progressively move to this style of operation. However corridors on the west of Melbourne are more interconnected with the national network; also the east-west corridor though Melbourne forms a key connection to Gippsland and to the Port of Hastings.

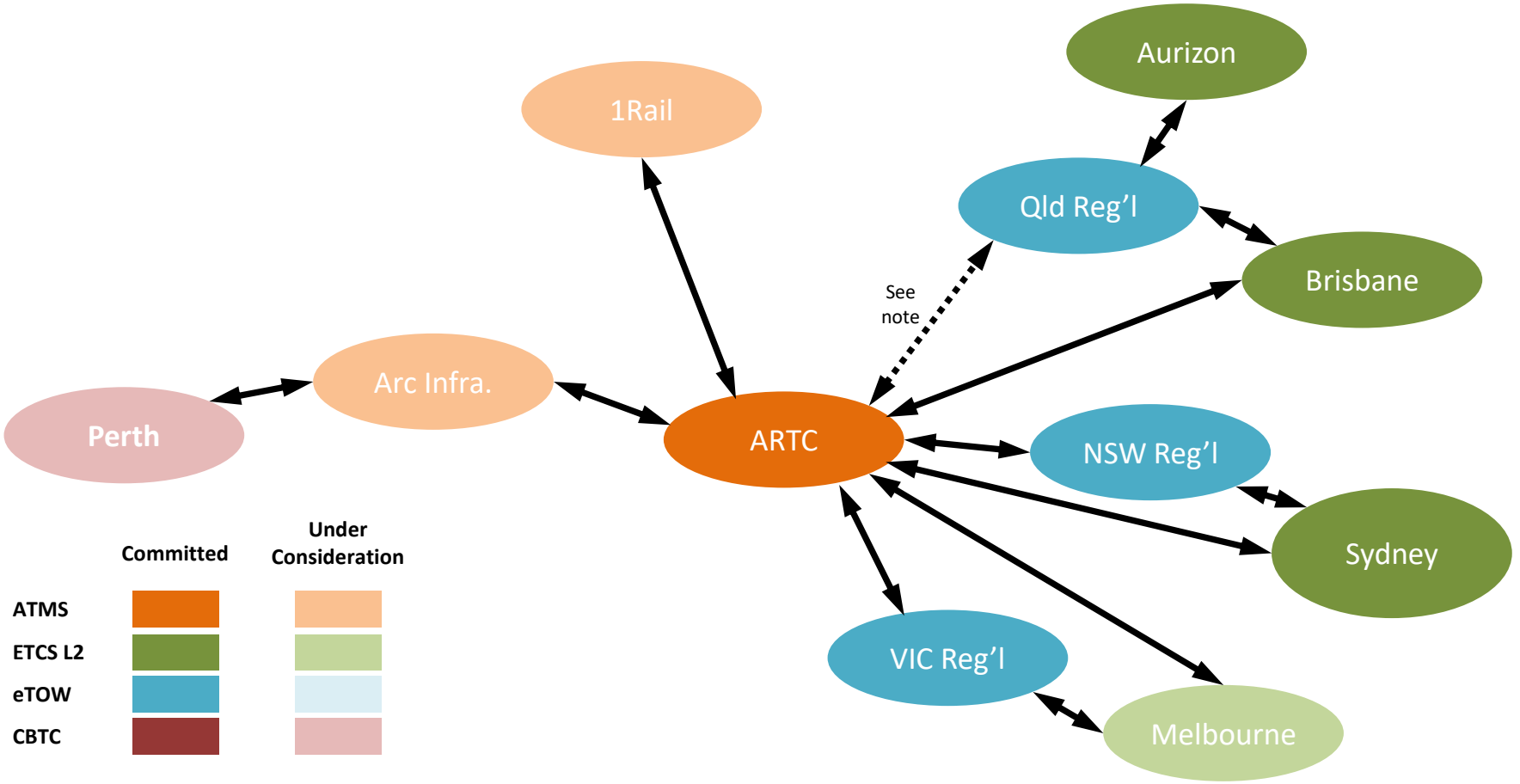


Planned in: **Perth**

Work is underway to separate freight and passenger movements via bridge works at Fremantle, and potentially to reroute the Indian Pacific to avoid the Midland to East Perth Corridor. However, regional passenger trains will continue to operate between the Arc Infrastructure network and the Perth suburban network, to East Perth and Perth stations.

Interfacing of planned systems

With current system choices and plans made by rail networks nationally, ATMS is in a central position with respect to interoperability needs.



Committed: Funding allocated and program underway
Under Consideration: Internal discussions held, but no program established as yet

Note: Interface between ARTC and Qld Regional will be established once Inland Rail is complete.

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD palazzirail

Operational interfaces between networks

The matrix below shows the operational interfaces between the nationally connected networks. A connection exists where trains regularly travel between the two networks (i.e. physical adjacency is not required for an operational connection).

Network	1Rail (Tarcoola to Darwin)	Arc Infrastructure	ARTC	Aurizon	Brisbane	Melbourne	NSW regional	Perth	Queensland regional	Sydney
Arc Infra.										
ARTC	Interstate freight, interstate passenger	Interstate + regional freight, interstate passenger								
Aurizon										
Brisbane			Interstate + regional freight, interstate + regional passenger	Regional freight, regional passenger						
Melbourne			Regional freight, Interstate + regional passenger							
NSW regional			Regional freight, Interstate + regional passenger							
Perth		~~Regional freight,~~ interstate + regional passenger	Interstate passenger							
Queensland regional			Interstate + regional freight, regional passenger	Regional freight, regional passenger	Regional freight, regional passenger					
Sydney		Interstate freight, interstate passenger	Interstate + regional freight, interstate + regional passenger		Interstate passenger	Interstate passenger	Regional freight, Interstate + regional passenger	Interstate passenger		
Victoria regional			Regional freight, regional passenger			Regional freight, regional passenger				

Note: Items shown in strikethrough reflect existing operational interfaces that may be eliminated if network segregation works in Perth proceed.

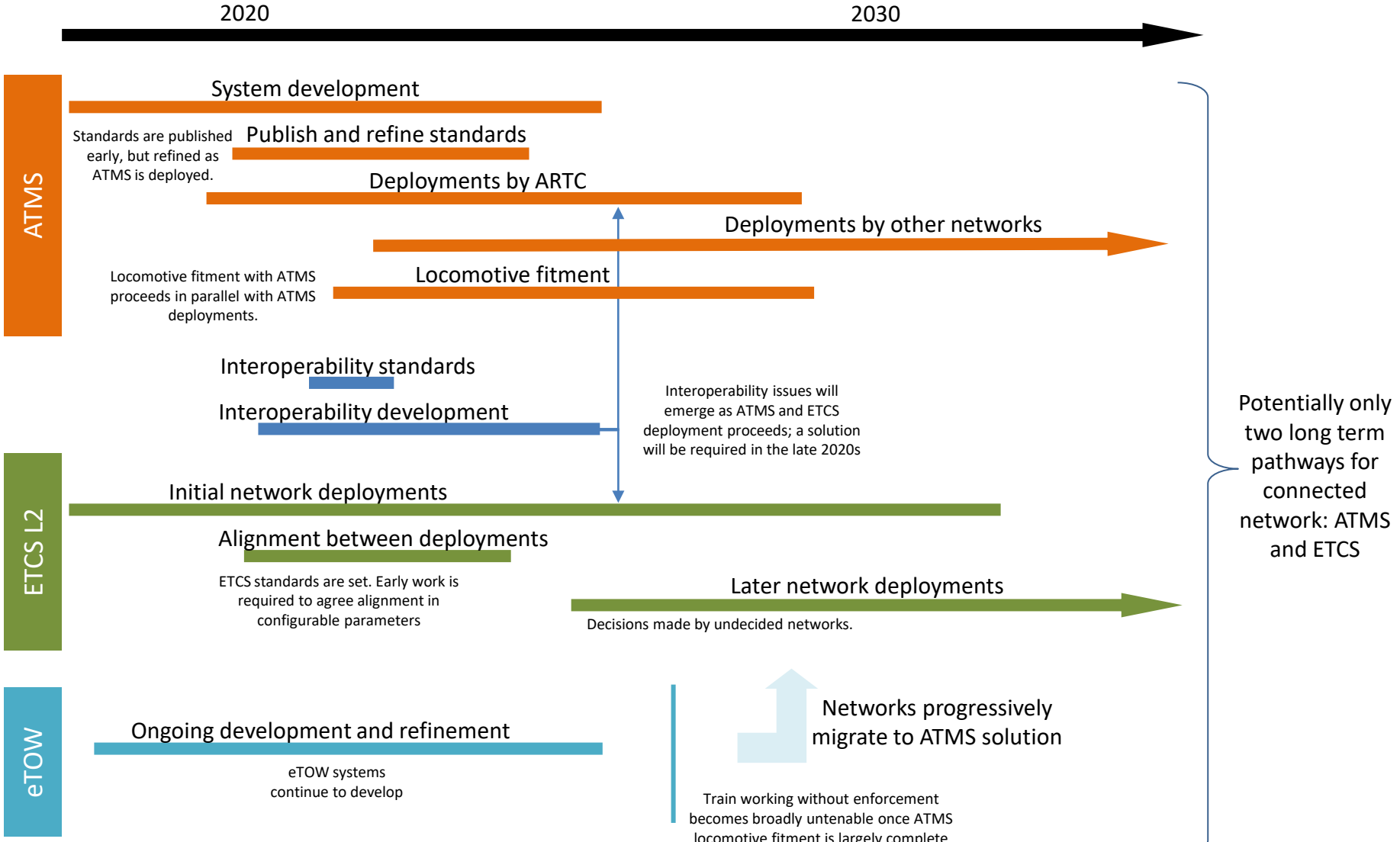
Intersections between systems

Based on the operational interfaces between the nationally connected networks, the matrix below shows the resultant interfaces between planned network control systems. Entries in bold reflect committed programs. Entries in italics reflect programs under consideration.

Network	1Rail (Tarcoola to Darwin)	Arc Infrastructure	ARTC	Aurizon	Brisbane	Melbourne	NSW regional	Perth	Queensland regional	Sydney
Arc Infra.										
ARTC	**ATMS** – *ATMS*	**ATMS** – *ATMS*								
Aurizon										
Brisbane			**ATMS – ETCS L2**	**ETCS L2 – ETCS L2**						
Melbourne			**ATMS** – *ETCS L2*							
NSW regional			**ATMS – eTOW**							
Perth		*CBTC – ATMS*	*CBTC –* **ATMS**							
Queensland regional				**ETCS L2** - *undecided*	**ETCS L2** - *undecided*					
Sydney		**ETCS L2** - *ATMS*	**ATMS – ETCS L2**		**ETCS L2 – ETCS L2**	**ETCS L2** – *ETCS L2*	**ETCS L2 – eTOW**	**ETCS L2** – *CBTC*		
Victoria regional			**ATMS – eTOW**			**eTOW** – *ETCS L2*				

Note: Items shown in strikethrough reflect existing operational interfaces that may be eliminated if network segregation works in Perth proceed.

Potential system pathways (see note)

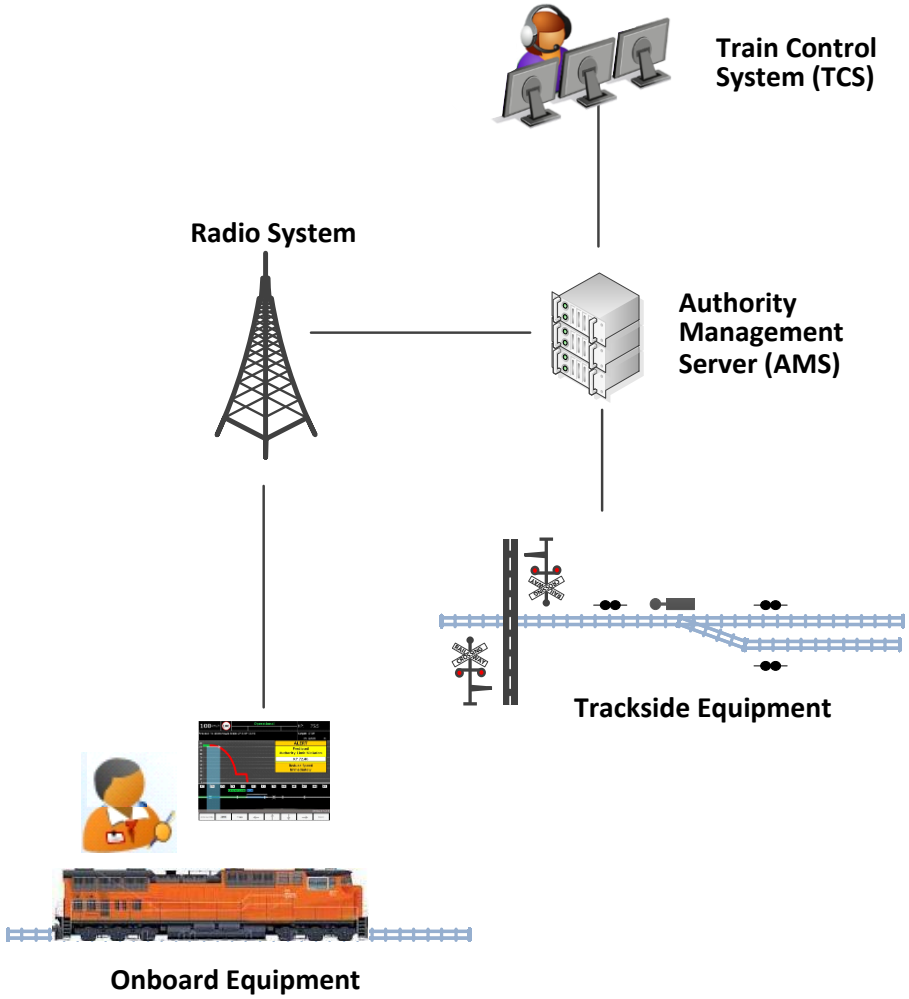


Note: This reflects a palazzirail view based on existing commitments and announcements successfully proceeding to completion, plus a considered judgement on future events.

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD palazzirail

ATMS components, functions and architecture

This slide presents a simplified view of the key components of ATMS and their functions, to provide a basis of understanding for the following slides.



Component	Functions
Train Control System (TCS)	• Provides tools to manage the network and authorise train movements. • Interfaces to other network management and business systems.
Authority Management Server (AMS)	• Manages network safety • Monitors and controls the position of infrastructure. • Generates instructions (Movement Authorities) and issues to trains.
Trackside Equipment	• Ensures route is safe for the passage of the train. • Displays appropriate indications to train crew of infrastructure status
Radio System (Telstra Next G)	• Provides data link between centralised equipment and trains.
Onboard Equipment	• Determines train position. • Displays instructions to train crew, including infrastructure status. • Enforces authority limits to ensure safety of operations.

A key initiative: Establishing interoperability between ETCS L2 and ATMS

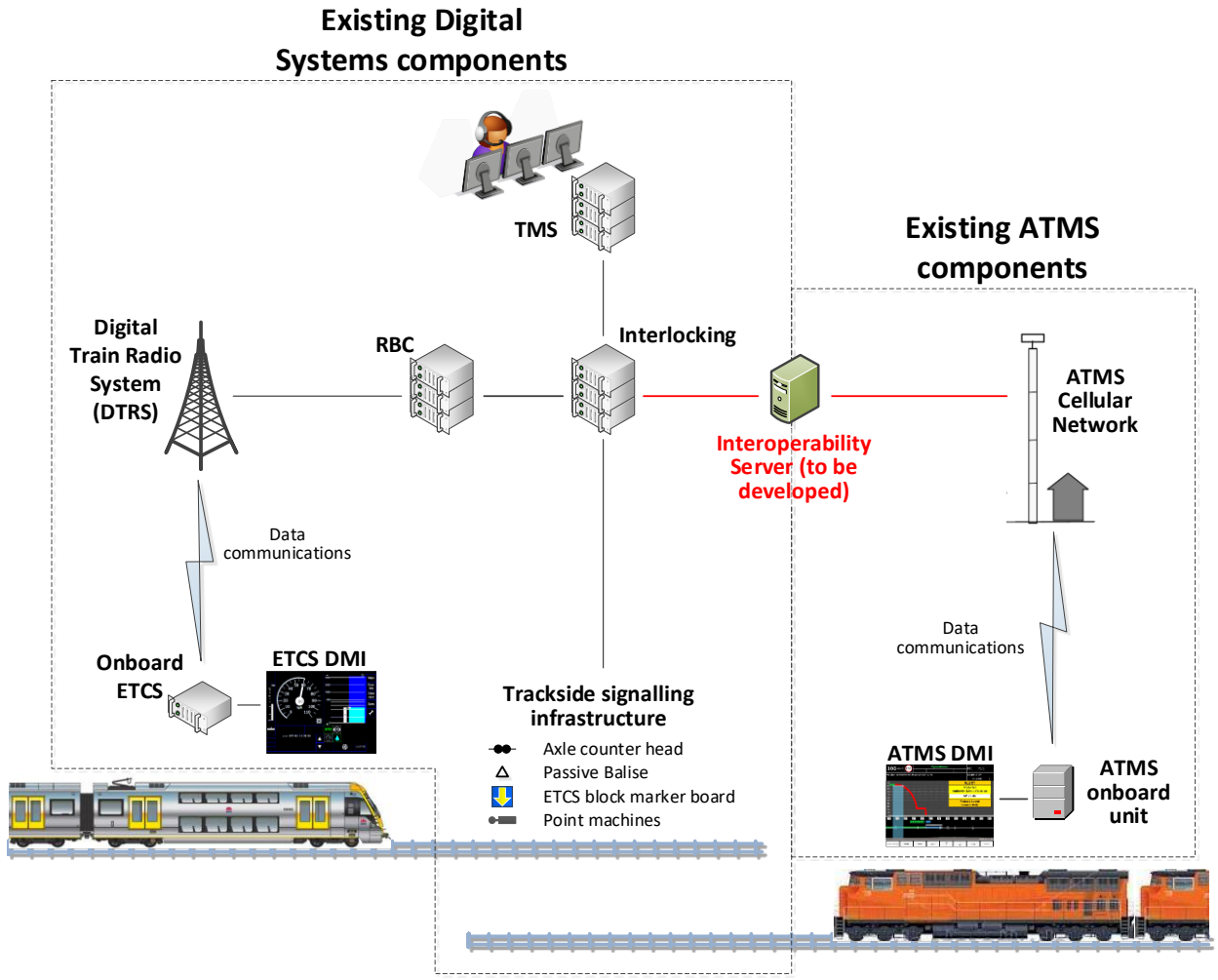
Transport for NSW and ARTC have investigated options for providing interoperability between Digital Systems (using ETCS L2) and ATMS, with the objective:

> Allow an ATMS-equipped train to travel through an ETCS L2 area, with movement authorities received, understood and enforced by the on-board ATMS equipment.

The intent is that any interoperability solution must work for ATMS-equipped trains travelling through any ETCS L2 areas in the Sydney Trains network, and ideally could also be used by any other ETCS L2 rail networks nationally.

A preferred technical solution has been identified, requiring the development of an 'interoperability server' to take a message from the ETCS L2 interlocking, and generate an ATMS Movement Authority and transmit it to the train.

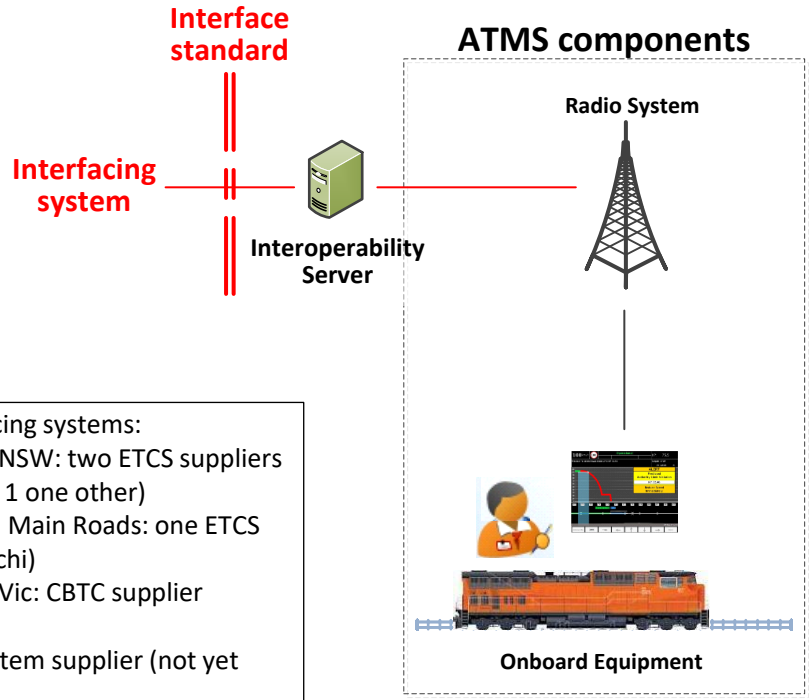
Transport for NSW and ARTC are now investigating the viability of this option, with a view to going to market for development of the server.



Text and diagram courtesy Transport for NSW

Generic ATMS interoperability option

- Based on TfNSW / ARTC work to develop an interoperability solution between ATMS and ETCS L2, but expands it to be generic solution.
- Allows a second system to manage ATMS-equipped trains through a non-ATMS territory, with enforcement of Movement Authorities.
- Applies where interfacing system already provides authority enforcement, e.g. ETCS L2, CBTC.
- A defined interface standard would permit widespread use of the interoperability server to provide interoperability with ATMS.



Potential interfacing systems:
- Transport for NSW: two ETCS suppliers (Siemens plus 1 one other)
- Transport and Main Roads: one ETCS supplier (Hitachi)
- Transport for Vic: CBTC supplier (Bombardier)
- PTA: CBTC system supplier (not yet determined)
- Other ETCS or CBTC suppliers, as appropriate

Functions and components from interfacing system

Component	Functions
Train Control System / Traffic Management System	• Provides tools to manage the network and authorise train movements. • Interfaces to other network management and business systems.
Interlocking	• Manages network safety • Monitors and controls the position of infrastructure. • Issues instructions for Movement Authorities to interoperability server.
Trackside Equipment	• Ensures route is safe for the passage of the train. • Displays appropriate indications to train crew of infrastructure status

Functions of interoperability server

Component	Functions
Interoperability Server	• Generates ATMS Movement Authorities and issues to trains.

Functions and components from ATMS

Component	Functions
Radio System	• Provides data link between centralised equipment and trains.
Onboard Equipment	• Determines train position • Displays instructions to train crew. • Enforces authority limits to ensure safety of operations.

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD palazzirail

Alignment of implementations

Current directions see parallel implementation of the same system or technology in a number of networks, within and outside of the connected network. Alignment of key elements between these implementations, where feasible, may provide a better national outcome and ongoing benefits for the rail industry.

Case 1: ATMS

Implementations planned:

- ARTC

Potential implementation (longer term):

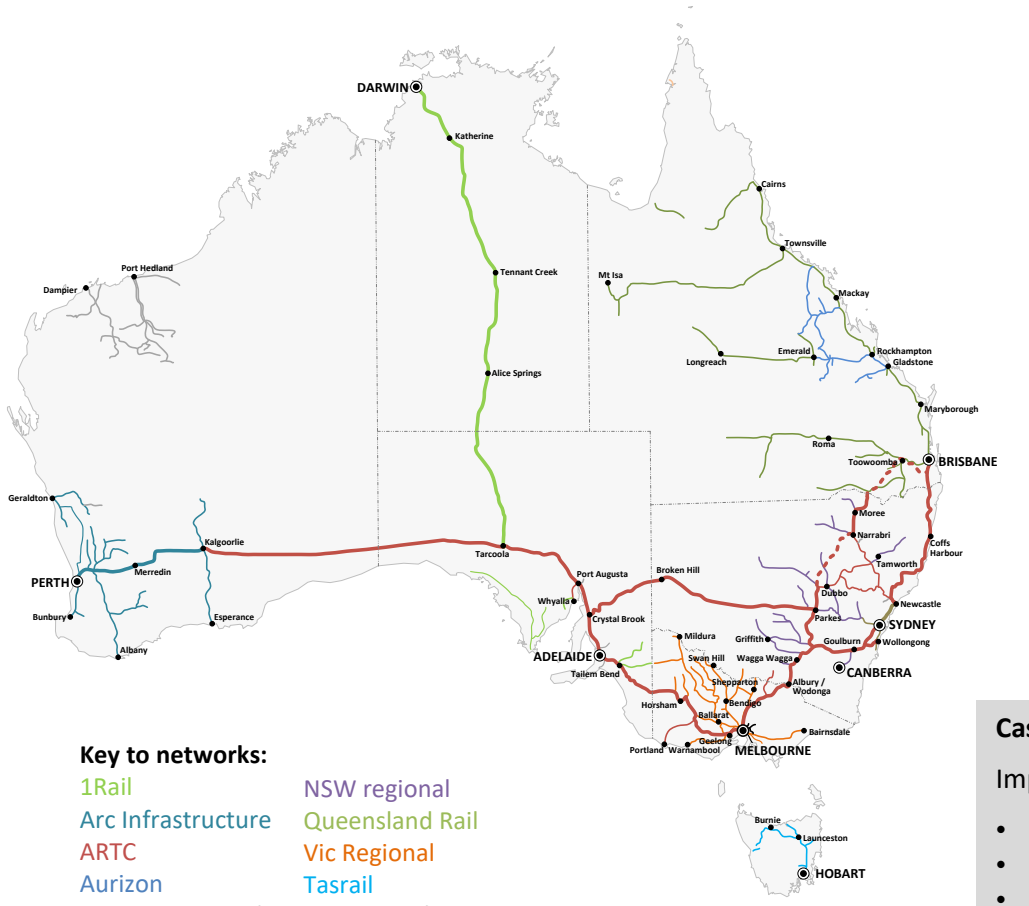
- Arc Infrastructure
- 1Rail
- NSW regional
- Vic regional
- Queensland Rail (regional)
- Tasrail

Dependency (though interoperability):

- Sydney
- Brisbane

Potential dependency:

- Melbourne
- Perth



Key to networks:

1Rail	NSW regional
Arc Infrastructure	Queensland Rail
ARTC	Vic Regional
Aurizon	Tasrail
Pilbara railways (several owners)	

Case 2: ETCS L2

Implementations planned:

- Sydney
- Brisbane
- Aurizon

Potential implementation (longer term):

- Melbourne
- Adelaide
- Queensland Rail (North Coast)
- Queensland Rail (regional)

Case 3: CBTC

Implementations by:

- Melbourne
- Perth
- Sydney Metro

Note: This reflects a palazzirail view based on existing commitments and announcements successfully proceeding to completion, plus a considered judgement on future events.

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD

palazzirail

Alignment of implementations

	ATMS	ETCS L2	CBTC
Applies to	Implementing networks Dependent networks	Implementing networks	Implementing networks
Relevant standards and governing body	One system with a single supplier, standards are managed by ARTC.	Interoperable standards published and governed by the European Rail Agency.	Systems independently developed to the standard IEEE1474.
Potential for variability between implementations	System is provided by a single supplier and only exists as a single product with no variants. A driver for diverse functionality to develop will be 'unique' characteristics or ways of working in different networks, plus perceived state-based constraints or requirements.	Systems from different suppliers are interoperable (see note), but equipment is not interchangeable. ETCS provides a degree of configuration in applications, including national values, equipment configurations, signalling principles and operating rules.	Systems from different suppliers are unique, and are applied within the parameters agreed with the supplier.
Issues that may arise from misalignment	Different rule books implemented on different networks, or different states. Industry overheads and/or safety implications at boundaries.	Industry overheads from different implementations and lost opportunities (see note).	Nil. Systems are distinct and implemented independently.
Opportunities for alignment **Note:** some of these initiatives are already underway by the responsible entity.	Ensure all ATMS implementations adhere to the established standards. Ensure a single set of ATMS rules on deployment regardless of state /territory or network. Provide non-ARTC networks adopting or dependent on ATMS a 'seat at the table' so their needs are heard. Ensure ongoing alignment of competency frameworks.	Coordinate National Values. Align signalling principles and operating rules as far as practical. Encourage of cross-acceptance of safety cases, where practical. Encourage of cross-acceptance of equipment type approvals, as far as practical. Develop and align competency frameworks.	No reason to seek technical alignment. Systems are distinct and implemented independently. Develop and align competency frameworks.

Note: This assessment assumes that appropriate 'technical' interoperability testing and validation will be undertaken by each jurisdiction when implementing ETCS L2.

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD palazzirail

Establishing the case for a national approach

Establishing the case for interoperability of train control systems requires that a national view is taken, rather than a network-specific view. By considering what a SFAIRP outcome would be at a national level, decisions made by individual networks on new system technologies, and decisions around interoperability, can be directed towards a unified outcome.

The National Interoperability Safety Case should:

1. Determine what would be a safe SFAIRP outcome nationally for new train control systems, considering the decision made and trajectory of system deployment (in this document and elsewhere).
2. Establish a framework for system decisions made by individual networks, so that a safe SFAIRP outcome is achieved at a national and at a network level.
3. Clarify accountabilities for interoperability between different rail entities.

Trains will continue to travel across network boundaries for the foreseeable future. Without interoperability there is the possibility of a train equipped with 'System A' travelling through an area managed by 'System B,' and for a accident to occur that could have been prevented had these systems been linked.

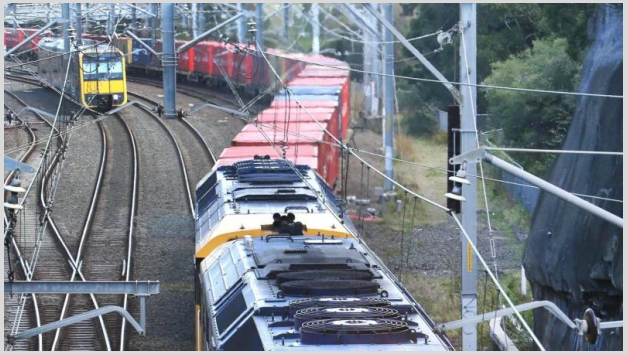


Photo source: Sydney Morning Herald

For consideration in the National Interoperability Safety Case:

- How does a national perspective of what is safe SFAIRP interact with what is safe SFAIRP on an individual network?
- To what extent does what can be considered safe SFAIRP vary across networks? What factors influence this?
- Can the retention of systems that do not provide authority enforcement (e.g. lineside signalling, TOW) be justified, and if so, under what conditions?
- Can operation of a SIL3 ATMS unit though an ETCS network be justified compared to the alternative of fitting all trains with a SIL4 system (i.e. dual-fit with ETCS)?
- Is there a role for devices that may assist with interoperation of trains but do not provide enforcement (e.g. a portable onboard device)?
- To want extent does alignment (or misalignment) of implementations of the same system (ETCS or ATMS) impact on what is safe SFAIRP.

Existing standards AS-7450_2013 and AS-7466_2013 require railway entities to consider the interoperability implications of their choices, with all stakeholders. However, without a national framework it is not easy to establish who all the relevant stakeholders are and what is the best outcome given decisions that have been or may be made by other entities.

The National Interoperability Safety Case would provide the context within which future interoperability decisions can be made.

Who pays for interoperability?

The interconnectedness of the national rail industry means that decisions made by one entity can have impacts on many others. With respect to train control systems, one network's choice will inevitably mean:

- For operators – costs for equipment, costs to fit and maintain the system, costs to train staff, cost of locomotive down-time
- For adjacent networks – costs to interface, costs to maintain data

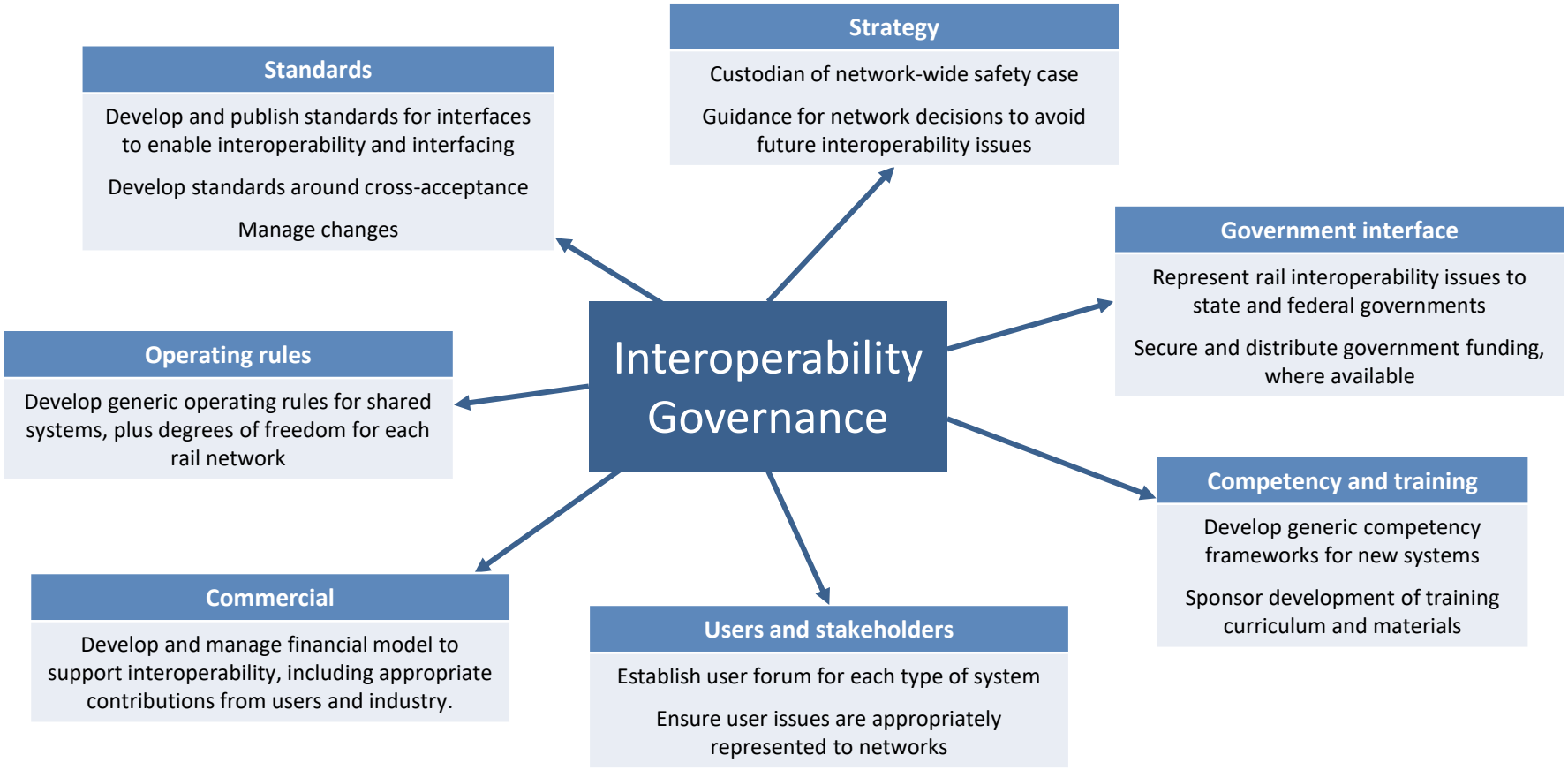
A national approach to interoperability may help to minimise these costs, but it itself has a cost.

Cost element	User / owner pays	Industry-wide levy	Government contribution	Notes
Development of interoperability options and solutions	Option	Not appropriate	Option	• Specific interoperability solutions will benefit particular networks. The network that made the choice that triggered the need for the solution should bear the cost. • Where one developed solution forms the basis of a second solution, costs may be recovered from the subsequent party by the funder of the initial solution. • Government funding might be an option to consolidate interoperability in the first instance.
Interoperability standards and governance	Not appropriate	Option	Option	• Will provide industry-wide benefit, so funding from across industry would seem appropriate. • Government seed funding may assist to establish interoperability arrangements.
Capex to implement systems, including trackside, onboard and interoperability components	Option	Not appropriate	Option, for onboard components	• System deployment provides benefits to networks and operators alike. Some form of user funding model is appropriate, negotiated between the parties. • Various commercial models exist for onboard fitment and to accommodate misalignment of benefits and costs, e.g. network pays and recovers through access charges; free issue of equipment and operator pays for fitment; operator funds fully where there is sufficient benefit. • Costs for onboard components are likely to be prohibitive for some operators. Government funding of initial fitment may be appropriate.
Ongoing costs for system management and development, esp. ATMS	Option	Option	Not appropriate	• Enhancements to systems would occur to provide improved functionality or business benefits. Funding should follow benefits. • Where multiple parties are using the same system, a mechanism will be needed to balance benefit to those originating the change against any incidental benefit to other system users.

Interoperability governance

To achieve interoperability between systems and alignment between implementations, and to maintain these outcomes over the longer term, will require establishment of appropriate governance around interoperability.

Some of the considerations for interoperability governance are illustrated below.



Possible roadmap for interoperability governance

		Immediate (1-2 years)	Medium term (3-5 years)	Longer term (6 years +)
What's happening across industry		Mobilisation for first large-scale deployments of ATMS and ETCS ATMS locomotive fitment program initiated ATMS-ETCS interoperability solution specified and underway	ATMS deployment underway in ARTC, ETCS deployments underway in Sydney, Brisbane and Central Queensland ATMS locomotive fitment program initiated ATMS-ETCS interoperability solution in development then delivery	Deployments continue in ARTC, Sydney, Brisbane and Central Queensland Bulk of the ATMS locomotive fitment program completed ATMS-ETCS interoperability solution in use ATMS / ETCS deployment in planning in other networks
Interoperability governance focus		**Alignment of early implementations, interoperability pathway for ETCS / ATMS.**	**Establishing baseline and structures for national deployments.**	**Transition to steady-state governance**
Specific actions	**ATMS**	Consult across potential users and networks to ensure generic applicability of ATMS standards	Refine standards as necessary	Manage ongoing issues, integration of new deployments and migration pathways e.g. for equipment obsolescence
	ATMS/ETCS Inter-operability solution	Support interoperability solution development; ensure generic applicability of the solution.	Establish an industry-acceptable approach to ATMS data management. Publish interface standard for interoperability solution.	
	ETCS	Work with TfNSW/TMR/Aurizon to achieve alignment between ETCS deployments, providing a baseline for other deployments.	Develop and publish standards and guidelines for national deployments	
	Other	Develop network-wide safety case Develop competency frameworks for use across all systems	Establish stakeholder and user groups Influence network decisions with a view to interoperability	

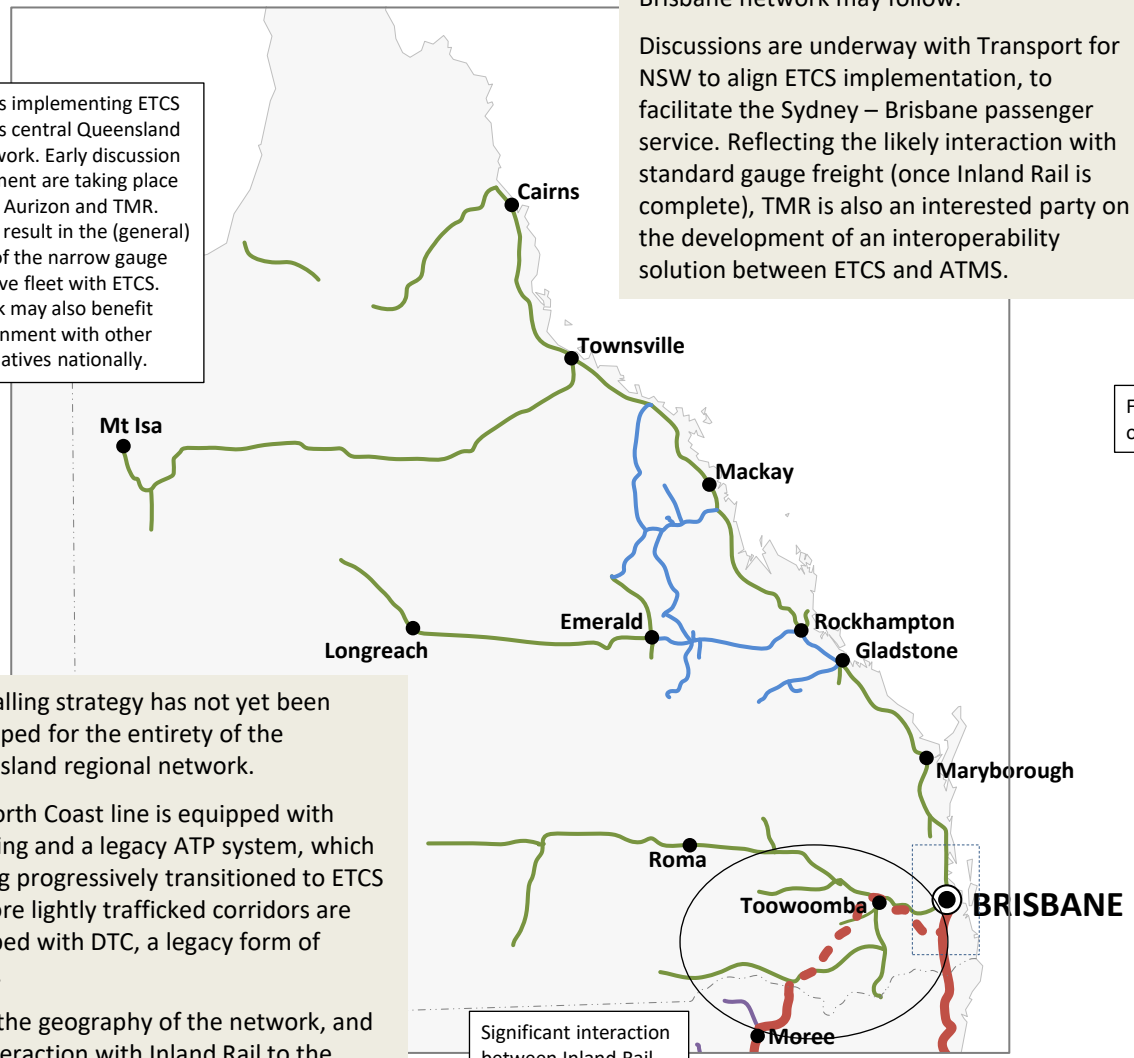
State by state focus

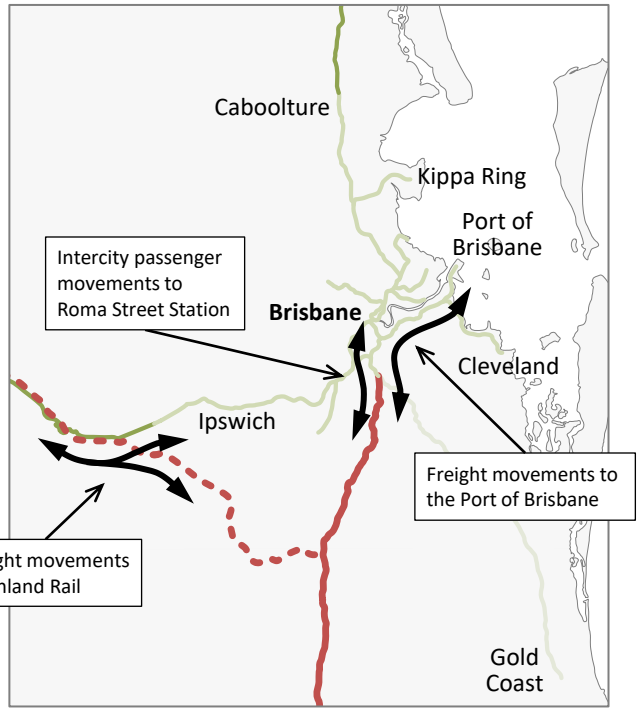
Queensland

ETCS is being deployed in the central areas of the Brisbane (SEQ) network as part of the Cross River Rail project. In future years deployment of ETCS across the entire Brisbane network may follow.

Discussions are underway with Transport for NSW to align ETCS implementation, to facilitate the Sydney – Brisbane passenger service. Reflecting the likely interaction with standard gauge freight (once Inland Rail is complete), TMR is also an interested party on the development of an interoperability solution between ETCS and ATMS.

Aurizon is implementing ETCS across it's central Queensland coal network. Early discussion on alignment are taking place between Aurizon and TMR. This may result in the (general) fitment of the narrow gauge locomotive fleet with ETCS. This work may also benefit from alignment with other ETCS initiatives nationally.





A signalling strategy has not yet been developed for the entirety of the Queensland regional network.

The North Coast line is equipped with signalling and a legacy ATP system, which is being progressively transitioned to ETCS L1. More lightly trafficked corridors are equipped with DTC, a legacy form of eTOW.

Given the geography of the network, and the interaction with Inland Rail to the south, it may be a viable path to separate the network into two parts and use ATMS in the West and South-West, with ETCS elsewhere). However, this would have a range of operational implications.

At present there is limited interface between the ARTC interstate network, the Queensland regional network (Western System) and the Brisbane suburban network. Inland Rail changes this.

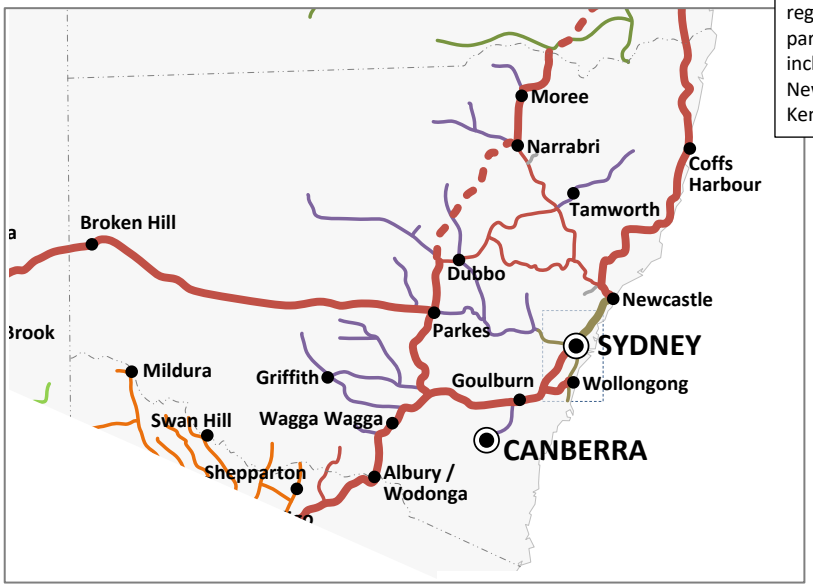
Inland Rail will be constructed in dual gauge in Queensland, to permit rail traffic serving the Darling Downs and nearby areas to use the Inland Rail alignment for a quicker route down the Toowoomba Range and to Brisbane. A key freight flow is the West Moreton coal, which will join Inland Rail west of Toowoomba, then travel through the Brisbane suburban network to the Port of Brisbane.

Inland Rail also creates opportunities for port shuttles, from the Port of Brisbane to intermodal terminals near Toowoomba and Bromelton. These trains will also increase the interaction between standard gauge freight and the Brisbane network.

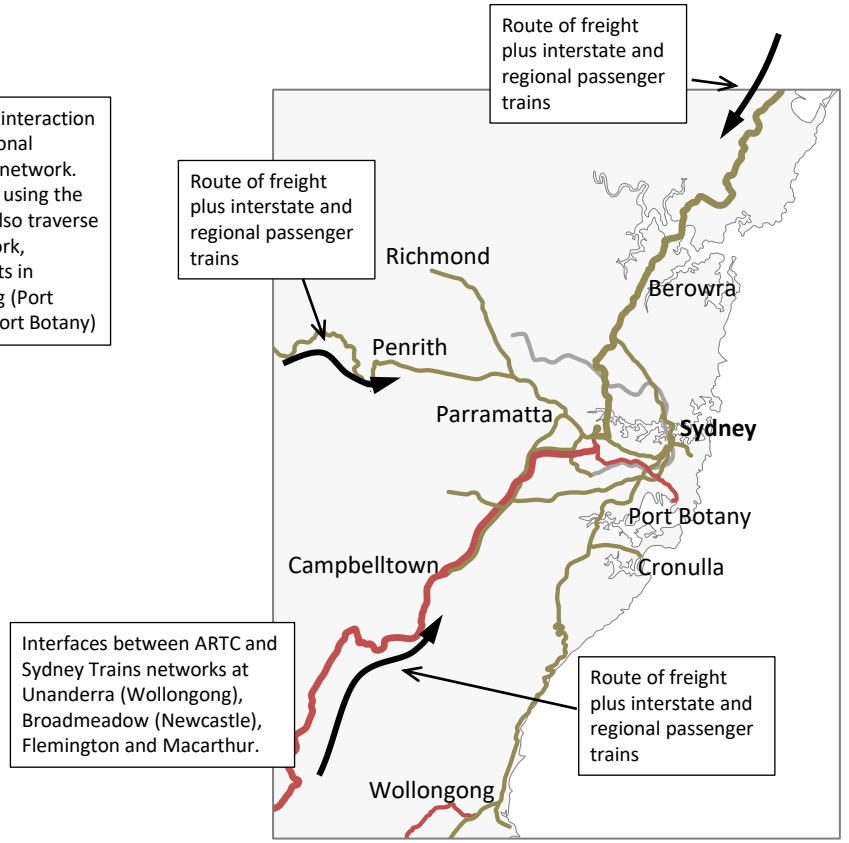
RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD

palazzirail

New South Wales



Significant operational interaction between the NSW regional network and the ARTC network. Most train movements using the regional network will also traverse part of the ARTC network, including to access ports in Newcastle, Wollongong (Port Kembla) and Sydney (Port Botany)



The majority of the network NSW regional network (Country Regional Network, or CRN) is controlled using eTOW, with a system that is well supported and still under development. Some sections of RVD signalling also exist. However, neither of these systems provides authority enforcement.

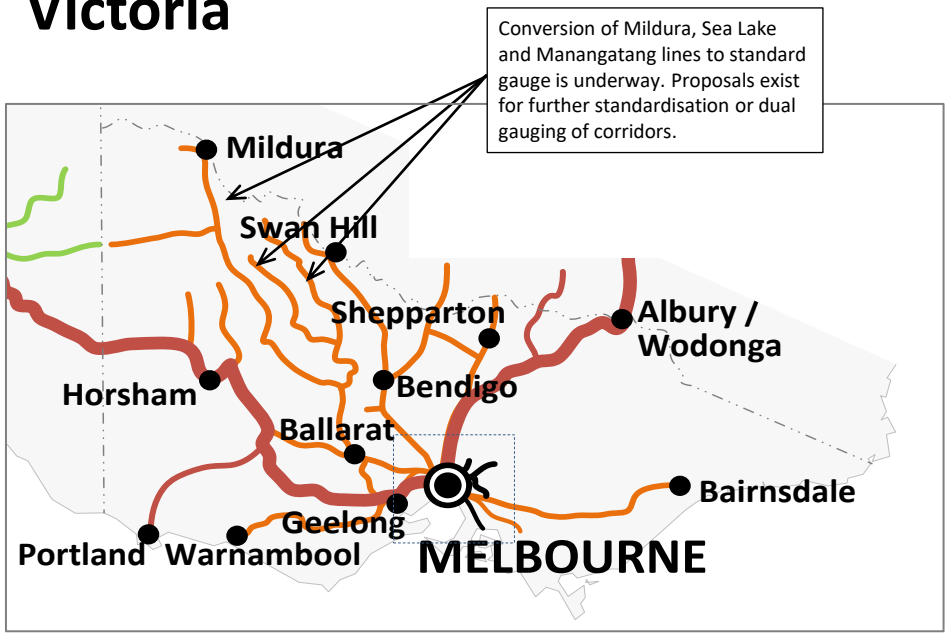
Once ATMS is available and fitted to all locomotive using the CRN, the deployment of ATMS across some or all of the CRN may follow, to take advantage of the benefits that would be available.

ARTC plans to deploy ATMS across its entire network over coming years, with an early stage being deployment onto Inland Rail as the new sections of this corridor (dashed lines on the map) are constructed. The section from Parkes to Broken Hill may also be early in the ATMS deployment sequence as an extension of the East-West corridor deployments Tarcoola to Kalgoorlie and Tarcoola to Port Augusta.

Transport for NSW's Digital Systems program is implementing ETCS L2 across the Sydney Trains-managed network. Deployment is funded for two initial corridors, selected in part because they have no impact on freight operation, However, deployment is planned across the whole network.

Because of the significant interaction between the Sydney network and freight trains, the scope of the Digital Systems program includes development of an interoperability solution to permit the passage of ATMS-equipped trains through the network. This initiative is being developed in partnership with ARTC.

Victoria



CBTC is being deployed on the Sunbury to Dandenong corridor, as part of the Melbourne Metro project. Lineside signals are being used on the eastern portion of the corridor, to accommodate freight and regional passenger movements. On the eastern portion of this corridor work is underway to segregate the metro corridor from freight and regional passenger operations as far as possible.

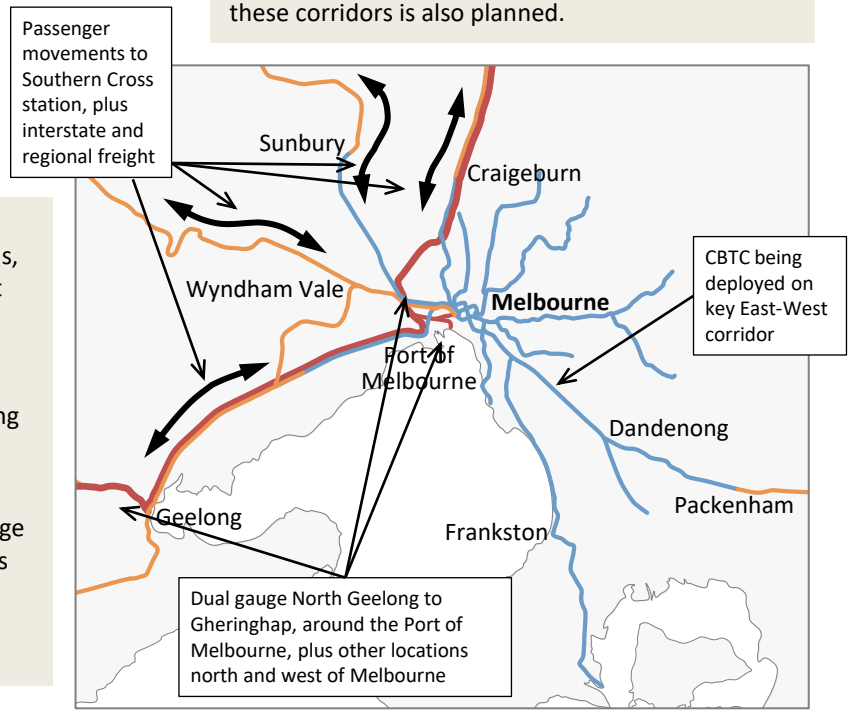
Progressive deployment of CBTC over other corridors in the Melbourne metropolitan network was envisaged in previous network plans. Plans have yet to be developed or committed for deployment. Separation of operation on each of these corridors is also planned.

A contract has recently been let to deploy an enhanced TOW (eTOW) solution for regional corridors in Victoria. This solution will require a new screen to be installed in locomotives, to receive an electronic authority.

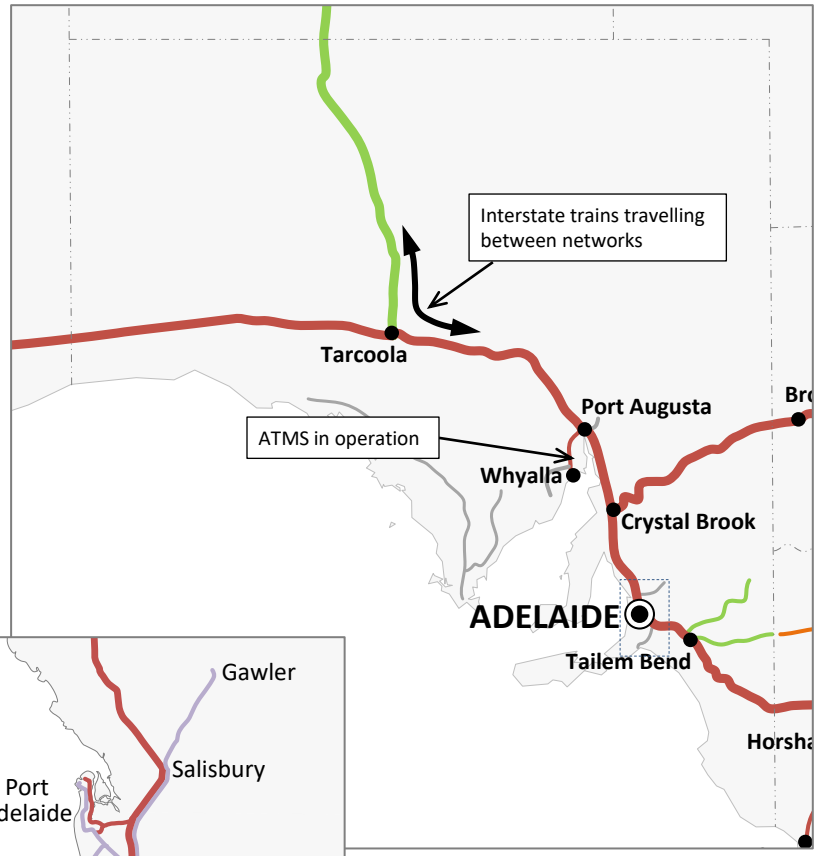
With the conversion of some regional corridors in Victoria to standard gauge, the amount of interworking between this network and the national network will increase. This will include a need to resolve the parallel working of the new eTOW screen and subsequent ATMS trainborne installation.

To the west of Melbourne, greater interaction between suburban and regional passenger trains, regional freight and interstate freight is brought about by several areas of dual gauge operation. Existing regional passenger operations already include broad gauge and standard gauge trains, depending on the route. This means interworking between the ARTC and V/Line networks.

Whilst no system choice has been made for the V/Line corridors in this area, the ability to manage variability of train type means that ETCS appears more suitable than CBTC. Interoperability with ATMS will be a key issue, as this will be installed onto ARTC corridors

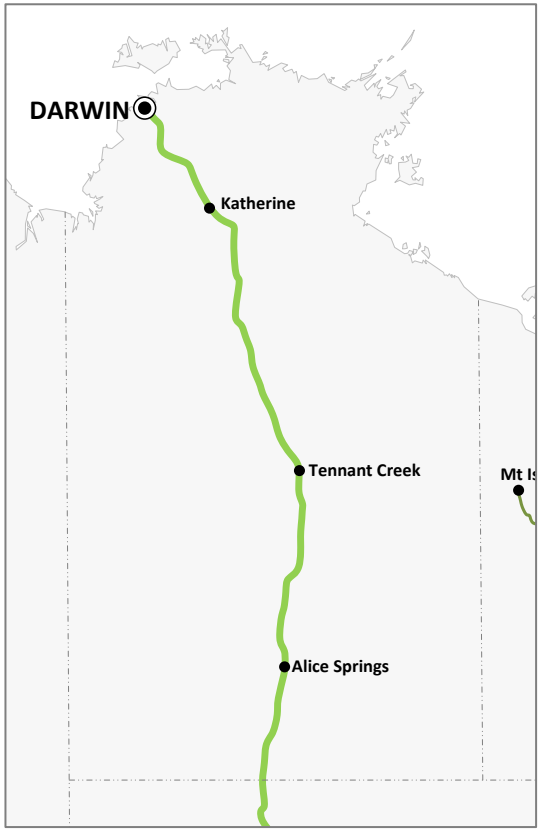


South Australia and Northern Territory



ATMS is operational between Port Augusta and Whyalla. ARTC is planning early implementation of ATMS on the section Tarcoola to Kalgoorlie, potentially around 2022, followed by the section from Tarcoola to Port Augusta.

ARTC intends to deploy ATMS across its entire network over coming years, and to work with operators to fit the standard gauge locomotive fleet with ATMS equipment.



No in-cab signalling solution has been selected for the Tarcoola to Darwin component of the 1Rail network, however this section was included in the FORG ATMS submission to the Commonwealth Government. This may mean that 1Rail ultimately chooses to implement ATMS across it's network.

This will provide interoperability for trains crossing between the 1Rail and ARTC networks

Separation between the Adelaide suburban network and the surrounding ARTC freight network has already been achieved, with the last components being the Goodwood Junction grade separation in 2018. However, DTEI has progressed the implementation of ETCS Level 1 across the Adelaide network, and may benefit from alignment with other ETCS initiatives nationally.

RISSB RAIL INDUSTRY SAFETY AND STANDARDS BOARD palazzirail

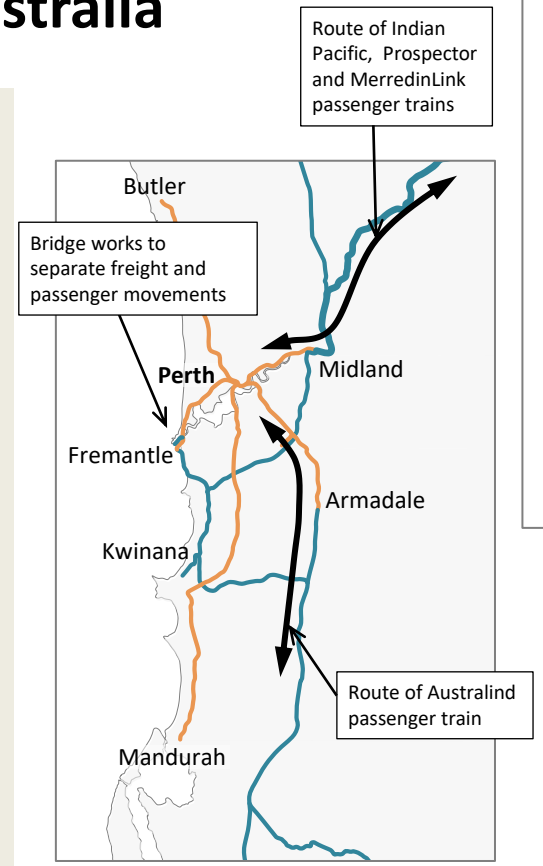
State by state focus

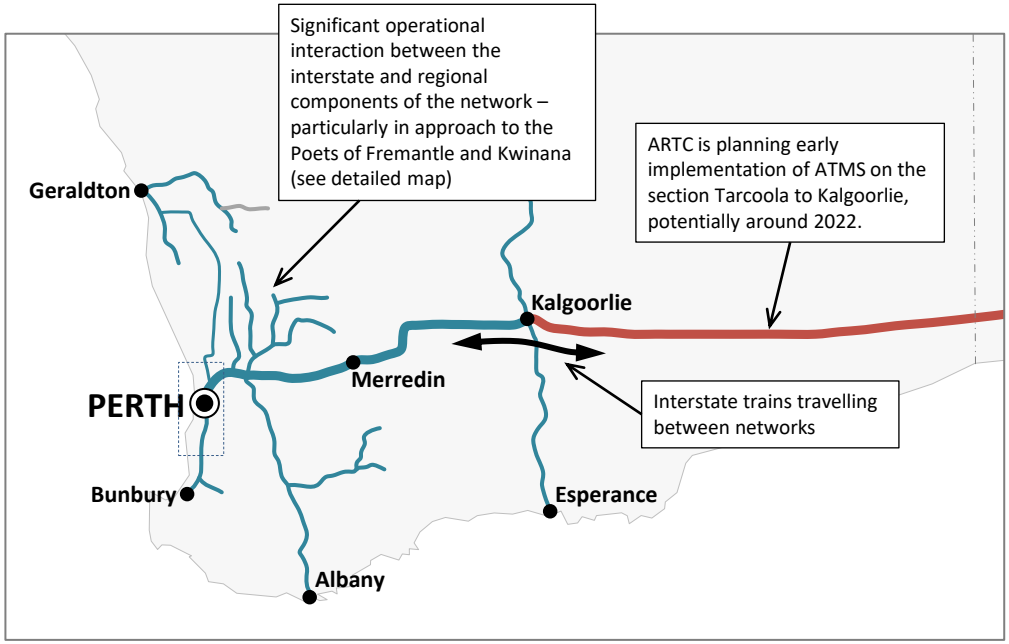
Western Australia

Public Transport Authority's High Capacity Signalling (HCS) program will implement an in-cab signalling (nominally CBTC) across the Perth network in the 2020s.

This system will be incompatible with freight and loco-hauled passenger trains. Works are planned to segregate the networks, including reconstructing the rail bridge over the Swan River at Fremantle.

This segregation work may include rerouting the Indian Pacific to a new terminal at Fremantle. However, should this train continue to operate to East Perth station a solution may be required to enable it to use in-cab signalling for this short segment of its journey.





Following the planned works to segregate the PTA network from the surrounding Arc Infrastructure freight network, the residual trains traversing the network boundaries will be regional passenger trains:

- Prospector – standard gauge, operating between Kalgoorlie and East Perth.
- MerredinLink – standard gauge, operating between Merredin and East Perth.
- Australind – narrow gauge, operating between Bunbury and Perth.

PTA plans to fit these trains with compatible in-cab signalling equipment as part of the HCS program.

In the event that Arc Infrastructure deploys a new system (potentially ATMS), a solution may be required to enable these trains to use in-cab signalling across their entire journey.

Arc Infrastructure's Enhanced Network Control Program (ENCP) has two phases:

- Phase 1 (underway): implement a new train control system and interface to existing business systems (timetabling, reporting, etc.), plus worksite management. This system will extend over both the interstate portion of the network, plus the regional lines.
- Phase 2: Add in-cab signalling. No solution has been chosen, however Arc Infrastructure's commitment is to be compatible with ARTC's system.

This commitment may ultimately mean that Arc Infrastructure chooses to implement ATMS across it's network. It is noted that the Arc Infrastructure network was included in the FORG ATMS submission to the Commonwealth Government.

Any system implemented on the Arc Infrastructure interstate line may additionally be extended across the regional components of the network, subject to need.