Lot STR02 – Point Fraser Bridge Design Report (15%)

Causeway Pedestrian & Cyclist Bridges Project

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Causeway Link Alliance

Control Page

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REV.	DATE	SECTION	DESCRIPTION
A1	27-07-2022	1000	15% Internal Design Review
A	04-08-2022	1000	15% External Design Review

	NAME	TITLE	SIGNATURE	DATE
PREPARED BY	Gerhard du Plessis	Structures Design Lead		27-07-2022
REVIEWED BY	Wolfram Schwarz	Design Manager		01-08-2022
APPROVED BY	Tim Cawley	Design Project Manager		01-08-2022

Contents

1. INTRODUCTION

1.1 Project Background

The Causeway Pedestrian and Cyclist Bridge Project is an opportunity to deliver a landmark pedestrian and cyclist connection across the Swan River that responds to the unique cultural and historic significance of the area, integrates with existing landscape and urban design, and provides an attractive link for both tourists and the wider community.

The existing causeway bridge is one of only four pedestrian and cyclist crossings of the Swan River, being one of the busiest carrying approximately 1,400 cyclists and 1,900 pedestrians per day, with peak hour volumes of over 150 cyclists and 200 pedestrians. The need to improve this connection has been identified for some time, with concerns about existing shared path width, surface condition and mix of user groups generally causing safety concerns.

The new bridge will have a 3.5 m wide cycle path and a 2.5 m wide pedestrian walkway provided for separated and safer access across the Swan River for both cyclists and pedestrians independent of the road traffic. Located 80-90m downstream of the existing Causeway, this alignment was considered appropriate in terms of its ability to improve pedestrian/cyclist amenity, maintain directness and minimise impacts on flora and fauna, as well as the Swan River itself. Consisting of two cable stay bridges, the proposed option limited the number of river piers to just three, acknowledging the spiritual and cultural importance of the Swan River (Derbal Yerrigan) to Perth’s first nations peoples.

1.2 Project Location

The project is located between East Perth and Victoria Park, located within the local government authority of the City of Perth and the Town of Victoria Park.

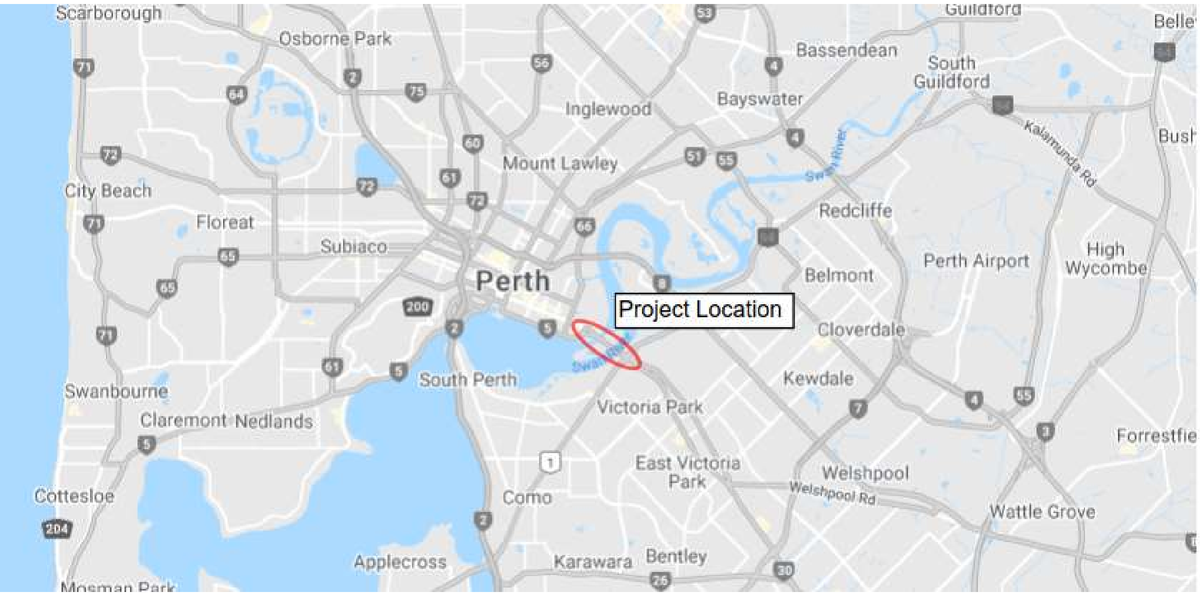

Figure 1: Project location

1.3 Purpose

The purpose of this report is to document the parameters adopted in the design, information and relevant standards used, design assumptions that may have been made, and design discussions and agreements between this consortium and the stakeholders.

This report is prepared to discuss specifically the 15% design for the Point Fraser Bridge 9506.

It is assumed that the recipients of this Design Report have an understanding of the Project, the BDC, the SWTC and other relevant referenced documents, prior to reading this document. Therefore, this Design Report is intended to highlight design constraints, assumptions, issues and exclusions and not reiterate all information outlined within the BDC and SWTC.

2. SCOPE OF WORKS

As specified in the BDC Section 2, the scope of the works consists of the following:

- Footbridges and other structures
  - new Footbridges No.9505 over the Swan River south of Heirisson Island (referred to as McCallum Park Footbridge)
  - new Footbridge No. 9506 over the Swan River north of Heirisson Island (referred to as Point Fraser Footbridge)
  - associated retaining walls and other structures as required
- Separated path, shared paths and footpaths
  - a new separated path comprising a cycle path and footpath over the Swan River, between the existing path network at Point Fraser and existing path network at McCallum Park;
  - shared paths and footpaths connecting the separated path with other paths; and
  - replacement or realignment of affected existing paths, and temporary paths.
  - stairs as required connecting separated path and paths on Heirisson Island.
- Pedestrian and cyclist safety fencing
- Accommodation works affected by the Project.
- Drainage measurements as required
- Lighting as specified
- Signage as required
- Allowances and other works and obligations as described in the BDC.

Design and construction of Bridges No.'s 9505 and 9506 shall comply with the BDC and SWTC where main requirements of the BDC and SWTC were extracted and included within:

- Section 4: Design Standards and Criteria
- Section 7: Design Considerations

2.1 Deliverables

The deliverables for the 15% Design of Point Fraser Bridge No. 9506 over the Swan River include the:

- 15% Design Report
- 15% Design Drawings (included in Appendix A)

2.2 Related Design Lots

- Geotechnical Investigation (GEO00)
- Geotechnical Interpretative Report Approach Embankment Design (GEO01)
- Piling Design (GEO02)
- Point Fraser Bridge Package (STR02)

- Project Wide Civil (CIV01)
- Lighting & Electrical & Security (MEP01)
- Asset Management Plan (AMP01)
- Utilities Combined (UTI01)
- LRUD, heritage and Wayfinding (LUH01)
- Hydrology (HYD01)
- Durability (DUR01)

3. PREVIOUS WORK

3.1 Previous Studies

In April 2020, WSP together with ipv Delft completed a pre-feasibility study on innovative and cost-effective designs for the Causeway pedestrian and cycling link on behalf of the Department of Transport.

Following workshops with stakeholders the ‘Tree Area Pylons’ option was selected as the preferred option to be taken forward to the next design phase.

During the tender period Civmec, Seymour Whyte and WSP completed a concept design, further developing the ‘Tree Area Pylons’ option withing the guidelines and restrictions of the BDC and SWTC.

After the award of the tender to CLA the tender design has been taken forward and developed to 15% design level.

3.2 Topographical Survey

The survey used at Tender was formed using an amalgamation of survey models provided by MRWA. The survey models are in the Perth Coastal Grid 1994 (PCG94) coordinate system with varying accuracy over a period of time and unverified for use. The survey data sources were provided in the Pre RFP data set 011 EOI CPCB – Survey and Services and include the following models:

- h001_0.25_1.092_slk_(causeway_psp_infill_additions)_dgs_pcg94_clipped.gen
- H001_0.93_1.38_DGSGEN_PCG94.gen
- Perth Inner City Rapid Transit Route Survey dgs pcg94 CLIPPED_v2.gen
- EGS2016_CAUSEWAYNORTH_MBES_AHD_0p25_avg_PCG94.GEN
- EGS2016_CAUSEWAYNORTH_MBES_AHD_1m_avg_PCG94.GEN
- EGS2016_CAUSEWAYSOUTH_MBES_AHD_0p25_avg_PCG94.GEN
- EGS2016_CAUSEWAYSOUTH_MBES_AHD_1m_avg_PCG94.GEN
- SC-2010-2011-a-s-l_herisson_island.txt (Converted from MGA94 Z50 to PCG94 by WSP)
- 102564de-001c.dwg (converted from ACAD dwg to MX genio by WSP)

A new topographic survey was commissioned by CLA to ensure accuracy of the detailed design as per SWTC requirements (Clause 4.2). The new survey was undertaken using the PCG94 coordinate system. It’s noted SWTC Template Clause 4.2 d) requires design and survey plan co-ordinates to refer to the Perth Coastal Grid 2020 (PCG2020). To date, design across all disciplines and reference files provided are in PCG94. It’s proposed that the design continues to use PCG94 with conversion to PCG2020 occurring at the end of the project.

Premier Engineering Surveys provided a new topographic survey for use by CLA on 24/06/2022 with revised survey files provided 28/06/2022. Survey files from tender phase have been used beyond the extents of the new survey by Premier Engineering Surveys.

3.3 Cadastral

Cadastral boundaries have been provided by MRWA as part of RFP tender design package information.

3.4 Services

Services within the vicinity of the works include:

- Communications (AARNet, NBN, Optus, Telstra)
- Electrical (Western Power)
- Gas (ATCO)
- Water – drainage, potable and sewer (MRWA and Water Corporation)
- Water reticulation (Town of Victoria Park)

3.5 Changes between Design Phases

Table 1 summarises the design changes between the 15% Design Phase and the previous Tender Design Phase.

Table 1: Changes between 15% Design Phase and Tender Design Phase

Location	Change	Reason for Change
Handrail on bridge	Clamped connection changed to seated connection.	Clamped connection introduced unnecessary additional stainless-steel component.
Handrail on approaches.	Changed handrail to 'base case' standard handrail.	Having the stainless-steel mesh handrail on the approaches is offered as an optional extra.

4. DESIGN CRITERIA AND STANDARDS

4.1 Codes, Reference Documents and Regulations

All structures will be designed in accordance with the Australian Standard for bridge design AS 5100 series and as modified in the Contract SWTC. The bridge design will be in accordance with the following documents, listed in order of precedence:

- AS 5100:2017 Bridge Design
- Bridge Branch Design Information Manual
- Structures Engineering Design Manual
- Circular SES 01/17 - Splicing of Reinforcement
- AS 4678:2002 Earth Retaining Structures
- AS/NZS 1170.0:2002 – Structural Design Actions – Part 0: General Principles
- AS/NZS 1170.2:2011 – Structural Design Actions – Part 2: Wind Actions
- AS/NZS 1170.4:2007 – Minimum design loads on structures – Part 4: Earthquake Loads
- AS 3600:2009 Concrete Structure

- AS 4100:1998 Steel Structure

All provisions may not be appropriate for the proposed bridge type. In accordance with AS5100.1, Clause 2 the provisions of this Standard shall be supplemented by other appropriate Standards and specialist technical literature for more complex bridges such as cable stay bridges. Therefore, the following supplementary Standards and specialist technical literature in Table 1 will be consulted and will take precedence where applicable:

Table 1: Specialist Technical Literature to supplement Australian Standards

Document	Document Title
CEB-FIP (fib) Bulletin 89 (2019)	CEB-FIP Acceptance of stay cable systems using prestressing steels
PTI DC45.1-12 6th edition 2012	PTI Recommendation for Stay Cable Design, Testing and Installation Recommendation for Stay Cable Design, Testing and Installation
JRC 53442 – 2009	JRC Scientific and Technical Report 53442, Design of Lightweight Footbridges for Human Induced Vibrations (ISBN 978-92-79-13387-9)
Eurocode 3 – 1993.1.5	Eurocode 3: Design of steel structures Part 1-5: Plated Structural Elements
Eurocode 3 – 1993.1.11	Eurocode 3: Design of steel structures Part 1-11: Design of structures with tension components
Eurocode 3 – 1993.2	Eurocode 3: Design of steel structures Part 2: Steel Bridges
PD 6688-2:2011	Background to the National Annex to BS EN 1991-2 Traffic loads on bridges
PD 6688-1-4:2015	Background information to the National Annex to BS EN 1991-1-4 and additional guidance
LRFD-8	AASHTO LRFD Bridge Design Specifications, Eighth Edition, 2017(1)

(1) Clause 3.14.8 Ship Collision on Pier

4.2 Deviation from Agreed Standards

As indicated in Section 4.1 above, supplementary standards and specialist literature will be consulted, and where applicable, these will take precedence. Table 2 displays a non-exhaustive list of deviations from the Agreed Standards:

Table 2: Non-exhaustive list of deviations

Document and Clause Number	Deviation Description
AS5100.2 (2017) Cl13.4	Dynamic behaviour of pedestrian and cyclist path bridges Clause 13.4 will be overridden completely by the requirements of JRC 53442 – 2009.
AS5100.2 (2017) Cl8.4	Deflection of pedestrian and cyclist path bridges Achieving live load deflection criteria set is not achievable and considered not relevant as the bridges will be designed to satisfy dynamic criteria.

4.3 Design Criteria and Assumptions

The design criteria used in the preparation of the design are presented in Appendix B.

4.3.1 BDC Requirements

BDC Sections 4 & 5 lists specific design requirements. The below list is not exhaustive but highlights some of the key requirements:

- The footbridges over the Swan River must have a high standard of appearance, and to the general public must look similar to the images in the Footbridge Concept Images provided in Appendix B of the BDC.

- Weathering steel must be used for the pylons and superstructure of the footbridges.
- The location of pylons must be as shown in the Concept Plan at Appendix A of the BDC.
- Pilecaps in the river must be visible above water level, and the underside of pilecaps must be submerged at all times.
- The location of abutments, including toes of spill through batters, must be at least 20 m from the shoreline of the Swan River at Highest Astronomical Tide (HAT).
- The vertical alignment of paths on the footbridges must only contain crest curves (and tangents if necessary) with smooth clean lines, and at a maximum grade of 3%.
- The footbridges must have pause points along their length, facing towards the west and suitable for resting and taking in river views, each with seating for at least 10 persons. Pause points must not impede traffic on the footpath. The Point Fraser Footbridge 9506 must have at least one pause point, and the McCallum Park Footbridge 9505 must have at least two.
- Only one pylon will be permitted in the Swan River for Point Fraser Footbridge 9506 and only two pylons will be permitted for McCallum Park Footbridge 9505. Locations as specified in the BDC.
- Batter slopes must not be steeper than 3 (horizontal) to 1 (vertical), unless otherwise approved by the respective LGA.
- Pedestrian and cyclist barriers on the footbridges must be designed to restrain crowds or people under panic conditions.
- Runoff from paths on footbridges may discharge directly into the Swan River but the discharge points must be detailed to control the flow of water and not adversely impact the performance of weathering steel bridge elements, create erosion or scour, or discharge onto areas utilised by the public such as paths and the navigation channel.
- The footbridges must be designed in accordance with AS 5100 Bridge Code, including for crowd loading.
- All structures must be classified as BEDC-3.
- Bridges to be designed for Vessel Impact as specified in BDC Section 5.12.
- Steel tube piles for the footbridges, if used, must be completely filled with reinforced concrete.
- Footbridge width must allow for a separated path comprising 3.5 m wide cycle path and 2.5 m wide footpath as a minimum, with linemarked separation between the two. Shoulders beyond these widths are not required.
- Vertical clearances as per BDC Section 5.16.

4.4 Aesthetic/Urban Design Requirements

Structural aesthetic requirements are set out in the BDC. In summary:

- The footbridges over the Swan River must have a high standard of appearance, and to the general public must look similar to the images in the Footbridge Concept Images at Appendix B of the BDC.
- Weathering steel must be used for the pylons and superstructure of the footbridges.
- The footbridges are intended to be landmark structures

Refer to the Urban Design Report for further details.

4.5 Durability Requirements

4.5.1 Criteria

In accordance with AS 5100 as modified by the SWTC Table 3 the design life of structural elements shall be as follows:

Table 3: Design life of structural elements

Component	Minimum Design Life
Structural elements, unless noted otherwise.	100 years
Bearings and expansion joints(1)	50 years
Handrails	50 years
Protective coatings to steelwork	25 years
Lighting	20 years
Public art works	20 years
Paint finishes to walls	10 years

(1) For bearings and deck joints, in accordance with AS5100.4:2017, Cl. 7.3, the design life, excluding replaceable components such as deck joint seals, and secondary elements shall be 50 years, whilst cast in items shall be the same as the deck design life.

The BDC further stipulates the following requirements:

- An independent Durability Consultant and welding inspector must be appointed.
- Hollow steel tube piles will not be permitted.
- The path on the footbridge must include a heavy-duty non-slip surfacing treatment with a minimum service life of 20 years. Service life is defined as the time taken to first maintenance.
- Weathering steel, where used, must be designed and constructed to 'world's best practice' procedures and techniques. The HERA Weathering Steel Design Guide for Bridges in Australia can be used as a guide for the design and construction of the footbridges.
- Special consideration must be given to using weathering steel in high-risk areas like the soffit of the superstructure or within 2.5 m of maximum water level of the river, where durability could be compromised. As a minimum, surfaces within 2.5 m of maximum water level must be assumed to be in Corrosivity Category C5 and the superstructure soffit in Corrosivity Category C3, all in accordance with AS 4312 Atmospheric Corrosivity Zones in Australia.
- At least 30 removable weathering steel 'coupons' must be installed on each footbridge to enable monitoring of corrosion during their service life.

4.5.2 Steel Exposure

The steelwork of the bridge deck and pylons consists of weathering steel. The bridge deck elements have been designed with a section loss allowance of 1.5 mm for exposed surfaces from 2.5 m above Highest Astronomical Tide (HAT). As it is impractical to hermetically seal the interior of the deck and the pylons, a 0.5 mm section loss has been allowed for the interior face. Those assumptions are in accordance with Table 3.2 of the HERA Weathering Steel Design Guide for Bridges in Australia for a C3 corrosion category as specified in the BDC Cl. 4.12.

For the steel section below 2.5 m HAT but above the HAT it is proposed to provide a Micaceous Iron Oxide (MIO) with Red Oxide paint coating to give a rust appearance similar to weathering steel. The appearance will alter as the MIO rises to the surface as the coating ages. The paint system is classified as an epoxy coating system in accordance with AS 2312.1:2014. In a C5 environment it would have a design life of 15-25 years.

Application as follows:

- 1st Coat Zincanode 402 @ 75 µm
- 2nd Coat FERREKO® No. 3@ 125 µm
- 3rd Coat FERREKO® No. 3 @125 µm – Tinted with Red Oxide

The soil aggressivity was assessed based on the Geotechnical Interpretive Report PS124806-GTT-REP-002 RevB dated 17/09/2021.

Buried steel is classified as non-aggressive (Fill) to mild (Perth Formation) (in accordance with AS 2159 Table 6.5.2 C). This corresponds to a steel corrosion allowance of 0.01 mm/year to 0.02 mm/year (in accordance with AS 2159 Table 6.5.3). To achieve a 100-year design life, the steel piles have been designed to allow for up to 1 mm and 2 mm respectively of corrosion on each face.

Due to the location of the river, the water flow is expected to be tidal water and steel elements in contact with the water have been assessed as severe (in accordance with AS 2159 Table 6.5.2 A). This corresponds to a steel corrosion allowance of 0.1 mm/year (in accordance with AS 2159 Table 6.5.3). To achieve a 100-year design life, the steel piles have been designed to allow for up to 10 mm of corrosion on outside face, as the inside is filled with concrete. The exposure classification for steel piles in contact with groundwater has been assessed as severe similar to the tidal water in the Swan River. A similar corrosion allowance has been made.

4.5.3 Concrete Exposure

The bridges are located approximately 12 km from the nearest coastline. The atmospheric exposure classification of B1 has been assessed as per Table 4.3 of AS 5100.5:2017, for near coastal structures.

Due to the location of the river, the water flow is tidal and concrete elements in contact with the water have been assessed as C2 based on Table 4.1 of AS 3735-2001 and Table C4.3 of AS 3735 Suppl1.

The soil aggressivity was assessed based on the Geotechnical Interpretive Report PS124806-GTT-REP-002 RevB dated 17/09/2021.

A summary of the assumed exposure classification for different elements and environments is listed in the Table 4 below.

Table 4: Concrete exposure classifications

4:Element	Concrete Grade	Exposure Class	Min. Cover to Reinf. (1)	Rationale
Cast in insitu piles cast against ground (Point Fraser)	S55M	C2	110	Durability requirements, assumes standard formwork and compaction
Cast in insitu piles cast against ground (elsewhere)	S50	C1	100	
Cast insitu concrete in-fill for driven steel piles	S50	C1	65	
Cast in insitu elements in the Swan River	S55M	C2	80	
Precast elements in the Swan River	S55M	C2	80	
Cast insitu walls above ground	S40	B1	45	
Precast elements above ground	S40	B1	45	

Notes:

(1) Where curing compounds are used, the cover shall be increased by 5 mm for classifications A and B1, and 10 mm for other classifications.

4.6 Environmental and Sustainability Considerations

4.6.1 Environmental Constraints

The incorporation of the sites heritage and environmental values will be key and our approach to environmental and heritage management will be to firstly meet all regulatory requirements for the project. We will do this by protecting the key environmental factors:

- Flora and vegetation
- Terrestrial environmental quality
- Fauna
- Inland waters
- Social surroundings

The team has completed a detailed approvals and risk register and we understand the environmental impacts do not warrant a referral to the Environmental Protection Authority (EPA) under the *Environmental Protection Act 1986*. The Preliminary Environmental Impact Assessment has not indicated any triggers under the *Environment Protection and Biodiversity Conservation Act 1999* to warrant an EPBC referral. Therefore, Main Roads is not considering referring this project to the federal agency (Department of Agriculture, Water and Environment). On award we will advance the following approvals as a priority:

- Section 18 of the Aboriginal Heritage Act 1972 - Main Roads will complete the Aboriginal heritage surveys subject to availability of Traditional Owners and heritage consultants. Once the surveys are conducted and reports are produced a Section 18 application will be submitted to the to the Department of Planning, Lands and Heritage later this year for consideration at the first ACMC Meeting.
- Native Vegetation Clearing Permit – Main Roads 818. It is Main Roads intent that the works can be conducted under NVCP 818.
- Development Approval - following discussions with the Department of Planning Lands and Heritage, Main Roads intends to submit the Development Application immediately following Contract Award, issuing the successful Proponent’s Proposal design as part of the submission to DPLH.

Compliance with secondary approvals will include:

- Department of Biodiversity and Conservation Attractions (DBCA) - Permit(s) under the Swan and Canning River Management Act 2006 (SCRM Act)
- Department of Water and Environmental Regulation (DWER) - Bed and Banks permits, and dewatering permits

The Swan River is one of Perth’s most important natural assets. The following approach will be used to protect the ecology:

- Our first priority on award will be to complete the risk and opportunities assessment (combining the Main Roads and the Alliance assessments completed). Environmental risks have been considered as part of the risk assessment and formed part the process when considering bridge design and construction methodologies with a focus on minimising environmental impacts.
- Construction techniques that minimise impacts to the shoreline and river bed (e.g eliminating sheet piles and a causeway) have been prioritised.

- Noise emissions and the impacts on/to the riverbed and embankments have influenced the choice of bored piles.
- The bridge structures have been designed to minimise interference with water flow and channel morphology has been an important consideration.
- Preassembly has been maximised (e.g. deck modules, pylons, pile caps and using precast) and the works sequenced to consider activities occurring on the river and the stream ecology.
- Technical management plans have been drafted to support the Construction Environmental Management Plan and these will be finalised on award following input from Main Roads and regulators. These include:
    - Appendix 1: Aboriginal Heritage Procedures if Artefacts are Found
    - Appendix 2: Acid Sulphate Soil Management Plan
    - Appendix 3: Contamination Management Plan
    - Appendix 4: Dust Management Plan
    - Appendix 5: Noise and Vibration Management Plan
    - Appendix 6: Revegetation Management Plan
    - Appendix 7: Water Quality Management Plan

a) The Water Quality Procedure for monitoring during construction activities will involve an extensive water quality monitoring program comparing to baseline conditions, and/or the reference sites.

b) Noise and vibration monitoring will be required including the incorporation of marine mammal observers with stop-work procedures.

c) Contamination management may need to consider potential PFAS contamination and asbestos and this will be confirmed once the final report become available.

Learnings from Main Roads with the alliance partners, regulator input and previous bridge projects will continue to be front and centre of environmental management. The team has brought and will continue to bring the lessons of the alliance partners together with Main Roads and the regulators to ensure the design and management actions build on the successes and learnings of the past. The purpose of this coming together is to always improve – each step we take is with a view to improve.

4.6.2 Sustainability Considerations

Sustainability considerations are detailed in the Sustainability Management Plan (SMP) which will be finalised on award with further input from Main Roads. The Sustainability Management Plan has built upon the Main Roads (2021) work completed to date which provides guidance on the work to be undertaken during the Project Development phases (defined as the ‘assess, select, development through to procurement’ phases as per Main Roads workflow), timing and dependencies for facilitating successful integration of sustainability into the design (later phases) and other activities of the development and delivery teams. This work is intended to provide guidance on the process the team will use to aim for the highest possible sustainability outcomes for the project.

Resource and materials optimisation, energy and water management is key. The ISCA framework supports sustainability opportunities associated with construction activities and the Sustainability Management Plan describes the sustainability initiatives associated with the Pilot Project: Causeway Pedestrian and Cyclist Bridge using the latest IS Essentials guidance material. The Alliance will throughout the project:

- Provide treatment options for direct risks and implement actions for direct opportunities and ensure there are no residual high priority direct risks. The risk assessment includes social, environmental and opportunities. A multidisciplinary internal team has participated in the identification and assessment of direct risks and opportunities, including selection of treatment or implementation options. This will continue on award and incorporate ISCA and Main Roads as part of the multidisciplinary team to ensure all agreed sustainability opportunities are realised.

- At design completion prepare a base case and materiality assessment in line with the latest IS Essentials guidance material at the time of kick off
- Ensure direct governance, economic, environmental and social risks and opportunities are assessed.
- Ensuring the integration of the SMP into the project planning and that the SMP achieves its intended outcomes
- Ensure that the resources required for the implementation of the SMP are available including an ISAP and a trainee ISAP
- Communicate the importance of effective sustainability management and conforming to the SMP requirements
- Direct and support persons to contribute to the effectiveness of the SMP
- Promote continual improvement in sustainability management throughout the Contract
- Support other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility
- Record and provide ongoing feedback to ISCA regarding the IS Essentials pilot trial
- Liaise with IS Project Manager from kick-off to closure.
- A summary of the sustainability initiatives is provided;

Materials, Procurement and Employment

- Local sourcing and/or fabrication of steel
- Facilitate a Supply Chain School Workshop for businesses interested in tendering for material packages
- Innovative lighting treatments to achieve project objectives and minimise impacts to river fauna
- Maintenance requirements considered early in the design and reduction of resources use for maintenance.

Environment

- Landscape design reflects the surrounding history and environment and considers heritage, the local environment in landscape and urban design features
- Minimising project footprint on the foreshores (specifically reduce impacts to trees and setbacks).
- Revegetation on Heirisson Island including:
- Providing habitat on Heirisson Island for native fauna
- Revegetation of berms with wildlife habitat
- Revegetate and rehabilitate unused or obsolete land areas with native species supported by Noongar Community.
- The Stakeholder Engagement Plan and Process
- Ongoing engagement of community reference groups for the remainder of the development phase to enable meeting objectives from reference groups
- Engagement of local schools/community groups or local/Aboriginal artists to incorporate artwork within the project which acknowledges Aboriginal heritage during bridge design and artwork. Engagement of local schools/community groups or local/Aboriginal artists to incorporate artwork within the project

- Single register of stakeholder feedback/suggestions/comments/concerns and records of stakeholder commitments
- Implement IAP2 framework on the project including establishing an exemplary communications blueprint with traditional owners that can be used across future projects at this site

Tourism and Connectivity

- Improve facilities and connectivity for visually impaired people (tactile surfaces) and disabled people (bridge and ramp gradients), and increase opportunities for participation and use by this user group.
- Explore synergies with adjacent works (e.g. Town of Vic Park (McCallum Park), Water Corporation water main upgrade at Point Fraser) to minimise rework and resource use.

Heritage

- Acknowledgement of Aboriginal and European heritage via signage and historical information including development of a Heritage Interpretation Strategy to educate the community via signage and publication regarding heritage and sense of place
- Acknowledgement of European heritage through design of bridge i.e. maximising views of the existing Causeway Bridges
- The Heritage Interpretation Strategy is based on heritage studies - to educate the community via signage and publication regarding heritage and sense of place

Infrastructure Sustainability Council of Australia (ISCA)

The Alliance is responsible to deliver the Pilot Project requirements under ISCA using the latest IS Essentials guidance material. ISCA will provide updates, additional resources and iterations of the Technical Manual throughout the Pilot process. The key deliverables will include:

- Finalised and auditable Sustainability Management Plan on award further to workshops with Main Roads
- Materiality Assessment and Base Case on Concept Design in line with the latest IS Essentials guidance
- Design Completion and complete self-assessment of design credits
- Commence on site and evidence gathering
- Practical completion and complete self-assessment of as-constructed rating.

5. STAKEHOLDER REQUIREMENTS

5.1 Introduction

We are committed to effective community and stakeholder engagement as a means of supporting more informed decision making and building better relationships, ultimately resulting in improved project planning and performance. We are seeking to design and implement a robust and deliberative engagement process, building on the early consultation process undertaken by Department of Transport and Main Roads WA.

Community and stakeholder engagement will be tailored to meet the specific needs and engagement and communication preferences of each of the Project’s stakeholder groups. We will engage proactively and consistently designing engagement and communications to focus on stakeholders with a high level of interest and influence in the project. As the project moves through different phases, stakeholder relationships will be reviewed regularly to reflect the changing needs and sentiment towards the Project.

Our detailed approach to engagement is further outlined in the Community and Stakeholder Engagement Plan, contained elsewhere in this submission. There are many stakeholders with an interest in the project, those listed below have either been involved in the consultation process to date or are listed as a major stakeholder, with decision making / approval responsibilities and are listed in our Community and Stakeholder Engagement Plan.

5.2 Main Roads Western Australia

As the client and member of the Alliance, Main Roads has a high level of interest in the project, with a focus on managing the State government's reputation. Whilst also through community and stakeholder engagement, focusing on mitigating and managing impacts to the road network and surrounding pedestrian and cycling connections through design outcomes and construction methodology.

5.3 Department of Transport (Marine and Urban Mobility)

In collaboration with Main Roads WA, DoT will be focused on the project building on the stakeholder consultation to date, particularly encompassing the design inputs into the next detailed design phase. In addition, they too will have a focus on the mitigation and management strategies for reducing impacts on river operations (marine) through engagement with recreational and business users as well as engagement to manage long term planning of PSP (urban mobility) and requirements for PSP compliance / standards to be met.

5.4 Department of Biodiversity Conservation and Attractions

DBCA have a high level of interest in how the Alliance manages impacts to the watercourse including interference with water, bed and banks across all the project sites. DBCA will be responsible for granting approvals for Permits required under the Swam and Canning River Management Act (2006).

5.5 Department of Water and Environment Regulation

The Alliance understands that a formal approval via the Environment Protection Authority will not be required for the project. Likewise, Federal approval through the Environment Protection and Biodiversity Conservation Act 1999 is not required. We do however acknowledge that we will need to seek Bed and Bank Permits as well as Dewatering Permit through DWER.

5.6 Department of Planning, Lands and Heritage

Working closely with the Town of Victoria Park and the City of Perth, DPLH will be responsible for granting approval for the project to undertake Development. Immediately following contract approval, it will be important for the Alliance to engage with the Office of the Government Architect in regards to the proposed bridge design and equally through the project's community and stakeholder engagement approach, the Alliance will need to demonstrate that key stakeholders have been appropriately engaged and their input considered and there is positive sentiment regarding the design outcomes. Giving confidence to DPLH that the Development Application and Design can be favourably progressed in a timely manner.

DPLH will also be responsible for granting Sections 18's as part of the Aboriginal Heritage Act 1972.

5.7 City of Perth

The City of Perth has jurisdiction over the Point Fraser and Heirisson Island sites. Primary considerations expressed during the RFP phase include:

- Maintaining and / or enhancing connectivity to existing businesses at Point Fraser
- Minimising clearing
- Ensuring pathways are maintained for the community during the construction period

5.8 Town of Victoria Park

The Town of Victoria Park has jurisdiction over McCallum Park. Primary considerations expressed during the RFP phase include:

- Ensuring that the overall design is integrated with the vision for McCallum Park
- Sensitivity of local residents, particularly those on Taylor St

5.9 Services

Consultation with services stakeholders (AARNet, NBN, Optus, Telstra, Water Corporation, Western Power) as well as City of Perth and Town of Victoria Park for the services listed in Section 3.4 is ongoing for the detailed design phase. Services Impact Drawings and a Services Impact Register are included within the 15% Civils Design Report and Drawings.

5.10 Advisory Groups

The Alliance will be responsible for facilitating a number of Advisory Groups to engage with key stakeholder groups. This includes an Elders Advisory Group, comprising Whadjuk Noongar peoples and a Construction Reference Group comprising state and local government agencies, representatives from the EAG and others yet to be determined. Engaging with these Advisory Groups will be key for the Alliance to seek input and approval of the design including at 15%, 85% and 100%. Equally these groups will also be able to be involved in mitigating and managing social impacts in the lead up to and during construction.

6. DESIGN INTEGRATION

6.1 Traffic

Not applicable.

6.2 Drainage

Bridge deck drainage is designed as follows:

- No discharge over the navigation channel.
- Where over water and outside of the navigation channel direct drainage discharge into the Swan River via scuppers
- Where over land the bridge deck drainage is directed through scuppers and downpipes into a pit and pipe system before discharging into the Swan River. Refer to 15% Civil Design Report for further details.

Further design integration required at the 85% design stage.

6.3 Alignment

Alignment design will be documented in the 15% Civil Design Report.

6.4 Noise

Not applicable. In accordance with the BDC Section 5.28 the installation of noisewalls is not required.

6.5 Pavement

There are no integration considerations for pavement design at 15% design stage.

6.6 Durability

The Durability Plan is yet to be finalised. However, based on current information, Concrete Exposure Classification and Cover Requirements, for standard conditions as outlined with AS5100.5:2017 Section 4 will be adopted unless noted otherwise.

The environmental exposure classification category in accordance with AS 5100.5:2017 is provided in Sections 4.5.2 and 4.5.3.

The Durability Plan will establish minimum performance requirements to comply with design life requirements. The concrete exposure classification and cover requirements as well as the corrosion classification for the steel works will be detailed in the Durability Plan and incorporated in the future revisions of this report as an Appendix.

The concrete early age thermal / restraint and shrinkage behaviour modelling of crack risk can result in the need for additional reinforcement in excess of that specified in AS 3735, AS 3600 or AS 5100.

The thermal / restraint and shrinkage modelling will be based on the approach recommended in Concrete Society Technical Reports, Construction Industry Research and Information Association (CIRIA) publications. Risk management decisions are involved, such as suggestions to include additional reinforcement based on the reduced likelihood of crack widths greater than specific values.

The concrete crack risk assessment approach typically used are outlined below.

- Reinforcement for crack control is based on a predictive model originally developed by Taywood Engineering Limited and included in CIRIA Report 91 Early Age Thermal Crack Control in Concrete, second edition. It has been continually enhanced by new knowledge with feedback from actual concrete project performance and the approach is in general accordance with CIRIA C660.
- Drying shrinkage assessment uses the CEB-FIP Model Code 1990 to determine long-term shrinkage. The model in this case assumes concrete that achieves a 56-day shrinkage result of 650 microstrain when tested in accordance with the Australian Standard AS 1012.13. Creep relief of the shrinkage strains has been determined by applying the approach adopted in CEB-FIP Model Code 1990. The in-situ average relative humidity has been assumed as mean annual relative humidity for the particular location for all concrete not water saturated.
- Autogenous shrinkage is not a matter of concern in the modelling for this project as cement content limits have been specified.

The hydration reaction that takes place when cement is mixed with water is exothermic and the volume of concrete will expand and contract as it heats up and then cools back down to the ambient temperature. If the concrete is restrained and unable to move freely, this expansion and contraction can result in cracking.

The adequacy of reinforcement detailed for the bridge structure will be based on limiting crack widths to less than 0.3mm for 100 year drying shrinkage. The thermal modelling for Bridge No.9506 will be undertaken as part of the 85% analysis, and the results included in the 85% drawings.

6.7 Urban and Landscape Design

Refer to Urban and landscape design report.

6.8 Utilities

Service Impact Drawings and a Service Impact Register will be provided in the 15% Civil Design Report. Further design coordination and clash check detection between the bridge structure and utilities will occur at 85% design.

6.9 ITS

Not applicable to pedestrian bridge.

6.10 Lighting

Lighting, Security and LV Impact Drawings and Design Integration Assessment will be provided in the 15% Lighting, Electrical and Security Report. Further design coordination and clash check detection between the bridge structure and pit and pipe requirements will occur at 85% design.

7. DESIGN DESCRIPTION

7.1 Bridge General Arrangement

Point Fraser Bridge consists of a cable stayed bridge over the Swan River between Heirisson Island on the South and Point Fraser on the North extending into the approach bridge on Point Fraser. The cable stayed bridge consist of two spans – a main span between Abutment 2 and the Pylon and the side span between the pylon and anchor pier, Pier No3. The approach bridge consists of 3 spans extending from Abutment 1 across two piers to Pier No3.

7.1.1 Superstructure

Pylons

The 51 m high Point Fraser Bridge pylon is inclined backwards at 15.1 degrees and then bends forward approximately at mid-height to take the shape of a boomerang. The pylon has a diamond shape cross section varying in depth from 1750 mm at the bottom to 3000 mm at the bend and then back to 1200 mm at the top. The section has a constant overall width of 900 mm and is designed such that all faces are planar. The wall thickness varies along the height between 20 mm and 60 mm with the maximum thickness at the kink. Internal transverse stiffeners are provided on a regular spacing throughout the height of the pylon.

The deck is propped against the pylon at a height of approximately 5 m above pile cap level. A horizontal bearing is provided at the deck to pylon connection point which allows rotation about all axes while restraining the deck against longitudinal movement.

The pylon is anchored to the pile cap through a baseplate with post-tensioned anchor bars around the outer perimeter. A stressing box with internal stiffeners is used to minimise the required clear space between anchor bars.

Figure 2 shows an elevation on Point Fraser Bridge pylon.

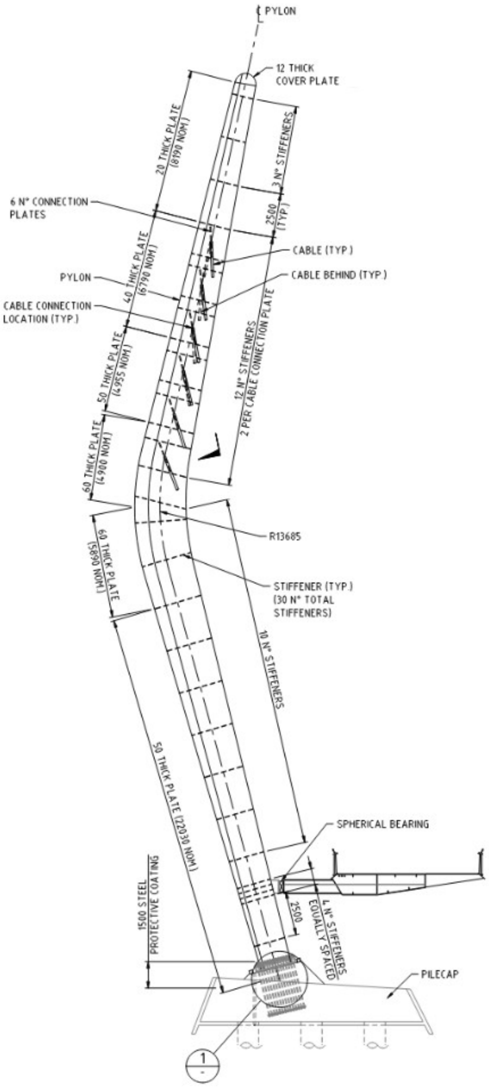

Figure 2 Pylon Elevation

Deck

The cable stayed bridge deck is an asymmetric section consisting of a trapezoidal closed steel box on the inside with cantilever outriggers extending towards the outside. The deck varies in depth across the width from 1200 mm at the inside of the box to approximately 300 mm at the tip of the outrigger. The box is stiffened transversely at a spacing of 1600 mm to 1700 mm coinciding with the outrigger spacing. The box top and bottom flanges are further stiffened with longitudinal stiffeners. The outriggers consist of V-shaped ribs curved at the bottom and welded to the underside of the deck plate to create closed sections. Transverse internal box diaphragms are provided at the cable positions transferring the deck loads to the cables.

Handrails are welded to the outside of the deck limiting the deck width to a minimum. The deck has 6000 mm clear spacing between the handrails allowing for a 3.5 m cycle path and a 2.5 m footpath. The deck widens at the pylon position providing a westward facing pause point for users and allowing seating for at least 10 persons.

The deck transitions from an asymmetric section to a symmetric section at the interface between the cable stayed bridge and the approach bridge over Pier 3. Figure 3 and Figure 4 below provides a typical deck section on the cable stayed bridge and the approach bridge respectively.

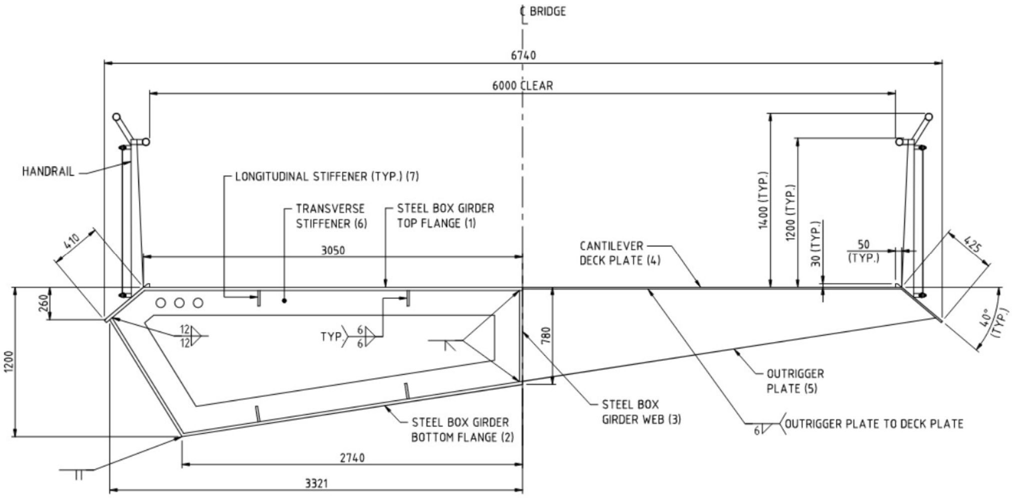

Figure 3 Typical Deck Section on Cable Stayed Bridge

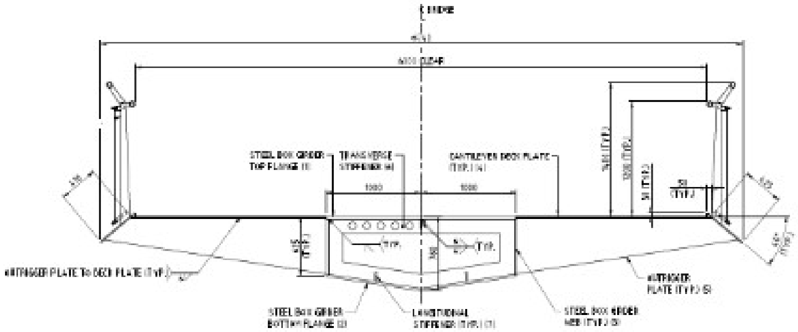

Figure 4 Typical Deck Section on Approach Bridge

Cables

The cables are arranged in a semi-harped formation connected with a regular spacing to the pylons and the deck. The semi-harp distribution introduces relatively large longitudinal moments into the pylons, but it relieves congestion at the cable connections and is aesthetical more pleasing than a fanned solution. The cable arrangement is shown elevation in Figure 5.

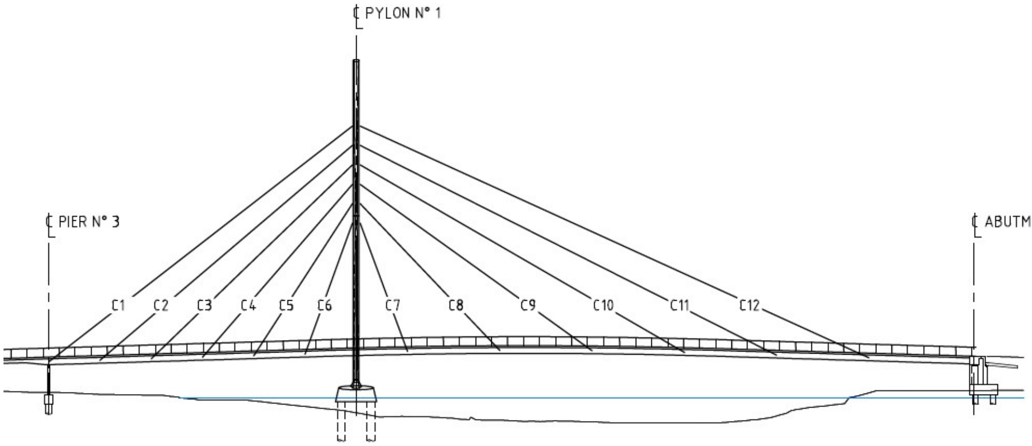

Figure 5 Cable Arrangement

The cable stays are 15.7 mm diameter parallel multistrand cables varying in size from cables with 19 strands to 27 strands. The span cables are typically 19 strand cables and the anchor cable and first cable adjacent to the anchor cable are 27 and 24 strand cables respectively. The cables are anchored to the deck with a pipe anchorage system connected to the diaphragm beam with a curved collar plate. The cables are anchored to the pylons with fork type anchors connected to diaphragm plates.

7.1.2 Substructures and foundations

Pylon Pile Caps

The pylon pile cap is an oval shaped cast insitu concrete pile cap formed within a permanent precast shell. The pile cap is rotated to align with the river flow. The pile cap is supported on 6 No. 1200 mm diameter concrete filled steel tube piles. The pile caps vary in depth from 1.85 m to 2.5 m. The pile cap soffit at R.L. 0.0 is above the lower water tide level to facilitate installation. Precast skirts extend from the shell downward to below R.L. -0.4 (LAT) to ensure the pile cap soffit is not exposed in low tide conditions.

An inclined plinth protrudes from the top of the pile caps to receive the pylons at right angles. 50 mm diameter post tensioned anchor bars are cast into the pile caps to anchor the pylons.

Figure 6 shows a typical plan and section of the pylon pile cap.

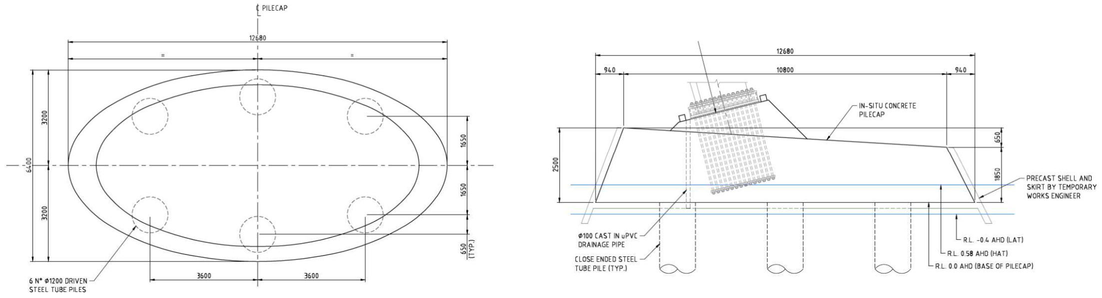

Figure 6 Pylon Pile Cap a) Plan b) Section

Abutments and Abutment Pile Caps

Abutment 1 at the start of the approach spans is a conventional bank seat type abutment. The pile cap forms the bearing seat without the need for an abutment wall above the pile cap. A headwall and curtainwalls extend from the top of the pile cap to shield the bearings from the embankment fill. No chamber is required as the bearings can be accessed from the front for inspection and replacement. Curved wingwalls cantilever off the abutment seat and headwall reducing the pile cap size and number of piles to a minimum. Figure 7 below provides a typical section through Abutment 1.

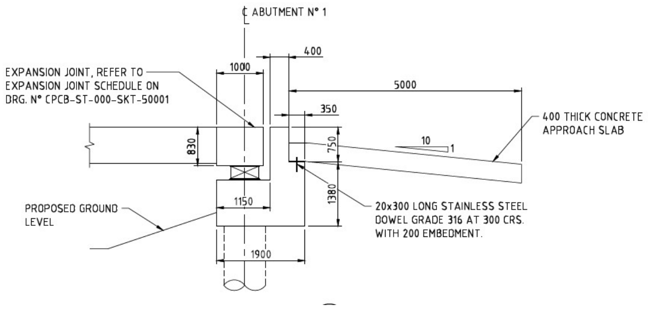

Figure 7 Section through Abutment 1

The Abutment 2 pile cap is positioned above ground level with the soffit typically 300 mm below ground level to minimise excavation. The pile cap is 1500mm thick below the abutments and 1200 mm thick below the wingwalls. Abutment 2 has a chamber housing the deck support column and the deck pendulum anchor. The chamber is enclosed by the abutment backwall and sidewalls retaining the approach embankments as well as a curved front wall with an access door in it. Curved wingwalls, retaining the side slopes of the approach embankment, extend outward from the abutment front wall.

Figure 8 below provides a typical section through the Abutment 2.

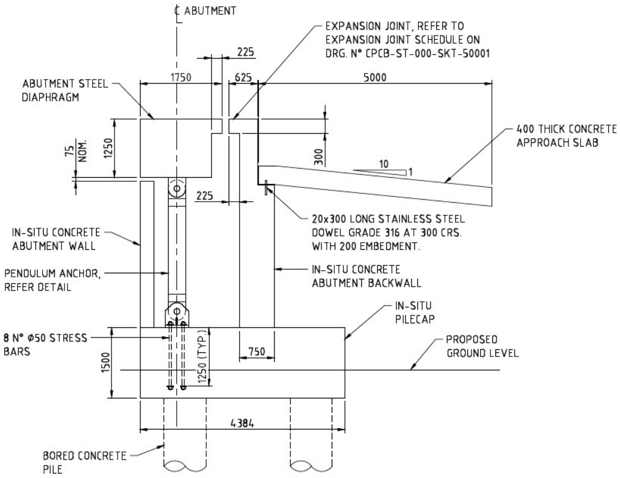

Figure 8 Section through Abutment 2 Chamber

7.1.3 **Articulation**

The deck is restrained as follows:

- Abutment 1 provides vertical support through 2 bearings. One bearing is a free float bearing and the other is a guided bearing providing transverse restraint.
- Piers 1 & 2 are integrally connected to the deck.
- The side span that extends over Pier 3 is supported by the approach span through a halving joint.
- Pier 3 provides vertical restraint to the deck against uplift.

- The pylon provides vertical, transverse and longitudinal restraint to the deck through a horizontal spherical bearing. Torsional restraint is provided through the couple formed between the two adjacent stay cables and the pylon connection beam.
- Abutment 2 provides vertical support and restrains the deck transversely through a single guided bearing on the outer side of the deck. The deck is restrained against uplift with a pendulum anchor on the inner side of the deck. Torsional restraint is provided through the couple formed between the tension pendulum anchor and the compression bearing.

Expansion joints are provided at Abutment 1& 2 and at the halving joint provided in Span 3 between Pier 2 & 3 to cater for the bridge deck movements caused by thermal variation and various transient load effects.

7.2 Design Optimisation

Deck Section

The reference design showed a symmetric box type deck with cantilevers. The centre of gravity of the deck using this configuration is in the middle generating large torsional moments. To improve this, an asymmetric deck has been chosen with the box on the one side, close to the cable support such that the lever arm between the centre of gravity and the support line is minimised. Light cantilever outrigger elements are used over the outer part of the deck to minimise torsion.

The deck is shaped to improve the aerodynamic properties by having the sloped soffit of the box aligned with the slope of the tapering outriggers. 'Drip-groves' are provided at the deck edges to avoid run-off staining of the bridge deck soffit.

Pylon Anchoring

The reference design showed stabilizing out of plane anchoring cables anchored on the riverbank. To create a more aesthetically pleasing design a new design not requiring anchoring has been developed. This was achieved by testing various deck alignment curvatures; pylon positions and pylon inclinations until a solution was found in which the transverse bending was minimised under dead load conditions. The pylon sections are sized such that it has adequate capacity to cater for transient loads and such that it is performing satisfactory under wind dynamic loading.

Deck Ballast

The use of mass concrete deck ballast in the side spans were considered to reduce the uplift forces at the abutments and to reduce the side-span hogging moments. These showed significant savings in anchoring elements and in deck steel. However, as it introduced an additional construction activity which includes complex concreting over the water the option was discarded.

Articulation and layout

The original abutment at Point Fraser was set back further from the river edge by transitioning the main cable stay bridge deck structure to short, light weight approach spans. This has significantly reduced the imported embankment fill quantity in this area and created more open space for landscaping. It has reduced the intrusive ground improvement requirements by eliminating the settlement issues associated with fill heights above 2.5 m as well as settlement issues to the existing Causeway bridge abutment.

7.3 Methods of Construction

Details of the construction methodology can be found in Section 10. Specific considerations that are included into the design are:

- Use of precast shells for pylon foundations to reduce work over water;
- Pylons are designed to be structurally stable when free standing to allow for construction staging;

- Deck segment structural design and precamber is specified to allow for placement of approximately 40m deck segments between temporary supports;
- Provision allowed at pylon pause point locations for the use of an elevated work platform (also able to be used in maintenance activities);
- Connection methodology between deck segments to allow for bolting (for securing) and then subsequent weld out (for full structural strength);
- Temporary lifting points and lifting lugs.

7.4 Structural Design

7.4.1 Structural Analysis Software

SOFiSTiK Structural Analysis and Design packages is used for global and local modelling. Refer to Section 7.4.3 for further information on the analysis approach.

7.4.2 Design Loads

General

Loads shall be in accordance with AS 5100.2 and as further clarified in Appendix B and the sections below.

Pedestrian and cyclist path loads

As specified in BDC Section 5.10, the footbridge shall be designed for crowd load. The bridge has therefore been designed for a 5 kPa loading without any reduction in intensity over larger loaded areas. Allowance has been made for the 'M-truck' maintenance vehicles as required by the Main Roads Bridge Design Information Manual.

Wind loads

Wind loads have been assessed in accordance with AS 5100.2:2017, Clause 17 and referenced standards for the 15% design phase. Wind load parameters and assumptions are listed in Appendix B.

A preliminary wind study was undertaken during this 15% design phase as part of the dynamic studies The Wind Study strategy that will be implemented for Detailed Design is described in Section 7.4.7.

Load combinations

The Ultimate Limit State (ULS) and Serviceability Limit State (SLS) load combinations are based on AS 5100.2 Appendix D3.

7.4.3 General Analysis Methods

Global Analysis

Global structural design has been undertaken using SOFiSTiK Structural Analysis and Design software. Initial modelling for conceptualising is performed with an instantaneous model ignoring construction stages. The model is parametrised using Grasshopper-Rhino software as input medium. With this workflow various configuration could be tested and optimised to obtain the most efficient solution. A further advantage flowing from using parametric input is that both the McCallum Park Bridge and Point Fraser Bridge models could be created using a single parametric system. Figure 9 shows an image of the model and Figure 10 shows an extract of the parametric script developed.

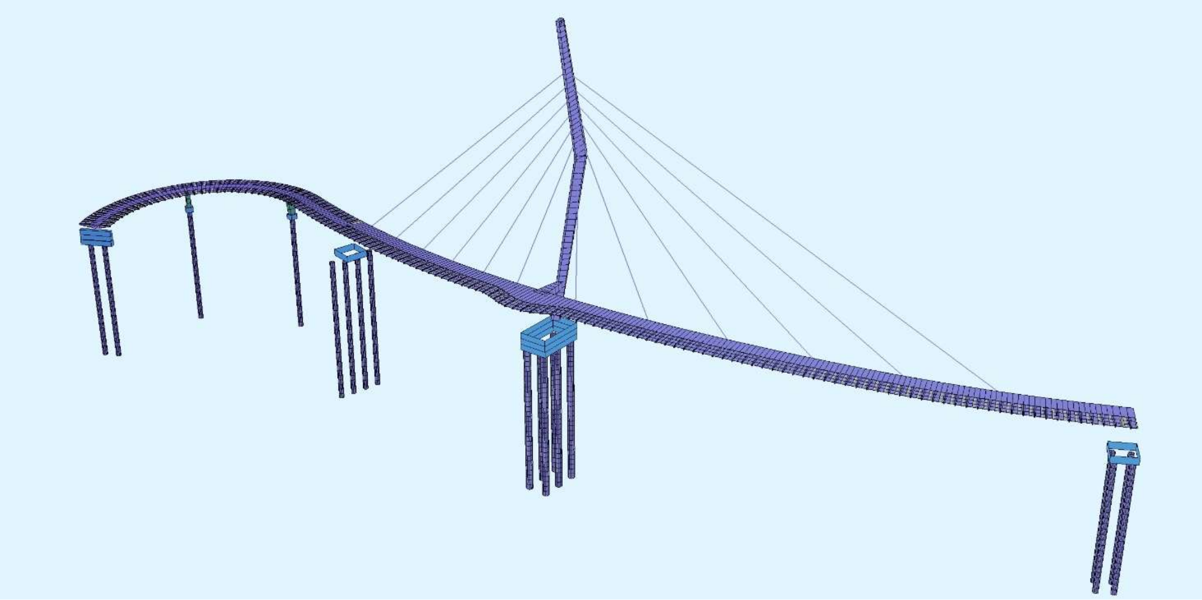

Figure 9 Global Model

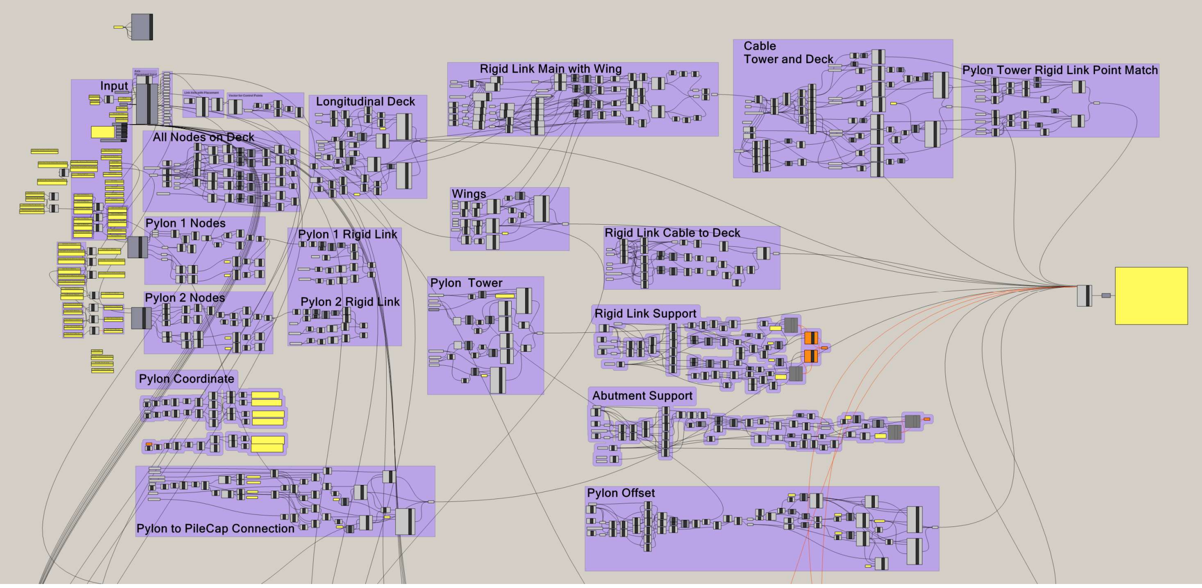

Figure 10 Parametric Input Visual Programming Script (Extract)

Local Analysis

Various local analysis models are used to analyse local effects on the decks and pylons. Figure 11 below shows the model that is used for the deck transverse analysis and local wheel load effects on the top deck plate and supporting elements below.

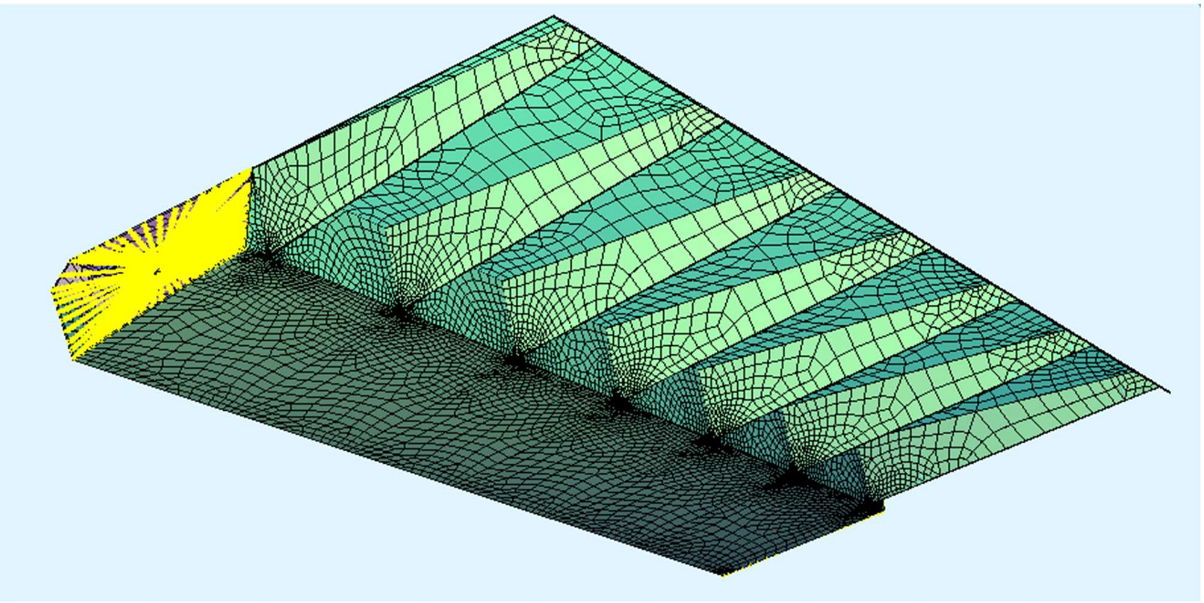

Figure 11 Deck Local Analysis Model

The abutments, piers and foundations are incorporated in the global model to determine overall global effects. For design of local effects on the substructure elements, the global reactions are transferred to the local models and analysed together with local effects. Figure 12 shows a typical model used for abutment analysis and design.

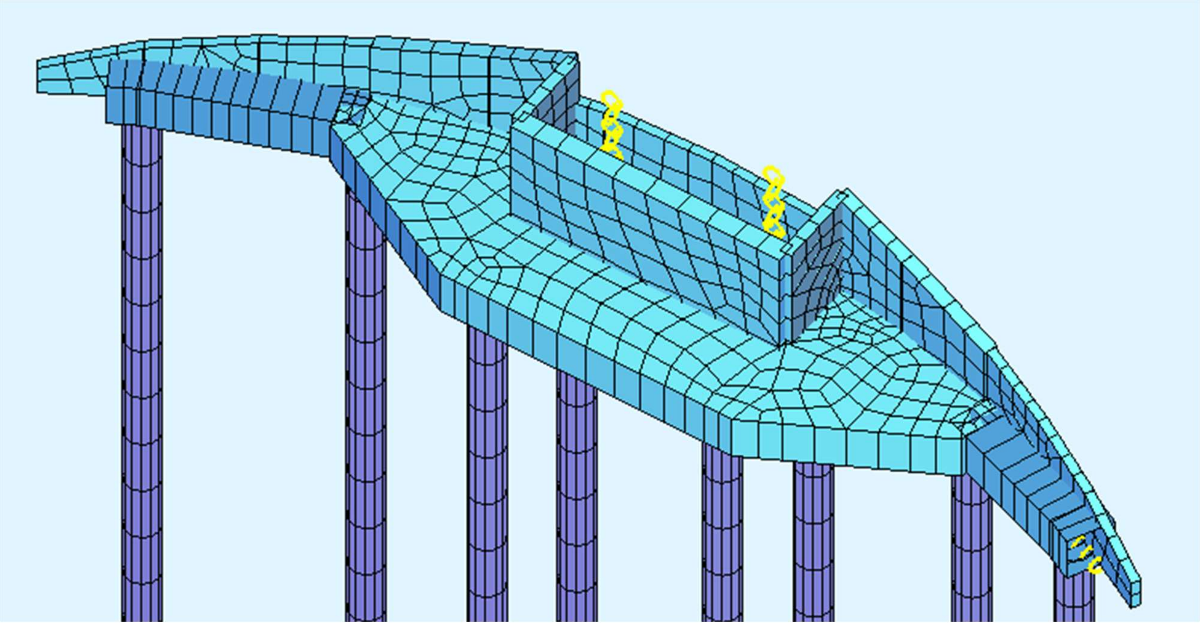

Figure 12 Abutment Local Model

7.4.4 Foundation Stiffness

The design approach for the foundation stiffness of the Global Analysis model used to establish substructure and superstructure design effects are summarised below.

- Geometric non-linear construction stage analysis is performed accounting for time dependent effects, (refer also to Section 7.4.5 for Construction Stage Analysis, and Section 7.4.6 for cable force finding considerations);
- Lateral soil-structure interaction is captured by modelling linear elastic soil springs along the length of piles, accounting for upper and lower bound scour conditions to determine critical load effects. These are based on the preliminary geotechnical information from the tender phase. The stiffnesses will be updated during the next design phase.
- Scour depths for the 15% design phase are based on initial preliminary estimates. Scour effects from a detailed scour assessment will be included during the next design phase. Load effects will be established considering upper and lower bound scour estimates depending on which case produces the critical load effect.

Linear-elastic buckling analysis is used to derive pile moment magnification factors in accordance with AS 5100.5 Cl. 10.4.3, due to the extended free length of piles above riverbed.

7.4.5 Construction Stage Analysis

Construction stage analysis is performed using the construction stage function, which allows for elements, boundary conditions and loads to be added at the relevant stage of construction. The stage analysis is an important consideration, as the final permanent load effects are altered by the chosen construction sequence. An example of a typical stage is shown in Figure 13.

Figure 13 Construction Stage Model - Cable C26 Installation Stage

7.4.6 Cable Forces

Cable force finding is performed as part of the instantaneous analysis construction stage analysis using the Unit-Force method. With this method the unknown cable forces are solved with a set of equations containing target forces or displacements. Non-linear effects such as P-delta effects and cable sag are solved through an internal iterative process.

Two approaches are commonly used, the target displacement approach and the target force approach. With the target displacement approach, the cable forces are adjusted to reach displacement targets in the deck or pylon and associated forces are developed. In contrast to this, with the target force approach the cable forces are adjusted to reach force targets in the respective elements, without having direct control over associated displacements. Displacements that are developed are then corrected by introducing pre-camber to the deck elements.

For the 15% design phase, the force target approach was used to minimise the deck and pylon forces. The backstay cable forces were solved to provide zero moment at the cable connection points and at the deck to pylon connection point. Using this approach, the pylon cross sectional dimensions are reduced to the absolute minimum to achieve aesthetic requirements, but with the penalty of higher deck forces being developed in the back spans. As indicated in Section 7.2, this can be improved by the use of ballast. The main span stay cable forces were solved to produce a deck with virtually zero global moment apart from small moments developing between the cable support points. By using the force target approach, moderate displacements are developed under dead load conditions. These are addressed by cambering the elements producing a solution with both zero effective displacement under dead load conditions together with the most optimised force distribution.

7.4.7 Wind Design Methodology

The Wind Study strategy that will be implemented for Detailed Design is described below.

Wind Climate Analysis

This study will be to determine the site-specific design wind speeds and turbulence properties, for strength design and stability verifications. Wind conditions at the site, historical meteorological data and local topography are assessed to evaluate how they translate into the wind speeds and turbulence to be considered in the design. This study defines normal and extreme conditions for estimation of user comfort and design loads.

Desktop Aerodynamic Stability Assessment and Early Design Advice

A design review will be conducted to assess the aerodynamic stability of the bridge.

This desktop study includes a review of the bridge details, some empirical calculations, and interpretations of data and experience from previous wind tunnel tests of bridge decks having similar geometry.

Wind Numerical Analysis (3D Wind Buffeting Analysis)

A 3D wind buffeting analysis will be undertaken using inputs from the Wind Study.

Wind Tunnel Studies – Deck Sectional Model Tests

This study is required where the aerodynamic stability assessment results indicate a potential for aerodynamic instabilities. The objective of the sectional model study will be to examine the aerodynamic stability of the deck with regards to vortex shedding induced oscillations and flutter and to provide the information necessary for the wind loading predictions for design. Remedies may be implemented to modify the deck cross-section to achieve the desired result and meet the project requirements. Force and moment coefficients and aerodynamic derivatives will be measured.

Wind Tunnel Studies – Free Standing Pylon Tests

A Force-Balance Test on the pylons will be carried out to quantify the overall aerodynamic characteristics. Measurements will include the overall mean forces and bending moments acting on the whole pylon. From this, drag and lift coefficients acting on the pylon will be defined. The results of this study will then be used in the elaboration of the overall wind loads acting on the entire bridge.

Wind Tunnel Studies – Aeroelastic Model Studies

A comprehensive approach for determining the aerodynamic stability and overall wind loads acting on the bridge. The study accounts for the 3-dimensional effects of the bridge itself and the surrounding terrain and buildings.

Cable Vibration Assessment

Using numerical and empirical methods, data available in the latest technical literature, and our experience, the potential for wind-induced vibration of the stay cables will be investigated. Damping levels required to mitigate wind-induced instabilities will be recommended. This assessment will be undertaken in collaboration with the stay cable system and cable damping system supplier.

7.4.8 Flood Design

Forces from waterflow and debris is calculated as per the requirements AS 5100.2 Cl. 16.1 to Cl. 16.6.

A summary of the flood loading considered is below:

- Forces resulting from water flow and debris
- Large item impact load
- Log impact load
- Effects due to buoyancy and lift.

7.4.9 Vessel Collison

The pylons are designed to resist vessel collision loading from waterway traffic as detailed in BDC Section 5.12. The impact loading is determined as per the method provided in AASHTO LRFD Bridge Design Specifications, Eighth Edition, 2017. Refer to Appendix B for further detail.

7.4.10 Seismic Design

All structural elements of the bridge shall be designed to BEDC-3 in accordance with BDC Section 5.11. Additional design requirements as per AS 5100.2 and AS 1170.4.

Earthquake effects are calculated using an elastic modal response spectrum dynamic analysis based on the parameters listed in Appendix B.

7.4.11 Stay Cable Loss and Replacement

The accidental cable loss design case shall comply with fib Bulletin 89 Cl. 3.1.1. The bridge will be designed to have adequate redundancy such that it remains stable and not incur any further damage to the structure as a result of a single accidental loss of a cable.

In establishing the dynamic factor for the cable break analysis, a rigorous time history dynamic analysis will be undertaken in the next design phase. A minimum dynamic factor of 1.5 shall be adopted in design in accordance with BS EN 1993-1-11.

All elements that introduce the cable force into the structure (for example, cable stay anchorages) shall be designed to 90% of the GUTS of the stay cable, as required by fib Bulletin 89 Section 3.2.3.

Accidental cable loss combination is to be considered with the full bridge width between balustrades loaded with the full design live load.

Cable replacement to be considered with 50% of bridge width between balustrades loaded with the full design live load. No dynamic factor need be considered however, cable exchange forces should include any cable exchange forces as per the guidance provided in PTI Recommendations for Stay Cable Design, Testing and Installation.

Accidental cable loss and cable replacement are assumed to be Ultimate Limit State load combinations only.

7.4.12 Pedestrian Footfall Dynamics

Dynamic criteria set in AS5100.2 Cl 13.4 will be replaced in full by the provisions JRC 53442, 2009 - Design of Lightweight Footbridges for Human Induced Vibrations'.

The criteria provided in Appendix B has been adopted to ensure adequate comfort and stability across the full range of traffic classes that can be expected on the bridge during the lifetime of the bridge.

Preliminary calculations have been performed in the 15% design phase to determine the dynamic response of the deck under pedestrian footfall. The response show that the allowable accelerations are exceeded significantly, and that substantial damping is required. Table 5 below show the damper allowances that have been made:

Table 5: Damper allowances

Point Fraser / Damper no	**weight**	**Type**

Damper #1 main span approx. centre	3 t	TMD for lateral mode ~0.62 Hz Movement ±100mm
Damper #2 main span off-set from span centre towards Abutment 2	5 t	TMD for lateral mode ~1.06 Hz Movement ±100mm
Damper #3 back span near pause point	0.5 t	TMD for vertical mode ~0.59 Hz Movement ±100mm
Damper #4 main span approx. quarter span Abutment 2 side	0.5 t	TMD for vertical mode ~1.36 Hz Movement ±100mm

Dynamic analysis of pedestrian loading will be further refined in the 85% design stage considering the following methodology:

- Determine the relevant pedestrian traffic classes measured in terms of pedestrian density
- Determine the relevant comfort classes measured in terms of acceleration criteria
- Apply the load associated to the relevant pedestrian traffic class harmonically
- Perform time domain dynamic analysis and determine the acceleration response
- Check response against the nominated criteria. If the criteria is not fulfilled, adjust the structure or apply damping measures and repeat the process.

7.5 Geotechnical Design

Details of the methodology, assumptions, analyses and recommendations for the geotechnical design of the bridge are provided in relevant geotechnical reports listed below:

- C301-CLA-0000– GE-REP-00001 Piling Design Report
- C301-CLA-0000– GE-REP-00002 Approach Embankment Design Report

7.5.1 Recommendations for Bridge Foundation

Recommended pile arrangement for the abutments, piers and pylons for Point Fraser bridge is provided in Table 6 below.

Table 6: Summary of Pile Arrangement

Support Location	**Pile Layout**	**Pile Length Below Underside of Pile Cap (m)**
Point Fraser Bridge – Abutment 1	2 x 900 mm bored piles	32
Point Fraser Bridge – Pier 1	1 x 900 mm bored pile	32
Point Fraser Bridge – Pier 2	1 x 900 mm bored pile	32
Point Fraser Bridge – Pier 3	4 x 900 mm bored piles	33
Point Fraser Bridge – Pylon 1	6 x 1200 mm steel tube driven piles	30
Point Fraser Bridge – Abutment 2	10 x 900 mm bored piles	19 to 43

7.6 Structural form and design outcomes

The structural form of Point Fraser Bridge has adopted the BDC and SWTC structural aesthetic requirements and the associated overall urban design concept. It was further enhanced by discarding the out of plane anchor cables. The deck shape is chosen to minimise torsional effects and to improve aerodynamic behaviour.

The 15% General Arrangement drawings are included in Appendix A.

7.7 Bridge handrailing

The bridge handrailing has been developed together with the bridge architects to provide a light appearance, restrain crowds, pedestrians and cyclists a well as allow integration of handrail lighting. The top rail is provided at 1.4 m above the surfacing to comply with AS 5100.1, Clause 16.2.3. The "smooth deflection rail" for cyclist is at 1.2 m above the surfacing in accordance with Austroads Guide to Road Design Part 6A, Figure 5.13. This allows for the handrail lighting to be installed in the deflection rail and comply with AS/NZS 1158.3.1:2020.

7.8 Bridge surfacing

The proposed Matacryl WS (pedestrian) system has a track record without maintenance since 2006 on some steel box bridges in Europe. The application of this multi-layer system is similar to paint systems. It is a low-density option to provide a wear, impact and abrasion resistance surface that will offer corrosion resistance and slip resistance.

7.9 Drainage

The bridge drainage design has been developed in line with the project requirements and MRWA standards and specifications.

Runoff from the bridge has been designed to discharge directly into the Swan River where the discharge points could be detailed to control the flow of water and not adversely impact the performance of weathering steel bridge elements, create erosion or scour, or discharge onto areas utilised by the public such as paths and the navigation channel. Where a direct discharge was not possible, the downpipes discharging into longitudinal collection pipes have been detailed. Those collection pipes discharge into drainage pits with vertical connections provided in the abutments. All longitudinal pipes are hidden from public view in the closed box cross sections.

Allowable spread width for the 6 m bridge deck is 1.25m based on 1 year ARI.

7.10 Geometric / Civil Design

The detailed design is in progress and is being completed in Bentley's open Roads Design Software.

Refer to 15% Civils Design Report for details on civil design aspects.

7.10.1 Design width

The bridge deck is 6.0 m wide between handrails which allows for a 3.5 m two-way cycle path and a 2.5 m pedestrian path.

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7.10.2 Bridge embankments

Bridge embankments are at 3H in 1V maximum and are generally shallower throughout to provide a more natural shape. This will be further refined in the detailed design phase as an integrated design element with the ULDF and stakeholder engagement processes.

7.10.3 Accessibility

Differentiation between the cycling and the pedestrian areas as well as defining right of way is to be undertaken. Further consideration and refinement will occur during in the following design stages. .

In general, the requirement for de-mountable bollards to protect the new facility from unapproved vehicle access will need to be agreed with the LGA's and MRWA.

7.11 Services

7.11.1 Electrical

The point of supply for the site will be at six separate locations to nearest Western Power easement adjacent Causeway. Underground consumers mains cables will be installed between these points of supplies to six main switchboards located onshore as follows in Table 7;

Table 7: Switchboard locations

Switchboard	Location	Area Served
MSB-1	Point Fraser (west)	Point Fraser (west)
MSB-2	Point Fraser (centre)	Point Fraser (east) & Bridge 9506 (west)
MSB-3	Heirisson Island (west)	Heirisson Island (west) & Bridge 9506 (east)
MSB-4	Heirisson Island (east)	Heirisson Island (east) & Bridge 9505 (west)
MSB-5	McCallum Park (west)	McCallum Park (west) & Bridge 9505 (east)
MSB-6	McCallum Park (east)	McCallum Park (east)

All switchboards will be rated at 100A and the design and construction will be in accordance with the requirements of AS/NZS 3000 and MRWA standard switchboard drawings with additional space for future lighting control.

3No 100 mm underground conduits will be installed adjacent footpath between western boundary of Point Fraser and eastern boundary of McCallum Park. These will be allocated for power, communications and one spare for future cabling.

7.12 Lighting

The proposed lighting aims to provide a fully integrated and sustainable design solution that caters for the varying needs of the users while achieving safe movement principles.

The lighting has been designed in accordance with the following:

- AS/NZS 1158.3.1:2020 Lighting for roads and public spaces Part 3.1 Pedestrian area (Category P) lighting- Performance and design requirements
- AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting
- Lighting to connecting elements at foreshore areas in accordance with City of Perth and Town of Victoria Park Local Government Area (LGA) requirements
- Main Roads Western Australia requirements

The lighting design considers the following:

- The operational, safety and security requirements of the bridge and connecting elements

- Provide lighting for safe pedestrian and cyclist movement to all areas through orientation and detection of potential hazards
- The maintenance, access and replacement flexibility of the lighting systems
- Security lighting for general surveillance including CCTV
- Appropriate illumination levels in accordance with CPTED principles to reduce the real and perceived risk of crime by revealing potential threats through adequate illumination
- The integration of lighting within the wayfinding and signage strategy to enable intuitive orientation
- Integration of the lighting with the landscape, to enhance and align with the natural environment
- Minimise glare and visual discomfort to the public and surrounding environment
- Minimise obtrusive light effects to surrounding areas and light pollution to the environment
- Consideration of lighting in the surrounding public domain, to ensure local regulatory body guidelines and requirements are met.

Luminaires for the project are selected to yield a harmonious integration with the architecture such that the outcome is a seamless solution. Generally, the luminaires perform two main functions:

- Public Safety Lighting
  - For safe movement and to discourage potential malicious behaviour
- Thematic & Architectural Lighting
  - For placemaking and civic pride.
  - For intuitive way-finding
  - For potential integration with public art and events

The Public Safety Lighting comprises LED luminaires mounted on free-standing light poles or handrail integrated lighting for safe movement and the improved perception of safety.

Given the exposed nature of the bridge infrastructure and connecting elements, the selected luminaires are of robust design to withstand the local environmental conditions and minimize potential malicious damage. All luminaires include high quality energy efficient LED light sources and are of marine-grade construction and the design considers the following:

- Colour rendering index (CRI) of 80+ in line with CIE-1960 for white light sources
- Maximum standard deviation colour matching (SCDM) of 3 MacAdam ellipses
- Ingress Protection (IP rating) and Impact Protection (IK rating) of the luminaires is appropriate for the exterior environment and accessibility where they are installed
- Surface temperatures of luminaires at or below 2.4m from finished floor level do not exceed 50ºC
- All control gear to be suitable for operation in ambient temperatures outside the luminaire of up to 40°C.
- Use of high-quality luminaires with manufacturer evidence of demonstrated experience in transport infrastructure projects
- Luminaires are to utilise high-quality and robust materials for improved maintenance cycles
- Lighting poles, luminaires and accessories are of robust, vandal and environmentally resistant design

7.12.1 Thematic / Architectural Lighting Design Intent

For placemaking and civic pride and for potential integration with public art and events the intent is to provide projectors for lighting the culturally noted pylons, as well as the ability to highlight the cables only during significant events.

7.13 Marine and Aviation Lighting

Provision has been allowed for both marine navigation and aviation obstruction lighting in the form of conduits and draw wires only.

7.14 Lighting Control and Remote Monitoring

Lighting will be controlled via local photoelectric cells and time clocks located at each of the switchboards.

Additional lighting control and remote monitoring has been considered in the design of each of the switchboards, allowing sufficient space for future control/monitoring hardware.

7.15 CCTV

A CCTV server will be located within MSB-1 at the western side of Point Fraser and be connected to nearby City of Perth (CoP) cabinet for integration into CoP CCTV network. This will facilitate connection to CoP City Watch equipment room where all cameras can be centrally monitored and recorded.

Network switches will be provided within each of the five other switchboards, interconnected via underground fibre optic cabling.

A total of 32 No cameras will be installed providing coverage along main footpath from western boundary of Point Fraser to eastern boundary of McCallum Park.

Cameras with 3-9 mm focal length lens' will be used at all entry/access points to facilitate facial recognition of persons of interest.

7.16 Urban Design

An Urban and Landscape Design Framework has been developed with the aim to:

- Coordinate the landscape architecture clearly with the architecture and engineering elements of the bridge, in particular the levels interface and connections to the abutments and flights of steps as well as the height clearances of the bridge as it relates to pathways as well as ground improvement extent.
- Coordinate the river's edge (and associated pathways) with a marine engineer, environmental consultant and liaison with the WA Government Department of Biodiversity, Conservation and Attractions.
- Coordinate geotechnical and civil engineering in relation to the paving specification, land forming, land drainage and any new drainage infrastructure required as part of the landscape.
- Coordinate with an irrigation design consultant to ensure there is water available for the lawn and planting areas. Water availability, licensing, bores, hydro-zoning issues all need to be worked through. Areas which do not have irrigation must be understood and agreed to as their establishment will be compromised. Non irrigated planting area works must be undertaken in winter.
- Identify any structural elements that require designing by a structural engineer – walls, paths, terracing, posts and public art features.
- Develop strategies for the liaison with the City of Perth, Town of Victoria Park and Main Roads for a holistic precinct design solution for wayfinding.

A public art strategy will be developed by a public art consultant. This will require extensive planning, engagement and coordination with stakeholders and design team. It is important to factor in this process to the project programme and financial plan at the earliest opportunity.

7.17 Design Departures form BDC or Agreed Design Standards

The proposed structure is fully compliant with the BDC requirements and the proposed standards.

7.18 Outstanding Issues

Outstanding issues and actions required for resolution, with status at the time of 15% Design Report are summarised in Table 8.

Table 8: Outstanding Issues

ID	Outstanding Issue	Description	Action Required	Status
1	Hydraulic modelling	Hydraulic and scour modelling outstanding	Sub-consultant to be engaged.	Open
2	Construction Engineering Interface	Finalise coordination of construction staging to be considered for design load effects.	Construction staging will be coordinated through development of staging drawings to be included in 85% design phase.	Ongoing
3	Bridge Lighting	Bridge lighting design ongoing.	Bridge lighting and associated conduits to be coordinated through 85% design phase.	Ongoing
4	Bridge drainage	Bridge drainage concept and detail to be finalised.	Coordination between civil, structural and architectural disciplines.	Ongoing
5	Durability Report	Durability assessment.	Sub-consultant to be engaged to perform durability assessment.	Open
6	Temporary Works Interface - General	Finalise the coordination of the temporary works including precast shell support details, temporary supports at piers, stc.	Temporary works detail coordination to be finalised with further input from the construction team. Weekly construction meetings to be held with construction team. Construction staging drawings will define temporary works loads as design inputs for temporary works.	Ongoing
7	Temporary Bolted Splices	Temporary bolted splices proposed as part of construction methodology.	Coordinate with permanent works design.	Ongoing
8	Cathodic Protection Provisions	Confirm and include provisions for cathodic protection to piles.	Location of cathodic protection point to be determined.	Open
9	Services	Services running through deck to be coordinated.	Coordination with relevant stakeholders to be arranged.	Ongoing

10	Bridge furniture	Confirm seating arrangements at pause points, information board sizing and position, etc.	Resolve through ongoing coordination with architect and stakeholders.	Ongoing
11	Wind Study and Wind Tunnel Testing	Wind Study and Wind Tunnel Testing outstanding	Sub-consultant to be engaged. Coordination meetings to be arranged. Input parameters to be determined and provided to wind consultant.	Open
12	Mast Feature Lighting	The mast feature lighting details at mast tip is being finalised with architect team and feature lighting consultant.	Detailing and provision for conduits to be finalised.	Open
13	Lightning protection to main mast	Earthing point for lightning protection system to be confirmed and coordinated.	Earthing location to be confirmed and detailed accordingly.	Open
14	Precast pilecap shells (permanent formwork)	Coordination and interface requirements for pile cap shell temporary works support, connection details for precast shell modules and precast concrete shell design. To be confirmed.	Temporary works detail coordination to be finalised with further input from the construction team. Weekly construction meetings held with construction team.	Open
15	Stay cable type	Final confirmation required on stay cable type (parallel strand cable vs locked coil rope). Parallel strand cable adopted thus far in design.	Finalise decision and present to stakeholders	Ongoing
16	Pylon tip geometry.	Pylon tip geometry to be changed in according to MEG requirement	Present proposal to MEG	Ongoing
17	Tune mass dampers and cable dampers	Dynamic modelling of pedestrian loads and integration of Wind Study and Wind Tunnel Test results	Footfall dynamic assessment to be finalised. Dynamic wind assessment and wind tunnel testing to be commenced.	Open

8. SAFETY IN DESIGN

Under the Occupational Safety and Health Act 1984 the Designer has a responsibility to undertake the design such that as much as practicable that people who maintain or construct the works are not exposed to hazards in doing so. In completing the 15% design, this obligation has been adhered to as practicable as possible for a preliminary stage design.

‘Safety in Design’ reviews are scheduled to take place for all packages and consider all the following phases:

- Construction;

- Operation; and
- Maintenance.

The reviews will take the form of a peer review and a checklist or “what if” review.

The first Safety in Design (SiD) workshop took place just before the submission of this concept design report, in August 2021. The workshop was combined with the Asset Managers workshop, so that all issues effecting both the design and specific operations and maintenance hazards that are to be mitigated for in the design of this bridge will be documented in the 85% design report.

This SiD workshop involved designers, project managers and engineers from a variety of disciplines. Due to the competitive Alliance Development stage, there was no representation from MRWA.

The primary scope of the SiD workshop component was generating a SiD workshop issues register with unique and project specific risks to be addressed during the reference and detailed design phases. The scope of the SiD workshop did not include broader construction health and safety management, although a number of issues were identified and captured for future review. See Appendix D.

The predominant focus was on major hazards/critical risks, unique hazards, human factors, interfaces and complex risks/risk treatments that require brainstorming.

The SiD workshop began by creating a list of major hazard creators using guidewords. Major hazard creators are elements part of or close to a project that have the potential to create major hazards impacting the successful completion of the project

After this list was constructed, the workshop then moved to identifying health, safety, environmental and sustainability hazards introduced and/or influenced by design using the structured “what if” technique (SWIFT).

The workshop participants focused on different hazard categories that may affect the project using guideword slides. The workshop looked at “People and Plant Movement” as an example. The SWIFT method was used to brainstorm hazards within the group which were then presented to the rest of the workshop attendees.

Hazards were categorised as per Table 9:

Table 9: Hazards

Standards and Practices	Covered adequately by current standards or normal design practices
Design	Unique and/or significant hazard to the asset during its lifecycle that should be managed by design
Construction	Constructability issue to be addressed during construction
Client/ Project	Project risk not influenced by the design that needs to be highlighted on the Project Risk Register

Once hazards were identified and categorised, the workshop attendees proposed recommendations to the design to eliminate those hazards so that they do not need to be managed during construction or later stages of the asset lifecycle.

Where it was not possible to eliminate a hazard, the workshop attendees used the hierarchy of control approach to propose ‘above the line’ controls to manage the hazard so far as is reasonably practicable. In descending order of preference, these controls are:

1. Substitute (change).
2. Isolate (separate).

3. Engineering (engineering controls).

The following general method and approach was facilitated throughout the workshop, enabling open dialogue and involvement of participants:

- Assemble the SiD workshop study team (including all nominated stakeholders).
- Facilitator welcomes participants and leads safety moment in discussing historical incidents or issues on similar projects using stories from attendees.
- Outlines study scope, methodology, objectives and expected outcomes.
- Facilitator confirms participants have been briefed on the project scope, design and project status.
- Safety in Design background brief and information provided including information on major hazard creators.

Workshop sequence included the following steps:

1. The team used GROUPMAP collaboration software to capture brainstorming information then group identified risks/issues into categories
2. Workshop attendees use the guideword slides on major hazard creators to build examples of major hazard creators that could be found in the CPCB Project.
3. Use the provided SWIFT guide word slides for 3-4 minutes each to brainstorm "what if" scenarios to focus areas across the entire asset lifecycle.
4. Categorise "what if" scenarios into risk categories:
    - Standards and Practices
    - Design
    - Construction
    - Client/Project
5. Brainstorm elimination or hazard reduction recommendations using the hierarchy of control for significant and minor hazards by exception through GROUPMAP.
6. The data of risks, hazards, consequence and likelihood, and control recommendations where then compiled by the facilitator using GROUPMAP.

Once a hazard (and corresponding risk) was identified, the workshop participants considered the consequence and likelihood of the risk occurring based on the consequence and likelihood tables. The attendees then recorded proposed changes to the design to eliminate the hazard so that it did not need to be managed during construction or other asset lifecycle phases (as applicable).

Due to time constraints in the workshop, recommended hazard elimination and mitigation mechanisms were captured by exception. A more detailed analysis of SFAIRP elimination and mitigation measures is to be undertaken in the detailed design stage.

8.1 Summary Of Critical Design Health and Safety Risks

In consultation with workshop stakeholders, 57 issues were identified during the design SiD review with risk owner by category as shown in

Table 10:

Table 10: SiD review

Risks managed by:	**Count of Risks managed by:**
Constructor	10

Designer	37
Operations	6

The design team then focussed on those risks managed by the designer. These were formally categorised against likelihood and consequence and grades as levels of risk, Very High, High, Medium and Low. This categorisation was undertaken in the risk review of 4th October (Vey High and High category risks) with medium and low risks reviewed and categorised by SiD Facilitator, Keith Chidley in consultation with Design Manager Wolfram Schwarz.

The inherent design risks identified to be managed by the designer are shown in Table 11:

Table 11: Inherent design risks

Inherent Risk Level	Count of risks
Very High	5
High	10
Medium	11
Low	15

These are to be further evaluated at mitigated through controls in design progresses to the point of acceptance or handover to the next stage. Due to time limitations there was no further exploration of Operational, Construction or those risks controlled under Standards or Processes. These shall be handed to the next design stage.

The second Safety in Design review will take place with the Alliance in the detailed design stage and the results of this review will be documented in the subsequent revision of the report for this package. Any residual risks or unresolved issues remaining at the completion of the design will be transferred to the Construction Risk Register for appropriate consideration during construction process planning.

9. RISK ASSESSMENT

As part of the 15% design stage no risk have currently been identified that would require specific risk analysis to be undertaken that is not part of the normal design phases. This will be continually reviewed as part of the detailed design.

10. CONSTRUCTABILITY AND STAGING

An extensive coordination between the design and construction methodology has been undertaken to confirm feasibility of the proposed construction sequencing. Full details regarding constructability and staging are included in the Construction Methodology. Summary details are provided below.

10.1 Pylon Pile Cap Construction

A precast concrete shell will be utilised as permanent formwork for the pylon pile cap to avoid having to construct complex formwork in the river. The precast shell will be manufactured on the shore and locally transported as required. It will be lifted in place, over the piles, on supporting brackets directly connected to the piles. Oversized circular openings in the soffit of the shell will ensure fit. Once the precast shell is in place, the openings will be made watertight and all water will be pumped out. The reinforcement cage and anchor bolts will then be installed after which the concreting will be performed.

10.2 Pylon Construction

The Point Fraser Bridge pylon will be manufactured, delivered and installed in two segments. Prior to the installation of the first pylon segment, the seating plates will be surveyed and a shim plate will be machined to the exact thickness to ensure the baseplate can be seated within tolerance. The pylon segment will be held in place by crane while a minimum number of anchor bolts are stressed and tightened. After all the anchor bolts have been stressed and tightened, the second segment will be lift into position on top of the first segment and temporarily spliced. The permanent splice welding will then be performed from temporary platforms.

10.3 Deck Fabrication and Installation

The deck will be manufactured in segments with lengths up to 42.5 m and weighing up to 110 t. The Tuned Mass Dampers will be installed in the workshop to minimize work on site. The segments will be transported to site and directly installed by crane, or moved by barge on the river into position before installing from the barge. The segments will be installed onto temporary piers and temporarily spliced with bolt splices to perfectly align the segments prior to welding.

10.4 Cable Installation

Once all the deck segments are in place cable installation will proceed. The cables will be installed with a crane to the pylon, with access by EWP on deck, and then stressed from below the deck, with an EWP on barge. After completion of the stressing the temporary piers will be removed. Final alignment stressing will then be performed as required.

10.5 Construction Sequence

The detailed staging is provided in Appendix C.

McCallum Bridge (BR 9505) will be installed prior to Point Fraser bridge (BR 9506).

Generally, the works follow the following sequence:

- Site establishment
- Site investigations
- Services protection or relocation
- Ground improvement:
  - Embankment fill and preload / surcharge installation.
  - Settlement monitoring
  - Surcharge removal
  - Controlled Modulus Columns (CMC) installation
- Bored piles installation on land
- Abutments / Piers construction
- Driven piles installation in the river
- Pile cap construction
- Temporary piers construction in the river and on land
- Deck segment adjacent to pylon installation
- Pylon installation after pile cap concrete has cured
- Deck segments installation, including temporary splicing and permanent welding
- Pylon / deck bearing installation

- Cable installation once the deck segments are fully welded
- Removal of temporary piers and piles
- Cable installation
- Final cable adjustment to achieve geometry
- Finishing works including bearings, expansion joints, landscaping, lighting installation, deck coating, asphalt etc
- Site demobilisation

11. OPERATIONS AND MAINTENANCE

The bridge structures and approaches have been designed to minimise maintenance requirements during the operational period. However, every structure requires maintenance to at regular intervals to ensure safe ongoing performance. Spherical bearings have been specified in most locations where compression loads need to be supported. Spherical bearings have minimum 50-year design life but may be able to last 100 years. The tension loads have been anchored using maintenance free pendulum anchors to account for the longitudinal movement of the bridge superstructures. The bearings and pendulum anchors are accessible for inspection via access doors in the abutments to shield them from the elements. They will be designed to be replaceable should that be required. The pin joints at Point Fraser Bridge Pier No. 3 are maintenance free with the same design life as the bridge.

To ensure maintenance vehicles can access the bridge deck during the service life of the bridge, the bridge has been designed for M-Truck vehicle access. In addition, a typical EWP (Reference JLG1500AJP) capable of reaching the cable attachment points on the pylons as well as the light fitting on top of the pylon has been designed for (13 t axle load, 26 t GVM). The vertical reach range of the EWP allowed for is 45.7m which is more than the height to the top of the pylon (45.1m).

The bridge superstructure has been detailed to allow run-off to drip of the provided edges. Sacrificial thickness has been allowed for based on the provided corrosion category to achieve a minimum design life of 100 years without having to maintain a corrosion protection system. The only corrosion protection system that needs maintaining is at the bottom sections of the pylons where they are anchored to the pile caps. The selected corrosion protection system at this location is a Micaceous Iron Oxide (MIO) with Red Oxide to give a rust appearance similar to weathering steel. In a C5 environment which is specified for all steel sections below 2.5 m HAT it would have a design life of 15-25 years.

The proposed expansion joint material is a polymer modified flexible plug joint that provides a completely waterproof surfacing. Other than steel cover plates this expansion joint type does not need cleaning nor flushing of any water collection systems, it is maintenance free for its expected life of 30 years.

Controlled Modulus Columns and load transfer platforms have been designed where high settlement is predicted due the embankment fill height. Although this solution is not the most cost effective, it reduces the settlement of the approaches to be within the acceptable figures

12. DESIGN VERIFICATION

The Structural Design verification procedures for the Project Works are described in the Design Verification Plan which forms part of the Design Management Plan.

12.1 Review Categorisation

The following categories have been allocated to this design package:

Table 12: Review Categorization

Location	Risk Level	Review Category	Review Responsibility
All Spans	High	3	Reviewed by independent design team.

12.2 Verification Level

Refer to Table 13 below for a summary of the Verification Levels for each submission of this package. Verification Levels are described in the CLA Design Verification Procedure.

Table 13: Verification level

Ref	REVIEW TYPE	15% Design	85% Design	100% Design	IFC
VL1	Design team engineering review	Required	Required	Required	Required
VL2	Design team drawings review	Required	Required	Required	Required
VL3	Design team technical reports review	Required	Required	Required	Required
VL4	Independent engineering review	-	Required	-	-
VL5	Independent drawings / model review	-	-	Required	-
VL6	Independent technical reports review	-	Required	-	-
VL7	Safety in Design review	Required	Required	-	-
VL8	Interdisciplinary review	Required	Required	-	-
VL9	Civmec-SW design review	Required	Required	Required	Required
VL10	External Stakeholder Review	To be performed as part of Stage gate submittal.			

12.3 Verification

12.3.1 Internal Review (VL1, VL2 & VL3)

During the 15% design phase an internal checking process has been implemented. This includes a self-check and a single discipline check and approve. It is the responsibility of the originating Design Package Lead to ensure these reviews are undertaken. The design package will not be issued without these reviews having been documented.

12.3.2 Independent Verification (VL4, VL5 & VL6)

Independent verification (IV) will take place at the 15%, 85% and 100% design stages. Responses to the IV will be captured in an IV register. These comments and responses will be tracked through to close out. All comments must be closed out prior to completion of the 100% design.

12.3.3 Interdisciplinary Reviews (VL8)

Interdisciplinary reviews are undertaken as described in the *Design Verification Plan*.

12.3.4 External Stakeholder Reviews (VL10)

External stakeholder reviews are undertaken as described in the *Design Verification Plan* and include a review from MRWA and the Independent Verifier.

13. CONCLUSION AND RECOMMENDATIONS

The presented design solution is a further development of the provided preliminary design drawings provided at EOI stage. The design incentive has not changed, maintaining the general appearance of the two bridges on the preferred alignment. Multiple improvements and design inputs of bridge and landscape architects as well civil, drainage, lighting and construction experts have been considered. The main design changes from the preliminary design drawings are the removal of the back-stay cables, the rearrangement of the cable layout, the revision of the deck cross-section and the modification of the Point Fraser approach. The Point Fraser approach uses a curvilinear alignment with the aim to provide a suitable speed environment to slow cyclists as they approach the tie into the existing cycle network. The abutment has been set back further to reduce fill height and intrusive ground improvement to reduce settlement risks to existing infrastructure as well as provide more opportunities for the landscaping and connectivity in this area.

The desktop dynamic studies have confirmed both bridges are sensitive to wind and pedestrian induced vibrations. A site-specific wind study together with section and aeroelastic wind tunnel testing will be performed in the next design phase to validate wind parameters and loads on the bridges, and to test and validate wind performance and damping requirements.

APPENDIX A: 15% DESIGN DRAWINGS

C301-CLA-0000-ST-SKT-00010	PROJECT WIDE - KEY PLAN
C301-CLA-0000-ST-SKT-10001	PROJECT WIDE - TYPICAL PYLON PILE DETAILS
C301-CLA-0000-ST-SKT-20001	PROJECT WIDE - TYPICAL DETAILS - ABUTMENT SECTIONS
C301-CLA-0000-ST-SKT-20002	PROJECT WIDE - TYPICAL PYLON PILECAP DETAILS
C301-CLA-0000-ST-SKT-30001	PROJECT WIDE - BEARING SCHEDULE
C301-CLA-0000-ST-SKT-40001	PROJECT WIDE - TYPICAL DETAILS - DECK SECTIONS
C301-CLA-0000-ST-SKT-40002	PROJECT WIDE - TYPICAL DETAILS - CABLE TO DECK CONNECTION
C301-CLA-0000-ST-SKT-40003	PROJECT WIDE - TYPICAL DECK SEGMENT
C301-CLA-0000-ST-SKT-40004	PROJECT WIDE - PAUSE POINT DETAILS - SHEET 1 OF 2
C301-CLA-0000-ST-SKT-40005	PROJECT WIDE - PAUSE POINT DETAILS - SHEET 2 OF 2
C301-CLA-0000-ST-SKT-40006	PROJECT WIDE - DECK THICKNESS TABLE
C301-CLA-0000-ST-SKT-50001	PROJECT WIDE - CABLE INFORMATION
C301-CLA-0000-ST-SKT-60011	PROJECT WIDE - TYPICAL BALUSTRADE DETAILS
C301-CLA-0000-ST-SKT-70001	PROJECT WIDE - EXPANSION JOINT SCHEDULE
C301-CLA-0000-ST-SKT-80101	PROJECT WIDE - TYPICAL DRAINAGE DETAILS
C301-CLA-0000-ST-SKT-80301	PROJECT WIDE - STAIR DETAILS
C301-CLA-2000-ST-SKT-00001	BRIDGE 9506 - POINT FRASER SPAN - GENERAL ARRANGEMENT
C301-CLA-2000-ST-SKT-10101	BRIDGE 9506 - POINT FRASER SPAN - ABUTMENT DETAILS - SHEET 1 OF 2
C301-CLA-2000-ST-SKT-10102	BRIDGE 9506 - POINT FRASER SPAN - ABUTMENT DETAILS - SHEET 2 OF 2
C301-CLA-2000-ST-SKT-10201	BRIDGE 9506 - POINT FRASER SPAN - PIER DETAILS
C301-CLA-2000-ST-SKT-20101	BRIDGE 9506 - POINT FRASER SPAN - PYLON BASE DETAILS
C301-CLA-2000-ST-SKT-20201	BRIDGE 9506 - POINT FRASER SPAN - PYLON DETAILS
C301-CLA-2000-ST-SKT-40001	BRIDGE 9506 - POINT FRASER SPAN - DECK LAYOUT PLAN
C301-CLA-2000-ST-SKT-40002	BRIDGE 9506 - POINT FRASER SPAN - DECK SECTIONS AND DECK TRANSITION DETAILS

CAUSEWAY PEDESTRIAN AND CYCLE BRIDGE KEY PLAN

1:1250

1:1250

Plotted By: Burgess, Brent   Plot Date: 22/07/2022 8:36 AM   Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-00010.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

VERIFIED

DATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION

MRWA DRAWING NUMBER

PROJECT TITLE: CAUSEWAY LINK ALLIANCE

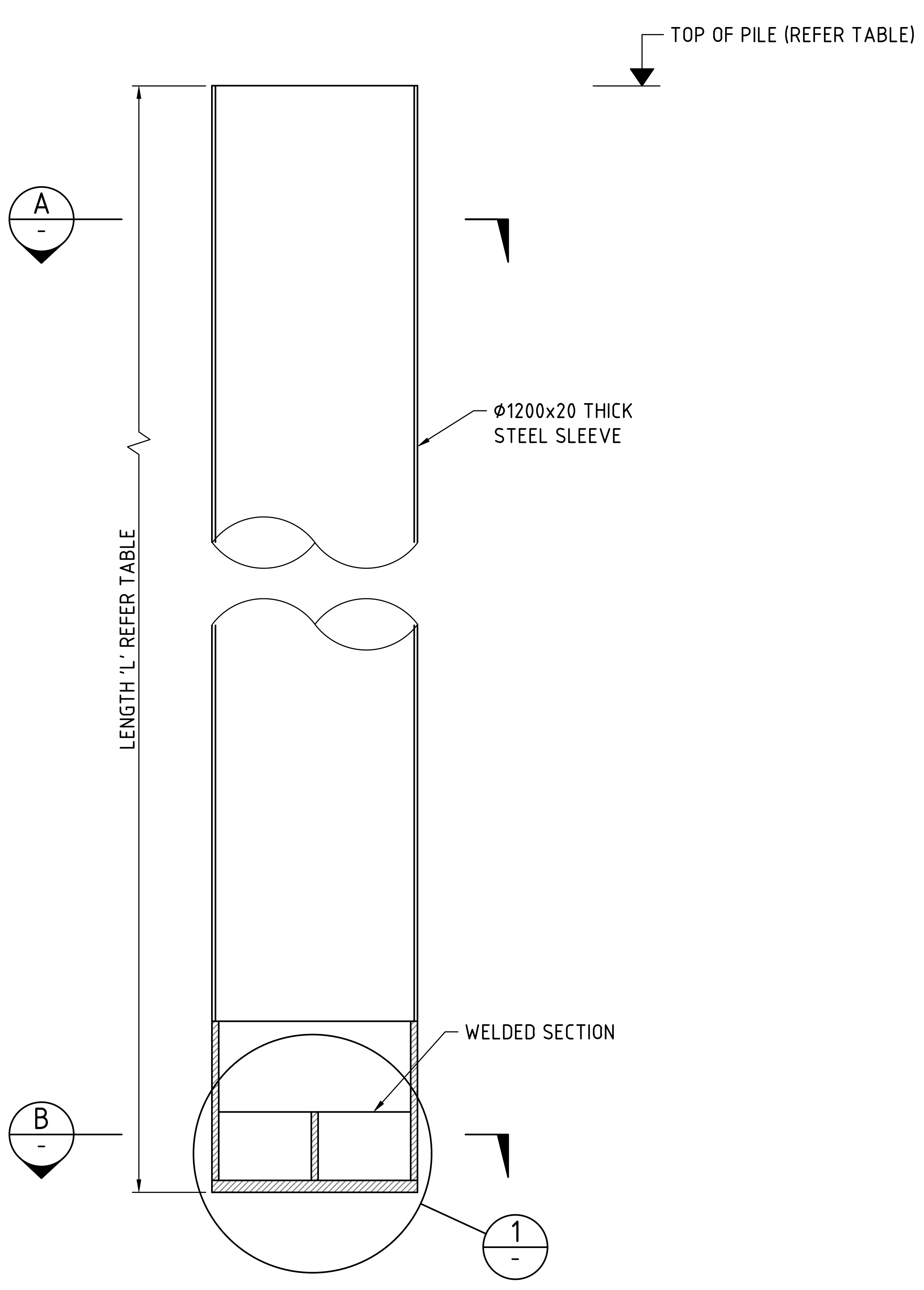
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
KEY PLAN

SHEET A1

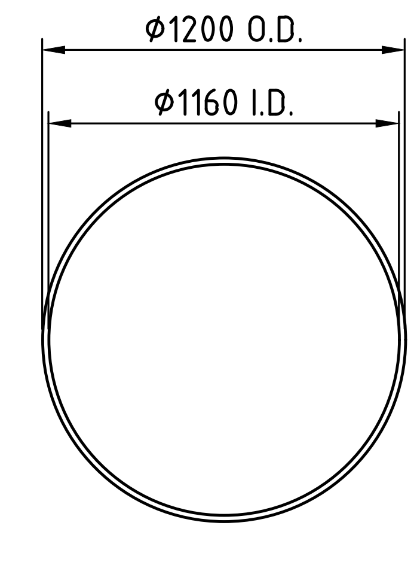
DRAWING STATUS 15%

DRAWING No. C301-CLA-0000-ST-SKT-00010

REV A



TYPICAL STEEL TUBE PILE
1:25



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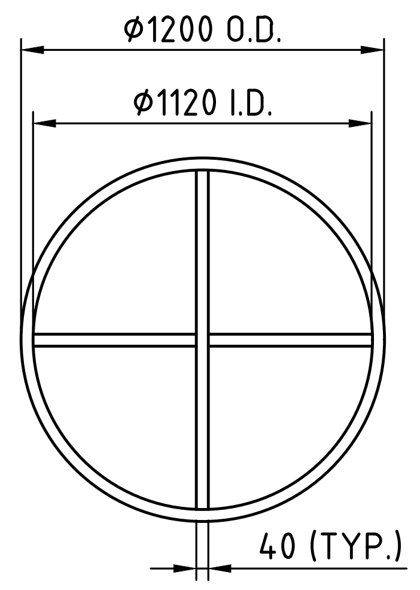

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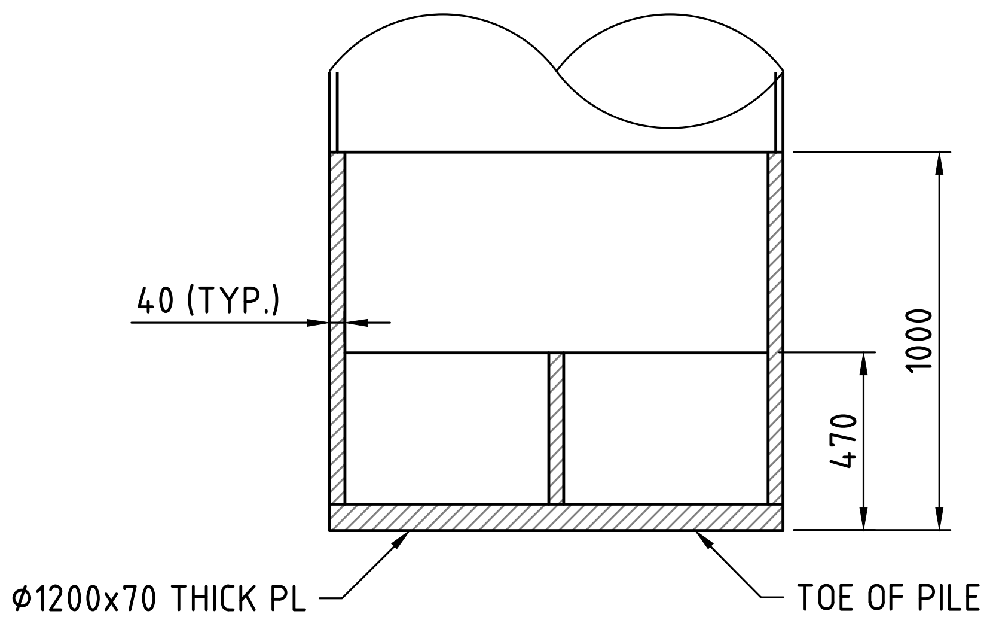


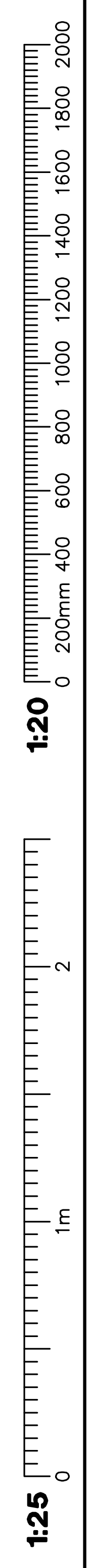
DETAIL 1 -
1:20

PILE DETAILS

BRIDGE	LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH 'L' (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
MCCALLUM PARK (BRIDGE 9505)	PYLON N° 1	DRIVEN STEEL TUBE PILE	1200	6	0.0	28.5	-	-29.0
	PYLON N° 2	DRIVEN STEEL TUBE PILE	1200	6	0.0	25.0	2.0	-23.0
POINT FRASER (BRIDGE 9506)	PYLON N° 1	DRIVEN STEEL TUBE PILE	1200	6	0.0	30.0	-	-38.0

NOTES:

1. REFER DRG. C301-CLA-0000-ST-SKT-20002 FOR GEOTECHNICAL NOTES.



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Plotted By: Burgess, Brent

FOR INFORMATION ONLY

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AMENDMENTS

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DATE OF CAPTURE:
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HEIGHT DATUM: AHD71

wsp
Level 5
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mainroads WESTERN AUSTRALIA
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PROJECT DIRECTOR DATE

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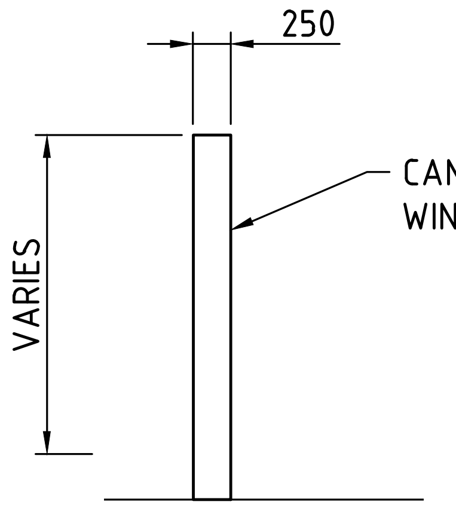
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL PYLON PILE DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-10001
REV: A



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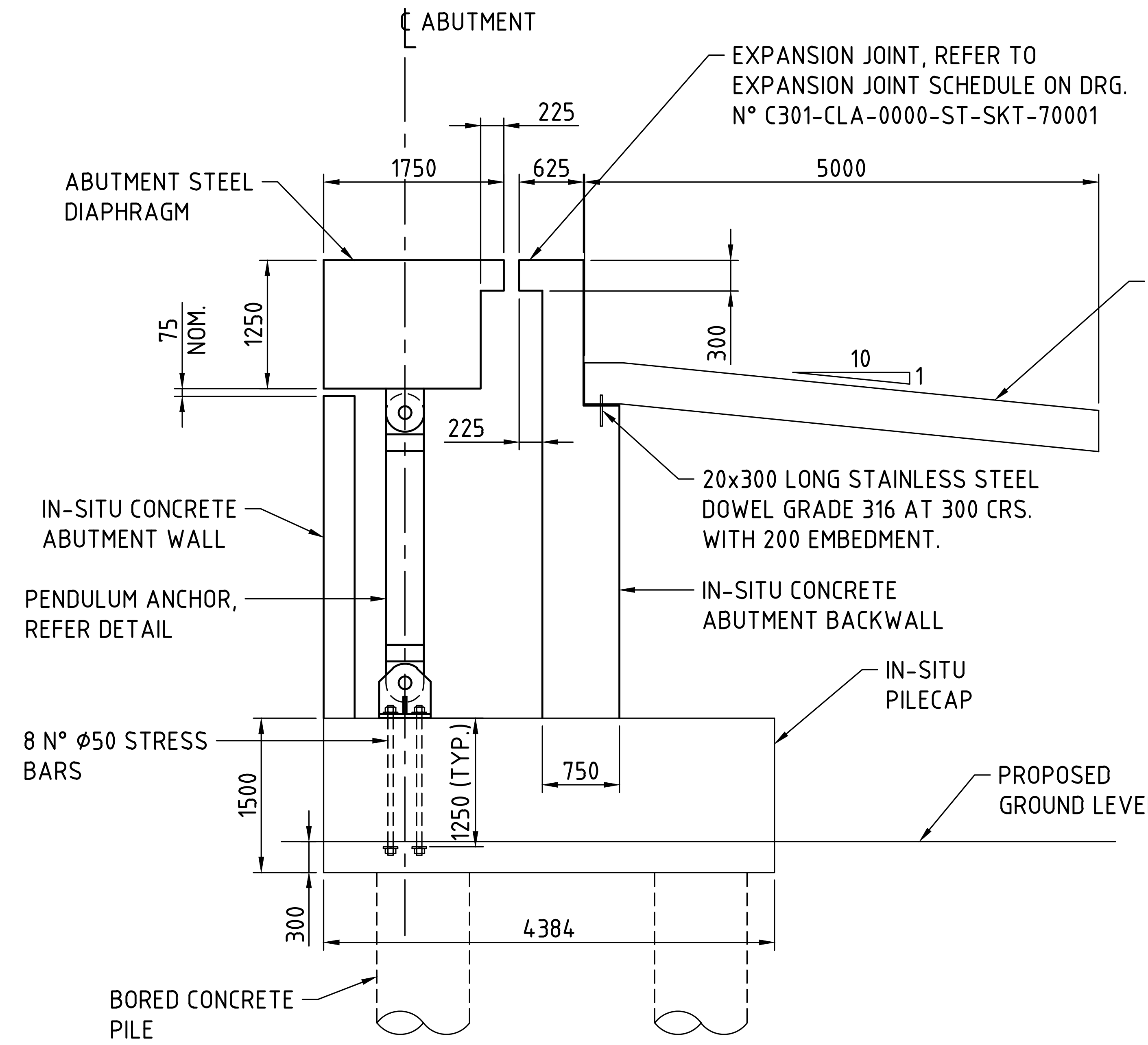

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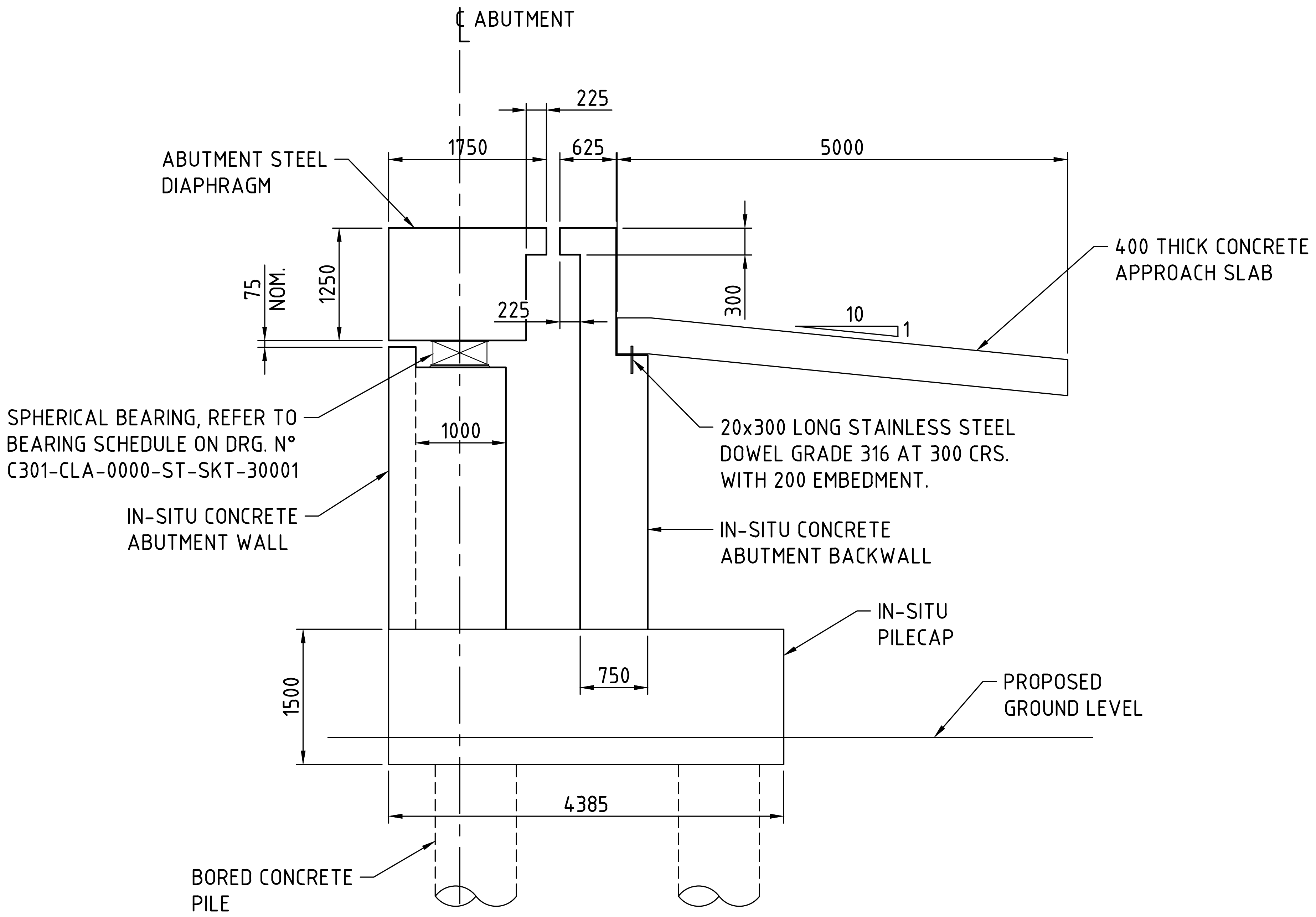

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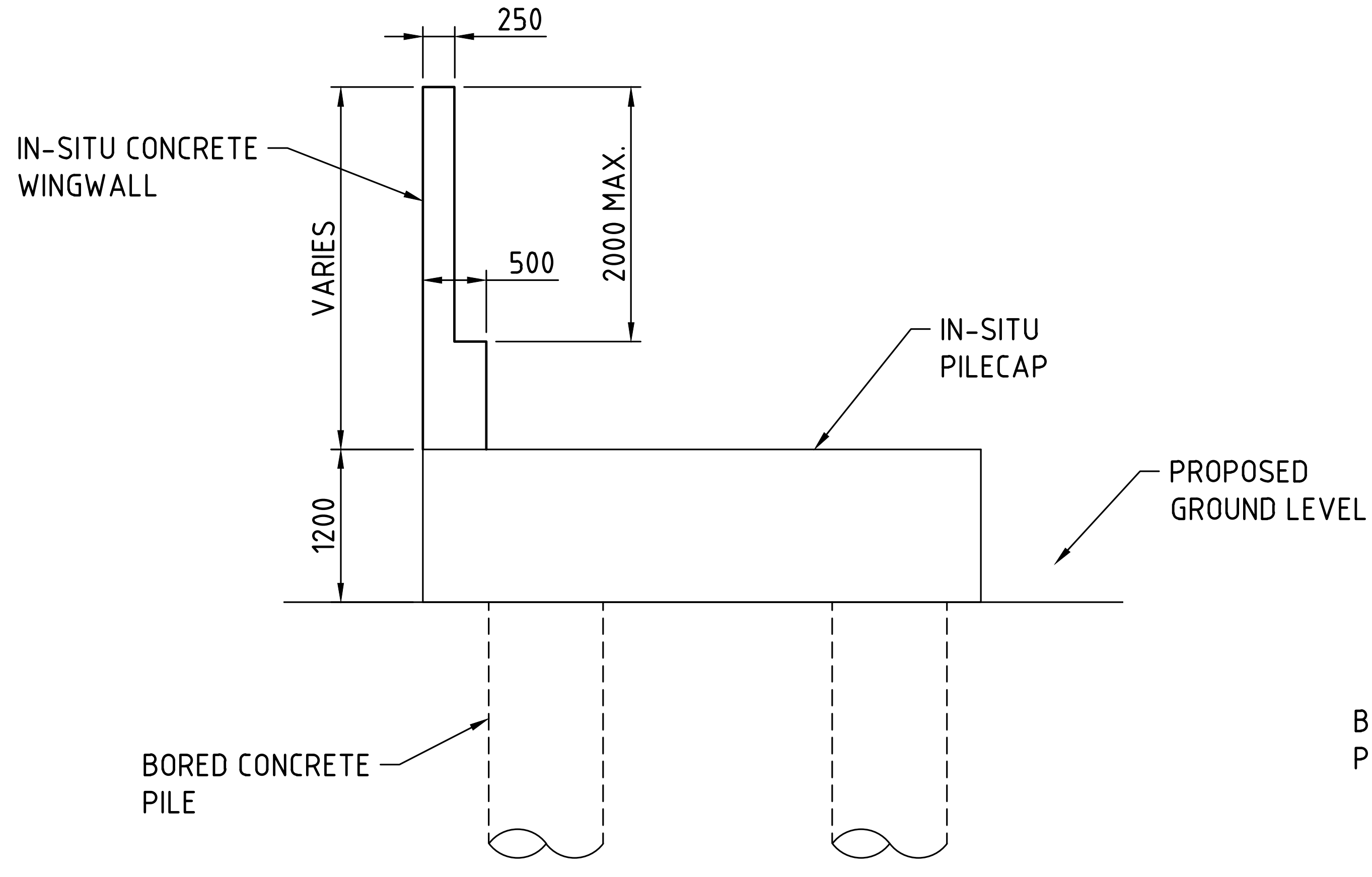

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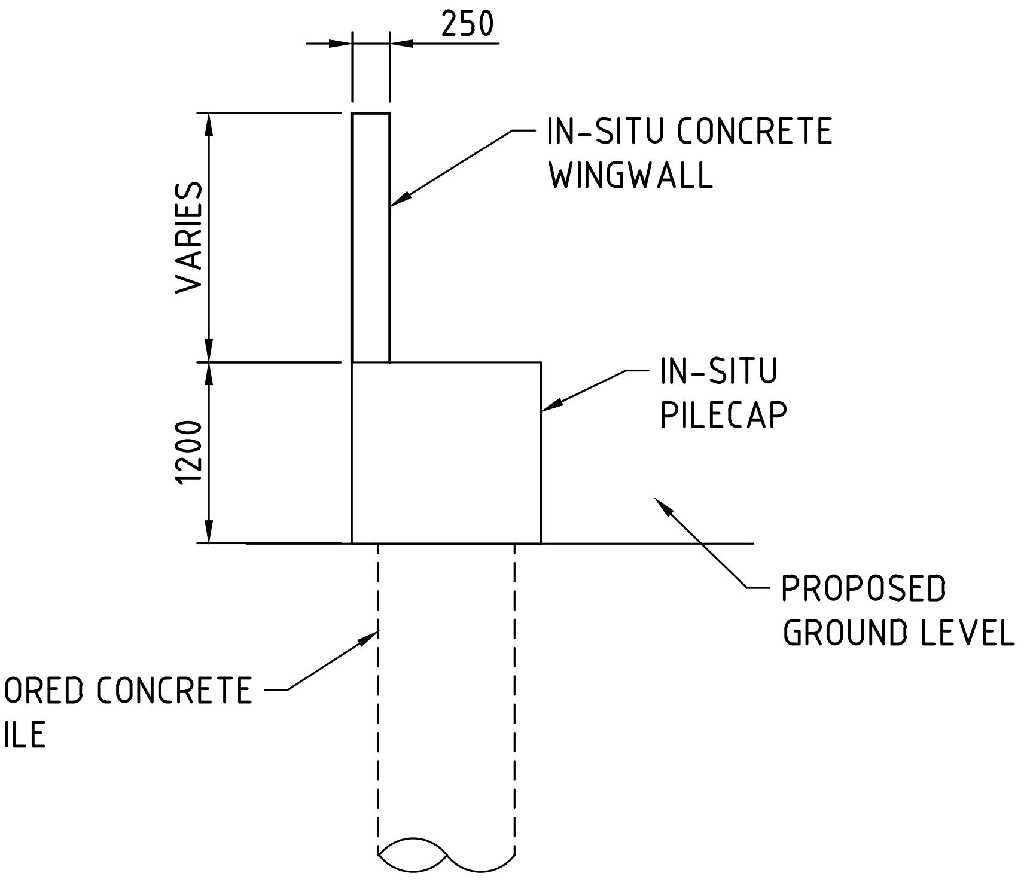

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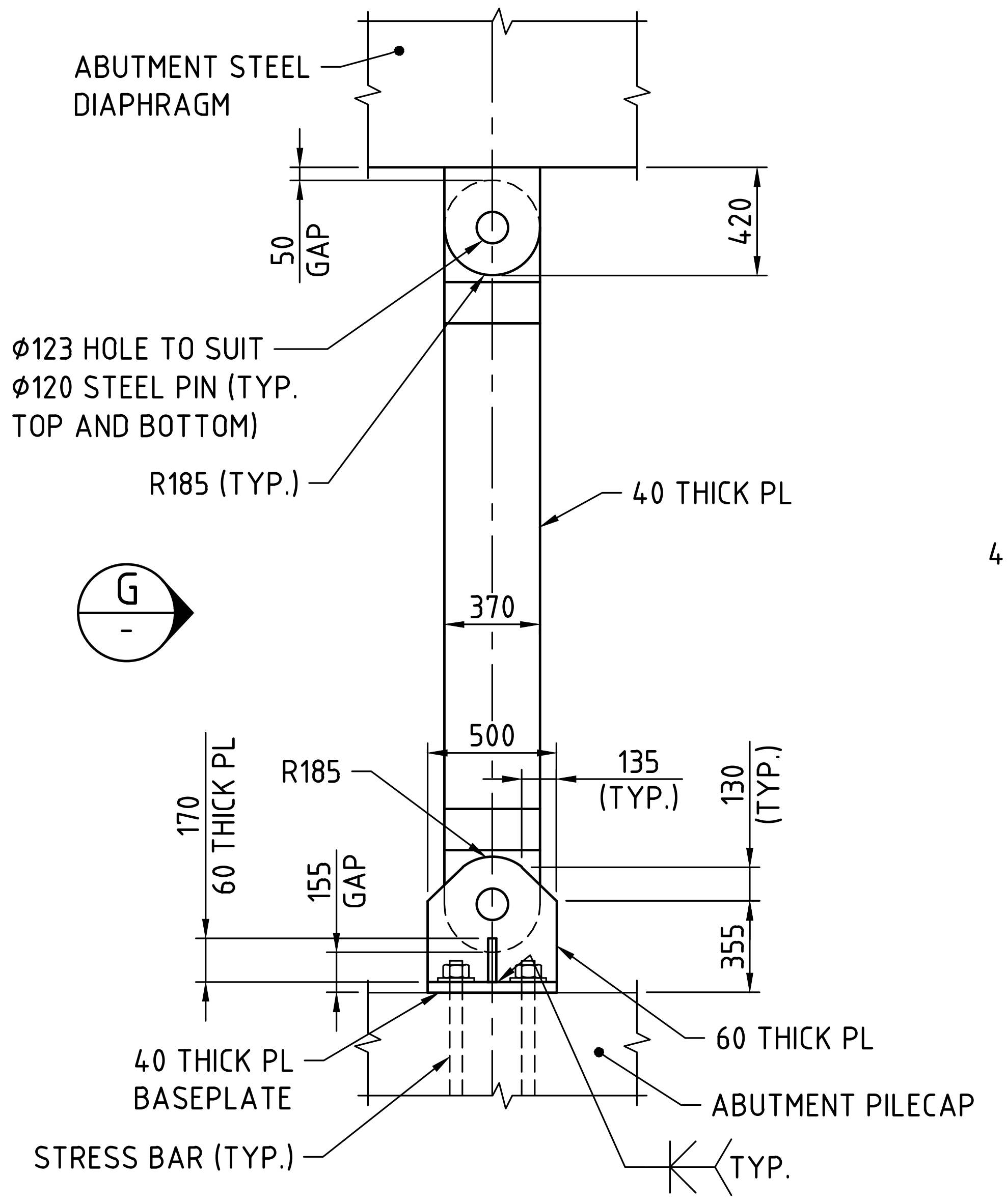

PENDULUM BEARING SECTION
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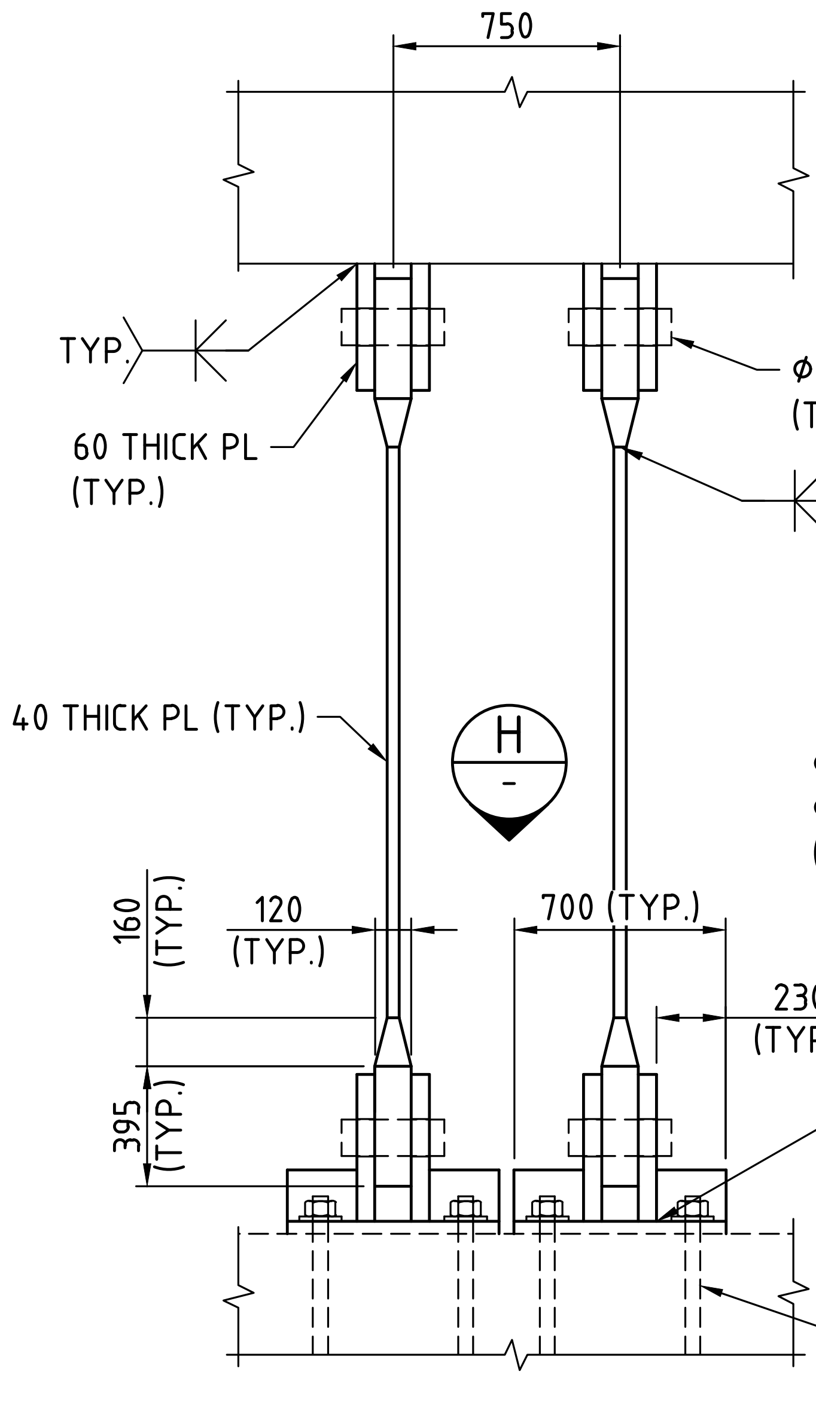
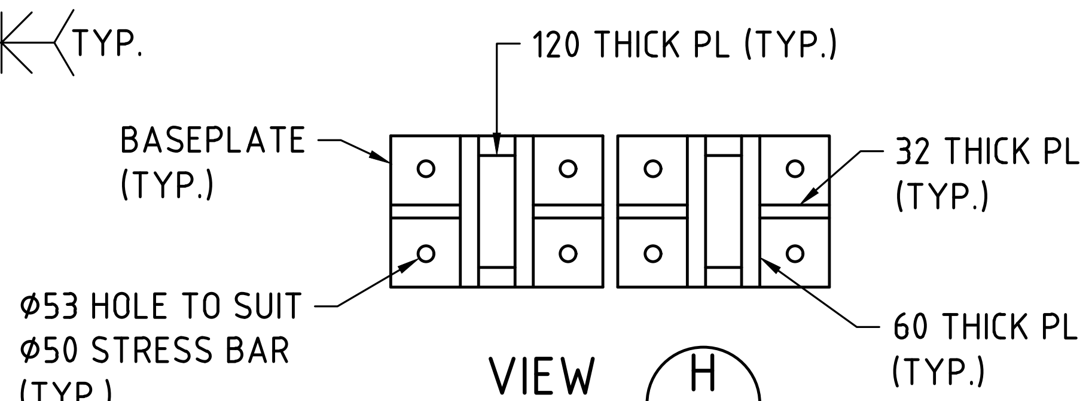


ELEVATION G
1:25



VIEW H
1:25

1:25

1:50

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:37 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-20001.dwg

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HEIGHT DATUM: AHD71

wsp
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VERIFIED
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Causeway Link Alliance

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PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

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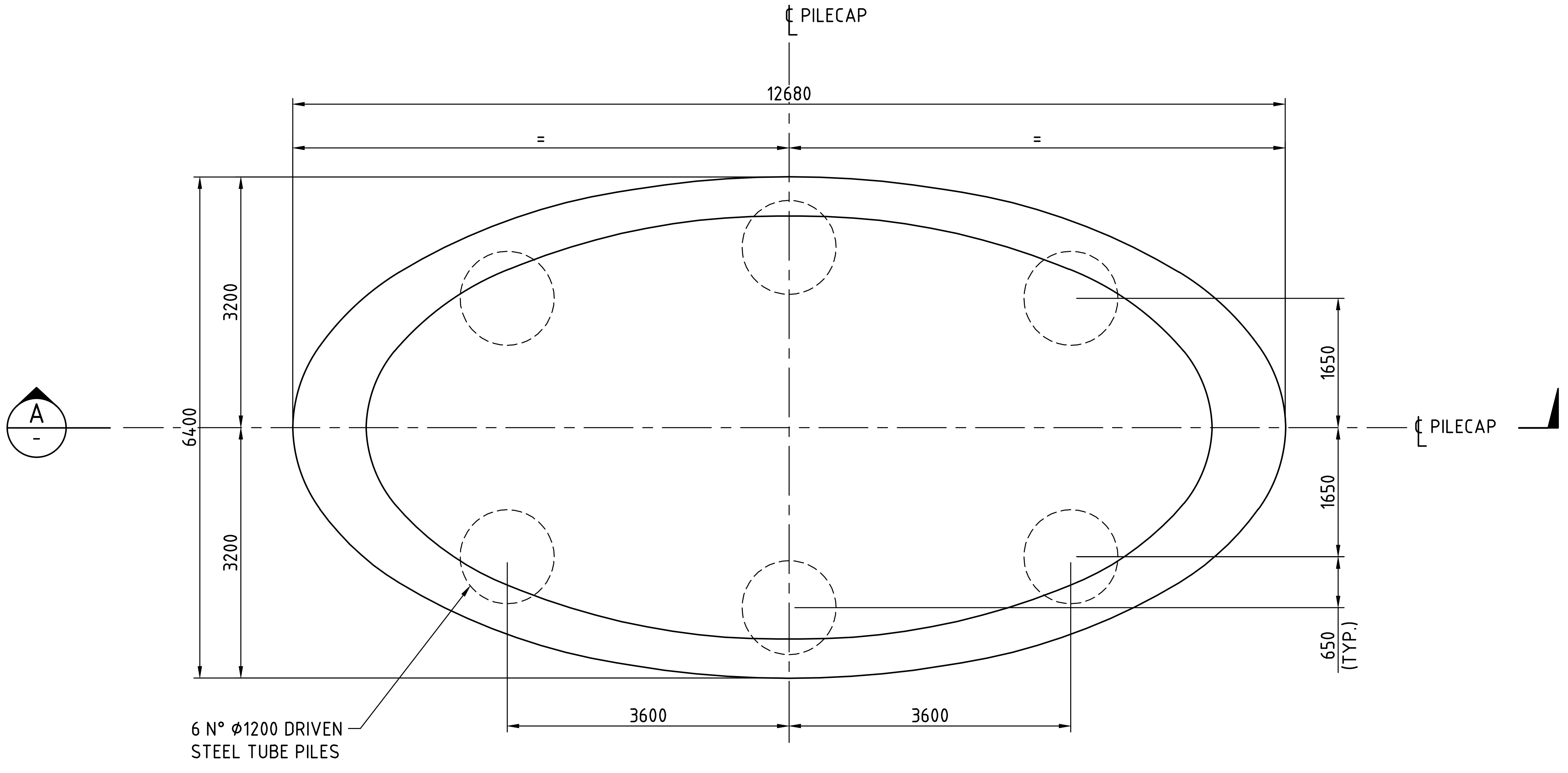
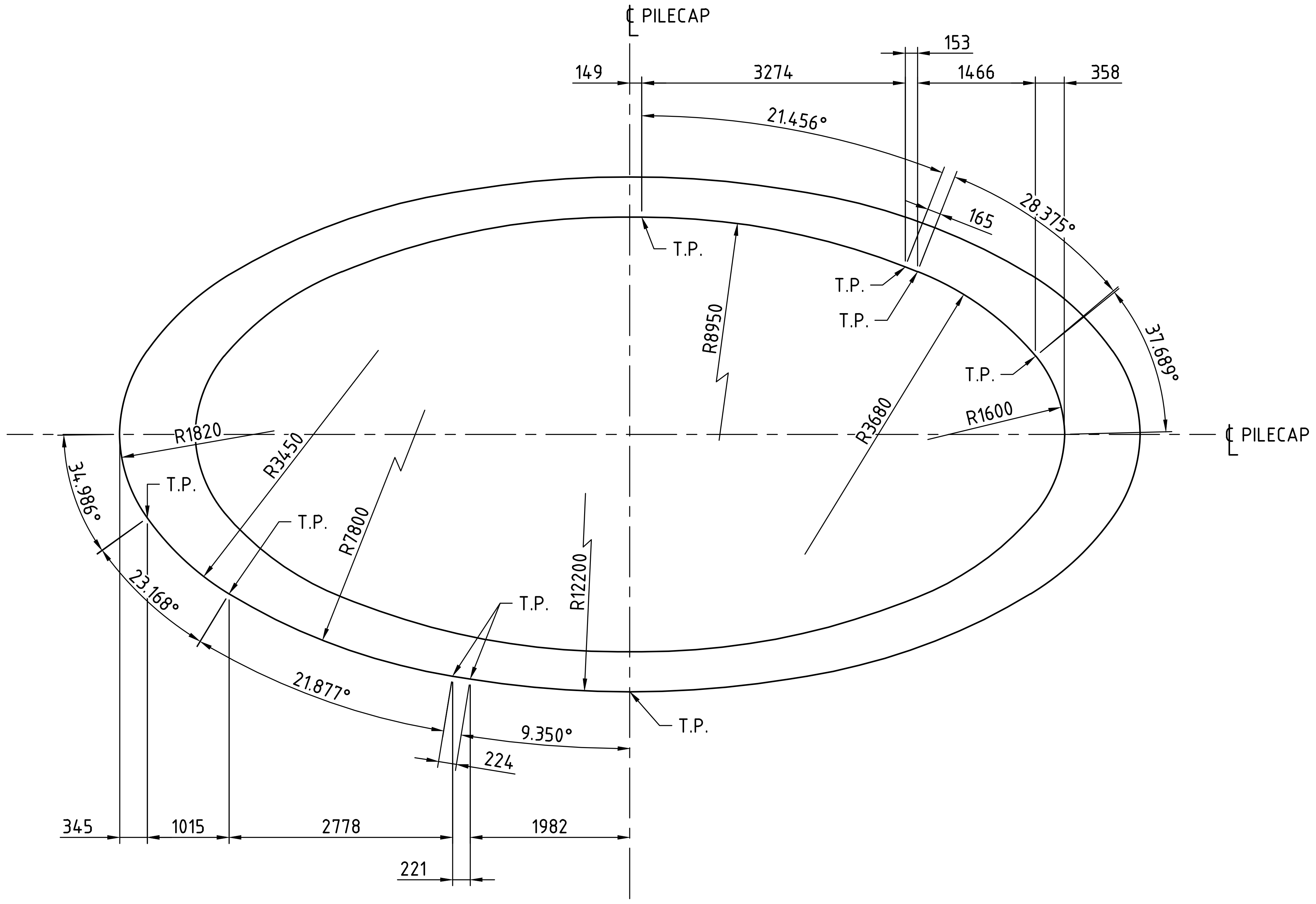
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DETAILS
ABUTMENT SECTIONS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-20001
REV: A



TYPICAL PYLON PILE ARRANGEMENT

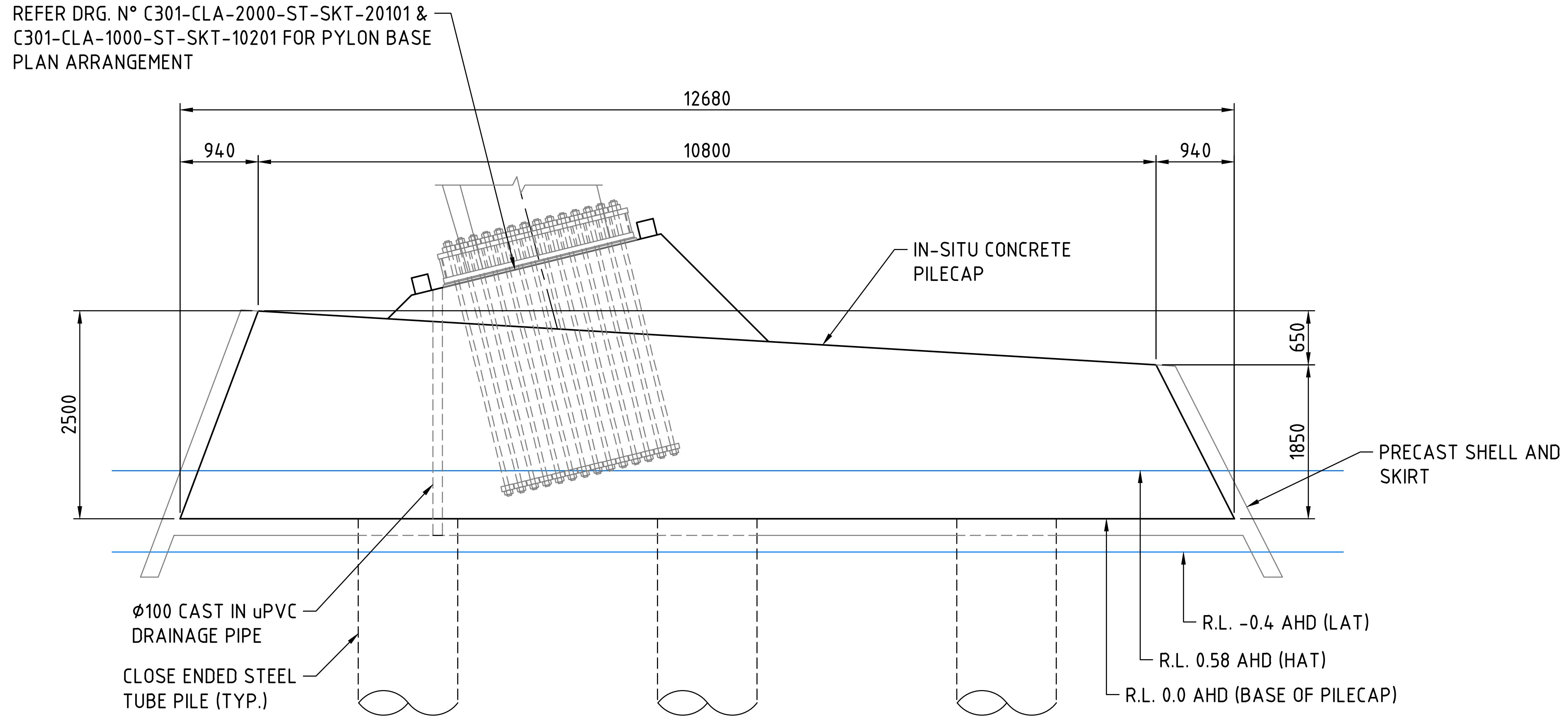
1:50



GEOMETRY CENTRAL ABOUT PILECAP CENTRELINES

TYPICAL PYLON PILECAP

1:25



SECTION A

1:50

GEOTECHNICAL NOTES:

1. GEOTECHNICAL STRENGTH REDUCTION FACTOR WAS ASSESSED ASSUMING THAT A MINIMUM OF 5% OF TOTAL PILES WILL BE SUBJECT TO DYNAMIC PILE LOAD TESTING WITH CAPWAP ANALYSIS FOR BOTH DRIVEN AND BORED PILE OPTIONS.
2. GEOTECHNICAL STRENGTH REDUCTION FACTOR OF 0.72 WAS APPLIED TO THE DRIVEN STEEL TUBE PILES TO CALCULATE THE MINIMUM REQUIRED DESIGN GEOTECHNICAL STRENGTH ($R_{D,G}$).
3. GEOTECHNICAL STRENGTH REDUCTION FACTOR OF 0.69 WAS APPLIED TO THE BORED PILES TO CALCULATE THE MINIMUM REQUIRED DESIGN GEOTECHNICAL STRENGTH ($R_{D,G}$).
4. FOR DRIVEN STEEL TUBE PILES, A DRIVING RECORD OF BLOWS/250 MM, HAMMER STROKE AND THE TIME FOR THE FULL DRIVING OF ALL PILES SHALL BE MADE BY THE CONTRACTOR AND PROVIDED AT THE END OF DRIVE OF EACH PILE.
5. AN EXPERIENCED GEOTECHNICAL ENGINEER SHALL WITNESS THE END OF DRIVING AND THE PDA TESTING.
6. END OF DRIVE (EOD) TEST AND BEGINNING OF RESTRIKE TEST (IF APPLICABLE) SHALL BE PERFORMED ON THE 1ST INSTALLED PILE AT EACH PYLON TO ASSESS PILE CAPACITY AND DETERMINE THE APPROPRIATE SET CRITERIA TO ACHIEVE LONG TERM CAPACITY. BASED ON THE DRIVING BEHAVIOUR AND PDA/CAPWAP TESTING OF THE FIRST DRIVEN PILE, GOLDER IN CONJUNCTION WITH THE PILING CONTRACTOR SHALL ASSESS TARGET END OF DRIVE SET CRITERIA FOR THE OTHER PILES IN EACH GROUP.
7. VISUAL INSPECTION SHALL BE UNDERTAKEN ON 100% OF STEEL PILES AFTER DRIVING AND PRIOR TO CONCRETING. THIS SHALL INCLUDE DIPPING TO THE PILE TOE TO CHECK FOR WATER AND/OR SOIL INGRESS.
8. SUPERVISION OF CONCRETING WORKS SHALL BE UNDERTAKEN ON 100% OF PILES AND SHALL INCLUDE RECORDING CONCRETE VOLUME PUMPED INTO EACH PILE AND MEASURING THE RATE OF RISE OF THE SURFACE OF THE CONCRETE INSIDE THE PILES. THESE RECORDS SHALL BE USED TO ASSESS ANY ANOMALIES IN THE CONCRETE WORKS.
9. DRIVEABILITY TO BE PERFORMED BY THE PILING CONTRACTOR AND REVIEWED BY GEOTECHNICAL DESIGN ENGINEER.

1:50

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wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

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DRAWING PATH

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Causeway Link Alliance
CONTRACT MANAGER DATE
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PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL PYLON PILECAP DETAILS
SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-0000-ST-SKT-20002
REV A

Plotted By: Burgess, Brent
Plot Date: 22/07/2022 8:37 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-20002.dwg

BEARING SCHEDULE

			ULS								SLS					
BRIDGE	LOCATION	BEARING TYPE	BEARING (kN) COMPRESSION	BEARING (kN) TENSION	BEARING TRANSVERSE (kN)	BEARING LONGITUDINAL (kN)	LONGITUDINAL MOVEMENT (TOWARDS PYLON) (mm)	LONGITUDINAL MOVEMENT (AWAY PYLON) (mm)	ROTATION (RAD)	LONGITUDINAL (EXTREME EVENT) (SHIP IMPACT AND EARTHQUAKE) (mm)	BEARING (kN) COMPRESSION	BEARING (kN) TENSION	BEARING TRANSVERSE (kN)	BEARING LONGITUDINAL (kN)	LONGITUDINAL MOVEMENT (TOWARDS PYLON) (mm)	LONGITUDINAL MOVEMENT (AWAY PYLON) (mm)
POINT FRASER (BRIDGE 9506)	ABUTMENT 1	LONGITUDINAL GUIDED	750	-	300	-	40	25	0.015	+/- 60	500	-	50	-	30	20
		FREE	250	-	-	-	40	25	0.015	+/- 60	100	-	-	-	30	20
	HALVING JOINT	LONGITUDINAL GUIDED	1300	-	550	-	75	45	0.02	+/- 120	1000	-	400	-	50	30
	PIER 3	PIN	-	8700	1200	700	-	-	0.03	-	-	6200	900	400	-	-
		PIN	5150	-	1200	700	-	-	0.03	-	3400	-	900	400	-	-
	PYLON (HORIZONTAL BEARING)	FIXED	1000	1000	3200 (VERTICAL)	1100 (HORIZONTAL)	-	-	0.02	-	350	300	2550 (VERTICAL)	350 (HORIZONTAL)	-	-
	ABUTMENT 2	PENDULUM ANCHOR	-	3050	-	-	60	135	0.05	+/- 140	-	2150	-	-	35	100
		LONGITUDINAL GUIDED	4400	-	1250	-	60	135	0.05	+/- 140	3000	-	750	-	35	100
MCCALLUM PARK (BRIDGE 9505)	ABUTMENT 1	PENDULUM ANCHOR	-	6650	-	-	90	60	0.05	+/- 110	-	4450	-	-	40	30
		LONGITUDINAL GUIDED	4100	-	1950	-	90	60	0.05	+/- 110	2500	-	1350	-	40	30
	PYLON 1 (HORIZONTAL BEARING)	FIXED	1950	600	6350 (VERTICAL)	4450 (HORIZONTAL)	-	-	0.02	-	1550	300	4750 (VERTICAL)	2650 (HORIZONTAL)	-	-
	PYLON 2 (HORIZONTAL BEARING)	FIXED	1950	600	6350 (VERTICAL)	4450 (HORIZONTAL)	-	-	0.02	-	1550	300	4750 (VERTICAL)	2650 (HORIZONTAL)	-	-
	ABUTMENT 2	PENDULUM ANCHOR	-	6650	-	-	90	60	0.05	+/- 110	-	4450	-	-	40	30
		LONGITUDINAL GUIDED	4100	-	1950	-	90	60	0.05	+/- 110	2500	-	1350	-	40	30

1:10
0 100mm 200 300 400 500 600 700 800 900 1000

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FOR INFORMATION ONLY

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MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP

MRWA DRAWING NUMBER

PROJECT TITLE
CAUSEWAY LINK ALLIANCE

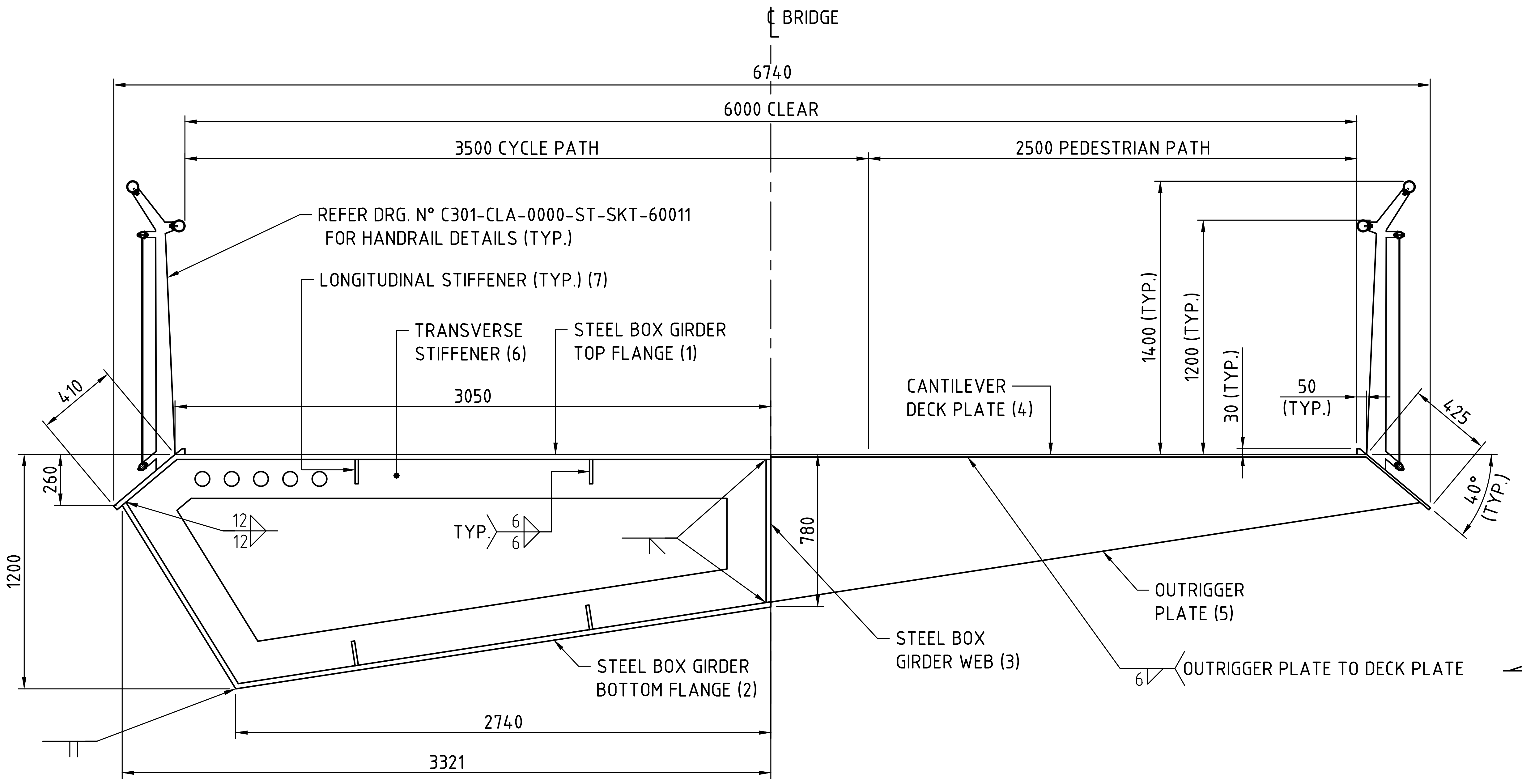
DRAWING TITLE
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
BEARING SCHEDULE

SHEET A1

DRAWING STATUS 15%

DRAWING No. C301-CLA-0000-ST-SKT-30001

REV A



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MEMBER SIZE. REFER DRG. N°
C301-CLA-0000-ST-SKT-40006.

TYPICAL DECK SECTION

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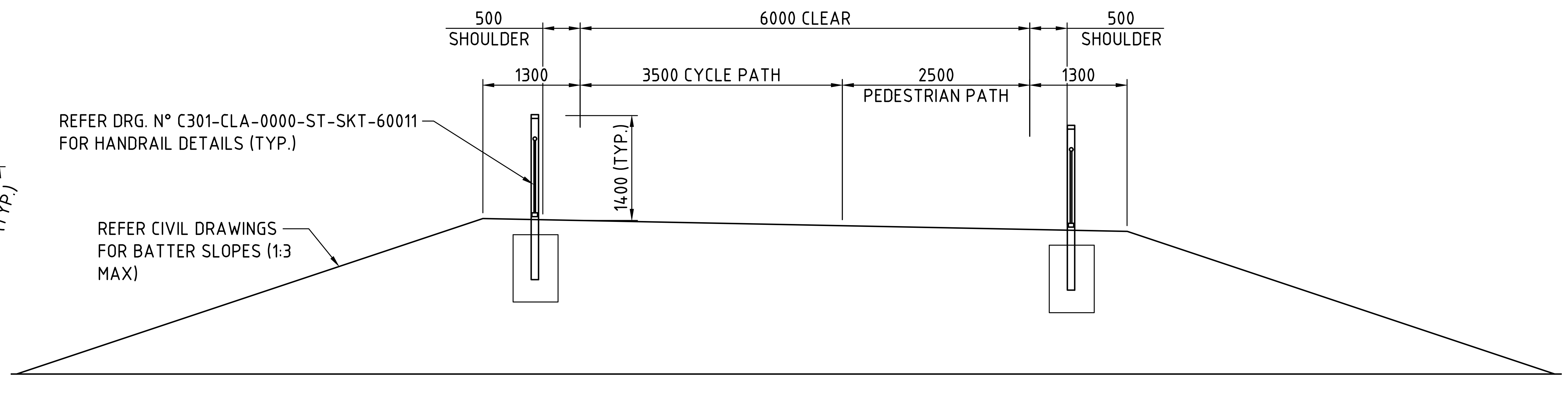

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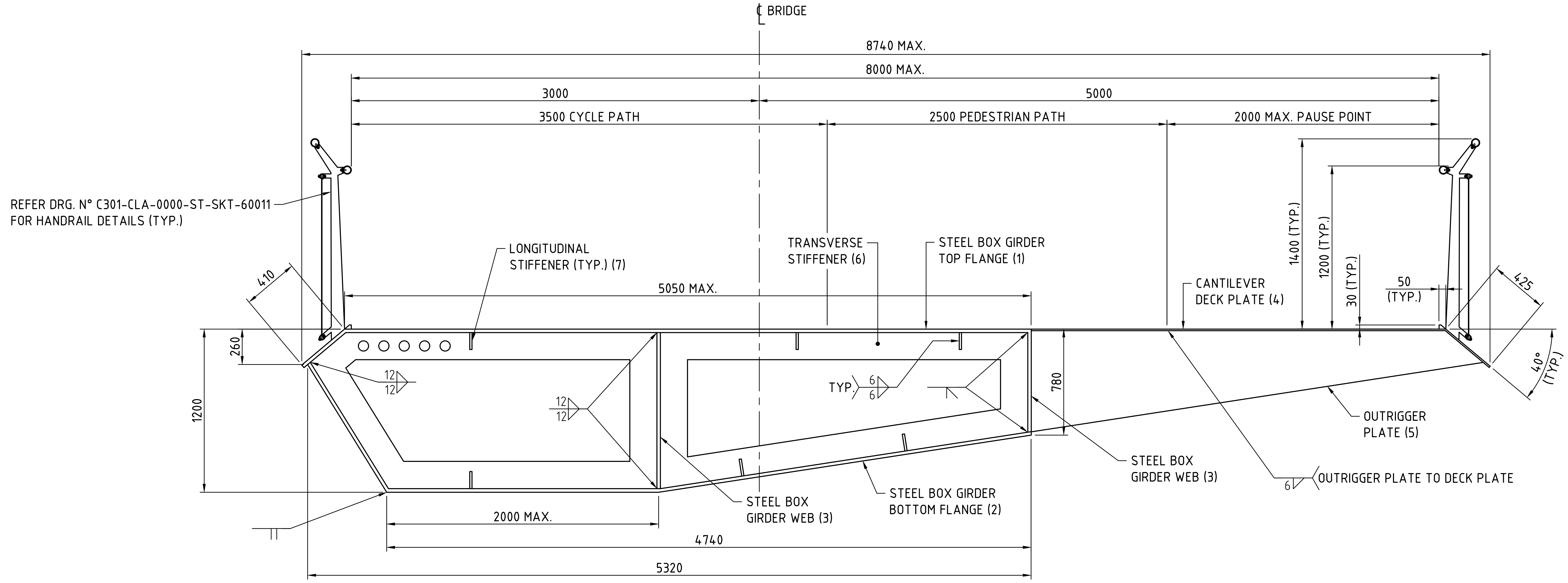

TYPICAL PAUSE POINT DECK SECTION

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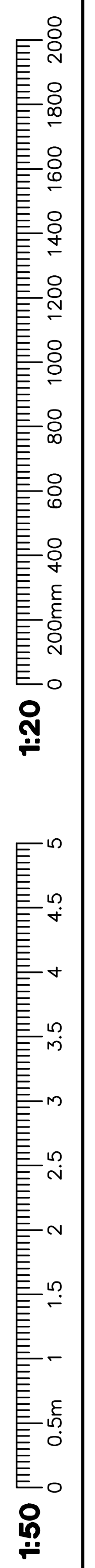

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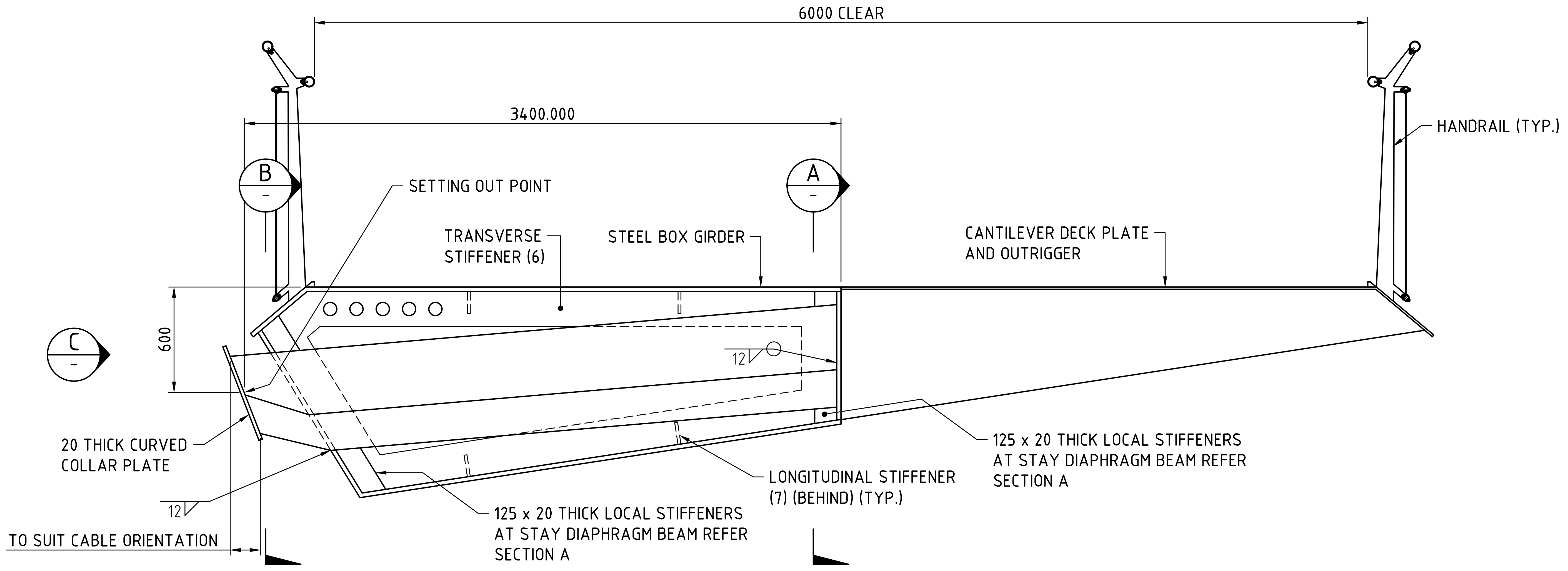
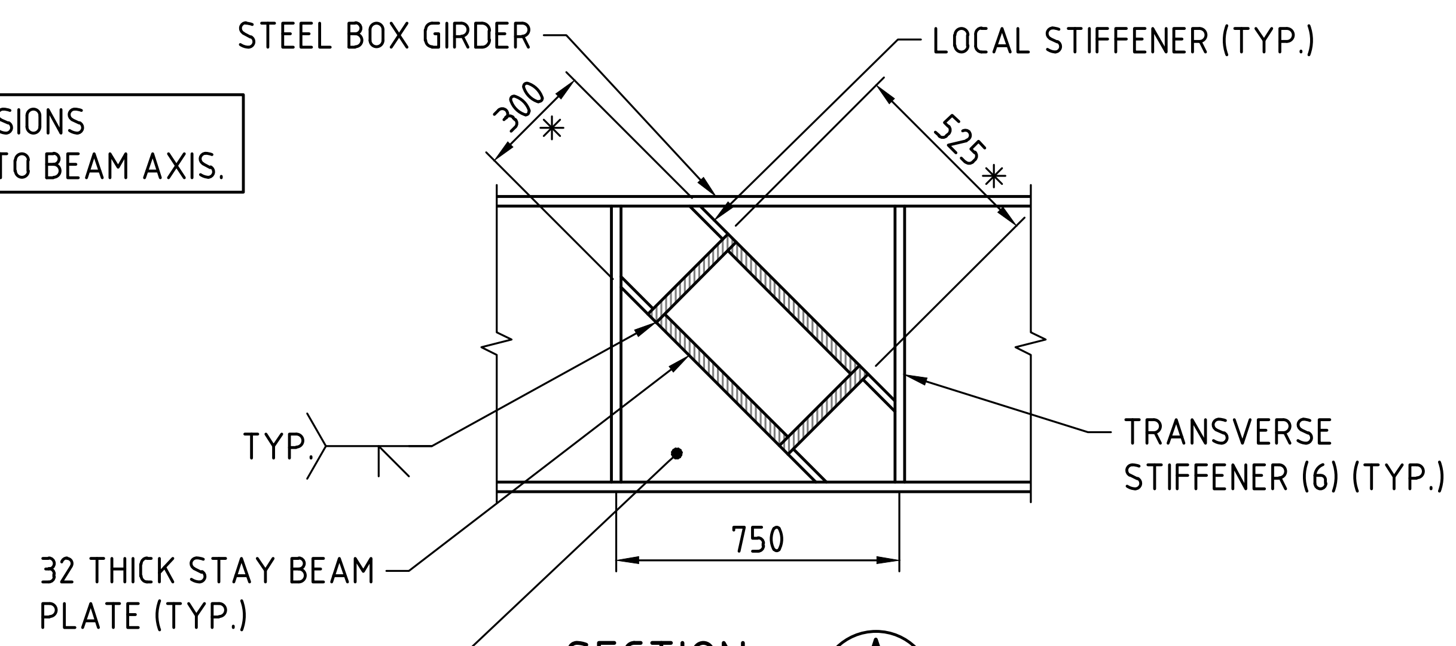
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40001
REV: A



CABLE AND ANCHOR PIPE OMITTED FOR CLARITY

TYPICAL SECTION
1:20

✳ SECTION DIMENSIONS PERPENDICULAR TO BEAM AXIS.



SECTION A
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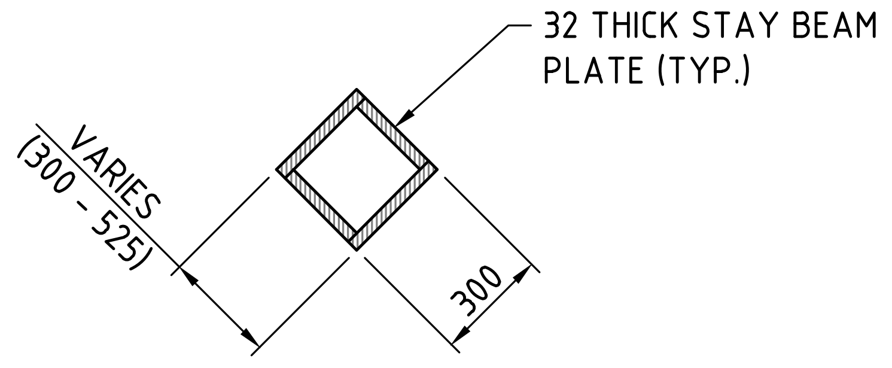

SECTION B
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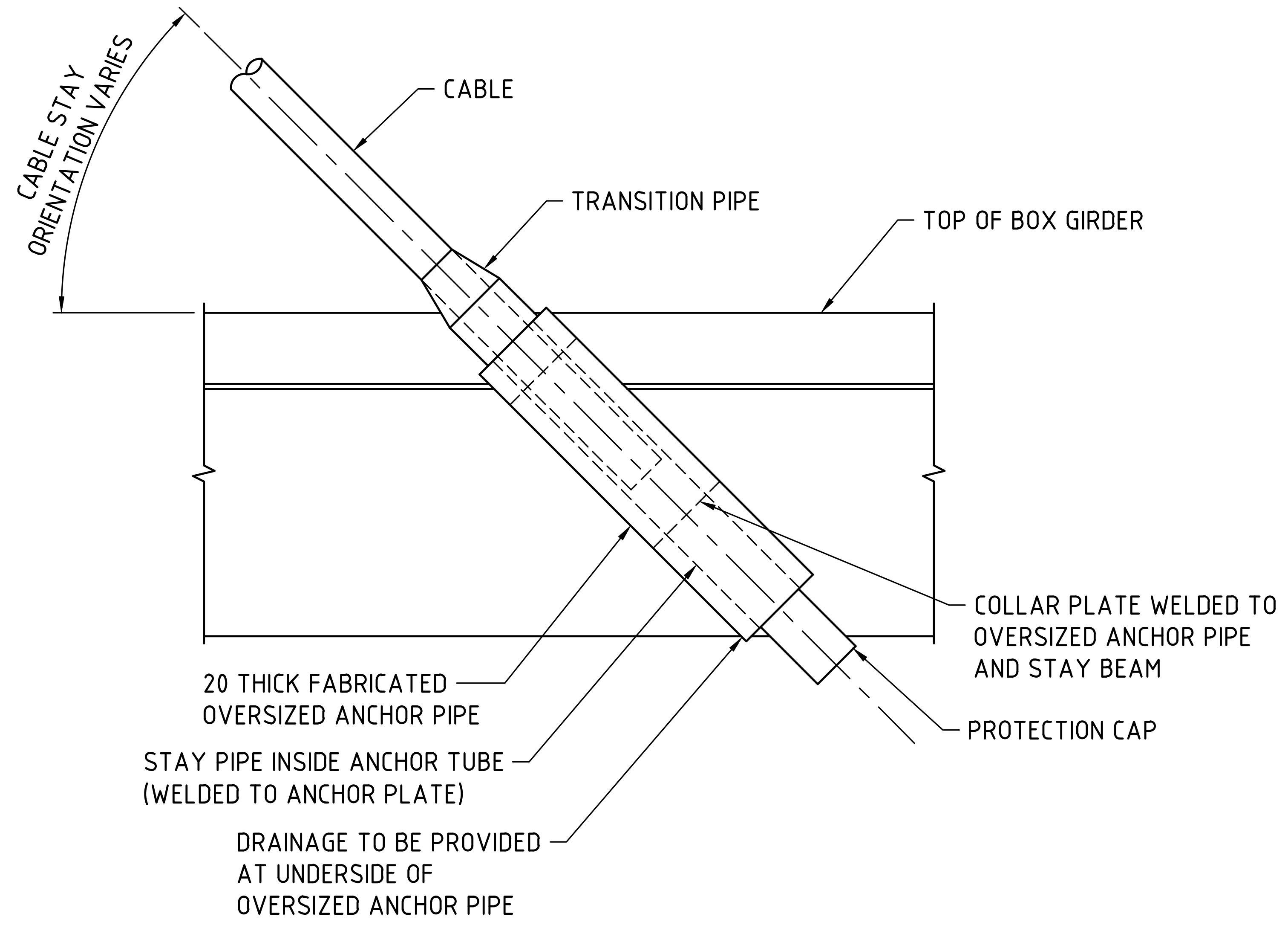

ELEVATION C
1:20

0 200mm 400 600 800 1000 1200 1400 1600 1800 2000
1:20

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MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

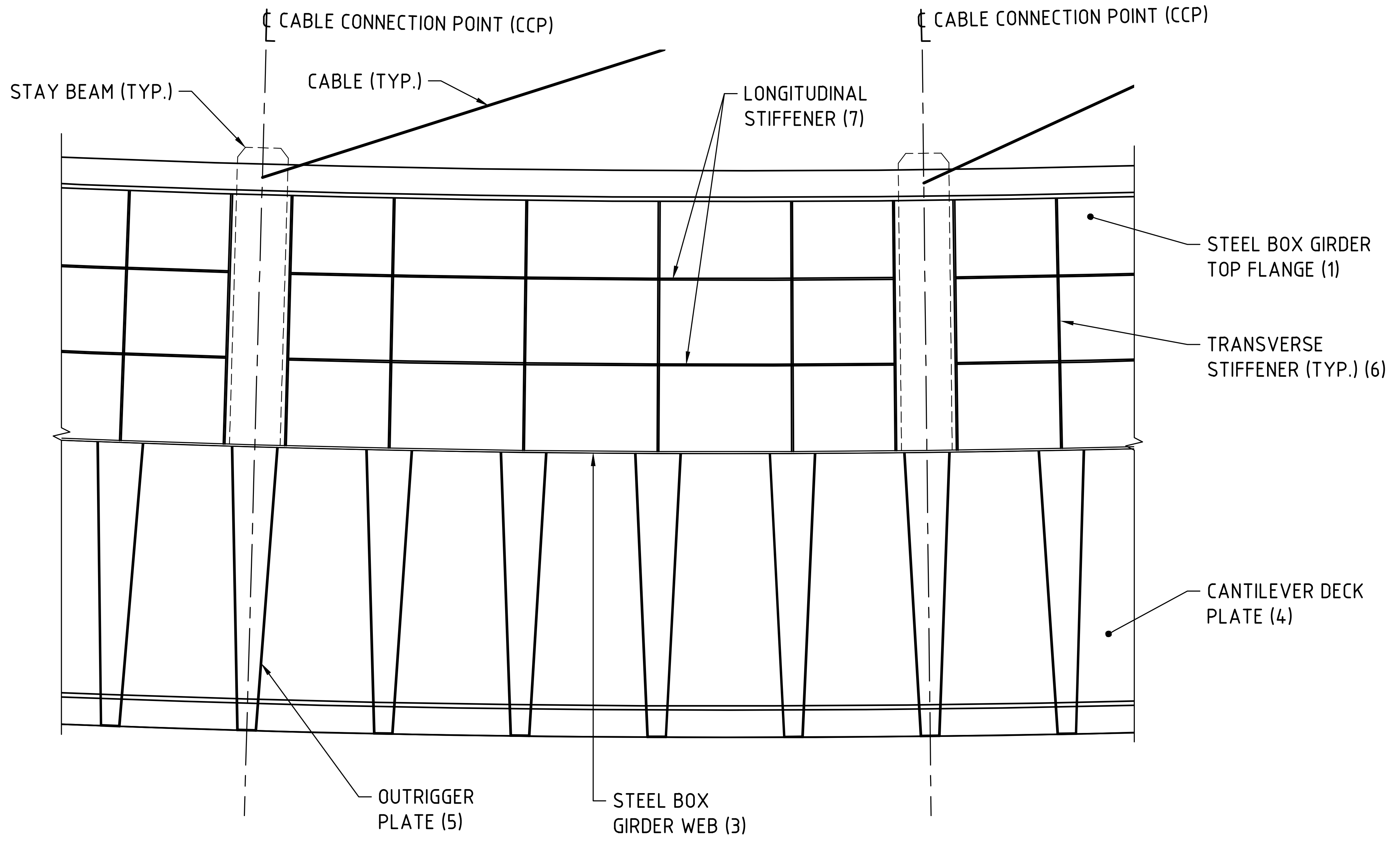
INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

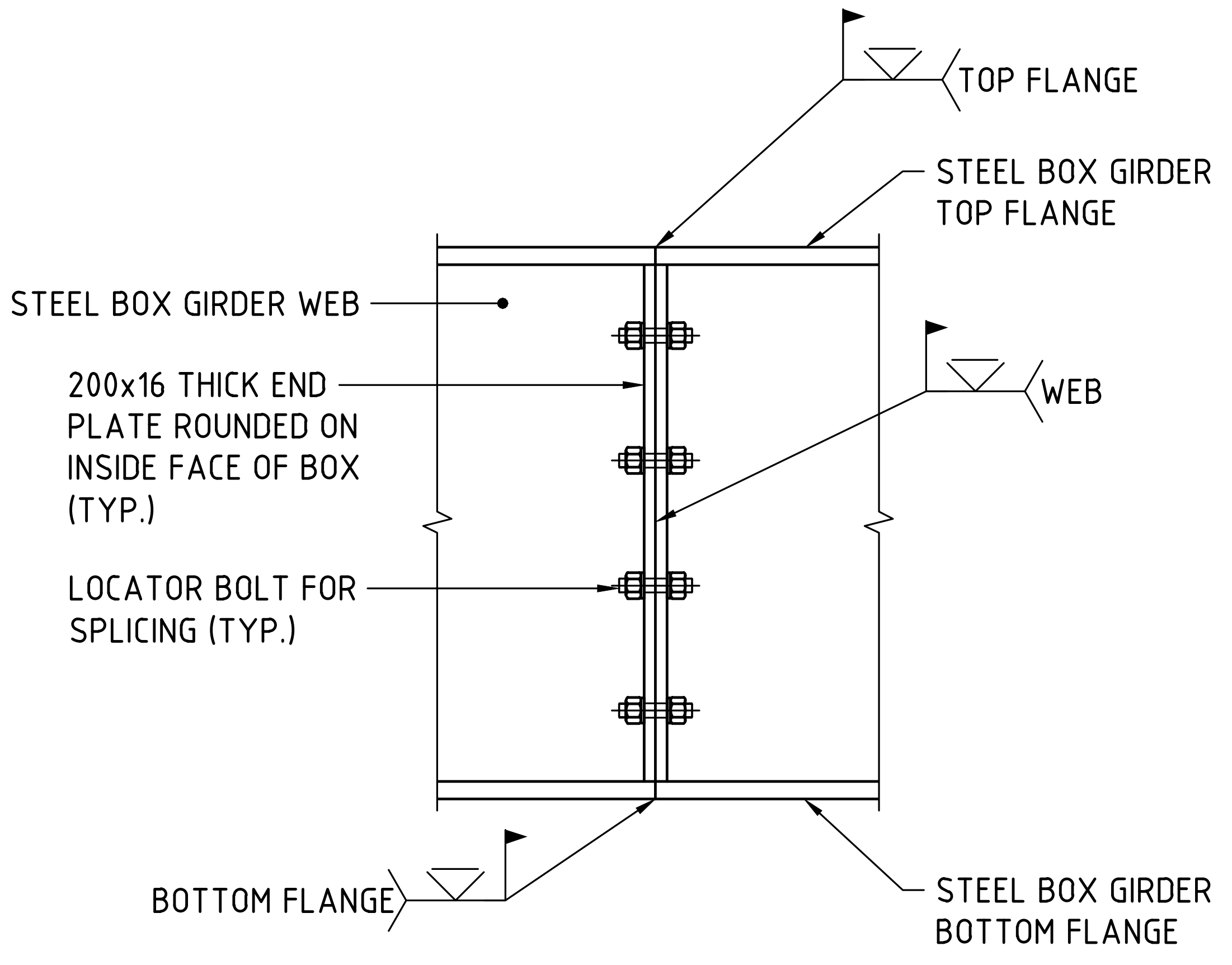
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DETAILS
CABLE TO DECK CONNECTION
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40002
REV: A

NOTES:

1. FOR DECK PLATE THICKNESS REFER DRG N° C301-CLA-0000-ST-SKT-40006.

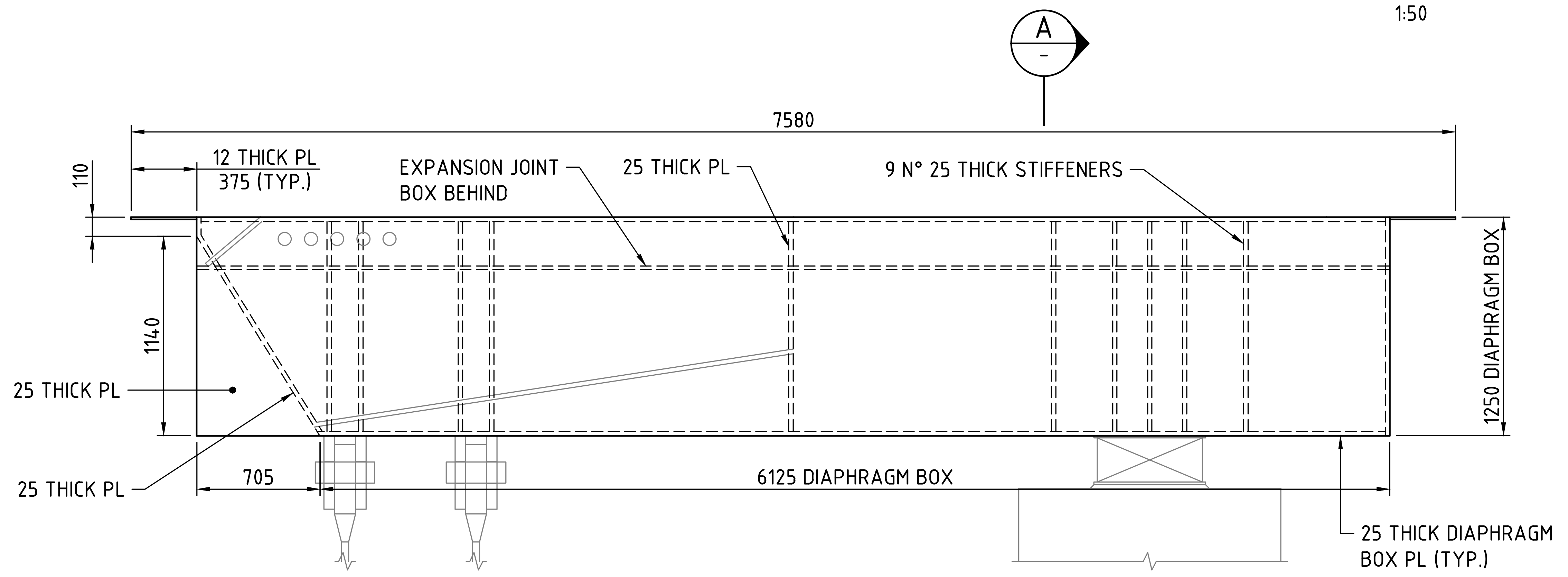


TYPICAL DECK SEGMENT
1:50



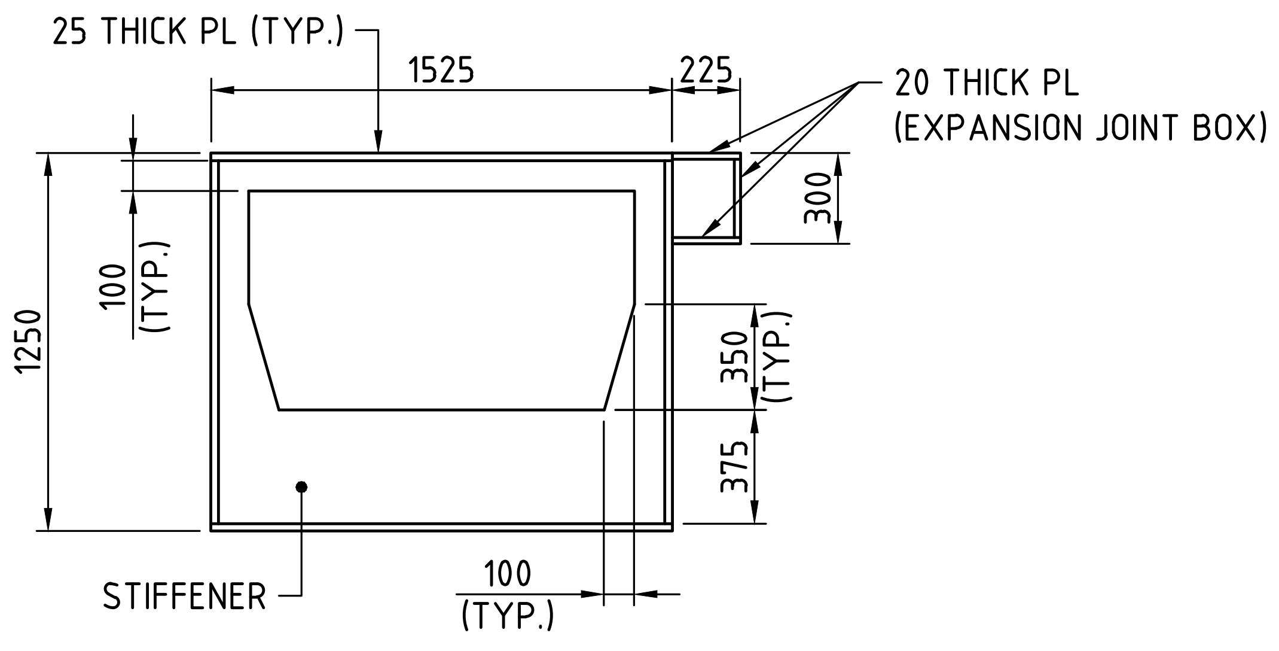
FIELD WELDED JOINT

TYPICAL ELEVATION
1:10



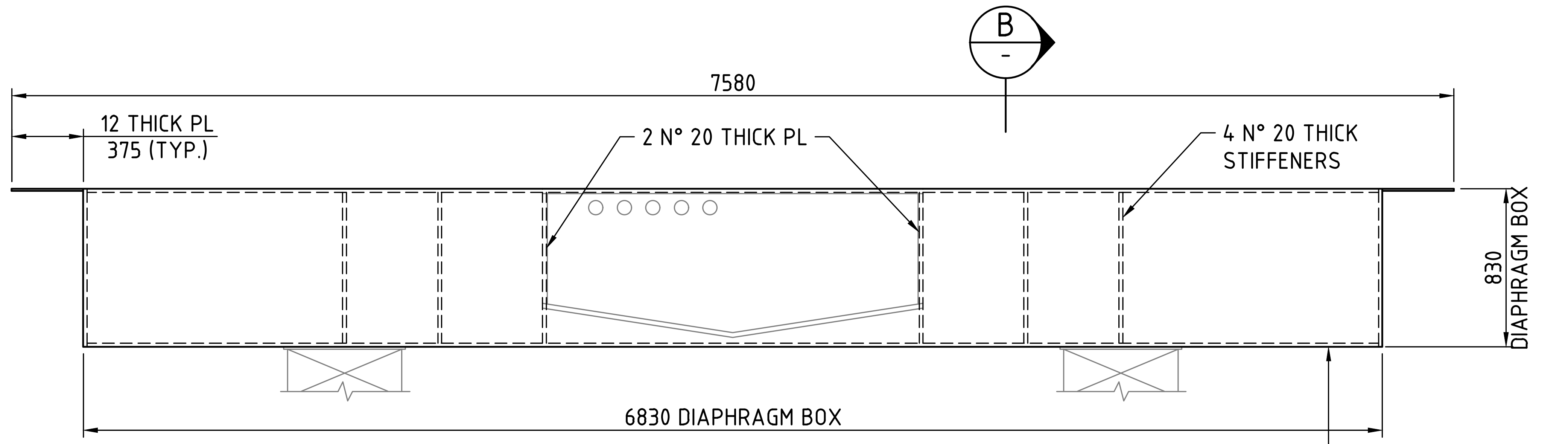
BR9505 ABUTMENT N° 1 - SHOWN
BR9505 & BR9506 ABUTMENT N° 2 - SIMLAR

TYPICAL DIAPHRAGM ELEVATION
1:25



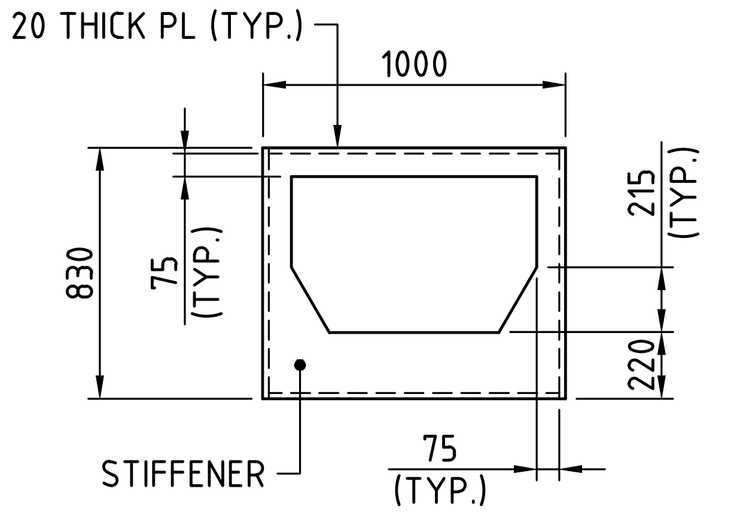
BEARING NOT SHOWN FOR CLARITY

SECTION A -
1:25



BR9506 ABUTMENT N° 1

DIAPHRAGM ELEVATION
1:25



BEARING NOT SHOWN FOR CLARITY

SECTION B -
1:25

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:38 AM Cad File: C:\Users\burgessbr\OneDrive - WSP O365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40003.dwg

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

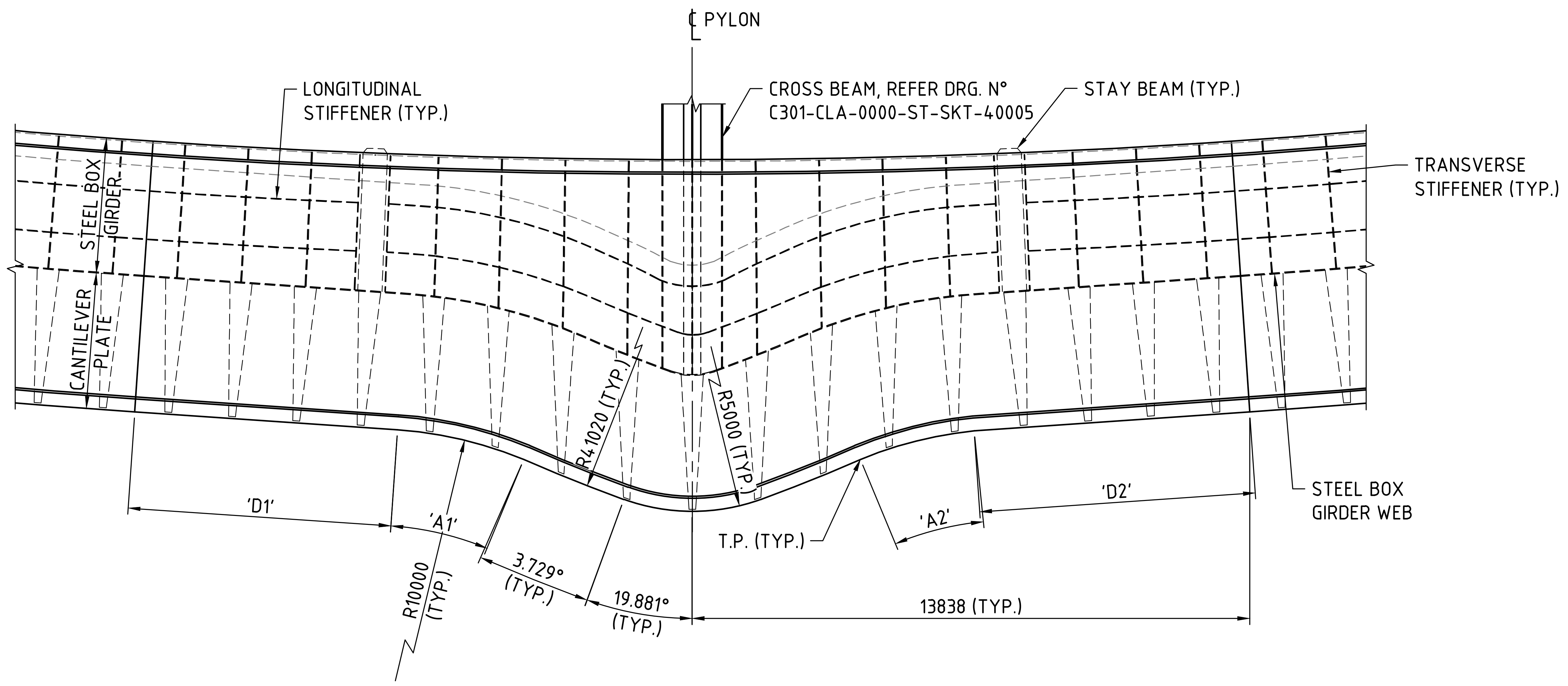
DRAWING PATH

VERIFIER
VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DECK SEGMENT
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40003
REV: A



PLAN
BR9506 PYLON N° 1 - SHOWN
BR9505 PYLON N° 1 - SIMILAR

PAUSE POINT
1:100

	PAUSE POINT INFORMATION			
	A1	A2	D1	D2
BRIDGE 9506	18.535°	16.730°	6359	6854
BRIDGE 9505	16.730°	16.730°	7000	7000

1:100

FOR INFORMATION ONLY

Plot Date: 22/07/2022 8:38 AM   Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40004.dwg

Plotted By: Burgess, Brent

No.	DESCRIPTION	APPROVED & DATE
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AMENDMENTS

METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
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HEIGHT DATUM: AHD71

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DRAWING PATH

VERIFIER
VERIFIED
DATE

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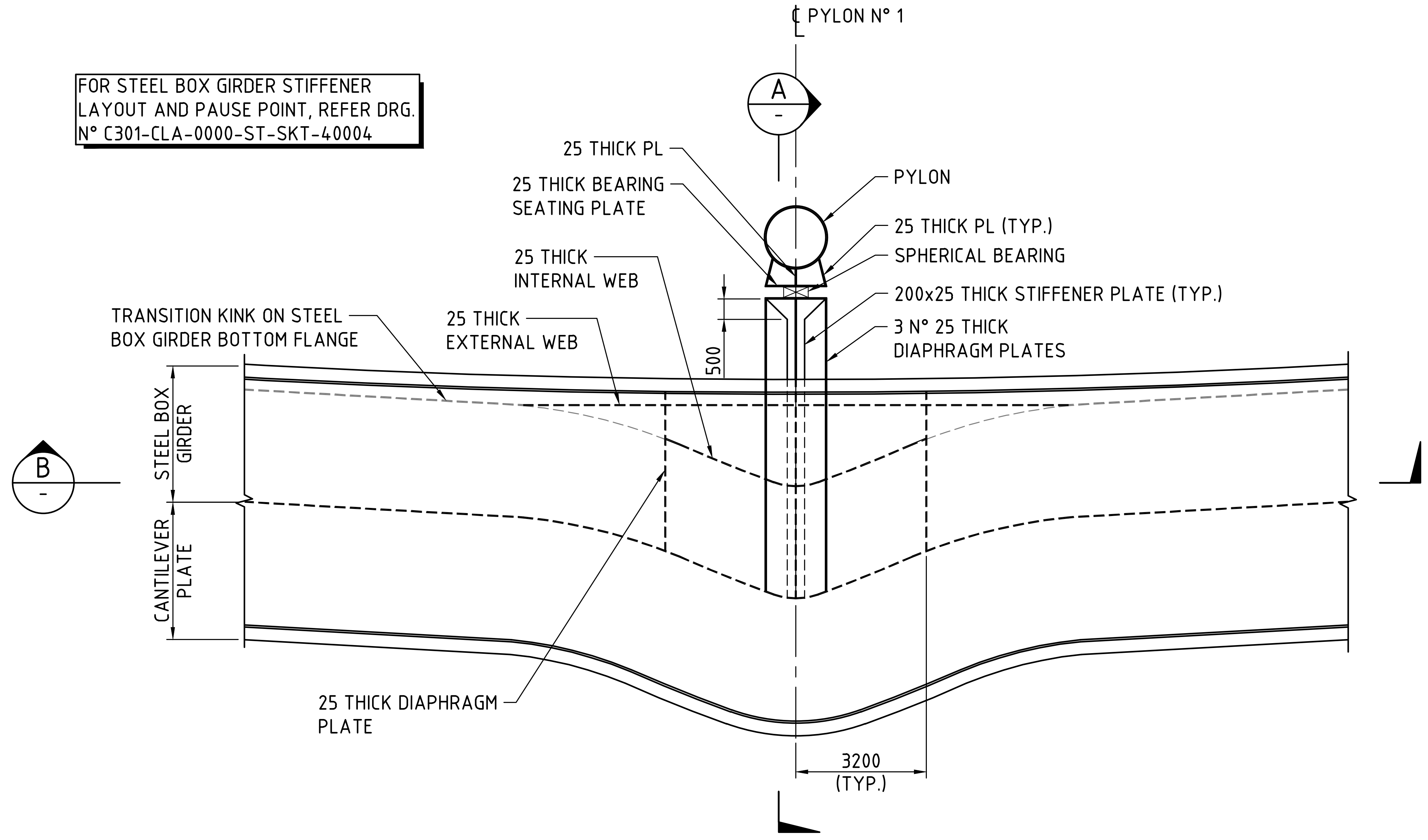
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

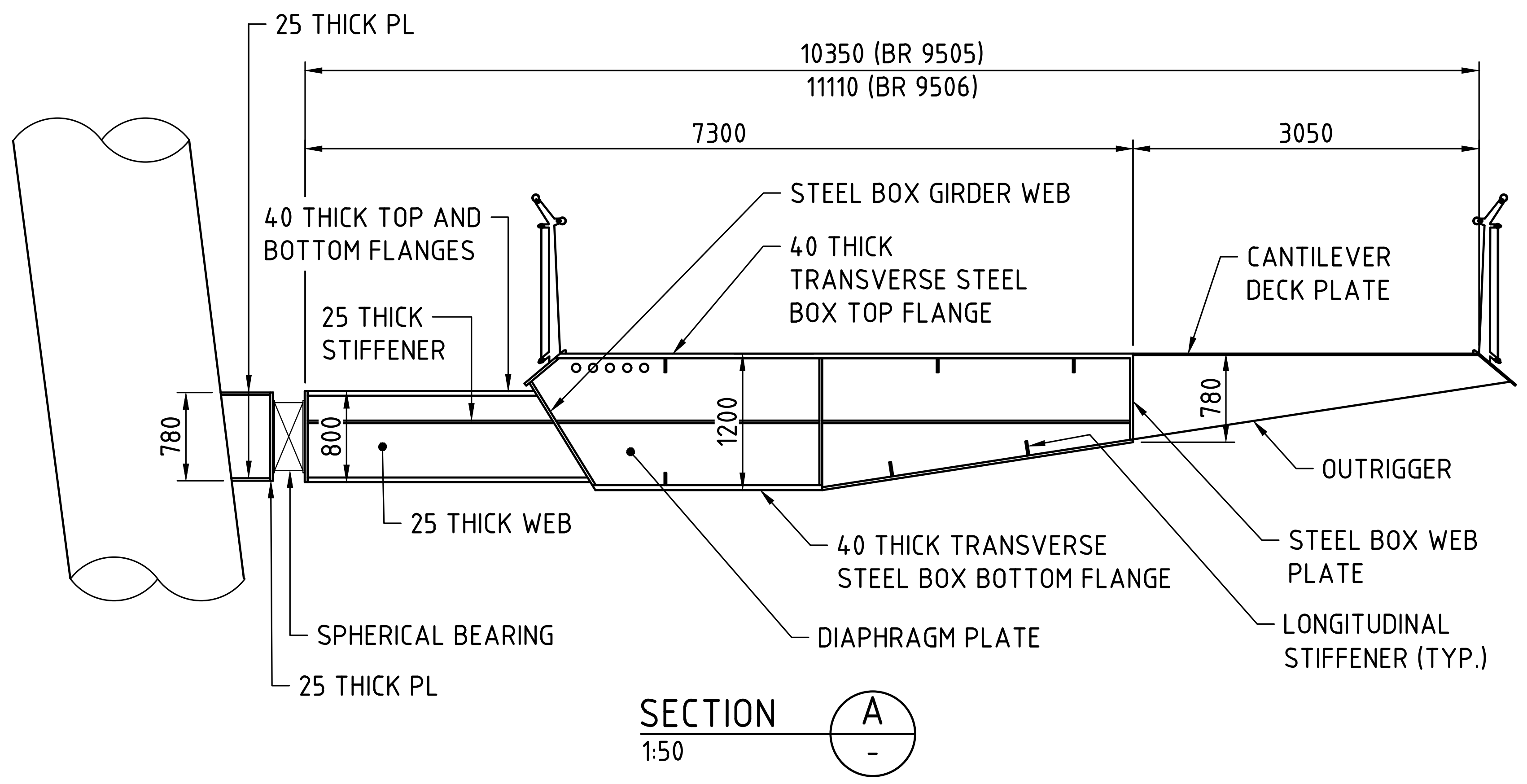
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
PAUSE POINT DETAILS
SHEET 1 OF 2
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40004
REV: A

FOR STEEL BOX GIRDER STIFFENER
LAYOUT AND PAUSE POINT, REFER DRG.
N° C301-CLA-0000-ST-SKT-40004



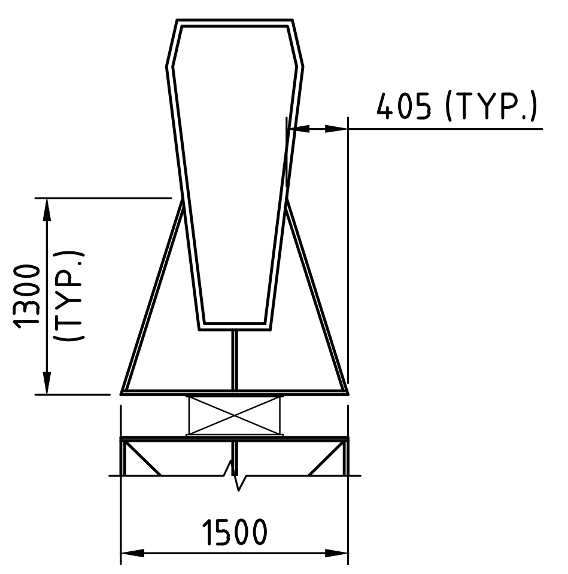
PLAN
BR9505 PYLON N° 1 - SHOWN
BR9506 PYLON N° 1 - SIMILAR

CROSS BEAM
1:100



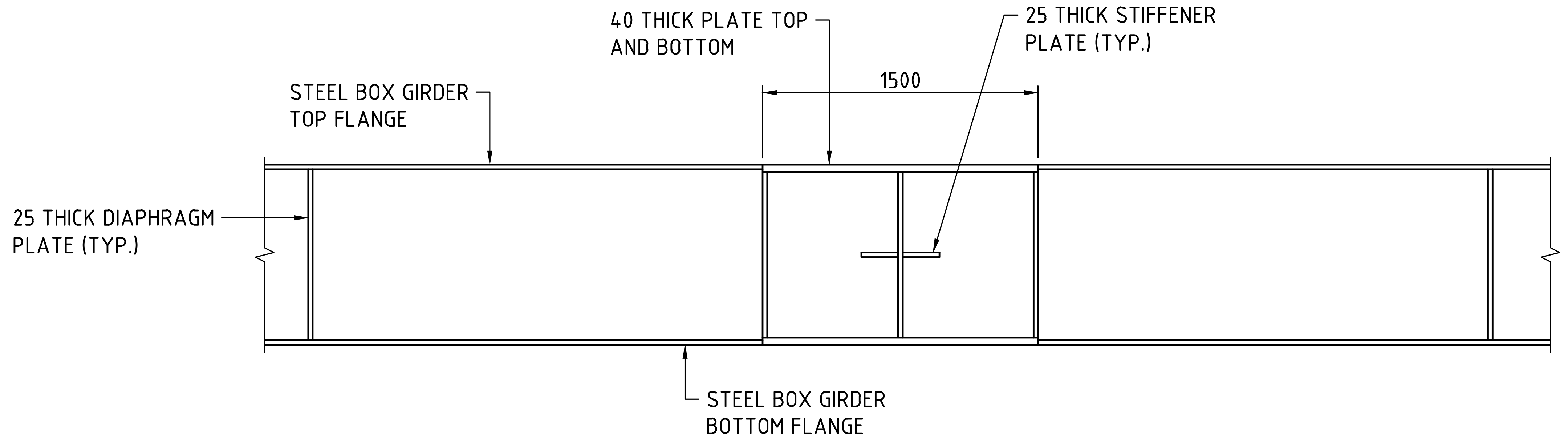
SECTION A -
1:50

FOR TYPICAL DECK DETAILS, REFER
DRG. N° C301-CLA-0000-ST-SKT-40001.



PLAN - PYLON N° 1

BR9506 BEARING BRACKET
1:50



SECTION B -
1:25

1:25
1:50
1:100

Plotted By: Burgess, Brent   Plot Date: 22/07/2022 8:38 AM   Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40005.dwg

No.	DESCRIPTION	APPROVED & DATE
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AMENDMENTS

METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email:
perth@wsp.com

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DRAWING PATH

VERIFIER
VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
PAUSE POINT DETAILS
SHEET 2 OF 2
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40005
REV: A

NOTES:

1. FOR BRIDGE N° 9505 DECK LAYOUT REFER DRG N° C301-CLA-1000-ST-SKT-40001.
2. FOR BRIDGE N° 9506 DECK LAYOUT REFER DRG N° C301-CLA-2000-ST-SKT-40001.

POINT FRASER BRIDGE (BRIDGE 9506)

GRID	A1 - P1	P1-P2	P2-P3	P3-C1	C1-C2	C2-C3	C3-C4	C4-C5	C5-C6	C6-PYLON 1	PYLON 1-C7	C7-C8	C8-C9	C9-C10	C10-C11	C11-C12	C12-A2
DECK MODULE NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SPAN NO	1	2	3	4							5						
DECK PLATE THICKNESS (mm)																	
TOP FLANGE (1)	20		32	40						25			20			25	
BOTTOM FLANGE (2)	20		32	40						25			20			25	
WEB (3)	20		25	25						20			20			20	
CANTILEVER DECK PLATE (4)	12																
OUTRIGGER PLATE (5)	12																
TRANSVERSE STIFFENERS (6)	150 x 16			200 x 16*						200 x 25		200 x 16*					
LONGITUDINAL STIFFENERS (7)	100 x 16			125 x 16													
ELEMENT SPACING (mm)																	
OUTRIGGERS	1600																
TRANSVERSE STIFFENERS	1600																

* 2 NO. 200 X 25 TRANSVERSE STIFFENERS AT STAY DIAPHRAGM POSITIONS

McCALLUM PARK BRIDGE (BRIDGE 9505)

GRID	A1/C1-C2	C2-C3	C3-C4	C4-C5	C5-C6	C6-C7	C7-PYLON 1	PYLON 1-C8	C8-C9	C9-C10	C10-C11	C11-C12	C12-C13	C13-C14	TRANSITION C14-C15	C15-C16	C16-C17	C17-C18	C18-C19	C19-C20	C20-C21	C21-PYLON 2	PYLON2-C22	C22-C23	C23-C24	C24-C25	C25-C26	C26-C27	C27-C28/A2
DECK MODULE NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
SPAN NO	1							2															3						
DECK PLATE THICKNESS (mm)																													
TOP FLANGE (1)	32				25				20			25							20			25				32			
BOTTOM FLANGE (2)	32				25				20			25							20			25				32			
WEB (3)	25				20				20			20							20			20				25			
CANTILEVER DECK PLATE (4)	12																												
OUTRIGGER PLATE (5)	12																												
TRANSVERSE STIFFENERS (6)	200 X 16*						200 x 25		200 X 16*													200 x 25		200 X 16*					
LONGITUDINAL STIFFENERS (7)	125 X 16																												
ELEMENT SPACING (mm)																													
OUTRIGGERS	1700																												
TRANSVERSE STIFFENERS	1700																												

* 2 NO. 200 X 25 TRANSVERSE STIFFENERS AT EACH STAY DIAPHRAGM POSITIONS

Plot Date: 22/07/2022 8:38 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40006.dwg

Plotted By: Burgess, Brent

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

VERIFIER

DRAWING PATH
VERIFIED
DATE

Causeway Link Alliance

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE

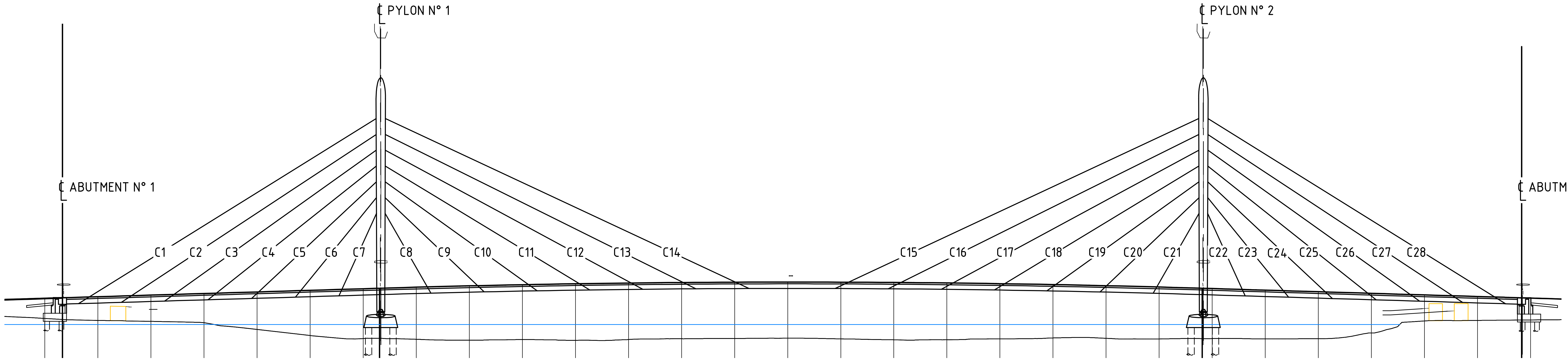
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP
MRWA DRAWING NUMBER
PROJECT TITLE CAUSEWAY LINK ALLIANCE
DRAWING TITLE CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
DECK THICKNESS TABLE
SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-0000-ST-SKT-40006
REV A

NOTES:

1. FOR BRIDGE N° 9505 CABLE PLAN LAYOUT REFER DRG N° C301-CLA-1000-ST-SKT-40001.
2. FOR BRIDGE N° 9506 CABLE PLAN LAYOUT REFER DRG N° C301-CLA-2000-ST-SKT-40001.
3. ALL STAY CABLES ARE PARALLEL STRAND CABLES.



BR9505 - ELEVATION

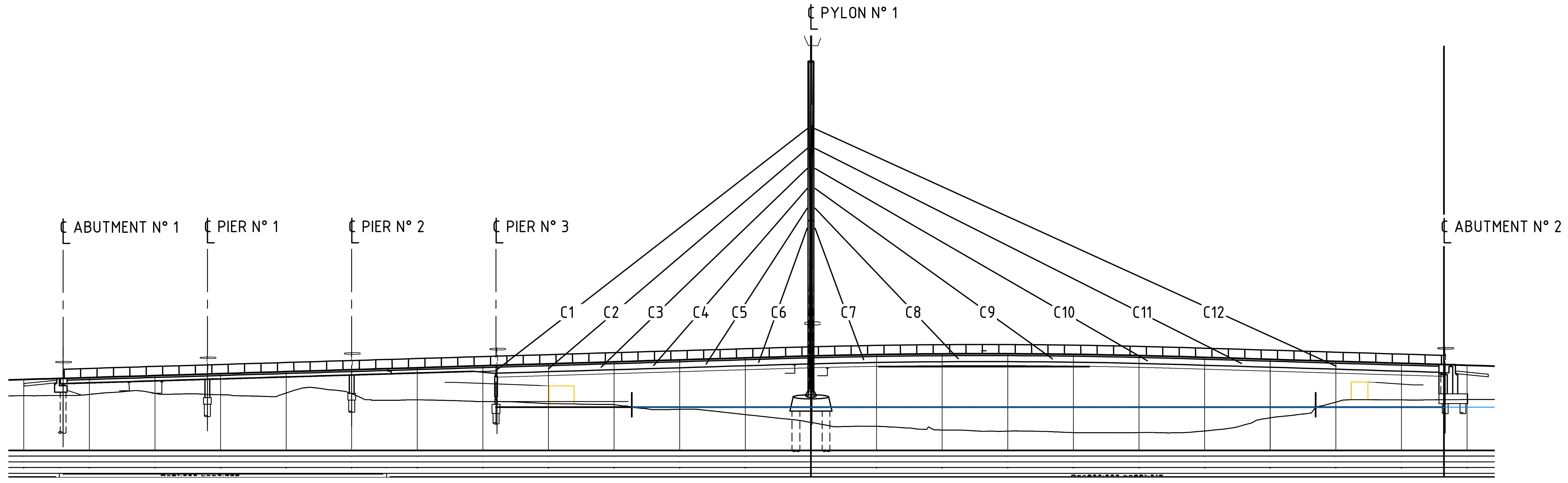
1:500

McCALLUM PARK BRIDGE (BRIDGE 9505)

CABLE STAY DATA

CABLE NO.	LENGTH NOM (m)*	CABLE SIZE
1,28	66.67	24 X 15.7mm STRANDS
2,27	58.16	19 X 15.7mm STRANDS
3,26	49.69	12 X 15.7mm STRANDS
4,25	41.30	12 X 15.7mm STRANDS
5,24	33.09	12 X 15.7mm STRANDS
6,23	25.25	12 X 15.7mm STRANDS
7,22	18.33	19 X 15.7mm STRANDS
8,21	18.59	19 X 15.7mm STRANDS
9,20	26.80	12 X 15.7mm STRANDS
10,19	36.17	12 X 15.7mm STRANDS
11,18	45.92	12 X 15.7mm STRANDS
12,17	55.85	12 X 15.7mm STRANDS
13,16	65.86	19 X 15.7mm STRANDS
14,15	75.91	19 X 15.7mm STRANDS

*MEASURED FROM ANCHOR PLATE BOTTOM TO FORK PIN TOP



BR9506 - ELEVATION

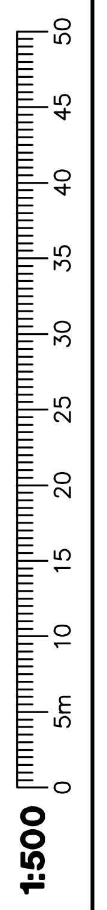
1:500

POINT FRASER BRIDGE (BRIDGE 9506)

CABLE STAY DATA

CABLE NO.	LENGTH NOM (m)*	CABLE SIZE
1	59.30	27 X 15.7mm STRANDS
2	51.88	24 X 15.7mm STRANDS
3	44.76	19 X 15.7mm STRANDS
4	38.07	19 X 15.7mm STRANDS
5	32.10	19 X 15.7mm STRANDS
6	27.32	19 X 15.7mm STRANDS
7	27.04	19 X 15.7mm STRANDS
8	34.59	19 X 15.7mm STRANDS
9	45.52	19 X 15.7mm STRANDS
10	57.92	19 X 15.7mm STRANDS
11	71.03	19 X 15.7mm STRANDS
12	84.44	19 X 15.7mm STRANDS

*MEASURED FROM ANCHOR PLATE BOTTOM TO FORK PIN TOP



Plotted By: Burgess, Brent

Plot Date: 22/07/2022 8:38 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-50001.dwg

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AMENDMENTS

METADATA

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Level 5
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DRAWING PATH

VERIFIER

VERIFIED

DATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION

MRWA DRAWING NUMBER

PROJECT TITLE: CAUSEWAY LINK ALLIANCE

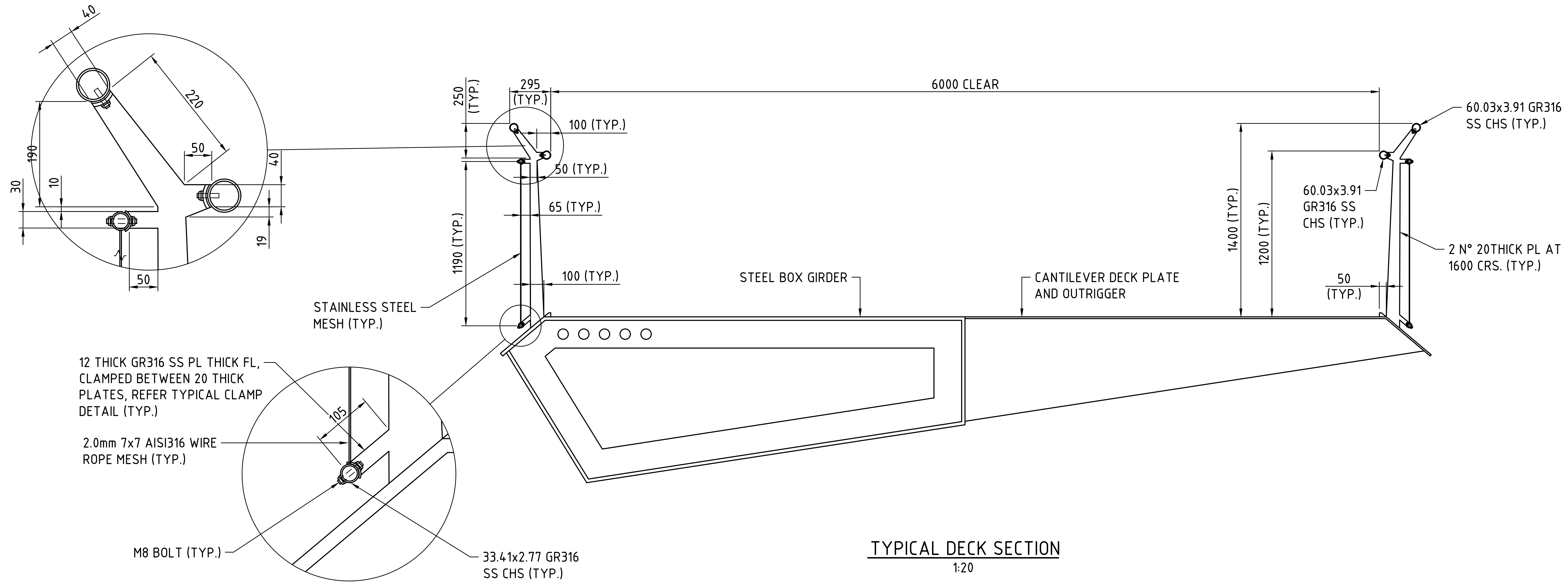
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
CABLE INFORMATION

SHEET: A1

DRAWING STATUS: 15%

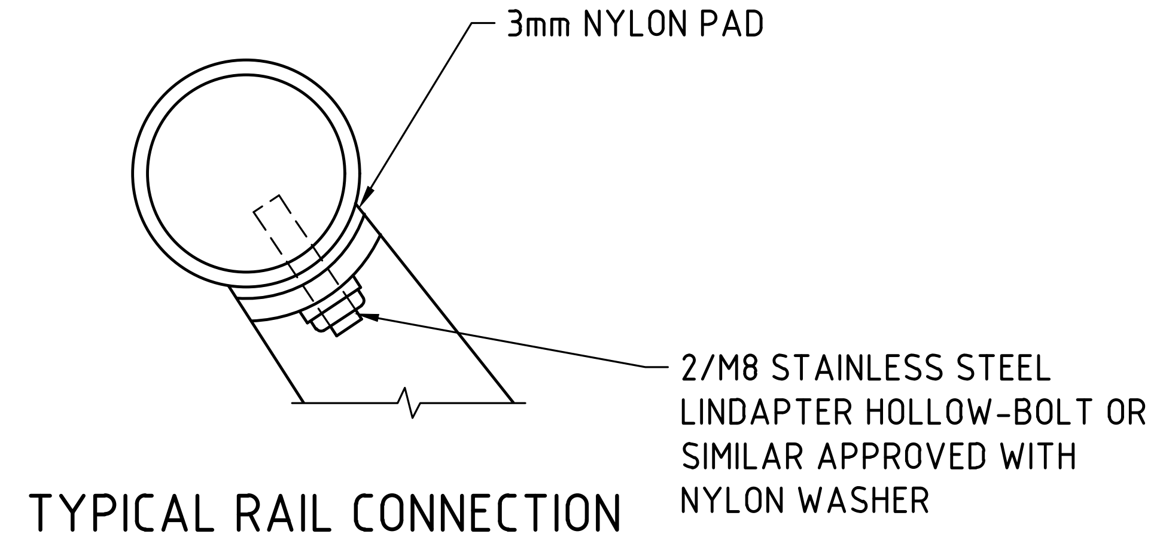
DRAWING No.: C301-CLA-0000-ST-SKT-50001

REV: A



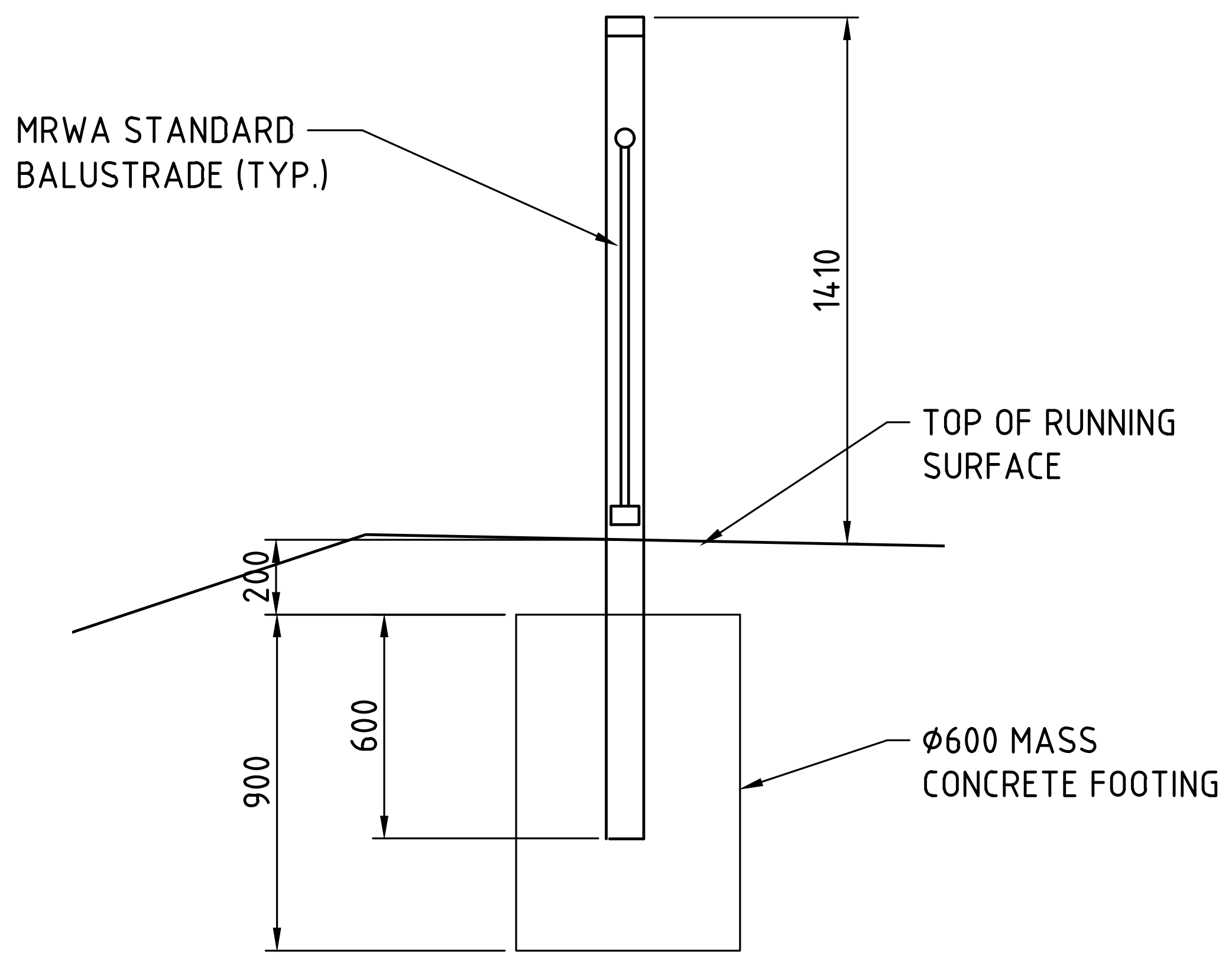
TYPICAL DECK SECTION

1:20



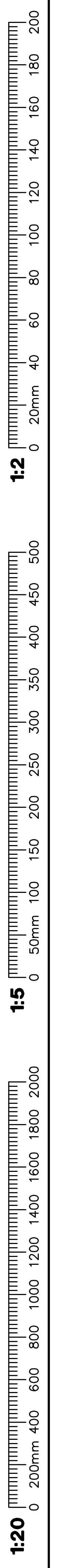
TYPICAL RAIL CONNECTION

1:2



TYPICAL EMBANKMENT HANDRAIL DETAIL

1:20



Plot Date: 22/07/2022 8:38 AM   Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-60011.dwg

Plotted By: Burgess, Brent

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AMENDMENTS

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DATE OF CAPTURE:
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HEIGHT DATUM: AHD71

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DRAWING PATH		

VERIFIER

VERIFIED

DATE

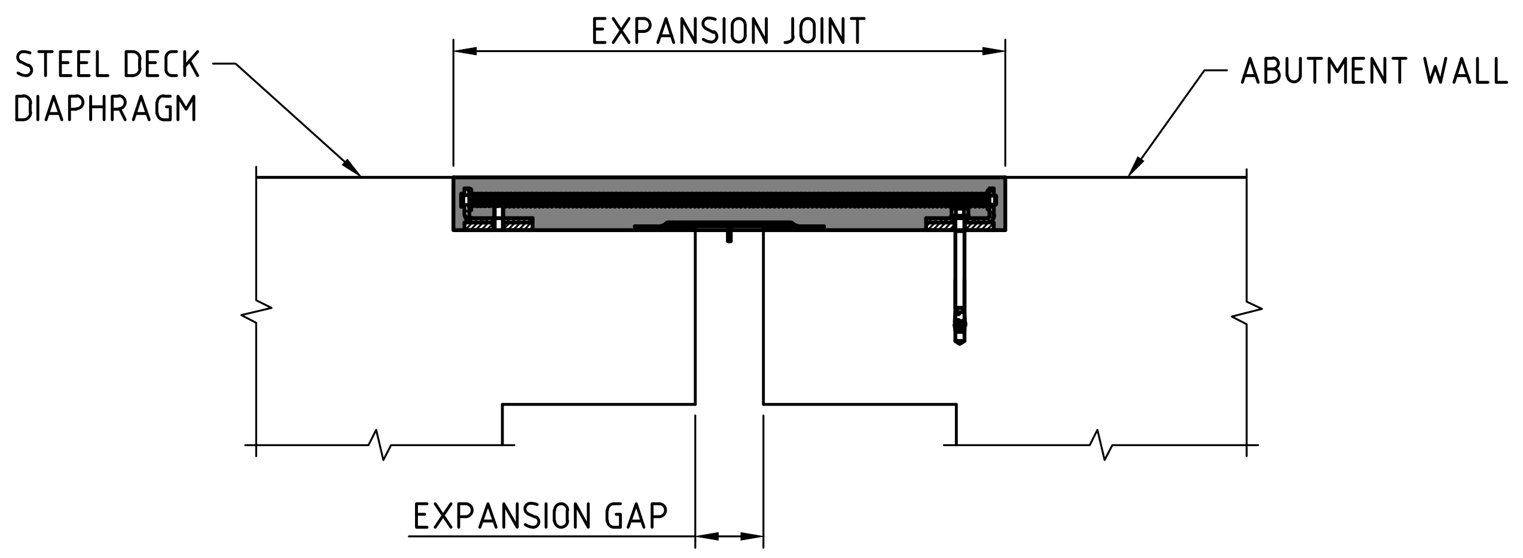
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

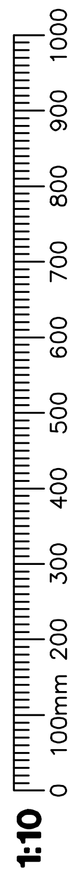
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL BALUSTRADE DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-60011
REV: A

		EXPANSION JOINT SCHEDULE		
		ULS (EXCLUDE EXTREME EVENT SUCH AS SHIP IMPACT AND EARTHQUAKE)		
BRIDGE	LOCATION	LONGITUDINAL MOVEMENT (TOWARDS PYLON) (mm)	LONGITUDINAL MOVEMENT (AWAY PYLON) (mm)	EXPANSION JOINT TYPE
POINT FRASER (BRIDGE 9506)	ABUTMENT 1	40	25	MAGEBA POLYFLEX PA-60
	HALVING JOINT	90	50	MAGEBA POLYFLEX PA-75
	ABUTMENT 2	45	120	MAGEBA POLYFLEX PA-135
MCCALLUM PARK (BRIDGE 9505)	ABUTMENT 1	75	75	MAGEBA POLYFLEX PA-90
	ABUTMENT 2	75	75	



TYPICAL EXPANSION JOINT DETAIL

1:10



Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:39 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-70001.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

VERIFIED

DATE

Causeway Link Alliance

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY

MAIN ROADS RESPONSIBILITY AREA
124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

METROP

MRWA DRAWING NUMBER

PROJECT TITLE CAUSEWAY LINK ALLIANCE

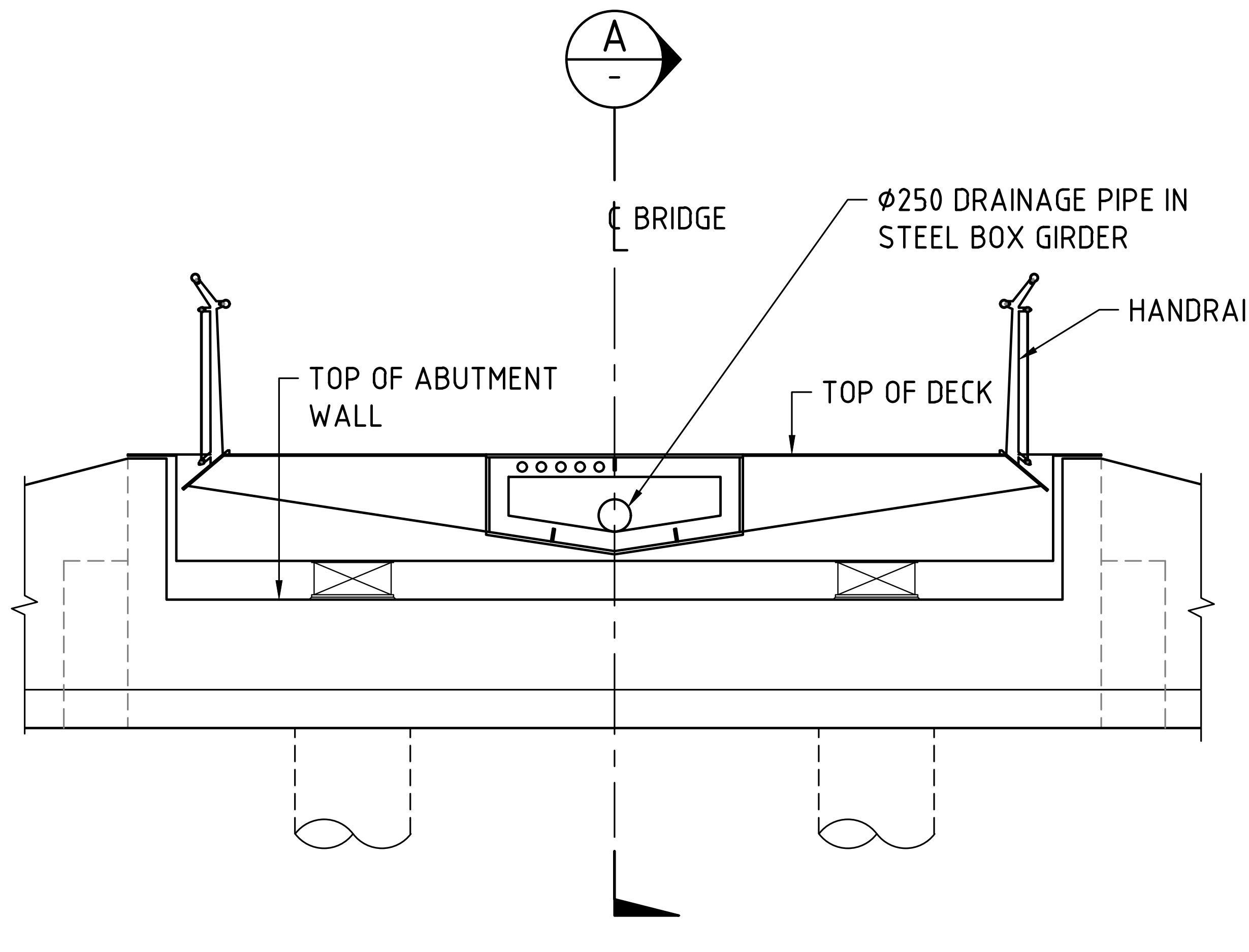
DRAWING TITLE
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
EXPANSION JOINT SCHEDULE

SHEET A1

DRAWING STATUS 15%

DRAWING No. C301-CLA-0000-ST-SKT-70001

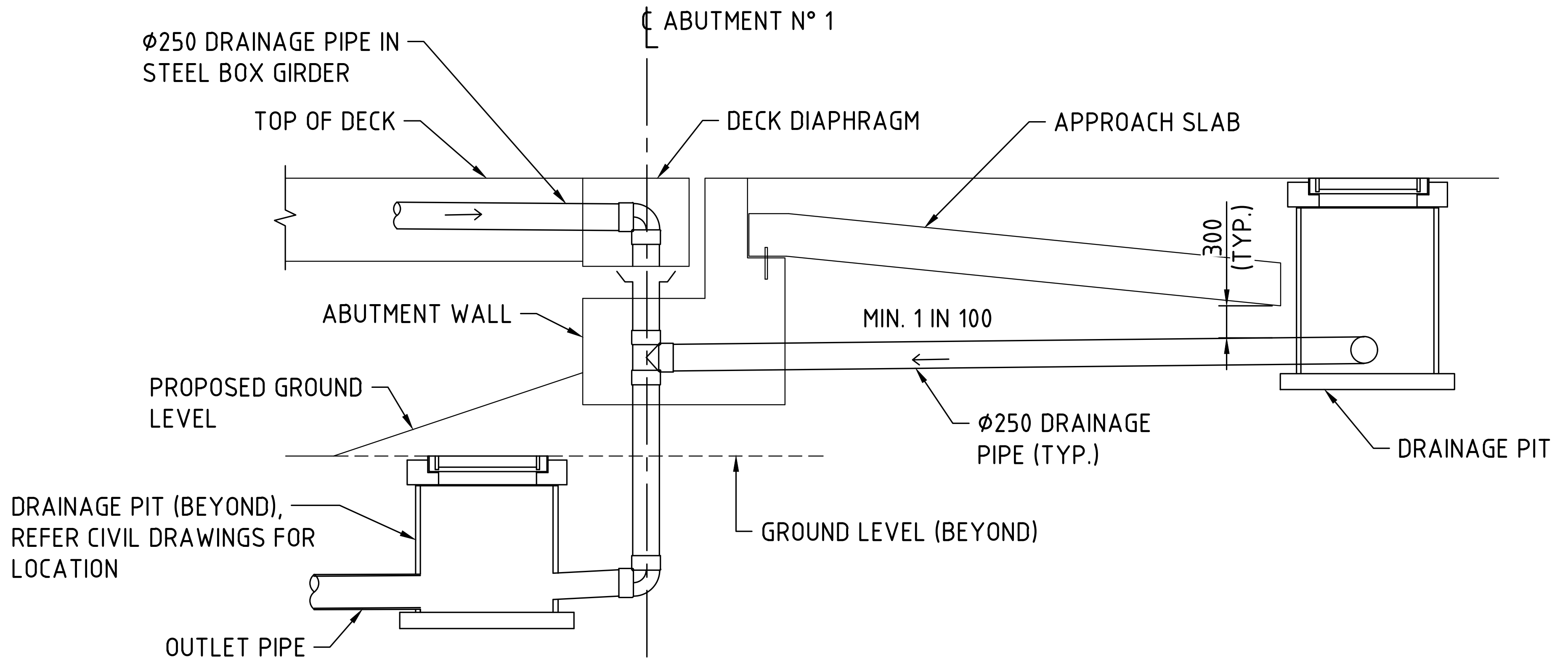
REV A



BR9506 ABUTMENT N° 1

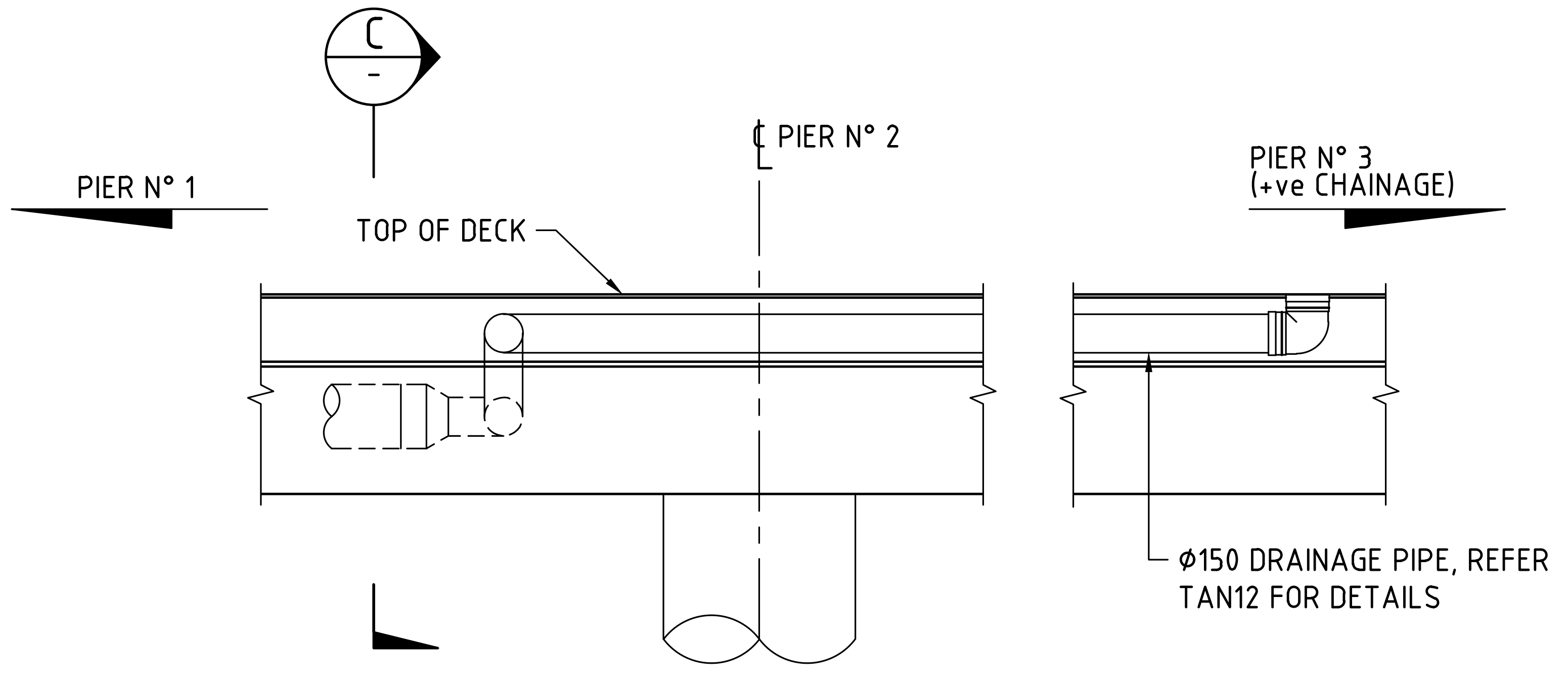
TYPICAL DRAINAGE ELEVATION

1:50



SECTION A -

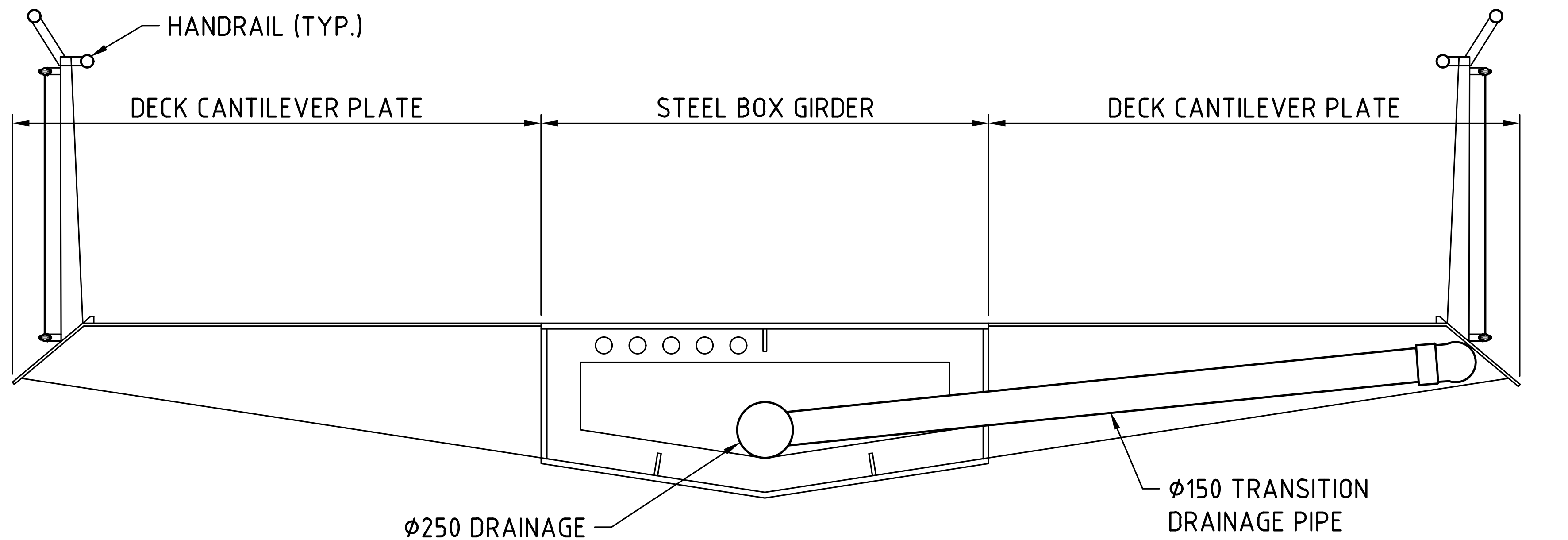
1:50



BR9506

DRAINAGE PIPE TRANSITION - ELEVATION

1:25



SECTION C -

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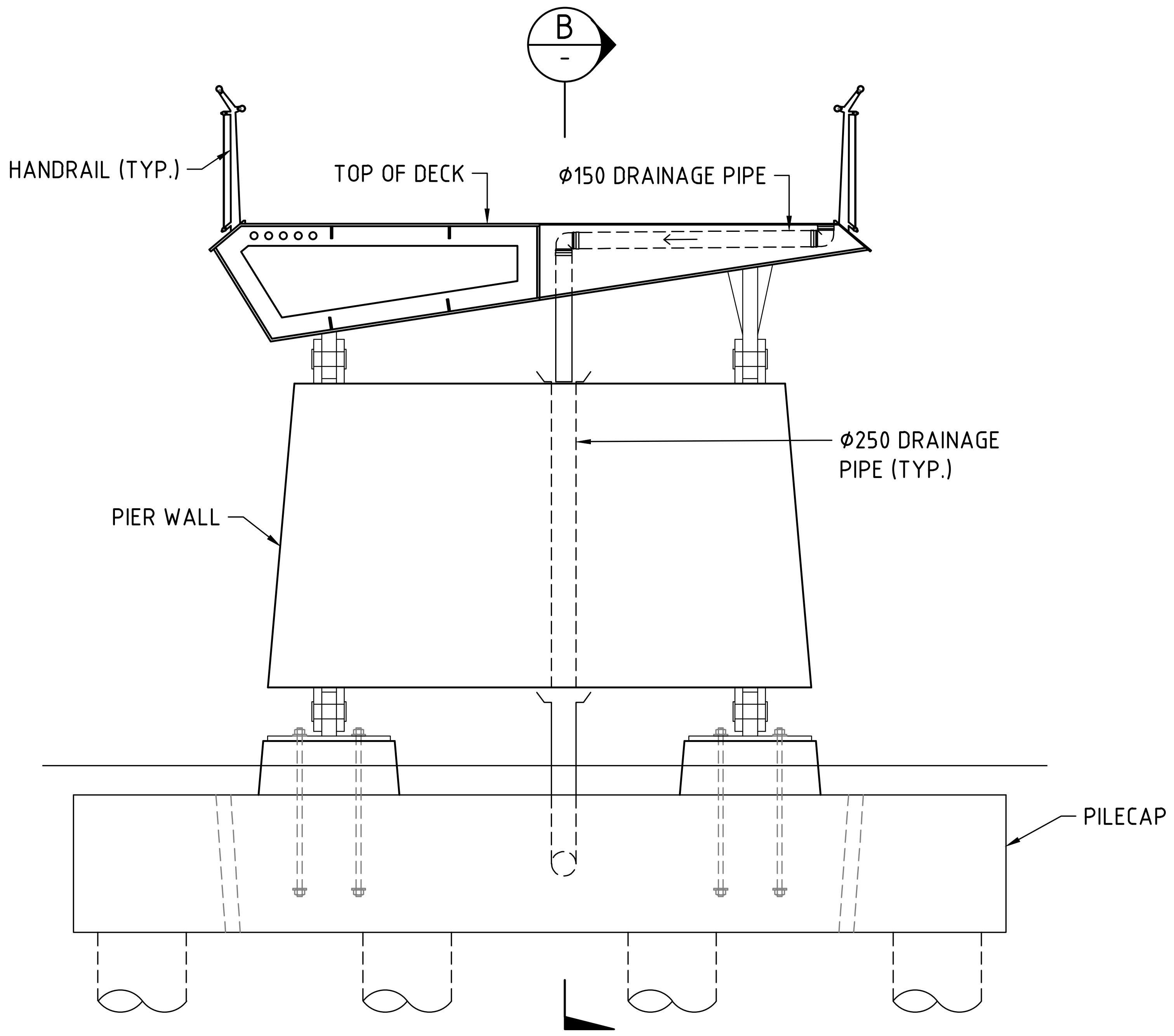
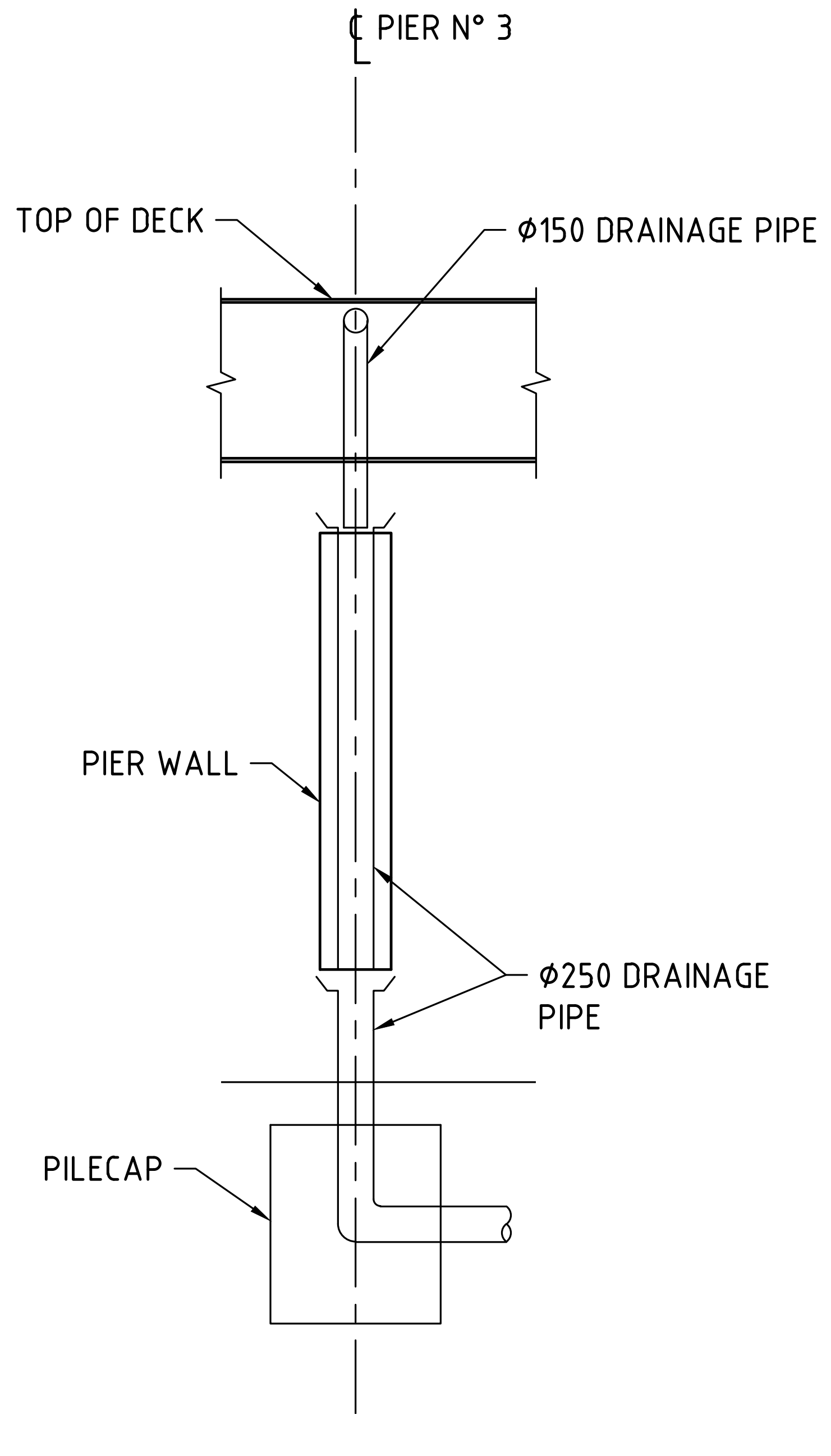


BR9506 PIER N° 3

DRAINAGE ELEVATION

1:50



SECTION B -

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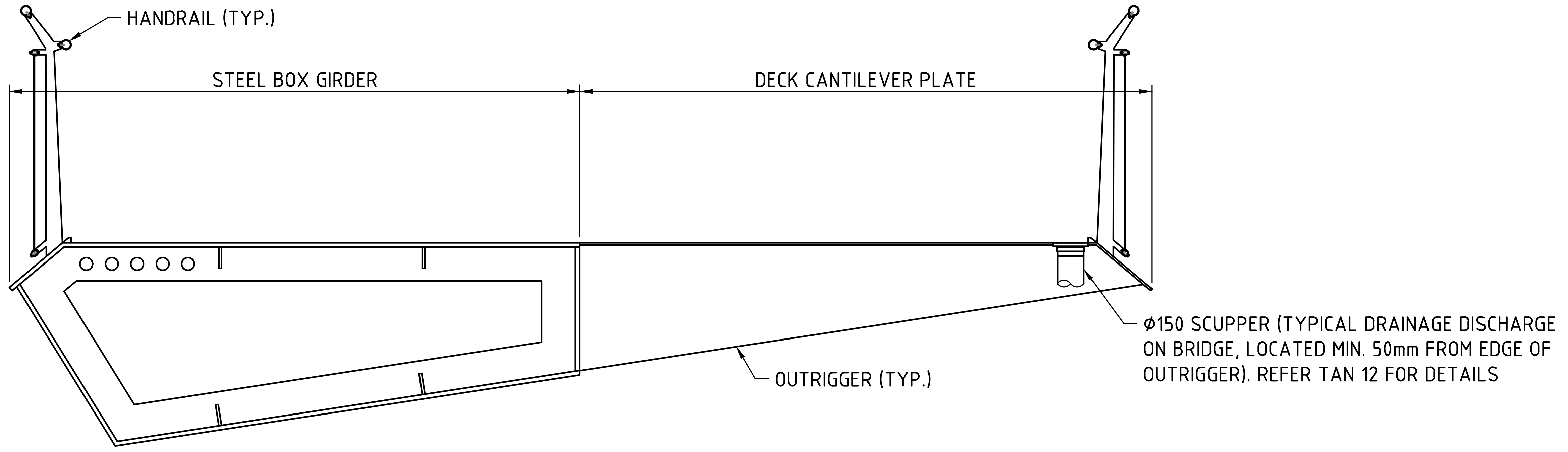


AT SCUPPER LOCATION

TYPICAL DECK SECTION

1:25

Plot Date: 22/07/2022 8:39 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-80101.dwg

Plotted By: Burgess, Brent

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

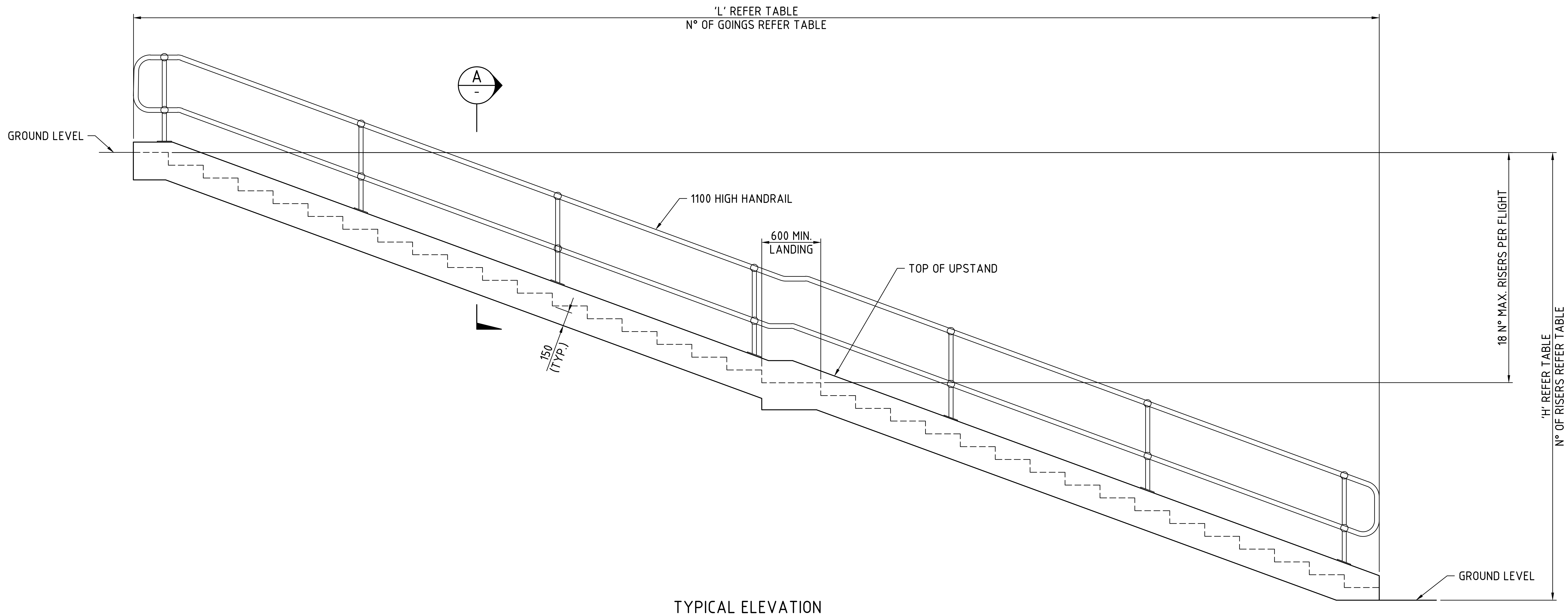
INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

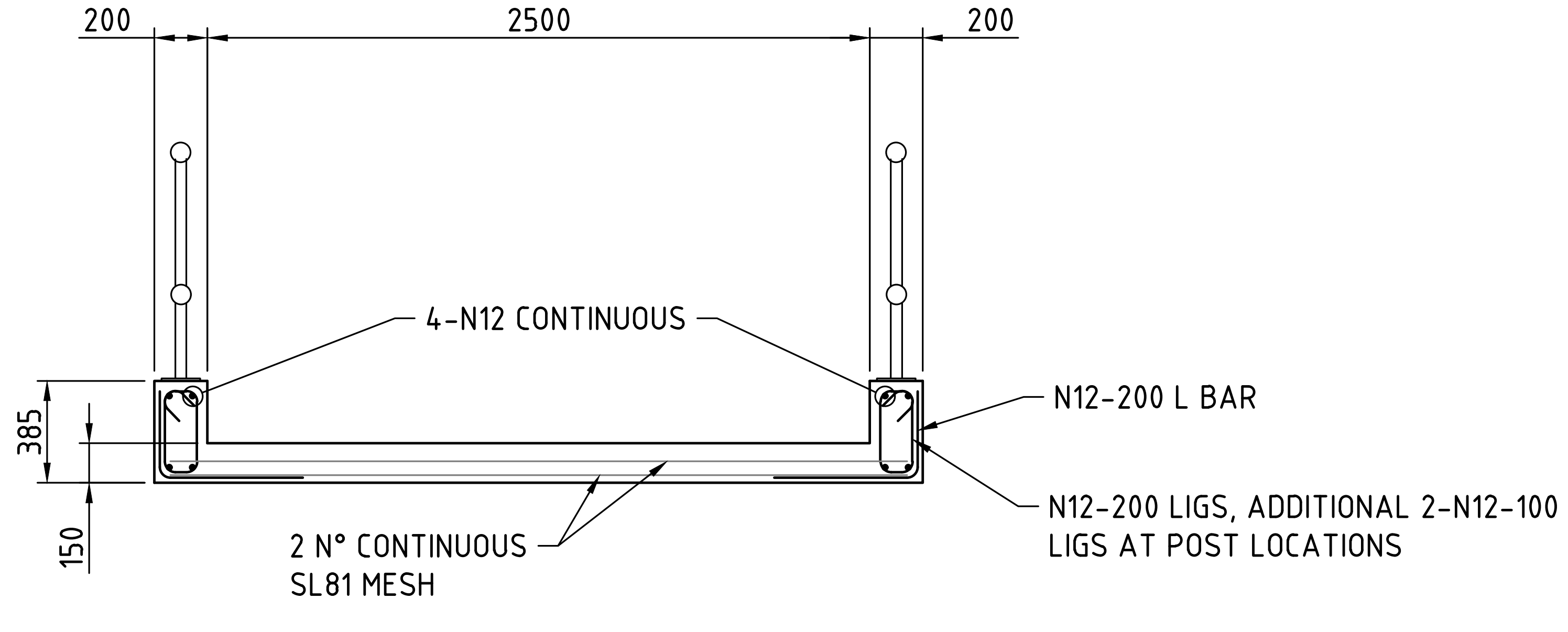
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DRAINAGE DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-80101
REV: A

1:25

1:50



TYPICAL ELEVATION
1:25



SECTION A -
1:25

STAIRS INFORMATION

	LENGTH 'L'	HEIGHT 'H'	N° OF GOINGS	N° OF RISERS	N° OF LANDINGS
BR9506 (ABUTMENT N° 1 APPROACH END)	8655	2615	17	20	3
BR9506 (ABUTMENT N° 2 DEPARTURE END)	12790	4550	34	35	1
BR9505 (ABUTMENT N° 1 APPROACH END)	6800	1615	9	13	4
BR9505 (ABUTMENT N° 2 DEPARTURE END)	13500	3300	23	26	3 (1500 MIN.)

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:39 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-80301.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22
DRAWING PATH		

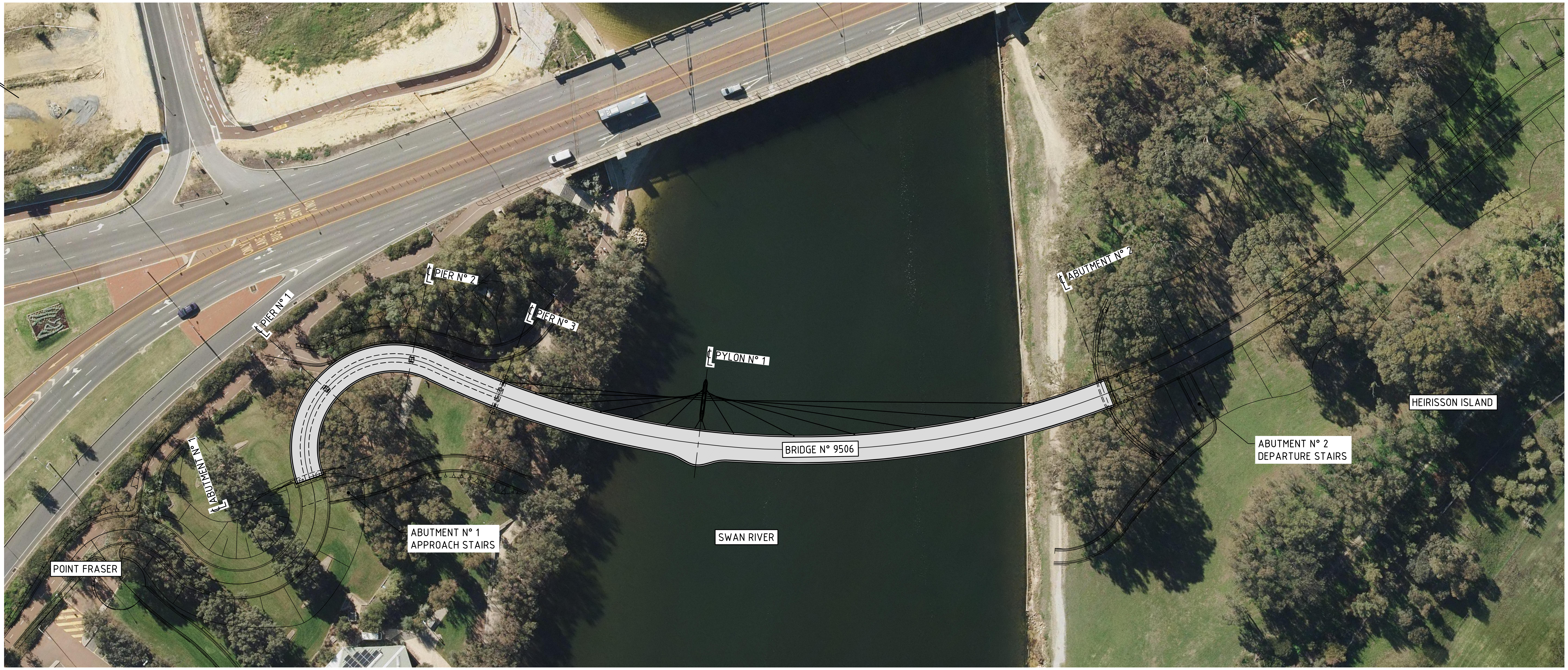
VERIFIER
VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

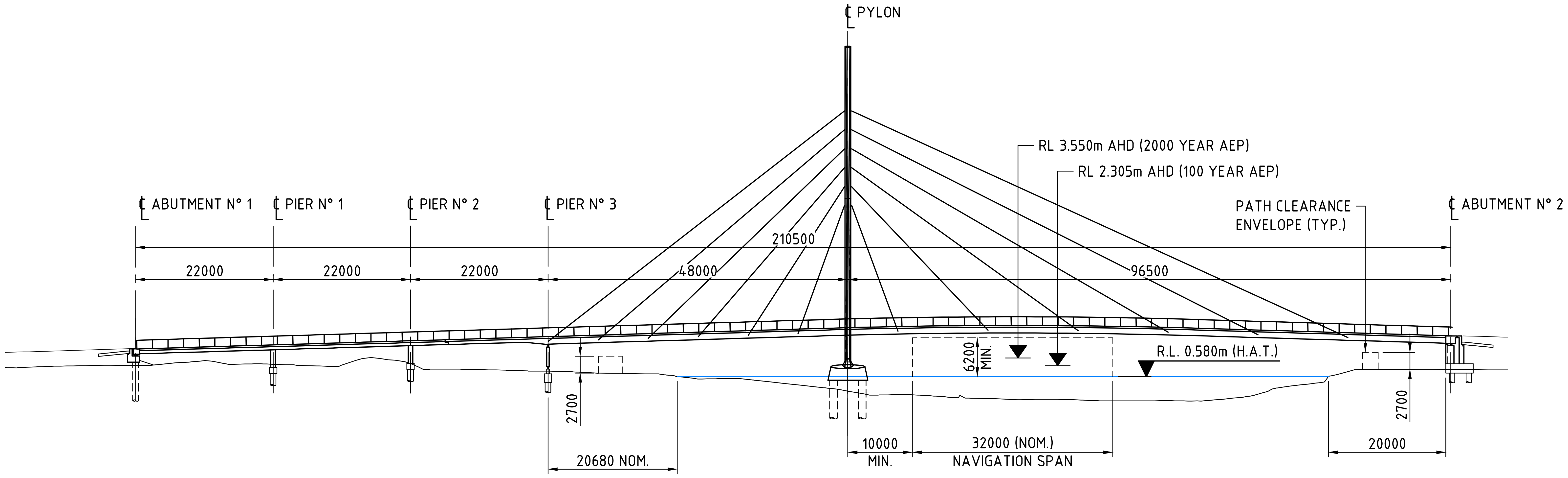
INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP
MRWA DRAWING NUMBER
PROJECT TITLE CAUSEWAY LINK ALLIANCE
DRAWING TITLE CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
STAIR DETAILS
SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-0000-ST-SKT-80301
REV A



GENERAL ARRANGEMENT PLAN
1:500



DEVELOPED ELEVATION
1:500

1:500

FOR INFORMATION ONLY

Plotted By: Burgess, Brent Plot Date: 03/08/2022 2:05 PM Cad File: C:\pwworking\wsp-aus-pw.bentley.com__wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-00001.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22
	AMENDMENTS	

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
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DRAWING PATH

VERIFIER

VERIFIED
DATE

Causeway Link Alliance

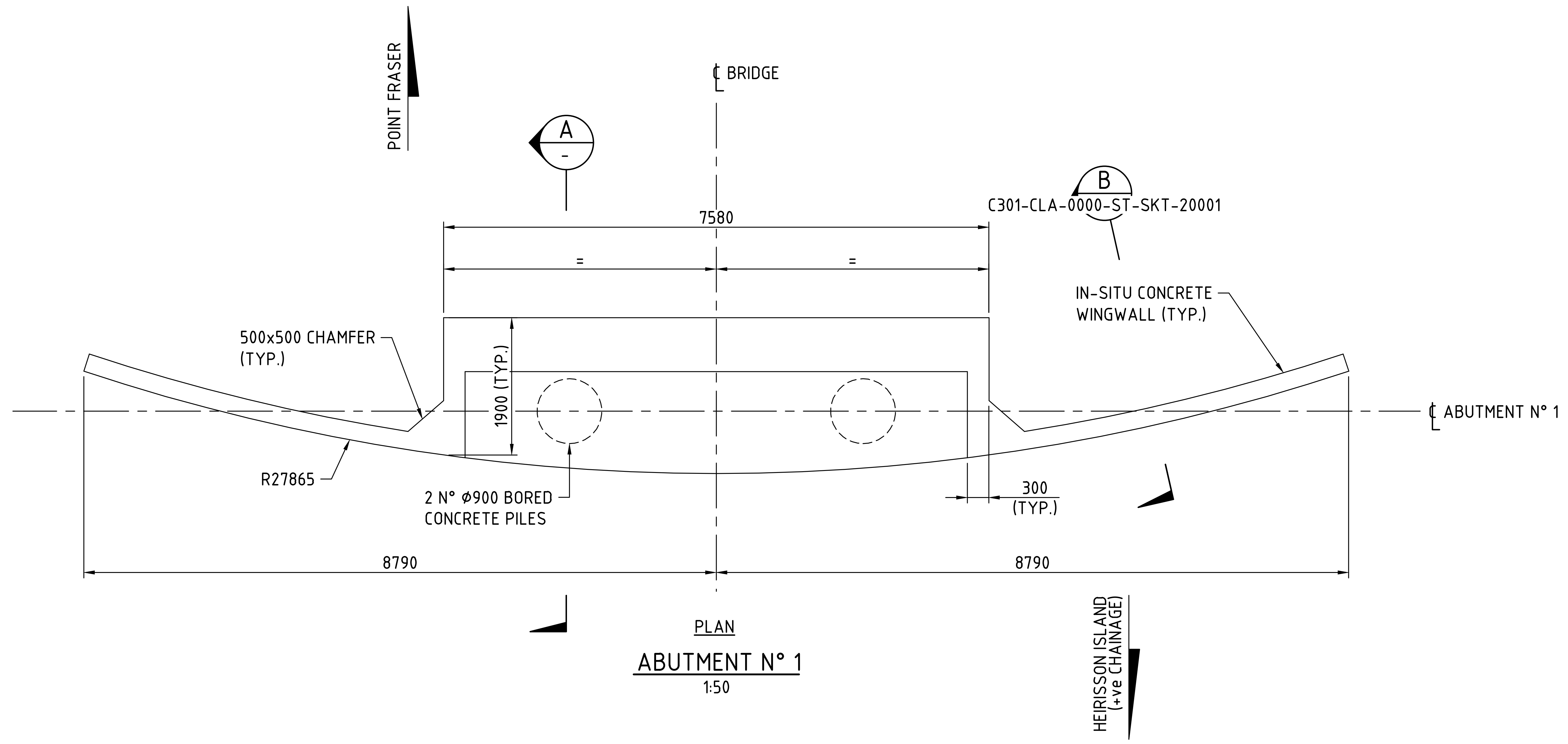
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

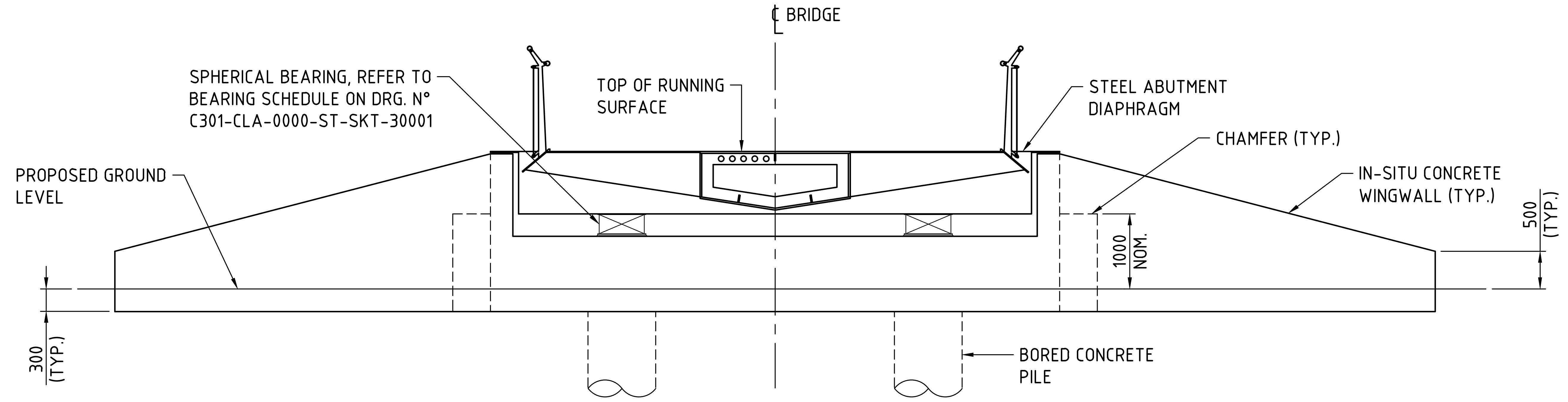
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
GENERAL ARRANGEMENT
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-2000-ST-SKT-00001
REV: A



PLAN

ABUTMENT N° 1

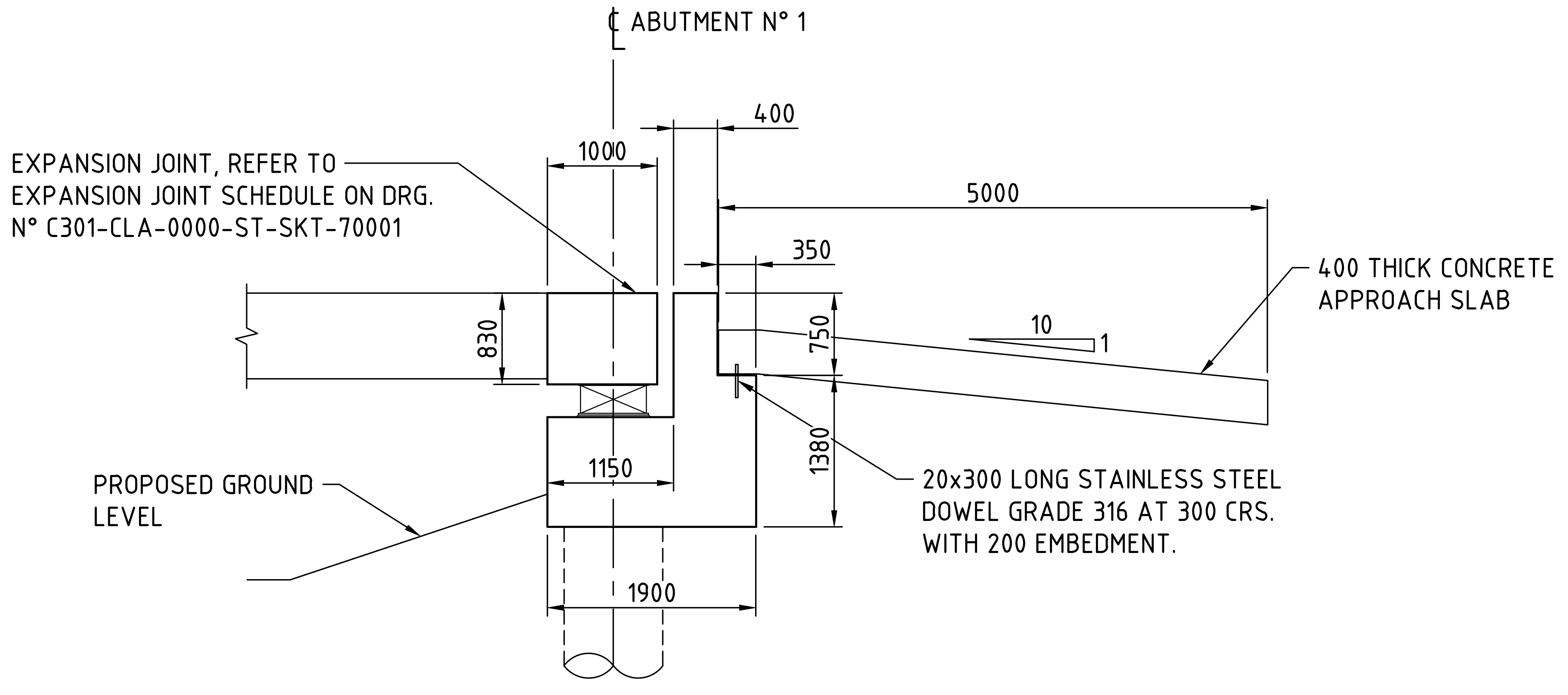
1:50



ELEVATION

ABUTMENT N° 1

1:50



SECTION A
-
1:50

1:50

PILE DETAILS

LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	MIN. TEMPORARY CASING LENGTH (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
ABUTMENT N° 1	BORED PILE	900	2	2.2	32.0	2.0	9.0	-28.0

NOTES:

1. REFER DRG. N° C301-CLA-0000-ST-SKT-20002 FOR GEOTECHNICAL NOTES.

Plotted By: Burgess, Brent   Plot Date: 03/08/2022 2:05 PM   Cad File: C:\pwworking\wsp-aus-pw.bentley.com__wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-10101.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH

VERIFIER

VERIFIED

DATE

Causeway Link Alliance

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

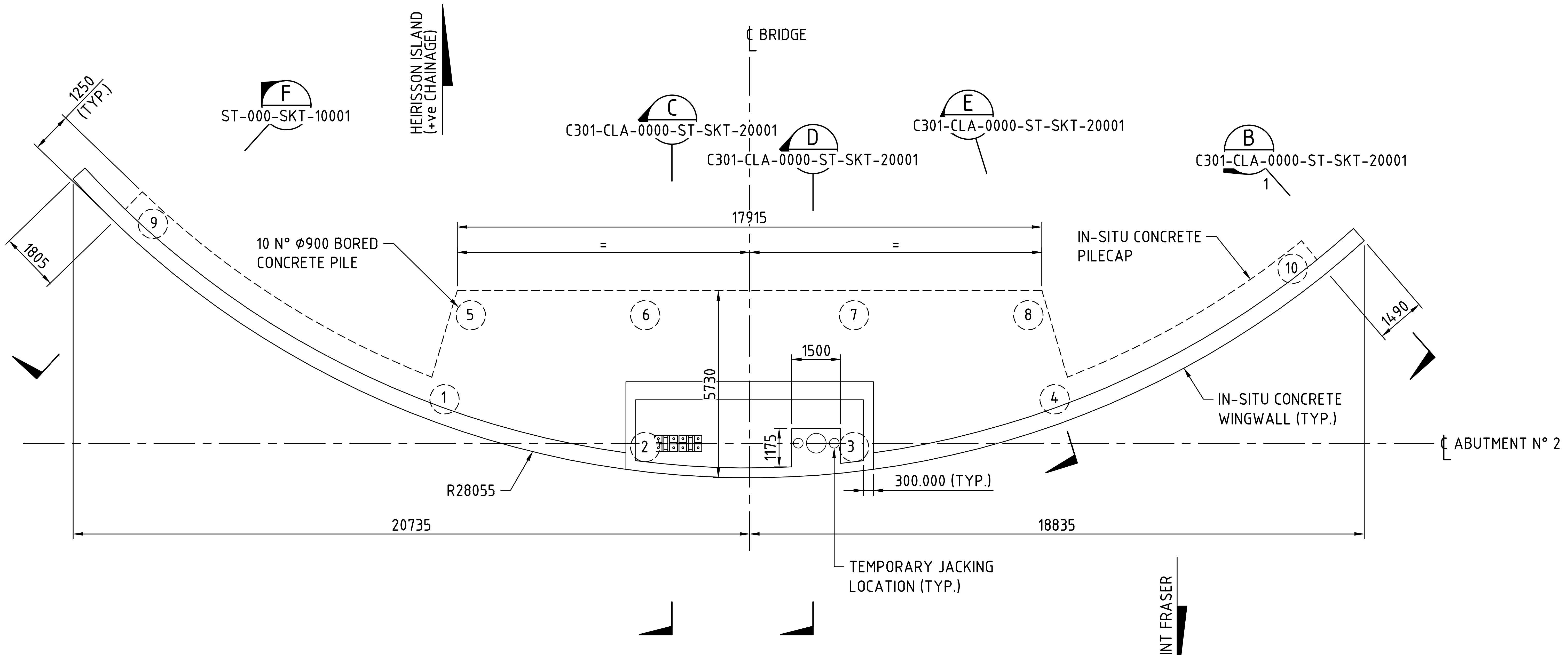
INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

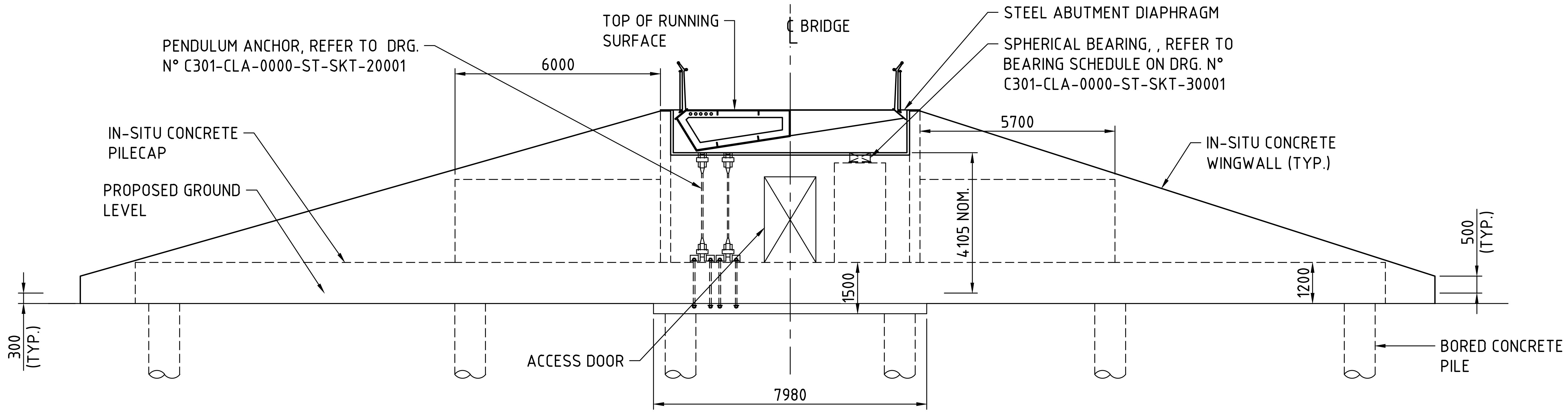
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
ABUTMENT DETAILS
SHEET 1 OF 2
SHEET: A1
DRAWING STATUS: 15%
DRAWING No. C301-CLA-2000-ST-SKT-10101
REV: A



PLAN - PILECAP

ABUTMENT N° 2

1:100



ELEVATION

ABUTMENT N° 2

1:100

PILE DETAILS						
LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH (m)	MIN. TEMPORARY CASING LENGTH (m)
ABUTMENT N° 2	BORED PILE	900	10	1.2	REFER PILE LENGTH TABLE	9.0

PILE LENGTH			
PILE N°	LENGTH (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
1 - 4	43.0	2.0	-40.0
5 - 8	31.0	-	
9 - 10	19.0	-	

NOTES:

1. REFER DRG. N° C301-CLA-0000-ST-SKT-20002 FOR GEOTECHNICAL NOTES.

1:100

Plotted By: Burgess, Brent Plot Date: 03/08/2022 2:06 PM Cad File: C:\pwworking\wsp-aus-pw.bentley.com_wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-10102.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9777
Facsimile +61 8 9489 9777
Email: perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22

VERIFIER

DRAWING PATH
VERIFIED
DATE

Causeway Link Alliance

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

mainroads WESTERN AUSTRALIA

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

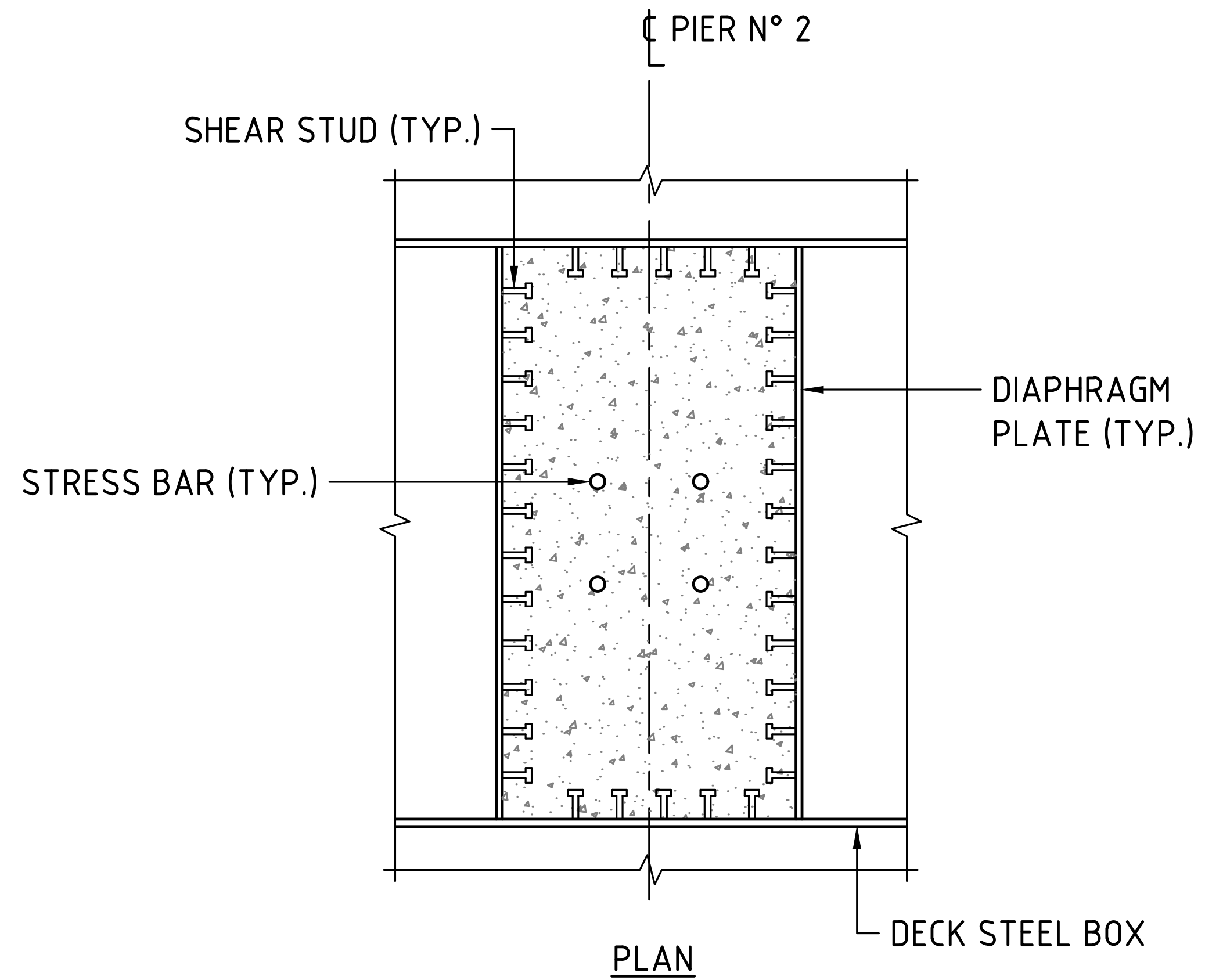
FOR INFORMATION ONLY

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP
MRWA DRAWING NUMBER

PROJECT TITLE
CAUSEWAY LINK ALLIANCE

DRAWING TITLE
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
ABUTMENT DETAILS
SHEET 2 OF 2

SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-2000-ST-SKT-10102
REV A



PLAN

CONCRETE DIAPHRAGM

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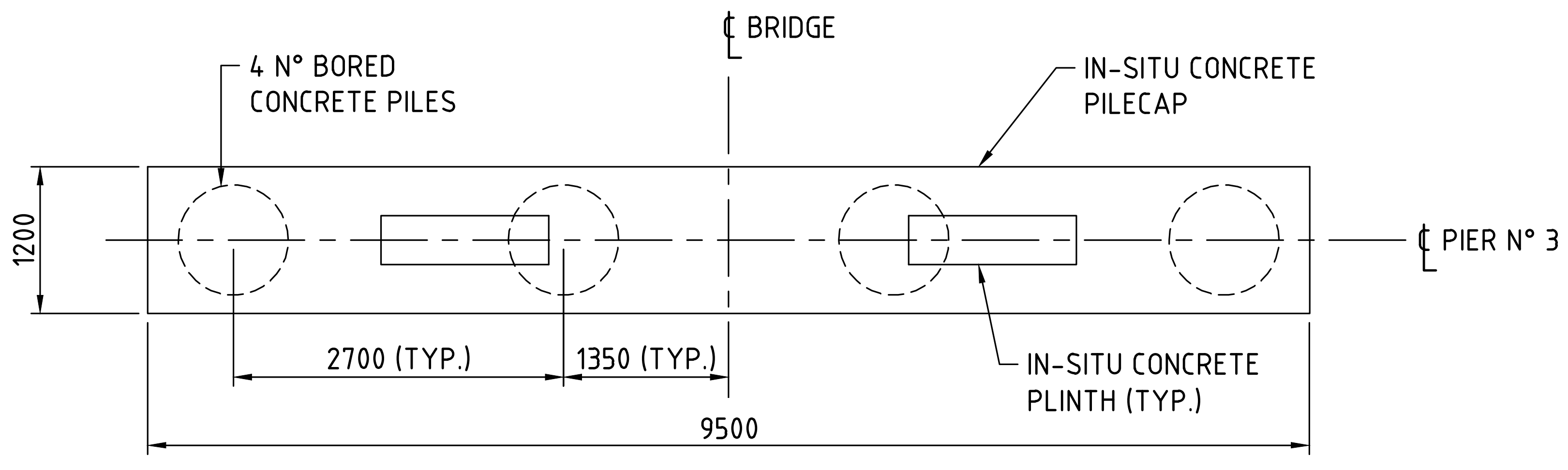

SECTION C

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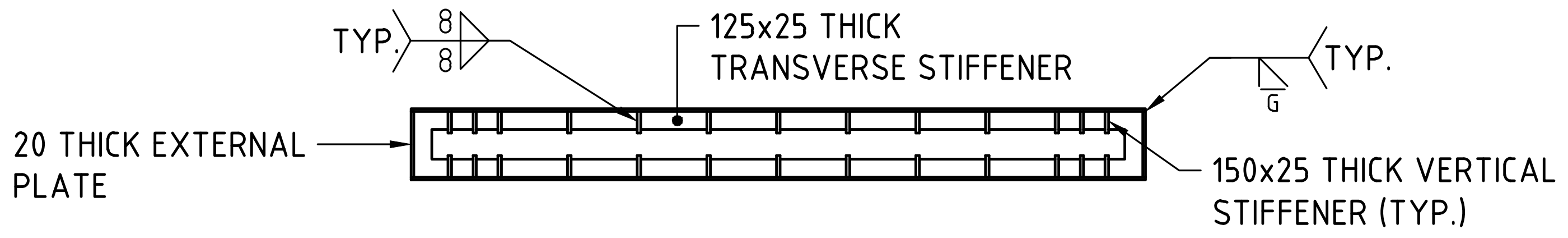

SECTION B

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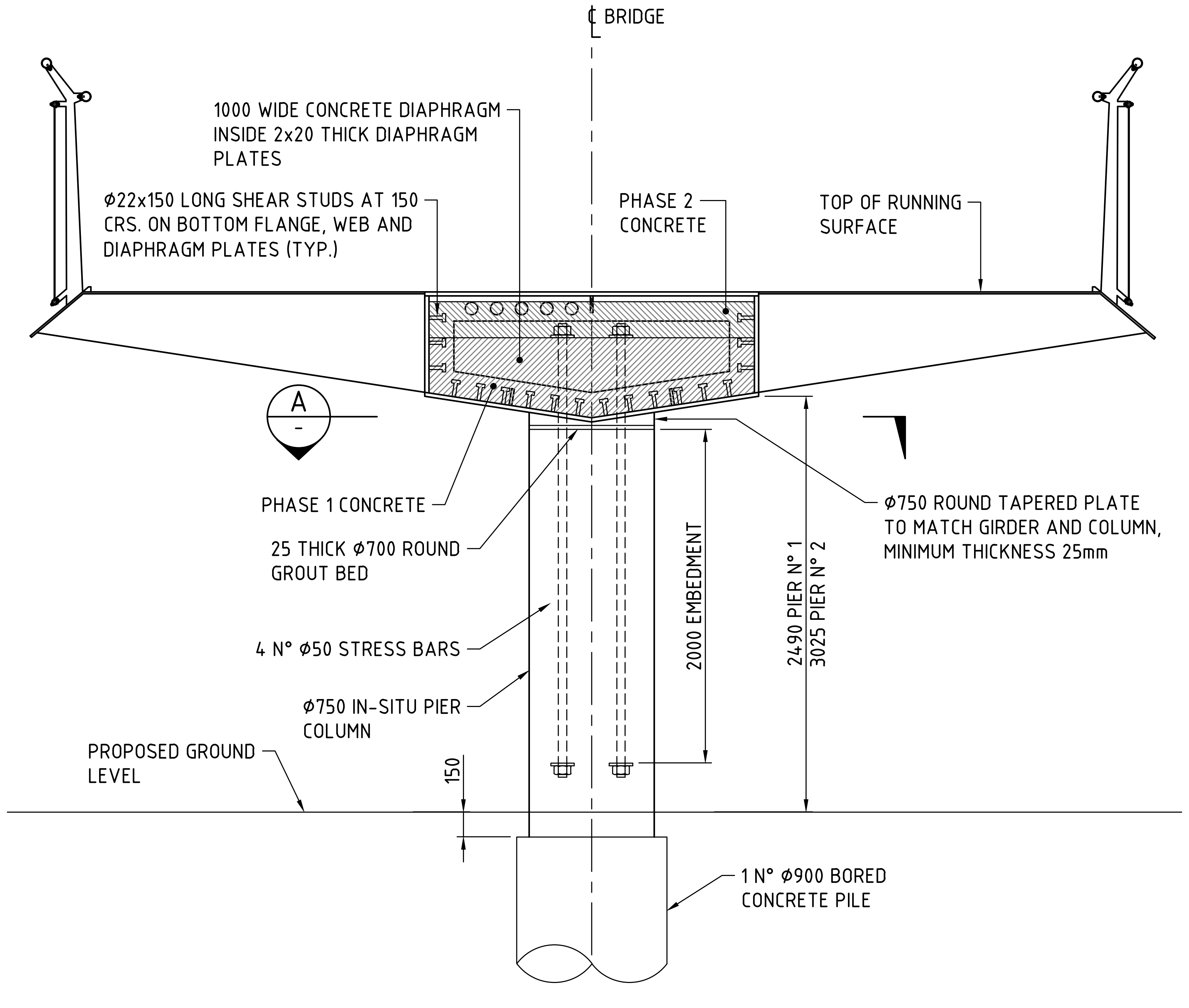
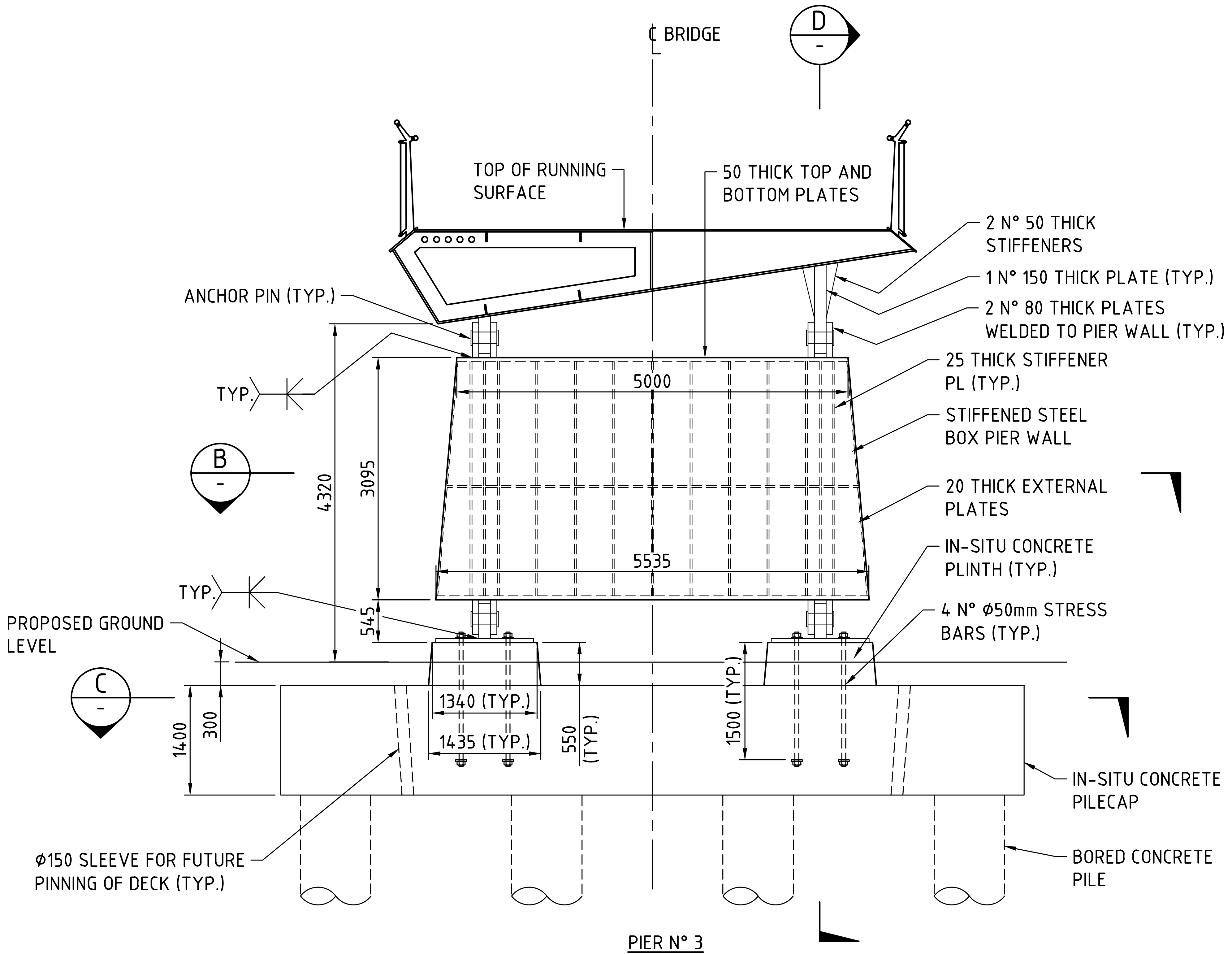


PIER N° 1 & PIER N° 2

TYPICAL PIER SECTION

1:25



PIER N° 3

PIER SECTION

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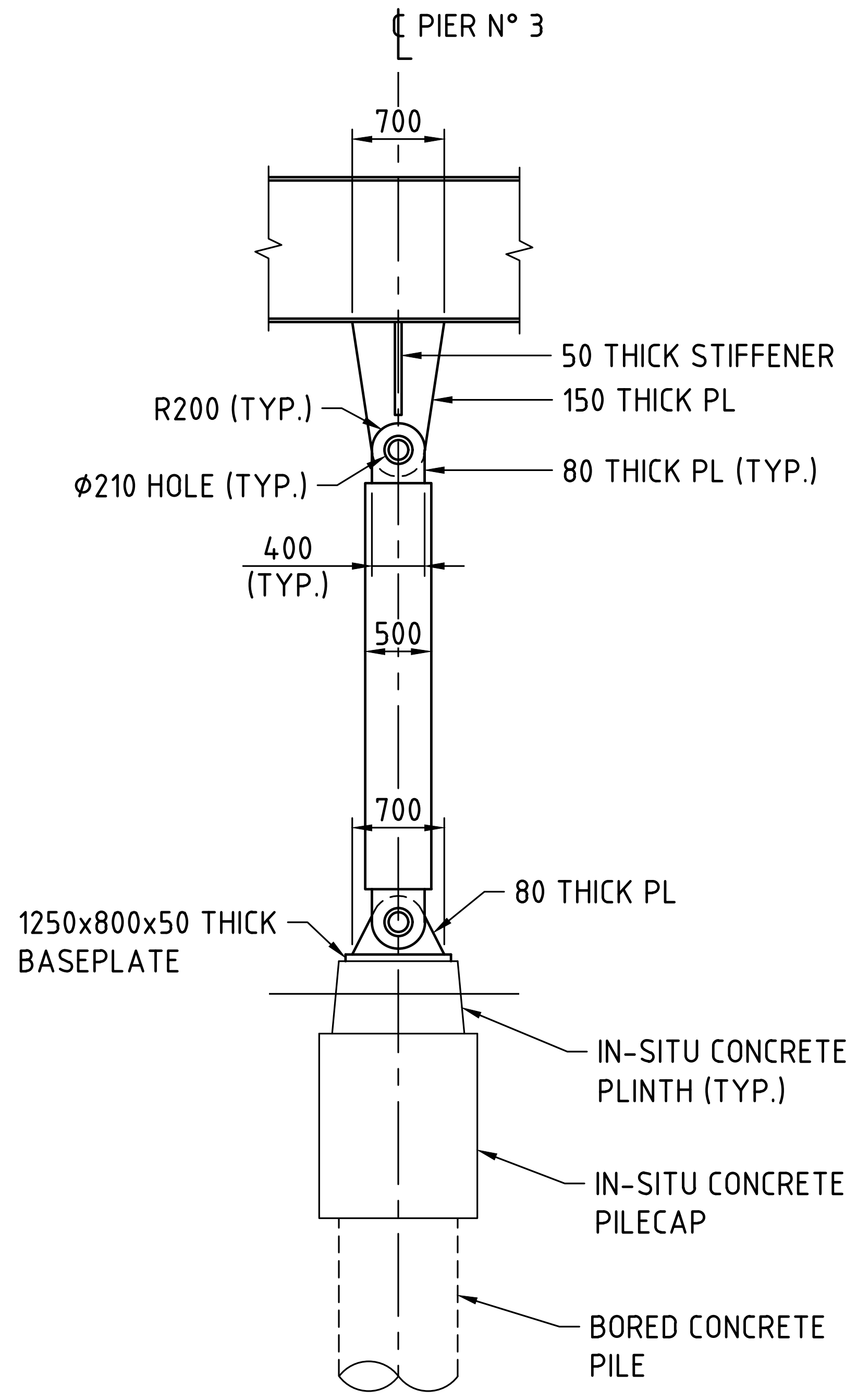

SECTION D

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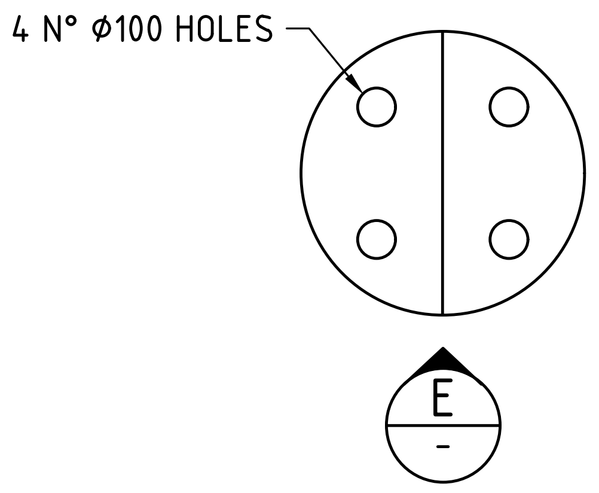
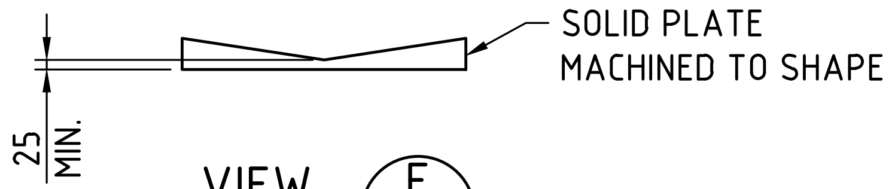


SECTION A

1:20



VIEW E

1:20

PILE DETAILS

LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	MIN. TEMPORARY CASING LENGTH (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
PIER N° 1	BORED PILE	900	1	2.2	32.0	2.0	9.0	-28.0
PIER N° 2	BORED PILE	900	1	1.7	32.0	3.0	9.0	
PIER N° 3	BORED PILE	900	4	0.3	33.0	8.0	9.0	-25.6

NOTES:

1. REFER DRG. N° CPCB-ST-000-SKT-20001 FOR GEOTECHNICAL NOTES.

FOR INFORMATION ONLY

Plot Date: 03/08/2022 2:06 PM Cad File: C:\pwworking\wsp-aus-pw-bentley.com_wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-10201.dwg

Plotted By: Burgess, Brent

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
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9777 Email:
perth@wsp.com

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DESIGNED	C.CHANG	04.08.22
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APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH
VERIFIER
VERIFIED
DATE

Causeway Link Alliance

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE

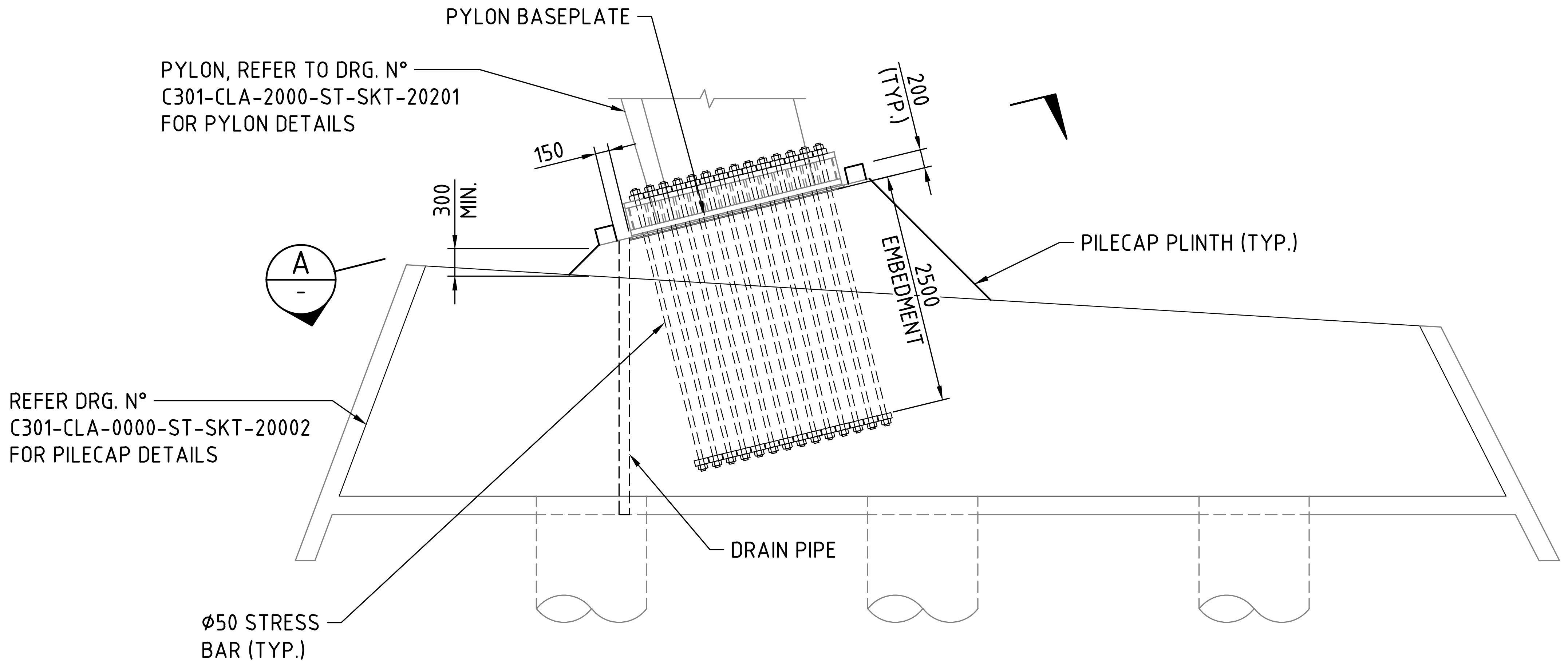
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP
MRWA DRAWING NUMBER

PROJECT TITLE CAUSEWAY LINK ALLIANCE

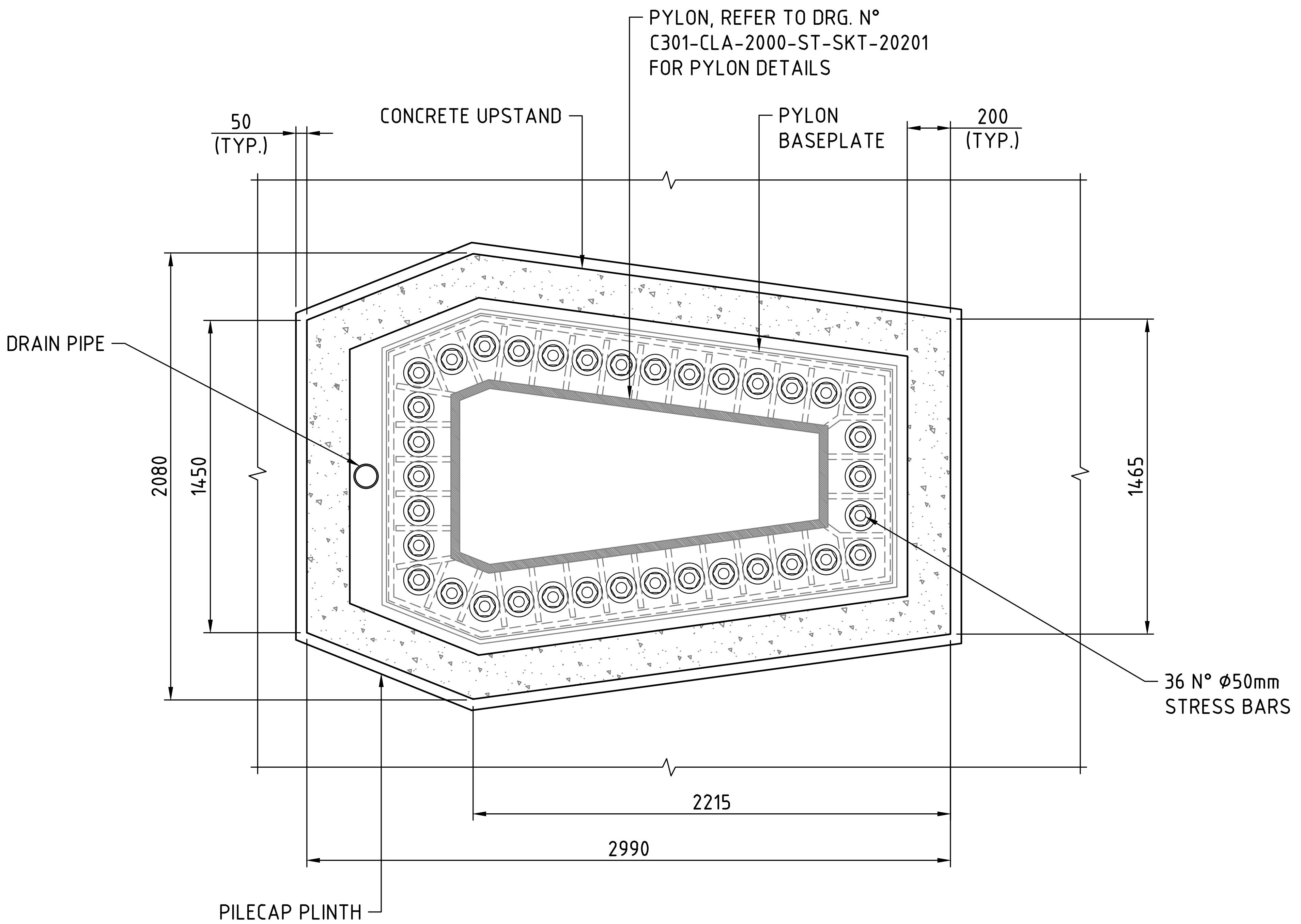
DRAWING TITLE CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
PIER DETAILS

SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-2000-ST-SKT-10201
REV A



PILECAP ELEVATION

1:50



SECTION A -

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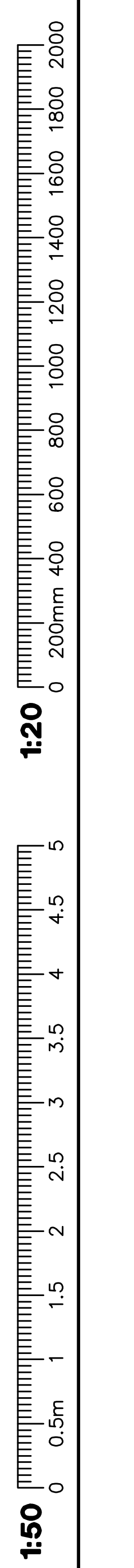

FOR INFORMATION ONLY

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AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
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MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

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perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22
DRAWING PATH		VERIFIED DATE

VERIFIER

Causeway Link Alliance

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP
MRWA DRAWING NUMBER

PROJECT TITLE
CAUSEWAY LINK ALLIANCE

DRAWING TITLE
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
PYLON BASE DETAILS

SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-2000-ST-SKT-20101
REV A

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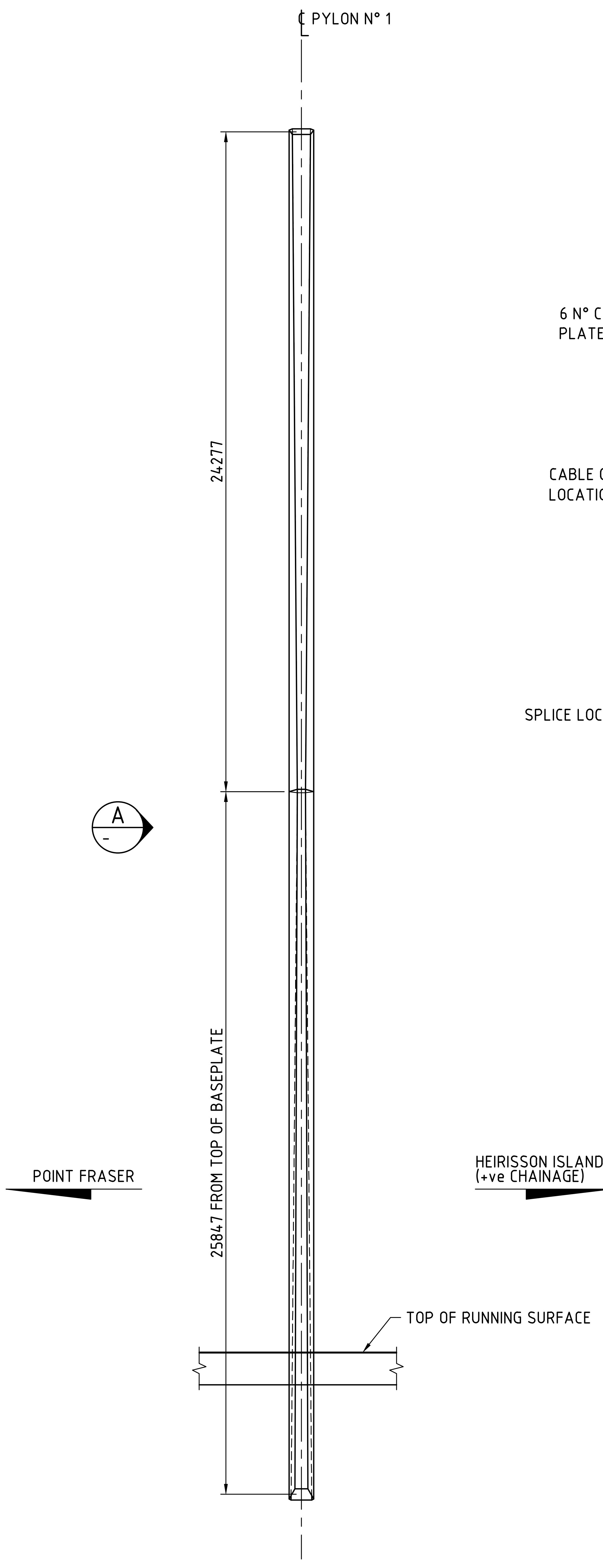

PYLON ELEVATION
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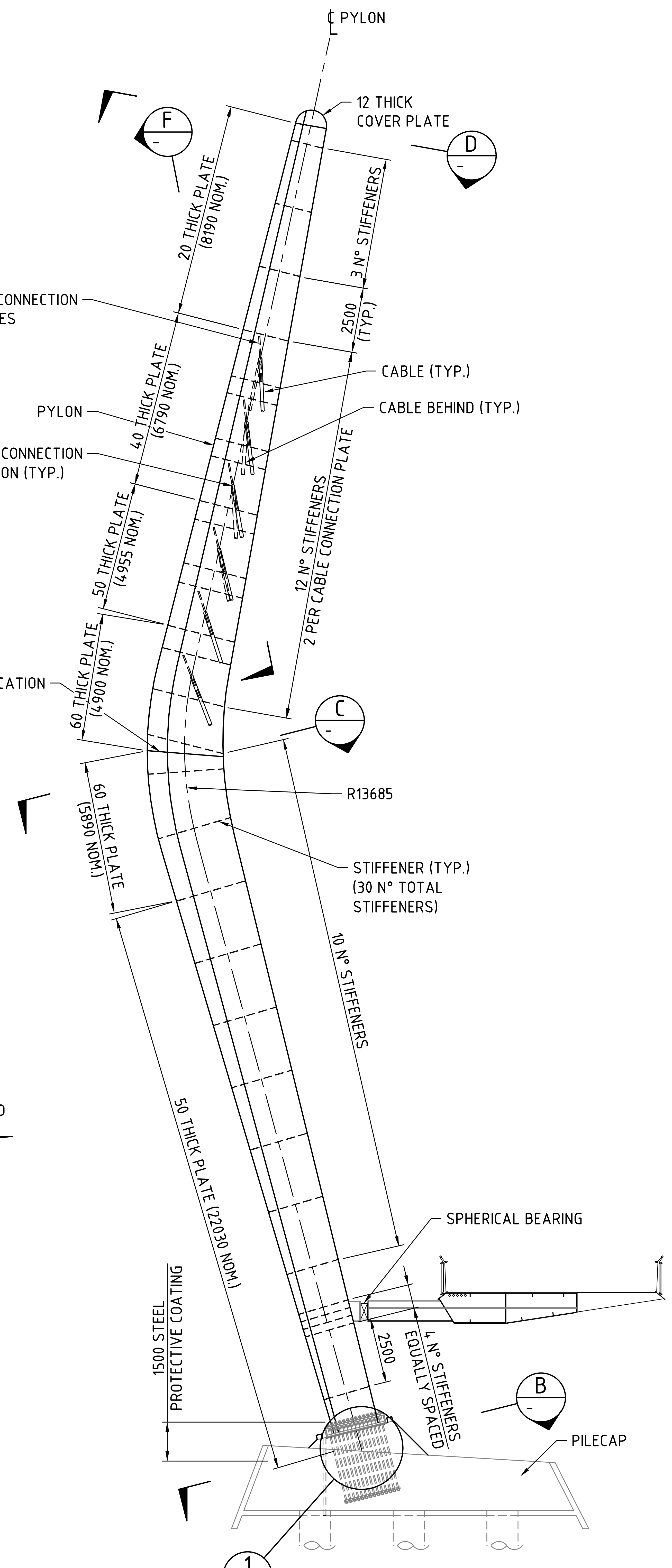

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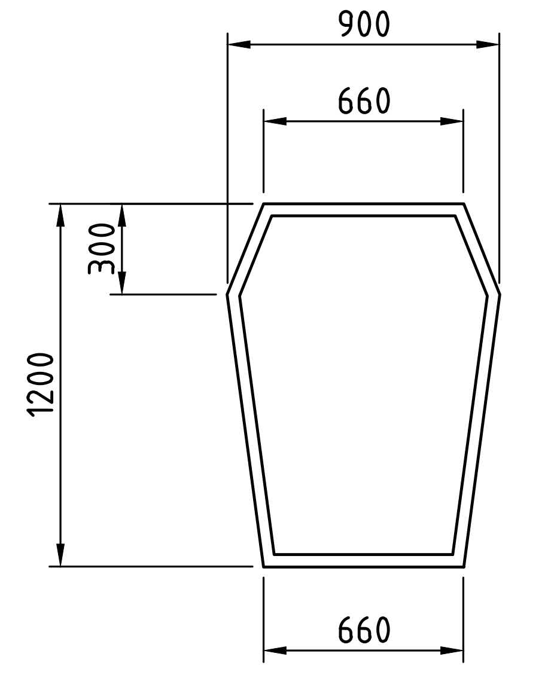

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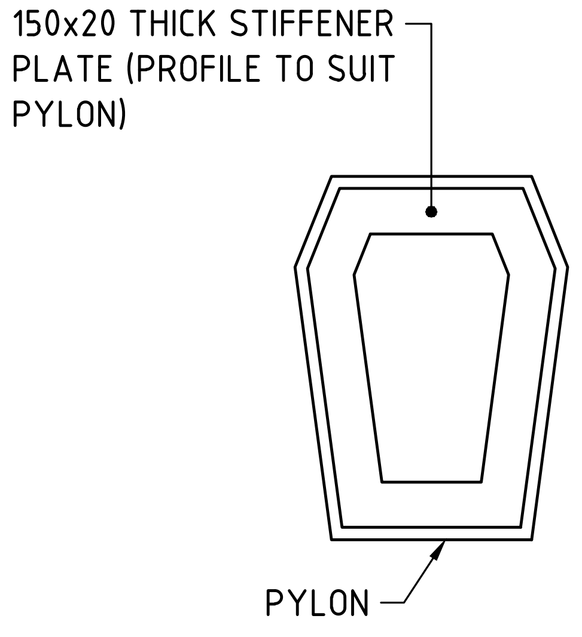

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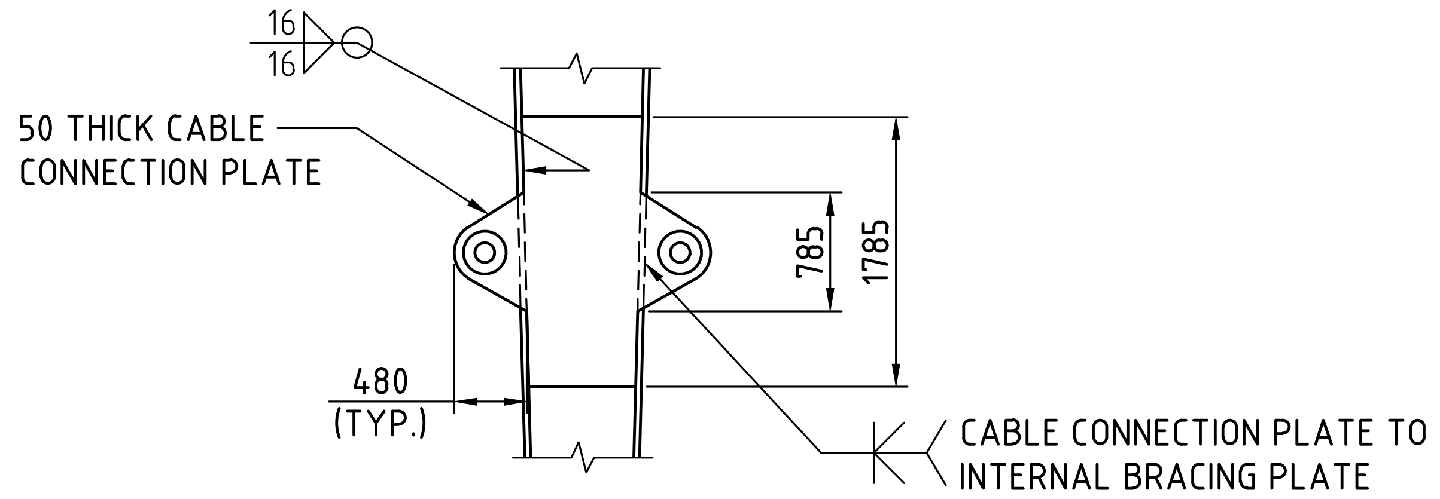

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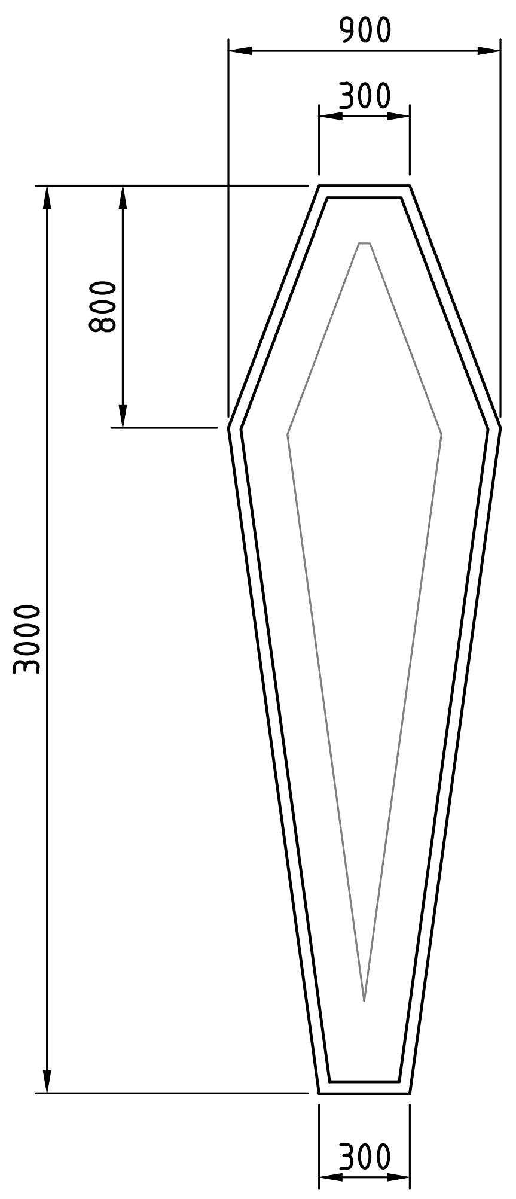

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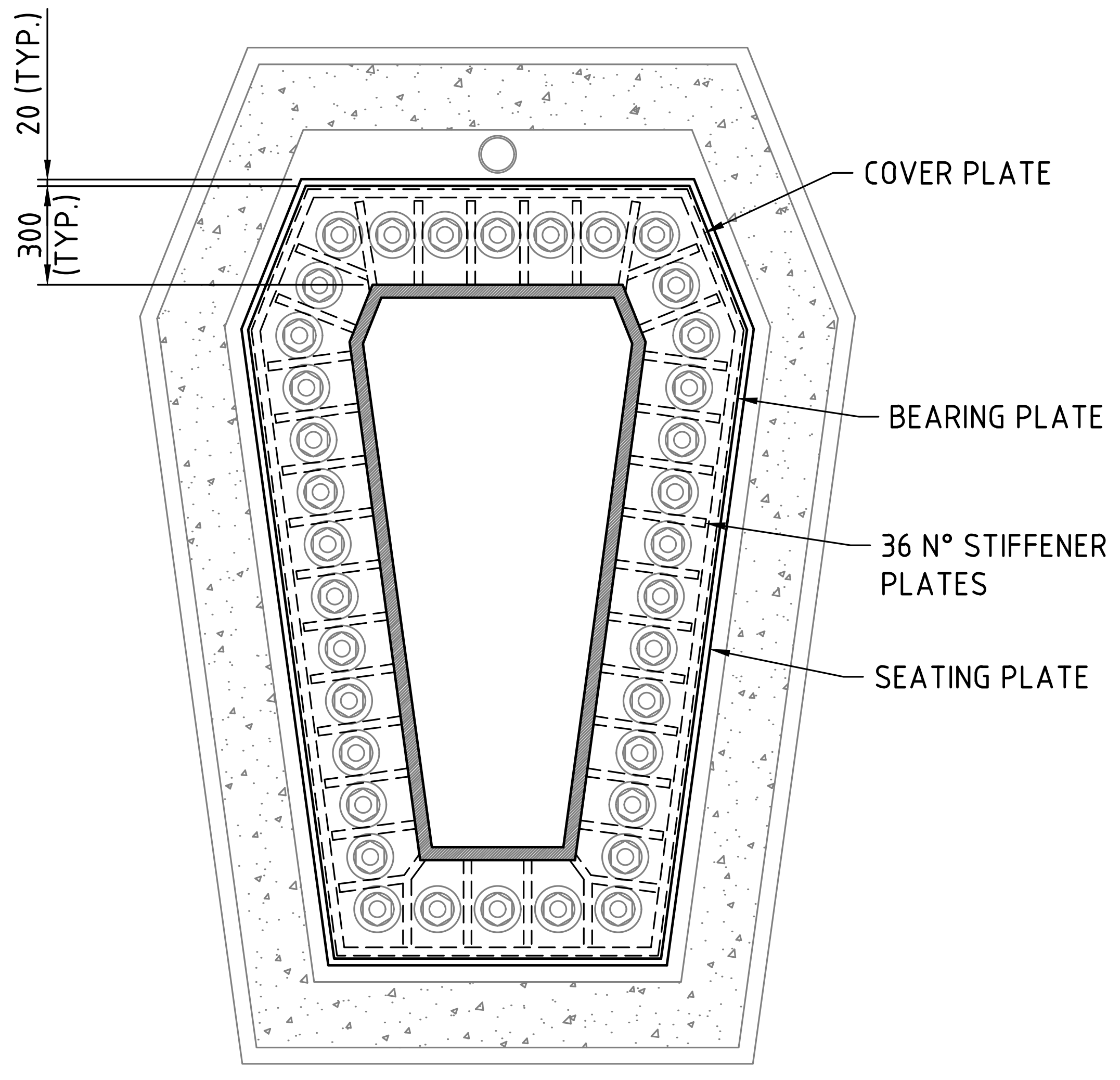

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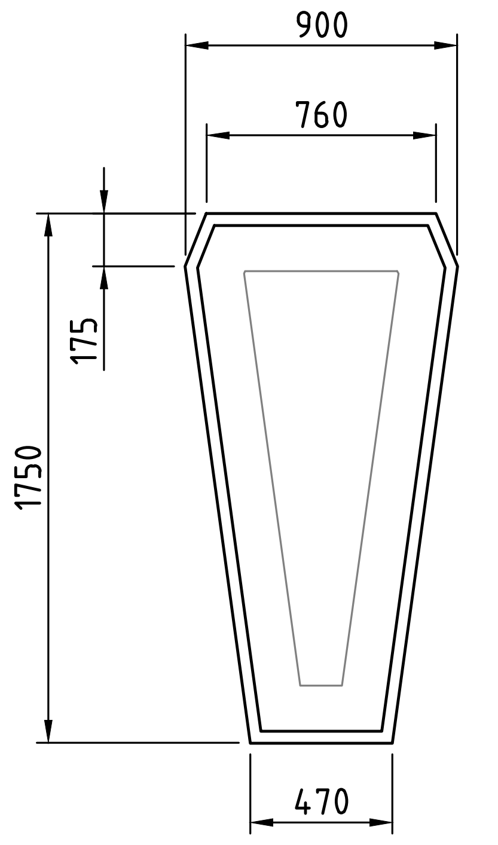

SECTION B
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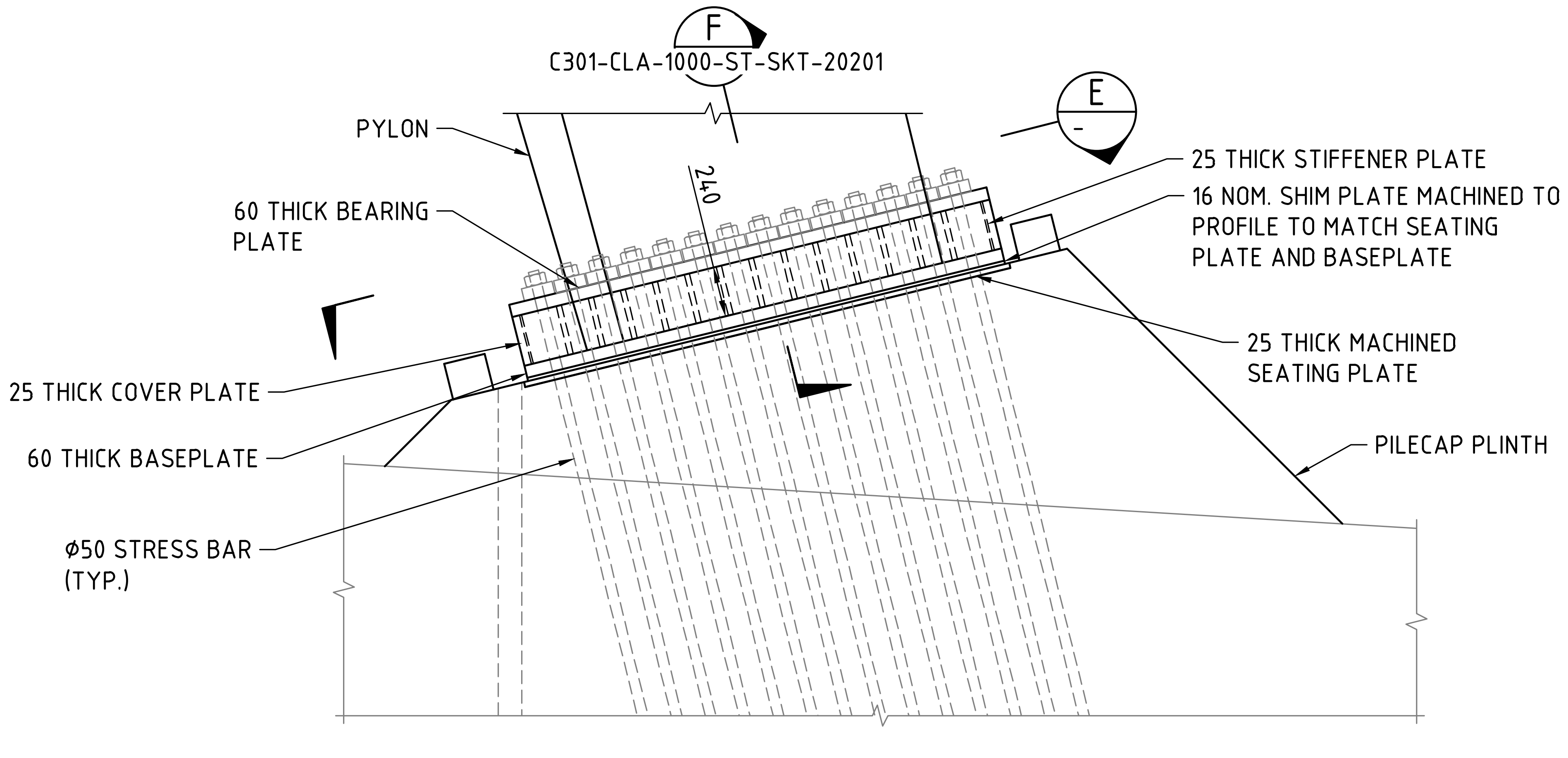

DETAIL 1
1:25

1:20
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Plotted By: Burgess, Brent

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No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH

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Causeway Link Alliance
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mainroads WESTERN AUSTRALIA
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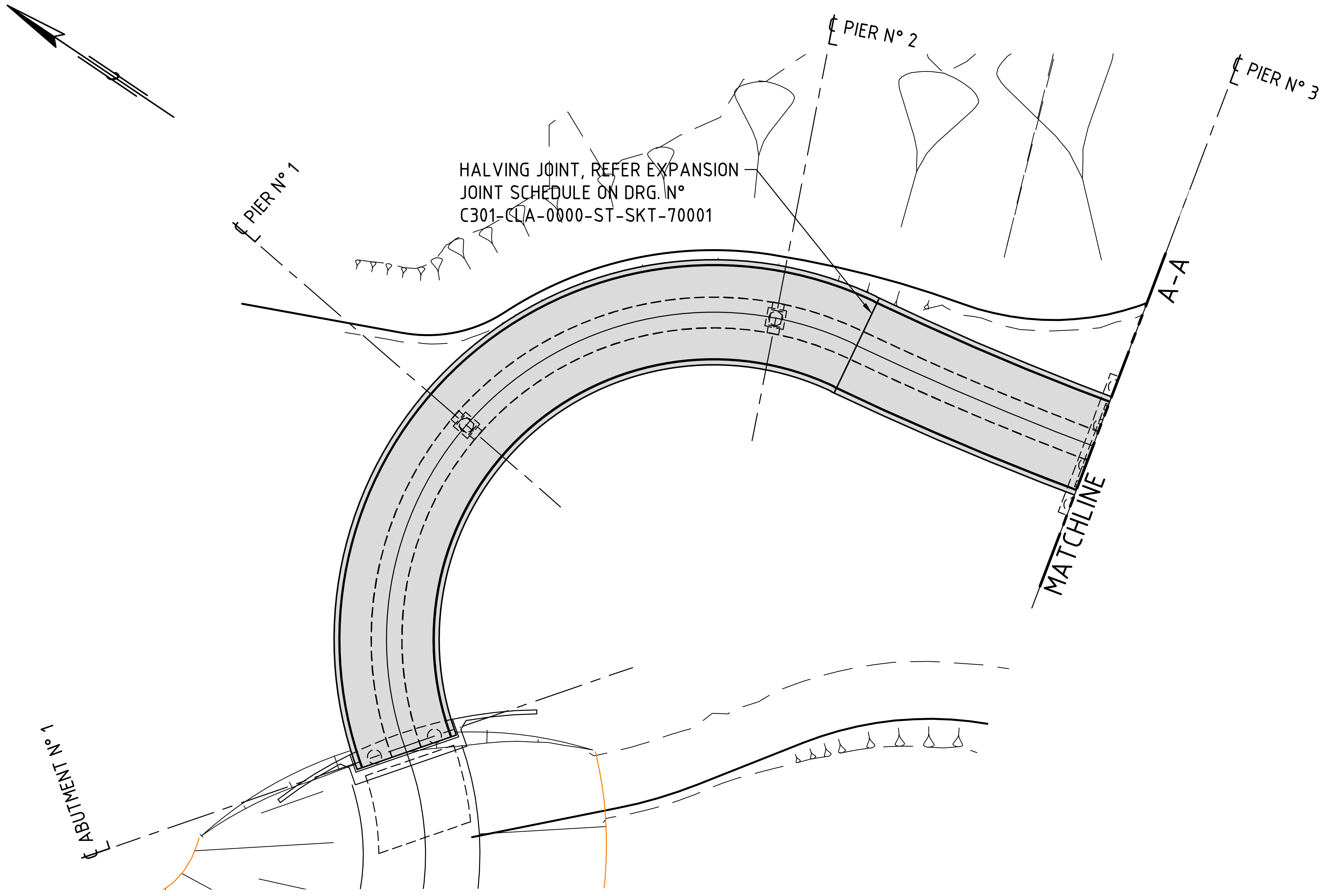
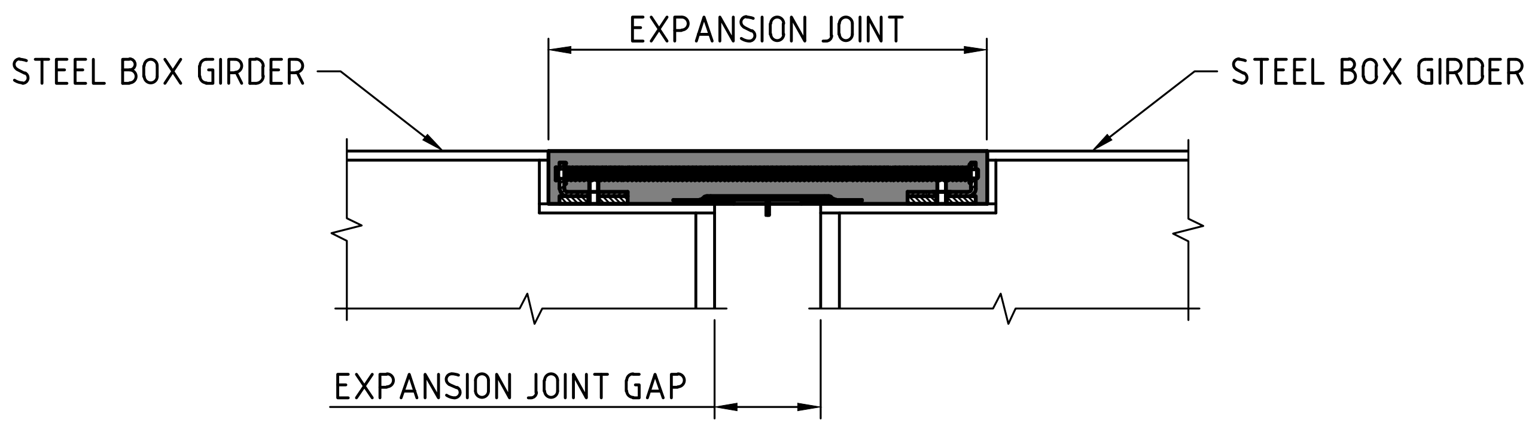
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
PYLON DETAILS
SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-2000-ST-SKT-20201
REV A

NOTES:
1. FOR DECK PLATE THICKNESS REFER DRG N° C301-CLA-0000-ST-SKT-40006.





HALVEN EXPANSION JOINT DETAIL
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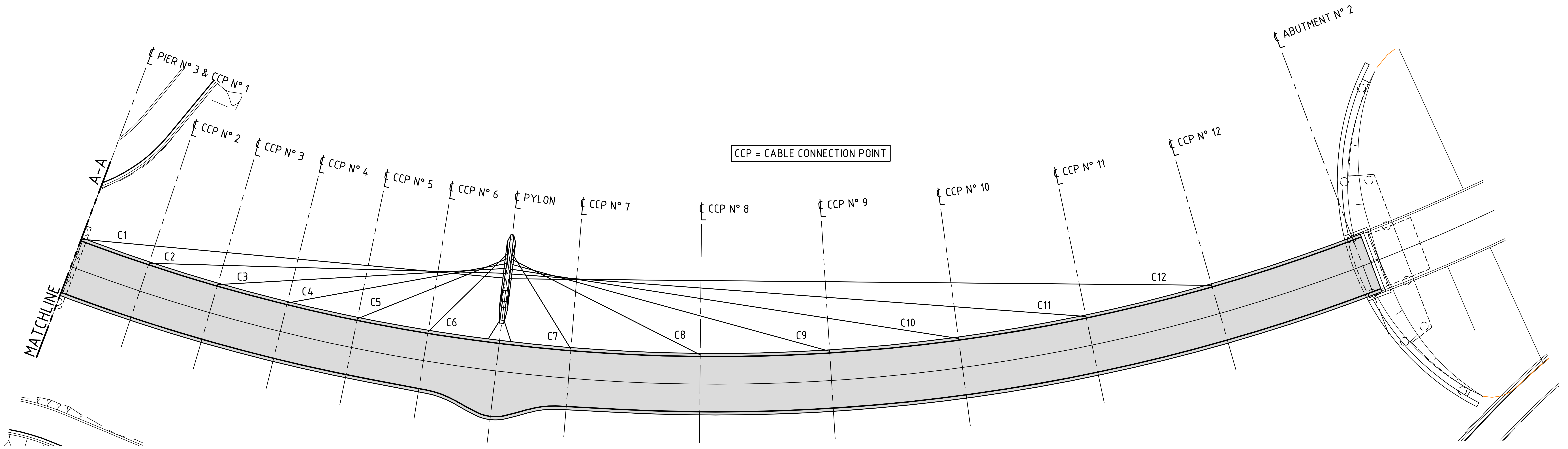
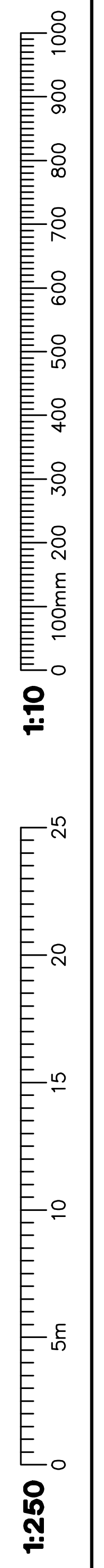


DECK LAYOUT PLAN
1:250



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No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22
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METADATA
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MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH

VERIFIER

VERIFIED

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Causeway Link Alliance

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PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

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FOR INFORMATION ONLY

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION

MRWA DRAWING NUMBER

PROJECT TITLE: CAUSEWAY LINK ALLIANCE

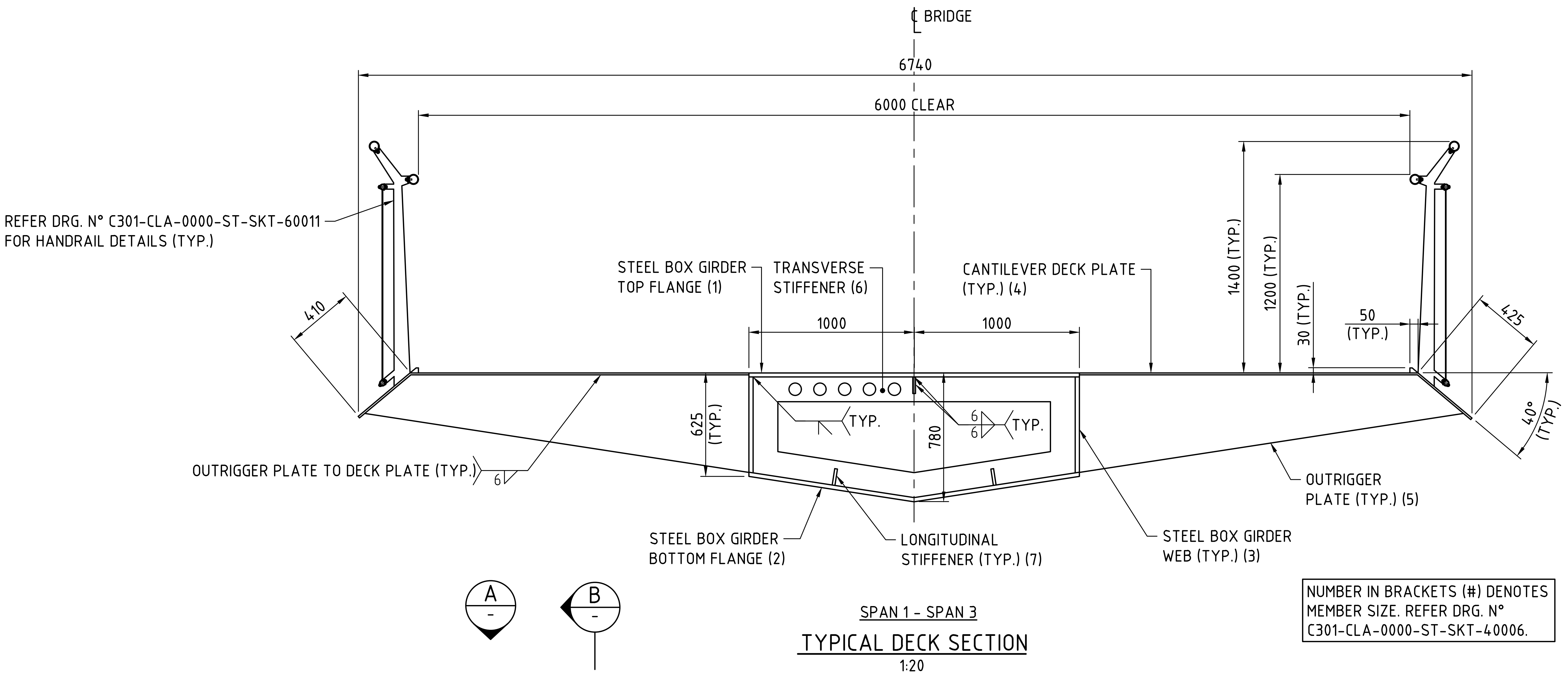
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
DECK LAYOUT PLAN

SHEET: A1

DRAWING STATUS: 15%

DRAWING No.: C301-CLA-2000-ST-SKT-40001

REV: A



NUMBER IN BRACKETS (#) DENOTES
MEMBER SIZE. REFER DRG. N°
C301-CLA-0000-ST-SKT-40006.

SPAN 1 - SPAN 3

TYPICAL DECK SECTION

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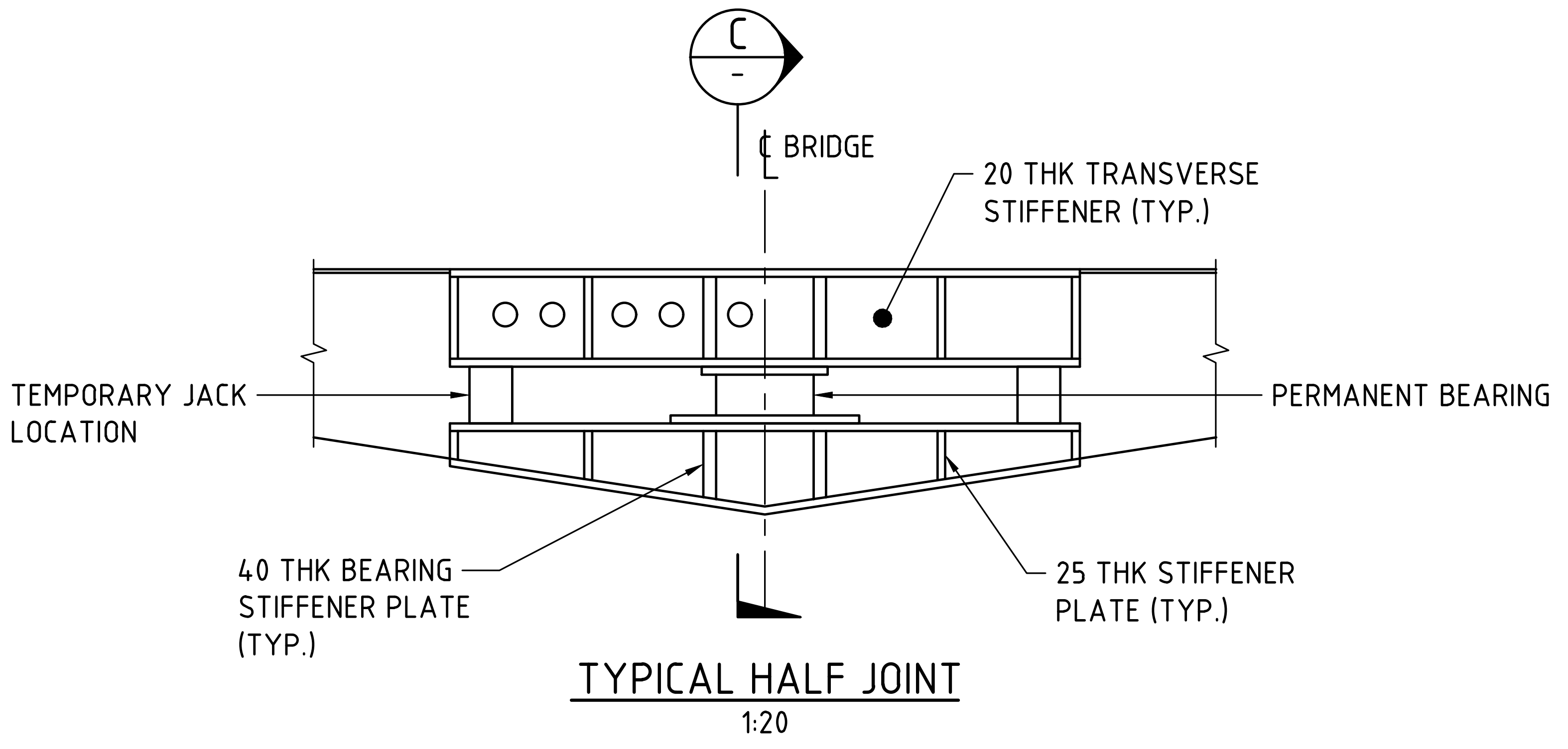

TYPICAL HALF JOINT

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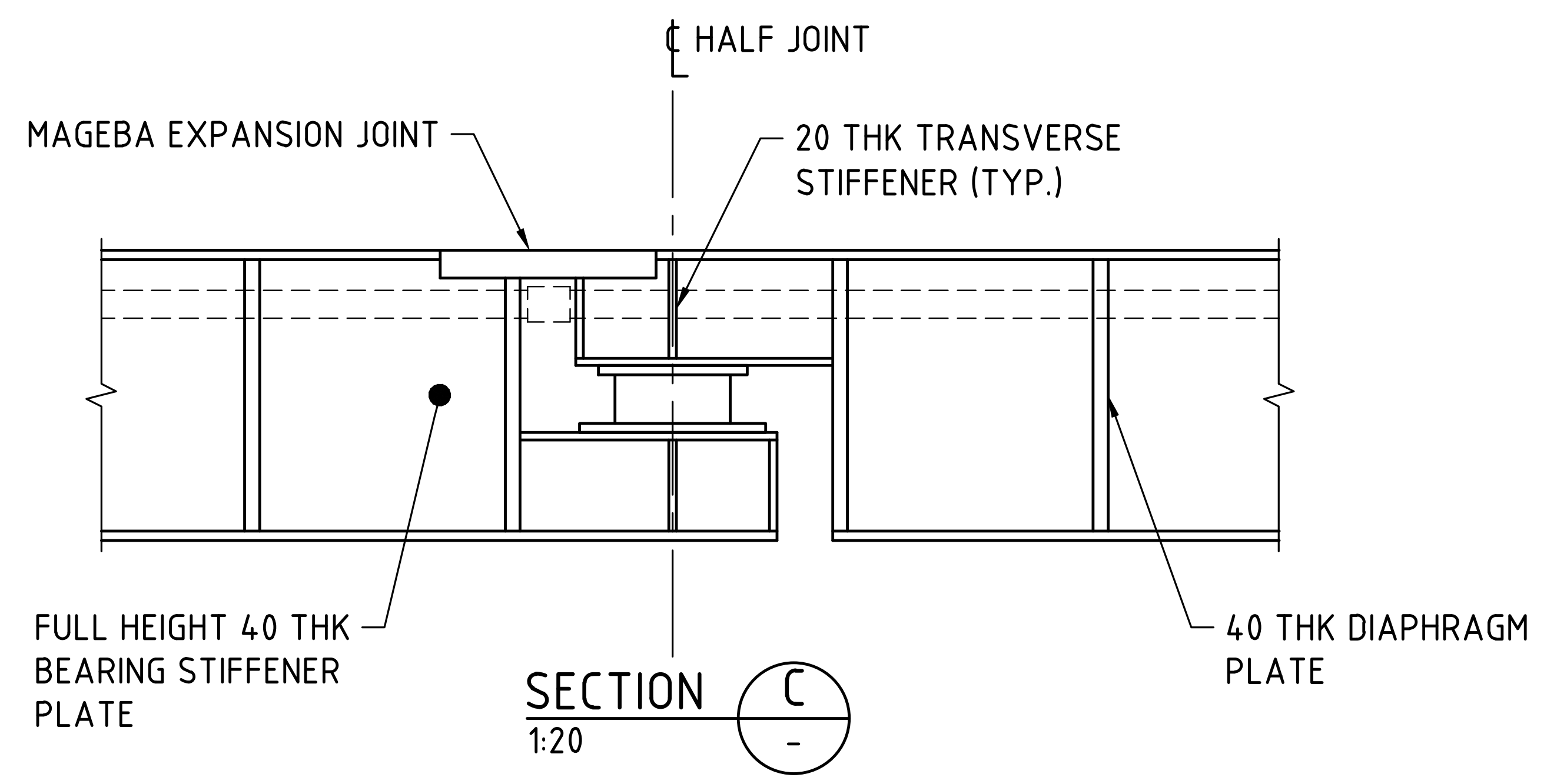

SECTION C

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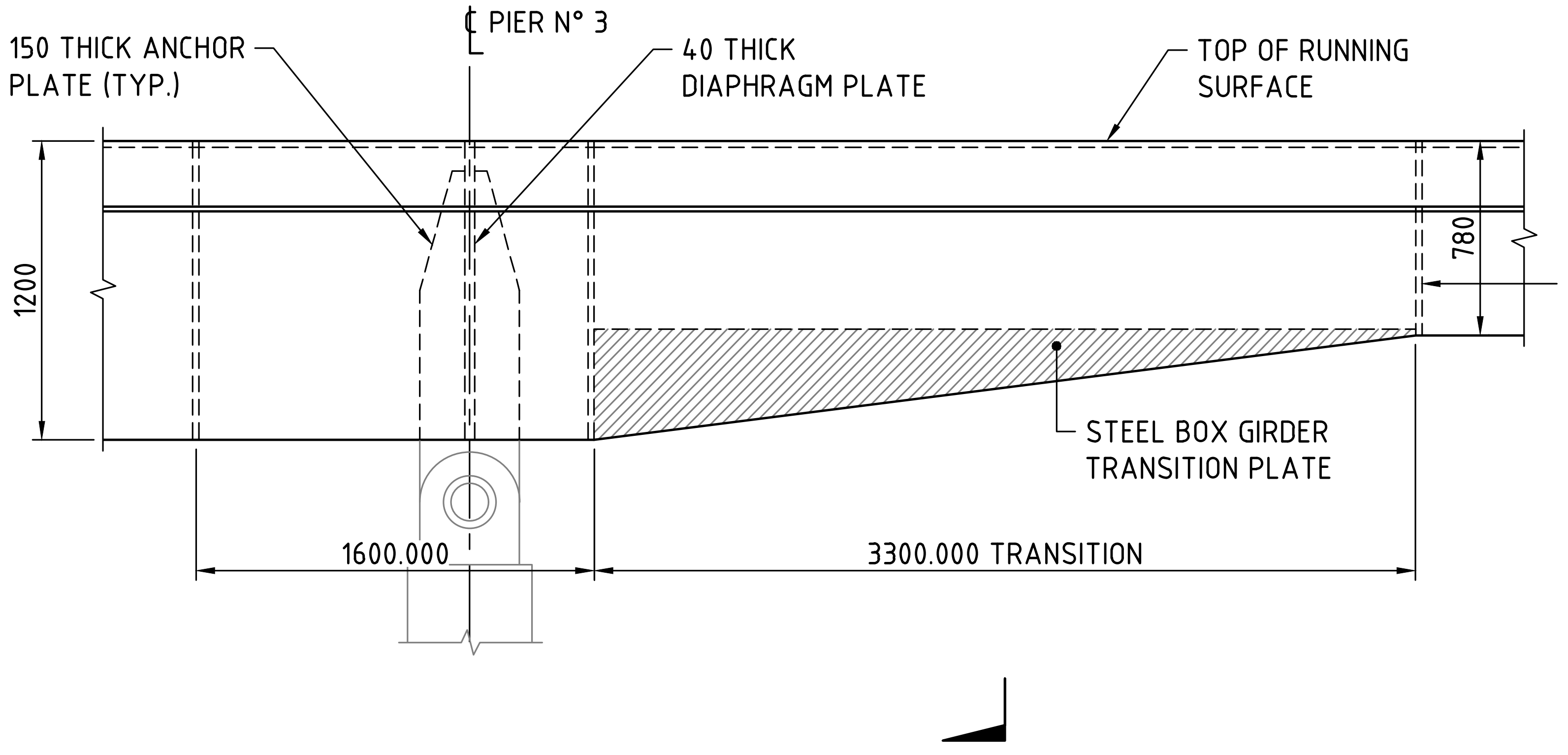
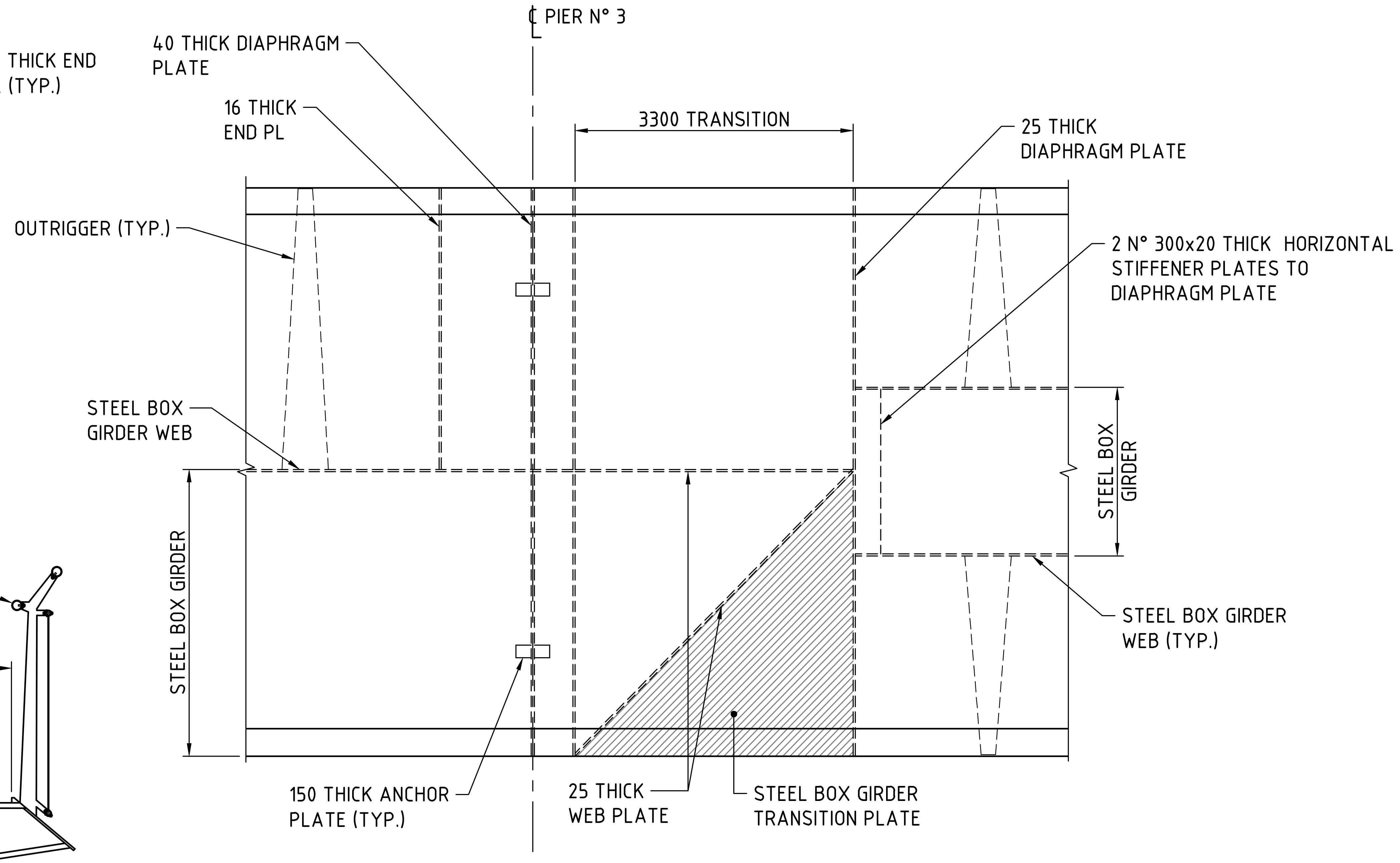


STEEL BOX GIRDER TRANSITION

ELEVATION

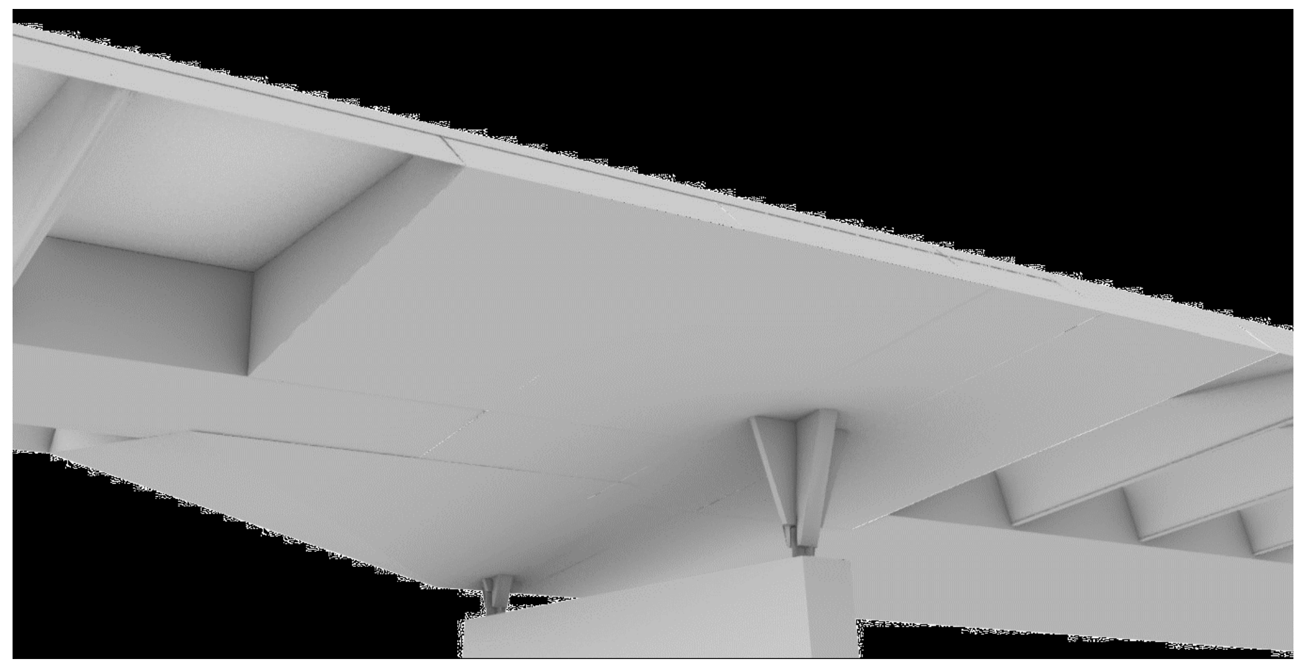
1:25

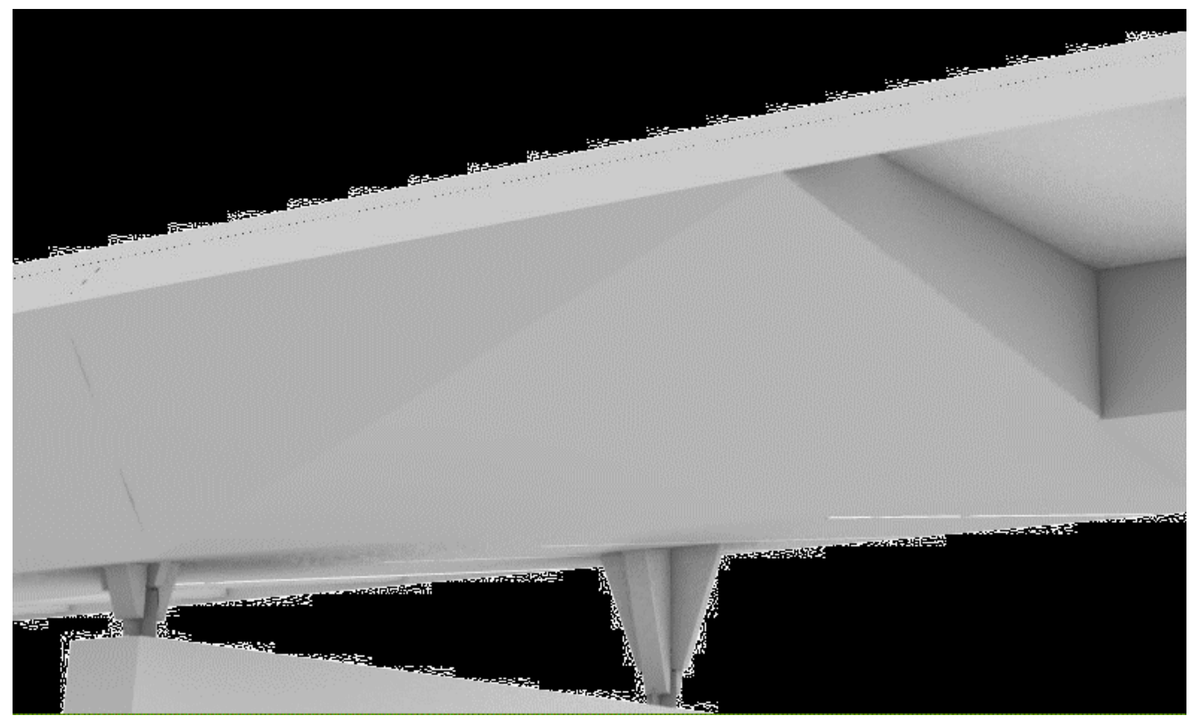


STIFFENERS IN STEEL BOX
GIRDER OMITTED FOR CLARITY

VIEW A

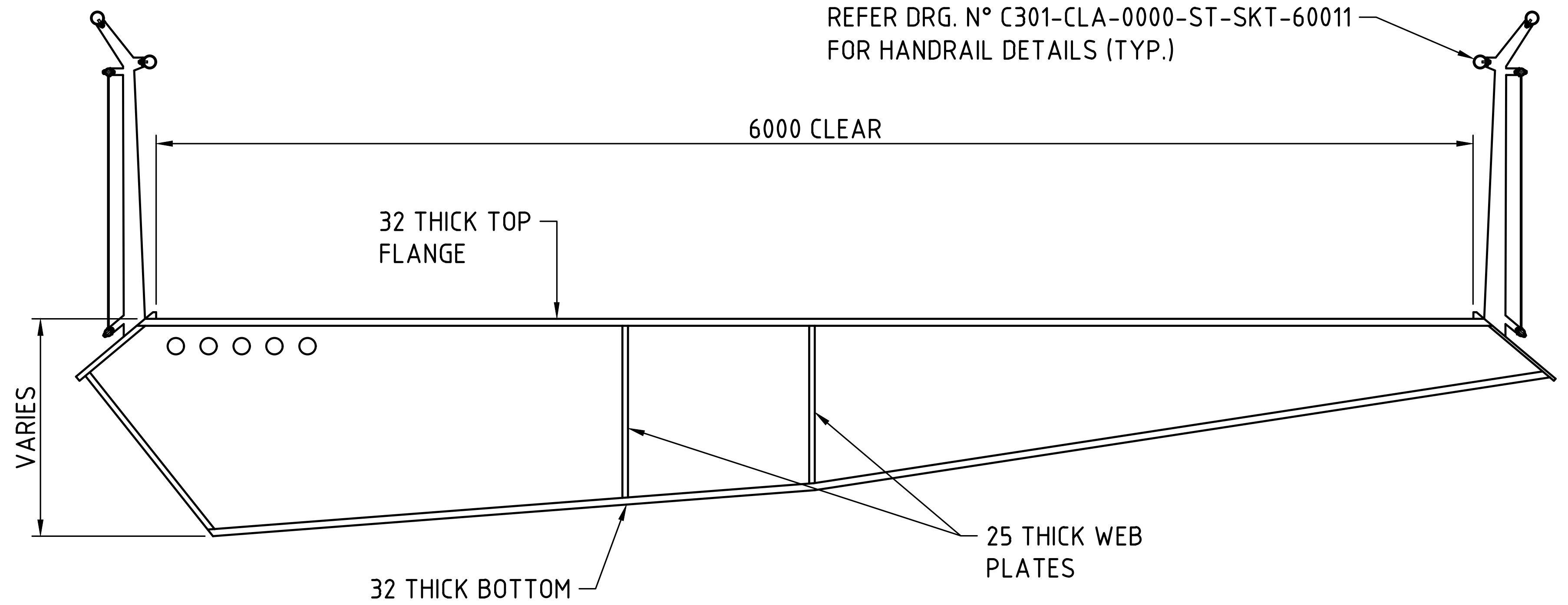
1:50





DECK TRANSITION - PERSPECTIVE VIEW

N.T.S.



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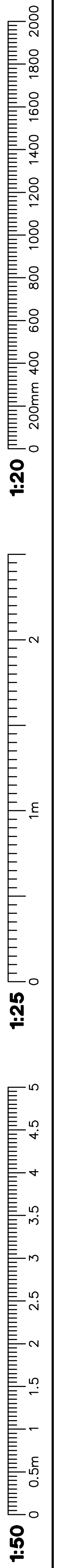

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AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
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MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
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DRAWING PATH

VERIFIER

VERIFIED
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PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

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MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
DECK SECTIONS AND DECK TRANSITION DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-2000-ST-SKT-40002
REV: A

APPENDIX B: STRUCTURAL DESIGN CRITERIA

Material Properties

The following material properties shall be adopted in the design:

Table 14: Concrete

PARAMETER	SYMBOL	VALUE	Source
Concrete	f'_c	40 MPa, 50 MPa	
Elastic modulus (28 days)	E_c	32,800 MPa for 40 MPa 34,800 MPa for 50 MPa	AS5100.5: 2017, Cl.3.1.2 & Table 3.1.2
Drying shrinkage strain	$\varepsilon_{cs.d}$	600με	MRWA Spec 820.
Basic creep factor	$\phi_{cc.b}$	2.8 for 40 MPa 2.4 for 50 MPa	AS5100.5: 2017, Cl 3.1.8.2 & Table 3.1.8.2
Coefficient of thermal expansion	α_c	10×10^{-6}/ °C	AS5100.5: 2017, Cl 3.1.6
Concrete Density (In-situ) (Precast)	r	25.5 kN/m^2 26.0 kN/m^2	

Table 15: Steel reinforcement

PARAMETER	SYMBOL	VALUE	Source
Elastic modulus	E_s	200,000 MPa	AS 5100.5:2017, Cl 3.2.2
Yield strength - Deformed bars Grade D500N	f_{sy}	500 MPa	AS 5100.5:2017, Table 3.2.1
Yield strength - Welded wire fabric Grade D500N	f_{sy}	500 MPa	AS 5100.5:2017, Table 3.2.1
Yield strength – Plain (fitments only) Grade R250N	f_{sy}	250 MPa	AS 5100.5:2017, Table 3.2.1

Table 16: Structural steel

PARAMETER	SYMBOL	VALUE	Source
Elastic modulus	E_s	200,000 MPa	AS/NZS 5100.6:2017, Cl 2.2.5
Coefficient of thermal expansion	α_c	11.7×10^{-6}/ °C	AS/NZS 5100.6:2017, Cl 2.2.5
Yield strength – Plate $t \leq 12$ mm Grade 400	f_y	400 MPa	AS/NZS 5100.6:2017, Table 2.1
Yield strength – Plate ($12 \leq t \leq 20$mm) Grade 400	f_y	380 MPa	AS/NZS 5100.6:2017, Table 2.1
Yield strength – Plate ($20 \leq t \leq 80$mm) Grade 400	f_y	360 MPa	AS/NZS 5100.6:2017, Table 2.1
Yield strength – Plate $t \leq 12$ mm Grade 350	f_y	360 MPa	AS/NZS 5100.6:2017, Table 2.1
Yield strength – Plate ($12 \leq t \leq 20$mm) Grade 350	f_y	350 MPa	AS/NZS 5100.6:2017, Table 2.1

Yield strength – Plate (20 ≤ t ≤ 80mm) Grade 350	f_y	340 MPa	AS/NZS 5100.6:2017, Table 2.1
Yield strength – Plate t ≤ 12 mm Grade 316 SS	f_y	205 MPa	ASTM
Yield strength – SS wire rope AISI316	f_y	205 MPa	DIN 3055

Design Loads

Permanent Effects

Dead Load

Dead loads shall be considered as the weight of structural elements, and any non-structural elements that are considered unlikely to vary during construction and use of the structure. Dead loads shall be calculated using the unit weights specified in Table 17.

Table 17 Material Unit Weights:

Material		**unit weight**
Reinforced concrete	40MPa	25.5 kN/m^3
	50MPa	26.0 kN/m^3
Steel	ALL	77.0 kN/m^3
Surfacing	ALL	22.0 kN/m^3

Superimposed Dead Loads

Superimposed dead loads shall be considered as the weight of non-structural elements which may vary during construction and use of the structure. Superimposed dead loads include all elements of the superstructure excluding the deck in accordance with the SWTC Cl 4.4(d)(ii)(A):

- Kerbs and barriers;
- Surfacing;
- Services of significant size.
- The material unit weight specified in Table 17 shall be used to calculate the superimposed dead load.

Differential Settlement

Differential settlement shall be applied in accordance with Main Roads WA Structures Engineering Design Manual and AS 5100.2:2017 clause 20.

Earth Pressure

Earth pressure from surcharge loads shall be determined in accordance with clause 14.2 of AS 5100.2:2017 and applied in accordance with AS 5100.3:2017 and AS 4678, as appropriate.

Thermal Effects

Variation in Average Bridge Temperature

The structure location shall be considered as coastal in Region II with a height above sea level less than 1000 m. This corresponds to an average bridge temperature range of -5.3°C to +68°C accordance with clause 18.2 of AS 5100.2:2017.

Transient Effects

Traffic Loads

The bridge shall be designed for crowd loading in accordance with clause 8 of AS 5100.2:2017. A design load of 5 kPa shall be used. The dynamic load allowance factor of 0.0 and an ultimate limit state factor of 1.5 shall be used.

In addition, the bridges shall be designed for a modified M-truck detailed in Main Roads' Document 3912/02-5 Design Vehicle Loading. For the M-truck vehicle, a dynamic load allowance of 1.1 shall be used and an ultimate limit state factor of 1.5.

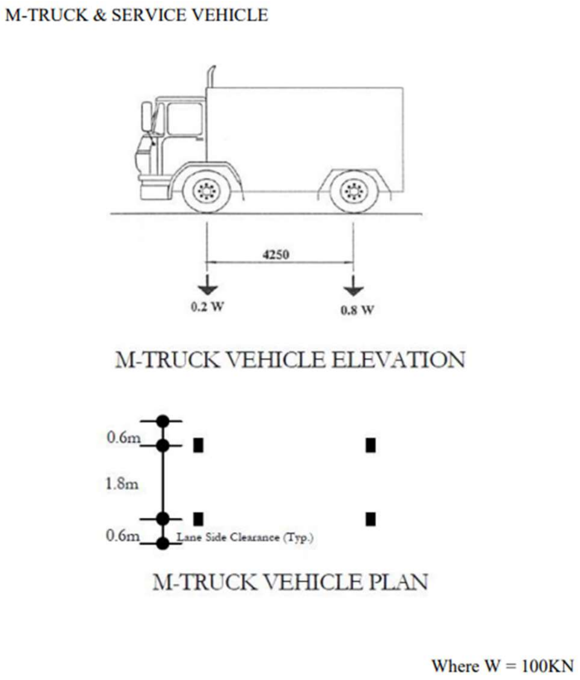


Figure 14 M-Truck

Pedestrian footfall dynamic behaviour assessment

The dynamic behaviour assessment shall be in accordance with the publication of JRC Scientific and Technical Reports, "Design of Lightweight Footbridges for Human Induced Vibrations" as an appropriate specialist literature and supplement the Bridge Code to design the dynamic serviceability comfort criteria. The comfort classes for common acceleration ranges can be found in Table 18 below and are in accordance with Clause 5.8 of the BDC. The relevant definitions are in accordance with Table 4-3 and Table 4-4 from the JRC report.

Table 18: Proposed comfort classes with common acceleration ranges

Design Situation	Description	Traffic Class	Expected occurrence	Comfort Class
1	Standard commuter traffic	TC 1	Daily	CL 1
2	Show weekends	TC 2	Monthly	CL 1
3	Skyworks	TC 3	Once per annum	CL 2

4	Opening and special events (Maximum design event)	TC 4	Once per decade	CL 2 & Ensure no lateral lock-in occurs

Braking Loads

N/A.

Wind Loads

Wind loading shall be in accordance with AS 5100.2:2017 and AS 1170.2 based on a geographical location of Region A1 and further assumptions listed in Table 19.

Coincident wind and live loading shall only be considered as a serviceability load with the wind speed limited to 35 m/s.

Table 19: Wind load assumptions

Parameter	ULS	SLS	Construction
Importance Level	IL3		
Annual Return Interval	1/2000	1/20	1/250
Wind Region	A1 (Perth)		
Regional Gust Wind Speed, V_R	48 m/s	37m/s	43 m/s
Terrain category (Longitudinal direction)	TC2 – (To be confirmed by Detailed Wind Study)		
Terrain category (Transverse direction)	TC1 – (To be confirmed by Detailed Wind Study)		
Terrain/height multiplier, $M_{z,cat}$	As per Table 4.1 of AS/NZS 1170.2 For deck design, $M_{z,cat}$ is determined at the approx. bridge deck level at (RL5.0 to RL10.0) For pylon design, $M_{z,cat}$ varies over the height of the pylon as per Table 4.1 of AS/NZS 1170.2		
Directional multiplier, M_d	0.95 (for determining the resultant forces and overturning moments on complete structure and wind actions on major structural elements). 1.0 for all other cases.		
Shielding multiplier, M_s	1.0		
Topographic multiplier, M_t	1.0		
Wind drag/lift coefficients	TBC by wind tunnel testing		
Dynamic response factor, C_{dyn}	1.0 for deck 1.2 for pylon Dynamic effect will be captured and validated by aeroelastic wind tunnel testing.		
Design Wind Speed	$V = V_R * M_d * (M_{z,cat} * M_s * M_t)$		

Earthquake Loads

Earthquake loads are to be determined during the detailed design. From the recommendations provided in AS1170.4-2007 (R2018), the design earthquake event is defined by the following characteristics:

- Site classification in accordance with Table 4.1 of AS1170.4-2007 (R2018):
  - E_e (very soft soil) for PFB Abutment 1 area.

  - D_e (soft soil) for PFB Pylon 1, PFB Abutment 2 and MPB Abutment 1 areas.
  - C_e (soft soil) for MPB Pylons 1 and 2 and MPB Abutment 2 areas.
- Site hazard design factor (Z) of 0.09 based on Figure 3.2(C).
- From Table 6.4 of AS1170.4-2007 (R2018),
  - a spectral shape factor $C_h(T)$ of 1.1 has been adopted based on a period of zero seconds and a site sub-soil class of D_e and E_e.
  - a spectral shape factor $C_h(T)$ of 1.3 has been adopted based on a period of zero seconds and a site sub-soil class of C_e.
- Importance factor:
  - k_p = 1.0 (AS1170.4-2007) with an annual probability of exceedance (AEP) of 1 in 500 for approach embankments.
  - k_p = 1.7 (AS1170.4-2007) with an annual probability of exceedance (AEP) of 1 in 2,000 for the abutments and pylons.
- Design ductility factors are summarised in Table 20 below, based on the guidance provided in AS 5100.2 Cl. 15.9.2.

Table 20: Bridge Ductility Factors

Direction	**Bridge configuration**	**Design Ductility Factor (μ)** **Damage control performance level**
Horizontal	Bearings - Abutment	4.0
	Bearings – Half Joint / P5	3.0
	Integral	3.0
Vertical	Any	1.0

The bridge is classified as Bridge Earthquake Design Category (BEDC)-3 as specified by BDC Cl 5.13.

Minimum Lateral Restraint

A lateral restraint system shall be provided in accordance with clause 10 of AS 5100.2:2017. The restraint system for each continuous section of the superstructure shall be designed to resist a minimum ultimate horizontal force normal to the bridge centreline of 500 kN or 5% of the superstructure dead load at the support, whichever is greater.

Vertical restraint devices shall be provided at all supports where the vertical design earthquake load opposes and is greater than 50% of the static reaction under permanent loads. Where vertical restraint devices are required, it shall be designed to resist not less than 10% of the vertical reaction from permanent effects of the support.

Kerb Design Loads

The kerb design loads shall be in accordance with clause 12.1 of AS 5100.2:2017.

Barrier Performance

The structure (bridge deck and elements supporting the barriers) shall be designed to accommodate the ultimate design loads to restrain crowd loads, in accordance with AS 5100.2:2017, Cl. 12.5 and the BDC, Clause 5.7.

Forces resulting from water flow

Forces on the superstructure due to water flow, debris moving objects and effects due to buoyancy and lift do not need to be considered as the soffit at its lowest level has a freeboard of 828 mm and

670 mm to the 2000-year ARI flood level for the McCallum Park bridge and Point Fraser bridge respectively according to the provided waterways report BGE-P0181-REP-W-0001.

Collision Loads

The structures shall be designed to resist collision from waterway traffic in accordance with the BDC, Clause 5.13.

AASHTO LRFD Bridge Design Specifications, Eighth Edition, 2017, Clause 3.14.8 shall be used to determine the collision impact force on the piers using the following vessel masses and velocities in Table 21.

Table 21: Vessel masses and velocities

Vessel	Mass (t)	Max Speed (knots)
Vessel 1 (River Ferry) *see Note 1	43	8
Vessel 2 (DoT Patrol Vessel)	C4.75	37
Vessel 3 (River Cruise Ferry)	36	11
Vessel 4 (River Cat)	10	25
Vessel 5 (Barge)	200	4

Note 1: The McCallum Park Footbridge is not required to be designed for Vessel 1 (River Ferry) collision loads.

Fatigue Loads

N/A.

Design for Shrinkage, Creep and Prestress Effects

The effects of shrinkage and creep shall be considered in accordance with clause 19.1 of AS 5100.2:2017 and Clause 8.10 of AS 5100.5:2017.

Construction Forces

The internal and external stability of the structure shall be assessed at each stage of construction.

Construction tolerances considered in the design will be detailed on the design drawings.

Limit States

The structure shall be assessed at the Serviceability Limit State (SLS), Ultimate Limit State (ULS). Load factors for each state are based on AS 5100.2:2017. It is assumed that the superimposed dead loads will be controlled, with a surfacing thickness of 5 mm adopted, and thus a factor of 1.4 is adopted for the ULS case as per AS 5100.2:2017, Cl 6.3 and Table 6.3.

Load Combinations

The behaviour of structural components shall be investigated for each stage that may be critical during construction, handling, transportation and erection, as well as during the service life of the structure.

Components shall be proportioned to satisfy strength and serviceability limit states, as well as extreme events.

Any special Loads not covered above

None.

Geotechnical Design Criteria

The use of AS1170.4-2007 parameters that are developed for structural design could lead to a conservative estimate of the peak ground acceleration for geotechnical assessment such as global stability of embankment or liquefaction assessment.

Based on the information provided in the Earthquake Loads (Refer pg 51)

- a design horizontal peak ground acceleration a_h = 0.12g and a_h = 0.1g (z × Ch(T=0s) × k_p) is defined for Class C_e and D_e/E_e respectively for approach embankments (AEP of 1 in 500).
- a design horizontal peak ground acceleration a_h = 0.20g and a_h = 0.017g (z × Ch(T=0s) × k_p) is defined for Class C_e and D_e/E_e respectively for the abutments (AEP of 1 in 2,000).

The 2018 National Seismic Hazard Assessment (NSHA) for Australia (Geoscience Australia 2018, accessible at www.ga.gov.au) indicates a maximum probabilistic hazard value of about 0.028g for Perth for a 1/500 AEP earthquake (in comparison to the hazard factor (z) of 0.09 in AS1170.4-2007). The 2018 NSHA states that “The 2018 update takes advantage of recent developments in earthquake-based research and ensures that the hazard modes use the best available, evidence-based science.” In the 2018 NHSA, a value of k_p of 1.0 and 2.27 is appropriate for a 500-year and 2,000-year return period respectively.

Therefore, based on information provided in the 2018 NSHA,

- a design horizontal peak ground acceleration a_h = 0.036g (0.028 × 1.3 × 1.0) and a_h = 0.031g would be defined for a 500 year return period event for Class C_e and D_e/E_e respectively.
- a design horizontal peak ground acceleration a_h = 0.083g (0.028 × 1.3 × 2.27) and a_h = 0.07g would be defined for a 2,000 year return period event for Class C_e and D_e/E_e respectively

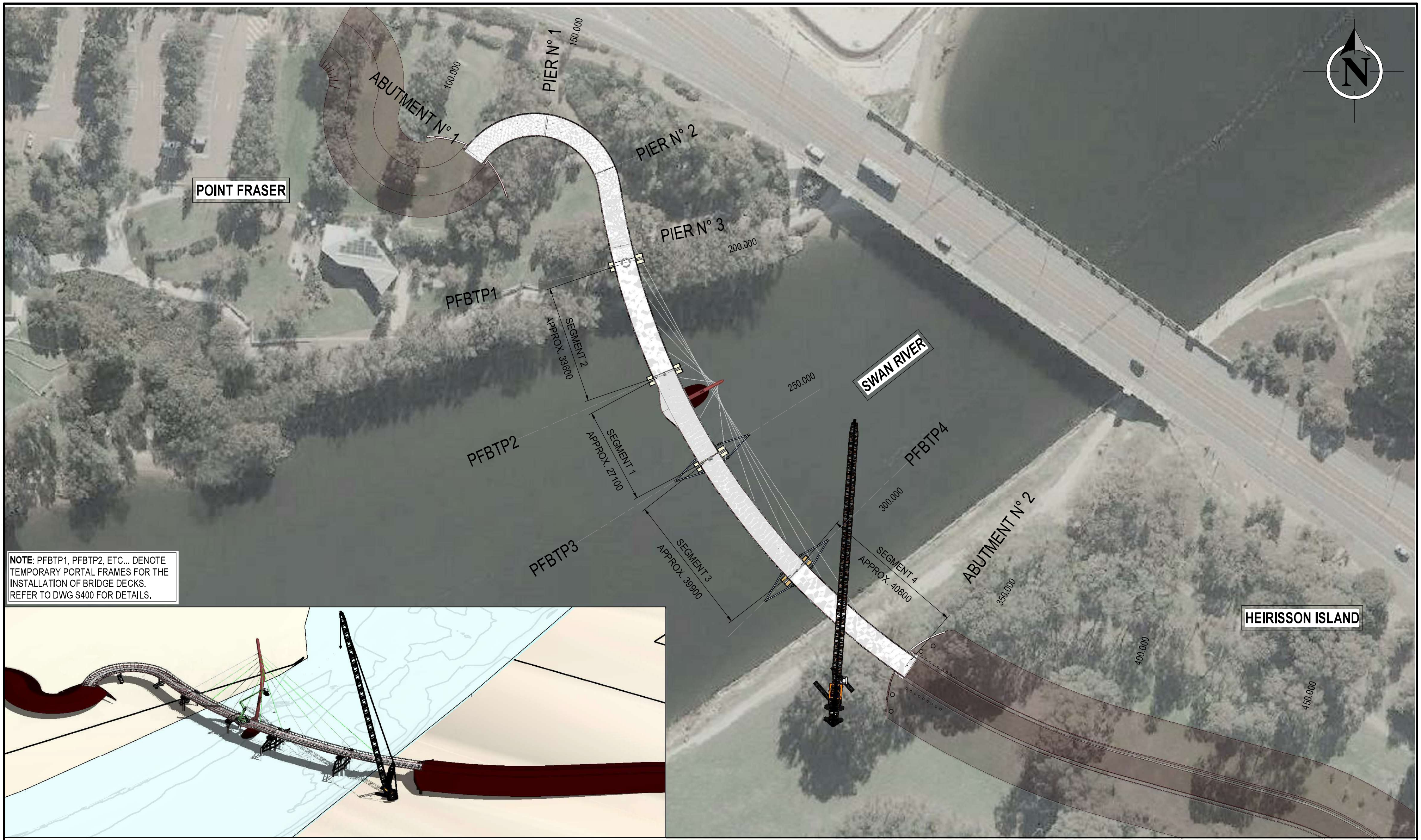
Based on the above, there would be benefit in applying the NSHA findings in situations where AS1170.4 does not apply.

For liquefaction potential assessment, the following parameters shall be adopted:

Pseudo-static horizontal coefficient of acceleration based on 2018 NSHA hazard value for Perth.

Moment magnitude of 6.0.

APPENDIX C: CONSTRUCTION STAGING DRAWINGS



NOTE: PFBTP1, PFBTP2, ETC... DENOTE TEMPORARY PORTAL FRAMES FOR THE INSTALLATION OF BRIDGE DECKS. REFER TO DWG S400 FOR DETAILS.

1 S300 POINT FRASER BRIDGE TEMPORARY WORKS LAYOUT PLAN

SCALE: 1 : 1000

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

AMENDMENTS

FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
WSP
CIVMEC

PROJECT:
PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

APPROVED BY:

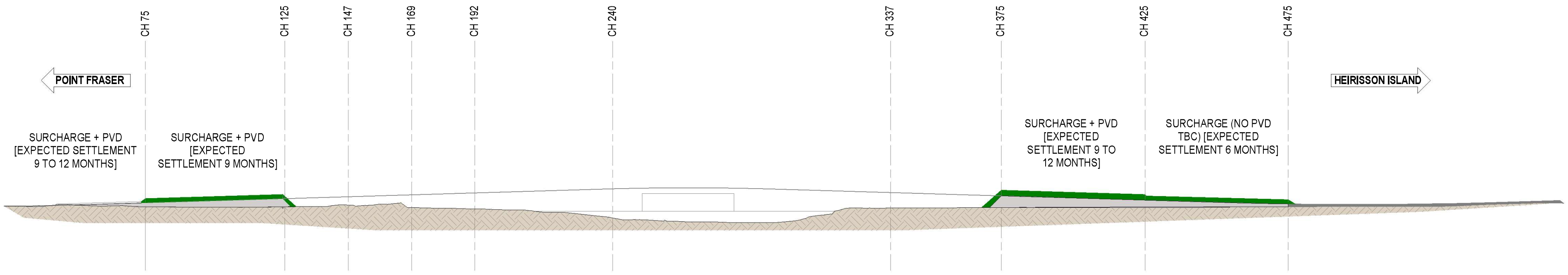
RPEQ: ____________
CPEng NPER
DATE: ____________

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506 TEMPORARY WORKS LAYOUT PLAN

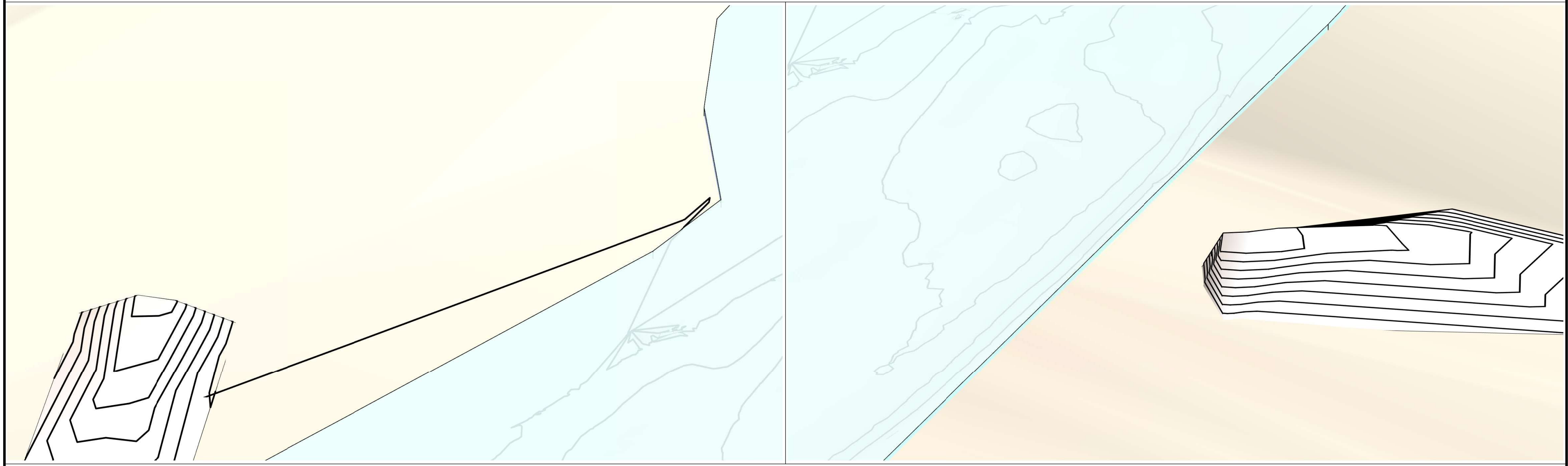
SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:	ISSUE:
RSH	20-10-21	WSBL	09-11-21	1 : 1000	B
DESIGNED: AS	DWG No.: FS3196A - S300		ISSUE TYPE: APPROVAL		

STAGE 1:	
POINT FRASER BRIDGE a. SERVICES PROTECTION / RELOCATION WORKS b. EMBANKMENTS FILL AND SURCHARGE + PVD	**McCALLUM PARK BRIDGE** *REFER SHEET S201*



1 S301 POINT FRASER BRIDGE STAGE 1 SECTION
SCALE: *NOT TO SCALE*



2 S301 PFB - STAGE 1 3D VIEW
SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
CIVMEC
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POINT FRASER TO MCCALLUM PARK
PROJECT REFERENCE No.: FS3196A

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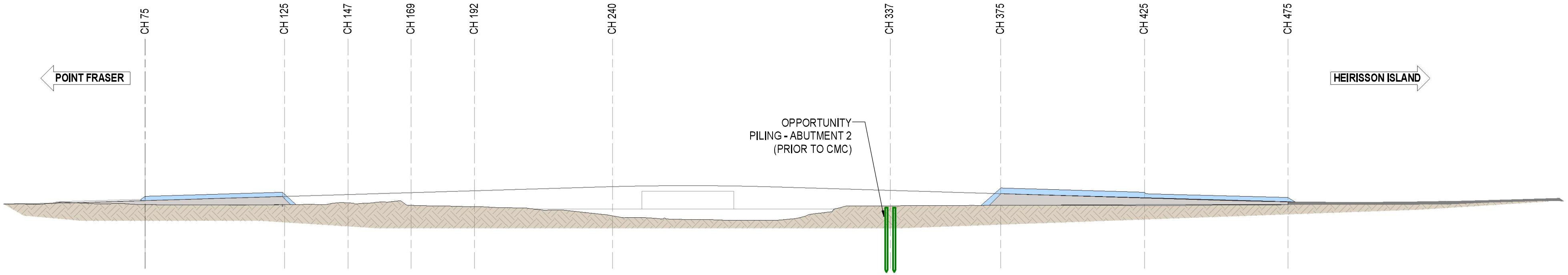
DATE:

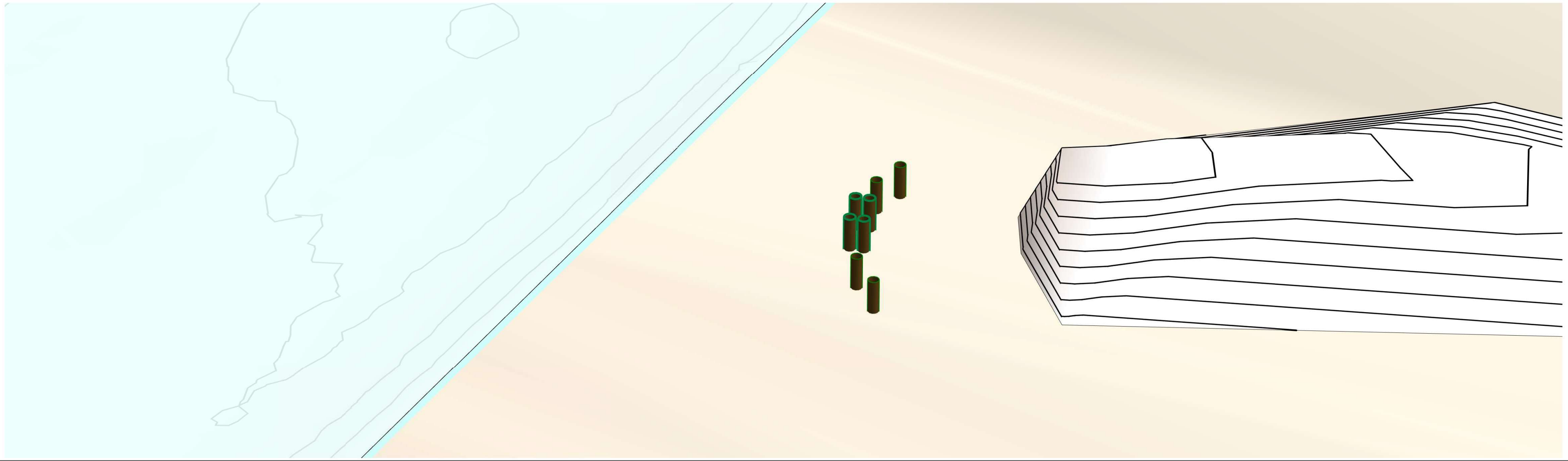
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 1

SHEET SIZE: A3
DRAWN: RSH
DATE: 20-10-21
Q.A. CHECK: WSBL
DATE: 09-11-21
SCALE: As indicated
ISSUE: B
DESIGNED: ARV
DWG No.: FS3196A - S301
ISSUE TYPE: APPROVAL

STAGE 6:	
POINT FRASER BRIDGE a. OPPORTUNITY PILING - ABUTMENT (PRIOR TO CMC)	**McCALLUM PARK BRIDGE** *REFER SHEET S206*



1 S302 POINT FRASER BRIDGE STAGE 6 SECTION
SCALE: 1 : 1400



2 S302 PFB - STAGE 6 3D VIEW
SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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B	09-11-21	VARIOUS AMENDMENTS	DMM
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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:

PROJECT:
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POINT FRASER TO MCCALLUM PARK
PROJECT REFERENCE No.: FS3196A

APPROVED BY:
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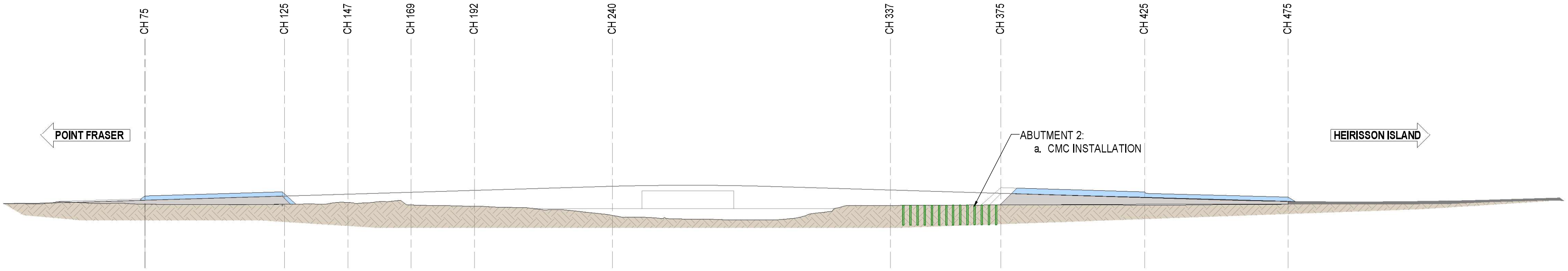
CPEng NPER
DATE:

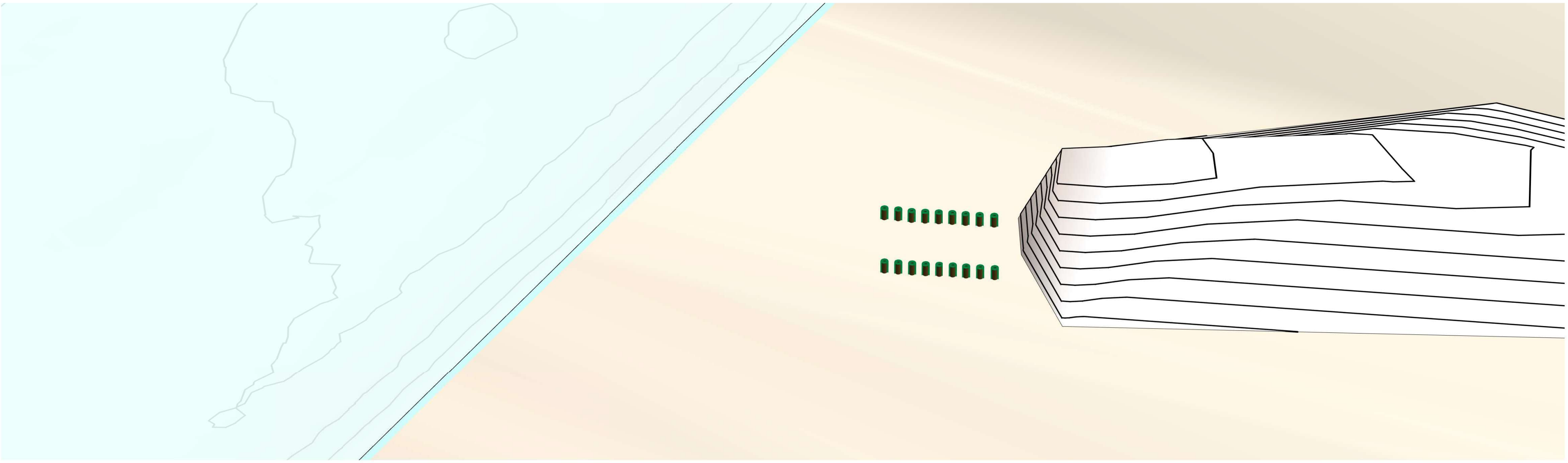
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 6

SHEET SIZE: A3
DRAWN: RSH
DATE: 20-10-21
Q.A. CHECK: WSBL
DATE: 09-11-21
SCALE: As indicated
ISSUE: B
DESIGNED: ARV
DWG No.: FS3196A - S302
ISSUE TYPE: APPROVAL

STAGE 10:	
POINT FRASER BRIDGE a. CMC WORKS ABUT 2	**McCALLUM PARK BRIDGE** *REFER SHEET S210*



1 S303 POINT FRASER BRIDGE STAGE 10 SECTION
SCALE: *NOT TO SCALE*



2 S303 PFB - STAGE 10 3D VIEW
SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:

PROJECT:
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POINT FRASER TO MCCALLUM PARK

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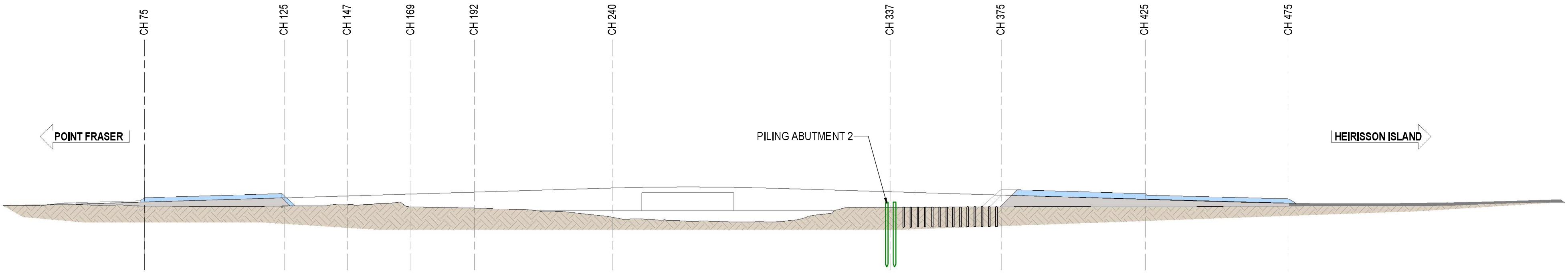
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 10

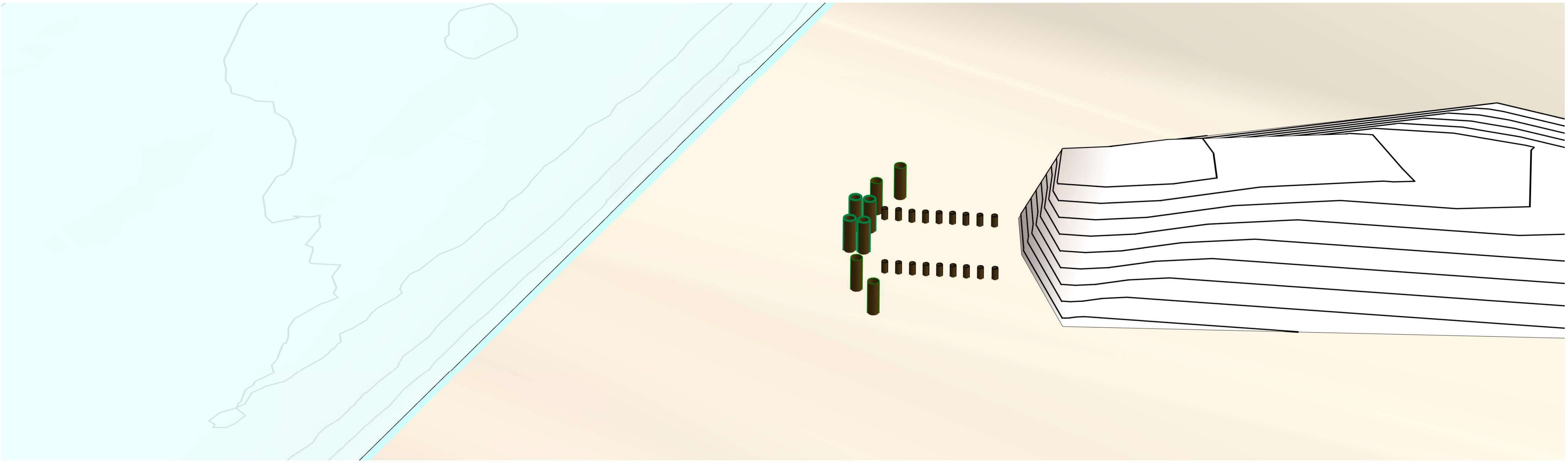
DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:
RSH	20-10-21	WSBL	09-11-21	As indicated

DESIGNED: ARV
DWG No.: FS3196A - S303
ISSUE TYPE: APPROVAL
SHEET SIZE: A3
ISSUE: B

STAGE 11:	
POINT FRASER BRIDGE a. PILING ABUT 2 (IF NOT DONE BEFORE)	**McCALLUM PARK BRIDGE** *REFER SHEET S211*



1 S304 POINT FRASER BRIDGE STAGE 11 SECTION
SCALE: 1 : 1400



2 S304 PFB - STAGE 11 3D VIEW
SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPARAVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
CIVMEC
WSP

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PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

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DATE:

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 11

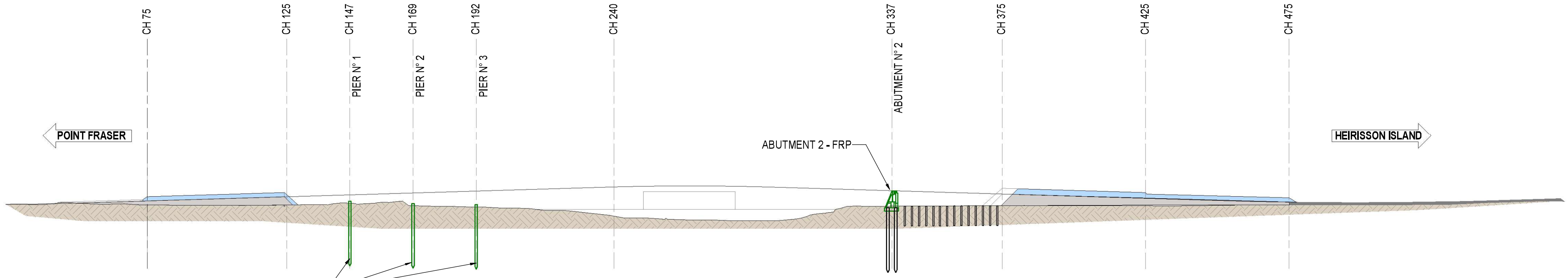
SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:	ISSUE:
RSH	20-10-21	WSBL	09-11-21	As indicated	B

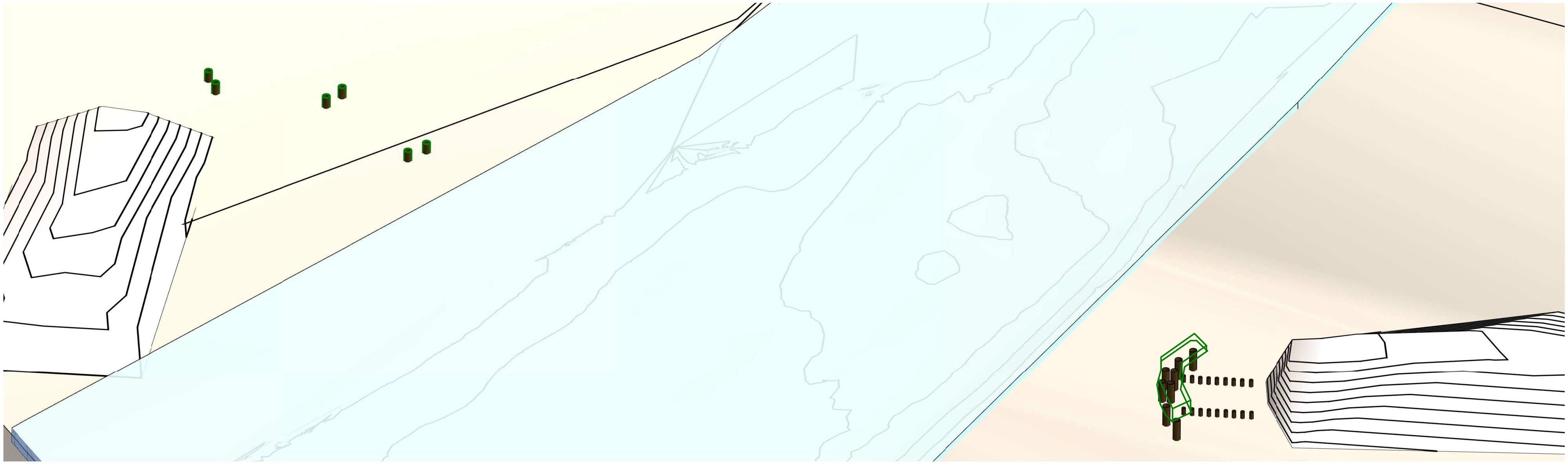
DESIGNED: ARV
DWG No.: FS3196A - S304
ISSUE TYPE: APPROVAL

STAGE 12:

POINT FRASER BRIDGE	McCALLUM PARK BRIDGE
a. FRP ABUT 2 b. PILING PIERS 1/2/3	*REFER SHEET S212*



1 S305 POINT FRASER BRIDGE STAGE 12 SECTION
SCALE: 1 : 1400



2 S305 PFB - STAGE 12 3D VIEW
SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
wsp
CIVMEC

PROJECT:
PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK
PROJECT REFERENCE No.: FS3196A

APPROVED BY:
RPEQ:
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DATE:

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 12

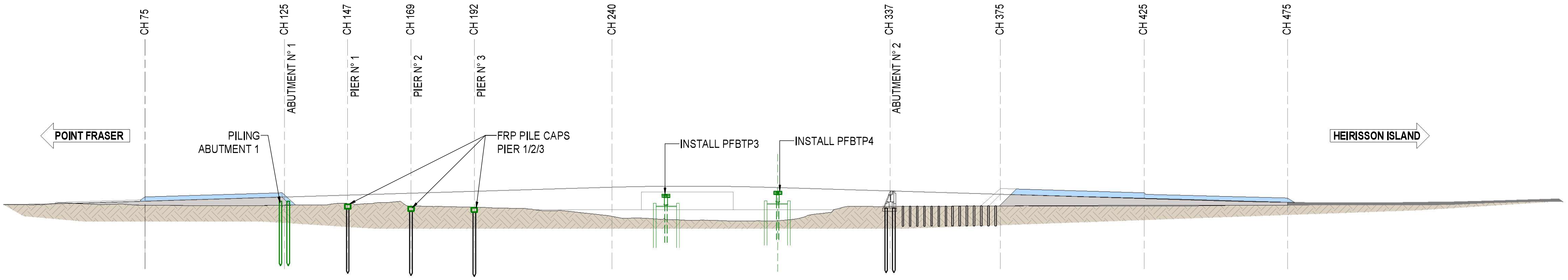
SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:
RSH	20-10-21	WSBL	09-11-21	As indicated

DESIGNED: ARV
DWG No.: FS3196A - S305
ISSUE TYPE: APPROVAL
ISSUE: B

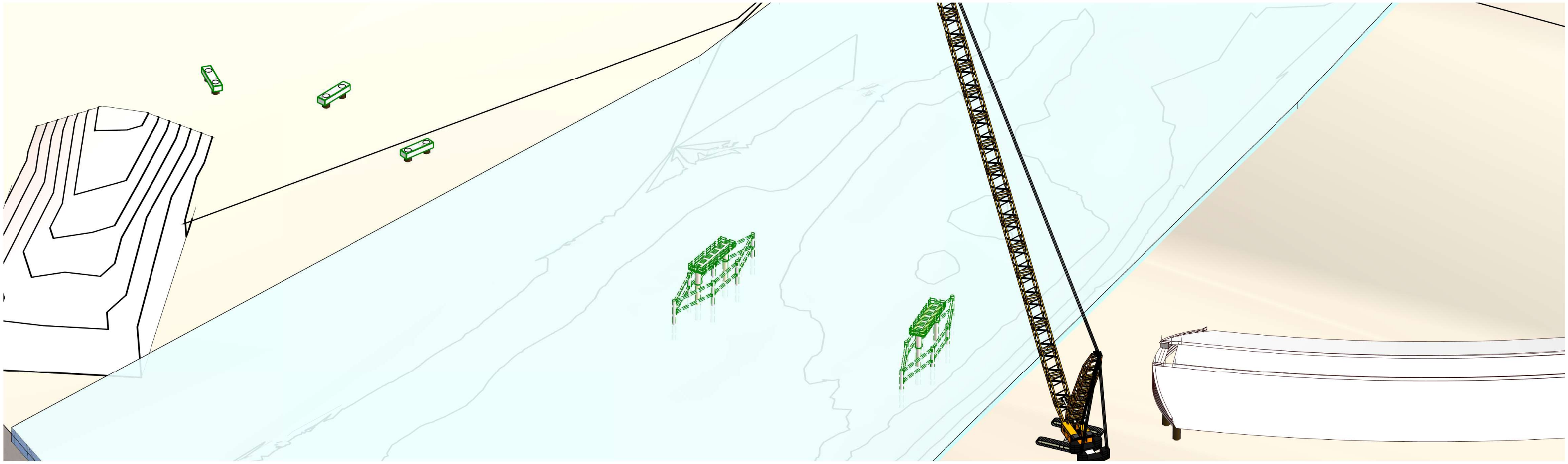
STAGE 13:

POINT FRASER BRIDGE	**McCALLUM PARK BRIDGE**
a. PILING ABUT 1 b. FRP PILE CAP PIERS 1,2&3 c. RELOCATE CRANE FROM HEIRISSON ISLAND NORTH (POINT FRASER ABUTMENT 2) d. INSTALL TEMPORARY PORTAL FRAMES + FENDER PILES.	*REFER SHEET S213*



1 S306 POINT FRASER BRIDGE STAGE 13 SECTION

SCALE: 1 : 1400



2 S306 PFB - STAGE 13 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
CIVMEC
WSP

PROJECT:
PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

APPROVED BY:
RPEQ:
CPEng NPER
DATE:

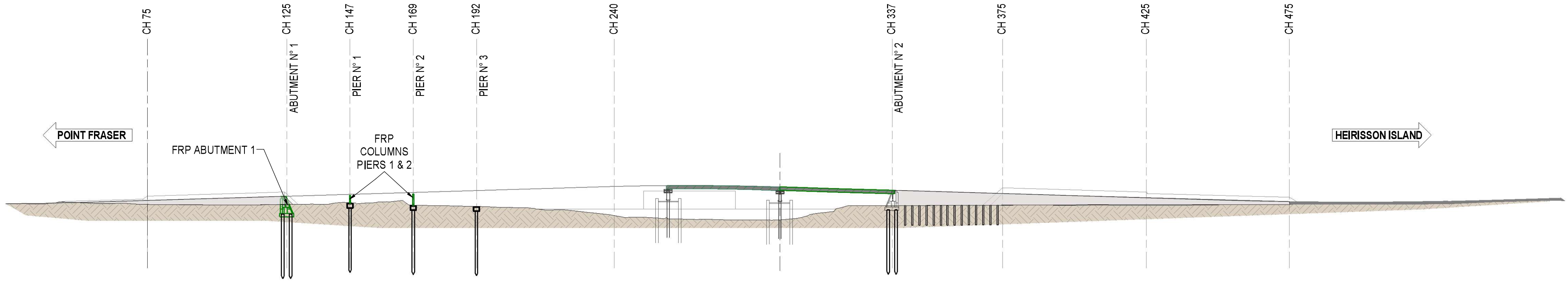
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 13

SHEET SIZE: A3

DRAWN: RSH
DATE: 20-10-21
Q.A. CHECK: WSBL
DATE: 09-11-21
SCALE: As indicated
ISSUE: B
DESIGNED: ARV
DWG No.: FS3196A - S306
ISSUE TYPE: APPROVAL

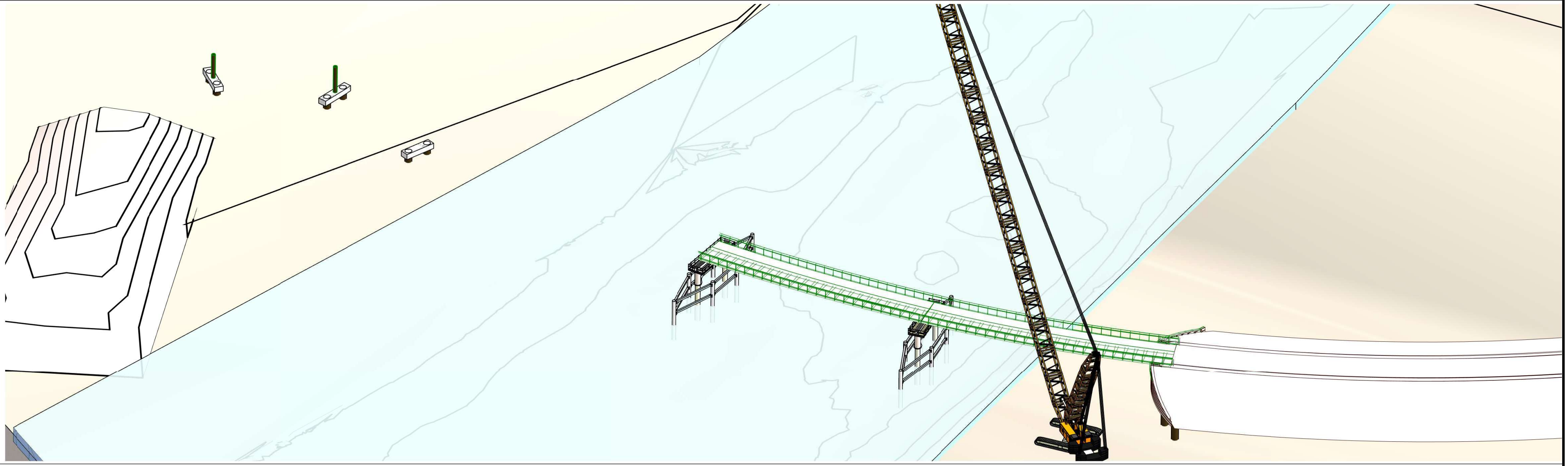
STAGE 14:

POINT FRASER BRIDGE	McCALLUM PARK BRIDGE
a. INSTALL DECK SEGMENTS 3 AND 4. TEMPORARY SPLICE b. FRP ABUTMENT 1 AND PIER 1,2 COLUMN	*REFER SHEET S214*



1 S307 POINT FRASER BRIDGE STAGE 14 SECTION

SCALE: 1 : 1400



2 S307 PFB - STAGE 14 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPARAVAL	RSH
ISSUE	DATE	DESCRIPTION	BY

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
CIVMEC
WSP

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POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

APPROVED BY:

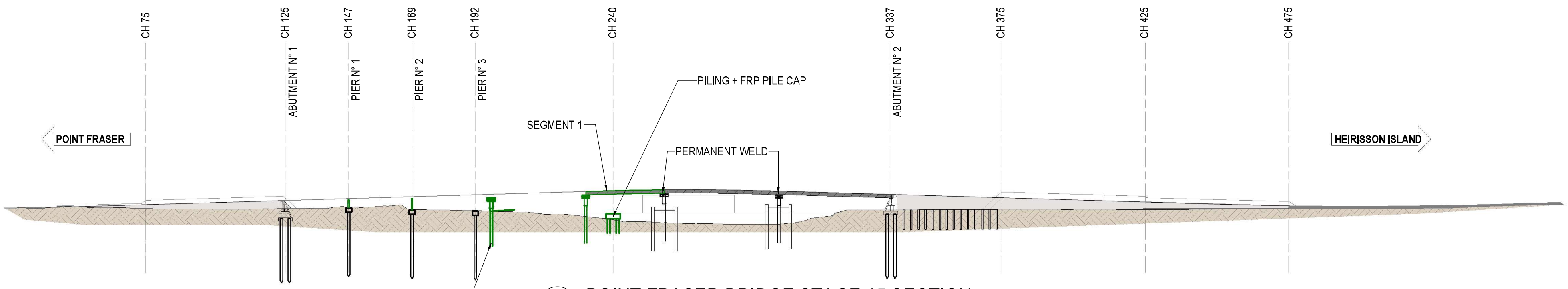
RPEQ: ____
CPEng NPER
DATE: ____

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 14

SHEET SIZE: A3

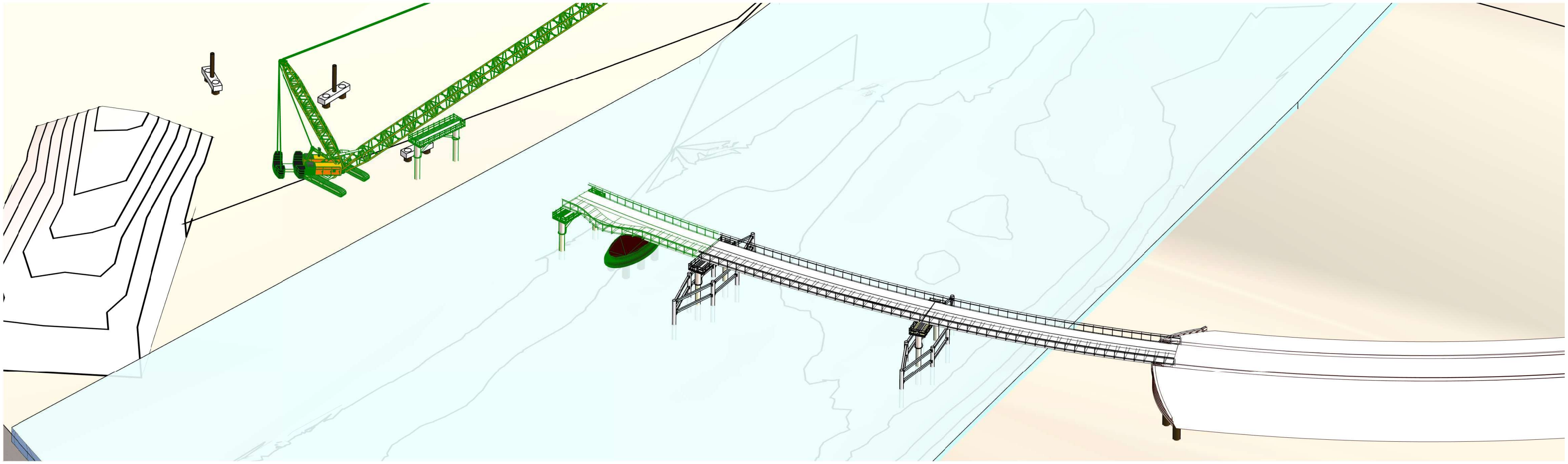
DRAWN: RSH
DATE: 20-10-21
Q.A. CHECK: WSBL
DATE: 09-11-21
SCALE: As indicated
DESIGNED: ARV
DWG No.: FS3196A - S307
ISSUE TYPE: APPROVAL
ISSUE: B

STAGE 15:	
POINT FRASER BRIDGE a. PILING + FRP PILE CAP b. INSTALL TEMPORARY PORTAL FRAME . c. INSTALL SEGMENT 1 d. PERMANENT SPLICE SEGMENTS 1 / 3 / 4	**McCALLUM PARK BRIDGE** *REFER SHEET S215*



1 S308 POINT FRASER BRIDGE STAGE 15 SECTION

SCALE: 1 : 1400



2 S308 PFB - STAGE 15 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
C	10-11-21	VARIOUS AMENDMENTS	DMM
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425

Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:

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PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

APPROVED BY:

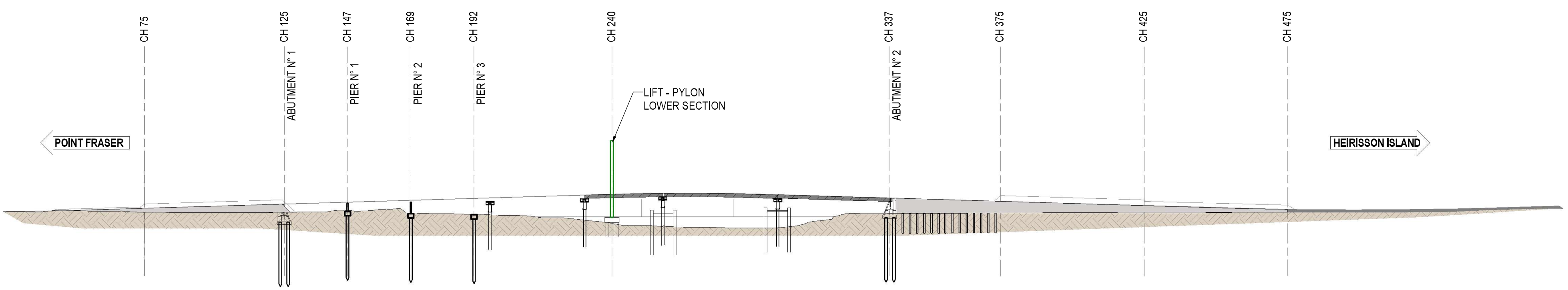
RPEQ: ____________
CPEng NPER
DATE: ____________

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 15

SHEET SIZE: A3

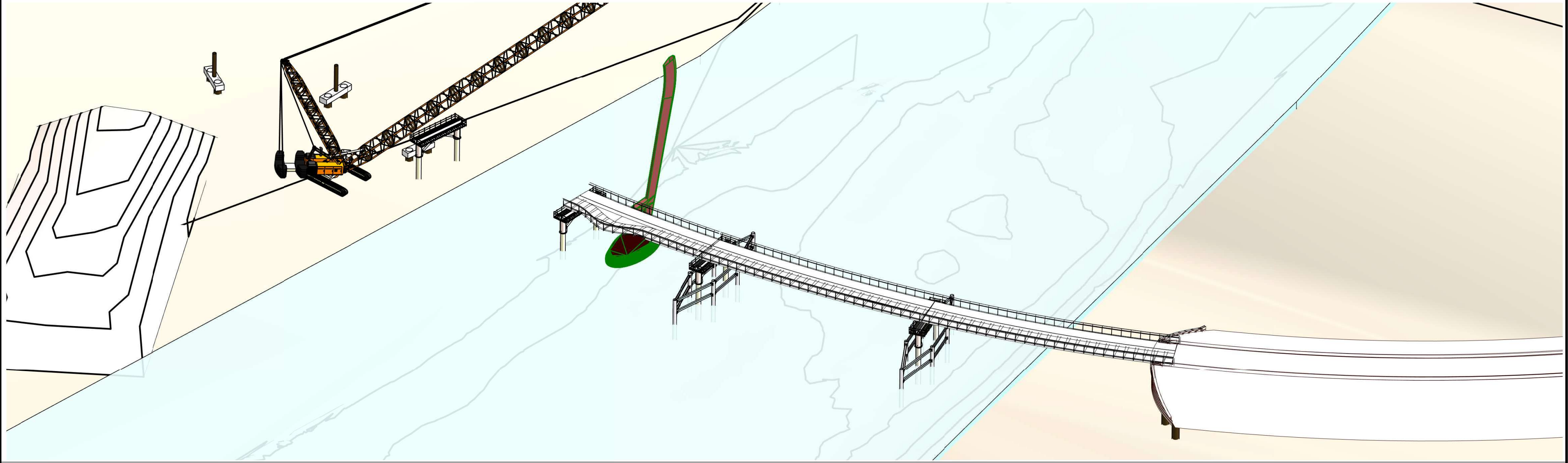
DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:	ISSUE:
RSH	20-10-21	WSBL	10-11-21	As indicated	C
DESIGNED: ARV	DWG No.: FS3196A - S308		ISSUE TYPE: APPROVAL		

STAGE 16:	
POINT FRASER BRIDGE a. INSTALL PYLON - BOTTOM	**McCALLUM PARK BRIDGE** *NO ACTIVITY*



1 S309 POINT FRASER BRIDGE STAGE 16 SECTION

SCALE: 1 : 1400



2 S309 PFB - STAGE 16 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:

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DATE: ________

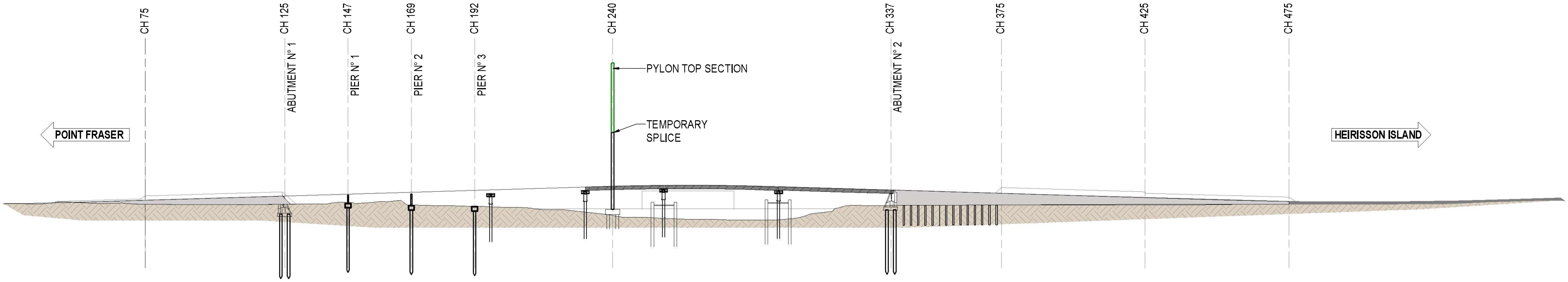
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 16

SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:
RSH	20-10-21	WSBL	09-11-21	As indicated

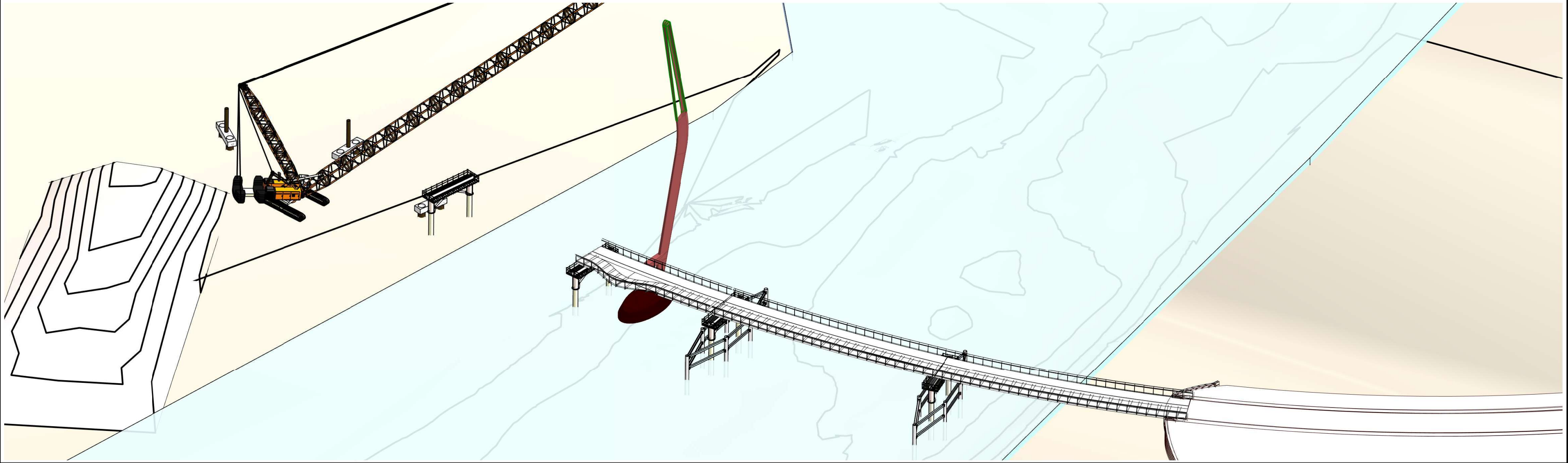
DESIGNED: ARV
DWG No.: FS3196A - S309
ISSUE TYPE: APPROVAL
ISSUE: B

STAGE 17:	
POINT FRASER BRIDGE a. INSTALL PYLON - TOP AND TEMPORARY SPLICE	**McCALLUM PARK BRIDGE** *NO ACTIVITY*



1 S310 POINT FRASER BRIDGE STAGE 17 SECTION

SCALE: 1 : 1400



2 S310 PFB - STAGE 17 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPARAVAL	RSH

AMENDMENTS

FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:

PROJECT:
PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

APPROVED BY:

RPEQ:
CPEng NPER
DATE:

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 17

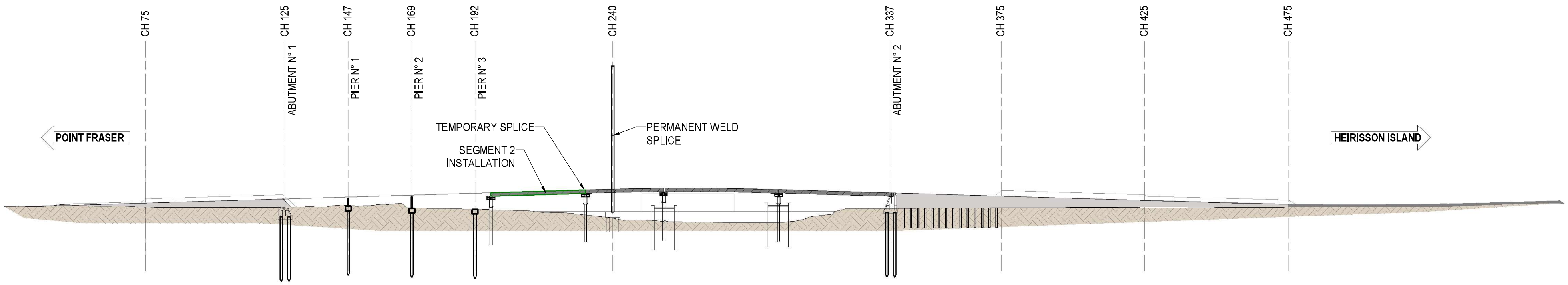
SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:
RSH	20-10-21	WSBL	09-11-21	As indicated

DESIGNED: ARV
DWG No.: FS3196A - S310
ISSUE TYPE: APPROVAL
ISSUE: B

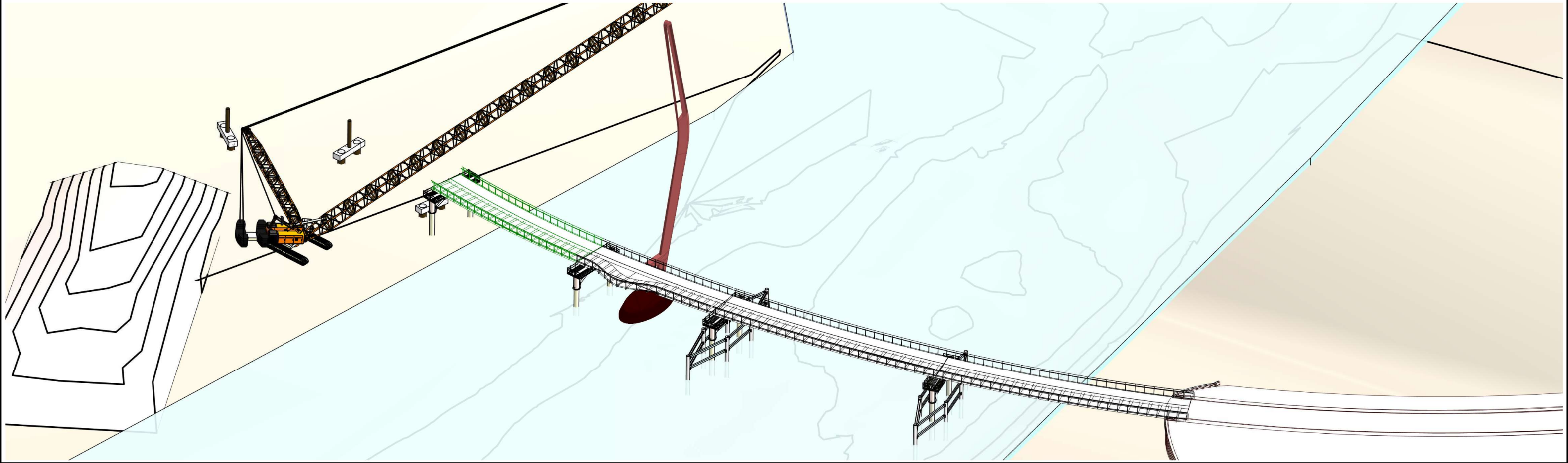
STAGE 18:

POINT FRASER BRIDGE	McCALLUM PARK BRIDGE
a. PERMANENT SPLICE WELDING PYLON b. INSTALL DECK SEGMENT 2	*NO ACTIVITY*



1 S311 POINT FRASER BRIDGE STAGE 18 SECTION

SCALE: 1 : 1400



2 S311 PFB - STAGE 18 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425

Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173

Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
CIVMEC
WSP

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POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

APPROVED BY:

RPEQ:
CPEng NPER
DATE:

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 18

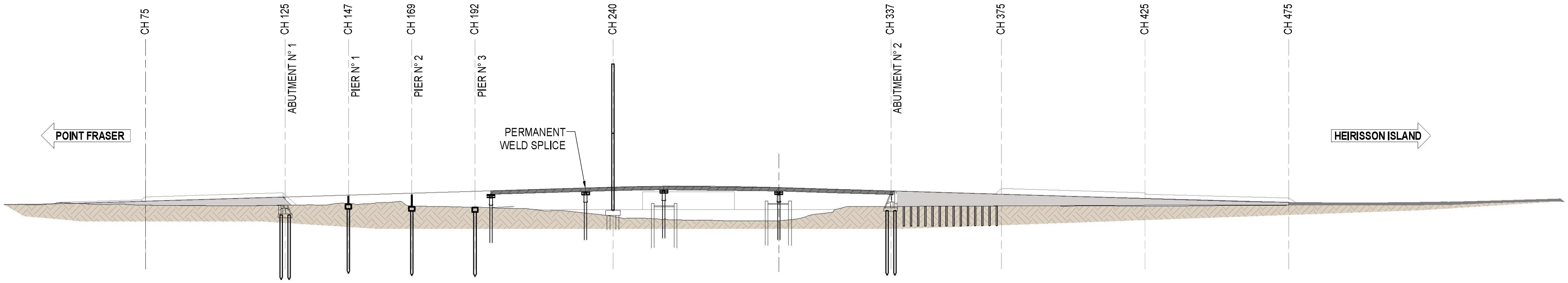
SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:
RSH	20-10-21	WSBL	09-11-21	As indicated

DESIGNED: ARV
DWG No.: FS3196A - S311
ISSUE TYPE: APPROVAL
ISSUE: B

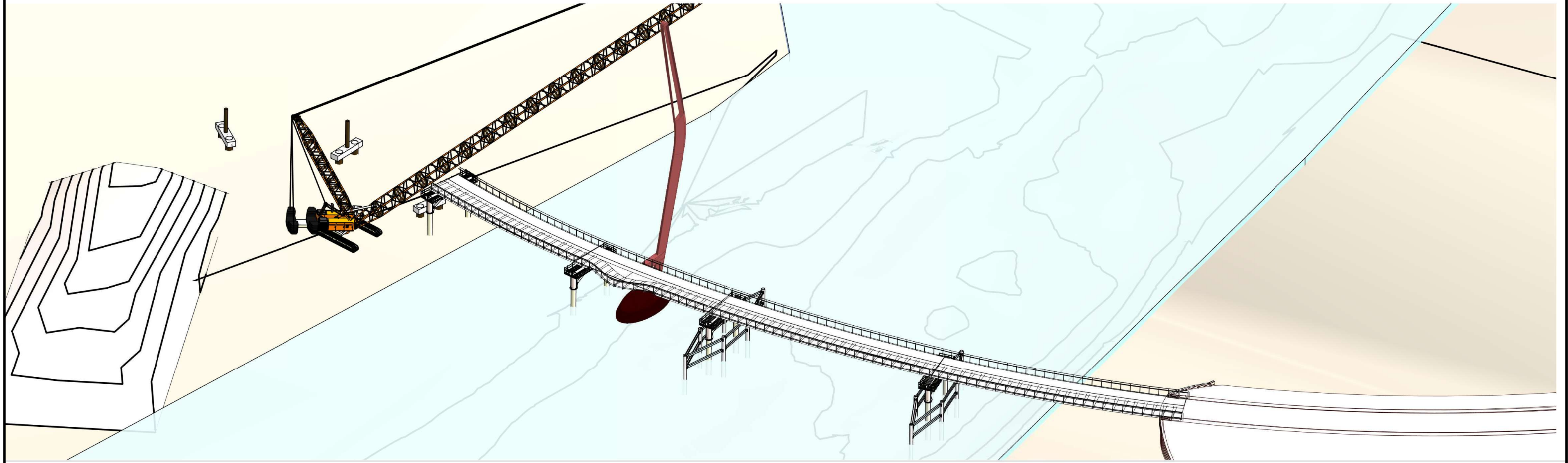
STAGE 19:

POINT FRASER BRIDGE	McCALLUM PARK BRIDGE
a. PERMANENT SPLICE WELDS SEGMENTS 1/2	*NO ACTIVITY*



1 S312 POINT FRASER BRIDGE STAGE 19 SECTION

SCALE: 1 : 1400



2 S312 PFB - STAGE 19 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

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WSP

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PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

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RPEQ: ____________
CPEng NPER
DATE: ____________

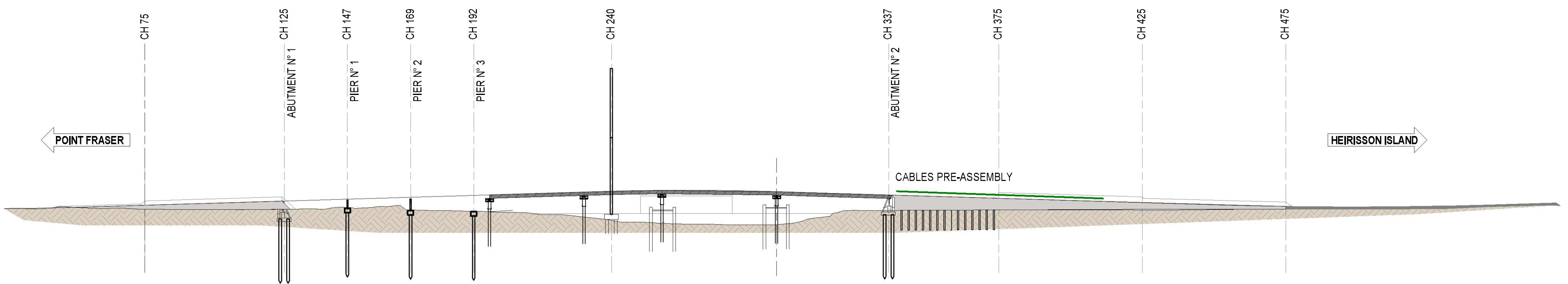
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 19

SHEET SIZE: A3

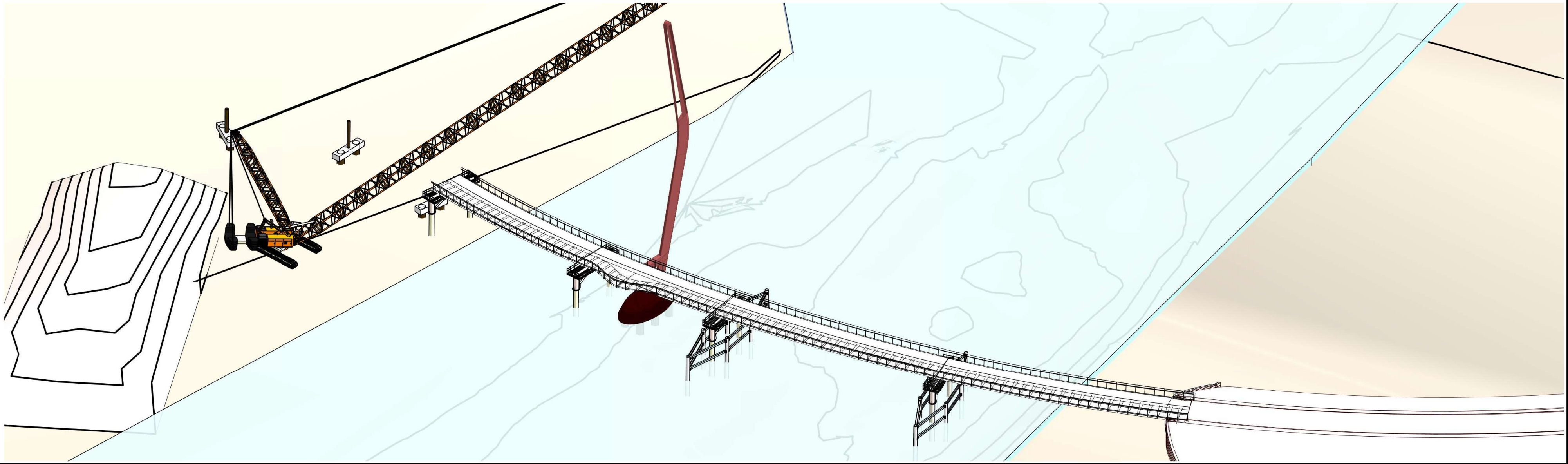
DRAWN	DATE	Q.A. CHECK	DATE	SCALE
RSH	20-10-21	WSBL	09-11-21	As indicated

DESIGNED	DWG No.	ISSUE TYPE	ISSUE
ARV	FS3196A - S312	APPROVAL	B

STAGE 20:	
POINT FRASER BRIDGE a. CABLES PRE-ASSEMBLY	**McCALLUM PARK BRIDGE** *NO ACTIVITY*



1 / S313 POINT FRASER BRIDGE STAGE 20 SECTION
SCALE: 1 : 1400



2 / S313 PFB - STAGE 20 3D VIEW
SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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ISSUE	DATE	DESCRIPTION	BY
C	10-11-21	VARIOUS AMENDMENTS	DMM
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
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POINT FRASER TO MCCALLUM PARK
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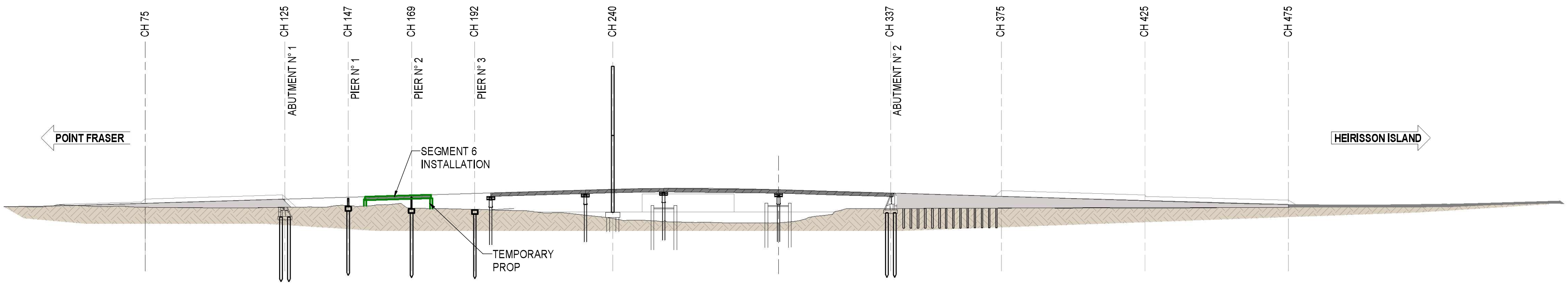
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 20

SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:
RSH	20-10-21	WSBL	10-11-21	As indicated

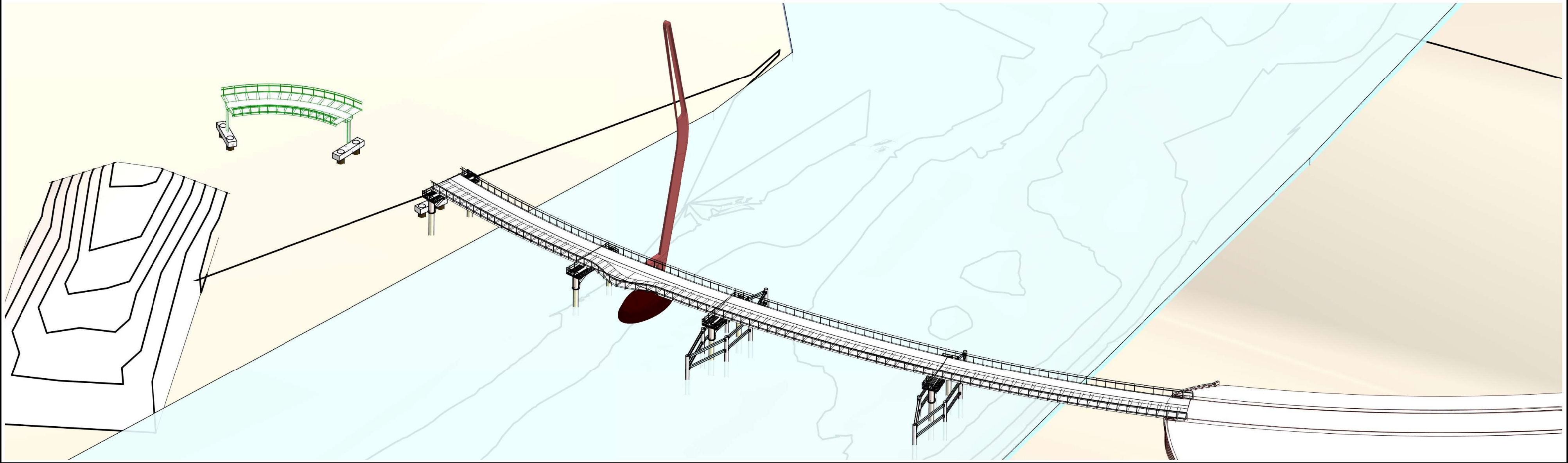
DESIGNED: ARV
DWG No.: FS3196A - S313
ISSUE TYPE: APPROVAL
ISSUE: C

STAGE 21:	
POINT FRASER BRIDGE a. INSTALL DECK SEGMENT 6	**McCALLUM PARK BRIDGE** *NO ACTIVITY*



1 S314 POINT FRASER BRIDGE STAGE 21 SECTION

SCALE: 1 : 1400



2 S314 PFB - STAGE 21 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

AMENDMENTS

FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

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POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

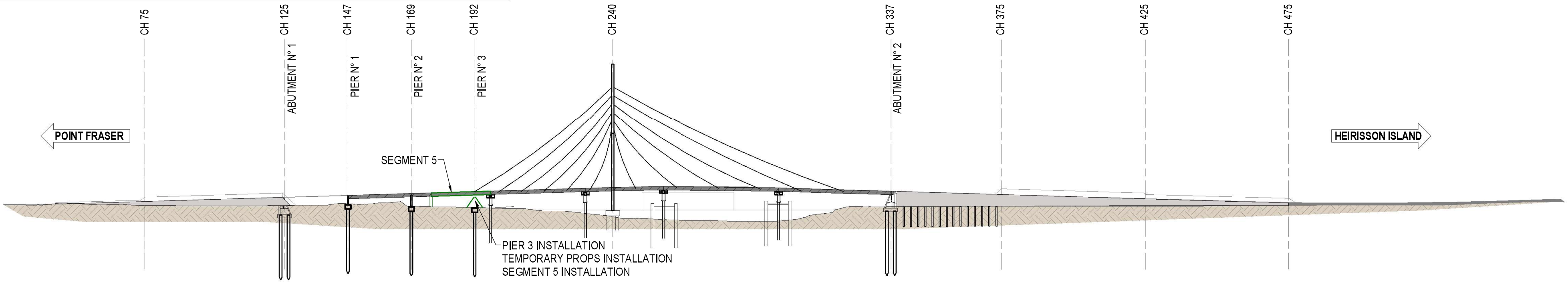
APPROVED BY:
RPEQ:
CPEng NPER
DATE:

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 21

SHEET SIZE: A3

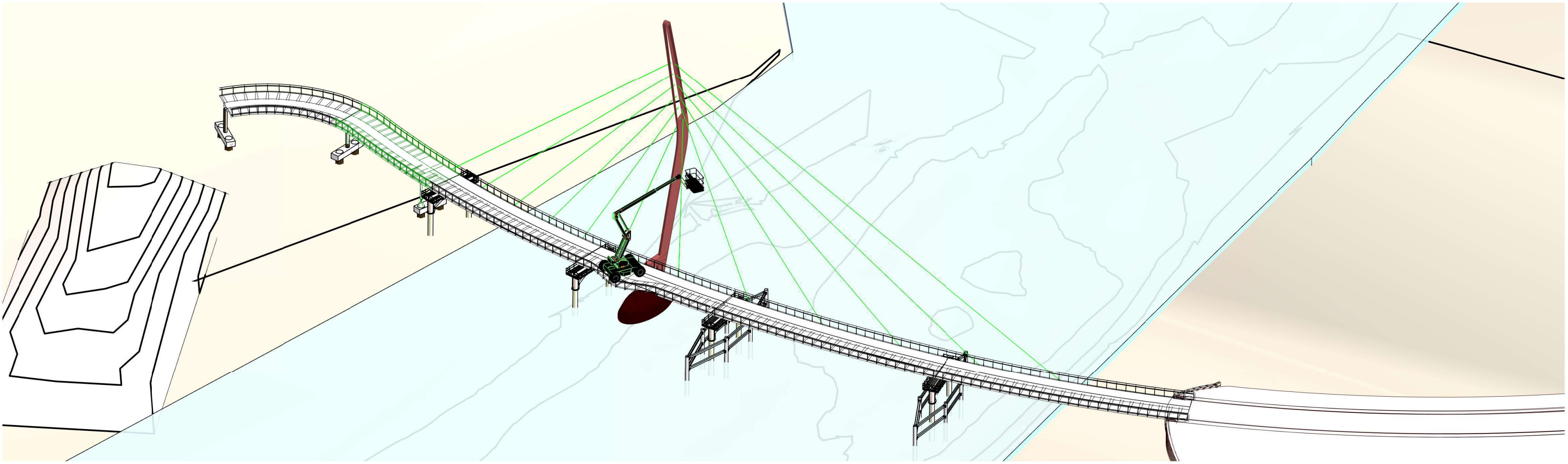
DRAWN: RSH
DATE: 20-10-21
Q.A. CHECK: WSBL
DATE: 09-11-21
SCALE: As indicated
DESIGNED: ARV
DWG No.: FS3196A - S314
ISSUE TYPE: APPROVAL
ISSUE: B

STAGE 22:	
POINT FRASER BRIDGE a. INSTALL PIER 3 b. INSTALL DECK SEGMENT 5 c. INSTALL CABLES ON PYLON ONLY (SECURE TO DECK)	**McCALLUM PARK BRIDGE** *NO ACTIVITY*



1 S315 POINT FRASER BRIDGE STAGE 22 SECTION

SCALE: 1 : 1400



2 S315 PFB - STAGE 22 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

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PROJECT:
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POINT FRASER TO MCCALLUM PARK
PROJECT REFERENCE No.: FS3196A

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RPEQ: ____
CPEng NPER
DATE: ____

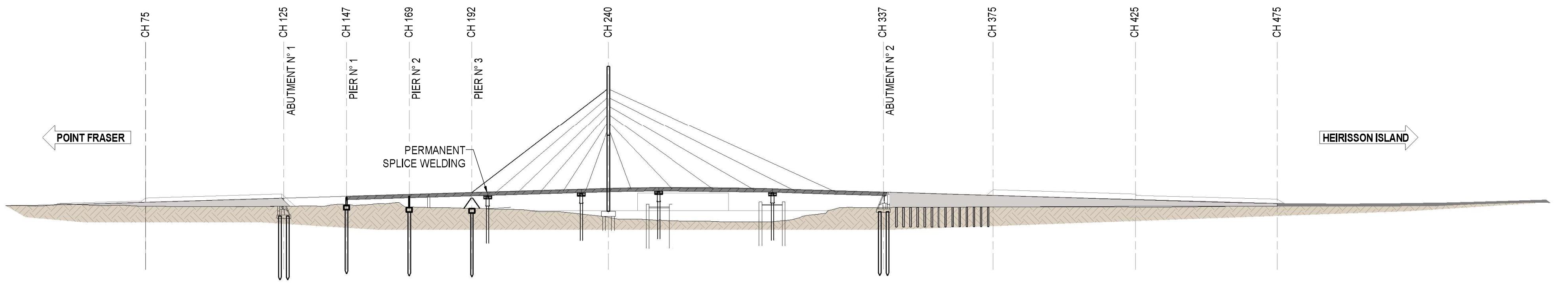
SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 22

SHEET SIZE: A3

DRAWN: RSH
DATE: 20-10-21
Q.A. CHECK: WSBL
DATE: 09-11-21
SCALE: As indicated
DESIGNED: ARV
DWG No.: FS3196A - S315
ISSUE TYPE: APPROVAL
ISSUE: B

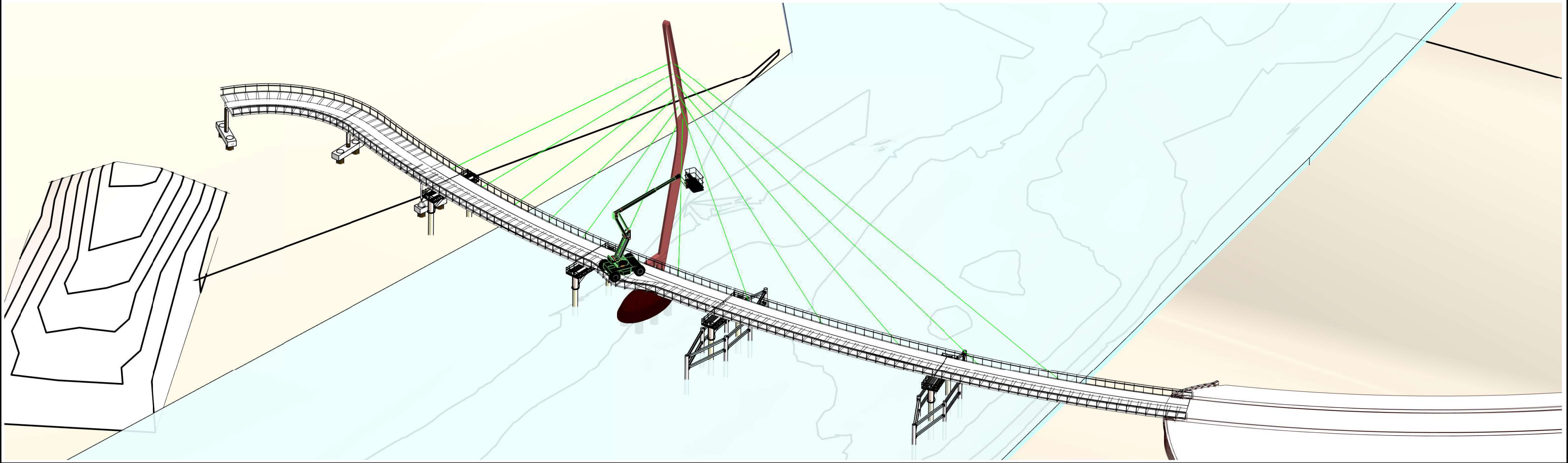
STAGE 23:

POINT FRASER BRIDGE	McCALLUM PARK BRIDGE
a. PERMANENT SPLICE b. INSTALL / STRESS CABLES SYMMETRICALLY FROM PYLON OUT	*NO ACTIVITY*



1 S316 POINT FRASER BRIDGE STAGE 23 SECTION

SCALE: 1 : 1400



2 S316 PFB - STAGE 23 3D VIEW

SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

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ISSUE	DATE	DESCRIPTION	BY
C	10-11-21	VARIOUS AMENDMENTS	DMM
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

AMENDMENTS

FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425

Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173

Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

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PROJECT:
PERTH CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE TEMPORARY WORKS DESIGN
POINT FRASER TO MCCALLUM PARK

PROJECT REFERENCE No.: FS3196A

APPROVED BY:

RPEQ:

CPEng NPER

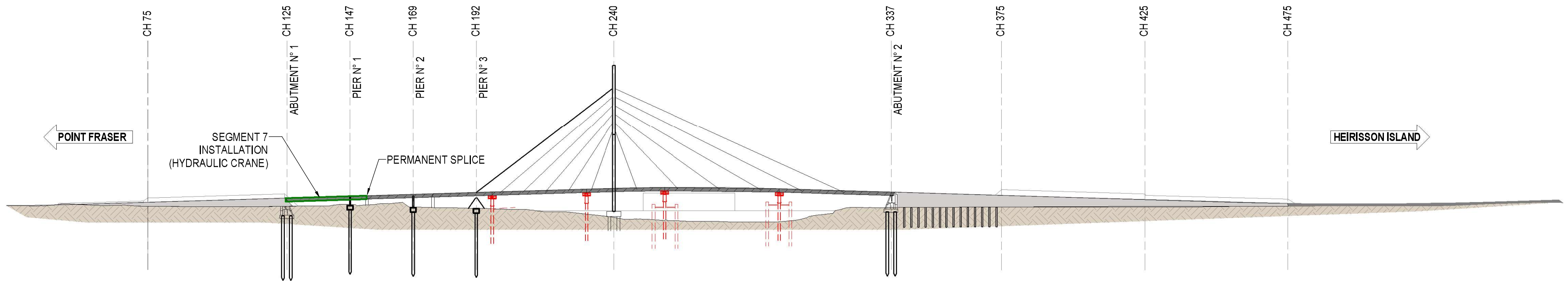
DATE:

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 23

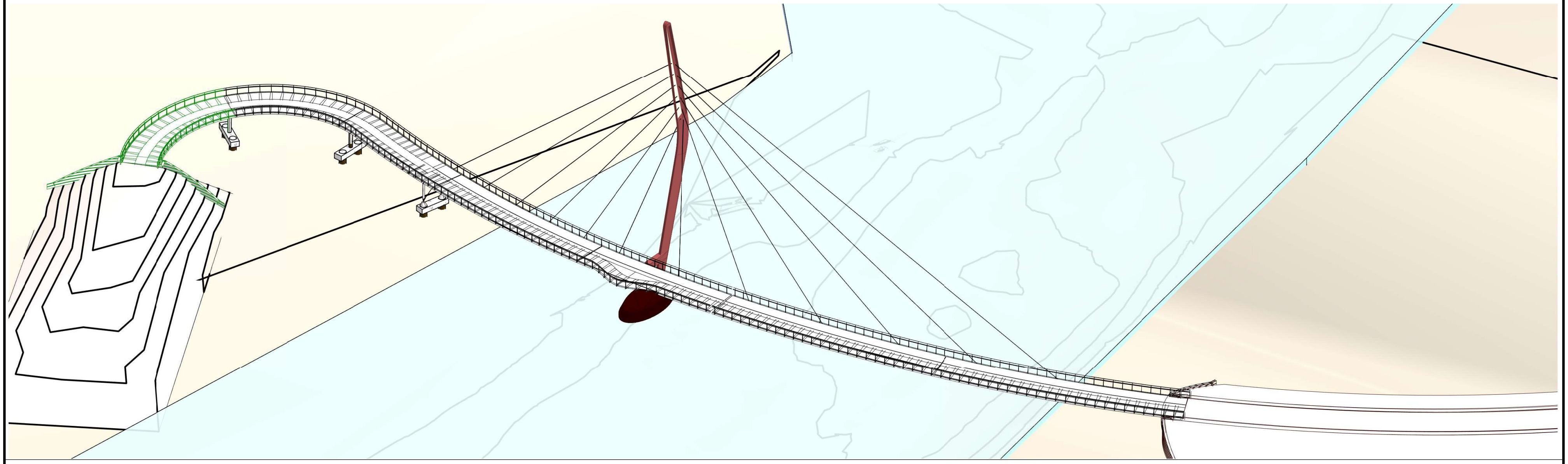
SHEET SIZE: A3

DRAWN: RSH
DATE: 20-10-21
Q.A. CHECK: WSBL
DATE: 10-11-21
SCALE: As indicated
ISSUE: C
DESIGNED: ARV
DWG No.: FS3196A - S316
ISSUE TYPE: APPROVAL

STAGE 24:		STAGE 25:	
POINT FRASER BRIDGE a. REMOVE TEMPORARY PIERS IN RIVER b. INSTALL DECK SEGMENT 7 c. SURVEY + CABLES ADJUSTMENT	**McCALLUM PARK BRIDGE** *NO ACTIVITY*	**POINT FRASER BRIDGE** a. PERMANENT SPLICE SEGMENT 6/7 b. REMOVE TEMPORARY PIERS	**McCALLUM PARK BRIDGE** *NO ACTIVITY*



1 S317 POINT FRASER BRIDGE STAGE 24 & 25 SECTION
SCALE: 1 : 1400



2 S317 PFB - STAGE 24 & 25 3D
SCALE:

NOTE: 1. REFER SHEETS S001 AND S002 FOR PROJECT NOTES.

NOT FOR CONSTRUCTION PRINT IN COLOUR

ISSUE	DATE	DESCRIPTION	BY
B	09-11-21	VARIOUS AMENDMENTS	DMM
A	20-10-21	ISSUED FOR APPAROVAL	RSH

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FSA CONSULTING ENGINEERS P/L
commercial | residential | marine
ABN 68802194425
Unit 12, Tingalpa Central
1631 Wynnum Rd, TINGALPA
PO Box 2282, TINGALPA QLD 4173
Tel. +617 3393 9447
email: admin@fsace.com.au
website: www.fsace.com.au

CLIENT:
SEYMOUR WHYTE
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POINT FRASER TO MCCALLUM PARK
PROJECT REFERENCE No.: FS3196A

APPROVED BY:
RPEQ:
CPEng NPER
DATE:

SHEET CONTENTS:
POINT FRASER BRIDGE BR 9506
INSTALLATION SEQUENCE
STAGE 24 & 25

SHEET SIZE: A3

DRAWN:	DATE:	Q.A. CHECK:	DATE:	SCALE:	ISSUE:
RSH	20-10-21	WSBL	09-11-21	As indicated	B
DESIGNED: ARV	DWG No.: FS3196A - S317		ISSUE TYPE: APPROVAL		

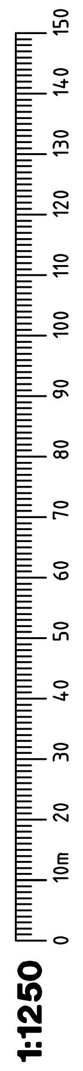
APPENDIX D: SAFETY IN DESIGN

							RISK REGISTER		
							Risk Rating		
Risk Reference Number	Project Risk	Project Stage	Causes	Resulting In	Priority	Consequence Category	Consequence Rating	Likelihood Rating	Level of Risk
	Example: Design Route -Route meets current and future customer requirements	Design, Procurement, Construction, Operations	Poor evaluation of current customer needs, lack of integrated long term planning for Perth CBD, insufficient stakeholder consultation.	Impact on project objectives, reputation damage	High, Medium, Low	Reputation & Trust	Moderate (3)	Possible (3)	**Medium 9**
43	Damage to fauna and flora during construction	Construction	construction practices, poor planning, lack of approvals and review	damage to flora and fauna, negative public image, impact on project objectives			Moderate (3)	Likely (4)	**High 12**
44	Poor water quality - Swan River	Construction	spills in river	impact to project objectives, impact on flora and fauna, potential health and safety risks			Moderate (3)	Likely (4)	**High 12**
31	Fire risk with large source of mulch.	Construction	Storage of mulch prior to distribution	Fire to surrounding area	Medium	Health & Safety	Major (4)	Rare (1)	**Low 4**
21	dust from high embankment due to high wind	Construction	weather conditions, construction		Medium	Health & Safety	Minor (2)	Possible (3)	**Low 6**
14	Electrocution from electrcial underground services / clash	Construction	poor planning and communication	death or injury, reputation damage			Major (4)	Unlikely (2)	**Medium 8**
16	Hitting underground services	Construction	poor planning and communication	death or injury, reputation damage			Major (4)	Unlikely (2)	**Medium 8**
46	Hitting services - live or abandoned	Construction	Unidentified services or historic abandoned services	Personnel injury, loss of critical services	Medium	Health & Safety	Major (4)	Unlikely (2)	**Medium 8**
3	Unauthorised access to constrcuction site	Construction	Illegal access - criminal activity, theft, purposeful damage to equipment, angry stakeholders Access has not been properly restricted or monitored (CCTV, security patrols, fencing…etc)	injury, damage to precinct, dangerous environment, reputation damage, damage to structure			Moderate (3)	Possible (3)	**Medium 9**
6	Injury or property damage in worksite	Construction	People wishing to pass through the site or get from one side to another	injury, damage to precinct, dangerous environment, reputation damage, damage to structure			Moderate (3)	Possible (3)	**Medium 9**
51	Lighting and emergency systems power outage.	Construction	weather conditions, fault, fault with provider, maintenance work	injury, damage to precinct, dangerous environment, reputation damage			Moderate (3)	Possible (3)	**Medium 9**
60	lack of access to the bridge and precinct for those with dissabilities	Design	lack of wayfinding and poor design	injury, impact on project objectives, reputation damage by not providing a safe and inclusive environment for all.			Minor (2)	Almost Certain (5)	**High 10**
37	Access to top of pylon (aircraft lights)	Design	Maintenace access requirements not taken into account.	Infrastructure failure due to lack of maintenance / creation of maintenance risks		Health & Safety	Catastrophic (5)	Unlikely (2)	**High 10**
53	Bridge becomes unstable	Design	Cables vibration under wind / rain condition	injury, damage to precinct, dangerous environment, reputation damage		Reputation & Trust	Major (4)	Possible (3)	**High 12**
33	Access for bearing maintenance	Design	Maintenace access requirements not taken into account.	Infrastructure failure due to lack of maintenance / creation of maintenance risks		Health & Safety	Moderate (3)	Likely (4)	**High 12**
4	People jump off bridge	Design	Suicide attempts, adrenaline - jumpng to swim, unsupervised children	injury, damage to precinct, dangerous environment, reputation damage			Moderate (3)	Likely (4)	**High 12**
48	Flood	Design	weather conditions, environmental factors, construction impact	impacting temporary piers; permanent piers with potential debris floatting at high velocity			Major (4)	Possible (3)	**High 12**
7	Pedestrians hit by vehicles accessing the site	Design	Limited site access	injury, damage to precinct, dangerous environment, reputation damage			Moderate (3)	Almost Certain (5)	**High 15**
12	High wind loads on structure without cables	Design	Pylon installed without cables tying it down	Impact on project objectives, reputation damage	High	Health & Safety	Catastrophic (5)	Possible (3)	**High 15**
11	Surrounding structures (utilities, Causeway bridge, etc) affected by settlement	Design	Settlement more than anticipated and affecting surrounding structures (utilities, Causeway bridge, etc)	damage to the structure or surrounding utilities			Moderate (3)	Almost Certain (5)	**High 15**
41	erosion and runoff to swan river	Design	weather conditions, extensive clearing	polution, environmental damage	Medium	Environmental	Catastrophic (5)	Possible (3)	**High 15**
18	Bridge maximum load exceeded	Design	event and no crowd control, lack of cctv monitoring of people on bridge	damage to structure, injury of crowd, possible structure collapse?			Insignificant (1)	Rare (1)	**Low 1**
40	Non-compliant bridge height for water traffic clearance	Design	Excessive deflection of the bridge impacting the required navigation clearance	River traffic blockage or damage to boats	Medium	Legal & Compliance	Insignificant (1)	Rare (1)	**Low 1**
35	Lack of traffic control at Point Fraser	Design	Changes to traffic management and flow around Point Fraser	Impact to access of Causeway Bridge			Insignificant (1)	Unlikely (2)	**Low 2**
1	Unlawful public access to laydown area	Design	Illegal access - criminal activity, theft, purposeful damage to equipment, angry stakeholders Access has not been properly restricted or monitored (CCTV, security patrols, fencing…etc)	injury, damage to precinct, dangerous environment, reputation damage, damage to structure			Insignificant (1)	Possible (3)	**Low 3**
34	Replacement of critical elements : bearing / cable etc	Design	Maintenace access requirements not taken into account.	Infrastructure failure due to lack of maintenance / creation of maintenance risks		Health & Safety	Minor (2)	Unlikely (2)	**Low 4**
27	Inaccessible call point on bridge to summon help	Design	poor design, not enough access points				Minor (2)	Unlikely (2)	**Low 4**
9	Damage or impact to pad requirements	Design	Change of crane requirements	injury, damage to precinct, dangerous environment, reputation damage			Minor (2)	Possible (3)	**Low 6**
13	fall from high embankment areas and securing batters	Design	easy access	potential injury and envirnmental damage	High	Health & Safety	Minor (2)	Possible (3)	**Low 6**
56	lack of CCTV clarity or signage recognition	Design	insufficient lighting	injury, damage to precinct, dangerous environment, reputation damage			Moderate (3)	Unlikely (2)	**Low 6**
36	Access to water conduit inside box girder ?	Design	Maintenace access requirements not taken into account.	Infrastructure failure due to lack of maintenance / creation of maintenance risks		Health & Safety	Moderate (3)	Unlikely (2)	**Low 6**
58	Pedestrian Safety risk - attack or injury between bridges	Design	Not enough lighting on Heirisson Island between bridges	attack or injury between bridges	High	Health & Safety	Minor (2)	Possible (3)	**Low 6**
47	Injury from thrown objects	Design	People throwing objects off the bridge	injury to people			Moderate (3)	Unlikely (2)	**Low 6**
39	access to maintain water for taps on bridge	Design	poor planning and design	no access to water taps for maintenance	Low	Legal & Compliance	Minor (2)	Possible (3)	**Low 6**

							RISK REGISTER		
							Risk Rating		
Risk Reference Number	**Project Risk**	**Project Stage**	**Causes**	**Resulting In**	**Priority**	**Consequence Category**	**Consequence Rating**	**Likelihood Rating**	**Level of Risk**
54	environment causes reduced life of the asset	Design	UV / Heat deteriorating structural components over time	reduced life of the asset, impact on project objectives			Moderate (3)	Unlikely (2)	**Low 6**
19	risk of the slipping off the slope	Design	wet weather, incorect surface treatment, incorrect incline	Impact on project objectives, reputation damage, injury	High	Health & Safety	Minor (2)	Possible (3)	**Low 6**
30	event occurs that requires injured people to be evaInjured people need to be evacuation from the structure	Design	accident / medical	if not able to exit in time or safely more harm may be done to injured person. May result in litigation.	High	Health & Safety	Catastrophic (5)	Rare (1)	**Medium 7**
2	Car accesses and drives across bridge	Design	bridge access not restricted enough - poor design, malfunctioning bollards	injury, damage to precinct, dangerous environment, reputation damage, damage to structure			Catastrophic (5)	Rare (1)	**Medium 7**
17	People creating excessive vibrations on purpose on the bridge (crowd)	Design	poor design	unenjoyable experience, avoidance of the bridge, injury	High	Health & Safety	Catastrophic (5)	Rare (1)	**Medium 7**
24	Access to lighting, handrail and feature	Design	Maintenace access requirements not taken into account.	Infrastructure failure due to lack of maintenance / creation of maintenance risks		Health & Safety	Minor (2)	Likely (4)	**Medium 8**
29	Emergency access to bridge restricted	Design	poor design, not enough access points	emergency situations may have have a lag in response times - results in injury, death, reputation or structural damage			Major (4)	Unlikely (2)	**Medium 8**
42	Limited or no access for landscaping and maintenance vehicles	Design	poor design, not enough access points	limited maintenance activities can be performed - may damage precinct over time			Minor (2)	Likely (4)	**Medium 8**
49	shared path clearance under the bridge decks when the sea level rises by 0.9m?	Design	climate change / rising water levels	low clearance height would not meet standards - may impact safety or call for re-design and project modification - $$$	Medium	Environmental	Moderate (3)	Possible (3)	**Medium 9**
57	injury / harrassment of visitors to the preceinct	Design	lack of adequate lighting	impact on project objectives, loss of visitors to the precinct, reputation damage			Moderate (3)	Possible (3)	**Medium 9**
23	Access to CCTV / Electrical infrastructure	Design	Maintenace access requirements not taken into account.	Infrastructure failure due to lack of maintenance / creation of maintenance risks		Health & Safety	Moderate (3)	Possible (3)	**Medium 9**
38	Boating incidents (crashes and near misses)	Design	poor communiaction with local authorities and lack of wardens or signage	collisions and injury			Moderate (3)	Possible (3)	**Medium 9**
22	Access to in bridge services is restricted	Design	poor design, not enough access points	limited maintenance activities can be performed - may damage precinct and structure over time			Moderate (3)	Possible (3)	**Medium 9**
8	Cyclist travelling at high speed collide with pedestrians	Design	Poor design, lack of signage, poor wayfinding, public behaviour (not following rules, overtaking)	death or injury, reputation damage			Major (4)	Likely (4)	**Very High 16**
10	Damage or impact to crane or bridge during and after construction	Design	Extreme weather - wind	injury, damage to precinct, dangerous environment, reputation damage			Catastrophic (5)	Likely (4)	**Very High 20**
61	Poorly marked bike paths	Design	poor design and incorect wayfinding/signage	injury (bike collision), impact on project objectives, reputation damage			Major (4)	Almost Certain (5)	**Very High 20**
55	Pedestrians slip on pathways	Design	rain or weather conditions, incorrect material selection	injury to pedestrians			Major (4)	Almost Certain (5)	**Very High 20**
28	Lightning hitting pylon, deck or cables -> Risk of fire / damage to structure	Design	weather conditions, design of structure, materials	Risk of fire / damage to structure	High	Business Operations	Major (4)	Almost Certain (5)	**Very High 20**
32	Failure of 1 cable	Operations	manufacturing defect	quality issue	Low	Business Operations	Insignificant (1)	Rare (1)	**Low 1**
15	Risk of fire - on bridge	Operations	Having a fire for a BBQ at the pause points	percieved poor planning, percieved lack of security and safety	Low	Health & Safety	Moderate (3)	Rare (1)	**Low 3**
45	throwing rocks from landscaping on to tourist boats or shared path below	Operations	poor security / too much access	injury and litigation	Low	Legal & Compliance	Major (4)	Rare (1)	**Low 4**
20	Terrorism, blowing a cable or bearing or support etc	Operations	opportunity, access, unhappy stakeholders	potential injury, sturctural damage, environmental damage, lowered community confidence	High	Reputation & Trust	Catastrophic (5)	Rare (1)	**Medium 7**
25	Risk of fire - bushfire near embankments	Operations	natural casues or arson	impact on safety of environment and community	Medium	Health & Safety	Major (4)	Unlikely (2)	**Medium 8**
	Incident occuring from colllission or disruption of pedestrian activities by electric quad bikes wrongly accessing the bridge	Operations	Quad bikes can be hired from local hire shop	injury, damage to precinct, dangerous environment, reputation damage			Moderate (3)	Possible (3)	**Medium 9**

CAUSEWAY PEDESTRIAN AND CYCLE BRIDGE KEY PLAN

1:1250



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A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

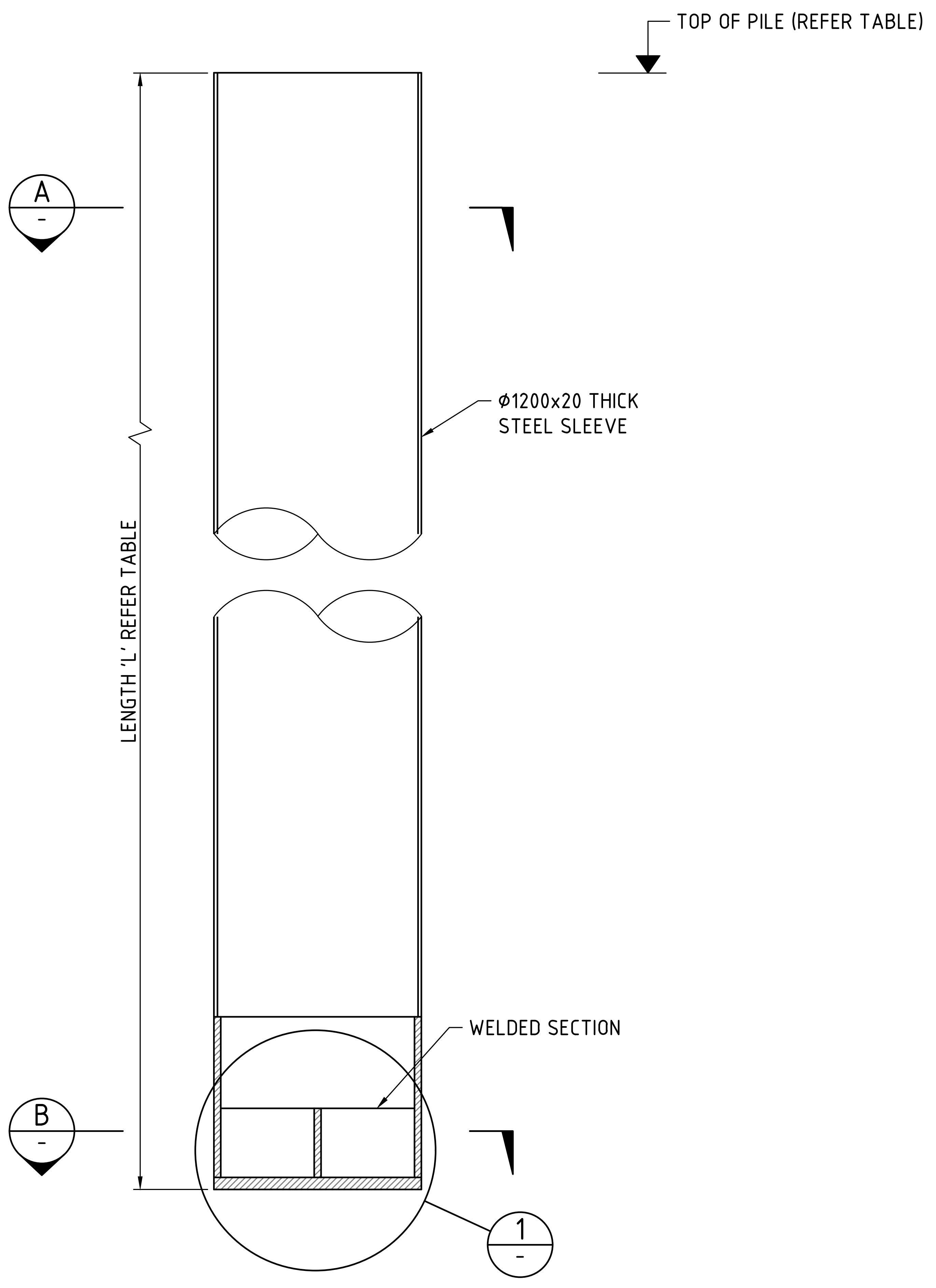
VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

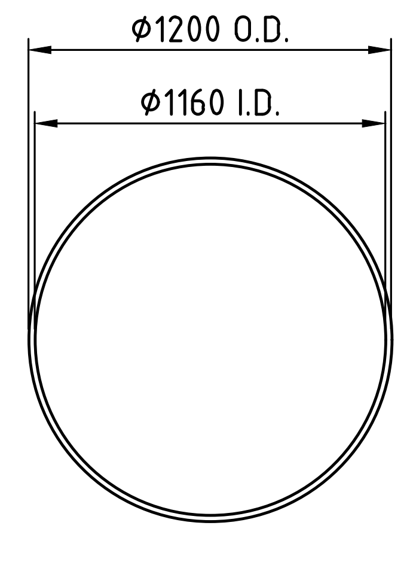
INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
KEY PLAN
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-00010
REV: A



TYPICAL STEEL TUBE PILE
1:25



SECTION A -
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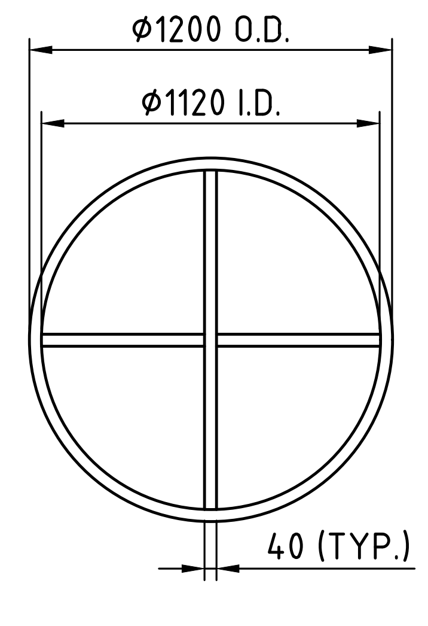

SECTION B -
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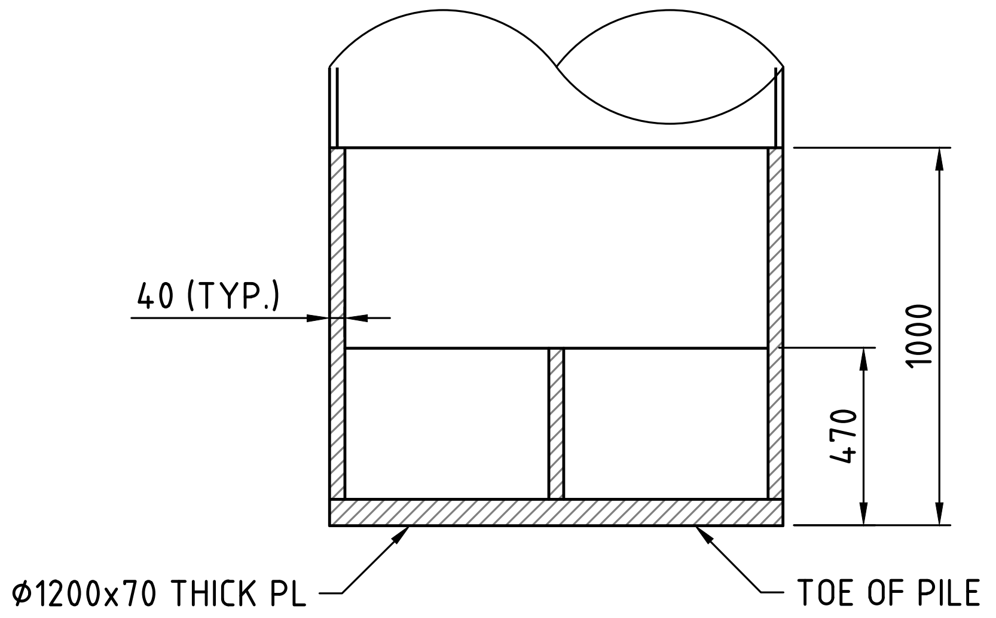

DETAIL 1 -
1:20

PILE DETAILS

BRIDGE	LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH 'L' (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
MCCALLUM PARK (BRIDGE 9505)	PYLON N° 1	DRIVEN STEEL TUBE PILE	1200	6	0.0	28.5	-	-29.0
	PYLON N° 2	DRIVEN STEEL TUBE PILE	1200	6	0.0	25.0	2.0	-23.0
POINT FRASER (BRIDGE 9506)	PYLON N° 1	DRIVEN STEEL TUBE PILE	1200	6	0.0	30.0	-	-38.0

NOTES:

1. REFER DRG. C301-CLA-0000-ST-SKT-20002 FOR GEOTECHNICAL NOTES.

1:20 0 200mm 400 600 800 1000 1200 1400 1600 1800 2000

1:25 0 1m 2

Plot Date: 22/07/2022 8:37 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-10001.dwg

Plotted By: Burgess, Brent

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wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

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VERIFIED

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Causeway Link Alliance

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PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

INFRASTRUCTURE DELIVERY DIRECTORATE

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PROJECT DIRECTOR DATE

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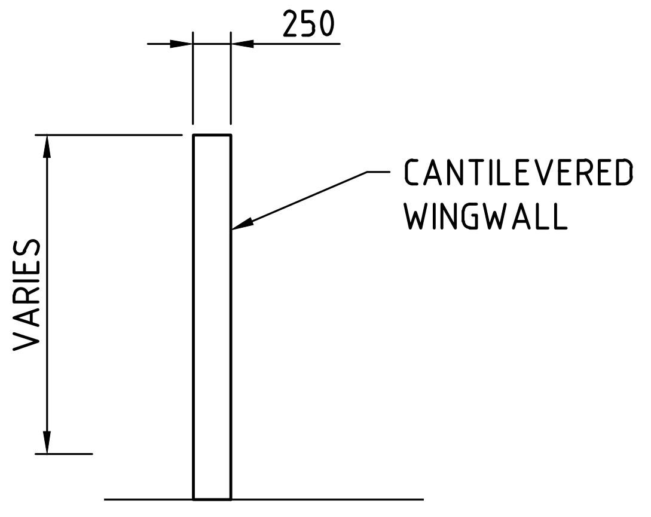
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL PYLON PILE DETAILS
SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-0000-ST-SKT-10001
REV A



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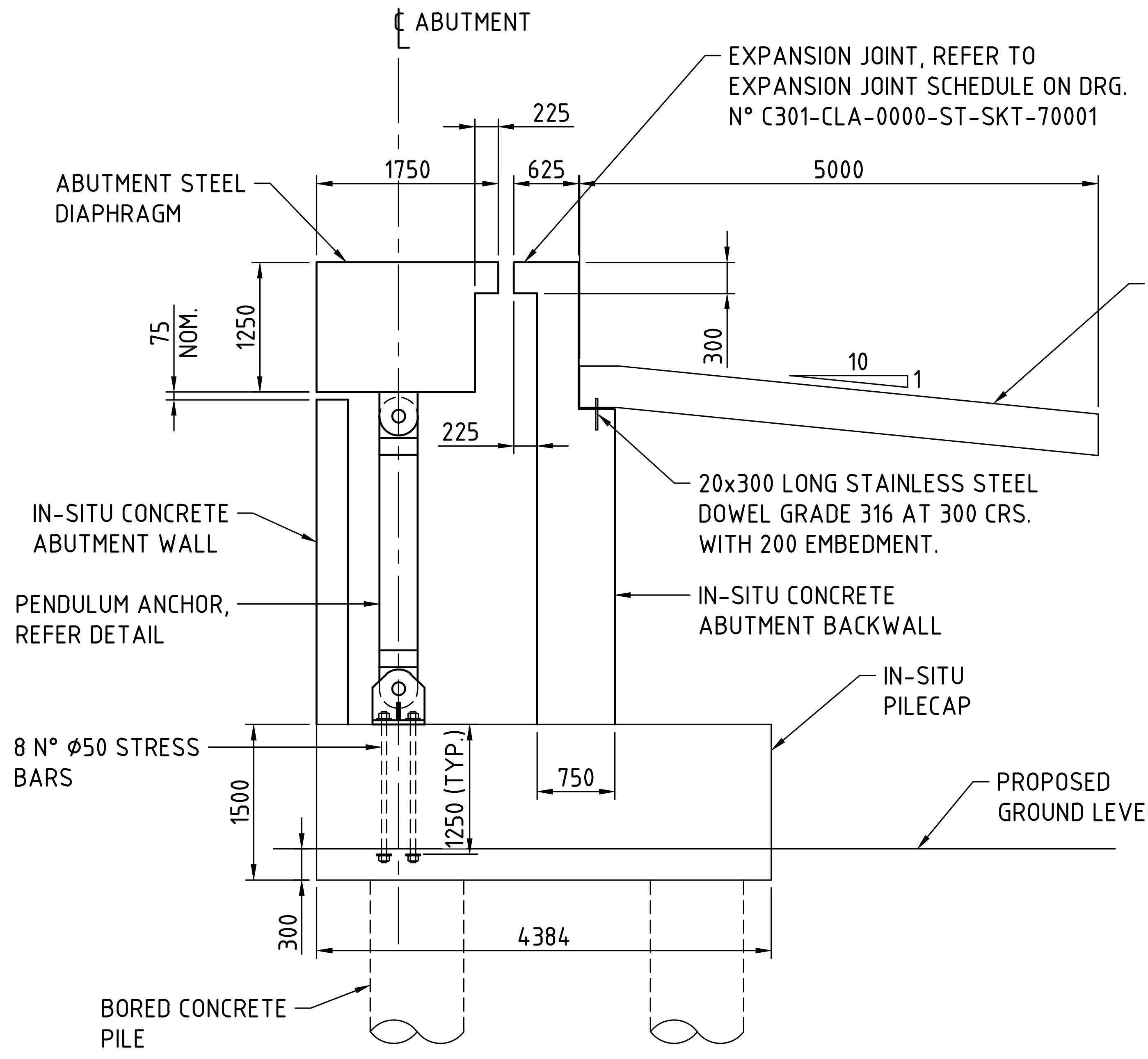

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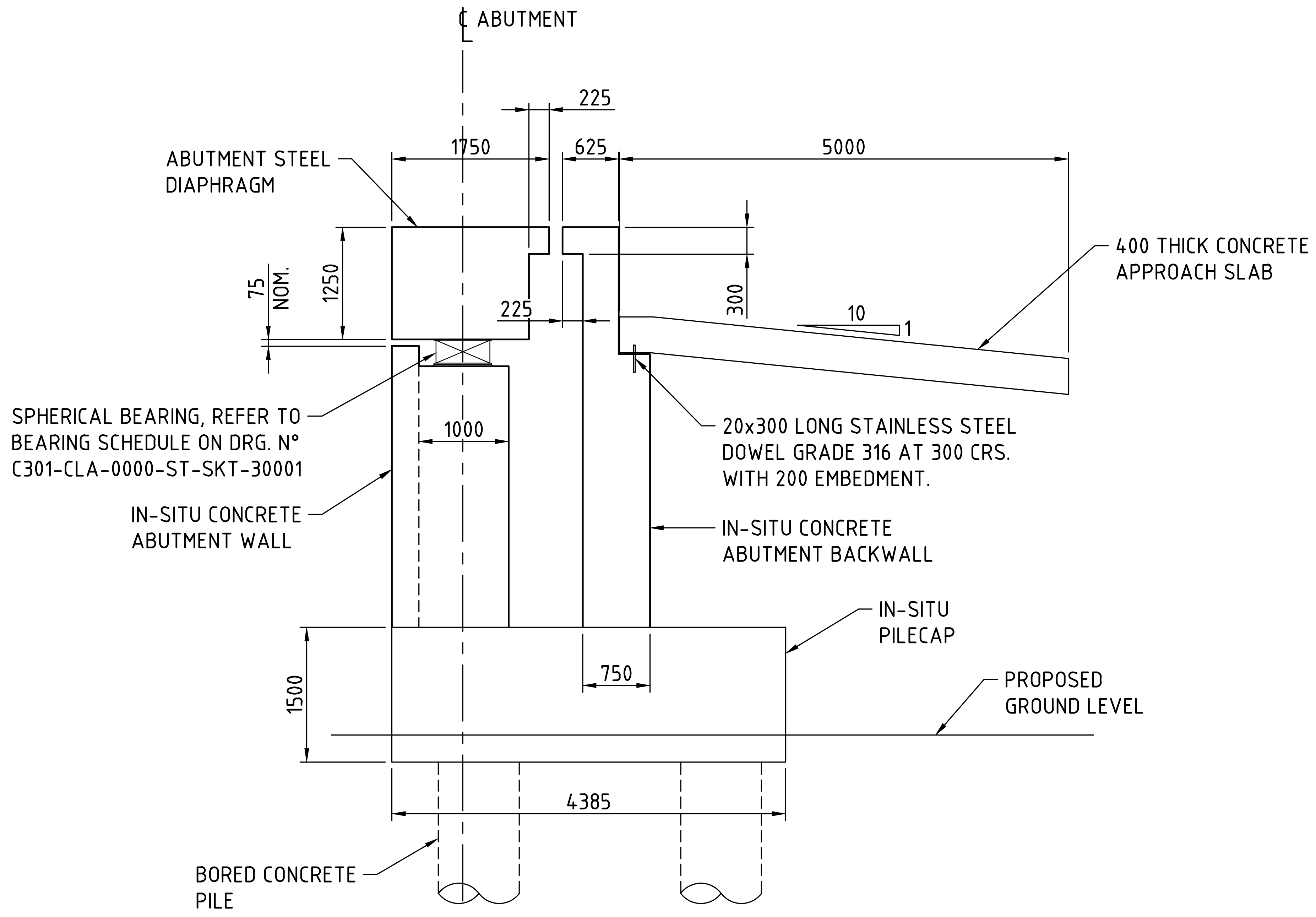

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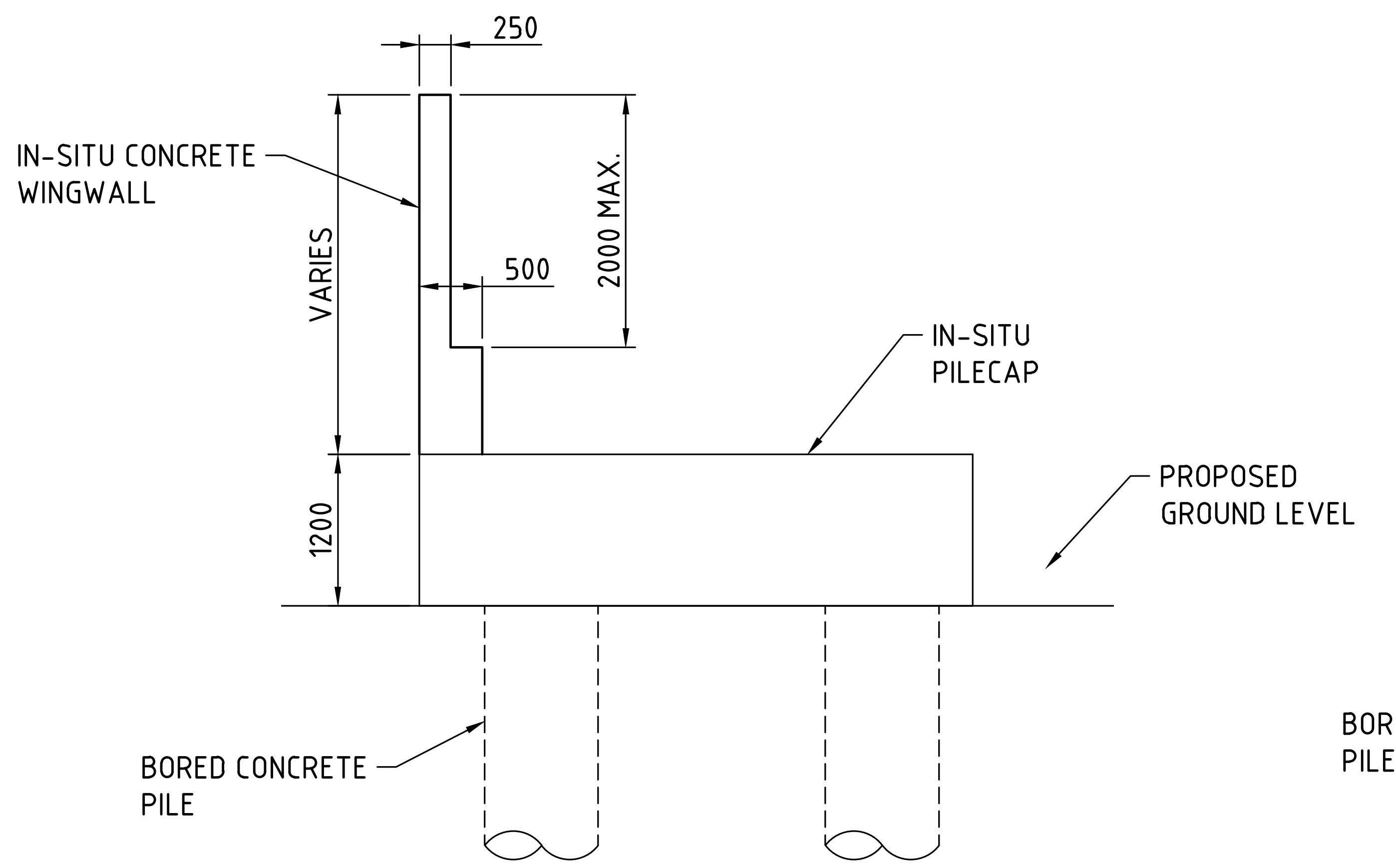

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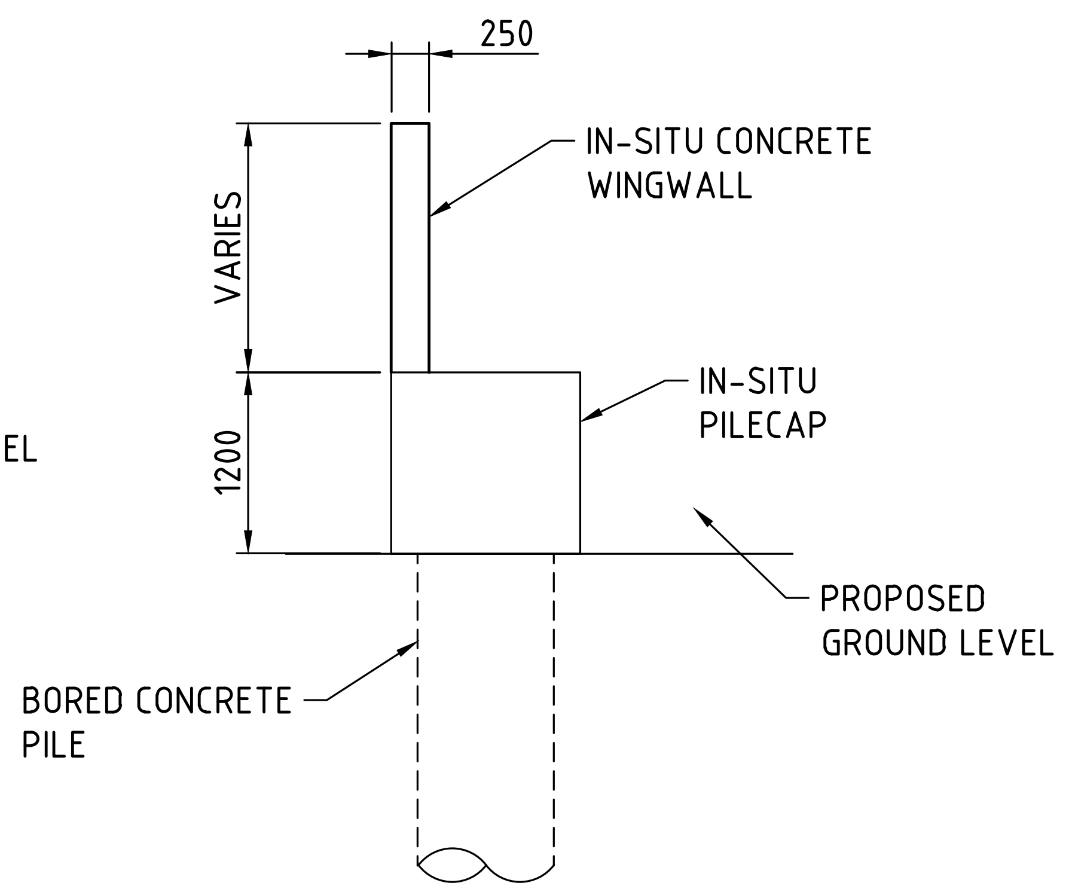

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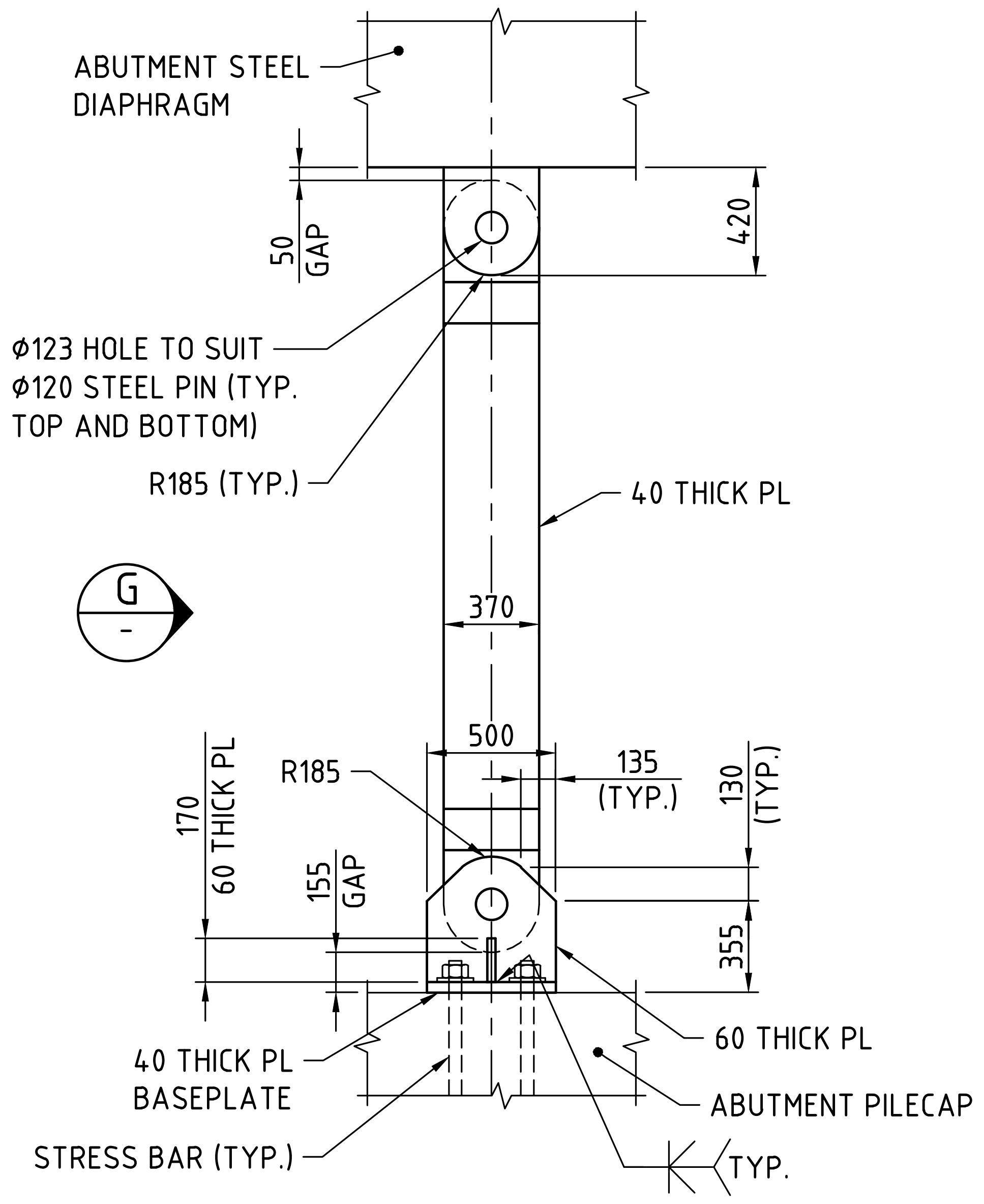
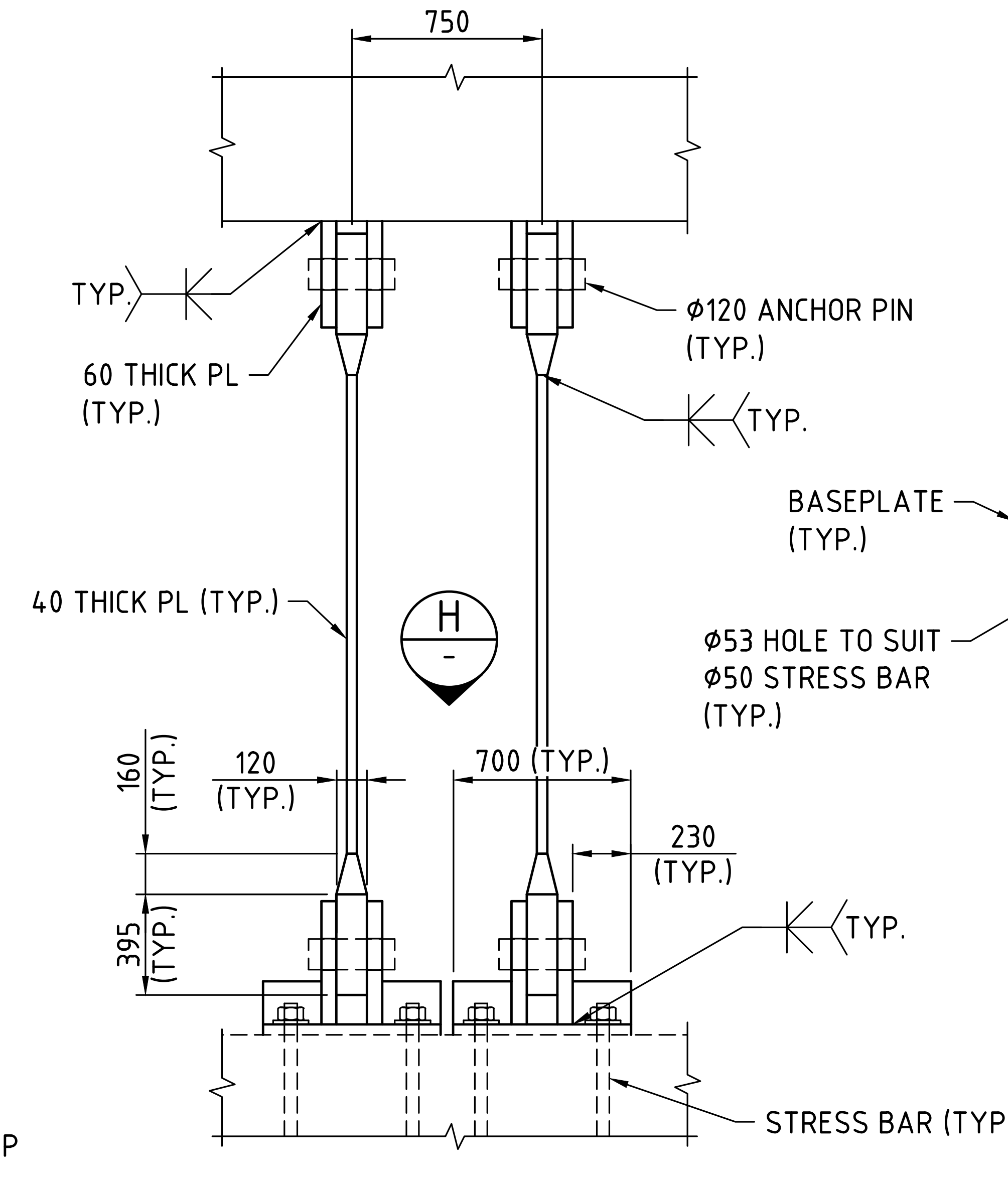
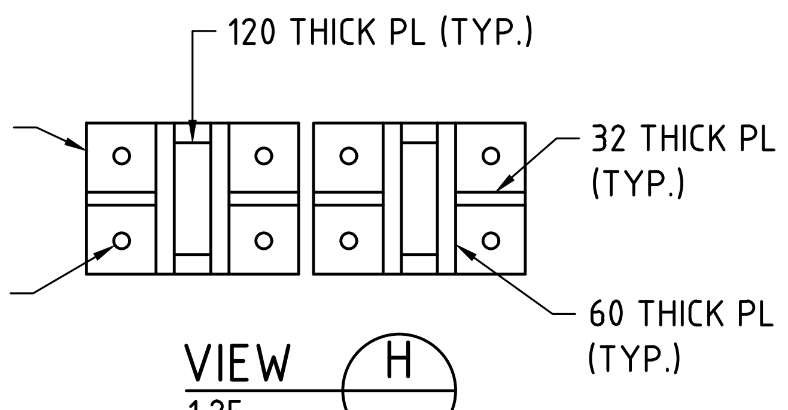


PENDULUM BEARING SECTION
1:25



ELEVATION G
1:25



VIEW H
1:25

1:25
1:50

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No.	DESCRIPTION	APPROVED & DATE
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wsp
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503 Murray Street
Perth WA 6000
Telephone +61 8 9489
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9777 Email:
perth@wsp.com

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APPROVED	W.SCHWARZ	21.07.22
DRAWING PATH		

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VERIFIED
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Causeway Link Alliance
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DETAILS
ABUTMENT SECTIONS
SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-0000-ST-SKT-20001
REV A

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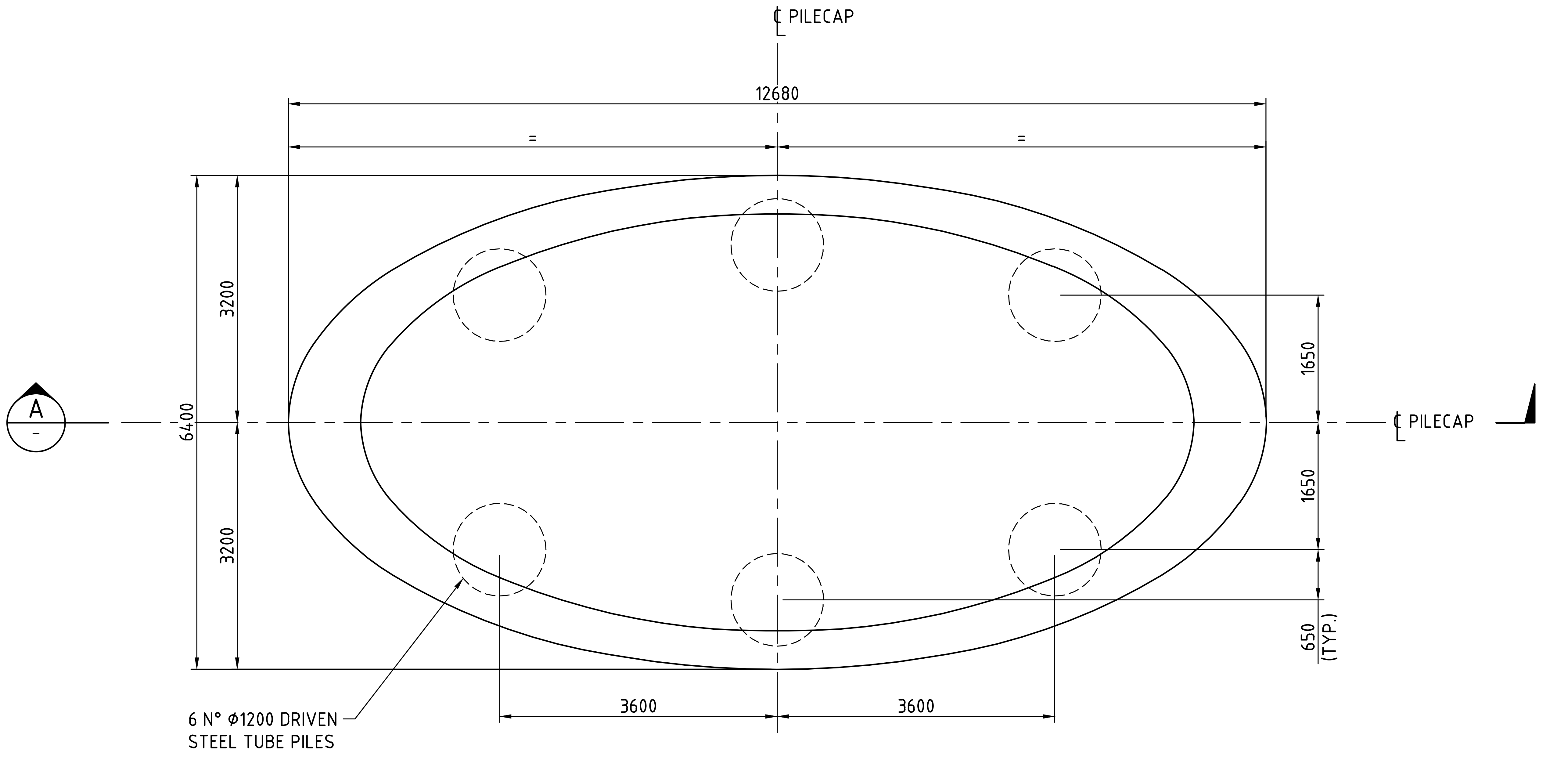
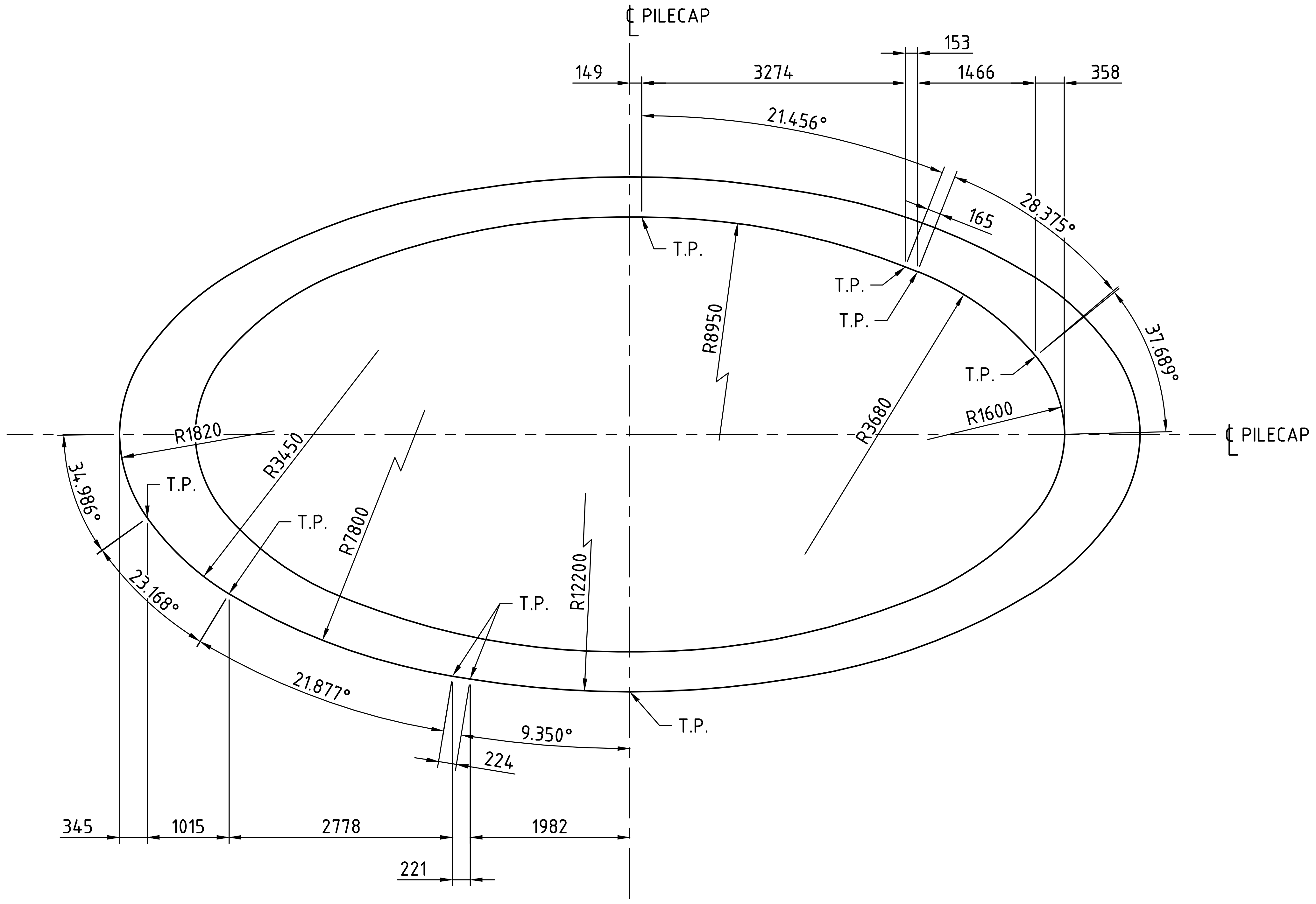
Plot Date: 22/07/2022 8:37 AM Cad File: C:\Users\burgessbr\OneDrive - WSP O365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-20001.dwg



TYPICAL PYLON PILE ARRANGEMENT

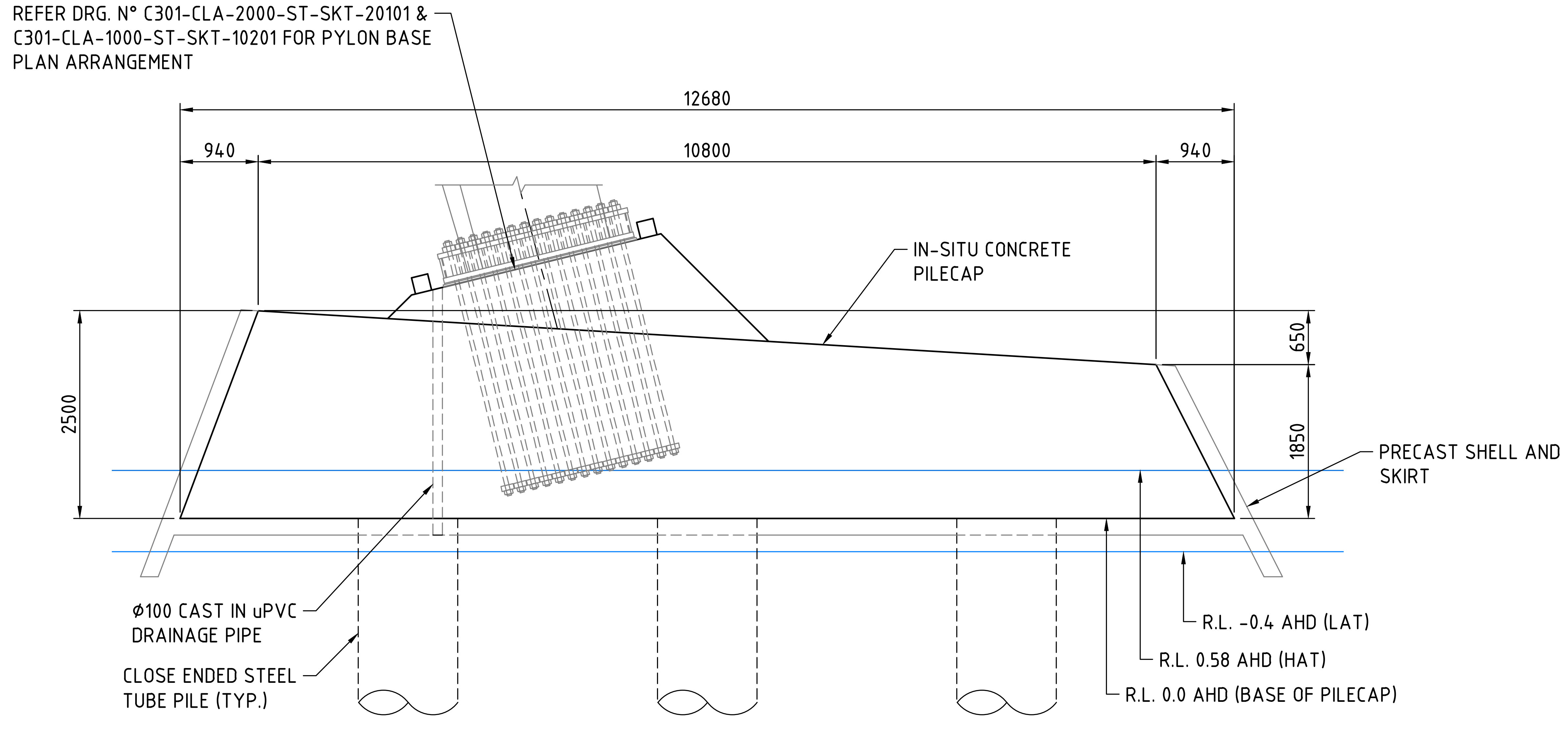
1:50



GEOMETRY CENTRAL ABOUT PILECAP CENTRELINES

TYPICAL PYLON PILECAP

1:25



SECTION A
-

1:50

GEOTECHNICAL NOTES:

1. GEOTECHNICAL STRENGTH REDUCTION FACTOR WAS ASSESSED ASSUMING THAT A MINIMUM OF 5% OF TOTAL PILES WILL BE SUBJECT TO DYNAMIC PILE LOAD TESTING WITH CAPWAP ANALYSIS FOR BOTH DRIVEN AND BORED PILE OPTIONS.
2. GEOTECHNICAL STRENGTH REDUCTION FACTOR OF 0.72 WAS APPLIED TO THE DRIVEN STEEL TUBE PILES TO CALCULATE THE MINIMUM REQUIRED DESIGN GEOTECHNICAL STRENGTH ($R_{D,G}$).
3. GEOTECHNICAL STRENGTH REDUCTION FACTOR OF 0.69 WAS APPLIED TO THE BORED PILES TO CALCULATE THE MINIMUM REQUIRED DESIGN GEOTECHNICAL STRENGTH ($R_{D,G}$).
4. FOR DRIVEN STEEL TUBE PILES, A DRIVING RECORD OF BLOWS/250 MM, HAMMER STROKE AND THE TIME FOR THE FULL DRIVING OF ALL PILES SHALL BE MADE BY THE CONTRACTOR AND PROVIDED AT THE END OF DRIVE OF EACH PILE.
5. AN EXPERIENCED GEOTECHNICAL ENGINEER SHALL WITNESS THE END OF DRIVING AND THE PDA TESTING.
6. END OF DRIVE (EOD) TEST AND BEGINNING OF RESTRIKE TEST (IF APPLICABLE) SHALL BE PERFORMED ON THE 1ST INSTALLED PILE AT EACH PYLON TO ASSESS PILE CAPACITY AND DETERMINE THE APPROPRIATE SET CRITERIA TO ACHIEVE LONG TERM CAPACITY. BASED ON THE DRIVING BEHAVIOUR AND PDA/CAPWAP TESTING OF THE FIRST DRIVEN PILE, GOLDER IN CONJUNCTION WITH THE PILING CONTRACTOR SHALL ASSESS TARGET END OF DRIVE SET CRITERIA FOR THE OTHER PILES IN EACH GROUP.
7. VISUAL INSPECTION SHALL BE UNDERTAKEN ON 100% OF STEEL PILES AFTER DRIVING AND PRIOR TO CONCRETING. THIS SHALL INCLUDE DIPPING TO THE PILE TOE TO CHECK FOR WATER AND/OR SOIL INGRESS.
8. SUPERVISION OF CONCRETING WORKS SHALL BE UNDERTAKEN ON 100% OF PILES AND SHALL INCLUDE RECORDING CONCRETE VOLUME PUMPED INTO EACH PILE AND MEASURING THE RATE OF RISE OF THE SURFACE OF THE CONCRETE INSIDE THE PILES. THESE RECORDS SHALL BE USED TO ASSESS ANY ANOMALIES IN THE CONCRETE WORKS.
9. DRIVEABILITY TO BE PERFORMED BY THE PILING CONTRACTOR AND REVIEWED BY GEOTECHNICAL DESIGN ENGINEER.

1:50
0 0.5m 1 1.5 2 2.5 3 3.5 4 4.5 5

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HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

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APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

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PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

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MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL PYLON PILECAP DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-20002
REV: A

BEARING SCHEDULE

			ULS							LONGITUDINAL (EXTREME EVENT) (SHIP IMPACT AND EARTHQUAKE) (mm)	SLS					
BRIDGE	LOCATION	BEARING TYPE	BEARING (kN) COMPRESSION	BEARING (kN) TENSION	BEARING TRANSVERSE (kN)	BEARING LONGITUDINAL (kN)	LONGITUDINAL MOVEMENT (TOWARDS PYLON) (mm)	LONGITUDINAL MOVEMENT (AWAY PYLON) (mm)	ROTATION (RAD)		BEARING (kN) COMPRESSION	BEARING (kN) TENSION	BEARING TRANSVERSE (kN)	BEARING LONGITUDINAL (kN)	LONGITUDINAL MOVEMENT (TOWARDS PYLON) (mm)	LONGITUDINAL MOVEMENT (AWAY PYLON) (mm)
POINT FRASER (BRIDGE 9506)	ABUTMENT 1	LONGITUDINAL GUIDED	750	-	300	-	40	25	0.015	+/- 60	500	-	50	-	30	20
		FREE	250	-	-	-	40	25	0.015	+/- 60	100	-	-	-	30	20
	HALVING JOINT	LONGITUDINAL GUIDED	1300	-	550	-	75	45	0.02	+/- 120	1000	-	400	-	50	30
	PIER 3	PIN	-	8700	1200	700	-	-	0.03	-	-	6200	900	400	-	-
		PIN	5150	-	1200	700	-	-	0.03	-	3400	-	900	400	-	-
	PYLON (HORIZONTAL BEARING)	FIXED	1000	1000	3200 (VERTICAL)	1100 (HORIZONTAL)	-	-	0.02	-	350	300	2550 (VERTICAL)	350 (HORIZONTAL)	-	-
	ABUTMENT 2	PENDULUM ANCHOR	-	3050	-	-	60	135	0.05	+/- 140	-	2150	-	-	35	100
		LONGITUDINAL GUIDED	4400	-	1250	-	60	135	0.05	+/- 140	3000	-	750	-	35	100
MCCALLUM PARK (BRIDGE 9505)	ABUTMENT 1	PENDULUM ANCHOR	-	6650	-	-	90	60	0.05	+/- 110	-	4450	-	-	40	30
		LONGITUDINAL GUIDED	4100	-	1950	-	90	60	0.05	+/- 110	2500	-	1350	-	40	30
	PYLON 1 (HORIZONTAL BEARING)	FIXED	1950	600	6350 (VERTICAL)	4450 (HORIZONTAL)	-	-	0.02	-	1550	300	4750 (VERTICAL)	2650 (HORIZONTAL)	-	-
	PYLON 2 (HORIZONTAL BEARING)	FIXED	1950	600	6350 (VERTICAL)	4450 (HORIZONTAL)	-	-	0.02	-	1550	300	4750 (VERTICAL)	2650 (HORIZONTAL)	-	-
	ABUTMENT 2	PENDULUM ANCHOR	-	6650	-	-	90	60	0.05	+/- 110	-	4450	-	-	40	30
		LONGITUDINAL GUIDED	4100	-	1950	-	90	60	0.05	+/- 110	2500	-	1350	-	40	30

1:10

0 100mm 200 300 400 500 600 700 800 900 1000

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DRAWING TITLE
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BEARING SCHEDULE

SHEET
A1

DRAWING STATUS
15%

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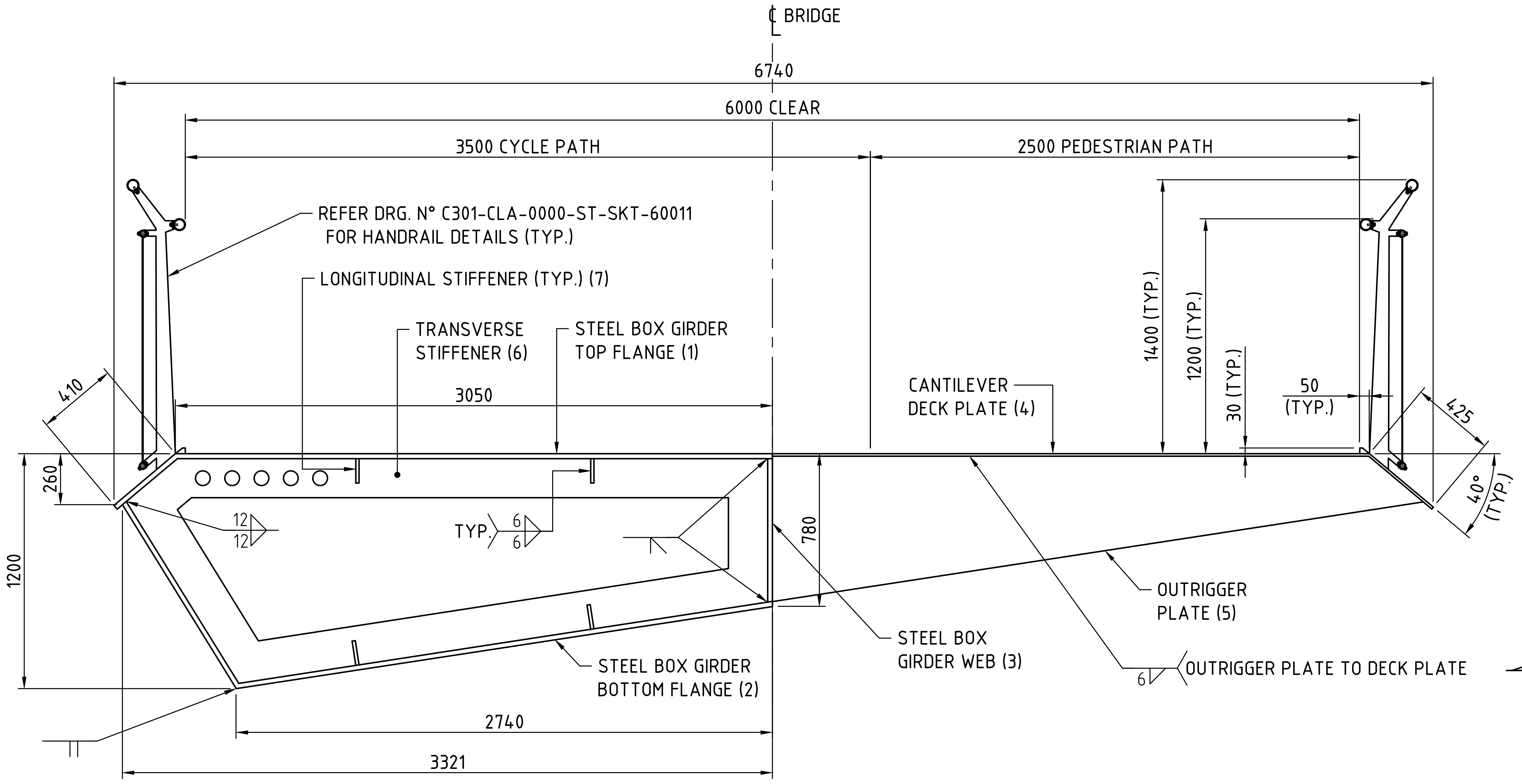
C301-CLA-0000-ST-SKT-30001

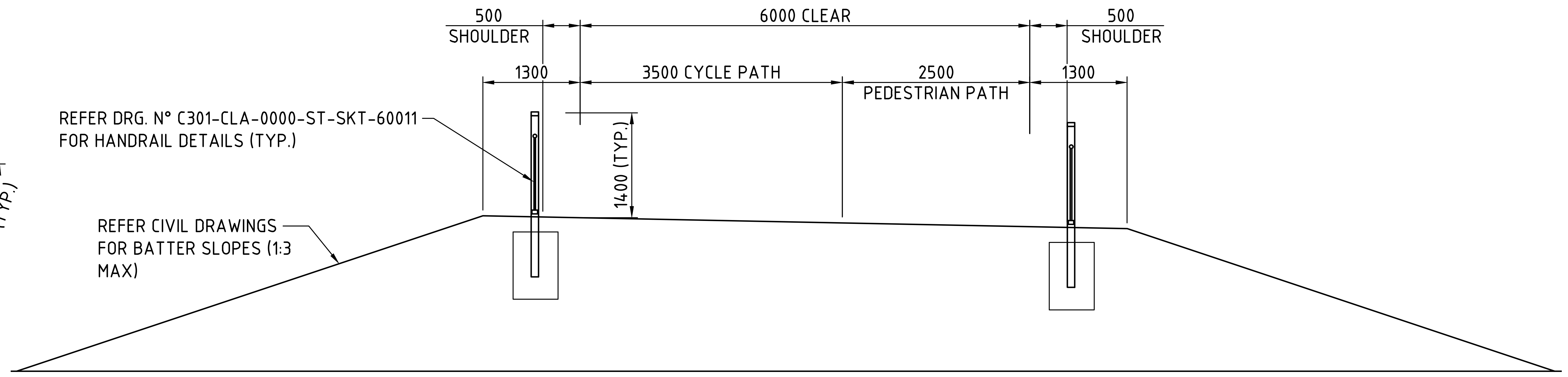
REV
A



NUMBER IN BRACKETS (#) DENOTES MEMBER SIZE. REFER DRG. N° C301-CLA-0000-ST-SKT-40006.

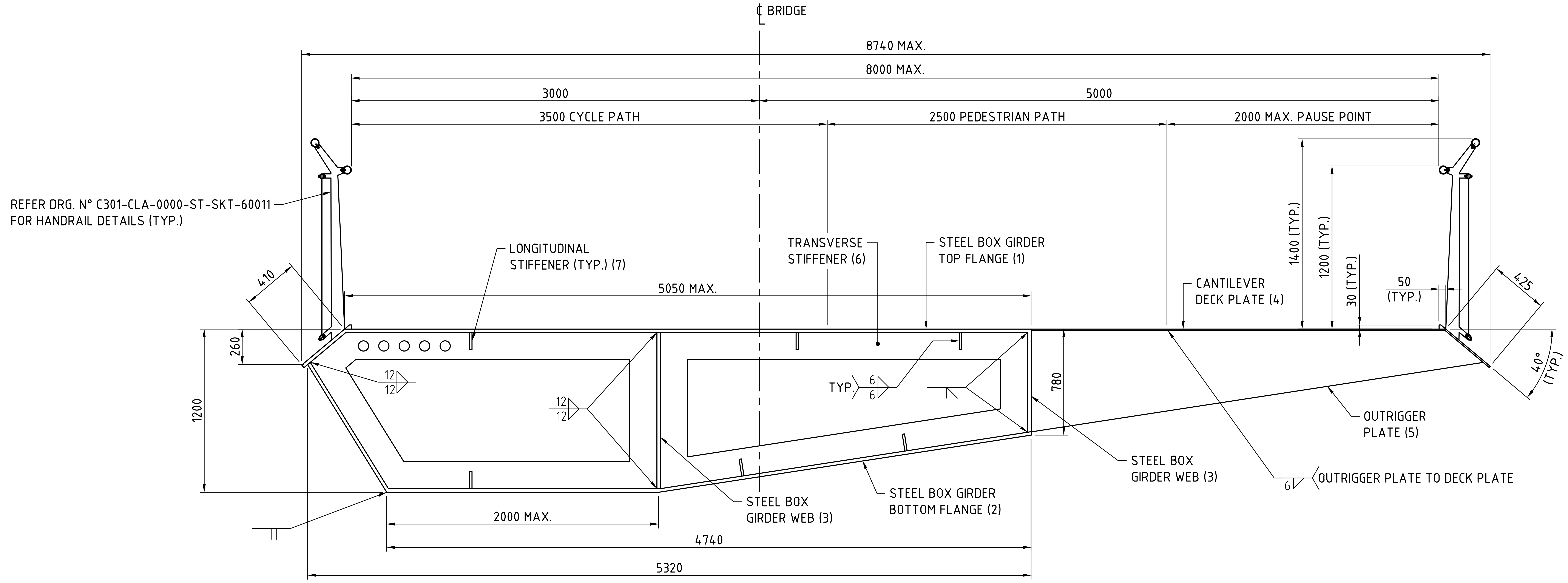
TYPICAL DECK SECTION

1:20



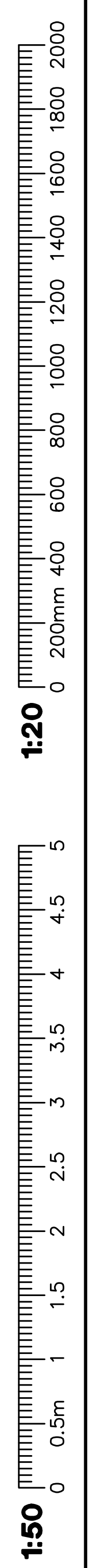
TYPICAL EMBANKMENT SECTION

1:50



TYPICAL PAUSE POINT DECK SECTION

1:20



Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:37 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40001.dwg

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

VERIFIED

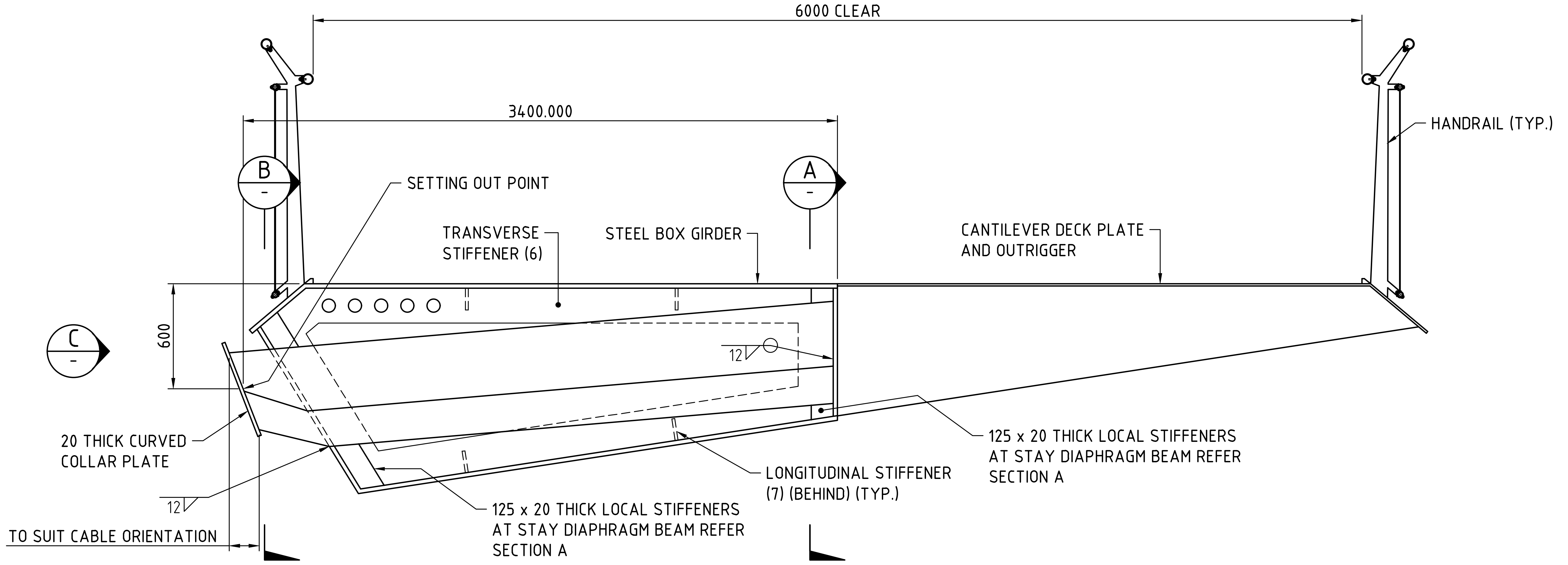
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

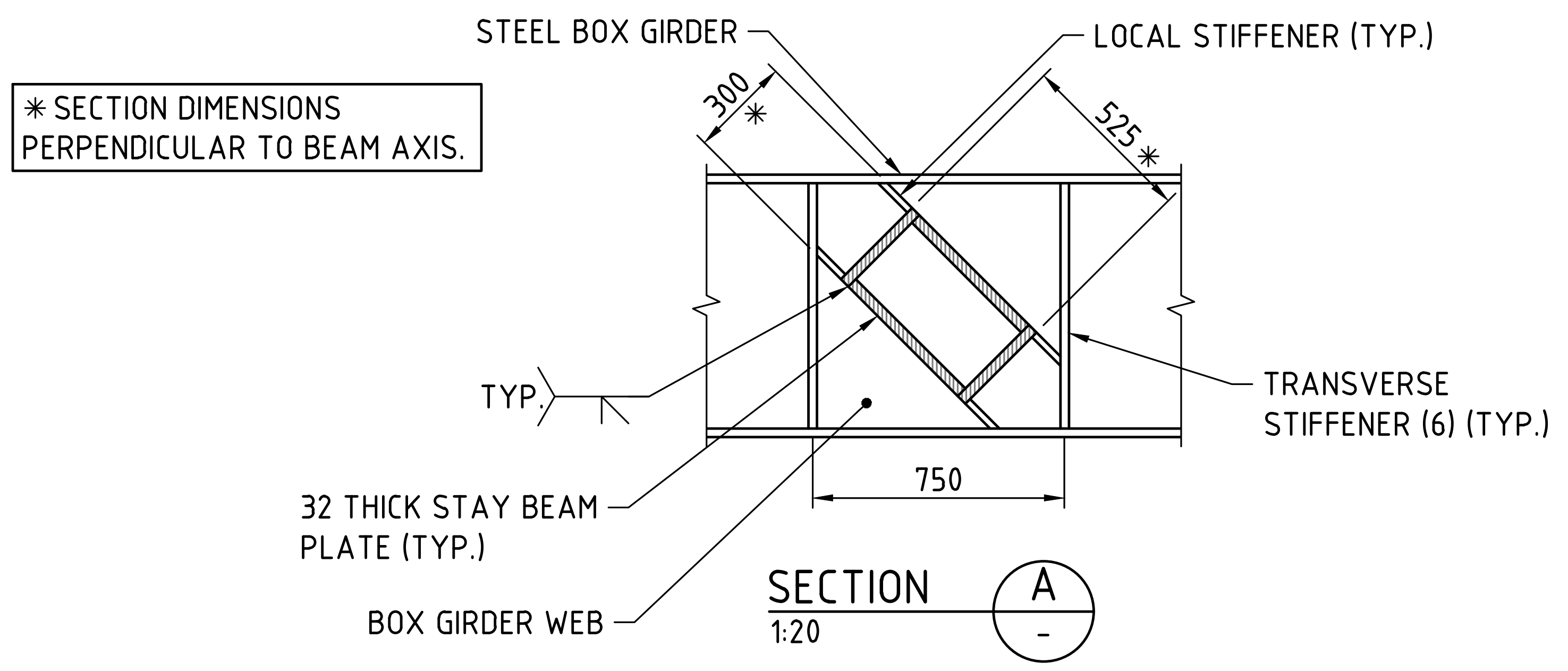
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DETAILS
DECK SECTIONS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40001
REV: A

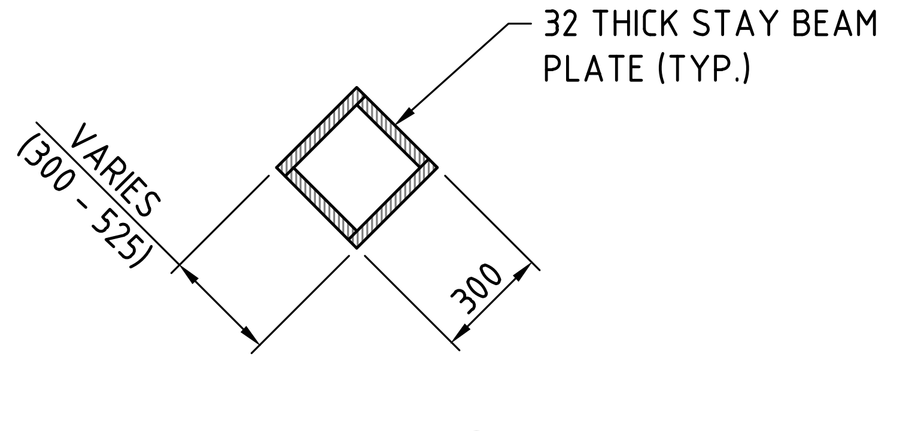


CABLE AND ANCHOR PIPE OMITTED FOR CLARITY

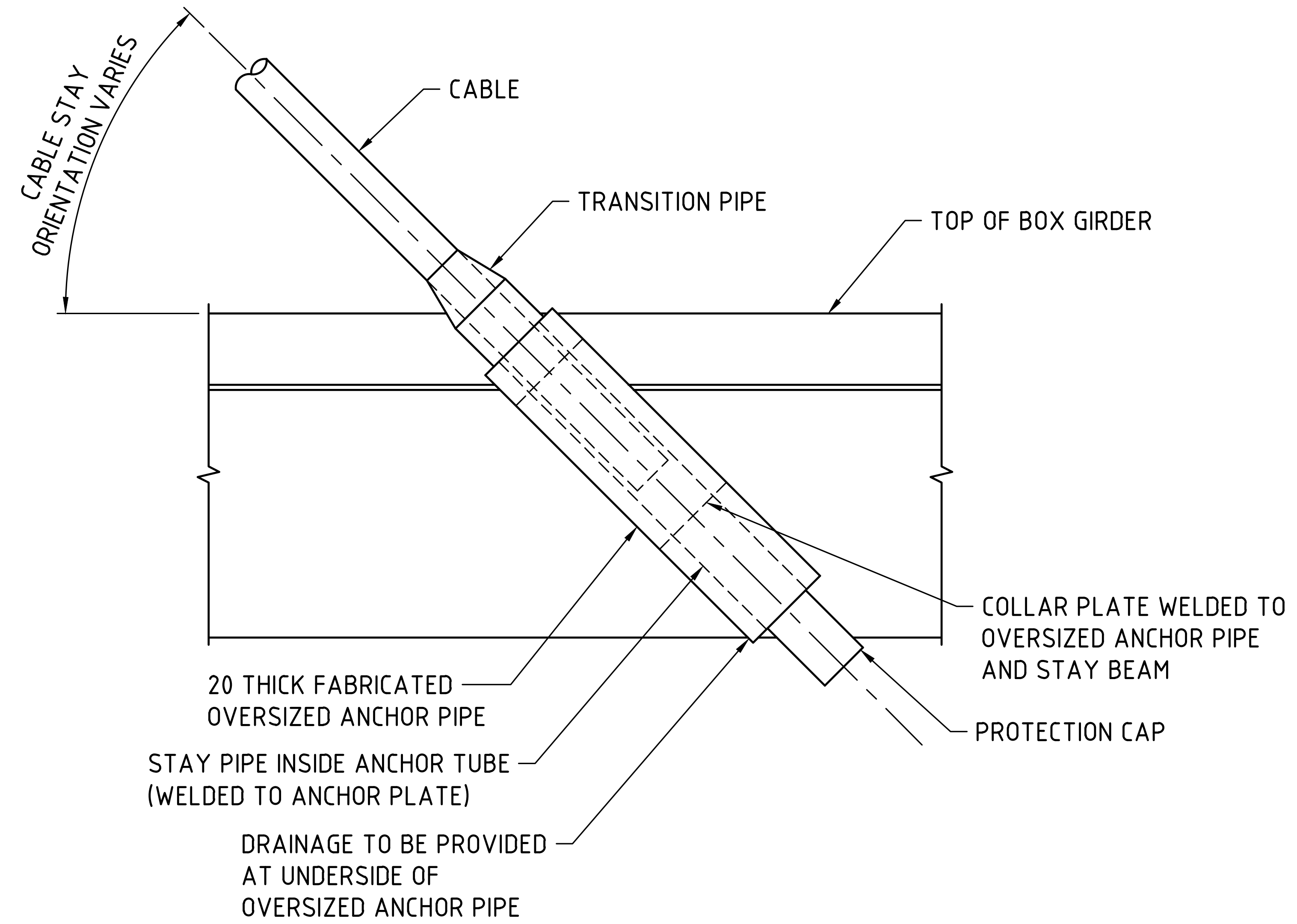
TYPICAL SECTION
1:20



SECTION A
1:20



SECTION B
1:20



ELEVATION C
1:20

1:20
0 200mm 400 600 800 1000 1200 1400 1600 1800 2000

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:37 AM Cad File: C:\Users\burgessbr\OneDrive - WSP O365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40002.dwg

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22
DRAWING PATH		

VERIFIER
VERIFIED
DATE

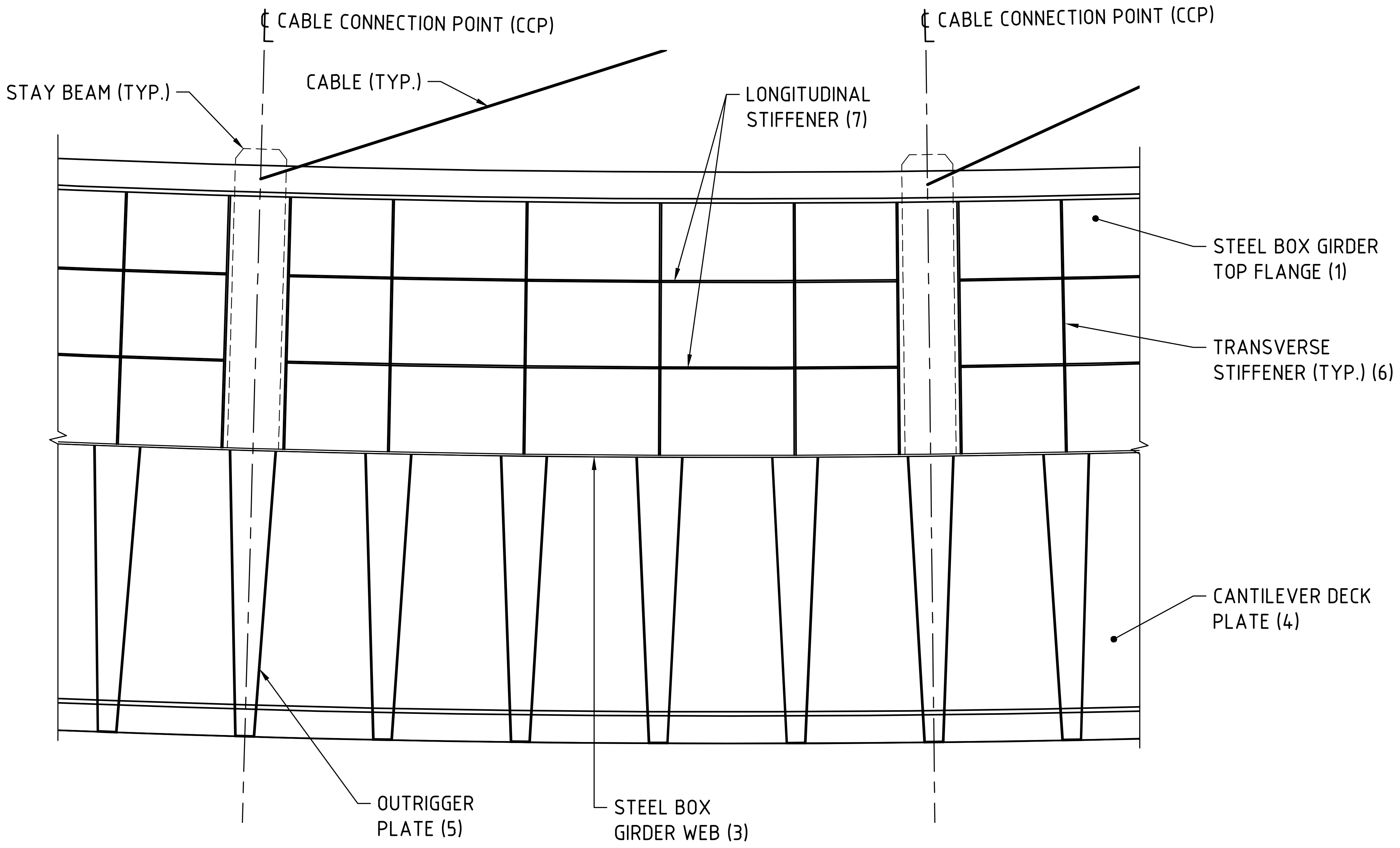
Causeway Link Alliance
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

THE GOVERNMENT OF WESTERN AUSTRALIA
mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

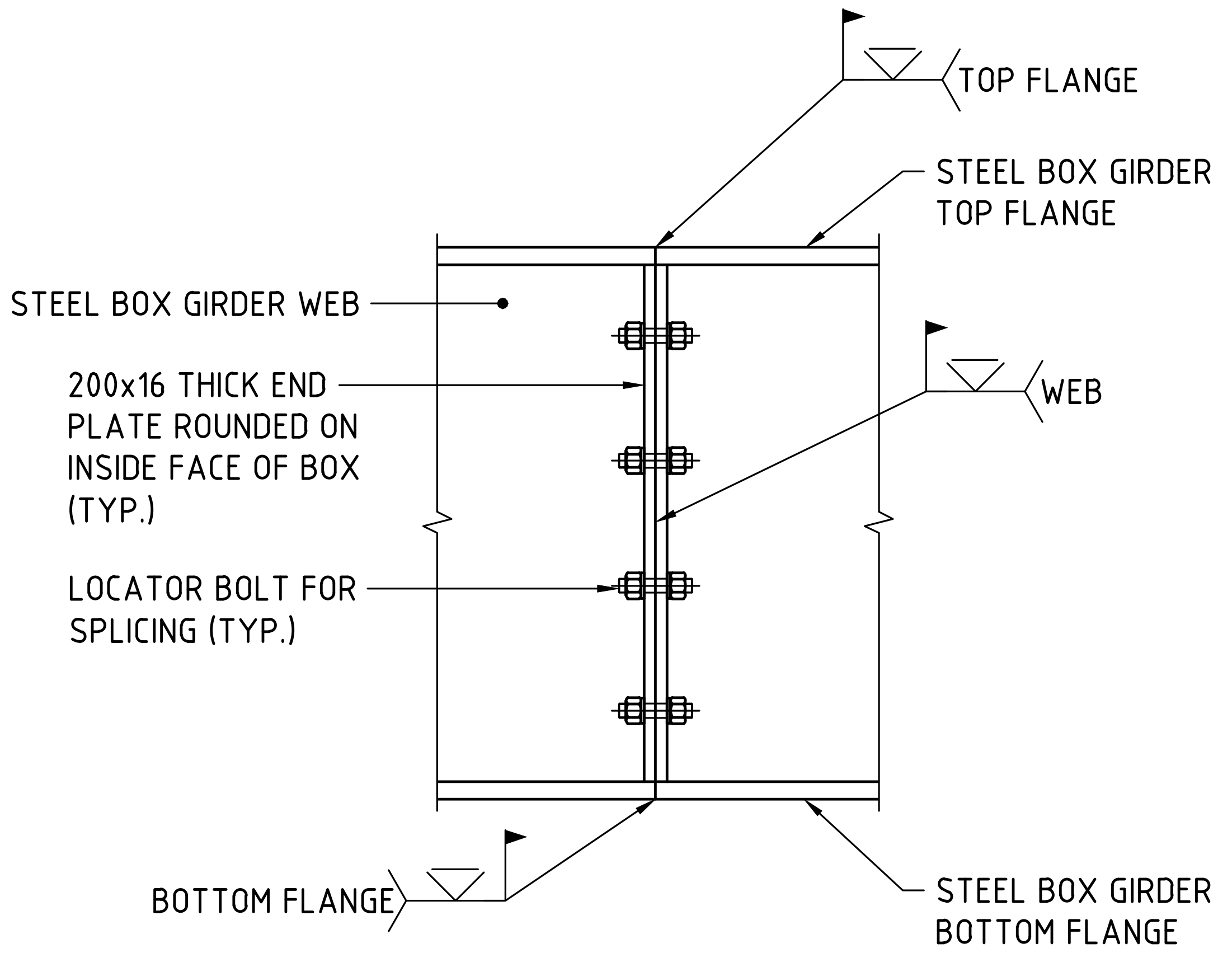
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DETAILS
CABLE TO DECK CONNECTION
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40002
REV: A

NOTES:

1. FOR DECK PLATE THICKNESS REFER DRG N° C301-CLA-0000-ST-SKT-40006.

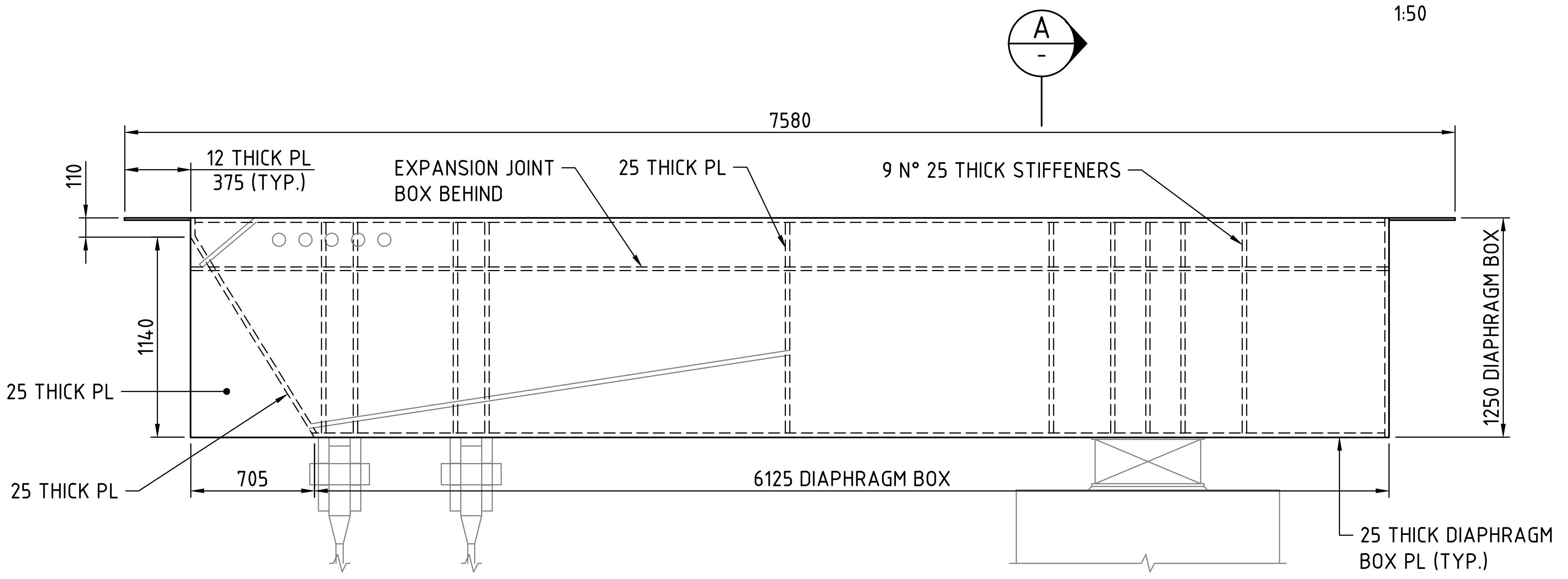


TYPICAL DECK SEGMENT
1:50



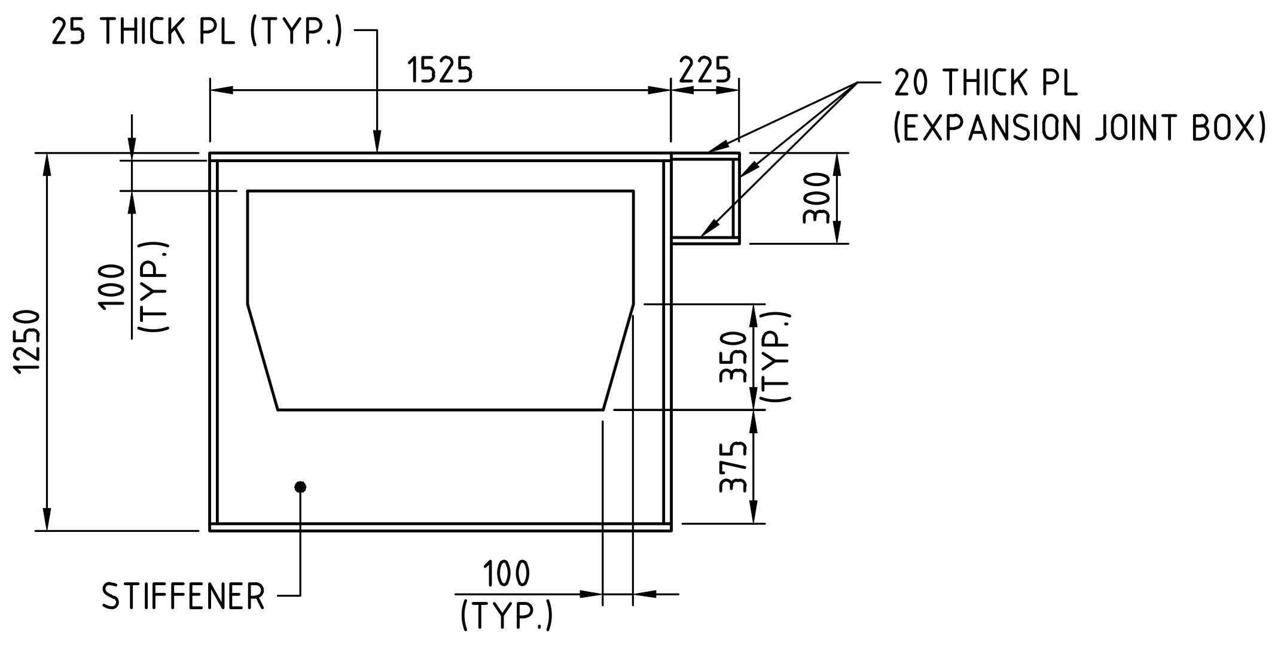
FIELD WELDED JOINT

TYPICAL ELEVATION
1:10



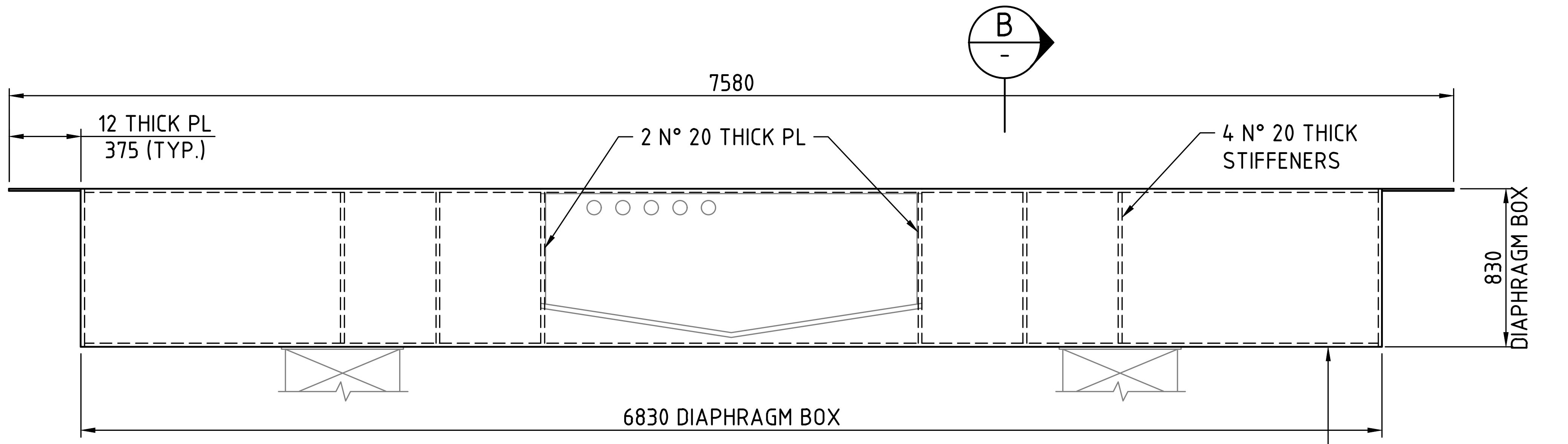
BR9505 ABUTMENT N° 1 - SHOWN
BR9505 & BR9506 ABUTMENT N° 2 - SIMLAR

TYPICAL DIAPHRAGM ELEVATION
1:25



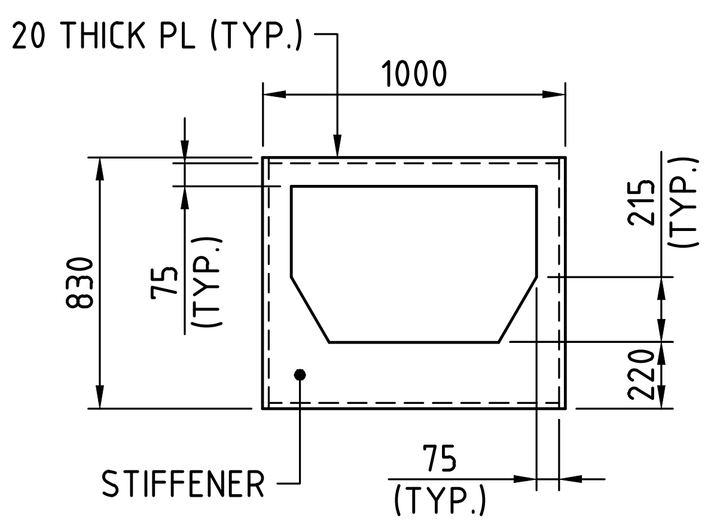
BEARING NOT SHOWN FOR CLARITY

SECTION A
1:25



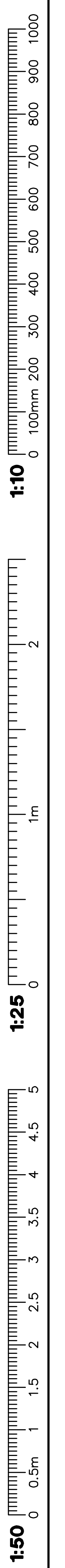
BR9506 ABUTMENT N° 1

DIAPHRAGM ELEVATION
1:25



BEARING NOT SHOWN FOR CLARITY

SECTION B
1:25



Plot Date: 22/07/2022 8:38 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40003.dwg

Plotted By: Burgess, Brent

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER
VERIFIED
DATE

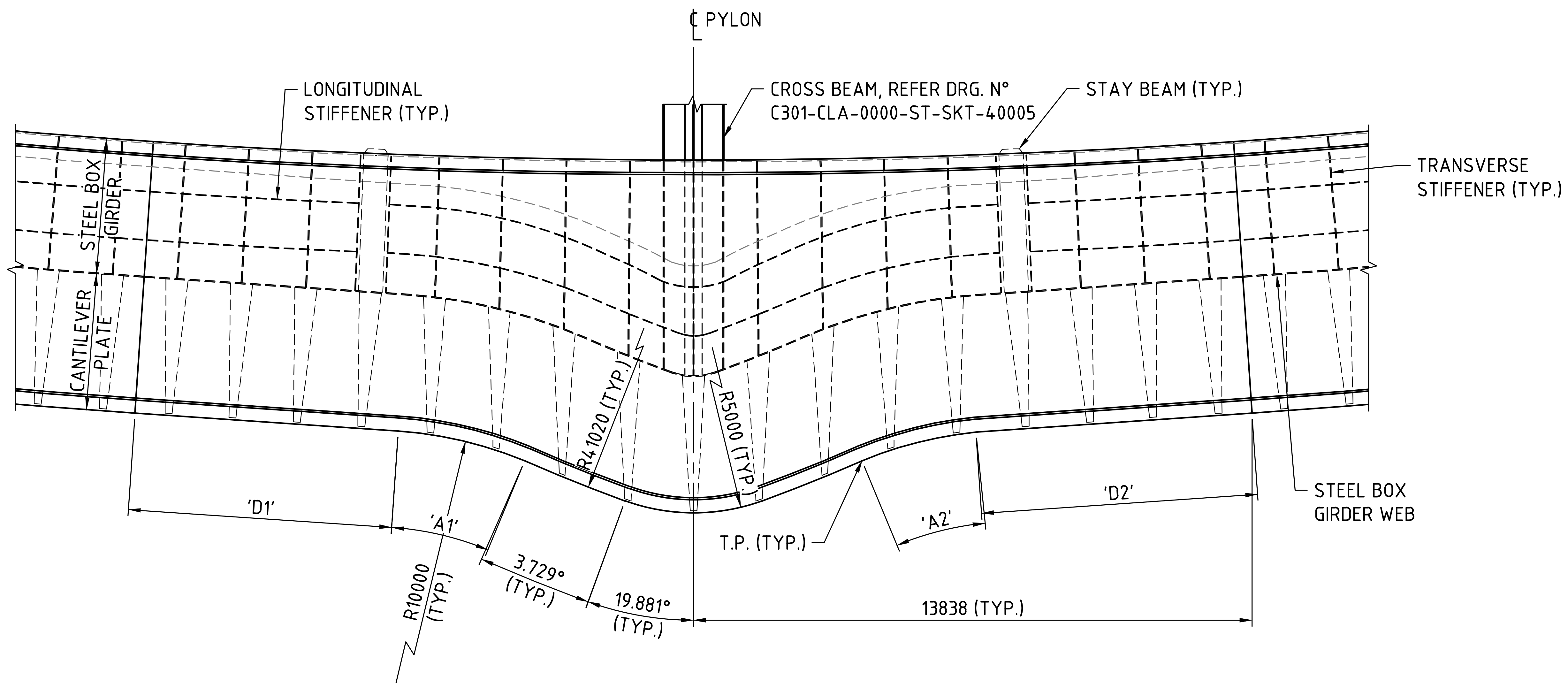
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DECK SEGMENT
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40003
REV: A

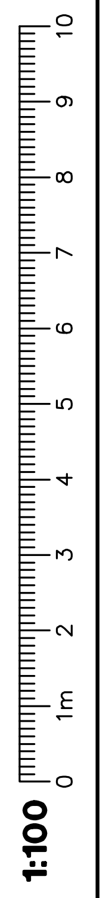


PLAN
BR9506 PYLON N° 1 - SHOWN
BR9505 PYLON N° 1 - SIMILAR

PAUSE POINT

1:100

	PAUSE POINT INFORMATION			
	A1	A2	D1	D2
BRIDGE 9506	18.535°	16.730°	6359	6854
BRIDGE 9505	16.730°	16.730°	7000	7000



FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
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AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
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DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
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DRAWING PATH

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DATE

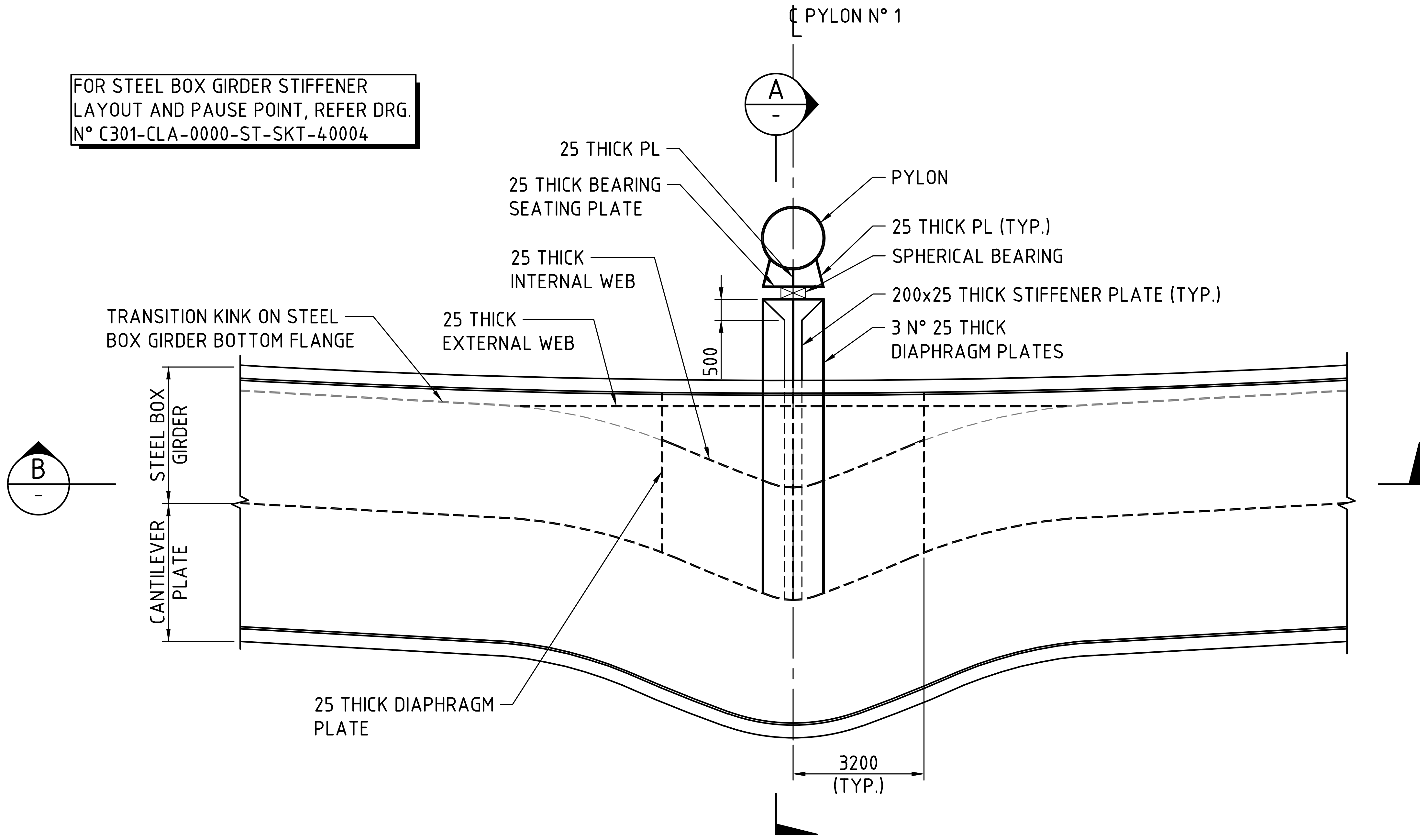
Causeway Link Alliance
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE
mainroads WESTERN AUSTRALIA
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
PAUSE POINT DETAILS
SHEET 1 OF 2
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-40004
REV: A

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:38 AM Cad File: C:\Users\burgessbr\OneDrive - WSP O365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40004.dwg

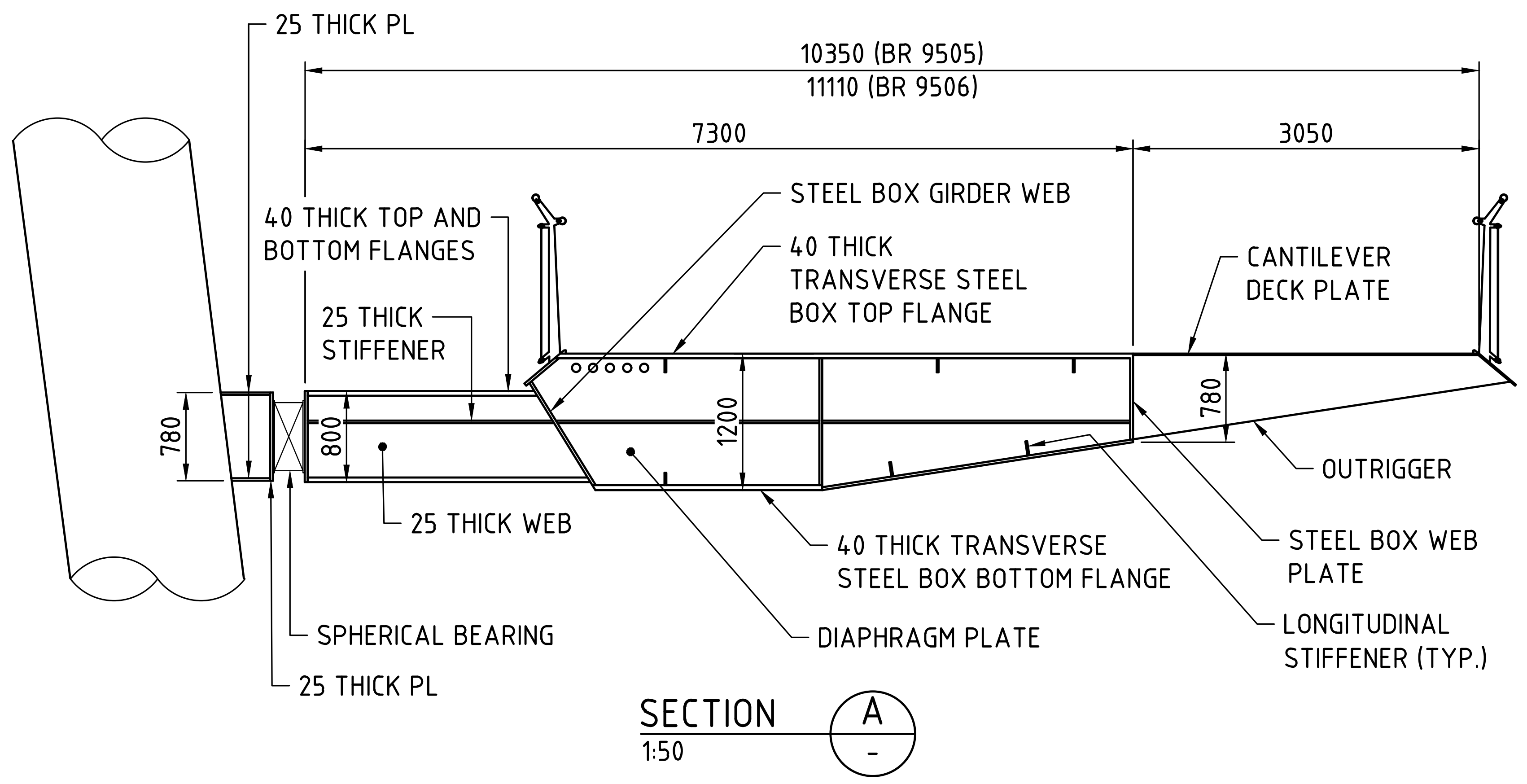
FOR STEEL BOX GIRDER STIFFENER LAYOUT AND PAUSE POINT, REFER DRG. N° C301-CLA-0000-ST-SKT-40004



PLAN
BR9505 PYLON N° 1 - SHOWN
BR9506 PYLON N° 1 - SIMILAR

CROSS BEAM

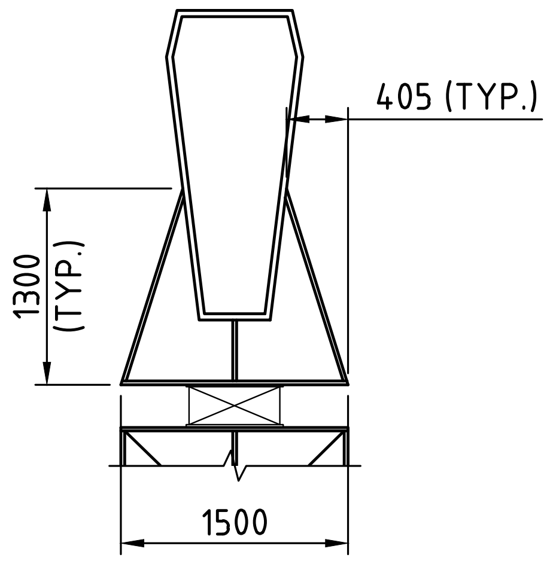
1:100



SECTION A

1:50

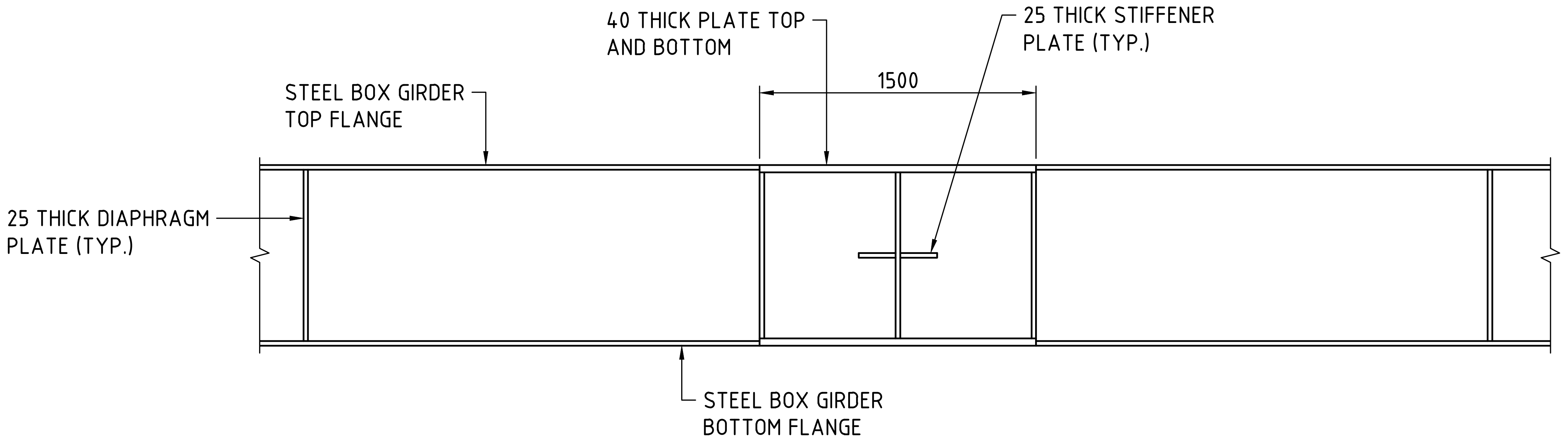
FOR TYPICAL DECK DETAILS, REFER DRG. N° C301-CLA-0000-ST-SKT-40001.



PLAN - PYLON N° 1

BR9506 BEARING BRACKET

1:50



SECTION B

1:25

1:25 0 1m 2
1:50 0 0.5m 1 1.5 2 2.5 3 3.5 4 4.5 5
1:100 0 1m 2 3 4 5 6 7 8 9 10

Plot Date: 22/07/2022 8:38 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40005.dwg

Plotted By: Burgess, Brent

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER
VERIFIED
DATE

Causeway Link Alliance
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
PAUSE POINT DETAILS
SHEET 2 OF 2
SHEET: A1
DRAWING STATUS: 15%
DRAWING No. C301-CLA-0000-ST-SKT-40005
REV: A

NOTES:

1. FOR BRIDGE N° 9505 DECK LAYOUT REFER DRG N° C301-CLA-1000-ST-SKT-40001.
2. FOR BRIDGE N° 9506 DECK LAYOUT REFER DRG N° C301-CLA-2000-ST-SKT-40001.

POINT FRASER BRIDGE (BRIDGE 9506)

GRID	**A1 - P1**	**P1-P2**	**P2-P3**	**P3-C1**	**C1-C2**	**C2-C3**	**C3-C4**	**C4-C5**	**C5-C6**	**C6-PYLON 1**	**PYLON 1-C7**	**C7-C8**	**C8-C9**	**C9-C10**	**C10-C11**	**C11-C12**	**C12-A2**
DECK MODULE NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SPAN NO	1	2	3	4							5						
DECK PLATE THICKNESS (mm)																	
TOP FLANGE (1)	20		32	40						25			20			25	
BOTTOM FLANGE (2)	20		32	40						25			20			25	
WEB (3)	20		25	25						20			20			20	
CANTILEVER DECK PLATE (4)	12																
OUTRIGGER PLATE (5)	12																
TRANSVERSE STIFFENERS (6)	150 x 16			200 x 16*						200 x 25		200 x 16*					
LONGITUDINAL STIFFENERS (7)	100 x 16			125 x 16													
ELEMENT SPACING (mm)																	
OUTRIGGERS	1600																
TRANSVERSE STIFFENERS	1600																

* 2 NO. 200 X 25 TRANSVERSE STIFFENERS AT STAY DIAPHRAGM POSITIONS

McCALLUM PARK BRIDGE (BRIDGE 9505)

GRID	**A1/C1-C2**	**C2-C3**	**C3-C4**	**C4-C5**	**C5-C6**	**C6-C7**	**C7-PYLON 1**	**PYLON 1-C8**	**C8-C9**	**C9-C10**	**C10-C11**	**C11-C12**	**C12-C13**	**C13-C14**	**TRANSITION C14-C15**	**C15-C16**	**C16-C17**	**C17-C18**	**C18-C19**	**C19-C20**	**C20-C21**	**C21-PYLON 2**	**PYLON2-C22**	**C22-C23**	**C23-C24**	**C24-C25**	**C25-C26**	**C26-C27**	**C27-C28/A2**
DECK MODULE NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
SPAN NO	1							2															3						
DECK PLATE THICKNESS (mm)																													
TOP FLANGE (1)	32				25				20			25							20			25				32			
BOTTOM FLANGE (2)	32				25				20			25							20			25				32			
WEB (3)	25				20				20			20							20			20				25			
CANTILEVER DECK PLATE (4)	12																												
OUTRIGGER PLATE (5)	12																												
TRANSVERSE STIFFENERS (6)	200 X 16*						200 x 25		200 X 16*													200 x 25		200 X 16*					
LONGITUDINAL STIFFENERS (7)	125 X 16																												
ELEMENT SPACING (mm)																													
OUTRIGGERS	1700																												
TRANSVERSE STIFFENERS	1700																												

* 2 NO. 200 X 25 TRANSVERSE STIFFENERS AT EACH STAY DIAPHRAGM POSITIONS

Plotted By: Burgess, Brent   Plot Date: 22/07/2022 8:38 AM   Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-40006.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
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DRAWING PATH

VERIFIER

VERIFIED

DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

Causeway Link Alliance

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP

MRWA DRAWING NUMBER

PROJECT TITLE
CAUSEWAY LINK ALLIANCE

DRAWING TITLE
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
DECK THICKNESS TABLE

SHEET A1

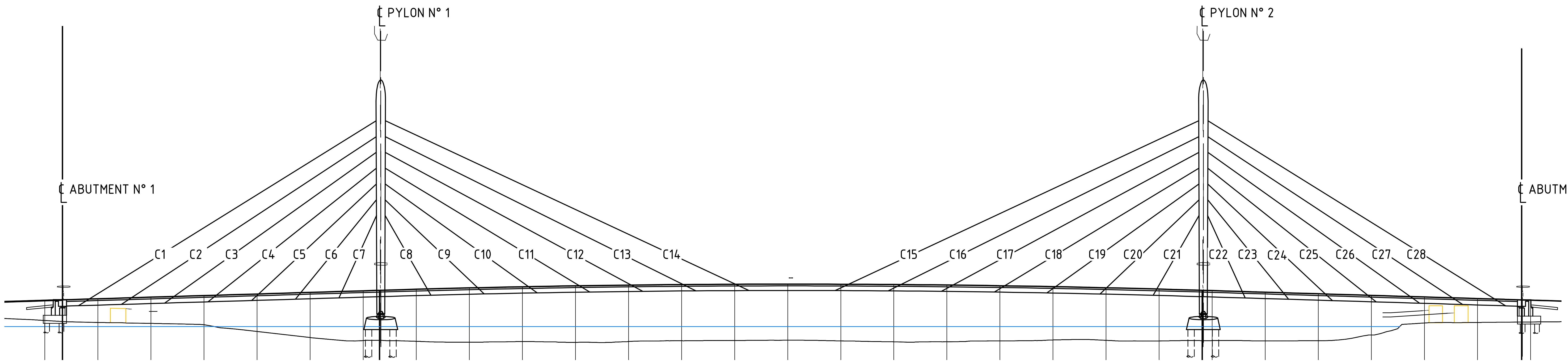
DRAWING STATUS 15%

DRAWING No. C301-CLA-0000-ST-SKT-40006

REV A

NOTES:

1. FOR BRIDGE N° 9505 CABLE PLAN LAYOUT REFER DRG N° C301-CLA-1000-ST-SKT-40001.
2. FOR BRIDGE N° 9506 CABLE PLAN LAYOUT REFER DRG N° C301-CLA-2000-ST-SKT-40001.
3. ALL STAY CABLES ARE PARALLEL STRAND CABLES.



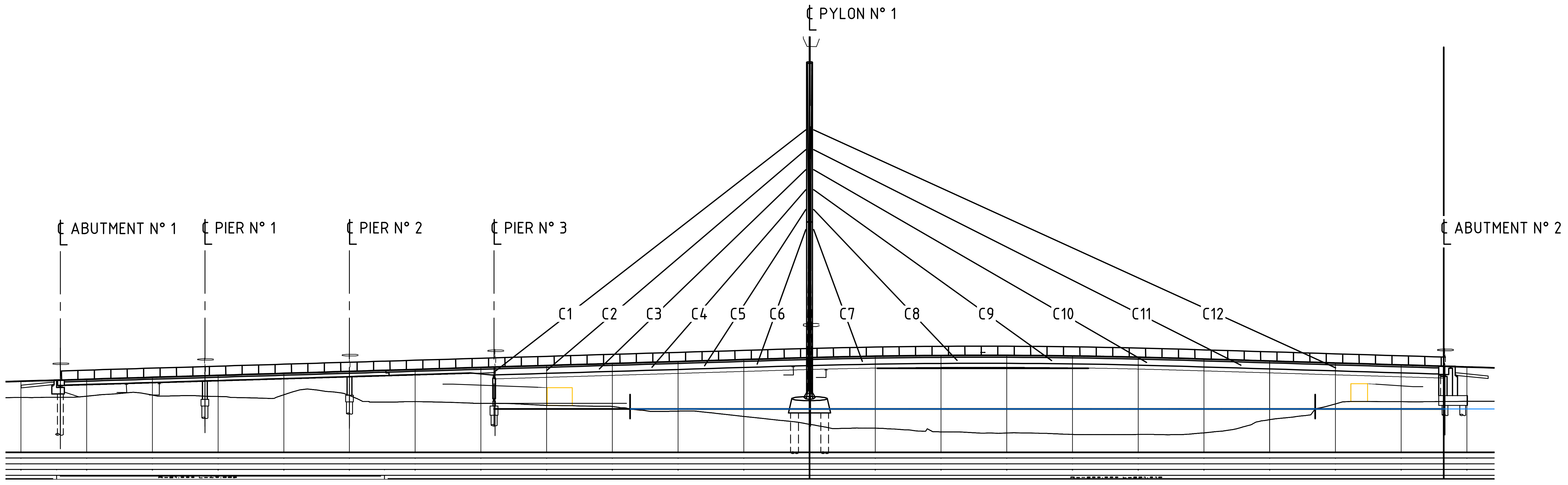
BR9505 - ELEVATION
1:500

McCALLUM PARK BRIDGE (BRIDGE 9505)

CABLE STAY DATA

CABLE NO.	LENGTH NOM (m)*	CABLE SIZE
1,28	66.67	24 X 15.7mm STRANDS
2,27	58.16	19 X 15.7mm STRANDS
3,26	49.69	12 X 15.7mm STRANDS
4,25	41.30	12 X 15.7mm STRANDS
5,24	33.09	12 X 15.7mm STRANDS
6,23	25.25	12 X 15.7mm STRANDS
7,22	18.33	19 X 15.7mm STRANDS
8,21	18.59	19 X 15.7mm STRANDS
9,20	26.80	12 X 15.7mm STRANDS
10,19	36.17	12 X 15.7mm STRANDS
11,18	45.92	12 X 15.7mm STRANDS
12,17	55.85	12 X 15.7mm STRANDS
13,16	65.86	19 X 15.7mm STRANDS
14,15	75.91	19 X 15.7mm STRANDS

*MEASURED FROM ANCHOR PLATE BOTTOM TO FORK PIN TOP



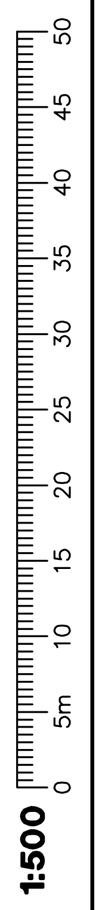
BR9506 - ELEVATION
1:500

POINT FRASER BRIDGE (BRIDGE 9506)

CABLE STAY DATA

CABLE NO.	LENGTH NOM (m)*	CABLE SIZE
1	59.30	27 X 15.7mm STRANDS
2	51.88	24 X 15.7mm STRANDS
3	44.76	19 X 15.7mm STRANDS
4	38.07	19 X 15.7mm STRANDS
5	32.10	19 X 15.7mm STRANDS
6	27.32	19 X 15.7mm STRANDS
7	27.04	19 X 15.7mm STRANDS
8	34.59	19 X 15.7mm STRANDS
9	45.52	19 X 15.7mm STRANDS
10	57.92	19 X 15.7mm STRANDS
11	71.03	19 X 15.7mm STRANDS
12	84.44	19 X 15.7mm STRANDS

*MEASURED FROM ANCHOR PLATE BOTTOM TO FORK PIN TOP



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Plotted By: Burgess, Brent

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

VERIFIED

DATE

Causeway Link Alliance

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

THE GOVERNMENT OF WESTERN AUSTRALIA

mainroads WESTERN AUSTRALIA

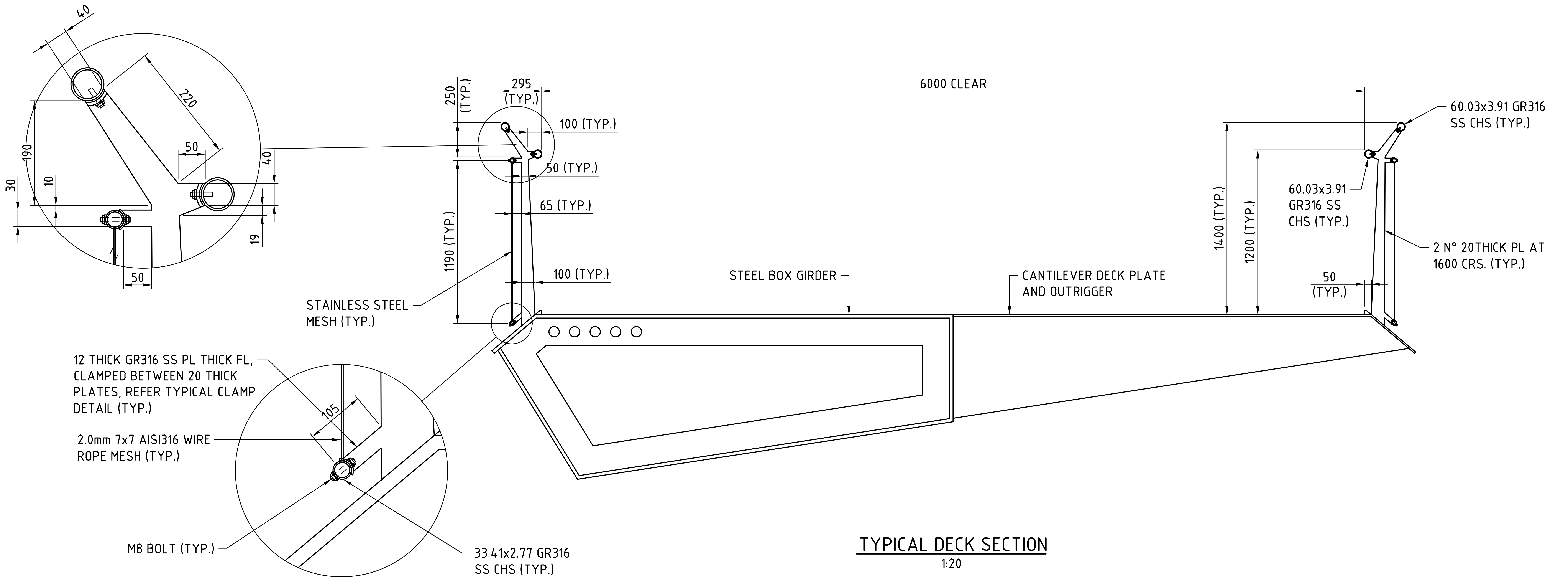
INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

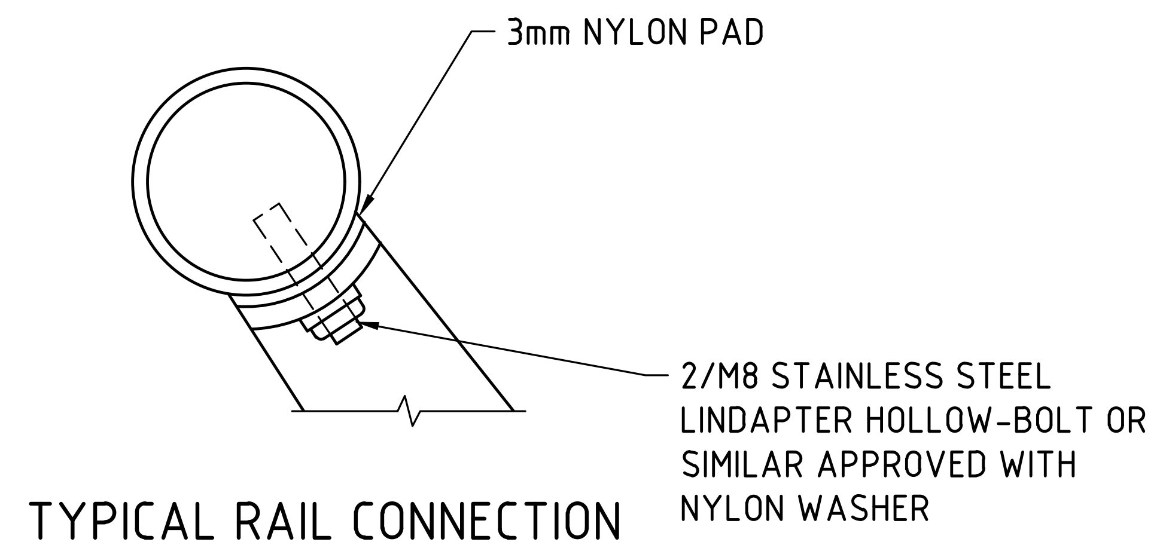
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

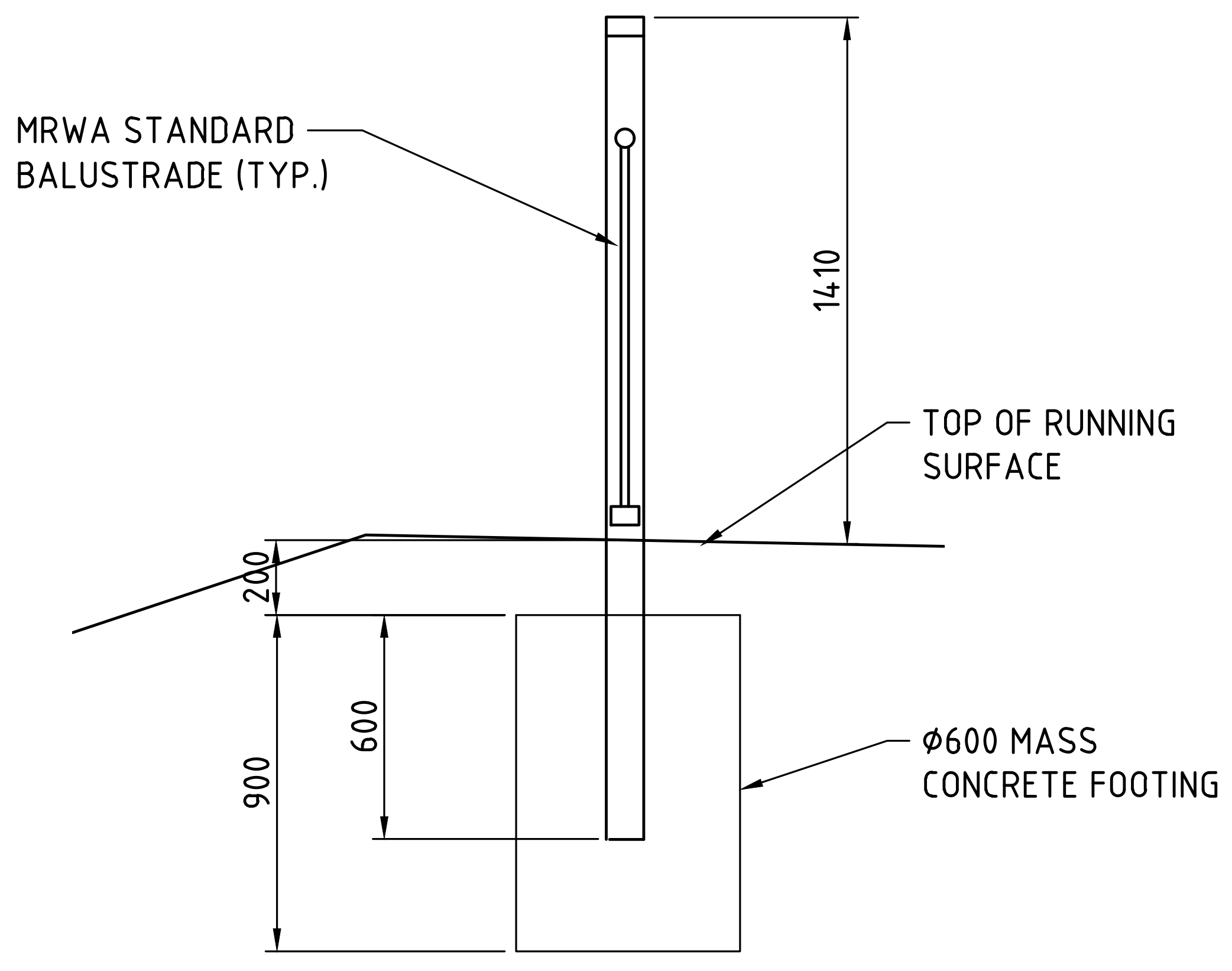
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
CABLE INFORMATION
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-0000-ST-SKT-50001
REV: A



TYPICAL DECK SECTION
1:20



TYPICAL RAIL CONNECTION
1:2



TYPICAL EMBANKMENT HANDRAIL DETAIL
1:20

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:38 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-60011.dwg

FOR INFORMATION ONLY

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AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
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APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER
VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

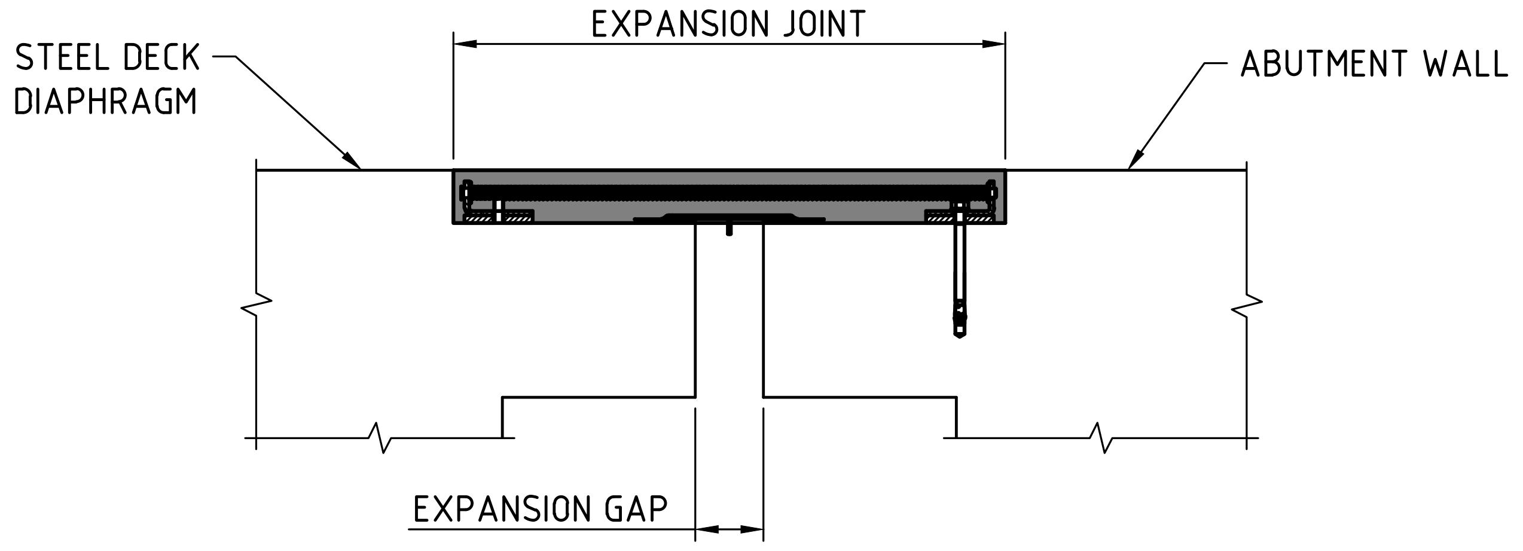
INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL BALUSTRADE DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No. C301-CLA-0000-ST-SKT-60011
REV: A

EXPANSION JOINT SCHEDULE

BRIDGE	LOCATION	ULS (EXCLUDE EXTREME EVENT SUCH AS SHIP IMPACT AND EARTHQUAKE)		EXPANSION JOINT TYPE
		LONGITUDINAL MOVEMENT (TOWARDS PYLON) (mm)	LONGITUDINAL MOVEMENT (AWAY PYLON) (mm)	
POINT FRASER (BRIDGE 9506)	ABUTMENT 1	40	25	MAGEBA POLYFLEX PA-60
	HALVING JOINT	90	50	MAGEBA POLYFLEX PA-75
	ABUTMENT 2	45	120	MAGEBA POLYFLEX PA-135
MCCALLUM PARK (BRIDGE 9505)	ABUTMENT 1	75	75	MAGEBA POLYFLEX PA-90
	ABUTMENT 2	75	75	



TYPICAL EXPANSION JOINT DETAIL

1:10

Plot Date: 22/07/2022 8:39 AM   Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-70001.dwg

Plotted By: Burgess, Brent

FOR INFORMATION ONLY

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AMENDMENTS

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MAIN ROADS PROJECT ZONE: PCG94
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VERIFIER

DRAWING PATH

VERIFIED

DATE

Causeway Link Alliance

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP

MRWA DRAWING NUMBER

PROJECT TITLE CAUSEWAY LINK ALLIANCE

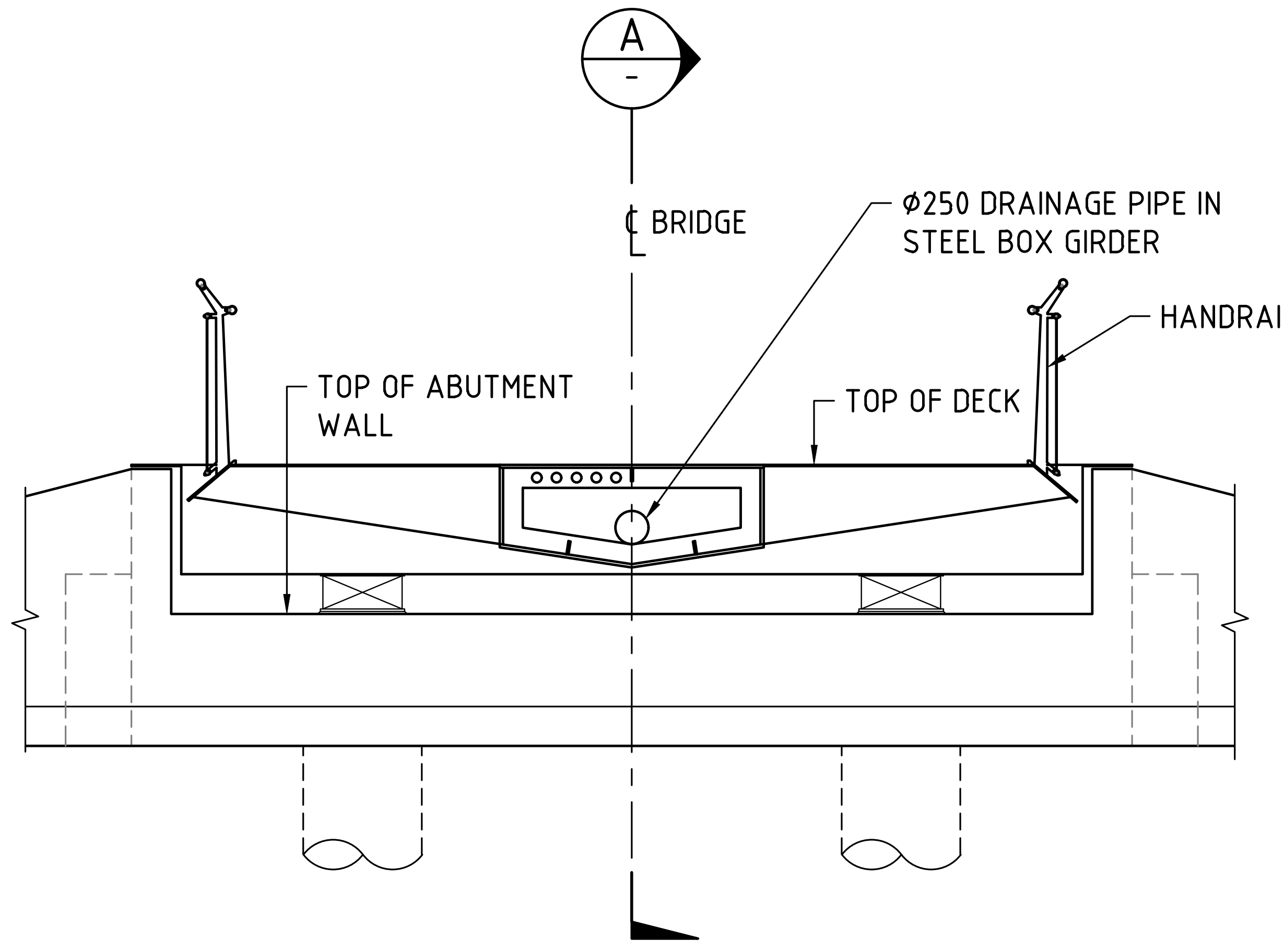
DRAWING TITLE CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
EXPANSION JOINT SCHEDULE

SHEET A1

DRAWING STATUS 15%

DRAWING No. C301-CLA-0000-ST-SKT-70001

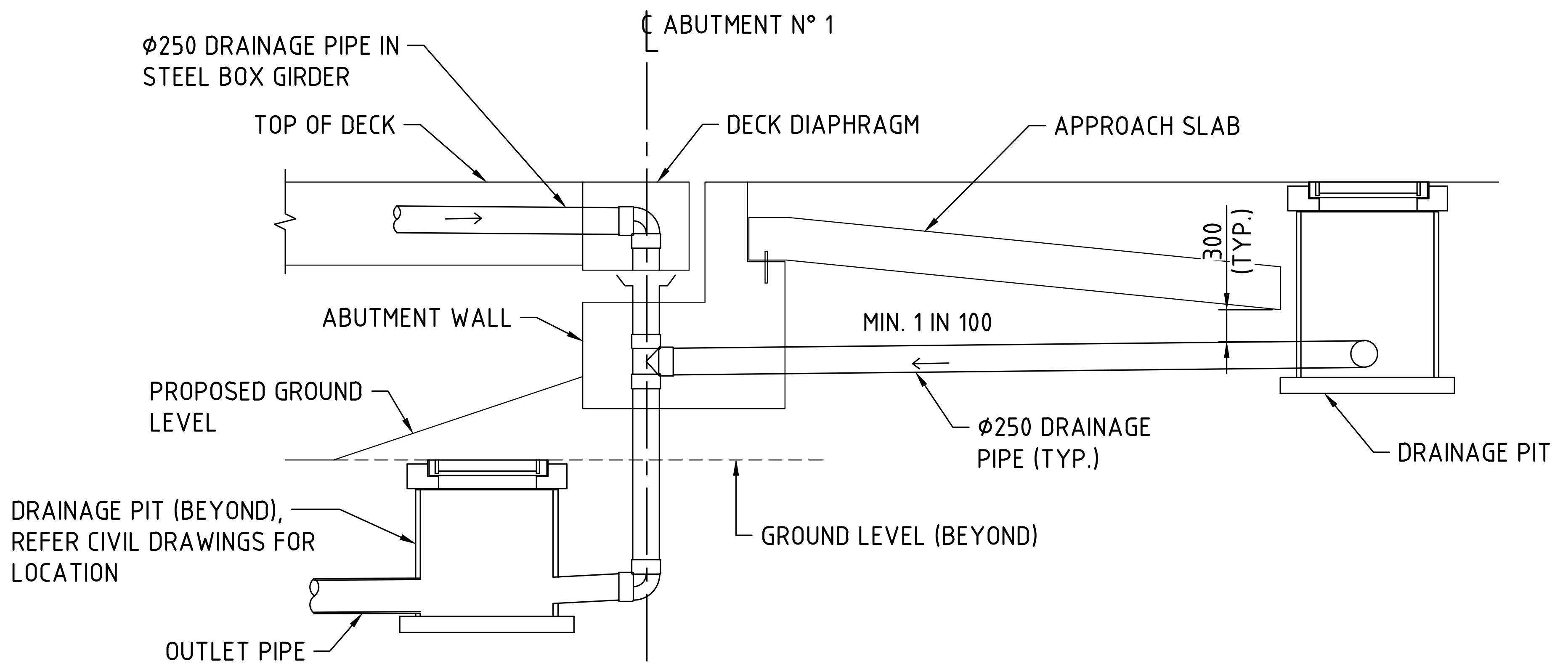
REV A



BR9506 ABUTMENT N° 1

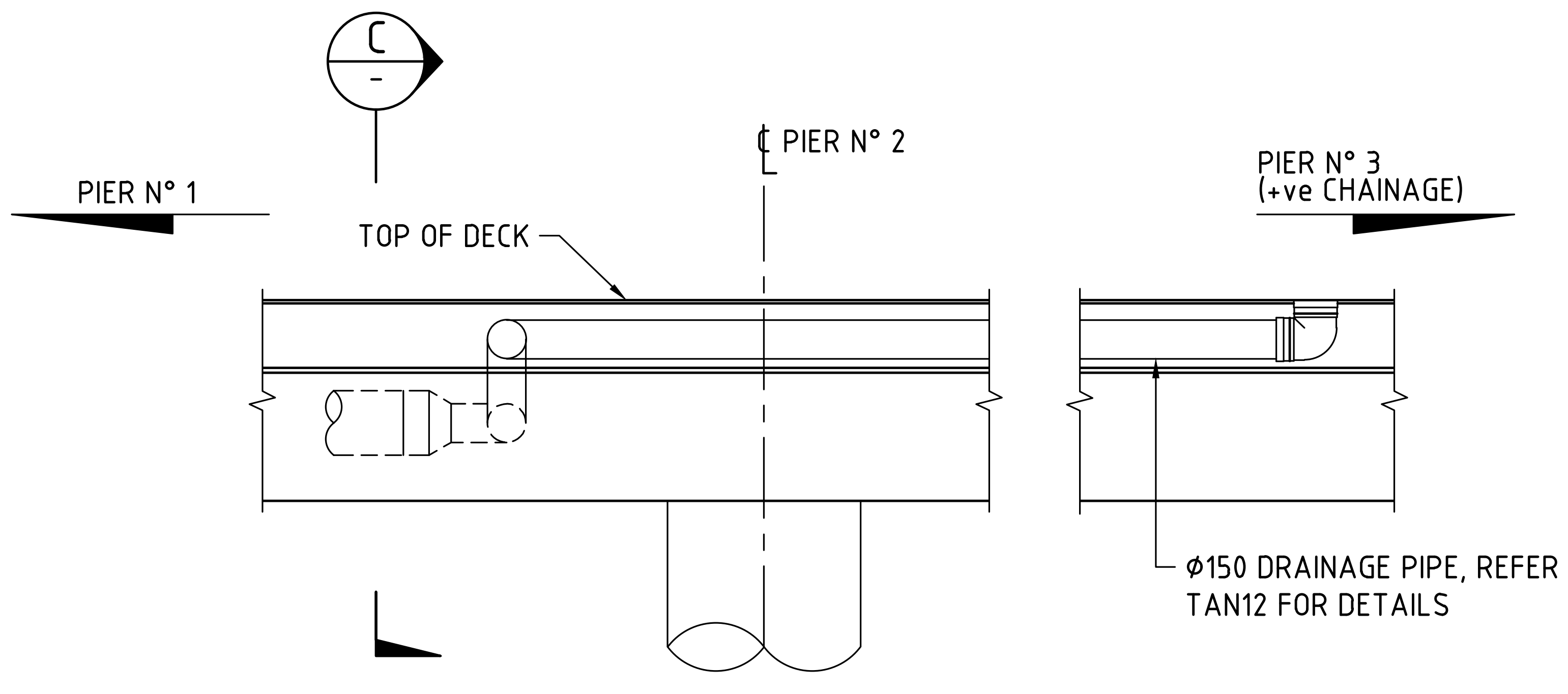
TYPICAL DRAINAGE ELEVATION

1:50



SECTION A -

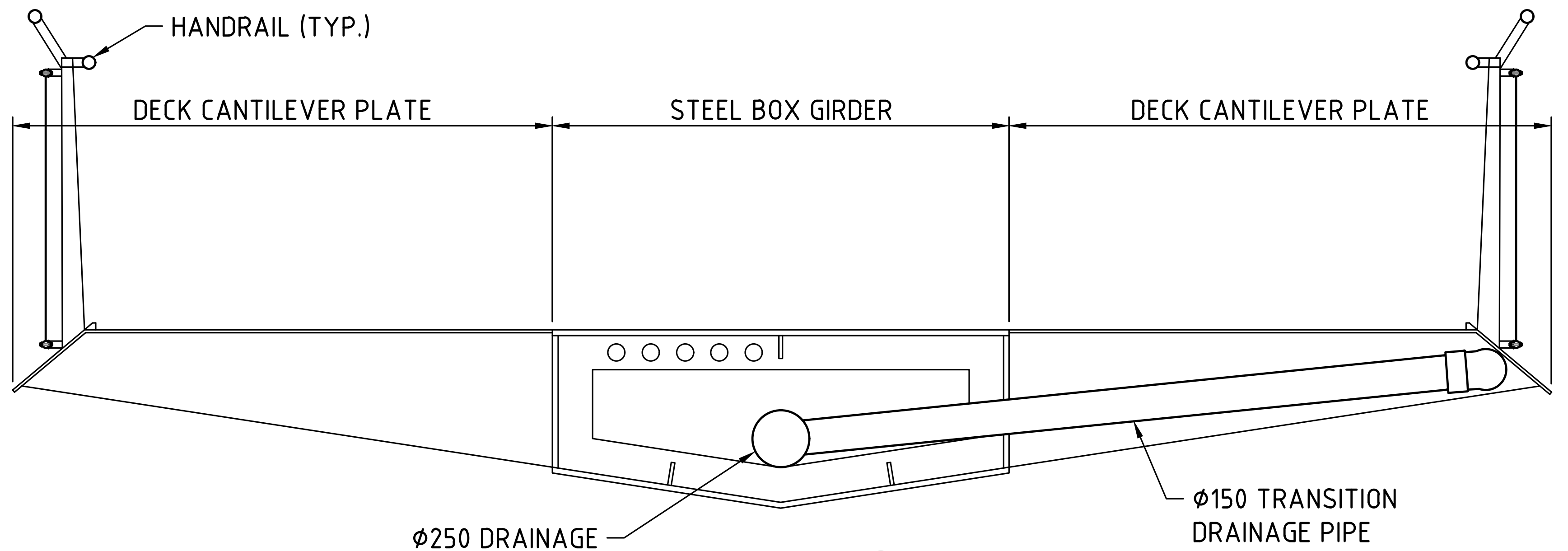
1:50



BR9506

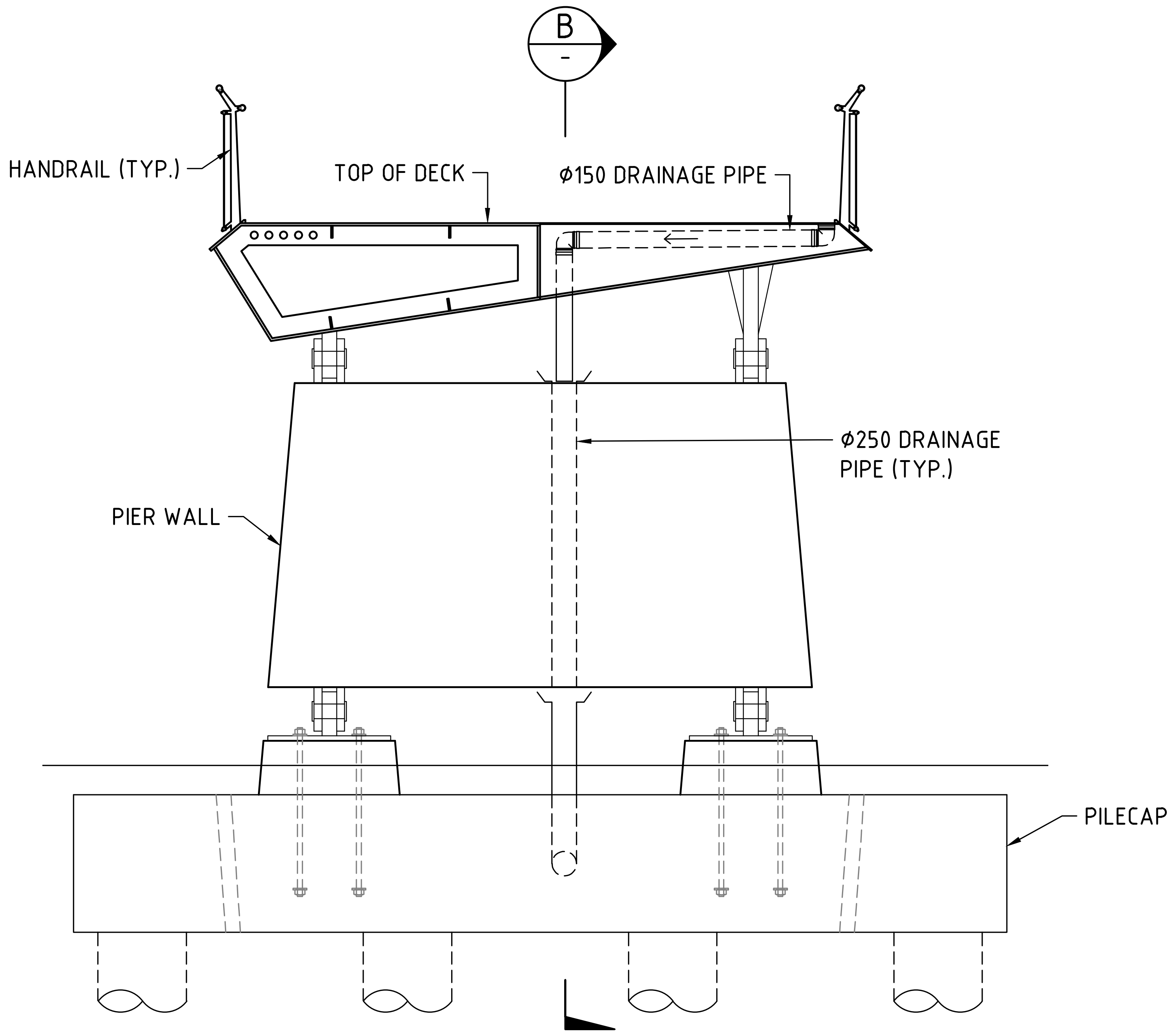
DRAINAGE PIPE TRANSITION - ELEVATION

1:25



SECTION C -

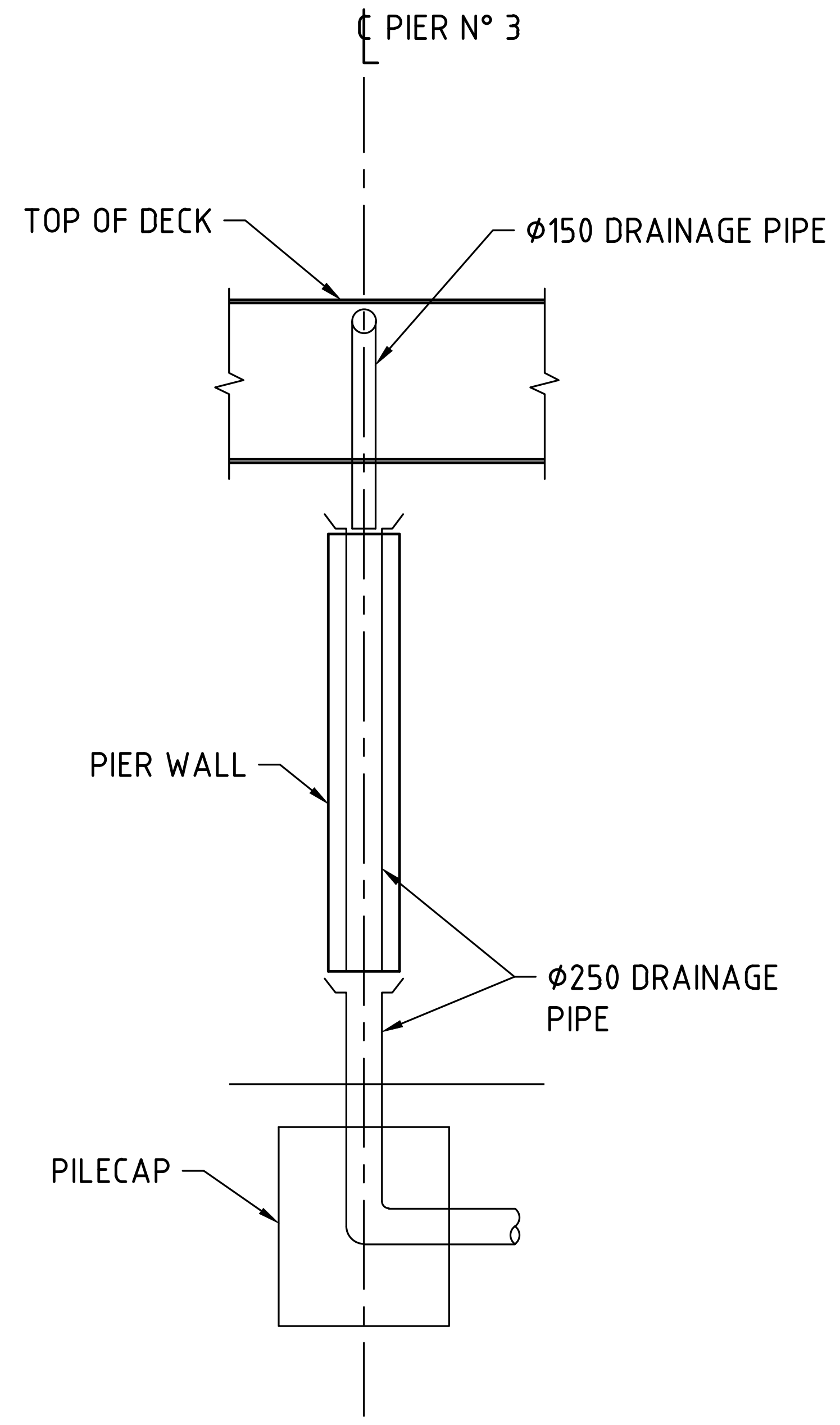
1:25



BR9506 PIER N° 3

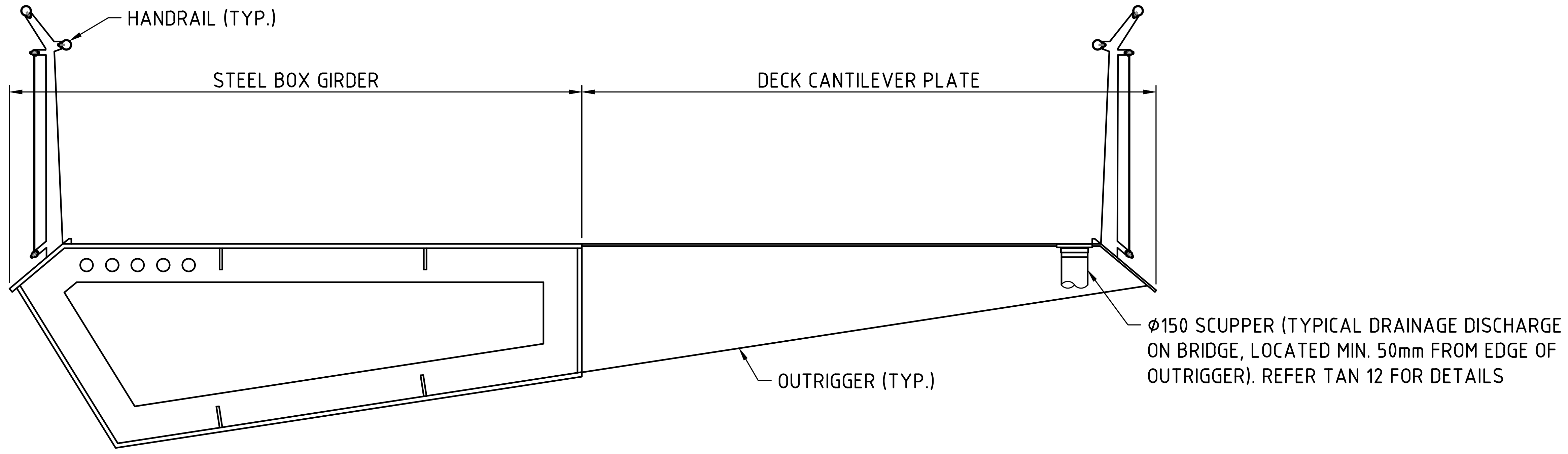
DRAINAGE ELEVATION

1:50



SECTION B -

1:50



AT SCUPPER LOCATION

TYPICAL DECK SECTION

1:25

1:25

1:50

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:39 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-80101.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

DRAWING PATH

VERIFIER

VERIFIED

DATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

Causeway Link Alliance

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION

MRWA DRAWING NUMBER

PROJECT TITLE: CAUSEWAY LINK ALLIANCE

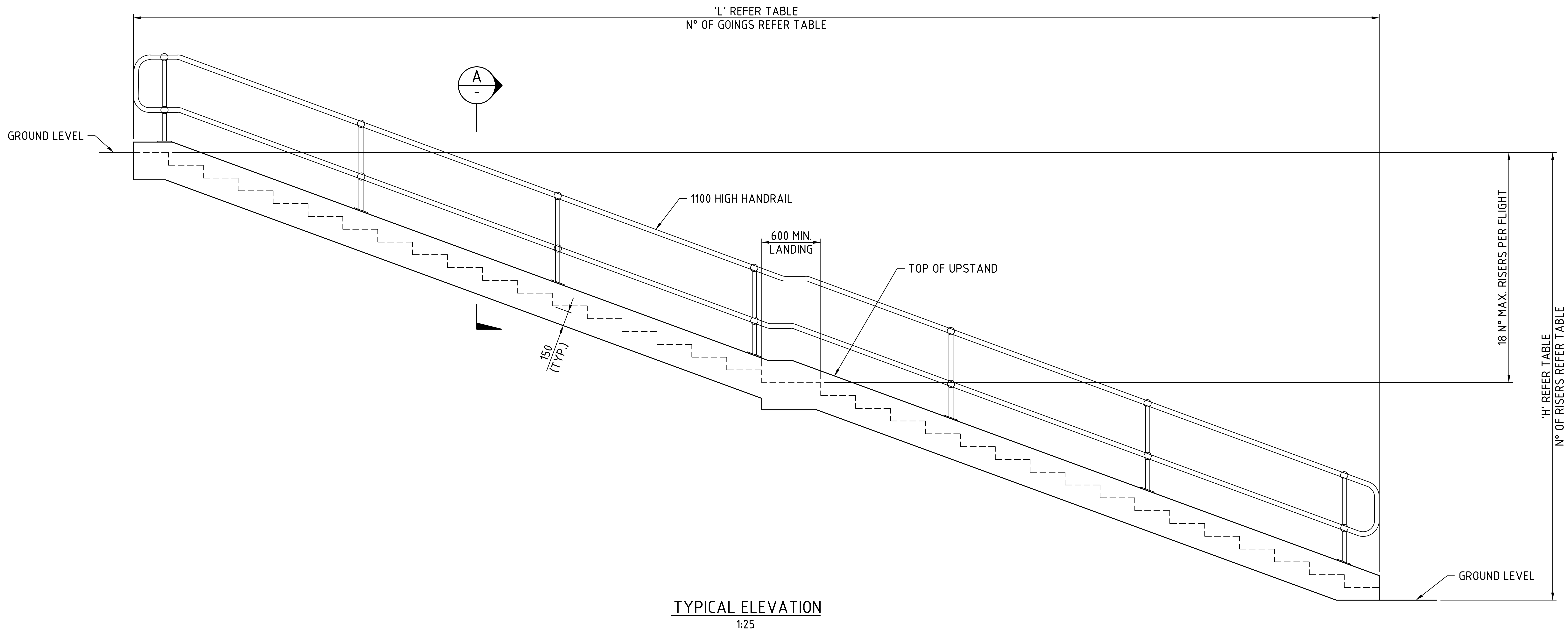
DRAWING TITLE:
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
TYPICAL DRAINAGE DETAILS

SHEET: A1

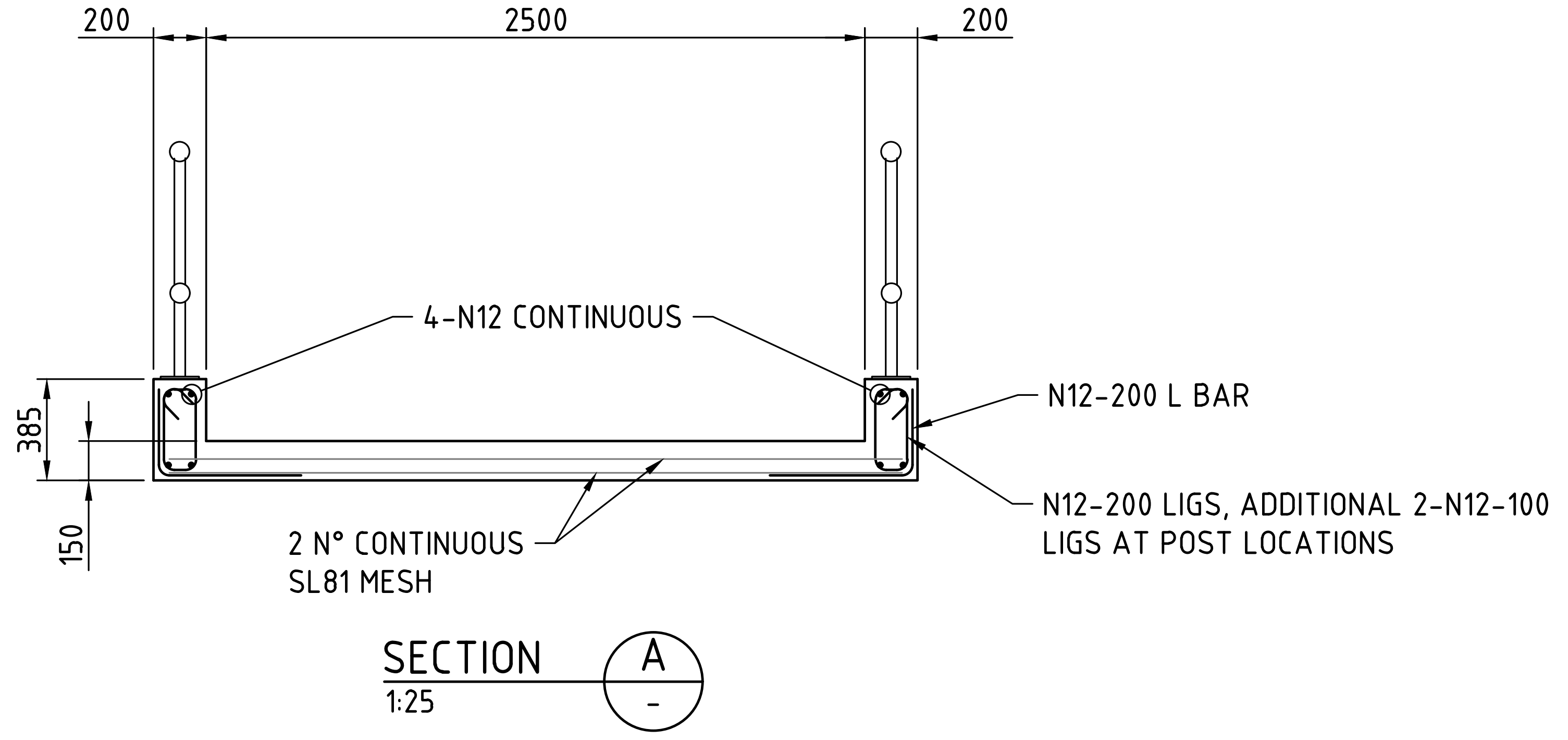
DRAWING STATUS: 15%

DRAWING No. C301-CLA-0000-ST-SKT-80101

REV: A



TYPICAL ELEVATION
1:25



SECTION A
1:25

STAIRS INFORMATION

	LENGTH 'L'	HEIGHT 'H'	N° OF GOINGS	N° OF RISERS	N° OF LANDINGS
BR9506 (ABUTMENT N° 1 APPROACH END)	8655	2615	17	20	3
BR9506 (ABUTMENT N° 2 DEPARTURE END)	12790	4550	34	35	1
BR9505 (ABUTMENT N° 1 APPROACH END)	6800	1615	9	13	4
BR9505 (ABUTMENT N° 2 DEPARTURE END)	13500	3300	23	26	3 (1500 MIN.)

Plotted By: Burgess, Brent Plot Date: 22/07/2022 8:39 AM Cad File: C:\Users\burgessbr\OneDrive - WSP 0365\Causeway\15% IDR PDFs\C301-CLA-0000-ST-SKT-80301.dwg

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 21.07.22

AMENDMENTS

METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	21.07.22
DESIGNED	C.CHANG	21.07.22
CHECKED	G.DUPLESSIS	21.07.22
APPROVED	W.SCHWARZ	21.07.22

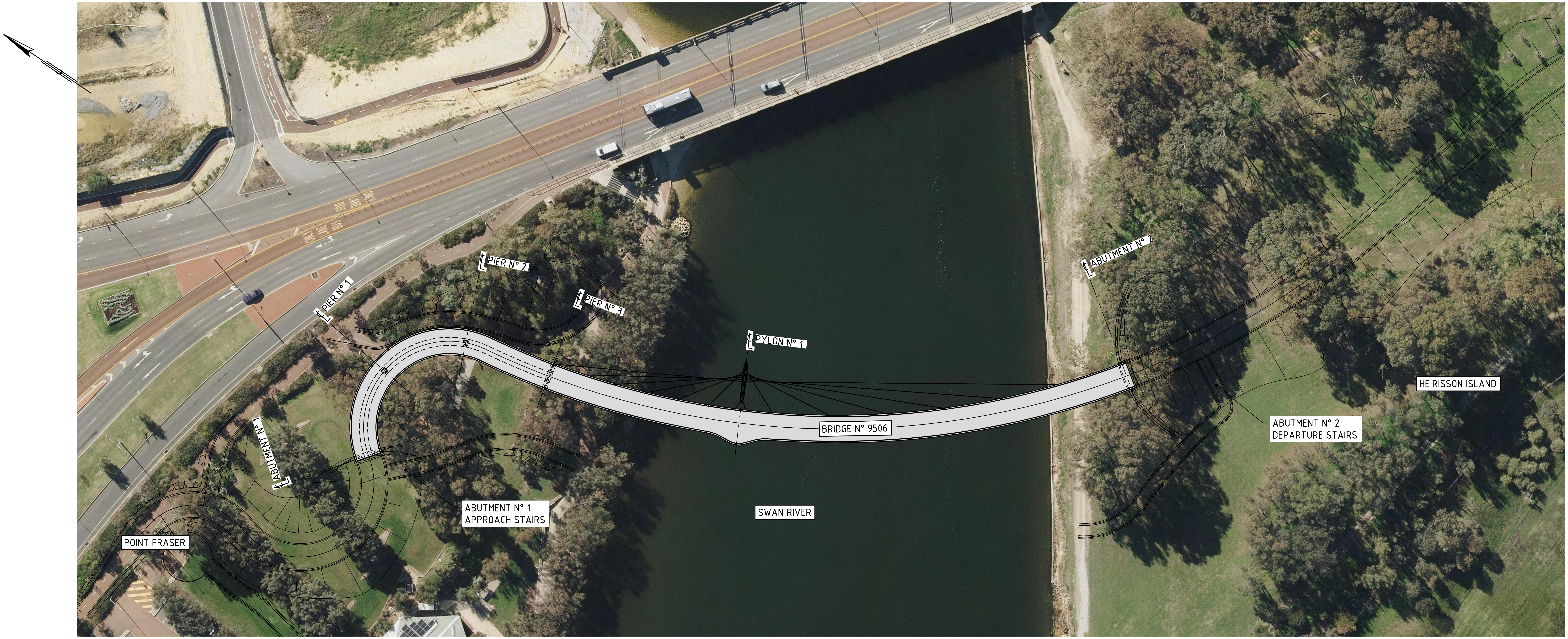
VERIFIER
DRAWING PATH
VERIFIED
DATE

Causeway Link Alliance
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

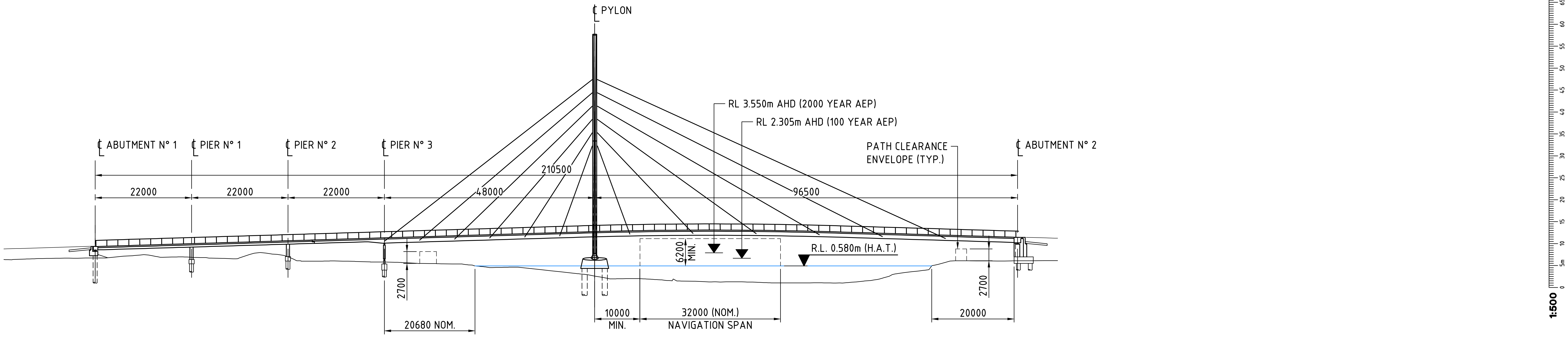
FOR INFORMATION ONLY

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP
MRWA DRAWING NUMBER
PROJECT TITLE CAUSEWAY LINK ALLIANCE
DRAWING TITLE CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
PROJECT WIDE
STAIR DETAILS
SHEET A1
DRAWING STATUS 15%
DRAWING No. C301-CLA-0000-ST-SKT-80301
REV A



GENERAL ARRANGEMENT PLAN

1:500



DEVELOPED ELEVATION

1:500

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
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perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
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APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH

VERIFIER

VERIFIED

DATE

Causeway Link Alliance

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

LOCAL AUTHORITY 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

MAIN ROADS RESPONSIBILITY AREA METROPOLITAN REGION

MRWA DRAWING NUMBER

PROJECT TITLE
CAUSEWAY LINK ALLIANCE

DRAWING TITLE
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
GENERAL ARRANGEMENT

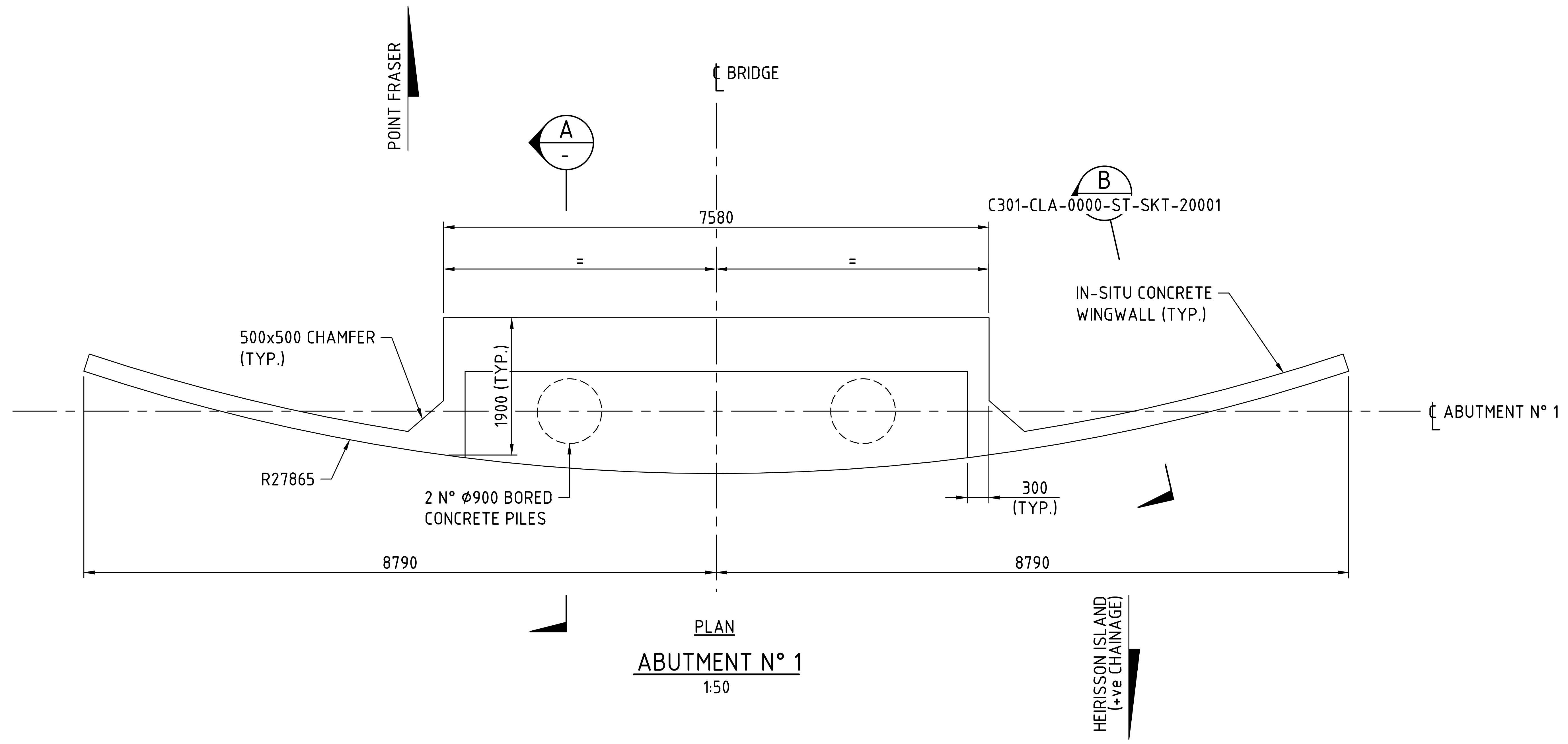
SHEET A1

DRAWING STATUS 15%

DRAWING No. C301-CLA-2000-ST-SKT-00001

REV A

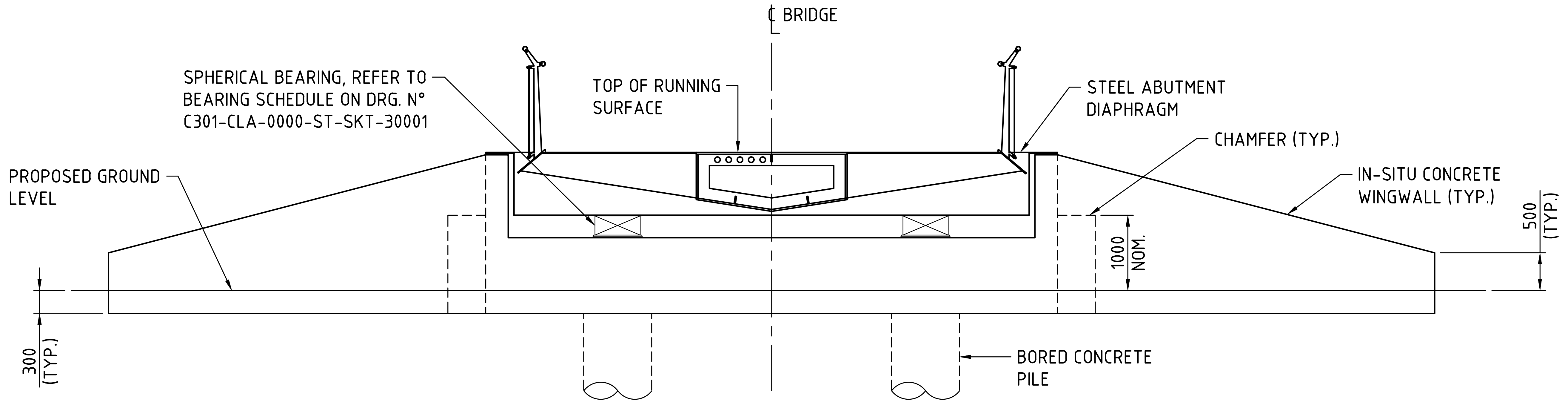
Plotted By: Burgess, Brent Plot Date: 03/08/2022 2:05 PM Cad File: C:\pwworking\wsp-aus-pw.bentley.com_wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-00001.dwg



PLAN

ABUTMENT N° 1

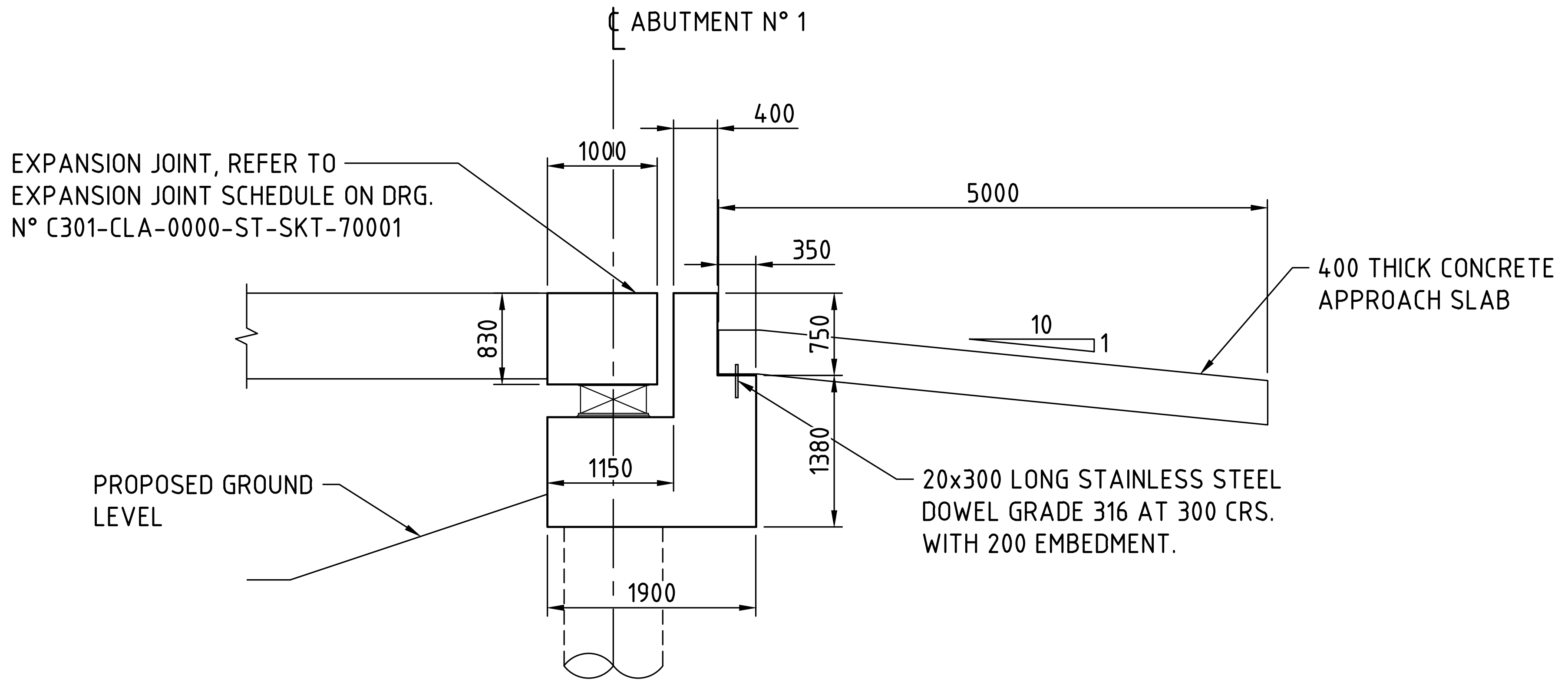
1:50



ELEVATION

ABUTMENT N° 1

1:50



SECTION A -

1:50

PILE DETAILS

LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	MIN. TEMPORARY CASING LENGTH (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
ABUTMENT N° 1	BORED PILE	900	2	2.2	32.0	2.0	9.0	-28.0

NOTES:

1. REFER DRG. N° C301-CLA-0000-ST-SKT-20002 FOR GEOTECHNICAL NOTES.

1:50

Plot Date: 03/08/2022 2:05 PM Cad File: C:\pwworking\wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-10101.dwg

Plotted By: Burgess, Brent

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
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DRAWING PATH

VERIFIER

VERIFIED

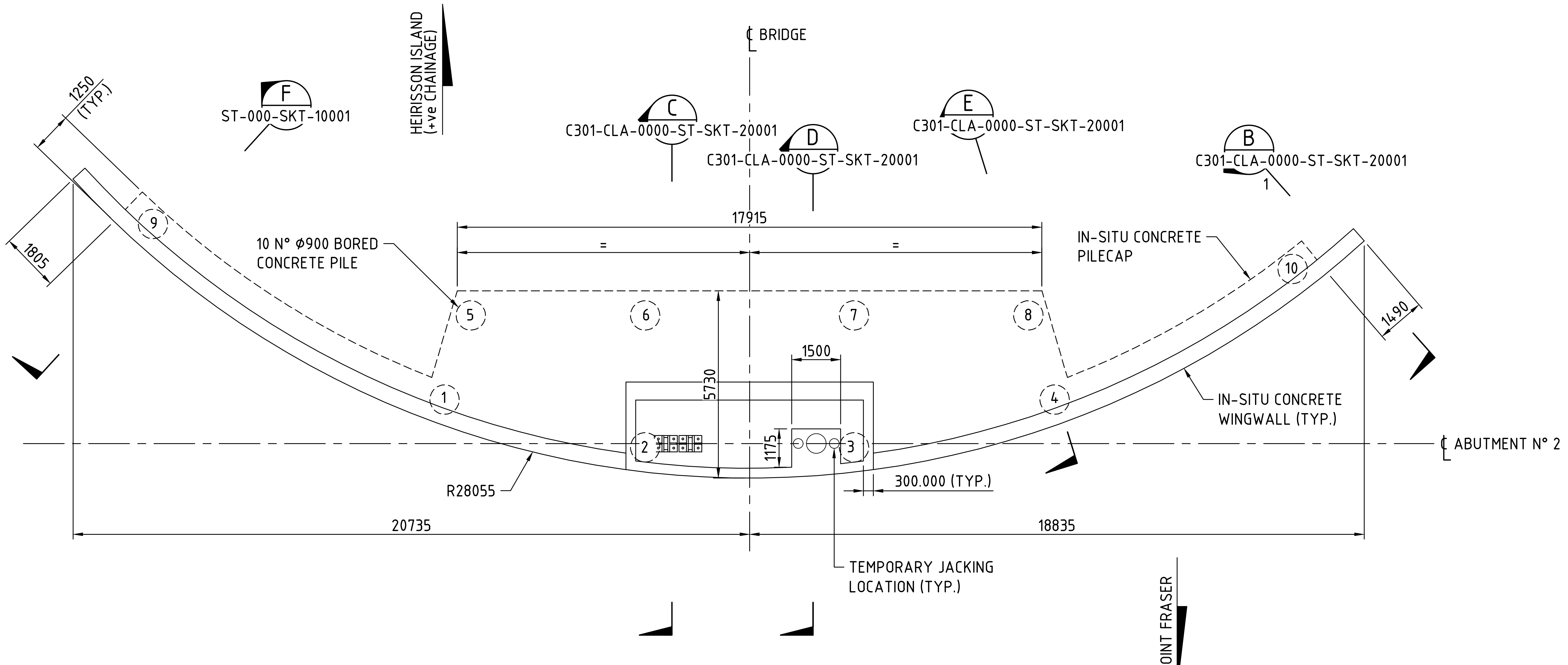
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

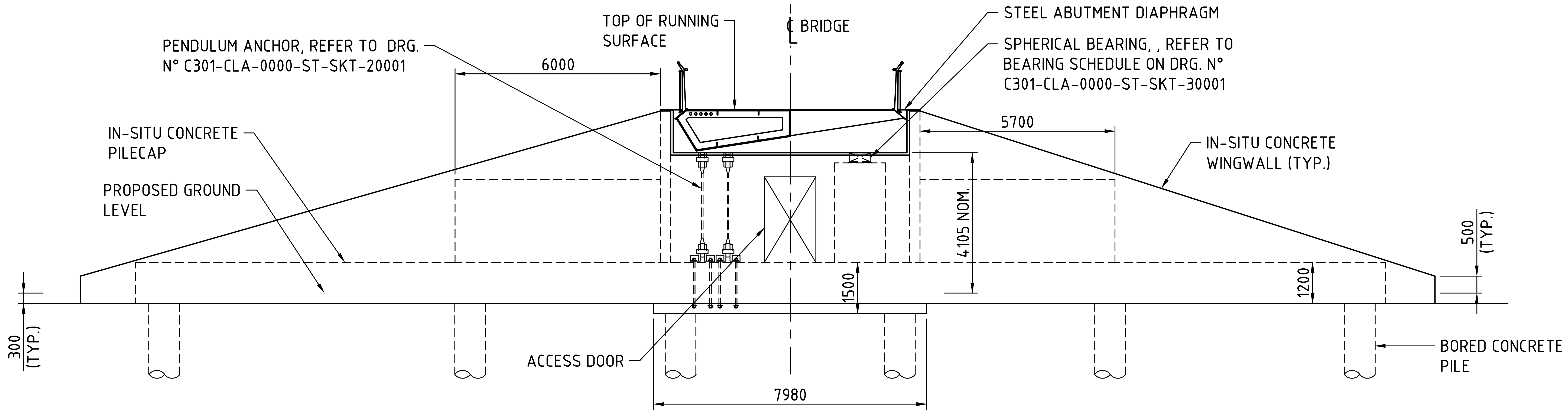
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
ABUTMENT DETAILS
SHEET 1 OF 2
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-2000-ST-SKT-10101
REV: A



PLAN - PILECAP

ABUTMENT N° 2

1:100



ELEVATION

ABUTMENT N° 2

1:100

PILE DETAILS

LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH (m)	MIN. TEMPORARY CASING LENGTH (m)
ABUTMENT N° 2	BORED PILE	900	10	1.2	REFER PILE LENGTH TABLE	9.0

PILE LENGTH

PILE N°	LENGTH (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
1 - 4	43.0	2.0	-40.0
5 - 8	31.0	-	
9 - 10	19.0	-	

NOTES:

1. REFER DRG. N° C301-CLA-0000-ST-SKT-20002 FOR GEOTECHNICAL NOTES.

1:100 0 1m 2 3 4 5 6 7 8 9 10

Plotted By: Burgess, Brent Plot Date: 03/08/2022 2:06 PM Cad File: C:\pwworking\wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-10102.dwg

FOR INFORMATION ONLY

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AMENDMENTS

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MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
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9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

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DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22
DRAWING PATH		

VERIFIER

VERIFIED

DATE

Causeway Link Alliance

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

mainroads WESTERN AUSTRALIA

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

LOCAL AUTHORITY

MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

METROP

MRWA DRAWING NUMBER

PROJECT TITLE CAUSEWAY LINK ALLIANCE

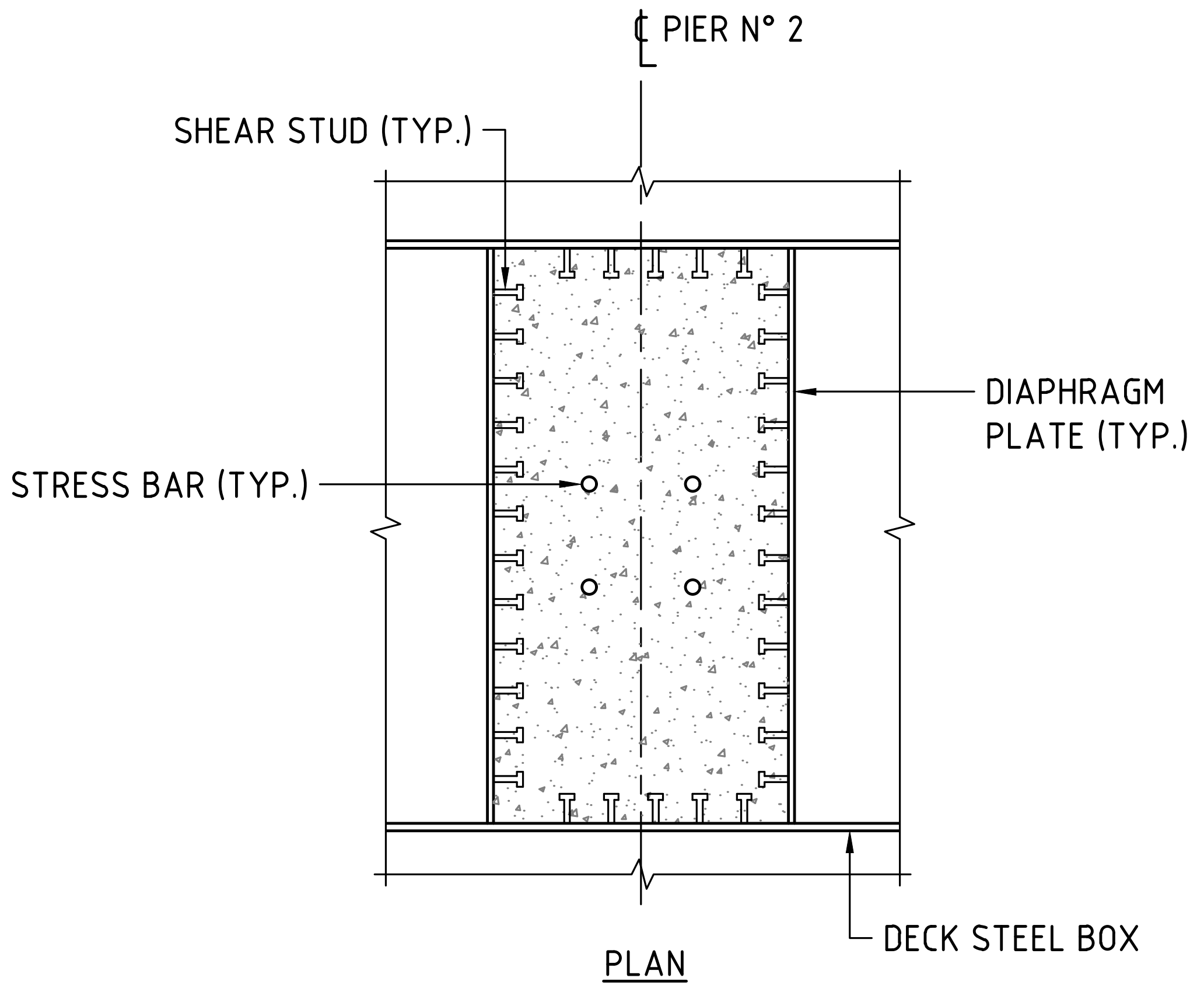
DRAWING TITLE CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
ABUTMENT DETAILS
SHEET 2 OF 2

SHEET A1

DRAWING STATUS 15%

DRAWING No. C301-CLA-2000-ST-SKT-10102

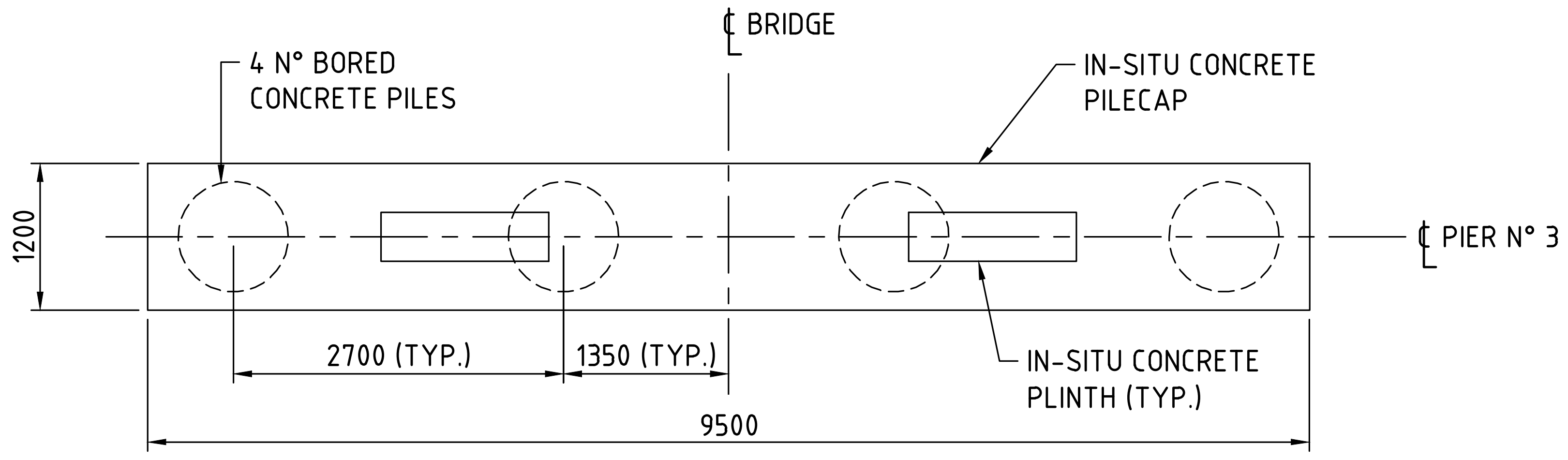
REV A



PLAN

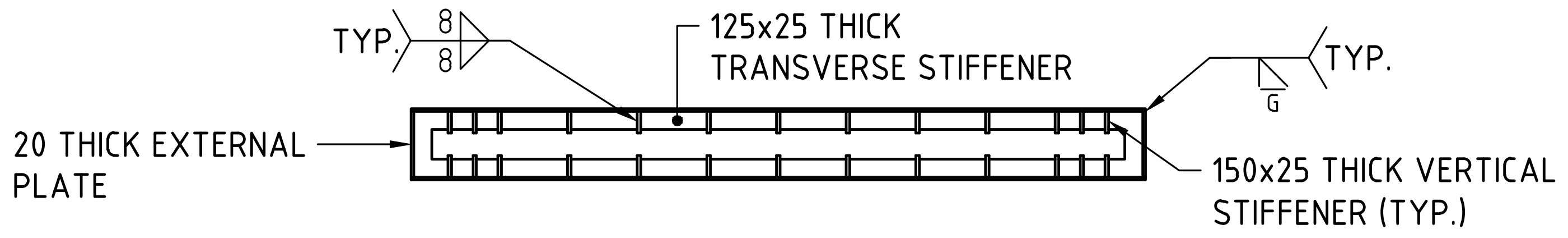
CONCRETE DIAPHRAGM

1:25



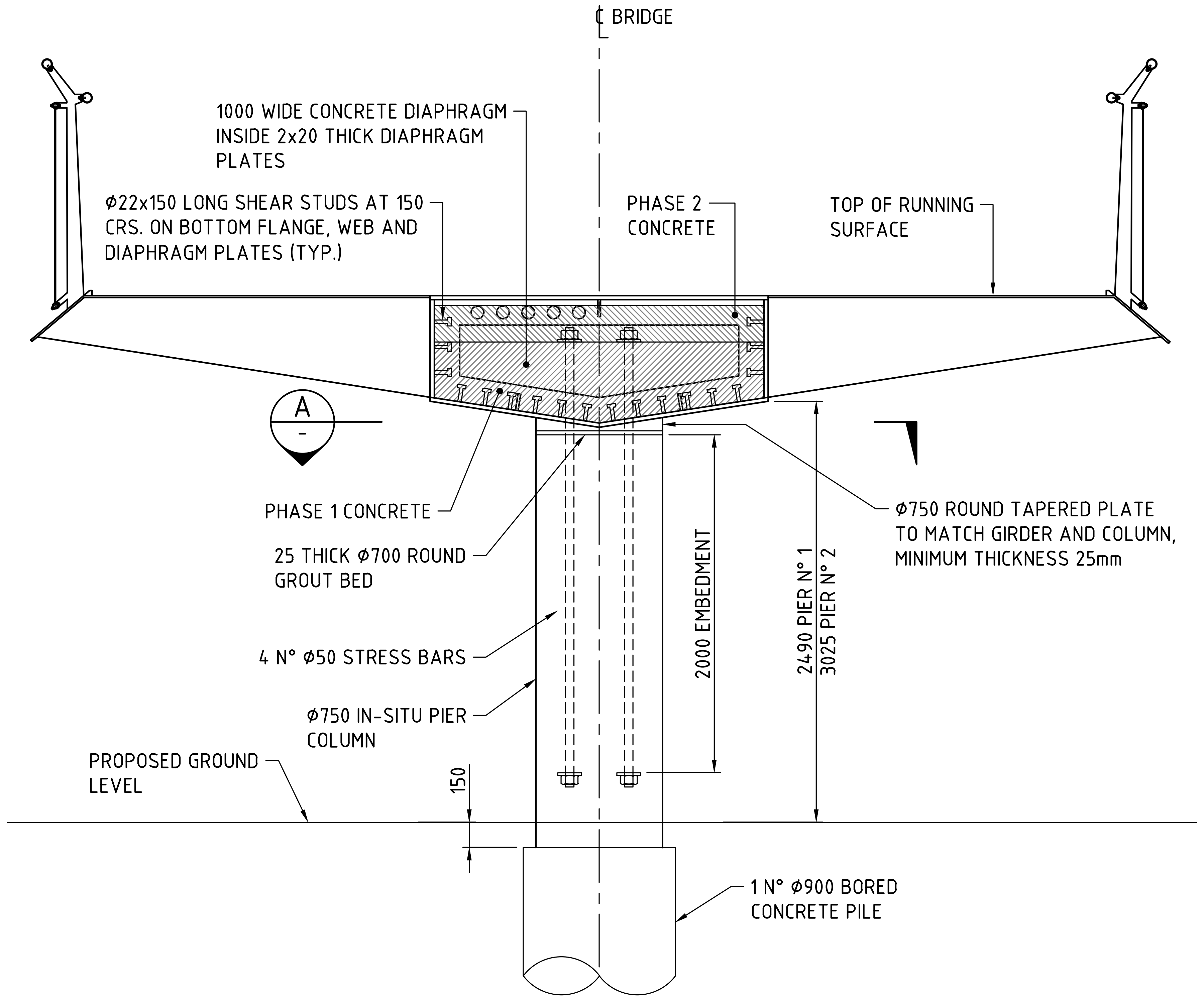
SECTION C -

1:50



SECTION B -

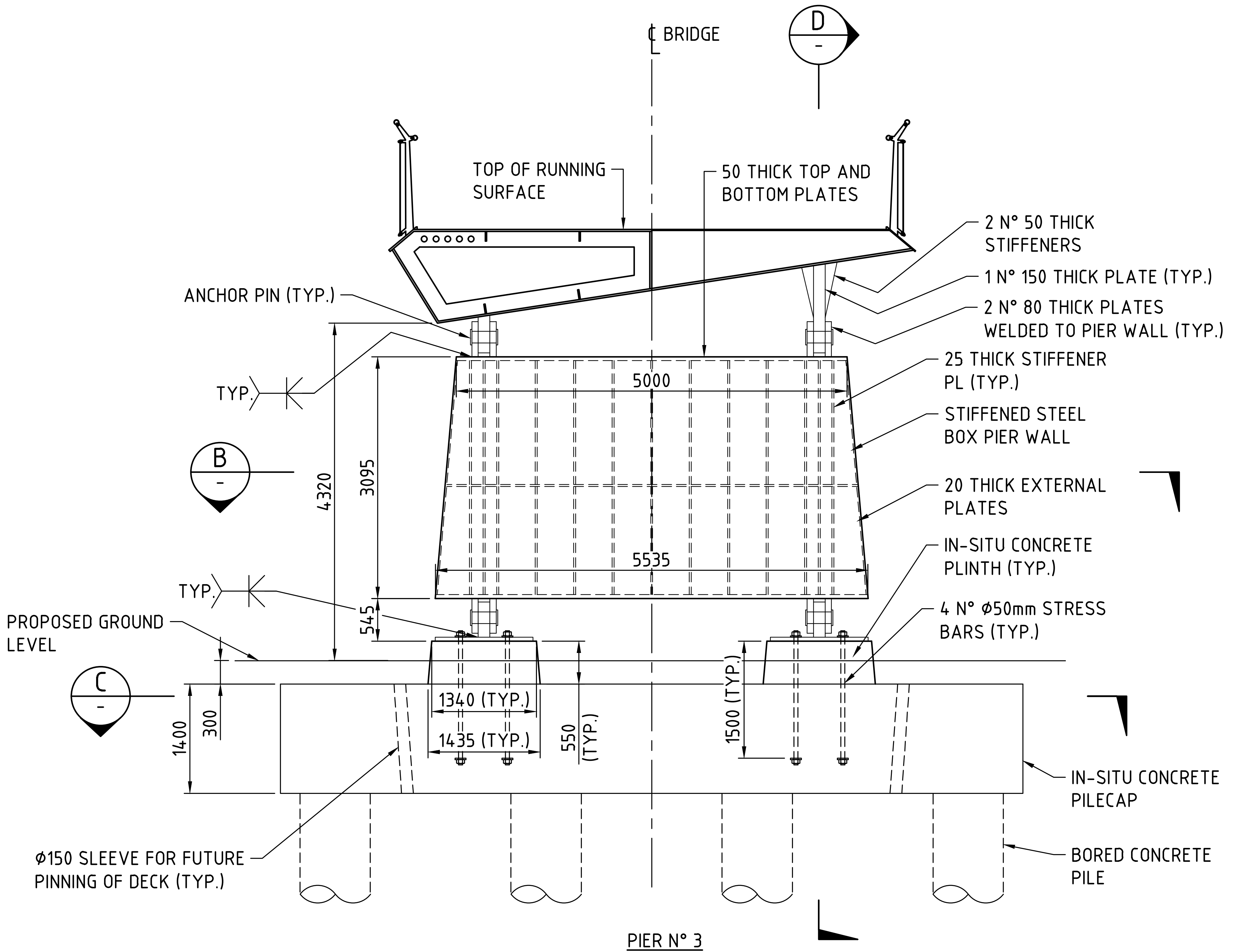
1:50



PIER N° 1 & PIER N° 2

TYPICAL PIER SECTION

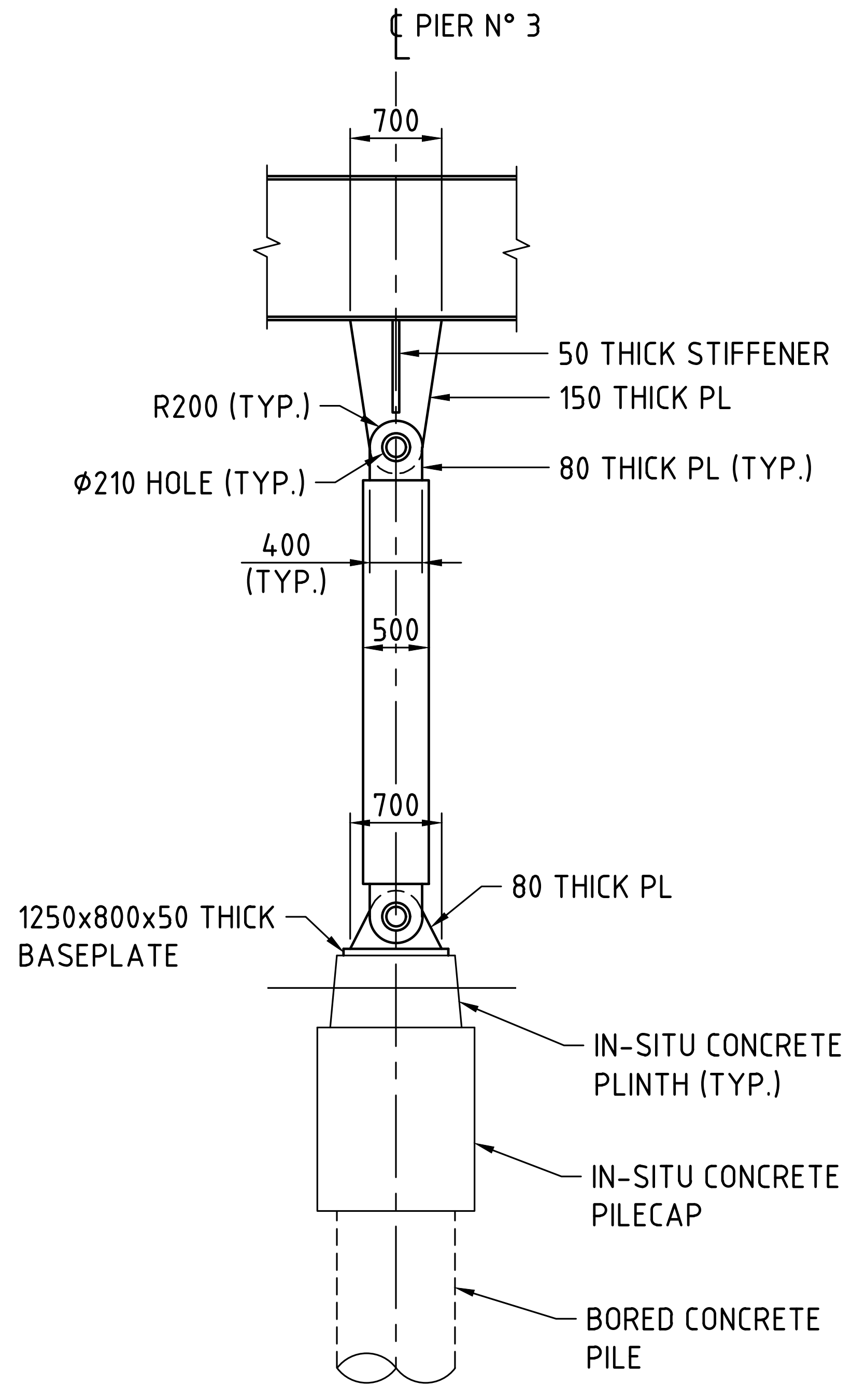
1:25



PIER N° 3

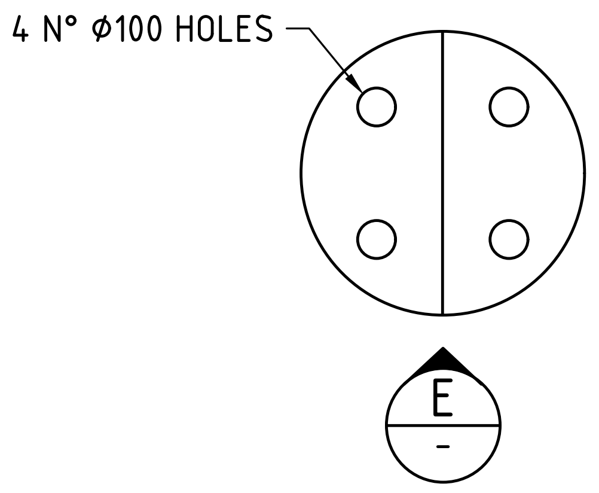
PIER SECTION

1:50



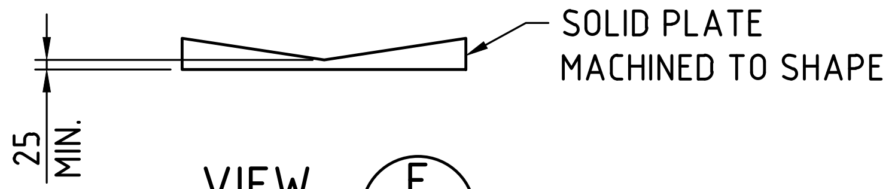
SECTION D -

1:50



SECTION A -

1:20



VIEW E -

1:20

PILE DETAILS

LOCATION	PILE TYPE	DIAMETER (mm)	N° OF PILES	TOP OF PILE RL (m AHD)	PILE LENGTH (m)	MIN. EMBEDMENT INTO KINGS PARK FORMATION (m)	MIN. TEMPORARY CASING LENGTH (m)	ESTIMATED TOP OF KINGS PARK FORMATION (m AHD)
PIER N° 1	BORED PILE	900	1	2.2	32.0	2.0	9.0	-28.0
PIER N° 2	BORED PILE	900	1	1.7	32.0	3.0	9.0	
PIER N° 3	BORED PILE	900	4	0.3	33.0	8.0	9.0	-25.6

NOTES:

1. REFER DRG. N° CPCB-ST-000-SKT-20001 FOR GEOTECHNICAL NOTES.

FOR INFORMATION ONLY

Plot Date: 03/08/2022 2:06 PM Cad File: C:\pwworking\wsp-aus-pw.bentley.com_wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-10201.dwg

Plotted By: Burgess, Brent

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22

VERIFIER

DRAWING PATH

VERIFIED

DATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE

PROJECT DIRECTOR DATE

LOCAL AUTHORITY

MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK

METROP

MRWA DRAWING NUMBER

PROJECT TITLE CAUSEWAY LINK ALLIANCE

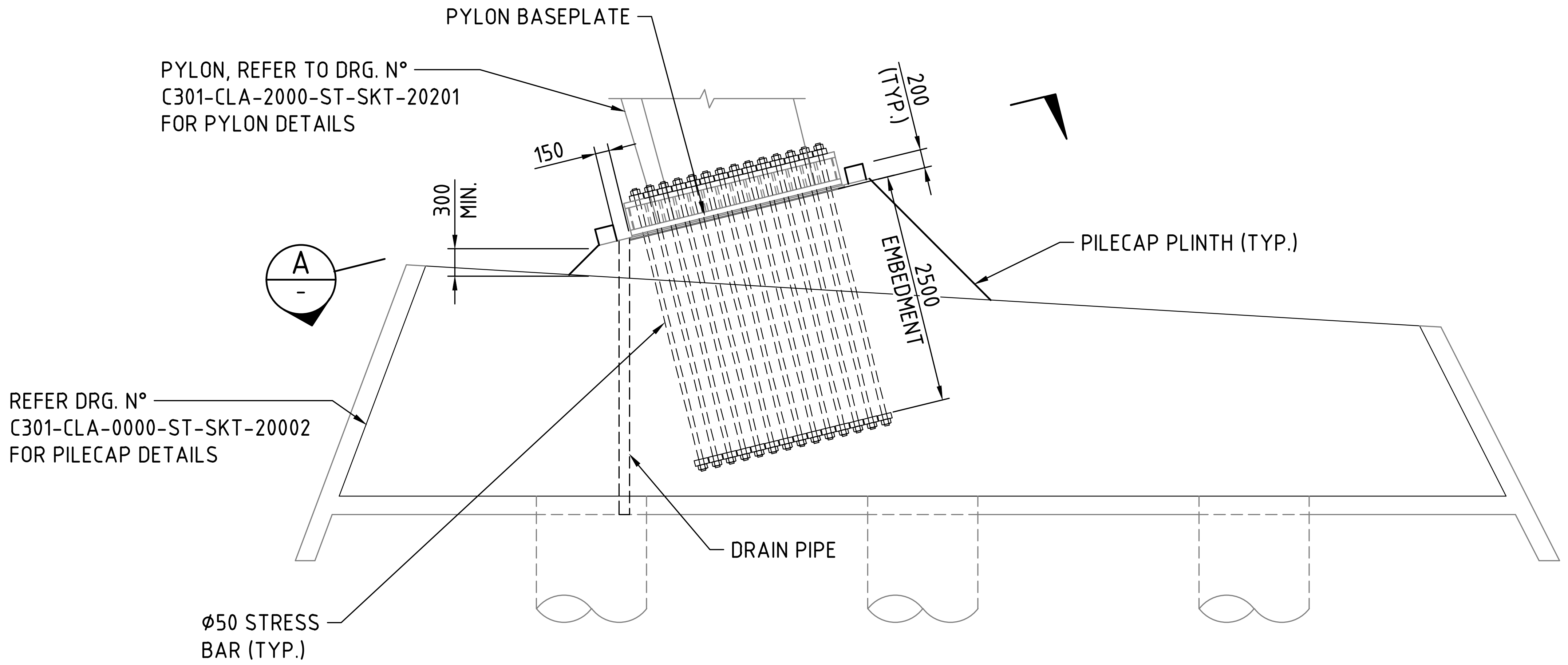
DRAWING TITLE CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
PIER DETAILS

SHEET A1

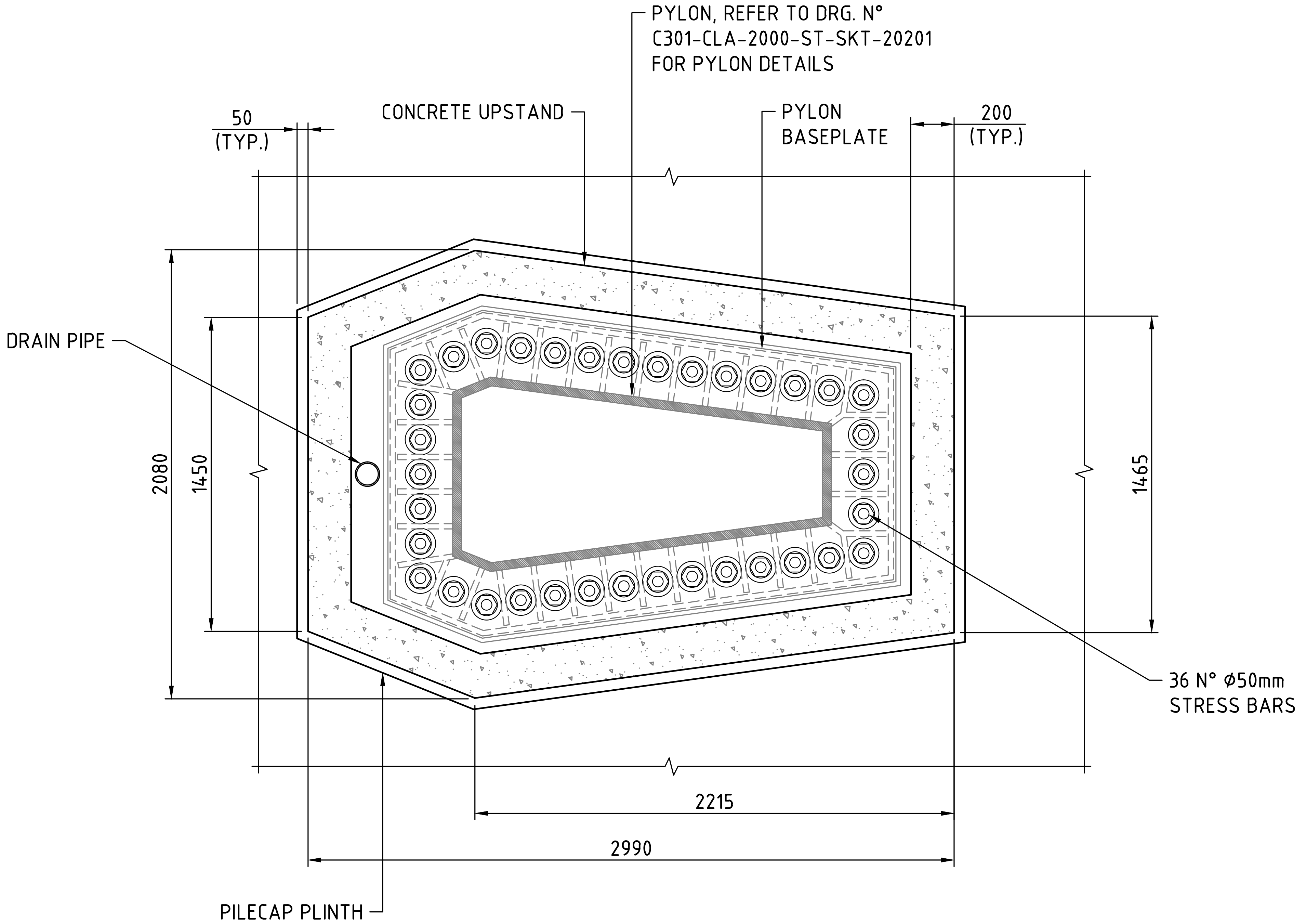
DRAWING STATUS 15%

DRAWING No. C301-CLA-2000-ST-SKT-10201

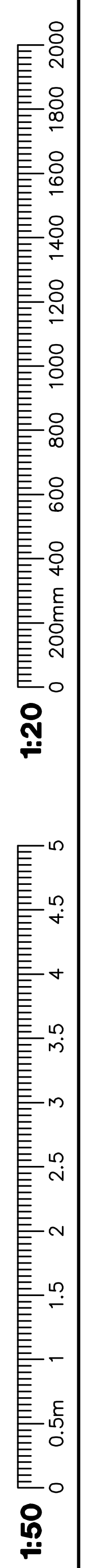
REV A



PILECAP ELEVATION
1:50



SECTION A -
1:20



Plotted By: Burgess, Brent Plot Date: 03/08/2022 2:06 PM Cad File: C:\pwworking\wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-20101.dwg

FOR INFORMATION ONLY

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22
DRAWING PATH		VERIFIED DATE

VERIFIER

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

LOCAL AUTHORITY
MAIN ROADS RESPONSIBILITY AREA
12 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
METROP

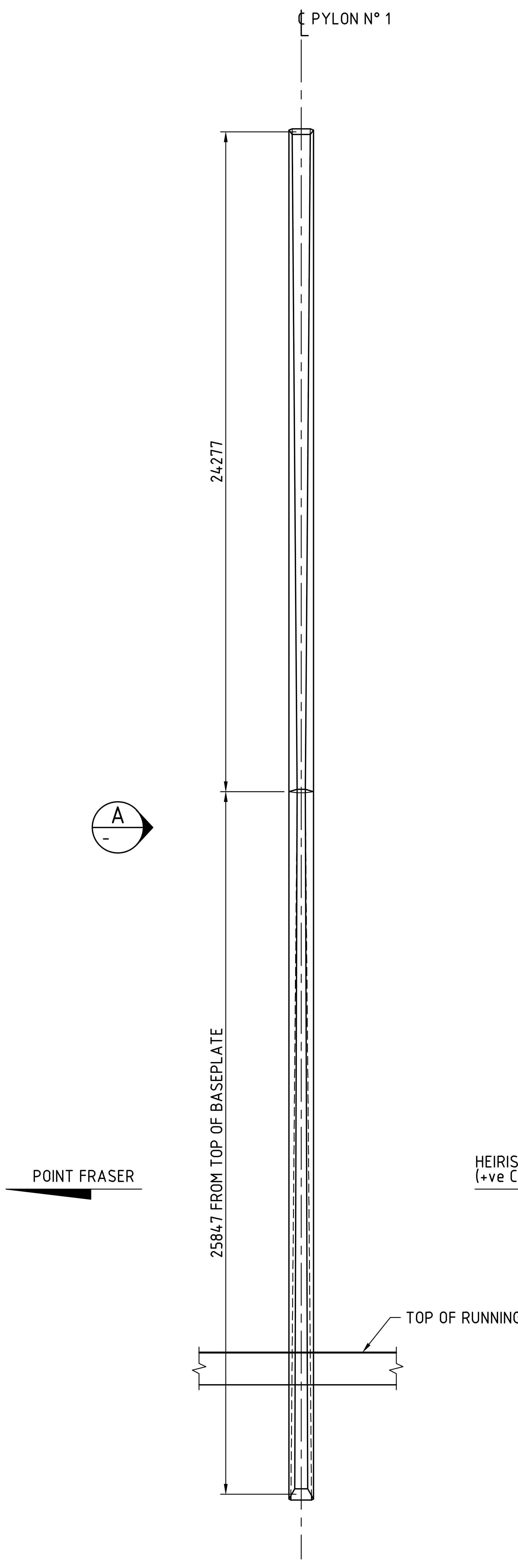
MRWA DRAWING NUMBER

PROJECT TITLE CAUSEWAY LINK ALLIANCE

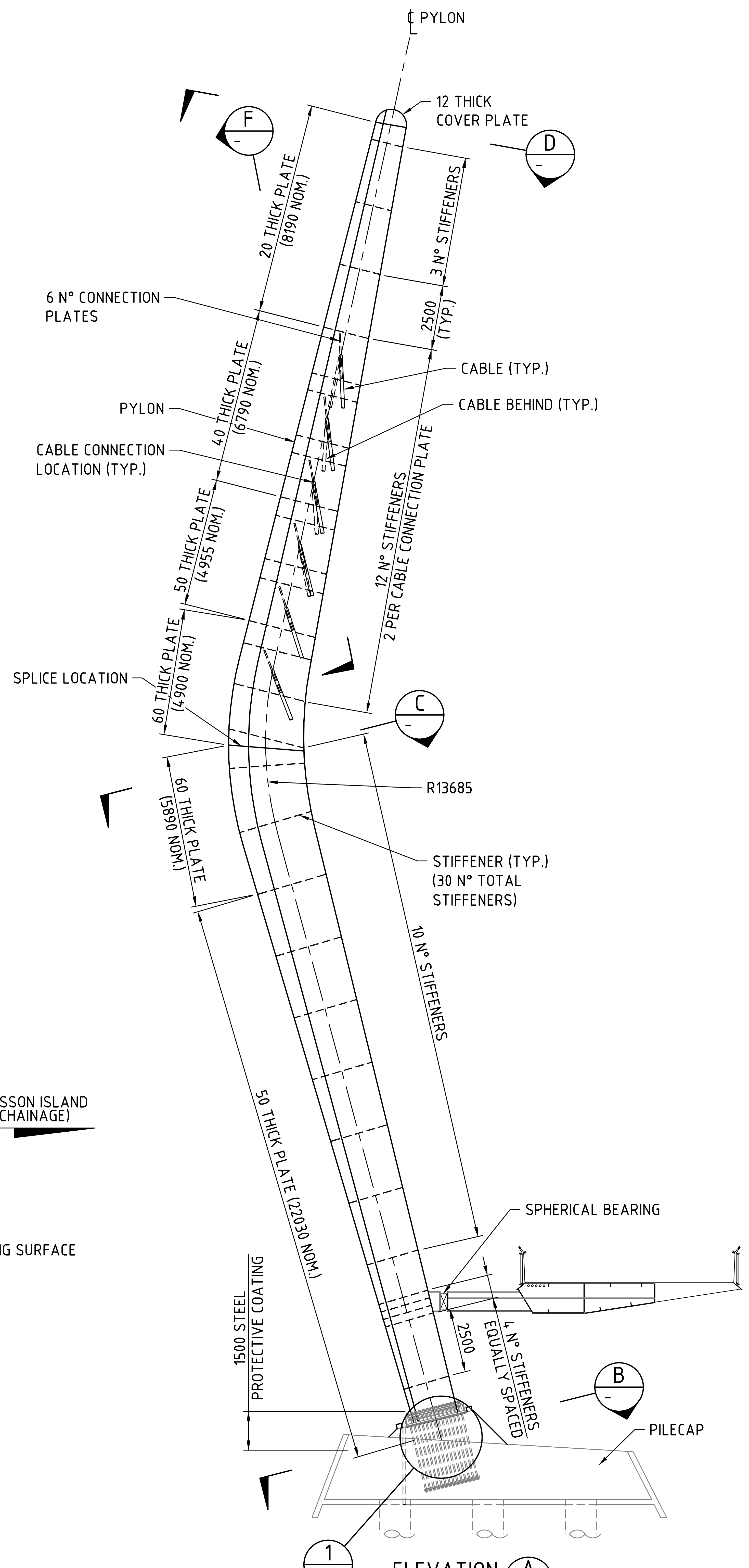
DRAWING TITLE
CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
PYLON BASE DETAILS

SHEET A1

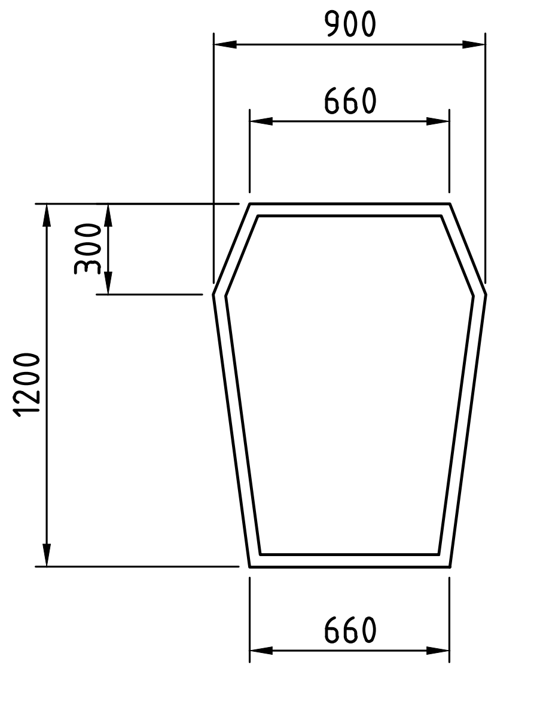
DRAWING STATUS 15%
DRAWING No. C301-CLA-2000-ST-SKT-20101
REV A



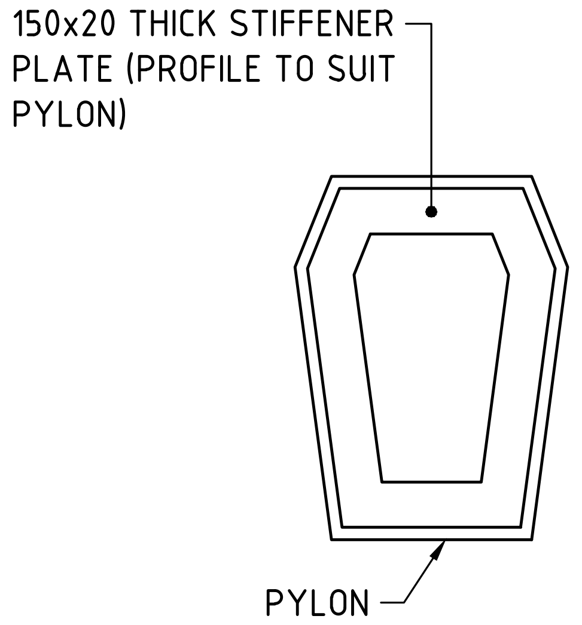
PYLON ELEVATION
1:125



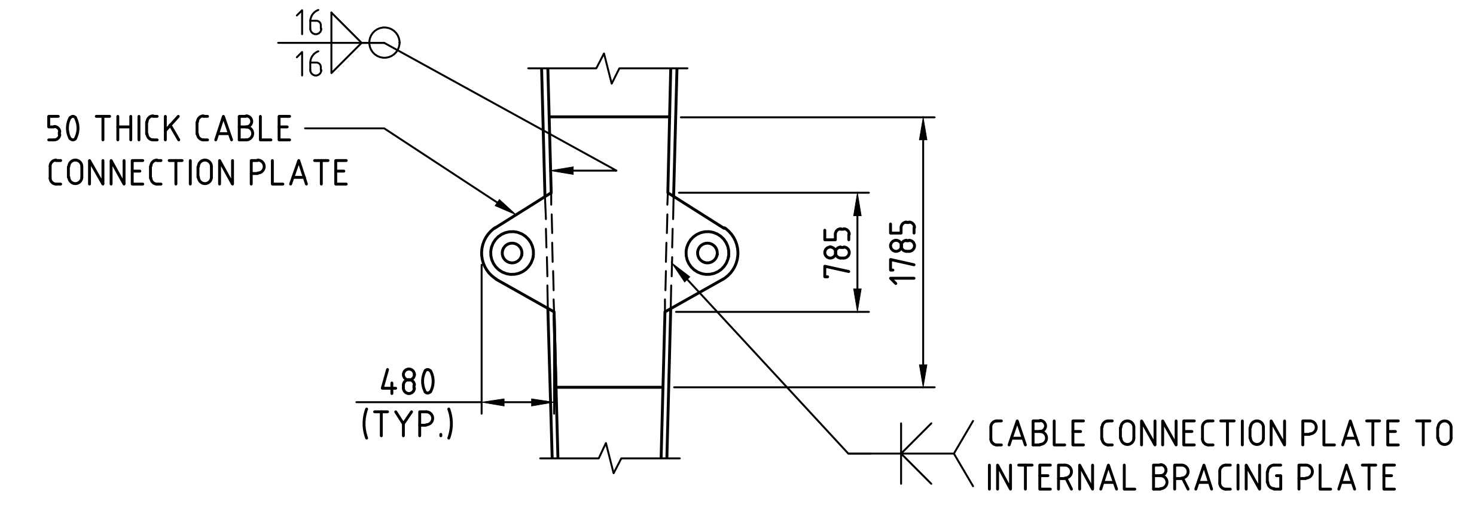
ELEVATION A
1:125



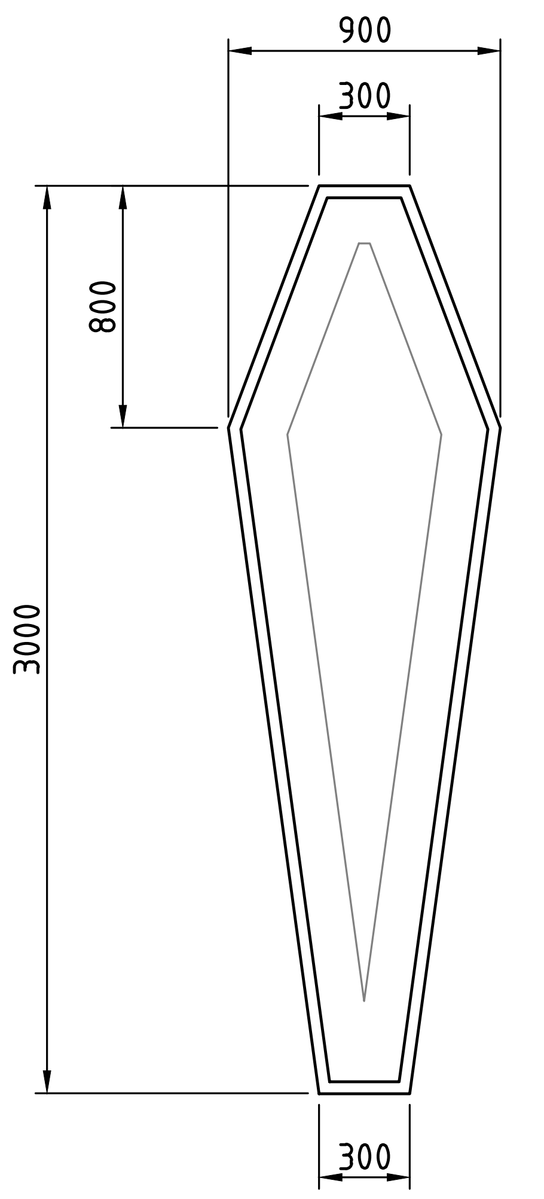
SECTION D
1:25



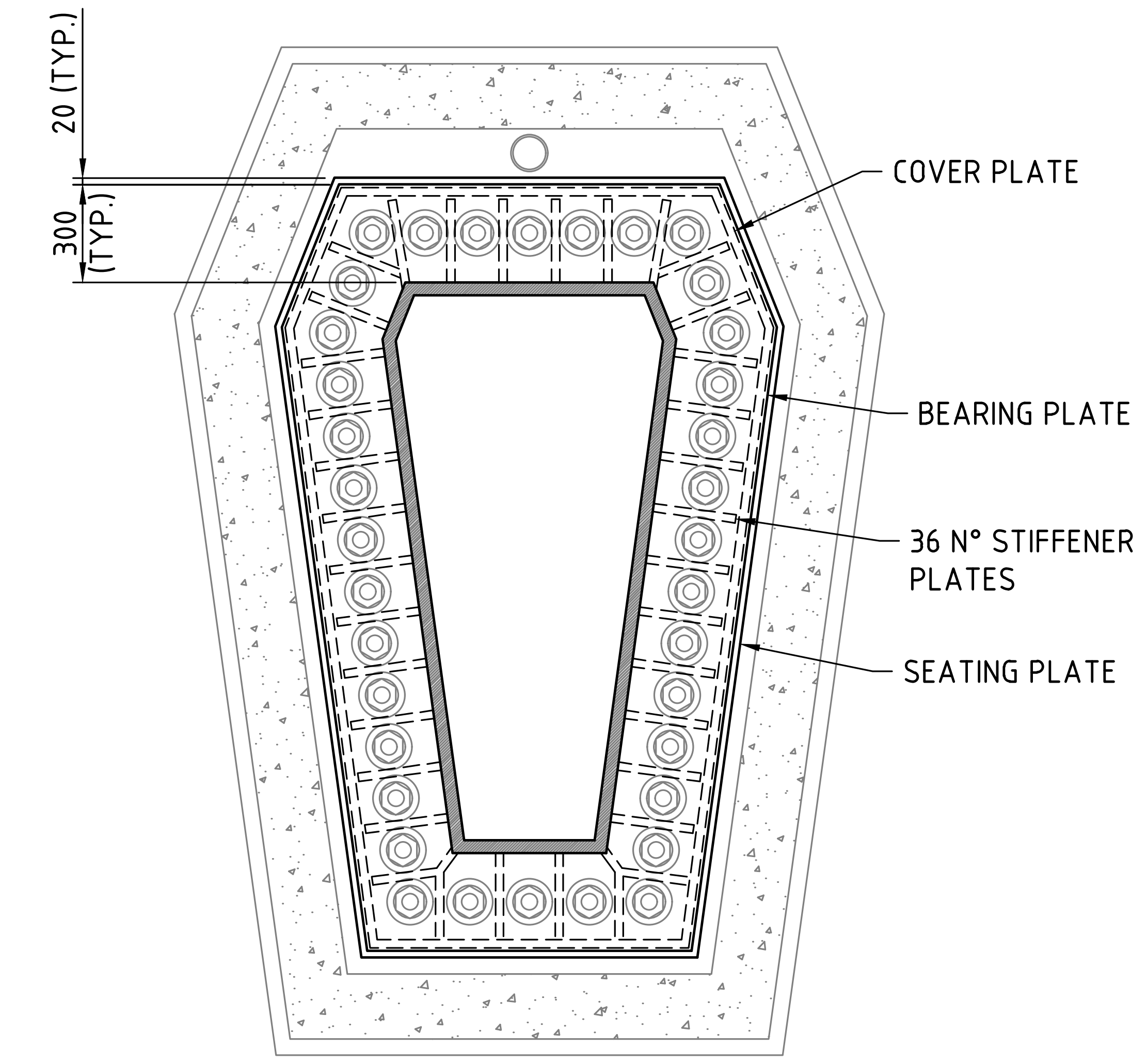
TYPICAL STIFFENER DETAIL
1:25



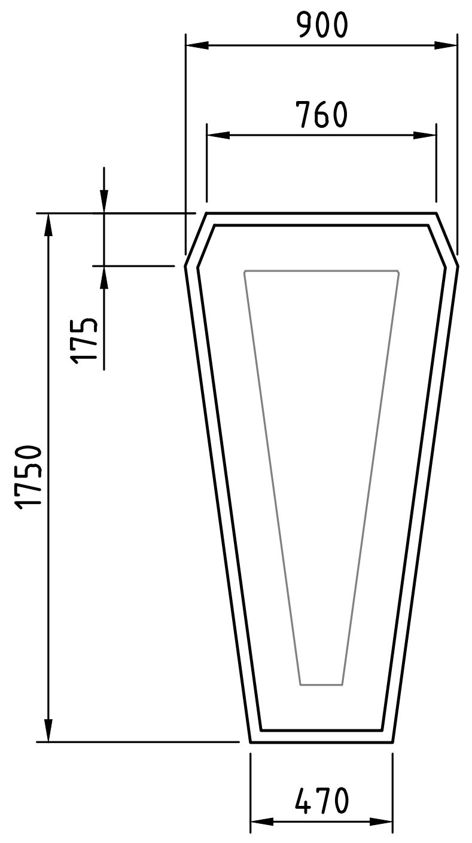
SECTION F
1:50



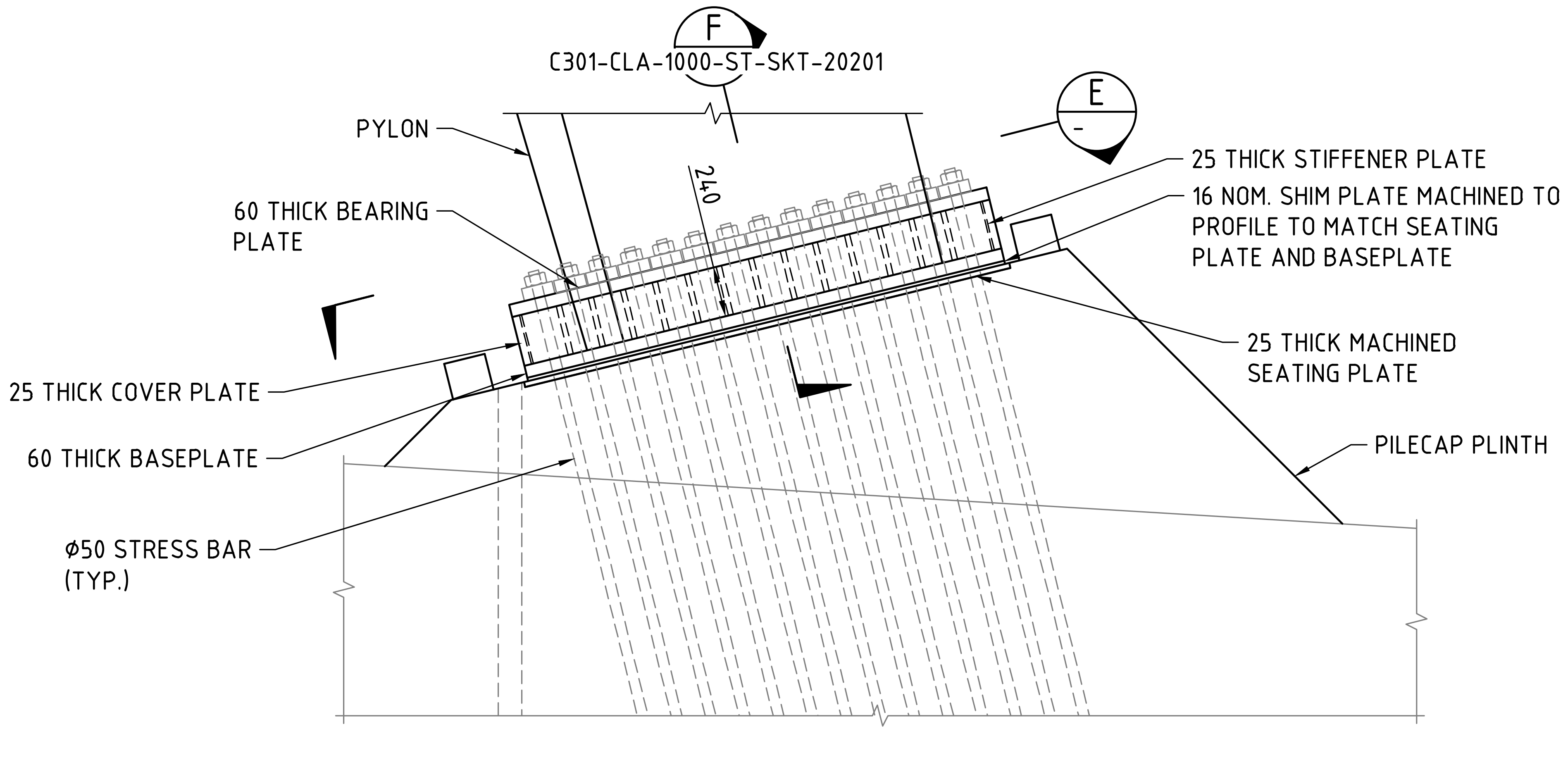
SECTION C
1:25



SECTION E
1:20



SECTION B
1:25



DETAIL 1
1:25

1:20
1:25
1:50
1:125

Plot Date: 03/08/2022 2:06 PM Cad File: C:\pwworking\wsp-aus-pw.bentley.com_wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-20201.dwg

Plotted By: Burgess, Brent

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH

VERIFIER

VERIFIED
DATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

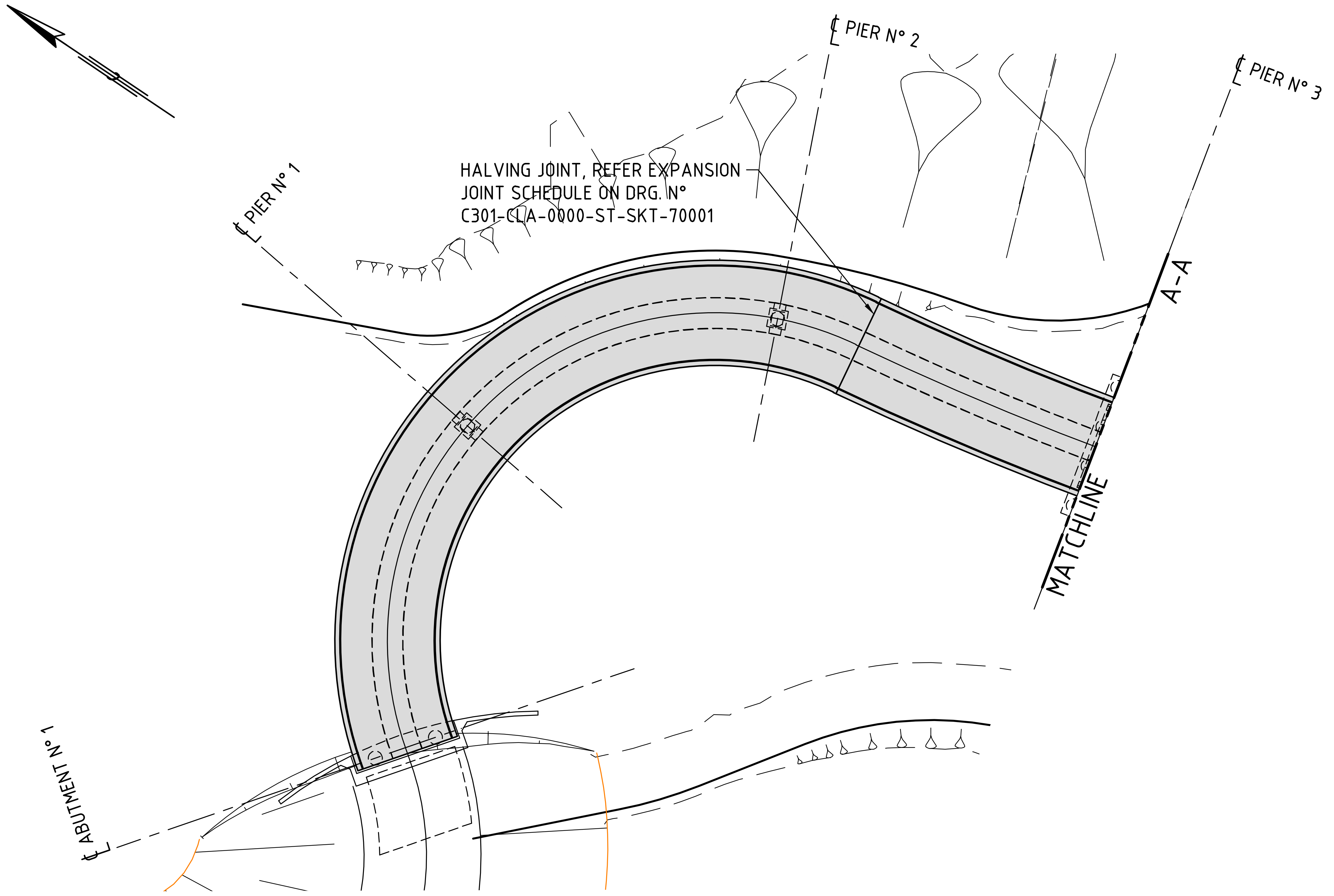
INFRASTRUCTURE DELIVERY DIRECTORATE

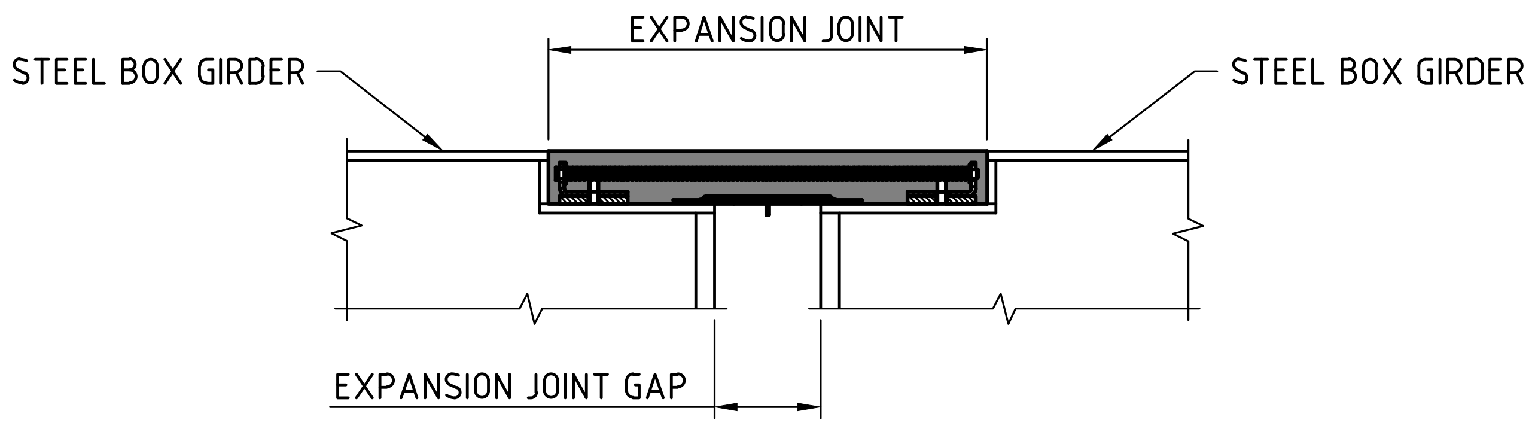
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

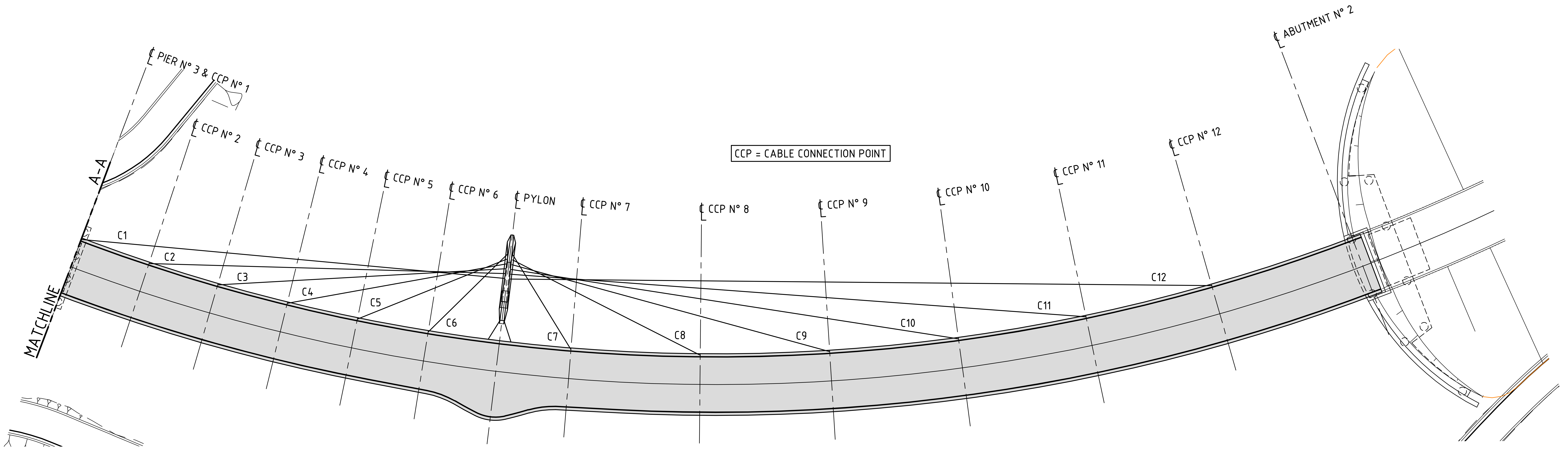
LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
PYLON DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-2000-ST-SKT-20201
REV: A

NOTES:
1. FOR DECK PLATE THICKNESS REFER DRG N° C301-CLA-0000-ST-SKT-40006.





HALVEN EXPANSION JOINT DETAIL
1:10



DECK LAYOUT PLAN
1:250

1:10 0 100mm 200 300 400 500 600 700 800 900 1000

1:250 0 5m 10 15 20 25

Plotted By: Burgess, Brent Plot Date: 03/08/2022 2:20 PM Cad File: C:\pwworking\wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-40001.dwg

No.	DESCRIPTION	APPROVED & DATE
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AMENDMENTS

METADATA
GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489 9700 Facsimile +61 8 9489 9777 Email: perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
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APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH

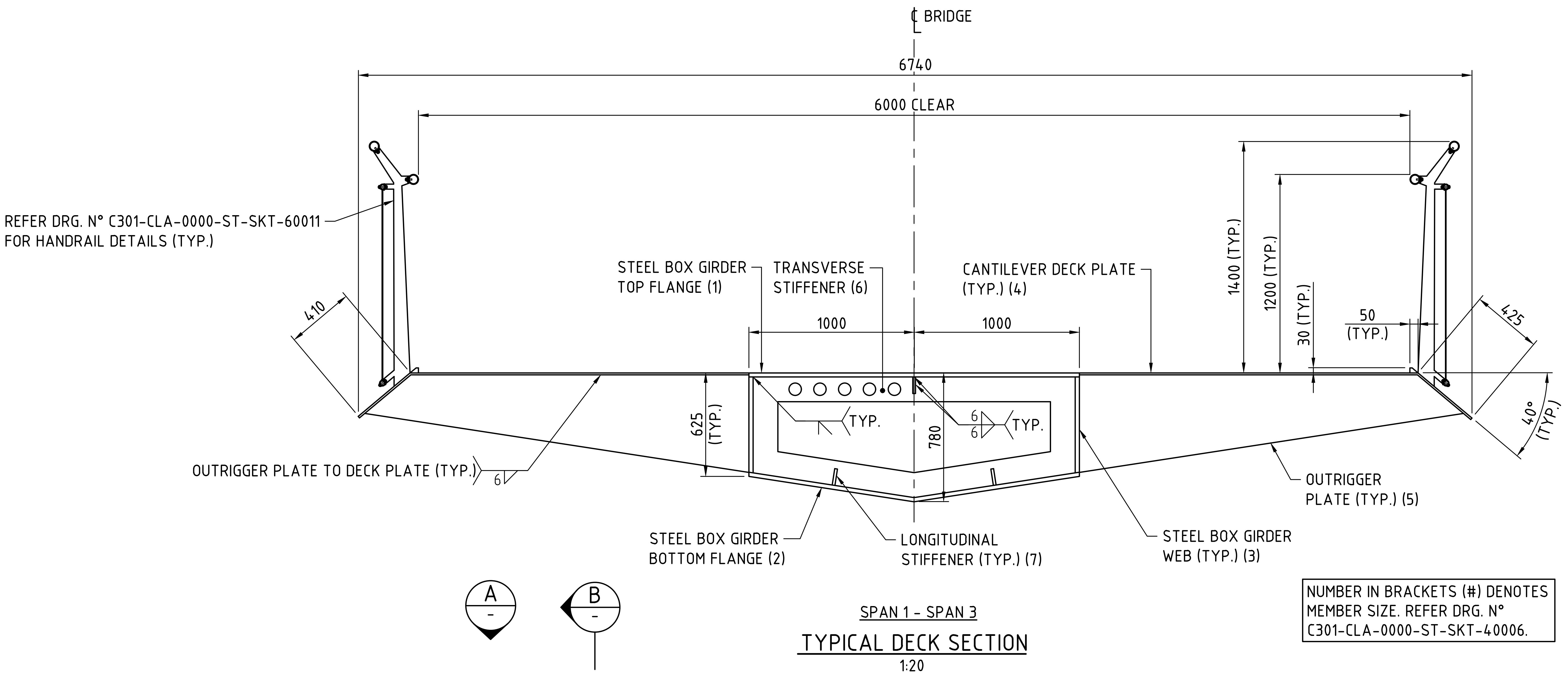
VERIFIER
VERIFIED
DATE

Causeway Link Alliance
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

INFRASTRUCTURE DELIVERY DIRECTORATE
mainroads WESTERN AUSTRALIA
CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
DECK LAYOUT PLAN
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-2000-ST-SKT-40001
REV: A

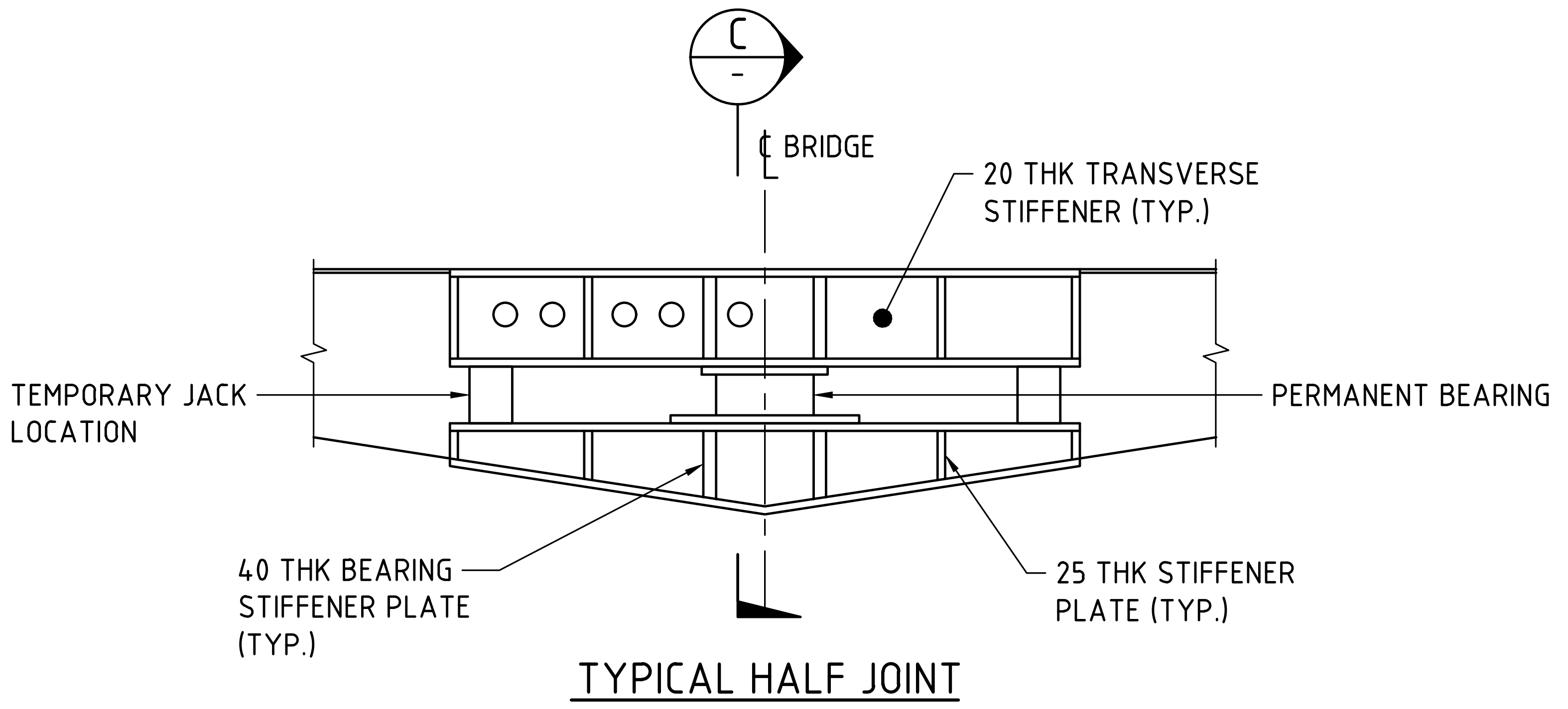


NUMBER IN BRACKETS (#) DENOTES MEMBER SIZE. REFER DRG. N° C301-CLA-0000-ST-SKT-40006.

SPAN 1 - SPAN 3

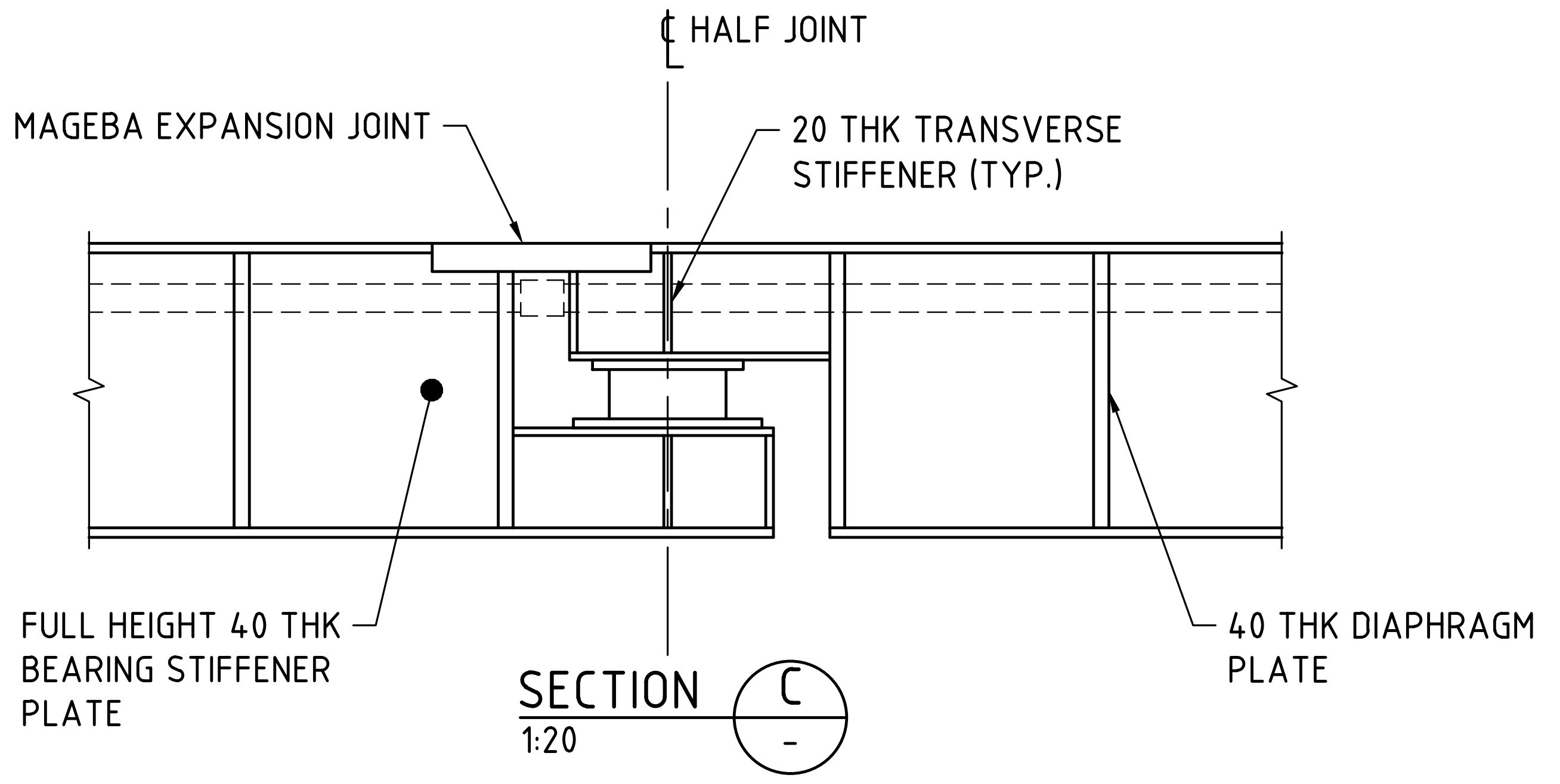
TYPICAL DECK SECTION

1:20



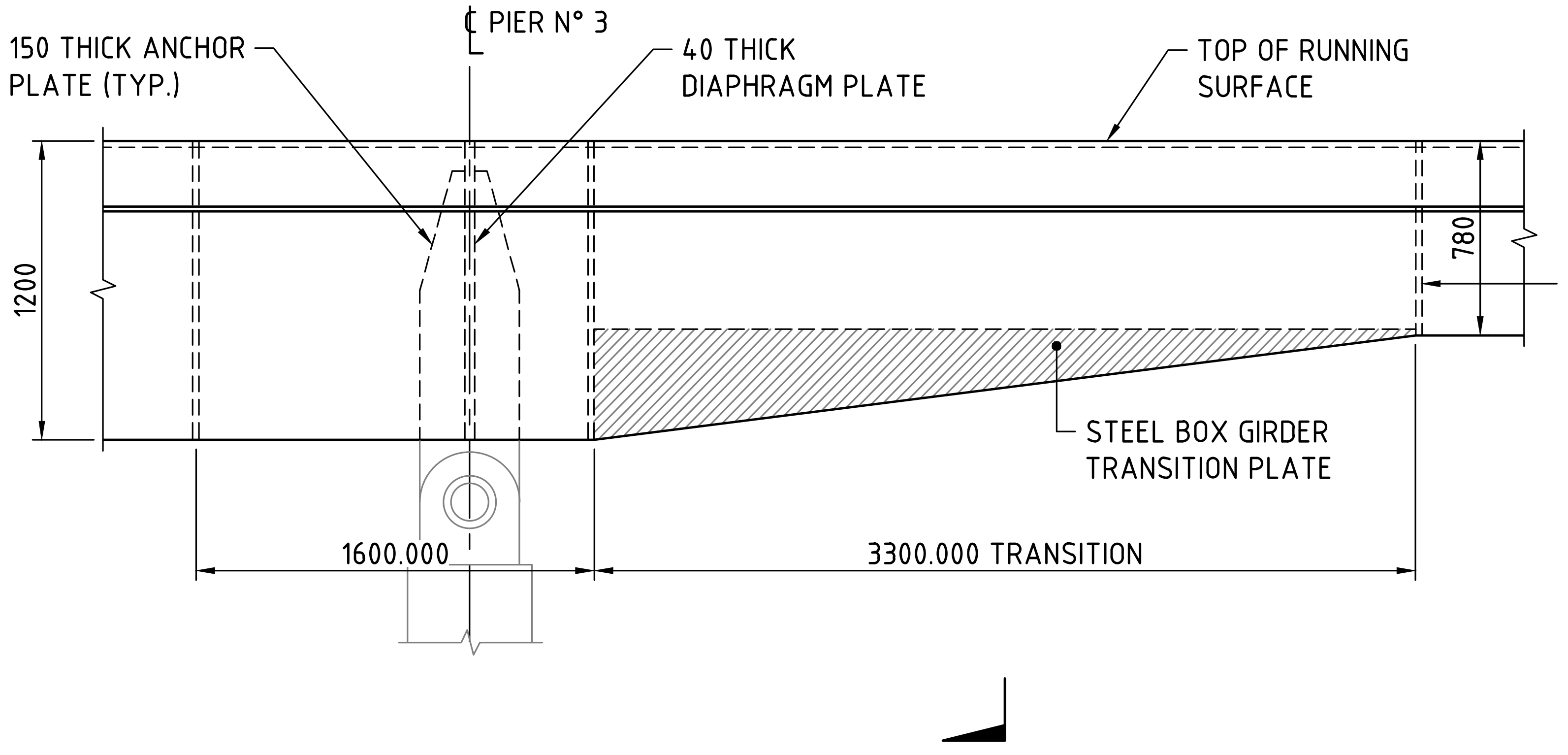
TYPICAL HALF JOINT

1:20



SECTION C

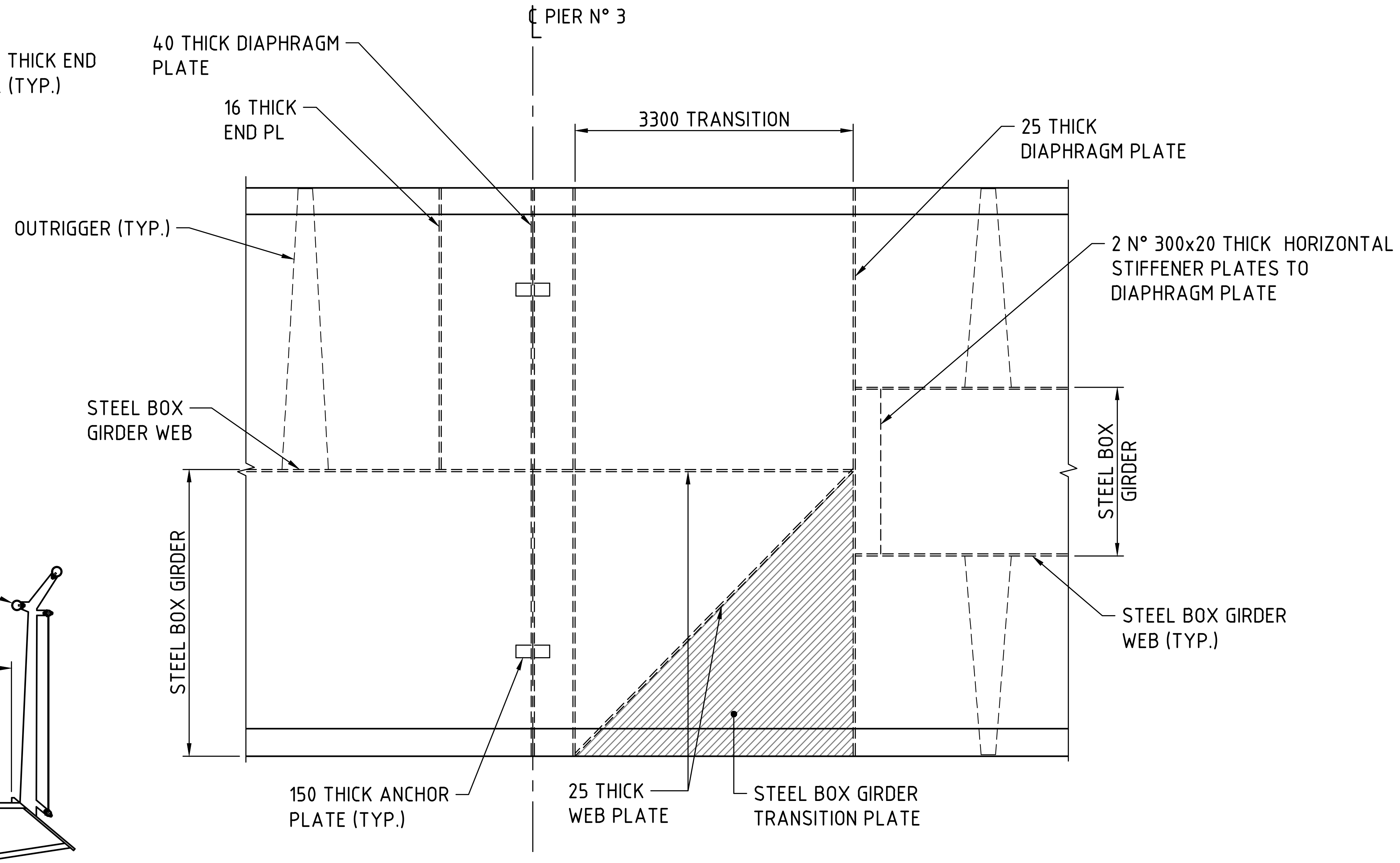
1:20



STEEL BOX GIRDER TRANSITION

ELEVATION

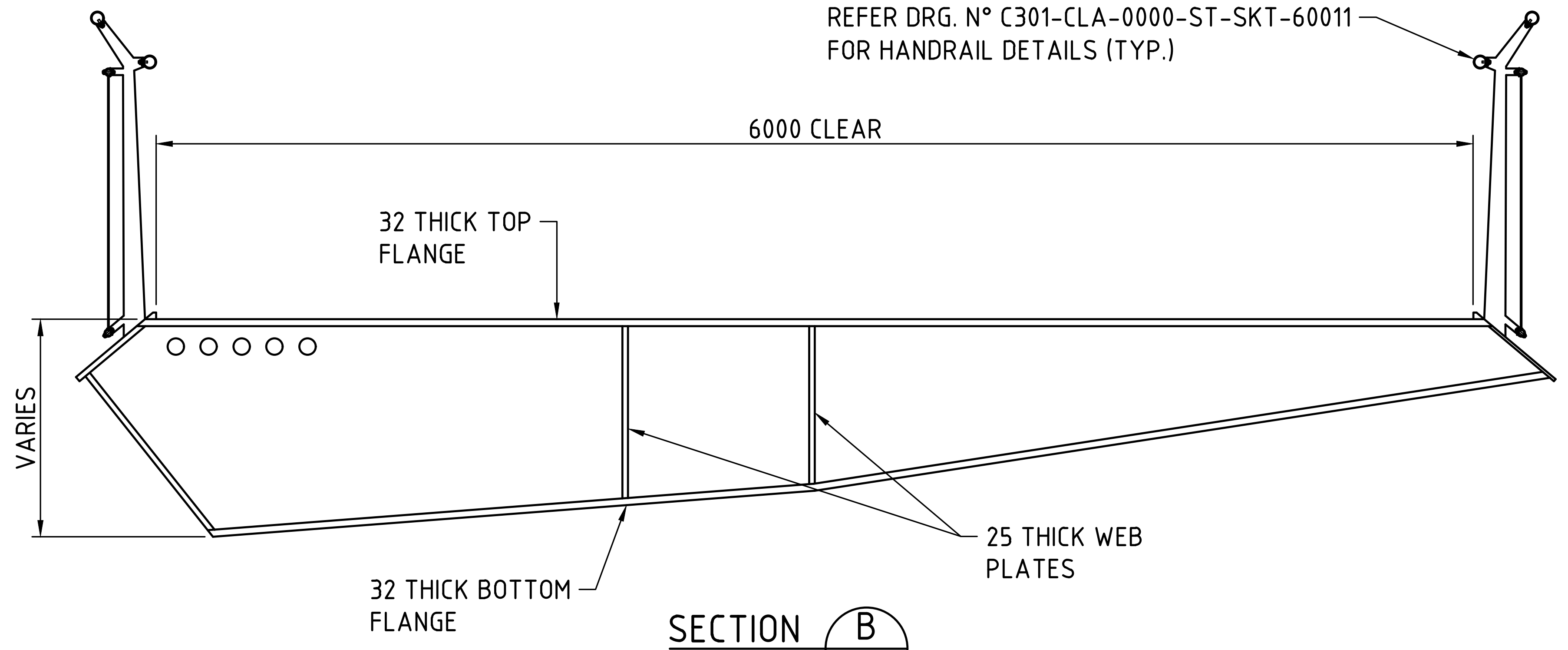
1:25



STIFFENERS IN STEEL BOX GIRDER OMITTED FOR CLARITY

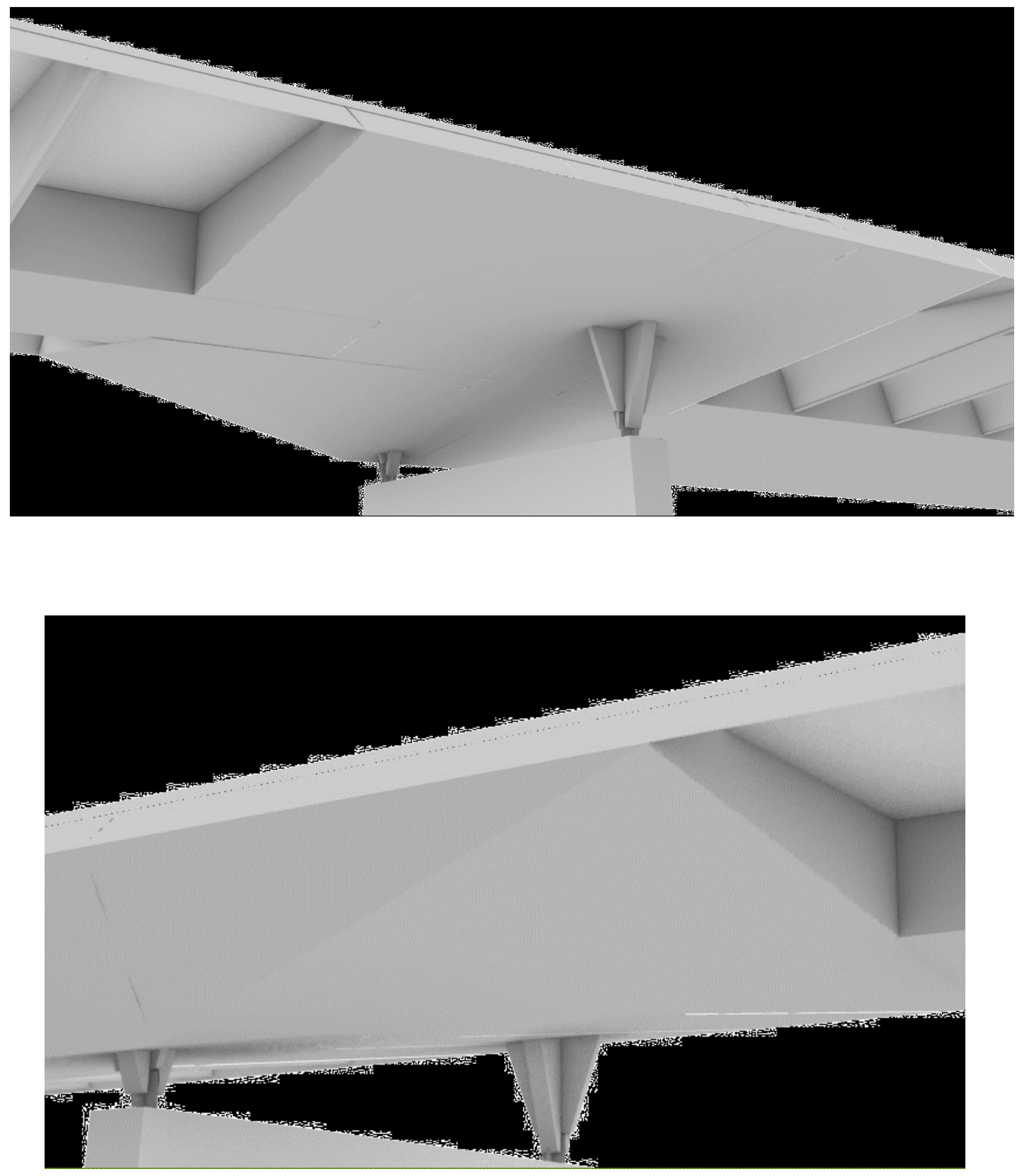
VIEW A

1:50



SECTION B

1:25



DECK TRANSITION - PERSPECTIVE VIEW

N.T.S.

Plotted By: Burgess, Brent   Plot Date: 03/08/2022 2:06 PM   Cad File: C:\pwworking\wsp-aus-pw.bentley.com_wsp-aus-pw-19\d0130591\C301-CLA-2000-ST-SKT-40002.dwg

1:20
1:25
1:50

No.	DESCRIPTION	APPROVED & DATE
A	ISSUED FOR 15% DESIGN REVIEW	W.S 04.08.22

AMENDMENTS

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
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DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE: PCG94
HEIGHT DATUM: AHD71

wsp
Level 5
503 Murray Street
Perth WA 6000
Telephone +61 8 9489
9700 Facsimile +61 8 9489
9777 Email:
perth@wsp.com

DRAWN	B.BURGESS	04.08.22
DESIGNED	C.CHANG	04.08.22
CHECKED	G.DUPLESSIS	04.08.22
APPROVED	W.SCHWARZ	04.08.22

DRAWING PATH

VERIFIER

VERIFIED
DATE

Causeway Link Alliance

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

THE GOVERNMENT OF WESTERN AUSTRALIA
mainroads WESTERN AUSTRALIA
INFRASTRUCTURE DELIVERY DIRECTORATE

CONTRACT MANAGER DATE
PROJECT DIRECTOR DATE

FOR INFORMATION ONLY

LOCAL AUTHORITY: 124 - CITY OF PERTH, 129 - TOWN OF VICTORIA PARK
MAIN ROADS RESPONSIBILITY AREA: METROPOLITAN REGION
MRWA DRAWING NUMBER:
PROJECT TITLE: CAUSEWAY LINK ALLIANCE
DRAWING TITLE: CAUSEWAY PEDESTRIAN AND CYCLIST BRIDGE
BRIDGE 9506 - POINT FRASER SPAN
DECK SECTIONS AND DECK TRANSITION DETAILS
SHEET: A1
DRAWING STATUS: 15%
DRAWING No.: C301-CLA-2000-ST-SKT-40002
REV: A