Harmonisation of Rail Standards

Summary Report

23rd October, 2024

→ The Power of Commitment

Forewords

The Australasian Railway Association (ARA) advocates for a national approach to harmonising standards and greater interoperability to support an efficient, safe and productive industry. The fragmentation of rail presents a substantial challenge for both existing and prospective rail freight and passenger operators. Beyond suburban services, a considerable portion of trips in Australia require operation across two or more networks, each with varying standards, performance, access requirements and rule books.

Improved interoperability across Australian networks enables increased investment and economies of scale with more standardised rail componentry to support a safer and more innovative rail system. It would support a national approach to training and labour mobility in addition to facilitating rail's transition to net zero.

The harmonisation of standards is a key aspect to support interoperability of our national network, and the ARA is actively working with the National Transport Commission and state and federal governments to identify opportunities for reform. With the industry undergoing significant technological transformation, we risk a digital 'break of gauge' in our future rail systems, exacerbating existing challenges, if we do not act now.

The harmonisation of standards will enable the rail industry to reap the full benefits of the record $155 billion investment in public rail infrastructure over the next 15 years. By adopting a national approach to procurement, harmonising standards, and improving interoperability we will have a more efficient, competitive, innovative and safe rail industry, ensuring more value for taxpayers in government procurement outcomes.

This report outlines the case for a more effective approach, with supporting legislation, to facilitate industry's efforts to harmonise standards and fully realise the benefits this would enable.

Caroline Wilkie
Chief Executive Officer, Australasian Railway Association (ARA).

At the National Transport Commission, we work with all governments and industry to reduce differences across our transport networks, so they work better for people and the Australian economy.

Right now, the countless differences across individual rail networks are driving up the costs of running trains, upgrading networks and attracting skilled workers.

That's why National Cabinet has asked us to develop a National Rail Standards Framework that will help better connect our freight and passenger networks. It'll do this through a critical set of mandatory interoperability standards, as well as model standards to support national harmonisation of rail.

This work is delivering the most significant change to Australian rail since electrification. It's part of the National Rail Action Plan to make rail simpler, safer and better through consistent national approaches.

This report lifts our collective understanding of what is stopping rail from having a bigger role in the national economy and moving more people and products between cities, regions and ports.

With a $155 billion pipeline of investments to modernise and expand our rail networks, now is the time to bring networks together to create a single national rail system that works better for everyone.

Michael Hopkins
Chief Executive Officer and Commissioner, National Transport Commission (NTC).

As the National Rail Manufacturing Advocate, I am pleased to introduce the *Harmonisation of Standards Research Report*, sponsored by ONRIC, ARA and RISSB, and authored by GHD.

Industry stakeholders have highlighted a range of barriers that stand in the way of achieving a more competitive and sustainable Australian rail manufacturing sector. This report lays out an important body of evidence supporting policy development to address these barriers.

I would like to thank the project co-owners for the collaborative spirit throughout the development of this report. I also thank stakeholders from across government and the rail industry for contributing to the development of these findings and insights.

Harmonisation of rail standards not only has the potential to advance interoperability and safety for Australian rail operations but is also an important measure to support the Australian rolling stock manufacturing industries. Harmonised design and manufacturing standards can enable suppliers to benefit from improved economies of scale, harness modern technologies and innovation and enable rail industry decarbonisation and the transition to net zero.

Adoption of harmonised standards is one of the central pillars of the Government's National Rail Procurement and Manufacturing Strategy. Harmonised standards can support a more competitive, efficient and sustainable domestic rail manufacturing sector. The evidence in the report and the recommended pathway options provide the foundation for further work in delivering the Strategy, alongside broader national rail reform under the National Rail Action Plan.

With continued collaboration we can enhance the interoperability, safety, efficiency, and sustainability of our national rail network, and provide a more sustainable business environment for the Australian rolling stock manufacturing industry.

Jacqui Walters
National Rail Manufacturing Advocate, on behalf of the Office of National Rail Industry Coordination (ONRIC)

Since its inception more than 20 years ago, RISSB has proudly provided industry with good practice standards, codes of practice, guidelines and rules that deliver strong safety and efficiency outcomes for the rail industry. These products are vital for achieving nationwide safety and productivity improvements.

Recognising the imperative need for a cohesive and efficient rail network, industry must seek to establish and implement a concise set of high-impact interoperability standards. Having a clear understanding of barriers to adoption becomes a key step to implementation success and this report lays out the challenges.

The application of RISSB's standards enables Australian railways to move towards greater harmonisation and interoperability through improving efficiency in production, procurement, and personnel management, and delivering broader economic benefits. One of the harmonisation initiatives in this report highlights that a greater focus on the promotion and facilitation of the voluntary adoption and implementation of RISSB products, is an integral part of the solution.

In commending this research report to industry, I would like to acknowledge the outstanding work done by GHD Advisory to develop this important piece of work. We look forward to continuing to work with the ARA, NTC, ONRIC, and the wider rail industry, to create a better, more interoperable Australian rail network.

Damien White
Chief Executive Officer, Rail Industry Safety and Standards Board (RISSB).

Contents

Scope and limitations

This report: has been prepared by GHD for ARA, NTC, ONRIC, and RISSB and may only be used and relied on by ARA, NTC, ONRIC, and RISSB for the purpose agreed between GHD and ARA, NTC, ONRIC, and RISSB.

GHD otherwise disclaims responsibility to any person other than ARA, NTC, ONRIC, and RISSB arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

1. Introduction and Context

Australia's rail network is not a singular system, largely because of its origin in separate State-based networks, but instead the composition of 29 distinct networks. It is large and complex, involving an estimated 197 accredited operators on approximately 51,100 kilometres of track. This fragmentation can be problematic for existing or prospective rail freight and passenger operators to navigate given that, aside from suburban services, a significant proportion of trips in Australia involve operation across two or more networks, which often have varying standards, codes, and rule books, as well other key technical and operational characteristics.

In determining their rail standards, Rail Infrastructure Managers (RIMs) and Rolling Stock Operators (RSOs) participate in co-regulation under the *Rail Safety National Law* (RSNL). Under co-regulation and the *RSNL*, Australian governments do not directly prescribe, mandate, or otherwise enforce the specific standards under which RIMs and RSOs need to operate. Instead, the governments set a performance requirement for railways to operate safely, allowing the RIMs and RSOs to develop, review, and implement whatever standards they deem necessary to meet these requirements. The relevant regulator (Office of the National Rail Safety Regulator, ONRSR) only oversights that the standards that the RIMs and RSOs enact are compliant with the performance requirements in a nationally consistent way.

As a result of the co-regulatory regime under the *RSNL,* Australia's distinct networks are frequently subject to bespoke standards that govern only the systems, processes, and technologies on that network, which are often incompatible with those other networks. This can increase operational complexity for Australia's rail network, given that a decision made by one RIM can have implications for RSOs operating across multiple networks.

It is because of these dynamics in the Australian rail standards ecosystem, that Australia's Infrastructure and Transport Ministers and National Cabinet have tasked the National Transport Commission (NTC) with delivering the *National Rail Action Plan* (NRAP). The significant reform program is taking a national approach to rail in Australia by locking in critical standards and practices to improve rail's safety, productivity and efficiency, and boost competitiveness.

This summary report is a truncated version of the full report which includes significant additional material, in particular in the areas of stakeholder engagement outcomes and research.

1.1 Project Purpose and Scope

Given the above context for Australia's rail standards ecosystem, this Project sought to gain deeper insights into what is preventing the adoption of existing International and Australian Standards, to achieve harmonised standards. To this end, the Project sought to do the following:

- Undertake a desktop overview of the Australian rail standards ecosystem.
- Assess the advantages and disadvantages of harmonising rail standards.
- Quantify the benefits and costs of harmonising standards.
- Assess the barriers and risks to harmonising standards and identify opportunities to address these barriers.
- Undertake a categorisation of standards.
- Develop options for harmonising standards.

Ultimately, the strategic outcome of this Project was to assist in engaging industry in supporting the development of the National Standards Framework under the NTC's *National Rail Action Plan* (NRAP), as well as supporting the prioritisation of future work under ONRIC's *National Procurement and Manufacturing Plan*.
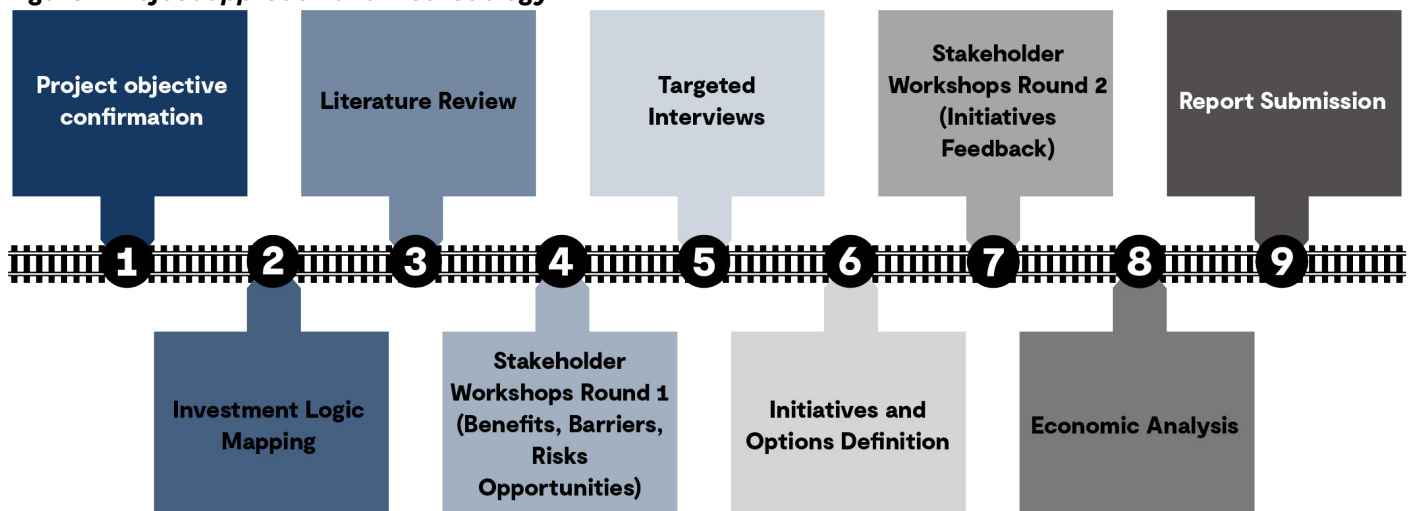
2. The Rail Standards Harmonisation Problem

2.1 Approach and Methodology

The issue of rail standards harmonisation has been the subject of several Australian and international studies. These have all presented some variation of several core problems with a non-harmonised rail standards environment, as well as key benefits of standardisation. Instead of simply repackaging these previous studies, this Project undertook an engagement-focussed approach to understand the 'case for harmonisation' (Section 2.2), as well as the opportunities, barriers, and risks of harmonisation (Sections 2.3, 2.4, and 2.5 respectively) in the current policy, operational, and technical environment.

This Project approach was centred around the Investment Logic Mapping (ILM) process[1], as well as a series of external stakeholder engagement workshops with RIMs, RSOs, and rail equipment suppliers, which worked to supplement and extend the extensive existing literature. These stakeholder workshops were supported by targeted stakeholder interviews across the rail sector.

The broad approach and methodology undertaken for this project is outlined in Figure 1.

Figure 1 Project approach and methodology

2.2 The Case for Standards Harmonisation

As identified in the existing literature and through stakeholder engagement, several problems exist relating to the lack of rail standards harmonisation across Australia. Importantly, resolving these current state problems is associated with benefits to be achieved in a future state. These problems and associated benefits from standards harmonisation relate to the following key areas:

– **Increased operational interoperability[2]:** Differing standards implemented by connected networks restrict the ability of the rail system to allow the seamless and unencumbered movement of trains across Australia, increasing costs, lowering efficiency and productivity, and impeding rail's modal competition.

– **'Economies of scale' for suppliers:** Differing standards fragment the market for common rolling stock components, increasing production and procurement costs, and impeding overseas market access.

– **More efficient Type Approval (TA) process:** Differing standards lead to bespoke and not mutually recognised TA processes, increasing costs, reducing efficiency, dampening competition, and creating uncertainty and delay.

---

1   Department of Treasury and Finance (Victoria). Investment Management Standard. 2017. https://www.dtf.vic.gov.au/infrastructure-investment/investment-management-standard

2   Interoperability is defined in Section 3 of RISSB's AS 7450:2013 standard as meaning "the ability of a process, system or a product to work with other processes, systems or products".

- **Decarbonisation and transition to net zero:** Differing standards decrease the value proposition and competitiveness of rail freight relative to road freight, decreasing rail's mode share and leading to slowed progress towards achieving net zero CO_2-equivalent emissions.
- **Improved safety:** Differing standards create complexity and opportunities for confusion, increasing safety risks for workers and rail users.
- **Greater technology adoption and innovation:** Differing standards mean development occurs in silos, so the rail sector is unable to harness network-scale benefits and efficiencies, reducing the extent of sector-wide innovation. It also discourages the market entry of existing technologies, with the varying standards-related approval processes of different RIMs creating a barrier to entry.
- **Lower training costs and increased labour mobility:** Differing standards mean that there are different skills and training requirements for workers across networks, creating inefficiencies, increasing training costs, and reducing labour mobility between networks.

These problems represent inefficiencies that are the consequence of the inconsistencies and legacy fragmentation between different networks, which has substantially driven the lack of harmonisation in the rail standards used. Network standards inconsistency is the 'highest-level' problem of the lack of standards harmonisation in Australia, as it is the problem from which all other problems stem.

2.3 Opportunities for Harmonisation

The benefits of rail standards harmonisation are becoming increasingly accepted by key industry stakeholders. This presents a real opportunity and impetus for rail standards harmonisation in the short term. These include the following:

- **Favourable policy and strategic environment:** Several government planning and strategy documents have been produced, which are creating a policy atmosphere that is conducive to the introduction, acceptance, and implementation of significant change. These include the *National Rail Action Plan* and the *National Rail Manufacturing Plan*.
- **Key stakeholder agreement and alignment:** There is formal stakeholder alignment acknowledging the issues posed by a lack of harmonised standards in key areas such as interoperability and manufacturing, including through a MoU[3]. This extent of agreement has not been seen previously.
- **Significant short-term infrastructure investment pipeline:** Over $155 billion is forecast to be invested in rail over the next 15 years. Given the magnitude of expenditure, even modest efficiency improvements resulting from appropriate standards harmonisation have the potential to generate significant returns during construction and ongoing operation.
- **Imminent technological advances:** New rail technologies associated with the rail network of the future will require the development of new and appropriate standards. This provides an impetus to proactively act on standards harmonisation, avoiding an extended 'lock-in' of non-interoperability.

Each of these opportunities for rail standards harmonisation is prone to change or are inherently ephemeral. Each could or will pass, meaning that if meaningful action is not taken on rail standards harmonisation in the short term, then the window of opportunity for large-scale benefits realisation could be lost.

2.4 Barriers to Harmonisation

Despite the various opportunities for standards harmonisation, in Australia's voluntary rail standards regulatory environment, there are also several 'barriers' to why standards harmonisation has not occurred. Barriers were identified through the stakeholder engagement process, in the existing literature, or through an original analysis of dynamics in Australia's rail standards ecosystem. These include the following:

- **Minimal incentive to change:** RIMs are only incentivised to make network-level decisions that provide the best-perceived outcome for them and their customers. There is no financial, regulatory, legal, or other incentive to move towards unilateral alignment with a national standard. This represents a classic example of a 'collective action problem', where individual entities' discrete behaviours create barriers to achieving a collectively beneficial outcome.
- **Lack of information sharing and collaboration:** RIMs and RSOs are without a readily available and low-cost way of understanding the standards used in an adjoining network. There are also limited opportunities for formal, structured, and accountable collaboration on rail standards harmonisation across the sector.

---

3   National Transport Commission (NTC). Memorandum of Cooperation to support National Rail System Interoperability for future major rail investments. NTC, 2023.

- **Path dependency[4]:** The initial path taken by State agencies and RIMs during the 19th and early 20th centuries has created entrenched legacy systems, which often lack compatibility with each other, making standards integration and interoperability more difficult.
- **Nature of voluntary national (RISSB) standards:** RISSB's approach to national standard development is driven by industry, which is not sufficiently incentivised towards standards harmonisation. As such, it has not been highly strategic or necessarily conducive to achieving interoperability or other standards harmonisation-related benefits. Additionally, some RISSB standards are minimally prescriptive, meaning RIMs tailor these standards to optimise outcomes for their jurisdictions, which does not necessarily consider alignment with other networks.
- **Network operating differences:** The Australian rail network has diverse operating conditions. This diversity means that different networks have different standards, especially infrastructure standards, which cause complexity in standards development when trying to achieve interoperability. Different commercial settings also impact preferences for standards that align with commercial imperatives.
- **Compliance costs and commercial pressures:** There is an inherent cost associated with changes in standards. This is because changes in standards could require RIMs and RSOs to materially change their assets, equipment, and practices to migrate towards compliance with a new, national standard.
- **Risk averse culture:** RIMs are often risk averse, preferring to maintain the status quo rather than undertake changes that could disrupt their operations or incur unforeseen risks, safety concerns, or costs. The perceived risks associated with harmonisation, such as the potential increased safety liabilities, make RIMs hesitant to commit to collective efforts.

2.5 Risks of Harmonisation

Despite the clear benefits, there are still several key risks in any process of rail standards harmonisation, which were identified by stakeholders, and/or that would be inherent to any implementation program. These risks include the following:

- **Compromised Standard Quality:** Harmonising standards could lead to a compromise in standard quality relative to the standards that RIMs currently develop and apply, due to 'watering down' standards to the 'lowest common denominator'. This risk could cause increased safety risk, operational inefficiency, and non-compliance. It could also mean that desired manufacturing economies of scale are not achieved, since there remain areas of potential difference in design.
- **RISSB has Insufficient Capacity to Support Harmonised Standards:** In its current form in a voluntary standards environment, RISSB may not have the organisational capacity, including the necessary funding, resources, governance, and expertise, to effectively manage the process of harmonising the requisite quantity of Australian standards in the appropriate manner and to the appropriate quality. This risk could cause quality issues and compromise stakeholder confidence.
- **Key Stakeholder Resistance:** The process of harmonisation could lead to a perceived or actual loss of control for RIMs and RSOs over established practices and governance mechanisms. This could result in resistance from stakeholders who fear losing their autonomy, influence, or ability to address specific local needs and issues as they deem appropriate. This risk could lead to missed opportunities and reputational damage.
- **Over-Regulation and Lack of Flexibility:** Harmonising standards across a diverse rail network carries the risk of over-regulation, where rigid, one-size-fits-all rules are imposed across diverse networks. This risk could cause operational inefficiencies, non-compliance, and reduced innovation.
- **'Wrong' Standards are Harmonised:** If the standards that are harmonised are not the most appropriate to realise the benefits of harmonisation, then the identified benefits of standards harmonisation may not be achieved. This risk could result in increased costs, reduced operational efficiencies, and inefficient resource utilisation.
- **Governance Risk:** Establishing a unified governance structure that aligns all the relevant stakeholders in rail standards harmonisation, especially if this is done in the context of a modified or heavily revised role for RISSB (and ONRSR), is complex and fraught with potential issues. This risk could result in governance confusion and a misalignment of authority and responsibility.
- **Failure to Deliver on a Unified Vision:** A unified vision is important for the successful harmonisation of rail standards, as it provides a clear and shared objective that guides all stakeholders through a complex process. Without a unified vision, the efforts to harmonise standards may lack direction, coherence, and momentum. This risk could result in a loss of opportunity and stakeholder frustration.

---

4   "Path Dependency" refers to processes where past events and decisions constrain later events or decisions, as development along a certain path becomes increasingly entrenched.

However, while these risks exist, the potential benefit from addressing standards harmonisation in Australia far outweighs them. Further, collective action and engagement can lay the basis for issue resolution and risk mitigation, as part of a considered course and approach towards harmonisation.

3. The Rail Standards Harmonisation Solution

3.1 Harmonisation Initiatives

Given a combination of stakeholder input, previous reviews, and original research, a long list of harmonisation advancement initiatives has been defined, to respond to the identified benefits, opportunities, barriers, and risks of rail standards harmonisation in Australia.

The sources of input for initiative identification include the following:

– The outcomes of the Investment Logic Mapping exercise, with a focus on strategic response identification.
– Stakeholder engagement including suggestions from the benefits, opportunities, barriers, and risk-related workshops, and one-on-one interviews.
– Preliminary strategic initiatives indicated in the report and informed by a wide literature review.
– Suggested considerations and initiatives from the GHD technical team, as informed by their international experience.
– The recommendations of the *Taig Review* (2012).
– Cross-domain expertise, from standard harmonisation processes in sectors such as mining and agriculture.

Ultimately, the long list of 12 initiatives identified and considered (which are of varying expected influence and costs) are listed as follows. Note that initiatives are still considered at the concept level, meaning specifics of what each strategic initiative looks like in practice have room for It could also mean that desired manufacturing economies of scale are not achieved, since there remain areas of potential difference in design.

1. Greater government and industry alignment and promotion of voluntary adoption and implementation.

2. Establish a central directory or database for high benefit standards.

3. Greater harmonisation-specific stakeholder collaboration forums and technical working groups.

4. Incentive programs for early harmonised standards adopters.

5. Regulation to mandate a limited range of specific standards.

6. Mandatory disclosure of derogation for non-standard projects and system changes.

7. Government support for industry in meeting the cost of change to comply with new standards.

8. Project investors (governments) refusing to finance projects not using specific harmonisation standards.

9. Develop a formal automatic mutual recognition scheme for rolling stock and adopt a national Type Approval framework with associated formal agreements.

10. Undertake a governance review to assess supporting arrangements, functions, and responsibilities that would be required to support any given option pathway for harmonisation.

11. Mandate that national training units of competency, skills sets and qualifications be delivered in the context of a generic railway, which is supported by a Guidance document.

12. Government investment in type approval technologies that help solve standards-related interface constraints.

3.1.1 Content of Harmonised Standards

The initiatives outlined in Section 3.1 occasionally refer to "high benefit" standard areas or a "limited range of specific standards". This reflects that the initiatives are focussed on an 'optimum' level of harmonisation in select areas, as opposed to across-the-board harmonisation for its own sake. For the avoidance of doubt, these high benefit areas are indicatively considered as being select standards in the following groups of standards:

– Train Control Command and Signalling.

– Rolling Stock Components and Approvals.

– Type Approval (TA).

– Telematics Applications for Freight Services.

These indicative groups of standards have been identified based on an assessment of the relative merit of harmonising the groups of standards to achieve the benefits outlined above, relative to the indicative cost to stakeholders of harmonising – "benefits at least cost". Consideration has also been given to the experience of the EU Technical Specifications for Interoperability (TSIs), direct stakeholder input (which consistently highlighted TA, rolling stock, and signalling, as the most important standard areas to harmonise), as well as the original economic analysis of rail standards harmonisation (see Section 4).

3.2 Harmonisation Option Pathways

Achieving the harmonisation of rail standards in Australia is a complicated and layered task, requiring meticulous planning, collaboration, and a dedication to long-term strategic goals. Therefore, addressing harmonisation challenges and ensuring the successful rollout of effective strategies demands a thorough action plan, including both short-term and long-term measures and initiatives.

Standards harmonisation will be a long and continual journey, not a singular event. This has been the case in other jurisdictions as well. In the EU, the process of standards harmonisation began in the early 1990s, with little solid development until 2016. Improvements have been slow for rolling stock and infrastructure, partly owing to their long-life nature, as well as inconsistent between jurisdictions – a fact that remains today[5]. Australia today is in the same position as the pre-2016 EU, with fragmented rules, closed markets, localised authorities, and low innovation. As such, there remains a long pathway to a more harmonised rail standards ecosystem.

Considering the above important considerations, option pathways (not just 'options') have been developed to achieve consistent adoption of international and Australian standards.

Option 1: Voluntary Pathway

Reflecting the dichotomy between voluntary and mandatory standards regimes and approaches, *Option 1: Voluntary Pathway* has been developed as an 'enhanced status quo', with minimal regulatory change. Under this option pathway, harmonised standards would be co-designed by industry in high-benefit standard areas and using international precedents, with supporting incentive mechanisms. This co-design would be supported by strengthened governance architecture and industry collaboration mechanisms. This option pathway aims to foster a cooperative environment where the voluntary adoption of standards is rewarded, guided by strong governance and supported by incentives to stimulate industry participation. In terms of timing, this option pathway would take less than 10 years to implement in full, with the timeline for the realisation of full benefits depending on option efficacy.

Option 2: Gradualist Mandatory Pathway

Reflecting the public policy dichotomy between 'gradualist' and 'interventionist' approaches, *Option 2: Gradualist Mandatory Pathway* has been developed. Under this option pathway, there would be mandatory rail standard harmonisation across high-benefit standards areas and complete with technical specifications. This option pathway will prioritise grandfathering of effective solutions, only apply to new equipment and systems, will be multi-year, and have a range of approved derogation areas. The option pathway aims to enforce a selective mandate that targets areas with the greatest potential for benefit while providing a structured transition period and accommodating exceptions where necessary. The option pathway has been heavily informed and influenced by the EU's experience of implementing mandatory standards harmonisation, through the EU TSIs. In terms of timing, this option pathway would take approximately five to 10 years to implement in full, with full benefits not being realised until 25 to 30+ years after implementation, given the long life of rail assets in tandem with the grandfathering approach.

---

5   European Union Agency for Railways. Report on Railway Safety and Interoperability in the EU. ERA, 2022. Pg., 64

Option 3: Interventionist Mandatory Pathway

Considering the interventionist approach, *Option 3: Interventionist Mandatory Pathway* has been developed for assessment. Under this option pathway, there would be a phased transition of a stringent mandate for rail standards harmonisation across both new and some existing rail equipment, with minimal grandfathering arrangements for high benefit standard areas. To assist with the rapid transition resulting from the mandates, high levels of government funding (subsidisation) would be available to those that bear costs and make the pathway more viable. In terms of timing, this option pathway would take approximately five years to implement in full, with full benefits not being realised until 20 years after implementation, due to the need for a reasonable implementation timeframe, even without grandfathering.

These three option pathways are defined by a package of the initiatives that constitute them, in line with their overarching parameters. This packaging is outlined in Table 1. Note that similar initiatives are apparent in option pathway 2 as option pathway 3, given both involve mandating. The difference is in the speed (timeline) and the extent to which harmonisation is mandated and implemented. Additionally, some initiatives are common to all options. These initiatives are the 'no regrets' initiatives that are considered beneficial and low risk under each option pathway.

Also important to note, each of these option pathways will require top-down political alignment, as well as a gradual and concrete implementation roadmap with prescribed responsibilities, so that stakeholders have time to react. This is a key 'facilitating factor' for meaningful change.

Table 1 Packaging initiatives into option pathways

Initiative	1 – Voluntary Pathway	2 – Gradualist Mandatory Pathway	3 – Interventionist Mandatory Pathway
Greater government and industry alignment and promotion of voluntary adoption and implementation.[6]	✓		
Greater harmonisation-specific stakeholder collaboration forums and technical working groups.	✓		
Incentive programs for early harmonised standards adopters.	✓		
Establish a central directory or database for high benefit standards.	✓ Permanent directory / database for RIMs and RSOs to voluntarily access and apply.	✓ Transitory measure in slower transition to mandating, until high benefit standards are mandated and public and database is no longer required.	

---

6   NOTE: This initiative is not considered in mandatory option pathways 2 and 3, because greater harmonisation-specific stakeholder collaboration forums and technical working groups are not necessarily aligned with mandatory harmonisation, but instead are subject to the outcome of the important review to assess supporting arrangements, functions, and responsibilities that would be required to support any given option pathway for harmonisation (another initiative). Put differently, there is the potential that they might not be required if there is greater focus on in-house standards development within RISSB, while also noting that a level of continued industry involvement is fundamental to assure stakeholder buy-in and standard quality.

Initiative	1 – Voluntary Pathway	2 – Gradualist Mandatory Pathway	3 – Interventionist Mandatory Pathway
Regulation to mandate a limited range of specific standards.		✓ A less expansive set of harmonised standards than 'interventionist'. Slower implementation timeframe. Grandfathering, applying to only new systems.	✓ A more expansive set of harmonised standards than 'gradualist'. Quicker implementation timeframe. Retrospectively applied in places, with a phase in process.
Mandatory disclosure of derogation for non-standard projects and system changes.		✓ Supports transition in a mandatory context. Applies to a less expansive set of harmonised standards.	✓ Supports transition in a mandatory context. Applies to a more expansive set of harmonised standards.
Government support for industry in meeting the cost of change to comply with new standards.		✓ Funds required to ensure 'none worse-off' from applying national standards.	✓ Significant funds required, given backdating and relatively rapid transition.
Project investors (governments) refusing to finance projects not using specific harmonisation standards.		✓ Looser conditions and likely more curtailed funds, as opposed to withholding.	✓ Strict conditions with quick implementation timeframe.
Develop a formal automatic mutual recognition scheme for rollingstock and adopt national type approval framework with associated formal agreements.	✓ Initiative to be pursued, pending a voluntary agreement on what is mutually recognised. May be non-binding MoU	✓ Linked to corollaries of the mandated standards.	✓ Linked to corollaries of the mandated standards.
Undertake a governance review to assess supporting arrangements, functions, and responsibilities that would be required to support any given option pathway for harmonisation.	✓ Less important to the voluntary pathway than mandatory pathways, as less changes are made relative to mandating pathways.	✓ Necessary to support the transition to implement and delivery a gradualist mandatory standards regime, including by defining the capability and role of RISSB, as well as how best to develop mandatory standards, and how to enforce mandatory standards.	✓ Necessary to support the transition to implement and delivery an interventionist mandatory standards regime, including by defining the capability and role of RISSB, as well as how best to develop mandatory standards, and how to enforce mandatory standards.

Initiative	1 – Voluntary Pathway	2 – Gradualist Mandatory Pathway	3 – Interventionist Mandatory Pathway
Mandate that national training units of competency, skills sets and qualifications be delivered in the context of a generic railway, which is supported by a Guidance document.	✓ Initiative to be pursued, pending a voluntary agreement on the national training units of competency, skills set, and qualifications that are delivered in the context of a generic railway.	✓ Linked to corollaries of the mandated standards.	✓ Linked to corollaries of the mandated standards.
Government investment in type approval technologies that help solve standards-related interface constraints.	✓	✓	✓

3.3 Option Pathway Assessment

The Multi-criteria Analysis (MCA) approach was selected to assist with the complex decision-making process involved in selecting a 'preferred' option pathway.

To assess and compare option pathways, an MCA framework was developed. Provided with the high-level descriptions in Table 2, the MCA framework sets out six criteria against which the three option pathways were compared, analysed, and filtered. Also included are weighting values, which are the aggregate of a Pairwise assessment undertaken with representatives of the ARA, NTC, ONRIC, and RISSB.

Table 2 MCA evaluation criteria high level descriptions and weighting as they relate to assessing option pathways

Criteria #	Criteria name / title	Criteria description	Weighting
1	Cost	This criterion considers the relative financial implications of adopting each option pathway.	18.15%
2	Certainty	This criterion measures the probability that the expected benefits of harmonisation will be achieved.	17.90%
3	Stakeholders buy-in	This criterion assesses the likely level of endorsement and buy-in each option pathway is likely to receive from key stakeholders, including RIMs, RSOs, rail equipment suppliers, government bodies, and the public.	19.14%
4	Timeliness	This criterion considers how quickly the benefits of harmonisation can be delivered under each option pathway.	14.81%
5	De-risking	This criterion focuses on the risk management practices and de-risking approaches possible within each option pathway.	13.70%
6	Efficiency	This criterion examines the resource utilisation efficiency of each option, considering the current constraints in the industry	16.30%

A summary of the results of the MCA, where option pathways were assessed from 0 to 10 against each criterion, is provided in Table 3.

Table 3 Option MCA scoring summary

Option Pathway	MCA Score	Preference Ranking
1 – Voluntary	4.59	3
2 – Gradualist Mandatory	*6.89*	*1*
3 – Interventionist Mandatory	5.74	2

Based on the outcome of this MCA, Option Pathway 2 is considered the Preferred Option Pathway.

Additionally, to ensure the robustness of Option Pathway 2 (Gradualist Mandatory Pathway) as the Preferred Option Pathway, sensitivity analysis was undertaken against both Pairwise weightings and select criteria scores. These sensitivity tests all showed Option Pathway 2 remaining as the Preferred Option Pathway.

3.4 Key Implementation Considerations

The benefits sought from harmonised standards do not materialise, either under the preferred option pathway 2 or under another option pathway, until the relevant and appropriate standards have been consistently adopted. As such, implementation considerations form an important part of achieving rail standards harmonisation. In this light, there are several key implementation considerations. They are as follows:

– **Capability and role of RISSB:** If the policy environment around rail standards harmonisation were to change (such as through mandating), then the capability and role of RISSB, which is currently configured for its role in a voluntary standards regime, would need to be reviewed and likely recast; to ensure the development of a sufficient quantity of quality standards.

– **Aligning Australia with international standards:** The benefits of rail standards harmonisation can be increased in certain, appropriate, areas if Australian standards are aligned with international standards, such as UIC, ISO, EN, and BS standards. To this end, several avenues could be considered in conjunction with an option pathway, such as mandatory international standards evaluation by RISSB.

– **Ensuring the best approach for developing standards with high adoption:** To ensure that the benefits of harmonisation are realised, national standards must be of high quality and have stakeholder buy-in. There are several ways of working to ensure this, such as increased resourcing and capability of RISSB, the direct adoption of proven standards from other jurisdictions (including overseas), and the mandatory involvement of RIM and RSO SMEs.

– **Enforcing mandatory harmonisation:** In implementing regulation to mandate a limited range of specific standards, there must be consideration for how mandating works in practice. The central avenue for mandatory standards enforcement in Australia is to include mandating and harmonisation-related standard compliance through a new regulatory regime, or into the existing role of ONRSR through an amendment to the RSNL.

– **Alleviating transition cost concerns:** Any process of rail standards harmonisation that enforces changes for RIMs and RSOs without compensation, will cause a loss in stakeholder buy-in. As such, consideration must be given to this area. This can take several forms, including only applying mandatory standards to new systems, and/or establishing a fund to compensate for costs incurred.

– **Independent regulation and centralised governance:** In the EU's rail standards harmonisation process, there is a pattern of increasing centralisation with a strong member-driven organisation, supported by a clear governance framework. There are also independent regulators in each jurisdiction, as well as a cooperative member-driven approach to the development of standards to drive interoperability. These examples present clear, positive, lessons learned for Australia.

– **Maintaining stakeholder buy-in:** Aside from simply alleviating cost concerns, the broader support of RIMs and RSOs is crucial in the development and adoption of rail standards. In this context, mandatory standards pose an inherent risk, as it would impede on RIMs and RSOs from being 'masters of their own destiny' under co-regulation. However, RIMs and RSOs also acknowledge that, especially in recent years, rail standards harmonisation has an industry-wide benefit.

- **Defining a continued role for co-regulation:** In any process of mandating national rail standards, consideration must be given to defining a continued role for co-regulation. Here, the avenue to pursue is to ensure that co-regulation remains the governing regulatory structure of Australian rail networks for all standards that are not considered 'high benefit' or a National Priority enough to be mandated.

- **Dealing with short-term non-compliance:** In an interventionist transition to mandatory standards, rapid changes could render the operations of RIMs and RSOs non-compliant unless impractical, costly changes are made. Time for transition is also required to minimise network disruptions. As a result, in any harmonisation process, it's still essential to create a framework that allows RIMs and RSOs to phase out existing methods that don't align with new standards, potentially over an extended period.

- **Managing continued infrastructure differences:** Differences across networks in physical rail infrastructure provide significant barriers to harmonisation. This means that standards are necessary, but not sufficient, for interoperability and broader benefit realisation. Other challenges, including disparate and incompatible infrastructure, will remain and will need to be addressed under any harmonisation option pathway.

- **Dealing with self-contained networks:** In any process to harmonise Australian rail standards, it is crucial to consider the unique operational requirements of self-contained rail networks. This is because self-contained rail networks operate independently, so would find no benefit in conforming to interoperability standards, though component manufacturing standards are still equally relevant.

- **Unintended consequences:** In any policy implementation process, it is important to consider the potential for unintended consequences. Unintended consequences in the context of rail standards harmonisation could range from minor disruptions in service to significant safety hazards, financial losses, or even systemic network failures.
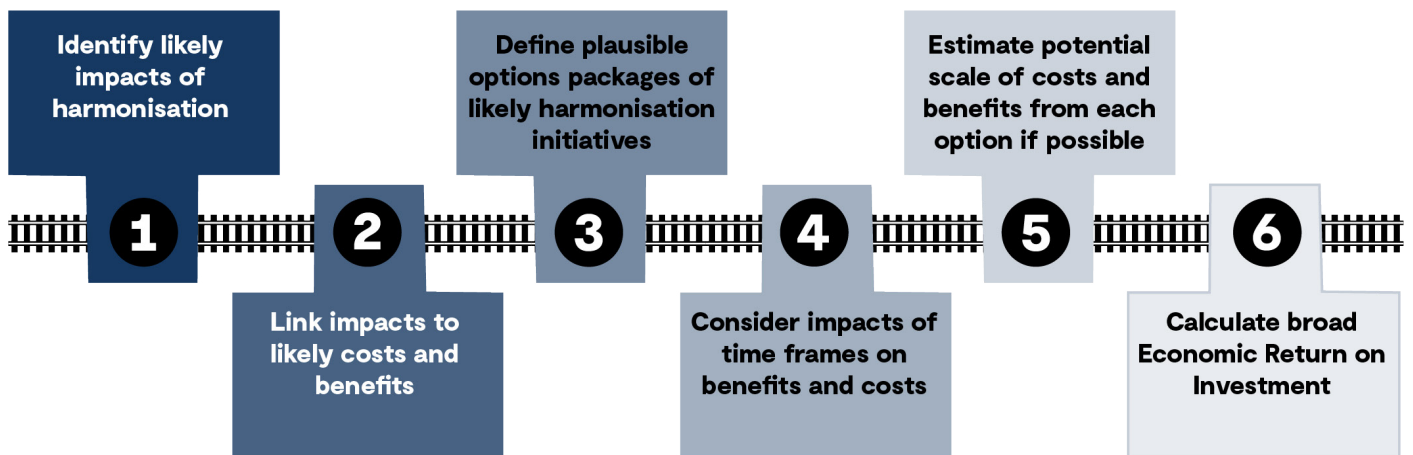
4. Economic Analysis of Standards Harmonisation

Agnostic to the specific option pathways and related implementation considerations outlined above, the indicative benefits and costs of harmonising a select set of appropriate, 'optimal' rail standards has been quantified. This analysis focussed on areas of high benefit standards, especially for interoperability and manufacturing, with consideration for the transition to net zero.

4.1 Approach and Methodology

As identified, there are numerous benefits and costs associated with harmonisation. The Project adopted a cost–benefit analysis (CBA) approach to the greatest extent possible while uncertainty remains over how much harmonisation may occur and over what timeframe. The steps in the analysis are shown in Figure 2.
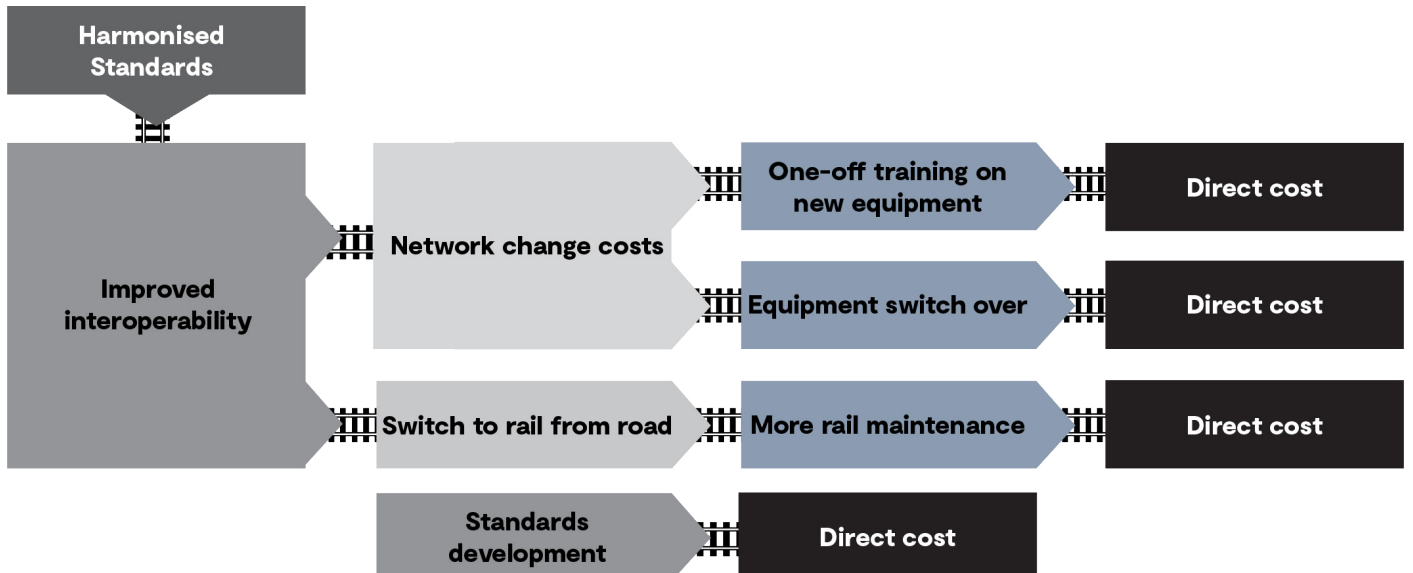
Figure 2 Steps in the economic analysis

1. Identify likely impacts of harmonisation
2. Link impacts to likely costs and benefits
3. Define plausible options packages of likely harmonisation initiatives
4. Consider impacts of time frames on benefits and costs
5. Estimate potential scale of costs and benefits from each option if possible
6. Calculate broad Economic Return on Investment

4.2 Costs and Benefits of Harmonisation

Identified costs were all direct financial impacts of implementing the changes associated with rail standards harmonisation. Assuming the grandfathering of existing rail assets in line with preferred option 2, the quantified costs in this economic analysis are as identified in Figure 3.

Figure 3 The costs of harmonisation

Harmonised Standards

Improved interoperability
- Network change costs
  - One-off training on new equipment → Direct cost
  - Equipment switch over → Direct cost
- Switch to rail from road
  - More rail maintenance → Direct cost
- Standards development → Direct cost

Conversely, the quantified benefits in this economic analysis are identified in Figure 4, as informed by the benefits identification in Section 2.2.

Figure 4 The benefits of harmonisation
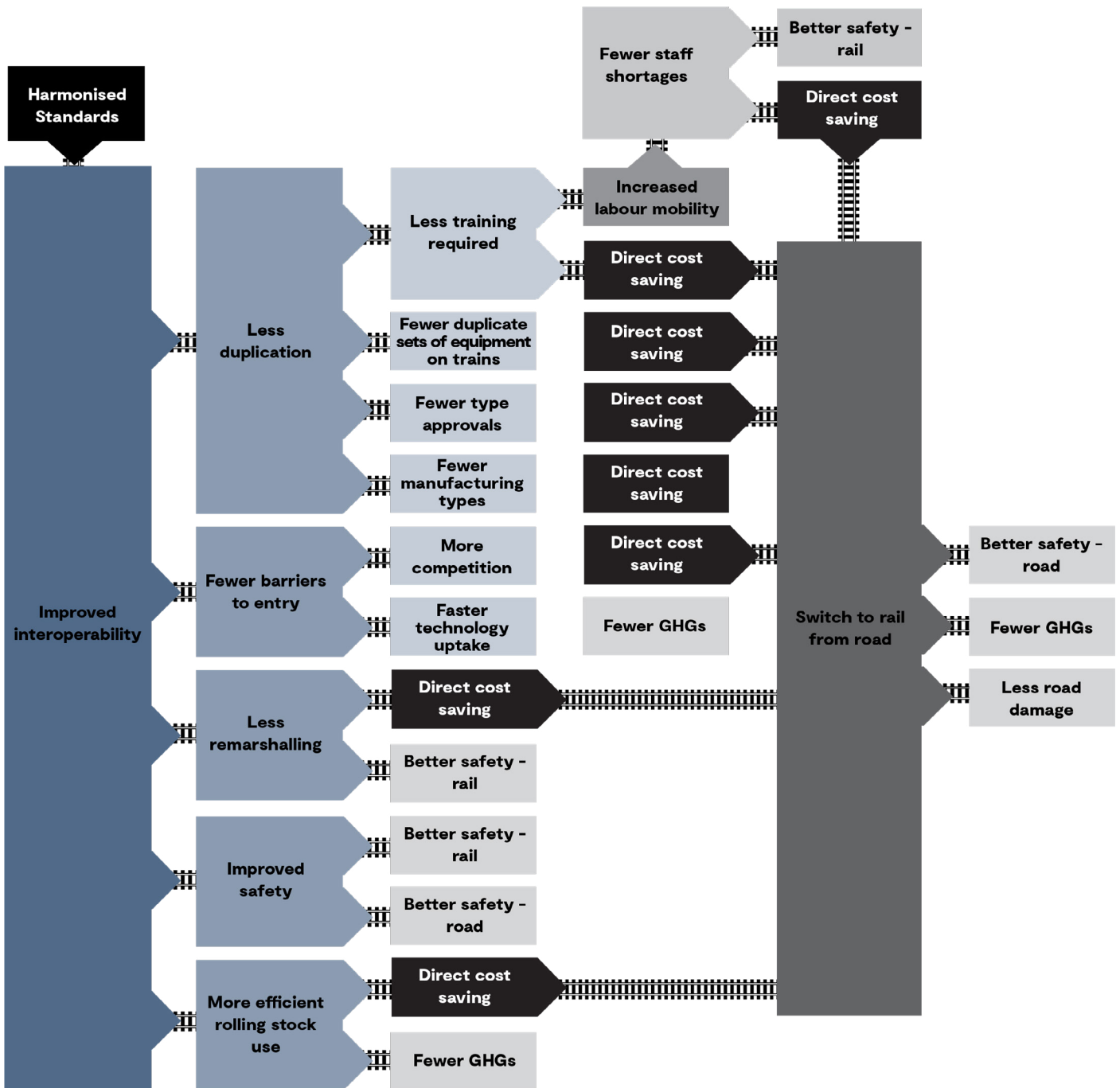
4.3 Plausible Modelled Scenarios of Harmonisation

Discussions with stakeholders indicated strong support for a relatively broad package of harmonised standards. That said, the main question that remains is whether the estimated benefits and costs in the model are sufficiently balanced, even though the analysis has developed estimates in a way that is likely to underestimate benefits and overestimate costs. As such, the analysis, therefore, developed a Low Benefit / High Cost Scenario (Low Scenario), in which the benefits stream is broadly assumed to be only 50% of that in the Base Scenario (noting again that we believe the Base Scenario to be modest in its benefits estimation) and that costs are 125% of those estimated in the Base Scenario. In a separate High Benefit / Low Cost Scenario (High Scenario), we broadly assume benefits are 125% of those estimated in the Base Case, and that costs are only 50% of those in the Base Case.[7]

7   The one exception to these assumptions is impacts related to the switch from road to rail.

Table 4 Three modelled scenarios presented in the analysis

Scenario / Assumptions	Base Scenario	High Benefit /Low Cost Scenario	Low Benefit /High Cost Scenario
Benefits	100% of modelled estimates	125% of modelled estimates	*50% of modelled estimates*
Costs	100% of modelled estimates	50% of modelled estimates	*125% of modelled estimates*
Exception – Rail maintenance costs	*100% of modelled estimates*	*125% of modelled estimates because rail maintenance costs linked to mode shift*	*50% of modelled estimates because rail maintenance costs linked to mode shift*
Exception – Harmonisation standards development	*100% of modelled estimates*	*50% of modelled estimates*	*200% of modelled estimates*

In other words, the analysis assumes a full harmonisation process, but that the scale of benefits and costs vary.

4.4 Broad Economic Return on Investment

This analysis has taken an especially conservative approach to estimating the net present value of benefits (i.e. has likely underestimated benefits) and a more balanced approach to estimating costs (i.e. may have overestimated costs) to present a defensible view of the net benefits of harmonisation.

Additionally, as noted in Section 4.3, while we present a Base Case, we also developed two further modelled scenarios – a Low Scenario with higher cost estimates and lower benefit estimates, and a High Scenario with higher benefits and lower cost estimates. We have chosen to present all benefits and costs that could be quantified in this analysis as if all the proposed harmonisation standards proceed. By adopting a long implementation timeframe (25 years), we avoid the major challenge of trying to price the cost of more rapid signalling and other system replacements because most major systems will need to be replaced in the next 25 years regardless of harmonisation.

But to avoid overestimating the benefits, we also assume that no benefits start accruing until all the changes are implemented (i.e. Year 26). This is unrealistic but provides a high level of confidence that the very significant benefits of harmonisation are not overestimated.

However, the preferred option of implementing the harmonisation standards with a significant grandfathering period means these assumptions are quite realistic. These assumptions give confidence in the credibility of the estimated benefits, costs, and net present value presented in this analysis.

The summary of the economic analysis in terms of the net present value (NPV) and the breakdown of the quantified economic benefits associated with standards harmonisation, is provided in Figure 5, with sensitivities.

Figure 5 Net present value of a harmonisation programme

Summary	Base Scenario	High Scenario	Low Scenario
Net present value	**$1,721**	**$2,170**	**$829**
Benefits in $m	**$1,825**	**$2,282**	**$913**
Direct cost savings	$1335	$1,668	$667
Less road damage	$402	$502	$201
Better safety – road	$48	$60	$24
Fewer GHGs	$38	$48	$19
Better safety – rail	$3	$4	$2
Costs in $m	**$104**	**$112**	**$84**

In the **Base Scenario**, the net benefits of the full harmonisation programme are $1.7 billion in net present value terms, consisting of $1.8 billion in benefits and $104 million in costs.

Also worth noting is that around 22% of the benefits accrue to state and federal governments outside of the rail sector (less road damage, $402 million net present value terms) and to road users through fewer deaths and injuries involving trucks (over $48 million by a very conservative estimate).

The **High Scenario** results in net benefits of the full harmonisation programme of $2.2 billion in net present value terms, consisting of $2.3 billion in benefits and $112 million in costs.

The **Low Scenario** results in net benefits of the full harmonisation programme of $0.8 billion in net present value terms, consisting of $0.9 billion in benefits and $84 million in costs.

To note, costs rise even in the High Scenario because the largest share of costs are linked to the rail maintenance costs incurred by a switch to rail from road freight. Conversely, the Low Scenario sees lower costs because the lower share of freight switching to rail induces less rail maintenance costs.

5. Harmonisation Priorities and Key Findings

Based on the analysis contained within this *Report*, the key finding by GHD is that:

> **1. A relevant national entity should lead the development of a National Rail Standards Harmonisation Strategy and accompanying Roadmap, based on the Preferred Option Pathway (Option 2: Gradualist Mandatory Pathway). This Strategy and Roadmap should consider the identified key implementation considerations, as well as Option Pathway-specific initiative implementation considerations. This Strategy and Roadmap should also be developed in collaboration with RIMs and key RSOs, to establish a shared vision across the sector for the future of rail standards harmonisation.**

Additionally, to enable a national standard-setting organisation to support greater harmonisation, GHD proposes the following priorities for further consideration:

2. The resourcing and capability needed for a fit-for-purpose national standard-setting organisation to ensure future standards are available to all and adopted across the industry. Membership and participation of RIMs in standard-development technical working groups are key issues.

3. A modified role of ONRSR through an amendment to the RSNL, to act as the enforcement entity for mandatory national standards under the Preferred Option Pathway.

4. Requiring relevant international standards to be evaluated first before any new Australian rail standard is developed, either mandatory or voluntary. International standards that are analogous to existing products should also be continually reviewed, identified and formally considered for adoption as national standards with only minor revisions (as needed for stakeholder-identified technical reasons). If deciding to not adopt a relevant, existing, international standard, a full justification for this decision should be consulted with industry.

5. Co-regulation under the RSNL should remain the regulatory structure of Australian rail networks for all standards that are not considered 'high benefit' enough to be mandated under the Preferred Option Pathway.

6. A legal mechanism to allow RIMs and RSOs to facilitate the orderly transition to a mandatory harmonised standards regime under the Preferred Option Pathway.

7. Once changes in specific standards are proposed to be nationalised, a Cost-Benefit Analysis (CBA) of this change should be undertaken to both ensure that the change is of high benefit, as well as determine the cost impact on individual RIMs. This consideration of cost impact should then be used to inform the extent and nature of Government support for industry in meeting the cost of change to comply with new standards, as established under the Preferred Option Pathway.

8. Conduct an internal audit and gap analysis of all RIMs and RSOs standards to the extent legally permissible, to inform national standard development and improve information sharing between networks under the Preferred Option Pathway.