Regulatory guidance for safer rail interoperability in Aotearoa New Zealand

Rail Safety Regulation
Regulatory Services

NZ Transport Agency Waka Kotahi
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NZ TRANSPORT AGENCY WAKA KOTAHI

Te Kāwanatanga o Aotearoa
New Zealand Government

More information

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1. Purpose

1.1. Purpose

New Zealand Transport Agency Waka Kotahi (NZTA) has developed this high-level guidance to support all rail participants—licensed and unlicensed— to work together safely and effectively.

This guidance explains how to manage interoperability across New Zealand's rail system.

With many different organisations and people all using the rail network simultaneously, there are many potential scenarios where safety can be compromised due to incompatibilities between systems. Effective interoperability ensures that systems and processes are in place to ensure all who use the rail network do so safely.

This guidance aligns with the intent of the Railways Act 2005. It is voluntary and non-binding. NZTA expects that most rail participants will already demonstrate many of the recommended actions. Some actions will be more applicable to some participants than others.

Note however, that this guidance represents good practice and meets NZTA's expectations for how a rail participant may meet its interoperability obligations.

You can meet your legal duties in other ways, as long as you comply with the Act.

Talk with your health and safety advisers about the right approach for your organisation.

1.2 The Railways Act, 2005

This guidance should be read alongside The Railways Act, 2005. Sections of most relevance to interoperability include:

- s5 – "meaning of reasonably practicable"
- s7(1) - "a rail participant must ensure, so far as is reasonably practicable (SFAIRP), that none of the rail activities for which it is responsible causes, or is likely to cause, the death of, or serious injury to, individuals."
- s8 "relationship of Act with Health and Safety at Work Act, 2015": s34 of that Act holds relevance in relation to consultations between multiple PCBUs ('Person Conducting a Business or Undertaking') who share the same duty
- s29 - s36 – All licenced rail participants are required to have an approved safety case approved by NZTA

Interoperability [s30(1)(f)], [s30(1)(j)]
Your safety case should show that all parties have processes for agreeing on the system of controls and there are no gaps in practice, which includes showing:

- there is open and constructive discussion between the organisations on how to stay safe
- concerns and problems are rapidly identified and addressed
- you are clear where your activities overlap and where they don't, and
- you are clear what risks are affected by each other's activities and how ownership will be shared.

Training and competency [s30(1)(g)]
To show that your team and contractors in safety critical roles have the right training and competencies, you need to demonstrate your systems can:

- identify what skills are needed

- track who has the skills and when they need refreshing, and
- assess whether the training actually gives people those skills.

It is especially important to show how you ensure contractors are competent, as their skills may be unknown and you may have less control over their actions than your own team.

External parties and licenced participants [s30(1)(l)], [s30(2)]
When another organisation performs rail activities under your rail licence, your safety case needs to demonstrate that:

- key people (such as the board, planners, training managers and team leaders) in your organisation understand they are responsible for the safety of operating under your licence
- those operating under your licence share similar safety culture, principles and goals as your organisation
- your safety systems can keep everyone safe (SFAIRP) including external parties as well as your team, and
- all parties understand your safety systems and can follow them

Your safety case may adopt parts of another approved safety case (by reference), as long as you make any modifications needed to fit your situation.

1.3. Updates

NZTA will update this guidance when new information, research, or better practices and innovations become available. Email updates for consideration to railregulator@nzta.govt.nz

2. Definitions

2.1. Interoperability

Interoperability means systems, processes, and products can work together safely and effectively. It covers mechanical parts, tools, hardware, software, and human factors. Risks should be reduced SFAIRP.

(Also see: Rail Industry and Safety Standards Board RISSB's AS 7450 standard, 2021, and the UK government's Railway Interoperability Glossary, 2022)

2.2. Interface

An interface is how systems and people connect and interact. It includes the physical connection, how humans use it, and whether it is safe and compatible.

(Also see: RISSB's AS 7450 standard, 2021, and the content of RISSB's Rail Systems Interoperability Guideline, 2015, and the UK government's Railway Interoperability Glossary, 2022)

2.3. Harmonisation

Harmonisation means aligning rules, standards, and procedures across organisations to support interoperability.

(Also see: of RISSB's AS 7450 standard, 2021 and the content of GHD's 'Harmonisation of Rail Standards', 2024)

3. Vision statement and current state

3.1. Vision statement

"Rail leaders will work together to create a safe, effective, and efficient rail system. Interfaces will be compatible, and we will keep improving over time through collaboration and continuous learning."

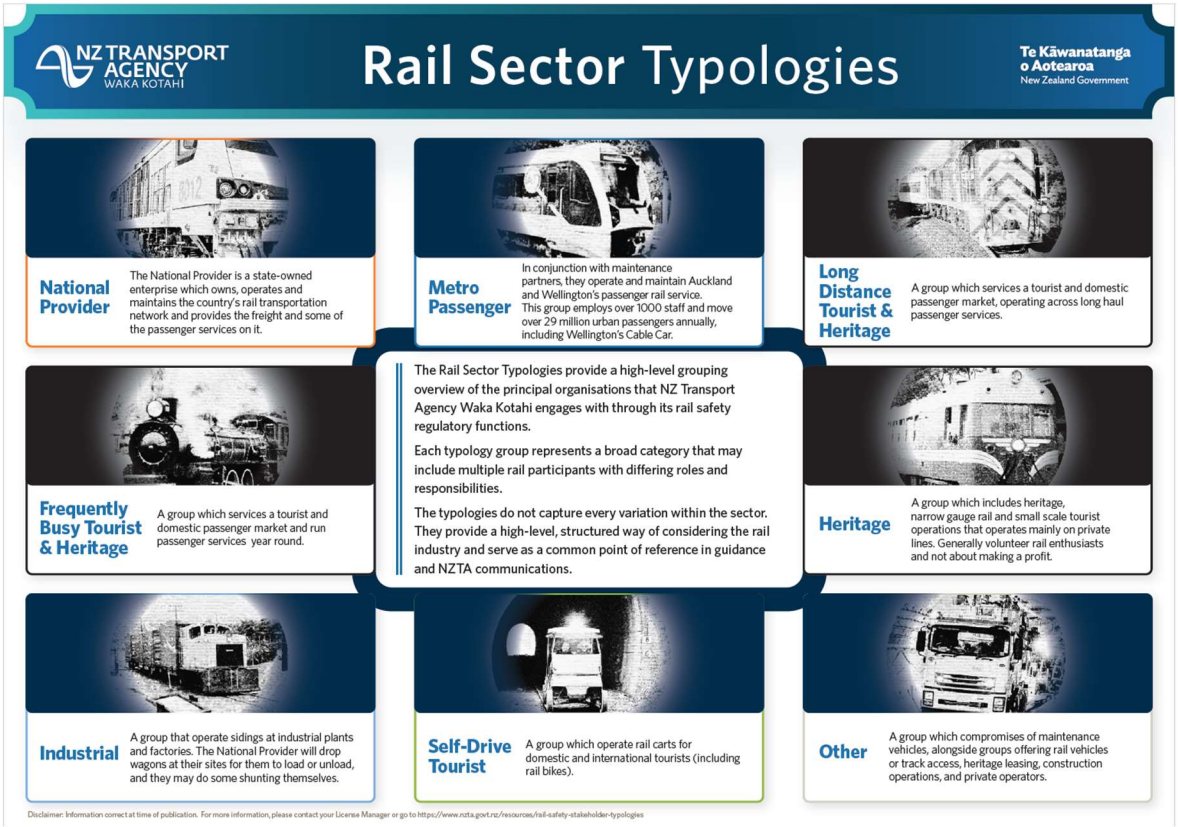
(Also see: RISSB (section 4.2) Interoperability Guideline and the RISSB National Framework for Interoperability (p.7) visions)

3.2. Current state: Diversity and complexity

New Zealand's rail industry is diverse. This creates technical complexity and increases the need for strong interoperability.

- Organisations include licensed rail operators and access providers, many unlicensed participants, and thousands of rail personnel, including volunteers.
- The national rail system has about 3,700 km of operating lines across both islands and the inter-islander ferry. Some routes aren't currently in use (Kauri–Otiria and Napier–Wairoa), and about 388 km are out of use long term.
- Private tracks total around 500 km, including industrial sidings.
- Most of the network is single track with trains running in both directions on the same track, which makes signalling interoperability especially important.
- The network includes about 1,600 bridges, 3,000 level crossings, 150 tunnels, and 3,100 signals.
- Volumes are high: millions of commuter and tourist trips, and millions of tonnes of freight each year.
- KiwiRail's train control centres manage thousands of suburban passenger services weekly in Auckland and Wellington, plus hundreds of freight trains and shunts, and long-distance services.

There is diverse range of rail participants, both licensed and unlicensed.



3.3. Current state: Commuter metro services are highest priority area

Most rail trips happen on Auckland and Wellington metro lines.

Safety and interoperability matter everywhere. Metro services require the greatest consideration because that is where the highest number of people are at risk.

Metro environments are dense and fast-changing, so safety controls need to reflect that. Good interface management reduces the chance of occurrences, improves service transitions, minimises delays, and lowers costs. Rail participants - including operators and local government - share risk and accountability.

Regional councils receive funding from NZTA to deliver metro rail services. They own commuter trains, stations, and precincts, and contract operations to third parties. Auckland One Rail and TransDev Wellington (under Metlink) operate commuter services. KiwiRail is the access provider for both metro networks, as well as Te Huia and Capital Connection. Various maintenance contracts are also in place.

4. Action areas for rail participants

4.1. Guiding principles

Use these principles to guide decisions:

- Safety: identify hazards, assess risks, and manage them SFAIRP, aiming to eliminate or minimise harm.
- Effectiveness: use your available and procurable assets, technologies, and skills to achieve strong interoperability outcomes.
- Efficiency: use the efforts of your people, materials, and budget wisely to achieve the best impact.

4.2. Action areas

Action Area	Description	Actions to Consider	Scenarios and examples
Leadership and Governance	Leaders take responsibility and set clear expectations for interoperability. *Why it's important* Strong leadership makes interoperability a priority and ensures everyone understands its value.	• Set a clear vision for interoperability and show commitment at all levels. • Assign a senior leader to lead interoperability and explain why it matters. • Promote a positive culture that values interoperability across teams and partners. • Act early to prevent problems by assessing and managing risks. • Look for ways to improve interoperability whenever changes are planned.	*Leadership prioritising interoperability* KiwiRail turned its historic Hillside Workshops in South Dunedin into a modern wagon assembly facility. This upgrade shows how leadership can drive innovation and sustainability.
Technical and Operational Interfaces	Make sure systems, processes, and safety controls work together across organisations. *Why it's important* Clear responsibilities and strong technical systems reduce risks and prevent accidents.	• Identify all interfaces and agree and clearly document who is responsible for safety. • Design safety systems so everyone using the network can operate safely. • Work together to reduce risks that involve the work of more than one organisation. • Include interoperability in your safety management system. • Bring in technical experts when needed. • Use overlapping handover zones when this helps to improve safety. • Align rules and processes across organisations. • Check new technologies for safety before using them (including artificial intelligence technologies). • Make systems resilient to disasters and emergencies e.g. extreme weather, slips, floods, earthquakes, tsunamis, fires, and collisions • Document standard operating procedures and make them easy to access. • Share asset registers and interface agreements with	*Working together* KiwiRail is leading a project to support the replacement of two Cook Strait ferries with two larger rail-enabled ferries. KiwiRail's partners in the project are Ferry Holdings Ltd, Port Marlborough NZ, CentrePort and NZTA. The project will ensure that freight rail interfaces safely with rail enabled ferries. And, that freight then interfaces safely again as it returns from the ferries to the rail network.

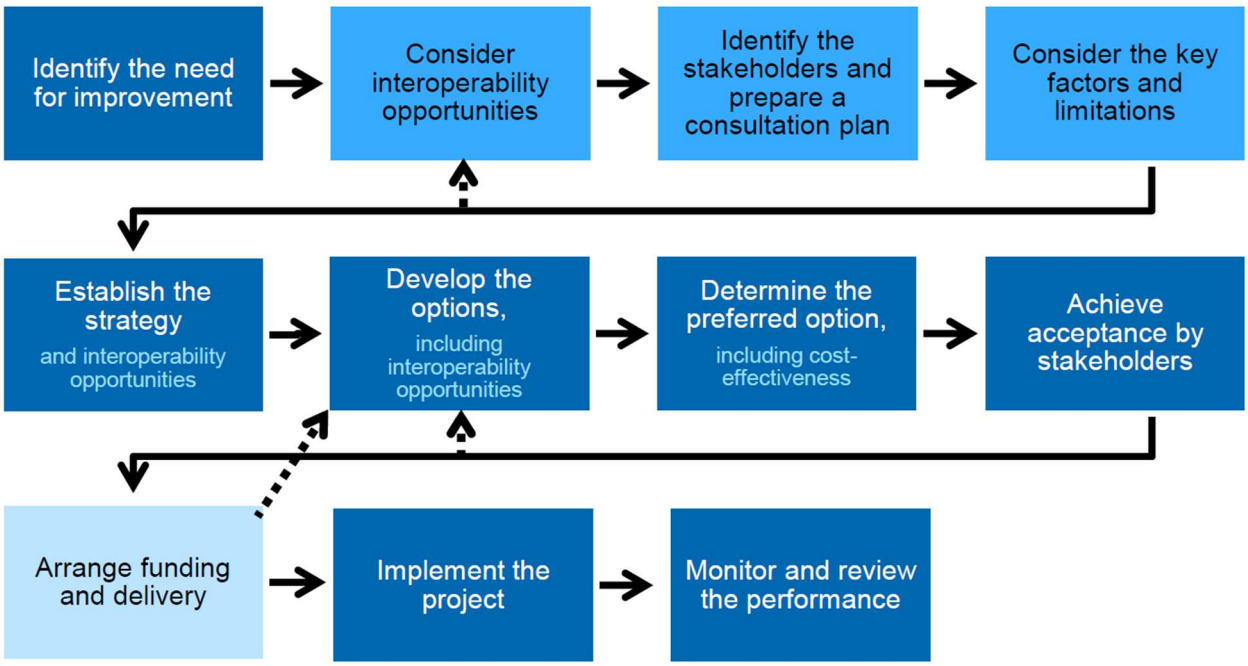
		partners. • Develop clear agreements and processes for accessing and working in shared areas (e.g., level crossings, sidings, emergency access).	
Communication and human factors	Communicate clearly and often, verbally, in writing and via technology, to develop shared understandings of roles and responsibilities. *Why it's important* Good communication builds trust, prevents misunderstandings, and keeps people safe.	• Agree responsibilities for shared risks and document interface and any other agreements (including memorandums of understanding). • Include interface management processes in safety cases. • Communicate openly and regularly using clear channels. • Proactively share safety critical information in a timely fashion. • Use plain language and avoid jargon. • Make sure people know what to do, why, and when—and feel comfortable asking questions. • Discuss overlapping roles and document decisions. • Ensure that people know how to raise concerns and provide suggestions and feedback • Keep everyone updated on changes and activities. • Avoid siloed operations. • Engage stakeholders early when changes are planned. • Set up memorandums of understanding and joint ways of working. • Share proposals, decisions, and safety-critical information promptly. • Try to resolve disputes between participants cooperatively and in good faith, before involving NZTA.	*The importance of sharing critical safety information* Technicians doing urgent line unscheduled work phones train control to request a temporary speed reduction. Train control processes the request but fails to pass it on to drivers in the area. A train passes through the area at normal speed, the driver sees the technicians and sounds the horn. The technicians move out of the way and are unharmed. Using radio and sharing the message properly could have avoided this near miss.
Functional human factors	Design systems that are easy for people to use in safe ways.	• Design systems with physical human capabilities in mind to reduce errors. • Automate actions where possible. • Make systems intuitive so the right choices are clear, even under stress. • Use fail-safes to prevent harm when mistakes happen. • Discuss workload, fatigue, and physical comfort with	*Ensure staff are well supported when dealing with new equipment* An experienced worker is injured installing a new product because it was different from what they were used to. Existing procedures didn't cover the differences. A proper risk assessment before

	Why it's important Systems designed for people reduce errors and improve safety.	staff. • Address cognitive factors like stress, attention, and memory. • Provide engaging training that is harmonised across organisations. • Certify and regularly re-certify staff competence. • Align rules and processes across teams and contractors. • Organise workloads and team structures effectively. • Promote a positive culture and encourage collaboration.	introducing the product could have prevented the injury.
Continuous improvement	Keep improving systems and processes through learning and innovation. *Why it's important* Continuous improvement optimises safety, efficiency, and readiness for the future	• Share and celebrate good ideas and improvements. • Review incidents and share lessons learned. • Audit interface agreements, fix gaps and work on improvements. • Use data and feedback to make evidence-based decisions. • Support staff development with training and updates. • Include interoperability in procurement and upgrades. • Assess new technologies, including those that use artificial intelligence, for safety before using them. • Protect systems against cyber threats. • Make sure software and hardware systems can work together safely and effectively.	*Trialling new technology* Before the City Rail Link opens, KiwiRail and partners are testing geofencing technology. It creates digital safety zones around tracks and overhead lines. If a machine gets too close, it slows down or stops automatically. This reduces human error and keeps people and equipment safe.

5. Taking action

RISSB's rail systems interoperability guideline (p.25) provides a process for implementing interoperability opportunities as part of project plans.

You can apply the action areas in Section 4 using this process.



I. Identify the need: Why change? Examples: improve safety, reduce maintenance costs, life-cycle expiry, technology advances.
II. Consider interoperability opportunities: Assess high-level options, costs, and benefits. Keep safety and SFAIRP at the core.
III. Identify stakeholders and prepare a consultation plan: Decide who to involve and how to engage them.
IV. Consider key factors: Identify technical and human factors and related risks.
V. Establish the strategy: Define goals, outcomes, and benefits.
VI. Develop options: Use key factors and strategy to shape the options.
VII. Determine the preferred option: Analyse choices and select based on cost, functionality, and ability to meet goals. Include stakeholder input.
VIII. Obtain stakeholder acceptance: Seek agreement. If views differ, find common ground with safety as the main focus.
IX. Implement the project: Choose a delivery method that matches the strategy. Use SMART: Specific actions, Measurable changes, Achievable resources, Relevant to values, Time-bound deadlines.
X. Introduce in stages: Commit to short- and long-term steps. Maintain ongoing commitment from everyone involved.
XI. Monitor and review: Track progress against goals and outcomes. Build on strengths and make improvements as needed.

6. Case studies

Rail interoperability has been achieved globally on different scales. Two case studies follow, which draw on the different elements of rail interoperability, what solutions were implemented and the lessons learnt.

6.1. City Rail Link (Auckland) (Ref 1 Ref2)

Establishing interoperability with the Existing Network

6.1.1 Background

The City Rail Link (CRL) is described in the Auckland Plan as “the foremost transformational project in the next decade” and “the most significant place-shaping opportunity.” It introduces twin tunnels and new underground stations into Auckland’s metropolitan network, enabling metro-style frequencies and ultimately 24 trains per hour per direction (TPHPD).

Passenger operations within CRL will be delivered by Auckland One Rail (AOR) under contract to Auckland Transport. KiwiRail provides Network Access and Train Control across the wider network. It continues to operate freight and long-distance passenger services (e.g. Northern Explorer), although none of these services or heritage train services are permitted inside the CRL tunnels.

The CRL is forecast to deliver $11.9 billion in benefits, including productivity gains ($4.2b), travel-time savings ($5.1b), reliability improvements ($1.6b), walking benefits ($589m), environmental improvements, and residual infrastructure value. It also aligns with the regulator’s recognition that metro commuter services are the highest-priority area for interoperability in New Zealand.

6.1.1. Challenge

Integrating CRL into a live brownfield rail system required resolving technical, operational, regulatory, and road–rail interoperability issues:

- Aligning ETCS Level 1 passenger operations with conventional signalling still used for freight and long-distance services, creating a potential SPAD (Signal Passed At Danger) risk at tunnel portals
- Upgrading wider junctions and stations (Newmarket, Otahuhu, The Strand, Henderson) to enable the future service pattern.
- Managing increased safety risks at level crossings from higher train frequencies, requiring coordinated closures or upgrades with road authorities.
- Embedding interoperability in relation to overlapping duties for rail participants.

6.1.2. Approach

Technical interoperability

- Integrated track, signalling, ventilation, and fire-life-safety systems with existing KiwiRail corridors.
- CRL infrastructure designed for 24 TPHPD and future-proofed for ETCS Level 2, Platform Screen Doors, and 9-car EMUs (Electric Multiple Units).
- Interim SPAD mitigations include training, written procedures, and buffer blocks ahead of freight, but long-term compliance requires ETCS fitment to freight locomotives.

Operational interoperability

- Harmonised operating rules and emergency procedures between AOR and KiwiRail Train Control.

- Establishment of the Network Access Forum (NAF) to coordinate metro, freight, and long-distance service access.
- A gradual launch strategy agreed: CRL opens mid-2026 under a transition timetable below 16 TPHPD, reaching full services (16 TPHPD) in late 2026 once freight ETCS fitment is complete.

Regulatory and assurance interoperability

- A single safety narrative across CRL, AOR, and KiwiRail, consistent with the Railways Act, 2005, and each party's Safety Case obligations.
- Formal interface agreements govern rail–rail and road–rail boundaries, clarifying shared risks and controls.
- Safety Case Variations (SCVs) for CRL and the wider network structured to reflect the staged path from Practical Completion to full service.

Data and systems interoperability

- Integrated passenger information and alarms across control centres to provide a consistent customer experience.
- Agreed data protocols for possessions, disruptions, and asset condition.

6.1.3. Benefits

- Unlocks metro-style services and improved accessibility for Auckland's growing population.
- Quantified economic and social benefits exceeding $11.9b.
- Safer integration of rail and road networks through progressive level crossing removals and upgrades.
- Strengthened resilience through embedded future-proofing and alignment with regulatory expectations for continuous improvement.

6.1.4. Lessons learned

- Treat every portal, junction, and crossing as a system-of-systems interface requiring clear ownership and validation.
- Recognise that interim administrative controls may be tolerated, but long-term interoperability depends on robust engineered solutions such as ETCS on freight locomotives.
- Use interface agreements to define shared responsibilities across rail participants and with road authorities.
- Coordinate wider network upgrades and level crossing works alongside CRL delivery to achieve the service uplift.
- Embed scalability and resilience (ETCS Level 2, 9-car EMUs, platform screen doors) early to ensure long-term efficiency.

6.2. Moreton Bay Rail Project, Australia (Ref 1 Ref2)

6.2.1. Background

The Moreton Bay Rail project in Queensland aimed to extend the rail network to serve the growing population in the region. The project involved constructing new rail lines, stations, and integrating them with the existing rail network.

6.2.2. Interoperability challenges

One of the primary challenges faced during the project was achieving interoperability between the new rail infrastructure and the existing systems. The key issues were:

- Different signalling systems: The new rail lines used a different signalling system compared to the existing network, leading to compatibility issues.
- Software interoperability: Integrating software systems for train control, scheduling, and communication posed significant challenges.
- Data exchange: Ensuring seamless data exchange between different digital systems, models, and tools was a major hurdle.

6.2.3. Solutions Implemented

To address these challenges, the project team implemented the following solutions:

- Standardisation: The operators made efforts to standardise signalling systems and software protocols to ensure compatibility across the network.
- Collaboration: Close collaboration between different stakeholders, including rail operators, technology providers, and regulatory bodies. This was crucial for resolving interoperability issues.
- Training: Industry experts conducted comprehensive training programmes for staff to ensure they were familiar with the new systems and protocols.
- Continuous improvement: Regular reviews and updates were conducted to address any emerging interoperability issues and improve overall system performance.

6.2.4. Lessons Learned

The project highlighted several key lessons:

- Early planning: Early identification and planning for interoperability issues can prevent significant challenges during implementation.
- Stakeholder engagement: Engaging all relevant stakeholders from the outset ensures a coordinated approach to resolving interoperability challenges.
- Flexibility: Being flexible and open to adopting modern technologies and standards can facilitate smoother integration of different rail systems.

6.2.5 Conclusion

By addressing interoperability challenges through a proactive, solutions focused approach, the project successfully integrated new rail infrastructure with the existing network. This demonstrates the importance of these factors for interoperability.

7. Acronyms

APIS – Access Provider Interoperability Standard

ARC – Auckland Regional Council

CCTV – Closed Circuit Television

CRL – City Rail Link

EMUs – Electric Multiple Units

ETCS – European Train Control System Level

GWRC – Greater Wellington Regional Council

LNIRIM – Lower North Island Integrated Mobility

NZTA – New Zealand Transport Agency, Waka Kotahi, Rail Safety Regulator

NRAIF – National Rail Industry Advisory Forum

NRSS – National Rail Systems Standards

RISSB – Australia's Rail Industry and Safety Standards Board

RNIP – Rail Network Investment Programme

R3F – The Rail Regulatory Risk Framework

SCVs – Safety Case Variations

SFAIRP – So Far As Is Reasonably Practicable

SPAD – Signal Passed At Danger

TPHPD – Trains Per Hour Per Direction

8. Further reading

Technical Interoperability Guidance – New Zealand: KiwiRail (2013) "NRSS 6 National Rail System Standard 6 – Engineering Operability Standards"

Technical Interoperability Guidance – New Zealand: KiwiRail (2007) "NRSS 7 National Rail System Standard 7 – Rail Operations Interoperability"

Technical Interoperability Guidance – New Zealand: KiwiRail (2022) "APIS 11 Access Provider Interoperability Standard 11 - Heritage Vehicle and Train Management"

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Risk Assessment / Management Guidance – New Zealand: National Rail Industry Advisory Forum (NRIAF) (2024) "Common principles for assessing and managing the risks to health and safety within New Zealand's railway sector" – See Section 16, "PRINCIPLE 10: Interfacing Participants" https://www.nzta.govt.nz/assets/Roads-and-Rail/rail/docs/Common-principles-for-assessing-and-managing-operational-risk-in-the-NZ-Railway-environment.pdf