Development of a Design Criteria for the Victoria Bridge Refurbishment

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| **Abstract**  The 313m precast segmental box girder Victoria Bridge is a key Brisbane River crossing opened in 1969 and remains a central link for public transport, pedestrians and cyclists within the city. As part of the Brisbane Metro Project, the bridge was reconfigured to suit the new electric Metro fleet while also providing a dedicated cycle corridor to supplement pedestrian walkways.  Due to the change of use, a detailed assessment of the structure was undertaken and identified theoretical overutilisations in several areas. Investigations showed that strengthening of the bridge to achieve full compliance to current Australian Standards Bridge Design suite (AS5100) was not practical, with various areas of the bridge including halving joints limiting its capacity. Additionally, as any strengthening works would require significant invasive drilling and coring into the heavily prestressed structure, overly conservative strengthening schemes were not seen as viable options.  To address this, a bridge-specific design criteria was developed with close collaboration between the engineer, Client (and asset delegate) and Client’s Technical Advisor to agree a rational set of parameters on which to base the strengthening works. This process involved the development of numerous ‘Special Studies’ to determine suitable parameters outside the typical scope of the code as well as the agreement of various parameters with the ‘Relevant Authority’ (BCC) in accordance with AS5100 provisions. Where parameters were deemed to be departures from the code, robust processes were implemented to ensure technical reviews and subsequent acceptance by the Client were carried out in a transparent manner.  This paper presents the processes and workflows developed to facilitate the documentation and agreement of the departures, discusses key departures and their significance on the final strengthening design and comments on the applicability of such an approach to future projects and the sustainable asset management field.  **Keywords:** Bridge asset management, bridge analysis design and assessment, codes and standards, sustainability and life cycle cost |

# Introduction

The Victoria Bridge has been a key crossing of the Brisbane River, between the CBD and South Bank, for pedestrians, cyclists, motorists and public transport users since its opening in 1969. It consists of two anchor-cantilever structures and a central suspended span, with its three spans covering a total 313m length between abutments. As an early form of free cantilever construction methods, the precast segmental bridge represented a unique design and construction form for its time.

Figure 1 The Victoria Bridge viewed from the north



As the fourth bridge at its location, the structure has undergone numerous changes of use and modifications throughout its 55-year service life. Modifications to bridge approaches and abutments, incorporation of critical utility services, local strengthening to girder segments and bearing replacements have ensured that the structure has remained suitable for the demands of its time.

As part of the Brisbane City Council’s (Council) Brisbane Metro project, the structure is once again being modified to meet the future transport needs of Brisbane. While previously accommodating a busway and public access road, the structure is being converted to a public transport only corridor with dedicated two-way cycleway along with improved pedestrian amenity. As part of the project, the structure was to be modified to suit the new metro operations and strengthening provided to accommodate the resultant design actions.

Following detailed historical study and local strengthening of the structure prior to its integration within the south-east busway in 2000, it was known that the bridge had limited capacity to accommodate load increases. Initial assessment of the structure as part of the Brisbane Metro project showed that achieving full compliance to current Australian Standards Bridge Design suite (AS5100) was not feasible. Given this, it was recognised that a rational set of bridge-specific design parameters incorporating departures to the design code was required to be agreed with the Asset Owner to ensure the structure could be strengthened rather than replaced.

This paper explores the collaborative framework which was developed on the project to substantiate and agree site-specific design departures with the Asset Owner, discussing key avenues within the design code that facilitates such an approach. Noting that this process requires significant trust and collaboration between all stakeholders, the paper also outlines key aspects of the project delivery framework which are required to permit such an approach. Finally, recognising the growing quantity of ageing infrastructure in Australia, the paper explores how such a methodology might be utilised to meet the requirements of Asset Managers on future projects.

# Project Context

Over the past 55 years, the expansion and development of the City of Brisbane has resulted in the continual need to evolve and adapt Victoria Bridge to service the needs of the community. As such, over time Victoria Bridge has seen numerous changes of use, modifications and strengthening operations. The planning and development of the Brisbane Metro project required a complete understanding of the structure’s history in order to formulate the necessary changes required to adapt the structure to the demands of the modified fleet and ensure serviceability throughout the next phase of its life.

An overview of historical modifications and structural assessments is presented below along with the client drivers for the Brisbane Metro Project, the project scope, and the initial structural assessment for the primary repurposing works.

## Historical Studies and Modifications

The structure has been subject to various modifications since its construction in 1969. Key modifications include:

* Post-construction shear strengthening (1970) of 5 no. box girder segments
* Modification of upstream cantilever walkways at both abutments
* Numerous kerb realignments at bridge approaches to suit varying lane configurations
* Shear strengthening (1998) of 5 no. box girder segments and bearing replacement prior to busway conversion12
* Bearing replacement prior to busway conversion5
* South-east busway conversion (two lanes dedicated to busway operations)

Prior to the conversion to the busway in 2000, Nick Stevens Consulting (NSC) was engaged by Council to undertake a detailed assessment of the structure. The brief for this work recognised limitations of the then current 1992 Austroads Bridge Design Code1 and sought to utilise the best available theories for the assessment of bridge capacity.

In line with this brief, the assessment undertook verification of the structure using a simplified approach to Modified Compression Field Theory (MCFT) and utilising material-based capacity reduction factors from the Canadian Bridge Code2.

As part of the investigation, a detailed durability assessment was also undertaken to determine the condition of the structure as well as site testing of cross section thickness to assess construction tolerances. These investigations indicated that the structure remained in good condition, had been constructed to tight tolerances (majority precast construction) and had concrete compressive strengths significantly above the design strengths.

Due to the identified tight construction tolerances and recognising conservatism in dead load factors in the Austroads Bridge Code for the anchor cantilever structure, modifications were made to the code defined dead load factors in the assessment. While these departures were discussed at length and agreed with BCC’s structural engineering leadership, there was no formal approval process at the time nor code defined process for obtaining departures.

## Client Requirements

In order to reduce costs and maximise the social and economic benefits to the community, Council endeavours to realise and achieve the full design life of all assets. Over time, the evolution of the assets purpose and applicable design standards results in the need to reassess residual design life against current operational demands, and where required, implement efficient upgrades to maximise asset serviceability. Key to this is the desire to have the most efficient assets possible which means reducing maintenance costs, frequency, and duration of inspections and replacements wherever possible. Where maintenance is required, it must be clearly understood and designed so far as reasonably practical to be as safe as possible.

As with any construction, a wholistic assessment is required in order to achieve the most efficient outcome. Recognising this means understanding the ongoing and evolving changes to the ownership costing of an asset. With every change to the bridge there is a direct and measurable change in the residual design life and associated asset management and maintenance costs. in remaining life costs and remaining life.

As the Relevant Authority for the Victoria Bridge, Council needed to determine a suitable scope for the project which would ensure the successful delivery of the Brisbane Metro Project while also ensuring the bridge whole of life costs would remain sustainable in the context of the new service levels. Given the remaining service life of the structure targets another 45 years, it was recognised that there may be significant permanent and compounding effects from any design decisions.

For the Brisbane Metro project, the fundamental service requirements revolved around maximising the residual design life of the structure under the revised load scenarios. These included new design loads resulting from the removal of public vehicles, the modified fleet including Brisbane Metro vehicles, bi-directional cycleway, crowd loading to footpaths and additional dead loads relating to safety barriers and fencing, In addition to the new service levels required for the Brisbane Metro project, Council also considered the high demand for the structure.

As well as busway and pedestrian/cyclist traffic, Victoria Bridge is utilised as a key connection during annual events such as ‘Riverfire Festival’ and New Year's Eve celebrations. Due to this, opportunities existed within the project for the review and assessment of how the bridge would perform and serve as a key connection for pedestrian movement supporting large events. As these events also occurred during construction, the project was required to accommodate these events and their unique loading and logistical constraints within the interim (construction phase) and permanent designs.

Finally, as a particularly slender example of prestressed box girder construction, Council had a desire to minimise negative impacts on the aesthetics of the structure. The balance of the above requirements led to the development of the project scope outlined below.

## Project Scope

The primary scope of the Victoria Bridge repurposing was to facilitate Brisbane Metro operations across the structure. This required modifications to the above deck layout as well as the completion of any required strengthening to accommodate the future design loads.

In order to increase the capacity of the Victoria Bridge for public transport and to reduce queueing times, Council elected to remove general traffic from the bridge deck and increase the number of bus lanes from two to three. Council also took this opportunity to create greater provision for active transport by adding a dedicated cycleway onto the bridge. To achieve these changes, modifications to the bridge deck were required. Cross sections before and after the Brisbane Metro works are shown in Figure 2 below.

Key modifications to the structure include integration of vehicular traffic barriers, kerb and balustrade to delineate pedestrians and cyclists, improved drainage, new bridge wearing surface and new footway surfacing. Provision has also been made for the future installation of a shade structure between the pedestrian and cycle lanes.

Figure 2 Typical bridge cross section before (top) and after (bottom) Brisbane Metro works

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## Initial Structural Assessment

Due to the above changes, the structure was subject to increased loading resulting from the heavier Metro vehicles (in comparison to existing bus fleet) as well as dead load of barriers, kerbs and miscellaneous works.

As part of feasibility studies for the Brisbane Metro Project, NSC was engaged by Council to undertake initial assessment of the structure for various potential traffic configurations. As part of these feasibility studies, a similar approach was adopted to the 1998 NSC study including numerous departures to the current Australian Bridge Design suite (AS51006). Additionally, the study recognised the unique operating conditions of the bus rapid transit system, with live load models reflecting expected bus and metro vehicles and incorporating modified accompanying lane factors adapted from a rail context. The feasibility studies indicated that with these assumptions, minor local overutilisations may be expected in anchor (end) spans, however, strengthening of the structure would likely be feasible.

For the Brisbane Metro project works, the above-mentioned feasibility studies were provided to the Brisbane Move delivery consortium, however, no explicit design criteria for the strengthening works were provided in the Project Requirements beyond compliance to AS5100. Given this, any underlying departures in the feasibility study could not be inherently relied upon, and initial assessment of the bridge was carried out in line with AS5100 requirements.

Figure 3 below presents a graphical illustration of the utilisations across the structure under the AS5100 compliant assessment. This figure shows a schematic plan of the bridge with each square representing a segment of the precast box girder. Colours are assigned to each box based on utilisation of the segment under a given effect, with yellow, orange and red indicating varying severity of overutilisation based on the initial compliant AS5100 assessment.

Figure 3 Schematic plan showing utilisations of girder segments – AS5100 compliant assessment

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Based on this, it was apparent that the bridge could not reasonably be strengthened to be fully compliant to AS5100 and departures would be required to demonstrate the feasibility of any rational strengthening scheme.

# Development of Design Criteria

The need for a bridge specific design criteria incorporating departures to current codes was identified early in the project lifecycle following the initial assessments above. While the Project Requirements made no specific allowance for the design of the strengthening works beyond compliance to AS5100, the standard itself provides significant scope for the use of specific design parameters and/or alternative methods subject to agreement by the ‘*Relevant Authority*’ (Council). This is evident in Sections 1 and 7 of AS5100:17, as well as Section 1.9 of AS5100.59 and Section 2 of AS5100.811.

Given this, it was agreed with Council to develop a bridge specific design criteria with formal approval of any departures needed to complete a rational strengthening design for the structure.

In pursuing this approach, the following was recognised by Council and the project team:

* The structure could not feasibly be strengthened without the acceptance of some level of departures from AS5100.
* Historical assessment of the structure had been based on various departures and the structure had demonstrated good performance during this time.
* The condition of the structure and quality of its construction was known to be good.
* The future loading situation of the structure (dedicated busway) represented a highly controlled loading environment.

In addition to this, Council had significant continuity of knowledge of the structure through NSC who were acting as their Technical Advisor. This provided confidence that any departures presented could be adequately assessed and scrutinised prior to approval.

## Departure Approval Process – Special Studies

The primary mechanism of agreeing departures on the project was through the development of ‘*Special Studies*’ as defined in AS5100.1 Appendix B which permits justification for the use of alternative design methods and materials outside those presented in the code. For all departures being requested, detailed study was undertaken to understand the current requirement, historical requirements and previous assessment, current local and international practice as well as any risks associated with the departure. This was used to inform the proposed adoption of any modifications to code-defined parameters or methods.

Recognising the technical nature of many of the departures for the project, a rigorous and transparent process was developed to ensure that various departments within Council and NSC had opportunity to review and comment on all departures prior to submitting for final approval. The departure review and approval process is shown in Figure 4 below.

Figure 4 Departure Approval Workflow

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Following this process, a total of 8 no. Special Studies containing 46 No. departures were submitted and approved prior to the commencement of the detailed design of the strengthening works. The Special Studies covered:

* AS5100 Matters for Resolution
* Dead Loads and Load Factors
* Live Loads and Load Factors
* Load Combinations and Factors
* Serviceability Limit State (SLS) Methodology
* Ultimate Limit State (ULS) Methodology
* Fatigue Limit State (FLS) Methodology
* Drainage

## Key Departures

For the Victoria Bridge Strengthening, significant benefits were realised through several specific departure areas. These are described below.

### Dead Load Factors

Built through free cantilever construction methods, Victoria Bridge is formed by two anchor-cantilever structures hinging about the piers with a central simply supported span. Such structures are highly sensitive to out of balance actions and stringent measures are generally undertaken during construction to minimise out of balance actions.

Within AS5100 as well as Austroads Bridge Design Code during previous assessments, various clauses pertain to differential factoring of adverse and relieving components of dead loads. When applied to Victoria Bridge, it is found that strict adherence to differential factoring over portions of the structure results in effective dead load factors in excess of 1.5 in most of the anchor span.

Drawing upon extensive earlier investigations of box girder geometry12, reduced dead load factors were adopted on the basis of demonstratable tight construction tolerances. Two sets of dead load factors were applied to suit either differential factoring between anchor and cantilever spans or uniform factoring of all dead loads.

Where factors were applied differentially, a factor of 1.05 was adopted for concrete elements resulting in adverse effects with 1.0 for relieving. Where a uniform factor was applied over whole structure, a factor of 1.15 was adopted. This reflected a slight increase compared to historical assessment of the bridge, however, aligned with factors in within EN19904.

### Live Load Model

Due to the tightly controlled operating environment across the bridge following the project works, site-specific live loads were adopted rather than code defined vehicles. In addition to the Brisbane Metro and Council bus fleet, live loads included specific heavy vehicles which including the Queensland Fire Department fleet, underbridge inspection units, tow trucks and asphalting plant.

For bus and metro travel on the bridge, the departures captured modifications to the ALF values which had been utilised in feasibility studies for the project. The modified values were more closely aligned with those in a rail context, considering two primary lanes with a factor of 1.0 with the third lane factored at 0.8. While the adopted values are more onerous than typically used for road traffic in AS5100, they were seen to be a more realistic representation of peak hour busway operations whereby with fully laden vehicles travelling in both directions.

### Capacity Model

While initial assessments of the structure utilised AS5100, it was recognised that the direct application of these provisions, in particular for shear and torsion, would require significant strengthening of the structure. While various alternative approaches were considered, the Canadian Bridge Design Code was ultimately adopted due its use of a Modified Compression Field Theory-based design approach (similar to AS5100) in addition to its rational approach of material factors. The material factoring approach was seen to better to reflect the likely capacity of the structure when governed by reinforcement or prestress failures. The use of the Canadian standard is consistent with TMR Tier 2 assessment of shear in concrete structures3 as well as earlier work carried out on the bridge.

### Serviceability Limit State (SLS)

As part of the departure process, it was agreed that the SLS would not form a governing criterion for the strengthening works. While stresses and deflections were calculated and reported, strengthening works were not designed to achieve compliance with AS5100 to these aspects.

With respect to stresses, this was justified based on inspections showing no evidence on the structure of historical flexural cracking due to applied loading as well as the presence of closely spaced tendons crossing segment joints at critical locations.

With respect to deflections, it was recognised that the structure had no history of poor performance or user discomfort arising from deflections. Due to the slender nature of the structure, only strengthening systems which added significant flexural stiffness could have achieved compliance, and such schemes were not seen to be practical.

**Impact of Departures on the Strengthening Concept**

The application of the above departures to the assessment had a notable impact on the concept developed for the strengthening design, with reductions in theoretical overutilisations seen from both the increased capacity from AS5100, as well as reduction of loads.

Following from the AS5100-complant outcome presented in Figure 5, the resultant utilisations across the structure when considering departures relating to capacity are shown below.

Figure 5 Schematic plan showing utilisations of girder segments with capacity departures

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When also considering the departures relating to loads and factors, the utilisations across the structure are shown in Figure 6.

Figure 6 Schematic plan showing utilisations of girder segments with all departures included

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As can be seen from Figure 7, the outcome of the departure process was that only local areas of the anchor spans were found to be overutilised. Based on this analysis, the concept design for the strengthening works was developed as shown below.

Figure 7 Victoria Bridge concept strengthening design

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Description automatically generatedIt is noted that the departure process resulted in a significant reduction in the extent of bridge which was identified as requiring strengthening. Where departures had not been explored or were used to a lesser extent than what was adopted, many more areas of the structure would have required strengthening. As the process of strengthening the structure requires many hundreds of coring and drilling operations in the vicinity of existing post tensioned tendons and reinforcement, provision of excessive strengthening based on conservative design parameters is not seen to offer a lower risk solution.

## Client Engagement

Throughout the departure process, the project team sought to maintain a transparent approach with various branches of Council. Due to the technical nature of the departures, the majority of technical review relied on NSC as the Technical Advisor to Council. As changes resulting from the departures would impact the asset for its remaining life, however, it was also important that other branches of Council including asset maintainers, managers and owners and Council’s Brisbane Metro project team were also informed of the departures and provided opportunity to comment throughout the process

To facilitate these discussions, schematic utilisation plans (e.g. Figure 7) showing the extent of structure which would require strengthening under a given set of design parameters assisted in demonstrating the impact of key departures to a broader audience. In general, it is noted that departures which were sought early in the project lifecycle such that stakeholders had the ability to influence the design direction were found to be best received.

# Project Delivery

## Delivery Models

During the initial phase of the project, BCC did not have an immediate preference as to the form of contract or delivery model to be used for the construction of the strengthening system. Given the uniqueness of the works proposed, a study was conducted to assess the various models for delivery which could be employed for the implementation of the strengthening system. Design & Construct (D&C) and sub-contracted models were initially considered for the scheme. Collaborative models for delivery were also considered as Brisbane Move, the consortium comprising of Acciona and Arup were engaged to deliver the wider Brisbane Metro project.

## Risks

Given the maturity of the design, it was known that a series of residual risks existed in terms of commissioning the works. Concerns existed due to the possibility of identifying defects or conditions within the bridge which were not expected and the associated evaluation required of these situations. The design developed was in a conceptual state and had not been fully assessed for constructability, nor were any detailed investigations or inspections carried for at the locations requiring strengthening. As such, obtaining a cost estimate with a high degree of certainty was expected to be difficult. In addition, approval from multiple stakeholders including transport authorities, the harbourmaster and utility authorities was necessary before a programme could be planned.

The full list of key design departures required acceptance and sign-off from the Asset Owner, a process that required further time for due consideration. In addition, BCC also sought to explore the possibility of adding a shade structure between the new cycleway and the downstream footpath in order to make the crossing more appealing in hot weather. This meant that BCC retained a desire to adjust or modify scope mid-project and to remain an involved participant in the project.

## Collaborative Delivery

A parallel review of recent major bridge strengthening schemes was undertaken, including the West Gate Bridge Strengthening Alliance in Melbourne (2011), the Hammersmith Flyover Strengthening in London (2012), and the Captain Cook Bridge in Brisbane (2022). Specific to the works occurring on the Captain Cook Bridge, the Queensland Department of Transport and Main Roads (TMR) provided great insight by facilitating a series of four separate workshops covering project planning through to construction.

Based on the evaluated case studies, consideration of the known and potentially unknown scope, risk allocation and the resultant risk profile it was determined that a collaborative delivery model was the preferred approach for complex works such as those proposed for the Victoria Bridge. A collaborative model allowed the Client flexibility, and it also provided the Contractor with an effective mechanism for dealing with change or addressing underlying conditions during the project. Importantly, integrated into the collaborative delivery model would be the appointment of a Specialist Contractor to design part of the local strengthening system and install the strengthening works. In order to retain control and coordination of the works within the broader scope of the Brisbane Metro project, the Specialist Contractor would work under the management and direction of Brisbane Move.

## Project Procurement

Once it was determined that a collaborative delivery model facilitated the most appropriate risk allocation for the project, it was necessary to identify and onboard a Specialist Contractor to assist with both the design and delivery of the strengthening system and its installation onto the existing bridge. An initial market sounding was conducted with some specialist contractors with recent experience in bridge strengthening and with presence in Queensland. This market sounding reaffirmed the decision to pursue a collaborative delivery model and provided some useful project references for further consideration.

To select a Specialist Contractor, a shortlisting was prepared with four specialist contractors invited to make an expression of interest (EOI). From this, two specialist contractors would be selected to participate in an interactive 6-week dual early contractor involvement (dECI) phase. The purpose of the dECI phase was to solicit ideas for the installation and integration of the strengthening system into the bridge. The Concept Design, developed in parallel with the Design Criteria, was used as a basis for the dECI phase. Methods for determining accessibility, blister construction, tendon installation and jacking were developed during this phase. In addition, innovation was encouraged which included the nomination of the use of novel materials such as ultra-high performance fibre reinforced concrete (UHPFRC / UHPC). Following the dECI phase, Freyssinet Australia were selected to join the Acciona-Arup team to deliver the design and construction of the strengthening.

# Future Applications

In order to plan or react to an asset’s needs in a timely and considered manner, Asset Owners need to understand many aspects of their asset at any given time, including:

* Asset records
* Condition
* Remaining life at current degradation
* Adequacy of maintenance
* Cost to operate
* Asset risks or vulnerabilities
* Planned time for renewal
* Network importance or asset priority for the network
* Current level of service vs desired level of service

Ultimately, Asset Owners are facing the question of how to manage an asset to get what is needed with the lowest whole of life cost within the parameters of an asset management framework and which includes allowable risks and service levels. With ageing assets throughout the country, demand on Asset Managers to make such decisions is growing at an increasing rate. Additionally, with an increased focus on sustainability and the circular economy, replacement of structures is likely to be seen as a last resort option when considering management strategies for any given asset.

As a result of this, Asset Managers and Asset Owners are likely to encounter ever increasing numbers of structures which are marginally to moderately overutilised when assessed to AS5100.28 and AS5100.710. The cost required to strengthen may not be economically viable based on the initial assessment when considered against the age of the asset and other network priorities. In these scenarios, a shift away from strict conformance to design standards in favour of a rational bridge-specific design criteria such as that developed for Victoria Bridge would likely result in cost savings in addition to sustainable outcomes.

As evidenced by historical assessments of the Victoria Bridge, TMR Tier 2 assessment guidelines or AS5100.7 directions towards ‘*higher tier assessments*’ where elements are found to fail, the use of departures from design codes for the assessment of existing structures is not uncommon. It is recognised, however, that without explicit guidance or processes in place, agreement of any departures required for ‘*higher tier assessments*’ or alternative parameters is left to individual project teams and assessed on a case-by-case basis. For the Victoria Bridge, this was done through the preparation of ‘Special Studies’, documented in accordance with AS5100.1 Appendix B, as outlined in Section 3.

Within constrained or ‘low-trust’ contractual environments, or where the project objectives are not collectively shared, it may not be possible to have the collaborative discussions required to propose, scrutinise and accept departures which might significantly improve project outcomes. Equally, these models may not facilitate unforeseen events or managing hidden defects in the same way.

Drawing from the experience of Victoria Bridge strengthening project, it is believed that that the agreement of departures or higher tier methods as part of a rational set of design parameters for bridge assessment and strengthening works requires:

* A strategic Asset Management Framework
* A clear understanding of the Asset Owners acceptable risk profile
* A collaborative project framework
* A transparent departure and technical approval processes agreed in early project stages
* A trusted Technical Advisor working on behalf of the Client, where appropriate

Where this can be established on a project, it is believed that Asset Owners have the greatest chance of ensuring a positive balance in achieving the best outcome for the structure, often with minimum intrusion, while achieving a suitably feasible cost. This is likely in turn to bring benefit to the whole of life asset costs and further asset management decisions.

# Conclusion

The current Victoria Bridge has performed a critical role as a Brisbane River crossing for the last 55 years and has been subject to many historical assessments, modifications and strengthening works during this time. As part of the Brisbane Metro project, the structure is being modified to suit its future use as a dedicated busway and pedestrian/cyclist bridge and strengthened to accommodate the additional loads.

While the structure had historically been assessed and strengthened based on methods incorporating notable departures to design codes regarding both design actions and capacity, no specific consideration was given in the project requirements beyond strengthening to achieve AS5100 compliance. Recognising that full compliance was not likely to be feasible, the project team undertook a detailed process of agreeing departures to the AS5100 bridge design suite to develop a rational bridge-specific design criteria for the project.

The success of the departure process relied upon the development of a clear review and approval framework which ensured all departures were subject to rigorous and transparent review by key stakeholders. Critical to this process and the strengthening works as a whole were the presence of a trusted technical advisor to Council as well as the delivery of the works through a collaborative project model.

With a growing demand for the sustainable management of bridge assets in the future, it is expected that Asset Owners will increasingly need to explore departures and ‘higher tier methods’ to justify the ongoing or extend use of assets. When it can be identified that Australian design standards are not practical to apply, it is believed that where suitable project frameworks, key personnel and transparent processes are in place, this can be done in a successful way to ensure the safe ongoing use of many existing assets.

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