Standardised Bridge Design - Rectangular Plank Superstructure

Revision 05
August 2020

Design Guide

Department of State Growth

Tasmanian Government

Contents

Definitions

Term	Definition
Abutment	Structural member that supports the planks and interfaces with either the substructure below, or directly with the surrounding soil
Alignment	The geometrical form of the centreline of a carriageway in both the horizontal and vertical directions
AS5100 Set	Australian Standard for bridge design that sets out the requirements for the design, using limit states principles, of bridges and other structures
Asset	An item of economic value owned by a person or organisation
Asset/infrastructure owner	The person or body responsible for ownership of the bridge. The person or body responsible for procuring and managing the design and construction of the new bridge
Australian Standard	Standards prepared, adopted or approved by Standards Australia
BEDC	Bridge Earthquake Design Category, as defined in AS5100.2:2017
Bridge inspection	Periodic examination of the structural members of the bridge
Carriageway	That portion of a road or bridge used by vehicles, including shoulders.
Cast-in-situ	Concrete that must be poured on site at a particular stage of construction, rather than precast and transported to site
Certification/certified	Document issued by the designer certifying that reasonable professional skill and care has been used in the preparation of the design, with a view to securing that it has been checked for compliance with the relevant standards, and has been accurately translated into construction drawings.
Component	Any discrete part of the bridge brought to site for assembly
Contractor	Organisation or individual that has been engaged to construct the bridge
Creep	Deformation of a material or structure under persistent loads
Cross fall	The carriageway slope at right angles to the alignment, expressed as a percentage
Department of State Growth	The authority responsible for design and certification of this standardised plank design

Term	Definition
Design criteria	The particular requirements specified by Australian Standards and other technical documents that the design must satisfy
Designer	Organisation responsible for the design and certification of the bridge
Design flood	A flood of known magnitude or average recurrence interval, or a historic event which is selected for bridge design purposes
Design life	The period adopted in design for which a structure or structural element is required to perform its intended purpose with periodic maintenance and without replacement or major structural repairs
Design standard	Published documents setting out specifications and procedures to ensure products, services and systems are safe, reliable and consistently perform as intended. They establish a common language which defines quality and safety criteria
Dial Before You Dig	Dial Before You Dig is a free national referral service designed to prevent damage and disruption to the vast pipe and cable networks which provides Australia with essential services
Environmental impact assessment	The process by which information about the potential environmental effects of a development proposal are collected, assessed and taken into account
Flood level	The level of the river or stream that inundate areas which are not normally covered by water
Flow rate	The amount of water that flows in a set time period
General arrangement	Drawing sheet that gives an overall view of the bridge as it will appear once constructed, including a plan, elevation, typical cross section, site plan and vertical alignment diagram (as appropriate), and general notes pertaining to the whole drawing set.
Grade	The rate of longitudinal rise or fall of a carriageway with respect to the horizontal, expressed as a percentage
HLP400	Traffic loading model defined in AS5100.2:2017: Design loads
Hydraulics	The study of water flow in waterways, in particular the evaluation of flow parameters such as water level and velocity
Hydraulic envelope	The area in the vertical plane of the alignment bounded by the natural ground surface and the design flood level, minus the area of piers, abutments and other permanent obstructions to flood flows

Term	Definition
Low performance level traffic barrier	Traffic barrier designed to meet low performance level criteria in accordance with AS5100:2017
Maintenance free	The asset or component requiring no major maintenance during its design life
Multi-span	More than one span
Pile	Fully or partially buried bridge element arranged vertically and providing bridge foundation
Road maintenance inspection	Periodic inspection of the road surfacing, drainage, signage and traffic barriers
Safety in Design	Process to incorporate control measures at an early stage in the design process to eliminate risks, to manage risks, or to minimise the risks to as low as reasonably practicable for the life of the structure
Safe work method statement (SWMS)	Document used for managing risk in delivering work. Identifies the activities, the risks and the mitigation measures
Scour	The erosion of material by the action of flowing water
Scour protection	Measures taken to reduce the effects of scour around bridge foundations and road embankments, such as large loose stones (rip rap) or gabions.
Scuppers	Deck surface drainage pipe
Shrinkage	A reduction in concrete volume due to hydration, occurring during curing and in-service life
Skew	The angle between a line at right angles to the alignment and the centreline of the abutment sill beam or pier headstock
SM1600	Traffic loading model defined in AS5100.2:2017: Design loads
Soffit	Downward facing surface of any bridge component
Span	The horizontal distance between supports of a member
Spread footing	Shallow bridge foundation where founding material is stable and has adequate bearing capacity
Standard penetration test (SPT)	A dynamic in-situ penetration test that provides geotechnical engineering properties of soils
Substructure	The part of the bridge that is below the bearings and supports the superstructure

Term	Definition
Superstructure	The part of the bridge that spans between the bearings and is supported by the substructure
Transverse post-tensioning	High tensile steel rods, oriented transversely (perpendicular to the direction of road traffic) and tensioned following placement of the planks
Utility owner	The owner or body responsible for the safe management of public utilities or public services, i.e. electricity, gas, water

Introduction

This document aims to inform Tasmanian infrastructure owners, maintainers, contractors and other stakeholders about the process of designing, constructing and maintaining a bridge that includes a standardised rectangular plank superstructure. The standardised plank design (SPD) comprises rectangular precast and prestressed concrete planks that are transversely post-tensioned together.

The SPD is limited to the superstructure. A site specific design is required for the substructure (abutments, columns/walls, or footings/piles), which would be undertaken by the proponent's design consultant.

Benefits of Standardised Plank Design

A selection of standardised designs provides stakeholders with:

- Standardised structural components that are suitable for a range of sites
- Confidence in a competently designed, durable and robust solution, with low maintenance requirements
- Cost effective production of the superstructure components by incorporating common construction procedures
- Potentially increasing competition in the market by enabling contractors and precasters, without ready access to design expertise, to construct the planks and thus enter the market
- More efficient response times following emergency events by removing part of the design process and enabling fabrication to commence swiftly, or pre-fabrication of planks
- A consistent level of load carrying (SM1600 and HLP400) capacity across Tasmanian roads, potentially improving road network access
- A reduction of in-situ concrete works
- A modular design that enables varying bridge widths
- Incremental spans that enable varying bridge lengths between 8 and 16 metres.

Suitability of Standardised Plank Design

Review Existing Information

Once the infrastructure owner has determined that a new bridge is required, an assessment regarding the suitability of the SPD should be undertaken. This assessment should involve acquiring all available existing records:

- Existing bridge and road drawings
- Traffic information
- Geotechnical information
- Hydraulic, catchment and flood information
- Relevant environmental regulations and planning schemes
- Utilities on the bridge (currently on the existing or required on the new)
- Site survey information.

This initial assessment should also involve a site visit and consider:

- Any anomalies identified from the existing records
- Existing structure (if applicable)
- Waterway (upstream and downstream of the site)
- Access to the site
- Traffic patterns
- Existing utilities
- Potential location of the new bridge (same as existing or on a new alignment).

Performance Criteria Checklist

Using the existing records and the information gathered from the site visit, the following checklist should be considered. If all items are met then the SPD will likely be suitable. If some items are missing, then further review as to the suitability of the SPD is recommended.

- Proposed bridge alignment is straight, with a constant grade, and up to 30° skew between the road and bridge alignments
    - The SPD provides for any skew between 0° and 30°
- Overall length of 8 to 16 metres
    - This equates to approximately 7 to 15 metre clear span
    - The length of the SPD cannot be adjusted; if the required clear span is less than 7 metres then the span could be increased (if appropriate)
    - The SPD can be used for multiple span bridges; so long as each span is simply supported (not continuous)
- Maximum width between barriers of 15 metres
- Design load of SM1600 and HLP400
    - The SPD is rated to SM1600 and HLP400 as per AS5100.2:2017
- Low or regular performance level traffic barrier
    - Refer to Appendix A of AS5100.1:2017 for a risk assessment to determine the required performance level of the bridge
    - Low and regular performance levels cover most roads in Tasmania
- Hydraulic requirements are met
    - The new bridge provides a hydraulic area sufficient to pass the water flow determined during hydraulic design
    - Design hydraulic flow rate does not exceed 3m/s
- A separate pedestrian / cycle path is not required
    - Whilst the bridge width can be increased to allow space for a walkway or cycleway, the barrier as designed is affixed to the edge of the outermost plank. The SPD does not provide separation between the traffic and pedestrians / cyclists.
    - The geometry of the regular performance level barrier is suitable for cyclists as per the requirements of AS5100.1:2017
- Earthquake design category BEDC 1
- Utility requirements do not exceed those provided by the bracket
- In-situ temperatures do not exceed those typically encountered in the Tasmanian climate

Site-specific Investigation

The following site-specific items should be considered once it has been determined that the SPD is suitable and has been selected:

- Planning assessment
- Heritage assessment
- Environmental assessment
- Level survey
- Geotechnical investigation
- Hydraulic assessment
- Road alignment and design
- Bridge setout and design.

Planning Assessment

Prior to undertaking work on the new bridge, a check of the applicable Planning Scheme must be undertaken to determine whether the works are exempt from planning approval or require a planning permit from the local Council. In general, a replacement bridge on an existing road alignment is likely to be exempt. Assessment of heritage or environmental matters may be relevant in determining whether the works are exempt from requiring planning approval.

The local Council should be contacted to advise them of the works and confirm any exemptions or planning application requirements.

Heritage Assessment

Prior to arranging for works on the new bridge, the existing site and structure (if applicable) must be checked to determine whether or not it is heritage listed at either a national, state or local level, whether it is within a heritage precinct in the local planning scheme or whether it is in the vicinity of any other sites that are heritage listed. If the bridge or impacted properties are found to be heritage-listed, the local Council (locally-listed items/properties/precincts) and/or Heritage Tasmania (state-listed items/properties) should be contacted to determine if any constraints are in place and how to incorporate them into the design to achieve the requirements of the local Council or Heritage Tasmania. Refer to https://heritage.tas.gov.au/local-government/heritage-everything-for-local-planning-(help)/legislative-processes for further information.

The site should also be reviewed to determine if it is known to be or likely to be in the vicinity of any Aboriginal Heritage items. Refer to https://www.aboriginalheritage.tas.gov.au/assessment-process for further information.

Environmental Assessment

As part of early investigations, an assessment of the proposed site should be undertaken to determine what threatened or protected aquatic and/or terrestrial flora, fauna and ecological and vegetation communities are likely to be present, and how to manage, mitigate or eliminate the impact of the construction works upon these species, relevant species' habitat and communities. In some cases, a field survey may be required to determine whether a species, habitat or community is actually present on site, as well as its exact location and extent. The presence and status of any reserves at the proposed site should also be determined. The assessment must consider whether any permits or approvals are required to undertake the works. The potential for erosion, spills and water flow changes that would affect water quality and aquatic habitats onsite or further downstream should also be taken into consideration, as well as the potential for the distribution and spread of weeds, pests and pathogens.

Level Survey

Unless accurate, modern and reliable survey data is available, a level survey is recommended as part of the investigation works so that the new bridge can be accurately modelled, designed, and built. This should be undertaken, prior to the design activities, by a qualified surveyor and should include:

- Location, size and levels of existing structure elements
- Contours of adjacent ground in all directions including the stream profile sufficiently up and downstream to allow a hydraulic analysis to be undertaken
- Location and alignment of adjacent road surface, formation and embankments
- Existing services
- Property boundaries

As a minimum, the survey should extend 50 metres in both road directions beyond the ends of the expected extent of road and bridge works. The Department of State Growth's specification "Engineering Detail Survey" T4 provides further information as to the level of information required.

Geotechnical Investigation

Whilst the superstructure design has been standardised, the substructure and foundation will vary between sites as they are dependent on in-situ geotechnical conditions. Specifically, the selection of driven piles, bored piles, or a shallow spread footing depends on the local ground conditions.

Consequently, during the design process, a geotechnical investigation should be undertaken to inform this decision, and should be undertaken by experienced geotechnical engineers. The findings should be clearly demarcated between factual and interpretive information and should be summarised in a report by a geotechnical engineer. The number of boreholes and/or test pits should be in accordance with the requirements of AS5100.3:2017.

The report should include the following:

- Type of soil and depth of each strata
- Presence of boulders or cobbles in the streambed
- Signs of scour or instability at existing bridge abutments
- Presence of soil acidity, sulphates or chlorides if there is any indication of aggressive soils in the area
- A recommendation as to the type of foundation to be adopted, and the geotechnical information required to enact the recommended design (e.g. allowable bearing pressure, SPT N values, friction angles, skin friction, soil stiffness as required).

Hydraulic Assessment

If the bridge crosses a waterway, the design of the bridge is heavily influenced by that waterway. For these structures, a hydraulic assessment should be undertaken during the design phase. In particular, scour is one of the leading causes of bridge failure and requires competent and rigorous consideration during the design phase.

This assessment should determine:

- Design flood levels and velocities
- Scour levels and therefore recommended protection extents
- Minimum waterway area and deck soffit levels
- An assessment of any existing waterway areas, bridge extents and the adequacy of the existing arrangement.

This assessment may require geotechnical information to inform the scour assessment, and therefore thought should be given to the programming of the two investigations (i.e. the geotechnical report should be provided to the hydraulic designer to enable their work to be completed).

The SPD does not include scuppers in the kerb. This is acceptable for the relatively short spans of the planks, and has been chosen to remove the need for their maintenance, to simplify the detailing and construction of the planks, and to prevent staining the side of the planks. This should be reviewed as part of the road hydraulic design. The storm water on the deck should be accounted for and adequately managed (e.g. safely discharged into a rocky batter, connected into an adequate storm water system, or otherwise).

Road Alignment and Design

Road design should be undertaken during the design phase, and should determine:

- Desired road geometry and alignment, either to match existing or to be improved / adjusted
- Traffic volumes, allowing for projected growth rates (refer AS5100.1:2017)
- Road lane and shoulders widths
    - AS5100:2017 nominates a standard design lane width of 3.2m
    - Road shoulder width can be taken as 0.6m
    - A single lane bridge could therefore comprise four units
    - A two-lane bridge could comprise six or more units
    - A three-lane bridge could comprise nine or more units
    - There are many reference texts with different recommendations regarding lane and shoulder widths that depend on many factors. This decision should be made by a competent designer as part of the design phase
- Off-structure barrier requirements and compliance with Austroads Design guide part 6: Roadside Design, Safety and Barriers.

Bridge Setout and Design

Bridge setout and design should be undertaken during the design phase and includes all aspects usually undertaken, other than the structural design of the planks. The bridge design should determine:

- Bridge span (informed by hydraulic assessment)
- Bridge skew
- Lane and shoulder widths on the bridge
- Superstructure setout (layout of standardised planks)
- Exposure classification of superstructure
- Traffic barrier performance level
- Substructure setout and design (informed by geotechnical investigation)
- Interface with road design.

Design Criteria and Components

Design Loads

The standardised planks have been designed in accordance with AS5100:2017, for the following in particular:

- Minimum strength, stability and durability requirements
- SM1600 traffic loads
    - 50% of this design load has been applied to each plank
    - This means that the load distribution effects of the grout infill and transverse post-tensioning are not essential for the strength requirements in AS5100:2017 to be met
    - Consequently, the design is robust in that failure of the transverse post-tensioning would still allow compliance with AS5100:2017 and the risk of catastrophic failure of the bridge would remain acceptably low
    - Furthermore, this provides additional flexibility regarding early opening of the bridge to traffic loads (e.g. prior to installation of the asphalt overlay and / or transverse post-tensioning)
    - In the unlikely event of failure of the transverse post-tensioning, reflective cracking may be evident in the asphalt overlay due to differential vertical movement between adjacent planks
- HLP400 traffic loads
    - 33% of this design load has been applied to each plank
    - This means that the load distribution effects of the grout infill and transverse post-tensioning are essential for the strength requirements in AS5100:2017 to be met
    - Periodic inspection and maintenance of the transverse post-tensioning is therefore required to ensure safe passage of HLP vehicles
    - This design load significantly exceeds the heaviest platform axle loads currently on Tasmanian roads, and as such this design loading has been adopted for these rare loads
- Low or regular performance traffic barrier loads
    - Whilst selection of the barrier performance level depends on a number of factors, the vast majority of sites for which a SPD will be applicable will be suitable for either a low or regular performance barrier
- Hydraulic flow loads incident on the planks and to the top of the traffic barrier at a maximum velocity of 3m/s
- Wind loads
    - Wind loads as per AS5100.2:2017 are not the critical load case for the planks, as documented in this SPD
- Seismic forces as per BEDC category 1 only
- Deflection limits, shrinkage and creep

- Thermal forces and effects within the context of the Tasmanian climate only
    - Unusually high or low temperatures (i.e. those beyond the Tasmanian climate) are outside the scope of the SPD, and therefore further consideration should be given to these effects during the design phase by a competent bridge engineer to certify that the SPD remains adequate or to implement further measures as required (e.g. concrete mix additives, site specific detailing).
    - Freeze-thaw effects have been considered and are not expected to be a concern for the bridge superstructure, as the planks are precast in a stressing yard which minimises the risk of this issue occurring. However, if the planks are at risk of freeze-thaw effects (e.g. a significant length of plank is to be in contact with ground that regularly goes below 0-4°C) then further consideration is required by a competent bridge engineer to certify that the SPD remains adequate or to implement further measures as required (e.g. concrete mix additives, site specific detailing).
- Minimum lateral restraint load specified in AS51000.2:2017 applied to the planks

The following loads have not been designed for as part of the SPD:

- Rail traffic and rail impact loads
- Lateral restraint load on the connection to the substructure
    - The substructure (plank-dowel connection, dowel-abutment connection, abutment, columns/piers, and any footings) is to be designed to suit site-specific information and therefore cannot be included as part of the SPD
- Collision load
    - This is a load incident upon the substructure and therefore cannot be included in the SPD
- Hydraulic flow loads incident on the substructure
- Flood debris loads on the traffic barrier and planks
    - The superstructure has been designed to sustain minimum restraint loads, and therefore has an inherent ability to sustain some level of flood debris loads. However, as the flood and debris load information is site-specific this cannot be designed for as part of the SPD.
- Crane lifting loads
    - The precast planks will need to be lifted into place, which will typically require a mobile crane. Consequently, a site-specific lift plan is required that will need to assess the outrigger loads and the adequacy of the in-situ soil to sustain them. Further information on safe crane operation can be found at https://www.safeworkaustralia.gov.au/system/files/documents/1703/general-guide-for-cranes.pdf

Design Components

The SPD comprises the following components:

- Precast concrete planks
    - The planks have been designed as simply supported members
    - The superstructure comprises a varying number of precast, longitudinally prestressed (in the direction of traffic) planks which are 1200 millimetres in width
    - The planks have been designed for overall lengths of 8, 10, 12, 14 and 16 metres, with the longer planks (12, 14 and 16 metres) containing voids to reduce mass and therefore increase the structural efficiency. The voids reduce the self-weight of the unit by replacing concrete with styrene foam, enabling a larger portion of the strength to carry traffic loads.
    - The planks have been designed to accommodate several durability classifications as outlined in AS5100.5:2017. The durability classification at a particular site should be identified during design, when gathering the site-specific information. This should be assessed by the competent bridge engineer that is undertaking the substructure design and certification.
- Transverse post-tensioning and grout
    - The narrow gap between each plank is filled with grout. Threaded high tensile steel or stainless steel bars which are orientated parallel with the abutments are then tensioned to apply a compressive force between the planks
    - This force creates friction between the planks, which enables load to be distributed between multiple planks and ensures that there is no differential movement between edges of adjacent planks. Generally, it makes the planks behave like a slab, rather than as a series of discrete beams. In this way, the performance of the bridge improves, and there should be no reflective cracking in the asphalt overlay.
- Asphalt overlay
    - The asphalt overlay provides a cross fall to enable drainage, protects the planks from vehicular wear-and-tear and improves the ride quality over the structure
- Traffic barrier (including kerb)
    - A design has been provided for low and regular performance level traffic barriers. The barriers are fixed to the outer planks
- Conduit attachment
    - A bracket for services is included in the design documentation and has been designed to carry 100kg/m which is sufficient to accommodate either 2 x 150DN or 1 x 225DN steel pipe(s) containing water.

Proponent's Responsibilities

During Design Phase

During the design phase, the project proponent is responsible for ensuring a compliant and contemporary design is achieved. The proponent's responsibilities include but are not limited to:

- All site-specific investigations and assessments listed above, as required
- Road design, ensuring approach roads from both directions match in with the bridge structure
- Producing or procuring substructure and footing design documentation that is suitable for the site-specific conditions
- Acquiring building code processes that may be required by State Legislation (e.g. development approvals, permits)
- Certification of the overall bridge and complying with all Australian Government and Tasmanian Government legislation relevant to the project, including (but not limited to) AS5100:2017

During Service Life

Across the life of the bridge, the project proponent is responsible for ensuring a safe and serviceable level of performance is achieved. To achieve this, the proponent's responsibilities include but are not limited to:

- Regular Inspections and maintenance during the in-service life of the structure
- Asset demolition and reinstatement of the road at the end of the design life of the bridge

Inspections

Purpose of Inspections

During the in-service life of the bridge, inspections are recommended as part of good practice asset management. Typically, these inspections will:

- Identify obvious and immediate safety issues
- Identify maintenance or serviceability issues

The level of inspection undertaken can vary from a simple high-level review to a detailed and rigorous assessment. In general, the infrastructure owner may undertake the less detailed inspections, however detailed inspections and investigations are often undertaken by experienced and qualified bridge engineers.

Inspection Methodologies

There are several detailed inspection methodologies that have been documented by State Road Authorities. The infrastructure owner should consider adopting one of these inspection methodologies. Inspection methodologies are published by VicRoads, Roads and Maritime Services NSW (RMS) and the Department of Transport and Main Roads QLD (DTMR).

Scope and Frequency of Inspections

The following list outlines items that should be checked during inspection of a bridge with SPD components:

- Precast planks
  - Visual inspection of concrete sides and soffit to identify any corrosion, spalling or other damage
  - Inspection of asphalt deck for reflective cracking to assess performance of planks as one structural entity
  - Nominally every 2-5 years, or as guided by the adopted inspection regime
- Transverse post-tensioning
  - Visual inspection of threaded bar ends and end componentry, specifically to determine if the coating has deteriorated with consequent corrosion of the bar
  - Nominally every 2-5 years, or as guided by the adopted inspection regime
- Traffic barrier and kerb
  - Inspection of protective coating (paint or galvanising) to prevent corrosion and progressive damage to the coating
  - Inspection of bolt torque, ensuring torque remains at the value stated on design documentation
  - Inspection of concrete kerb for corrosion, spalling or other damage
  - Inspection for damage caused by vehicular impact or flood damage
  - Nominally every 2-5 years, or as guided by the adopted inspection regime
- Road approaches
  - To ensure a smooth transition from the road approaches onto the bridge to minimise dynamic effects and impact damage to the bridge
- Utility attachment
  - Visual inspection of steel bracket and bolts to identify any corrosion
  - Nominally every 2-5 years, or as guided by the adopted inspection regime

This list only considers the SPD components and is not exhaustive. The substructure and river channel (if relevant) should also be considered.

Maintenance

Timely maintenance works are required as part of good practice asset management to ensure the design life of the bridge is achieved and should be undertaken in response to routine inspections. Broadly, maintenance work can be categorised as either 'routine' and part of a component's functional use (e.g. keeping gutters, scuppers and other water pathways clear), or 'repair / replacement' works that are typically in response to issues identified during inspections.

Demolition

Demolition should be carried out by a qualified and experienced contractor, and should be undertaken in accordance with all relevant permits, codes of practice, state and national legislation and other workplace health and safety legislation.

For the demolition of any bridge with SPD components, the tension force in the transverse bars represents a source of stored energy that must be relieved safely in accordance with any manufacturer's information and the Demolition Work Code of Practice prior to any demolition works affecting the planks.

Safety in Design

This section constitutes a Safety in Design assessment relevant to the SPD. This considers risks inherent to the design, pre-fabrication, transport, and installation (craneage) of the planks. The assessment also includes a list of risks that may be relevant to the site and construction more generally. This list is not exhaustive and there may be further risks on site that should be identified as part of the site specific assessment outlined in the following paragraph.

In addition to this, as part of the site-specific design and certification process as outlined above, the bridge designer should prepare and submit a Safety in Design report for the structure in order to comply with the Work Health and Safety Act 2012. This report should specify the hazards relating to the entire lifecycle of the bridge as a whole and the substructure in particular.

SPD Safety in Design Assessment

Project Address	Various
Project Reference	Various
Client	Various
Prepared By	Department of State Growth
Purpose of the Structure	Enable vehicular traffic over the feature, be it a waterway, road or otherwise
Design Description	Precast and prestressed concrete planks that are transversely post-tensioned together

SITE HAZARDS

Hazard Category	Control Measure
Access	A traffic management plan should be adopted for the work site.
Adjoining Areas	Ensure that construction does not impact on the safety of persons in adjacent areas.
Climatic Conditions	Severe weather including high wind conditions are possible. The contractor should take measures to ensure the stability of the partially constructed structure during any severe weather events.
Climatic Conditions	The site may be in a flood zone and the contractor should ensure that measures are taken to ensure stability of the partially constructed structure and that evacuation plans are in place.
Earthworks	Where the construction work involves excavation for services or for the structure the contractor should maintain exclusion zones and provide adequate temporary support. Refer to the Excavation Work Code of Practice for further details.
Electrical	Overhead power lines may be on or near the site. Contractors should consult with the electricity provider if work is to occur close to assets.
Hazardous Substances	Reticulated gas may be present on the site and the contractor should follow standard controls for dealing with hazardous substances if required.
Hazardous Substances	Contaminated soils may be present on this site – the contractor should consult the Contaminated Lands Register and follow appropriate controls if required.
Hazardous Substances	There is potential for acid sulphate soils (ASS) on the site. Consult with the designer or refer to ASS Management Plan for recommendations if required.
Mobile Plant	Crane and plant operators must ensure that site slope does not exceed manufacturer's specification and ground is stable prior to operation.
Noise	Ensure that dust, noise or vibration does not adversely affect neighbouring properties.
Underground Services	The contractor should contact dial before you dig and confirm on site any underground building services or service provider assets prior to construction.

CONSTRUCTION

Hazard Category	Control Measure
Work at Height	High risk construction work includes work that involves a risk of a person falling. Contractors are required to prepare a Safe Work Method Statement (SWMS) to ensure falling risks are sufficiently mitigated.
Earthworks	The contractor should maintain exclusion zones around excavations for services and construction and provide adequate temporary support. Refer to the Excavation Work Code of Practice for further details.
Manual Tasks	Components within this design may pose a risk for manual tasks. Mechanical lifting devices or safe work procedures are recommended where there are hazardous manual tasks. The designer recommends consultation with suppliers or fabricators to limit the component mass and in selection of components to reduce hazardous manual tasks.
Mobile Plant	Maintain exclusion zones around services pipes and pits or ensure site is able to take the load of plant without damage to pipes and pits.
Mobile Plant	Maintain exclusion zones around underground tanks during construction to prevent damage and collapse.
Craneage	Installation of the planks during construction will typically require a mobile crane. These lifts should be undertaken in accordance with a site-specific lift plan. This plan should, at a minimum, assess the outrigger loads and the adequacy of the in-situ soil to sustain them, and should be in accordance with Safe Work Australia's documentation regarding lifting.
Structural Stability	During construction, components of the structure may be exposed to temporary instability. The contractor should include adequate temporary support during construction to ensure the stability of the partially constructed structure. The contractor should obtain advice from a qualified structural engineer to determine temporary propping requirements. Where the project involves removal of structural elements, the contractor must prepare a SWMS and ensure that bracing or other support requirements are in place. Structural elements should be identified and confirmed on site. The contractor should consult with the designer or qualified structural engineer regarding specific requirements or safety controls, prior to any alteration or demolition of elements, particularly if they are tensioned members.
Prestressed concrete elements	Prestressed concrete construction involves stored tension forces that need to be correctly managed during the concrete placing, curing and transfer processes. These forces should be managed in accordance with the design drawings, allowing minimum concrete strength to develop prior to transfer of stress into the planks.

Hazard Category	Control Measure
Post-tensioned concrete elements	The transverse post-tensioning involves stored forces, similar to the longitudinal prestressing strands. These forces need to be generated and transferred into the planks in-situ via external jacks. All tensioning processes should be undertaken in accordance with the guidelines and documentation of the Post Tensioning Institute of Australia, any manufacturer's instructions and guidelines, and the design drawings.

MAINTENANCE AND REPAIRS

Hazard Category	Control Measure
Mobile plant	Ensure exclusion zones are maintained around underground tanks during maintenance to prevent damage and collapse.
Work at Height	The structure has been designed so far as is reasonably practicable to reduce the need for maintenance. Client and contractors should ensure that the designer's safety information relating to future maintenance and a copy of these plans are passed on to persons occupying the structure and to workers conducting maintenance on the structure.
Post-tensioned concrete elements	The transverse post-tensioning involves stored forces, similar to the longitudinal prestressing strands. The end componentry has been designed with context-specific corrosion protection to ensure a durable product. In addition to this, periodic inspection and maintenance is recommended to ensure that progressive corrosion and/or degradation does not result in release of stored tension stress.

DEMOLITION (AT END OF LIFE)

Hazard Category	Control Measure
Demolition	Demolition should only be undertaken by qualified persons. The contractor should refer to the complete documentation including structural engineers' plans prior to commencing demolition work. Structural components should not be disturbed without proper consultation with a qualified person as this may lead to instability and collapse. A demolition plan should be prepared prior to commencing any demolition work. The contractor should refer to the Demolition Code of Practice for further information.
WHS Regulations	The structure may require notification for demolition in accordance with the WHS Regulations.
Tensioned members	The transverse post-tensioned members and prestressed concrete planks contain stored forces. At end-of-life, these forces need to be safely managed during demolition. The tension stress should be relieved safely in accordance with any manufacturer's information and the Demolition Work Code of Practice prior to any demolition works affecting the planks. Additional length of threaded rod on the transverse post-tensioned members has been provided to enable these works to be safely undertaken.

Tasmanian Government

Department of State Growth

4 Salamanca Place
Hobart TAS 7001 Australia

Phone: 03 6166 3431

Email: info@stategrowth.tas.gov.au

Web: www.transport.tas.gov.au