

Peer reviewed paper

Outlook of TfNSW Bridges & Structures Standard

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Abstract

Transport for NSW (TfNSW) is responsible for strategy, planning, policy, regulation, funding allocation and other non-service delivery functions for all modes of transport in NSW including road, rail, public transport, ferry, light rail, cycling and walking.

Under TfNSW Standards Management Framework (SMF), one of the key initiatives is the development of multi-modal bridges and structures standard. The goal of the proposed standard is combining existing TfNSW Standard artefacts, which were previously developed for specific transport mode. These mode specific standards include, but not limited to:

- TfNSW Scope of Work and Technical Criteria documents used for D&C Projects
- TfNSW PS Series PS261 and PS361 technical requirement documents used for design only Projects.
- Bridge Technical Direction Manual
- T HR CI 12030 ST Overbridges and Footbridges standard

The proposed standard will aim to supplement AS 5100 Bridge Design, and address matters for resolutions in AS5100. TfNSW will also update existing technical criteria and introduce new technical criteria through collaborative engagement with internal and external stakeholders. The standard will provide an only source of technical requirements for TfNSW bridges and structures.

Notwithstanding, the development of multi-modal bridges and structures standard will reach hybrid technical criteria covering prescriptive acceptance criteria, risk based and performance-based outcome requirements. This will enable intelligent compliance through improving industry collaboration, promoting innovation solution, achieving sustainable outcomes on projects and evolving with advancements in technology and industry practice.

Keywords: bridges, structures, standards, AS5100, Transport for NSW

1 Introduction

TfNSW Standards were developed for a specific mode of transport and by different operating agencies in the past. Large numbers of existing standard artefacts create challenges to a harmonised approach and a drive for consistent requirements across all modes. There is a need to clarify the order of precedence related to standards application in projects for specific transport modes. With the large technical knowledge database and SMEs' (Subject Matter Expert) expertise in TfNSW, there is an opportunity to combine TfNSW standards or technical requirements into harmonised multi-modal standards.

With all agencies' standards brought under the custodian of the Asset Management Branch TfNSW, the structures and bridges cohort are actively reviewing and identifying outdated/unused standard artefacts and identifying gaps or missing technical requirements through consultation with internal stakeholders.

There are a full suite of bridges and structures technical design requirements stipulated in the different Design and Construct (D&C) Scope of Work and Technical Criteria (SWTC) documents and the Professional Services Contract PS 261 and PS 361, which are commonly included as part of project contract documents. The requirements are applicable to the design of structures and bridges and are essential for the safe and reliable construction and operation of TfNSW's bridge assets. An initiative has been identified to consolidate the technical requirements of the SWTCs and PS 261 / PS 361, as well as several BTDs (Bridge Technical Direction), and potentially T HR CI 12030 ST Overbridges and Footbridges which is used for heavy rail projects, into a single source of truth Bridges & Structures Design Standard.

The target outcome with the development of multi modal Bridges & Structures Standard is to confirm that standards needed for road and rail projects will complement each other and ideal for amalgamation. The proposed new standard will consolidate road mode and rail mode standards, which have extensive design criteria, supplementary requirements and substantial number of standard artefacts on topical issue for design of bridges and structures.

1.1 Background

Current Transport design requirements related to bridges and structures include artefacts produced and published by TfNSW Asset Management Branch (AMB) and artefacts produced by other TfNSW divisions and its agents that have responsibility for managing separate phases of the asset life cycle for the different transport modes. Technical documents outlining bridges and structures requirements include:

- AMB Standards, such as T HR CI 12030 ST Overbridges and Footbridges and T HR CI 12020 ST Underbridges
- TfNSW Bridge Technical Direction Manual (BTDs)
- D&C Projects - Scope of Work and Technical Criteria (SWTC)
- Design Projects – Professional Services Series such as PS301, PS261 and PS361.
- TfNSW Standard Drawings
- TfNSW Bridgework and Austroads Technical Specifications
- Structural Detailing and Drafting Manual

Above technical documents have requirements that supplement each other. However, there may be repetition of technical criteria across different TfNSW Standards / technical documents, which were developed for specific transport mode or agency. These documents may have discrepancies or lack of interdependencies.

Transport for NSW (TfNSW) initiative to develop a new bridges and structures standard in setting out the requirements across whole of life cycle activities (such as plan, design, construct, maintain and dispose) of bridges and structures which are procured through TfNSW Projects. The bridges and structures include TfNSW assets or those that will be transferred to TfNSW or bridges and structures over or next to TfNSW corridors.

1.2 Objectives of the new Multi-Modal Bridges & Structures Design Standard

The goal and purpose of multi-modal bridges and structures standard are to:

- identify and consolidate existing TfNSW Standards and technical criteria.
- review existing TfNSW Standards and technical criteria and identify gaps.
- supplement Australian Standards such as AS5100 series and relevant matter for resolutions.
- update and improve TfNSW Standards and technical criteria.
- harmonise technical criteria across transport modes.
- develop and incorporate new technical criteria in emerging issues or design / construction approaches not currently covered in TfNSW Standards
- align with other international standards or other state jurisdictions' requirements.
- develop technical position papers to inform research findings and rationale of technical criteria.

- stipulate consistent and transparent, as well as industry accepted technical requirements.
- incorporate risk assessment and technical governance process when dealing with new products / design approach / construction practice which are not covered in TfNSW standards, and first introduced in TfNSW projects/ infrastructure assets.

The proposed bridges and structures standard is to develop and publish a single source of TfNSW Standard for design of bridges and structures, following TfNSW Standards Management Framework (SMF).

The target outcome of the new bridges and structures standard shall:

- minimise number of TfNSW Standard Artefacts
- improve industry compliance in the delivery of projects.
- reduce non-compliant solutions.
- enable sustainable levels of technical capability to develop new criteria.
- allow new innovations or technologies through so far as is reasonably practicable (SFAIRP) and value creation approach.
- incorporate improvements based on lesson learnt, queries and concessions.
- uplift technical criteria through collaboration with internal stakeholders and industry partners.

The development of these new multi-modal bridges and structures standard will consolidate existing technical content and reduce quantity of TfNSW Standard Artefacts. The standard will set out the design requirements across whole of life cycle activities (such as plan, design, construct, maintain and dispose) of bridges and structures which are procured through TfNSW Projects.

2 Outlook of TfNSW Bridges & Structures Standards

The new multi-modal bridges and structures standard aims to be the sole source of TfNSW Design Standard for Bridges (excluding underbridges – railway bridges). To achieve this goal the scope of this standard will encompass the following:

- Appropriate adjustment and supplement to latest Australian Standard AS5100
- Multi-modal application (road and rail projects), including light rail and metro (where possible)
- Consolidate / harmonise existing TfNSW Standards, for examples:
 - o T HR CI 12030 ST Overbridges & Footbridges
 - o PS261 / PS361
 - o SWTC (Appendix B4 for Motorway Project or Appendix 13 for Highway Upgrade Project)
 - o Relevant Bridge Technical Direction Manual (BTDs)
- Find gap in AS5100 or TfNSW Standards
- Improve technical criteria (including TfNSW lesson learnt in past recent projects)
- Update technical criteria or create new technical criteria through research, referencing technical resource and recommendations.
- Work with TfNSW internal SMEs in resolving technical discrepancies and deliver TfNSW and industry accepted Standard.

2.1 Strategy in developing the Standard.

The TfNSW Standards Management Framework (SMF) outlines the following six principles, which provide a consistent, whole of life cycle approach. The implementation of the framework aims to maximise value for customers, communities and the people of NSW.



Standards are an asset

TfNSW standards are an intangible asset with a life cycle



Industry accepted

TfNSW adopts industry accepted standards with no or minimal modification



Outcomes based

The Framework is outcomes focused producing performance-based standards where appropriate



Risk-based management

TfNSW standards provide for an appropriate balance of cost, risk and performance across the life of the asset



Collaboration and consistency

TfNSW standards management facilitates Transport-wide collaboration and consistency



Innovation and improvement

TfNSW standards promote and support innovation, continuous quality improvement, risk control and organisational effectiveness

2.1.1 Risk-based and Performance-based Standard.

Standards provide a benefit to the community and economy by:

- Guiding TfNSW through safe and effective operation, maintenance and enhancement of the transport network.
- Ensuring TfNSW requirements are clear, consistent and transparent thereby enabling efficiency in the development, procurement, delivery, and maintenance of assets and services with industry partners.
- Creating valuable intellectual property that supports safe, effective, sustainable and repeatable outcomes by drawing upon the knowledge and experience of a cross section of relevant stakeholders including competent subject matter experts.
- Managing the opportunity of emerging technologies or innovations by assessing and communicating their right application to the TfNSW network.
- Providing an overarching framework for risk management and compliance.
- Establishing a basis for asset management and considerations for the whole of life management.
- Ensuring so far as is reasonably practicable (SFAIRP) approach, integration (especially multi-modal) and interoperability from a technical and engineering perspective and customer experience viewpoint.

TfNSW Standards are developed through a scaled approach, such as tiering, based on risk and change impact assessment to ensure governance and assurance. When a trigger event requires development of a new standard or modification to an existing standard, the following standard development process is followed:

- Stage 1: Proposal and planning – complete Standards Project Proposal Form and Standards Tier Tool
- Stage 2: Draft and develop – document risk register, draft standard and prepare an assurance argument.
- Stage 3: Collaboration – consult key stakeholders.
- Stage 4: Governance and approval – validate risk register and assurance argument.
- Stage 5: Publication – publish standard and notify relevant stakeholders of publication.
- Stage 6: Operate and maintain – maintain currency of content through technical directions or standard update.

2.1.2 Intelligent Compliance and Value Creation

Transport Standards will continue to evolve with advancements in technology and improvement of industry practice. Hybrid standard requirements covering prescriptive acceptance criteria, as well as incorporating risk based and performance-based governance and assurance processes will be a key focus area to improve industry collaboration, promote innovation and achieve more sustainable project outcomes.

The Concessions to Transport Standards process enables technical experts and industry partners to seek opportunities to challenge the status-quo and develop engineering solutions that provide alternative and fit-for-purpose outcomes. Risk-based and performance-based TfNSW Standards will empower the industry to be more creative through intelligent compliance. The Concessions process offers a mechanism to facilitate innovation outside of standard requirements. The governance process enables deviations from the Standards through adequate technical justification, whole-of-life cost benefit analysis, risk management, and safety control and assurance.

A Value Creation Toolkit (VCT) has been developed by TfNSW to identify, monitor and report the value created by the development and application of Transport Standards or the granting of concessions. It captures financial and/or non-financial benefits, or a combination of both, associated with an activity in the context of the Transport cluster and its customers. To deliver the best outcomes for our customers and communities across the whole of life cycle, the VCT focuses on driving and capturing intelligent approaches to Standards development and management to achieve better quality, safety, performance, and financial outcomes. It is important to note that the financial and non-financial aims must not be compromised solely for the purpose of cost savings or cost avoidance in the development or delivery of TfNSW assets.

3 Bridges & Structures Standard Development

Review of TfNSW Standards / technical documents and preparation of gap analysis. The gap analysis will outline the following:

- comprehensive review of the existing T HR CI 12030 ST, SWTC, PS261/PS361 and BTDs
- inconsistencies / discrepancies of existing technical requirements / topics
- AS5100 (including matter for resolutions and draft amendments), other international standards or other state jurisdictions' requirements for harmonisation.
- The technical criteria to be considered or included in TfNSW standard, are categorised as:
 - o Withdraw obsolete or superseded design requirements.
 - o Migrate / consolidate and maintain existing requirements.
 - o Minor update of existing requirements / topics
 - o Major update of existing requirements / topics
 - o New topic / technical criteria

3.1 Scope of the Standard

The bridges and structures standard will merge the technical content currently stipulated in following standards:

- T HR CI 12030 ST Overbridges & Footbridges
- TfNSW Bridge Technical Direction Manual (BTDs)
- D&C Projects - Scope of Work and Technical Criteria (SWTC)
- Design Projects – Professional Series PS261 and PS361.

3.2 Out of Scope of the Standard

The proposed bridges and structures standard will not combine or supersede following standards or criteria:

- T HR CI 12020 ST Underbridges
- T HR CI 12002 ST Durability requirements
- Bridge inspections and maintenance requirements
- Bridge load rating for TfNSW bridge assets
- Heavy Vehicle assessment requirements
- Bridge components or systems approval
- Bridge drafting requirements
- Bridgework Specifications or Austroads Technical Specifications (ATS)
- Standard Drawings

3.3 Application of the Standard

The bridges and structures applicable to the scope include the following:

- bridges subject to vehicular traffic loadings
- culverts or underpass structures subject to vehicular traffic loadings
- pedestrian, cycleway or shared user path bridges
- other structures on bridges or connected to bridges (e.g. noise walls, advertisement sign frames, protection screens, retaining walls, etc)
- bridges and structures subject to light rail loadings
- dive structures (not part of tunnel structures)

Bridges and structures not applicable to the scope include the following:

- bridges subject to rail loadings
- retaining walls (not connected to bridge abutments) on road / rail corridors.
- noise walls (not on bridge structures) on road / rail corridors
- tunnel structures.
- maritime structures
- pavements

- road furniture, such as sign and lighting structures, poles, and gantries.

4 Conclusion

Two fundamental elements underpin the development of any new TfNSW Standard or the modification of an existing standard:

- Risk Management: risk-based and performance-based requirements demonstrated by an argument with evidence that safety will be ensured so far as is reasonably practicable.
- Value Creation: intelligent compliance and asset lifecycle consideration demonstrated by an argument with evidence of optimal asset management outcomes across whole of life cycle.

TfNSW Standards will continue to harmonise and evolve in accordance with the TfNSW Standards Management Framework (SMF). In addition to ensuring ongoing technical excellence, standard requirements will also adapt to incorporate sustainability, circular economy, climate change, customer demand, emerging technologies and latest industry best practice.

Therefore, the development of this new Bridges and Structures Design Standard will ensure that valid risks are addressed such as:

- Capturing design requirements in single source of technical standard, under Standard Management Framework.
- Managing departure or non-compliant to design requirements through the Concession to TfNSW Standards / Non-Conformance processes.
- Ensuring consistent technical requirements for bridge design across TfNSW bridge asset, regardless of procurement methods, transport modes, or project types.
- Minimising the number of standard artefacts and streamlining processes, such as immediate standard update through Technical Direction (TD) under the SMF and routine standard update program to consolidate TDs in timely manner.
- Improving industry compliance in the delivery of projects related to bridges & structures design and construction.
- Reducing project disputes and non-compliant solutions unless otherwise managed through the Concession process, i.e. demonstrating safety in SFAIRP, and value creation.
- Enabling sustainable levels of technical capability to develop new criteria or adopt innovations / technologies and maintain technical documents.

5 References

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