Amsted Rail Public Submission:

National Transport Commission 2026, Options to harmonize rolling stock testing and test locations – Discussion Paper

Executive Summary:

Amsted Rail supports the National Transport Commission's (NTC's) objective of harmonizing rolling stock testing requirements and test locations to reduce duplication, cost, delay, and uncertainty while maintaining appropriate safety assurance. Amsted Rail believes harmonization should initially focus on common high-impact assessments such as hunting stability and base ride accelerations, supported by harmonized acceptance criteria, standardized documentation, and a clear recognition of test results across participating RIMs. AS 7509 provides an appropriate technical foundation for this work, with documenting RIM-specific variations retained only where justified by network-specific infrastructure or operating conditions.

Amsted Rail also supports greater recognition of validated simulation models in lieu of testing. Physical testing remains important for model validation but once a model is validated for a defined purpose and operating envelope, simulation can efficiently assess additional load cases, worn conditions, wheel/rail contact scenarios, and route-specific cases that might otherwise require costly and time-consuming repeat testing. A national testing location register would be a practical near-term improvement, and a dedicated national test facility could provide substantial long-term value if results from that facility are recognized by multiple RIMs.

Question 1: To what extent do current rolling stock testing requirements and practices contribute to inefficiency and delay in certification and registration? How should efforts to address testing requirements be prioritized relative to other rolling stock approval elements of the National Pathway?

Question 1 Response: Current rolling stock testing requirements and practices appear to be a material contributor to inefficiency and delay, particularly where a vehicle is intended to operate across more than one RIM network. The primary issue is not that testing itself is unnecessary, but that comparable safety assurance may be required to be re-presented, re-interpreted, or repeated under different RIM-specific methodologies documentation expectations, acceptance criteria, or nominated test locations. The NTC has already identified that different RIM testing arrangements can drive duplication, cost, delay, and uncertainty, even where the underlying safety objectives are broadly aligned. 'Options to harmonize rolling stock testing and test locations' describes the current approval landscape as complex and fragmented, with RSO's needing to engage with multiple network-specific approval pathways and sometimes adapt or repeat evidence for different networks.

Efforts to harmonize testing should be treated as a priority within the National Pathway because testing evidence is often one of the most resource-intensive elements of certification and registration. However, harmonization should be coordinated with other pathway reforms, especially safety assurance guidance, the single application form, mutual recognition, and future data/register arrangements. NTC's wider rolling stock approval project already links harmonized testing requirements and locations with a single application approach and safety assurance guidance, and states that a more consistent approach should reduce time and costs while providing greater certainty around compliance requirements.

From Amsted Rail's experience supporting Australian rolling stock projects, the most efficient approval pathway is one where the required evidence, test conditions, acceptance criteria, and documentation expectations are clear before testing or simulation work begins. Where those expectations are not harmonized or are clarified later in the process, additional analysis, report revisions, and project coordination are often required.

Question 2: Are there particular types of tests or approvals where harmonization would be most effective?

Question 2 Response: Yes. Harmonization would be most effective for tests that are commonly required and broadly comparable across networks. In the dynamic behavior area, hunting stability and base ride acceleration assessments should be treated as high-priority candidates because they are core safety and performance assessments under AS 7509 for new or modified rolling stock [1]. This acts as a barrier to the introduction of new rolling stock and stifles innovation. It gives an incentive to keep using old rolling stock which is 'grandfathered' in.

Further, these tests could be harmonized into a single test delivering immediate value by allowing one properly specified and documented hunting/base ride test or validated simulation assessment to be accepted across participating RIMs. This would reduce duplicated effort while preserving safety by requiring the test or validated simulation assessment to be conducted under agreed worst-case or representative conditions.

Harmonization should also prioritize consistent terminology and required content of test reports, including loading condition, wheel/rail condition (including profiles), track geometry/quality, sensor locations, processing methods, and acceptance criteria. This would make test evidence more transferable between networks and easier for RIMs to review consistently.

Question 3: In rolling stock approvals there are three stages: certification, registration, and network approval. For table 1 on pages 21-22, could the various tests be identified as belonging to certification, registration and network approval?

Question 3 Response: Yes, it would be beneficial for Table 1 to identify the primary approval stage associated with test, while recognizing that some tests may support more than one stage. A practical approach would be to classify each test as one, or more, of the following: Certification-oriented, Registration-oriented, Network-approval-oriented.

That distinction would improve clarity because some tests, such as dynamic behavior and kinematic outline assessments, may have a general vehicle acceptance component but still require confirmation against network-specific infrastructure conditions. For example, AS 7509 states that the maximum permitted rolling stock size varies by route, that the RIM specifies the appropriate reference stock outline, and that the RSO is responsible for ensuring compliance with the appropriate outline [1].

Question 4: Are there additional learnings or approaches from international jurisdictions that should be investigated to inform potential reforms to rolling stock testing requirements or locations in Australia?

Question 4 Response: Yes, Australia should consider international approaches that combine standardized technical assessment methods with clear provisions for route- or network-specific limitations.

In the United States, FRA vehicle/track qualification requirements for higher speed or high cant deficiency operations provide a useful example of combining qualification testing, simulation, representative route assessment, defined safety limits, and submission of a qualification test plan. FRA track safety standards subpart G 49 CFR § 213.345 requires a qualification program to demonstrate that the vehicle/track system does not exceed wheel/rail force safety limits and wagon body/bogie acceleration criteria; it also includes provisions for simulation, representative route testing, test plans, and comparison of simulation predictions with full-scale test data where simulations are required.

The AAR system is also relevant because AAR technical committees develop, maintain, and enforce North American interchange rules, mechanical standards, and component specifications, and AAR Technical Services processes applications for approval of facilities and components and maintains related records. This suggest that Australia could benefit from a clearer national mechanism for maintaining harmonized technical requirements, managing interpretations, and documenting accepted test evidence.

Europe's EN 14363 framework is useful because it formalizes the relationship between testing and simulation for acceptance of running characteristics. EN 14363 defines assessment processes for running characteristics and includes information intended for validating simulation models and defining operating conditions outside reference conditions [2].

Amsted Rail has applied EN 14363-style methodologies in international projects where the standard is used as a technical backbone while local conditions are separately addressed. This supports the concept that Australia can adopt a harmonized technical framework while retaining documented local variations where justified. For example, network-specific infrastructure, gauge, and operating conditions.

Regarding dynamic performance assessment, many tests in AS 7509 define general test conditions with some flexibility to accommodate specific network requirements (i.e. isolated/cyclic irregularity sizes, P2 limits for base ride performance, etc.). The different track quality/class definitions from one network to another can be a significant contributor to why some safety assurances and testing need to be repeated and re-presented for multi-network approval. One possible solution is to shift the paradigm of

safety assessment from a more deterministic approach using specific track irregularity shapes of varying sizes for each network to a more statistical approach that incorporates track quality information across all Australian networks (and perhaps separated by gauge) easing the path for broad network approval.

A first step toward this approach is gaining a global view of the track conditions across Australia. For instance, the running safety assessment of EN 14363 defines general track quality parameters (TL50/90 values) that were found, through detailed measurement and analysis, to be valid across most networks in the European Union. These parameters, used in conjunction with other infrastructure considerations, provide a centralized description of the track quality across the European Union and give strong guidance on testing and simulation requirements even though the EU contains diverse environmental and infrastructure conditions. Having a global perspective of the track quality of Australian networks may help RIMs come to an easier agreement on harmonizing, at the very least, test conditions for approval across multiple networks.

Assuming an effort like this proves to be successful, a more robust statistical approach for safety assessment can be developed in coordination with the RIMs, possibly similar to the running safety analysis of EN 14363, which could provide a single pathway for multi-network approval. A standard like AS 7509 could then offer RSOs, manufacturers, and others the current, network specific, route for approval or a more generalized, statistical, but possibly more sophisticated and intensive method of approval that covers all relevant networks. To reduce the load of on-track testing obligations, use of simulations with validated vehicle and track modeling would be performed for demonstrating running safety under this approach.

Question 5: To what extent is there a need for a national testing facility in Australia, and how could it deliver value to the industry?

Question 5 Response: Testing on revenue-generating track complicates scheduling and can often lead to re-scheduling of tests and duplicated efforts and expenses. Having dedicated non-revenue track for testing could mitigate some of these issues. Another current issue is the difficulty with running the wagons sufficiently for 'bedding-in' the suspensions of test vehicle's bogies prior to testing. In North America, there are dedicated non-revenue loops of track for this purpose at the dedicated North American test facilities.

Another inefficiency with the current system is that some RIMs are reluctant to share measured track data, it can take months to receive the data, and often mainline track measurements are dated so that the track geometry and irregularities of the measured data is no longer representative of the track during testing. A national dedicated testing facility with its own track scanning equipment and enhanced track maintenance standard could help to ensure that track condition is known, current, and accurate. This is especially important for validating simulation models.

A national testing facility could deliver substantial long-term value to the Australian rail industry, particularly if it provides recognized test conditions for dynamic behavior, hunting, base ride, curving, vehicle/track interaction, and infrastructure compatibility assessments. The greatest value would be achieved if testing conducted at the facility were accepted by multiple RIMs, subject to clearly defined operating limits and route-specific exceptions. This would reduce duplicated testing, improve consistency of evidence, and provide a controlled environment for evaluating new vehicle designs, modified rolling stock, and emerging technologies.

The Transportation Technology Center (TTC) in the United States provides a useful example. The TTC is described as the largest railway testing facility in the world with more than 50 miles of test tracks used for prototype testing, type testing, homologation, research, vehicle/track interaction assessments, dynamic curving, pitch and bounce, twist and roll, yaw and sway, intentional perturbation testing, and infrastructure/component testing. TTC is a nearly 52-square-mile facility with test tracks including the High Tonnage Loop, Railroad Test Track, Transit Test Track, Precision Test Track, Wheel/Rail Mechanism Loop, and High-Speed Adjustable Perturbation Slab Track, with facilities supporting rail vehicle safety and dynamics research [3, 4].

For Australia, the value proposition would need to be balanced against practical implementation challenges. It would require significant investment. A dedicated facility would need to address who funds and maintains it, where it is optimally located, and how it accommodates Australia's different rail gauges and diverse axle loads. These are significant issues but are not reasons to reject the concept; rather, they are reasons

to consider phased implementation, such as a recognized register of approved test sites first, followed by a dedicated national facility or limited-purpose national dynamic test corridor if justified.

Amsted Rail supports the idea strongly but sees it as valuable only with multi-RIM recognition. The facility itself is only useful if its results are accepted.

Question 6: Are the options for harmonization mentioned in section 4.3 better considered as standalone options, as a combination of options, or altogether? Which options should be implemented as a priority?

Question 6 Response: The options should be considered as a coordinated package rather than isolated alternatives. A test requirements matrix, harmonized acceptance criteria, standardized methodologies and documentation, recognized test locations, and consolidated standards are mutually reinforcing. A matrix without harmonized methodology may identify differences but not resolve them; harmonized criteria without common documentation may still leave RIMs unable to efficiently review evidence; and recognized test locations will only provide value if the associated tests and reporting requirements are accepted consistently.

A practical sequence which is aligned with the NTC's own options in 'Options to harmonise rolling stock testing and test locations' is as follows:

1) Develop a national test requirements matrix identifying common tests, RIM-specific variations, acceptance criteria, documentation requirements, and whether evidence is generally transferable or route-specific.
2) Harmonize high-impact dynamic test first, particularly hunting and base ride.
3) Standardized test report content, including wheel/rail conditions, track geometry, loading, instrumentation, filtering, and processing.
4) Set standard requirements for track maintenance and timeliness of track measurement prior to testing.
5) Establish recognized test location register.
6) Progress toward broader mutual recognition and, where justified, a national test facility

Question 7: Are there specific acceptance criteria or documentation requirements that could be quickly harmonized to deliver immediate benefits?

Question 7 Response: Yes, the most practical quick wins would be harmonizing acceptance criteria and documentation for common tests, particularly hunting and base ride acceleration assessments. These tests are well suited to early harmonization because they are already recognized in AS 7509, widely relevant to rolling stock, and depend heavily on consistent test conditions, instrumentation, filtering, and reporting. AS 7509 identifies hunting and base ride accelerations as key evaluation categories. This would not require all RIMs to abandon legitimate network-specific requirements. Instead, it would require those variations to be clearly documented and justified, allowing applicants to understand before testing whether one test will be accepted across several networks.

Furthermore, increasing accessibility of relevant testing and infrastructure standards across Australian networks is a simple first step towards harmonization of network requirements. For instance, the Rail Safety and Standards Boad (RSSB) maintains a free and open repository of all of its standards, significantly lowering the barrier for users to understand what is required in the registration, certification, and approval processes. Even if it proves to be unfeasible for RIMs to agree on centralized acceptance criteria; ensuring RSOs, manufacturers, and others have easy access to the necessary acceptance criteria and network documentation can help in planning testing and simulation activities, potentially lowering the various costs associated with the disparate organization of network requirements. Collating and maintaining all the necessary documentation from these networks and making them freely accessible through a central location, such as the ARISO website, is a comparatively low-cost step for more immediate benefits.

Question 8: Would allowing greater flexibility in where dynamic and static tests are conducted, for example recognizing results from a wider range of approved sites or simulators, help reduce costs and improve timing?

Question 8 Response: Yes, provided flexibility is governed by an agreed recognition framework. Allowing results from a wider range of approved test sites, representative route sections, and validated simulation models would likely reduce costs and improve timing by avoiding unnecessary repeat testing and by permitting evidence to be generated where the required conditions can be safely and reliably achieved.

This is particularly important for dynamic tests where the difficulty is often not the engineering assessment itself, but obtaining track access, arranging instrumentation, confirming vehicle testing conditions, securing appropriate wheel/rail contact conditions, and aligning the test location with the required acceptance criteria. On-track testing is expensive and can take a long time because of logistical hurdles.

Amsted Rail experience also supports the importance of clear and complete test information. It is often required to have clear documentation with report availability, measured load conditions, sensor/accelerometer locations, service worn condition details, rail profile information, track construction details, calculation methodologies etc. to support dynamic and static model validation.

Question 9: Is simulation testing a viable alternative to physical trials and, if so, what protocols would need to be adopted to validate simulation models? Are there specific tests that simulation testing could be used to demonstrate compliance?

Question 9 Response: Yes, simulation testing is a viable alternative or complement to physical trials for selected assessments, provided the model has been validated for the intended purpose and operating envelope. Simulation should not be treated as a blanket replacement for all physical testing. Rather, physical testing should be used to validate key aspects of the model, after which the validated model can be used to assess additional load cases, wheel/rail conditions, wear conditions, speeds, or network-specific scenarios that would be costly or impractical to physically test.

Amsted Rail's experience is that a physical test remains important to establish confidence in the model, but once validated, the model can provide significant value by assessing conditions not physically tested. This can reduce repeated testing, support faster technical evaluation, and improve the quality of evidence available to RIMs.

Question 10: Should harmonization of testing requirements and locations be progressed as a separate, dedicated project, or could it be effectively managed by the Technical Working Group for a single registration application pilot during a future stage of the National Pathway?

Question 10 Response: It would be beneficial to allow the work to proceed with clear technical deliverables, such as a test requirements matrix, harmonized report templates, a recognized test location register, and simulation validation protocols, however that may be achieved.

Question 11: Would a testing location register be useful?

Question 11 Response: Yes, a testing location register would be useful if it includes not only location names, but also the technical characteristics that determine whether a location is suitable for particular tests. The register should identify which tests may be performed at each location, the available gauges, axle-load suitability, speed capability, curve radii, track geometry features, track quality, rail profiles, known perturbations, instrumentation support, access constraints, and which RIMs recognize results from that location.

A register might be particularly valuable as an interim step before any dedicated national testing facility is developed. It could reduce uncertainty for RSOs and manufacturers by allowing test planning to begin with an agreed list of recognized locations and known limitations. It could also support mutual recognition by documenting the conditions under which a test result is transferable to other networks.

The register should be maintained through a national process, with updates when track geometry, rail profile, access conditions, or recognition status changes. This would support the NTC's identified option of shared and recognized test locations and help prevent repeated debate over whether a given test site is suitable.

References

1. Rail Industry Safety and Standards Board, 2017, *AS 7509:2017 Rolling Stock – Dynamic Behaviour*, Rail Industry Safety and Standards Board, Kingston ACT.

2. European Committee for Standardization, 2016, *EN 14363:2016 Railway applications – Testing and Simulation for the acceptance of running characteristics of railway vehicles – Running Behaviour and stationary tests,* CEN, Brussels.

3. Transportation Technology Center, n.d., *Railway Test Tracks,* ENSCO, viewed 10 July 2026, available at: Railway Test Tracks - Transportation Technology Center

4. Federal Railroad Administration, n.d., *Transporation Technology Center (TTC),* U.S. Department of Transportation, viewed 10 July 2026, available at: Transportation Technology Center (TTC) | FRA

