

Construction Management Plan

Causeway Link Alliance

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Control Page

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1. INTRODUCTION

1.1 Purpose

The purpose of this Construction Management Plan (CMP) document is to provide an overview of the construction processes that will be implemented by Causeway Link Alliance (CLA) for the construction of the Causeway Pedestrian and Cyclist Bridges Project and to satisfy the requirements as detailed in the Contract Schedule.

The CMP is a live document that is reviewed and updated throughout the life of the Project.

The CMP is supported by a suite of management plans that form a detailed, cohesive, and consistent framework for managing all aspects of the Project.



Figure 1: Concept Image of the Causeway Pedestrian and Cyclist Bridge

1.2 Key Stakeholders

Causeway Link Alliance recognise this project has a number of key stakeholders all with differing drivers and objectives. Below is a summary of key stakeholders identified and who will have input during the construction works:

- ATCO;
- Burswood Park Board;
- City of Perth;
- Main Roads of Western Australia;
- Department of Biodiversity Conservation and Attractions;
- Department of Primary Industries and Regional Development;
- Department of Transport Marine;
- Department of Water and Environmental Regulation;

- Development WA;
- Office of the Government Architect;
- On the Point businesses at Point Fraser;
- Town of Victoria Park;
- WA Recreational Water Sports Association;
- Water Corporation; and
- Western Power.

1.3 Definitions

Term	Definitions
Alliance	Causeway Link Alliance
Contract	Document detailing the binding agreement between the MRWA and the Proponent for completion of the Project.
Subcontractor	An approved service provider/supplier engaged by the Alliance under subcontract to deliver service and/or supply materials and resources for the execution of the Alliance Project's Scope of Work.
Project	Causeway Pedestrian and Cyclist Bridges Project.

1.4 Abbreviations

Term	Definitions	Term	Definitions
CLA	Causeway Link Alliance	PFC	Parallel Flange Channel
CMC	Controlled Modulus Column	PPE	Personnel Protective Equipment
CRAW	Construction Risk Assessment Workshop	PVD	Perforated Vertical Drain
DBYD	Dial Before You Dig	QA	Quality Assurance
DPR	Daily Progress Report	RFI	Request for Information
E&I	Electrical and Instrumentation	RRM	Road Reference Marks
EWP	Elevated Work Platform	SDR	Supplier Document Register
GA	General Arrangement	SHS	Square Hollow Section
GI	Ground Improvement		
HR	Human Resources	SOW	Scope of Work
HSE	Health, Safety and Environment	TMP	Traffic Management Plan
ITP	Inspection Test Plan	TQ	Technical Query
JHA	Job Hazard Analyses	UB	Universal Beam
LGA	Local Government Authority	VOC	Verification of Competency
LED	Light Emitting Diode	VMP	Vessel Management Plan
MRWA	Main Roads Western Australia	WA	Western Australia
NDT	Non-Destructive Testing	WBS	Work Breakdown Structure
NOP	Non-Owner Participants		

1.5 Scope of Work

The scope of works to be performed under this Contract includes:

1.5.1 Footbridges and Other Structures

Footbridges, retaining walls and other structures including:

- New Footbridge No. 9505 over the Swan River south of Heirisson Island (hereafter called McCallum Park Footbridge);
- New Footbridge No. 9506 over the Swan River north of Heirisson Island (hereafter called Point Fraser Footbridge); and
- Associated retaining walls and other structures.

1.5.2 Separated Path, Shared Paths and Footpaths

The separated path, shared paths and footpaths will include:

- 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.

1.5.3 Fencing

Provision of pedestrian and cyclist safety fencing.

1.5.4 Accommodation Works

Accommodation works affected by the Project.

1.5.5 Drainage

Drainage including underground drainage, basins, subsoil drainage and culverts.

1.5.6 Lighting

Installation and modification of public space lighting to the separated path, shared paths, footpaths, and stairs. Installation of architectural and feature lighting on the footbridges, including to illuminate pylons and the superstructure.

1.5.7 Signage and Pavement Marking

Removal of signage and pavement markings no longer required, provision of new signage and pavement markings and modifications to existing signage and pavement markings within and outside the Site which are required as, a consequence of the Project.

1.6 Project Timing

The project is scheduled to commence construction works on site in November 2022 for a duration of 22 months.

2. MANAGEMENT PLANS

This methodology will be supported by the following management plans to outline a detailed, cohesive, and consistent framework for managing all aspects of the project:

Table 1: Management Plan List

Document Number	Management Plan
C301-CM-PLN-0001	Commercial Management Plan
C301-CM-PLN-0002	WAIPS Participation Plan
C301-CM-PLN-0003	Insurance Risk Management Plan

Document Number	Management Plan
C301-CR-PLN-0001	Community and Stakeholder Engagement Plan
C301-CR-PLN-0002	Heritage Interpretation Plan
C301-CR-PLN-0003	Heritage Interpretation Strategy
C301-CT-PLN-0001	Construction Management Plan
C301-DE-PLN-0001	Design Management Plan
C301-DE-PLN-0002	Urban Landscape and Design Framework
C301-HR-PLN-0001	Aboriginal Heritage Management Plan
C301-HR-PLN-0002	Industrial Relations Management Plan
C301-HR-PLN-0003	Aboriginal Participation Plan
C301-HR-PLN-0005	Workplace Relations Management Plan
C301-HS-PLN-0001	Safety and Health Management Plan
C301-HS-PLN-0002	Environmental Management Plan
C301-SU-PLN-0001	Sustainability Management Plan
C301-HS-PLN-0010	Traffic Management Plan
C301-SU-PLN-0001	Industry Sustainability Plan
C301-PM-PLN-0001	Alliance Management Plan
C301-PM-PLN-0002	Asset Commissioning and Handover Plan
C301-PM-PLN-0006	Vessel Management Plan
C301-PM-PLN-0009	Risk Management Plan
C301-PR-PLN-0001	Procurement Management Plan
C301-QU-PLN-0001	Quality Management Plan
C301-QU-PLN-0002	Records Management Plan

3. PROJECT MANAGEMENT

The Alliance Director will be the focal point for the Project and will define manpower and organisation requirements to ensure that the project is adequately resourced with the best people for the job, throughout the contract execution period. The job description of each member of the Alliance Management Team will be clearly defined and shown on the project organisation chart.

All personnel who will be employed on the project are assessed against the relevant job descriptions to ensure competency to carry out the relevant role.

3.1 Project Team Responsibilities

The Alliance Project team will be responsible for the delivery of the works in accordance with the agreed scope of work and the project schedule. The organisation is structured to provide central focal contact points for the management of subcontractors executing various construction subcontract packages.

The Alliance Project team will be responsible for the execution the work as outlined in the Contract. In addition, the project management team will interface and liaise with MRWA and other key stakeholders as required.

The key roles and responsibilities of the site management team is as follows:

Roles and Responsibilities
Alliance Director
<p>It is the responsibility of the Alliance Director to:</p> <ul style="list-style-type: none"> ▪ Provide support and guidance to the team; ▪ Review and authorise all project management plans; ▪ Assign responsibilities to project personnel; ▪ Have a regular presence onsite and monitor project performance, to ensure compatibility with the project objectives and other requirements; and ▪ Liaise with the client and Alliance Board to assess progress and performance and resolve any issues which may arise over the course of the project.
Construction Manager
<p>It is the responsibility of all Construction Manager to:</p> <ul style="list-style-type: none"> ▪ Ensure all HSE requirements are fully met and implemented; ▪ Ensure own work is in line with the issued management plans; ▪ Manage construction of the works underway; ▪ Manage the field supervision and construction crews; ▪ Manage interfaces with key stakeholders and sub vendors; and ▪ Report or action (as appropriate) identified breaches of regulatory requirements to management.
Project Engineers
<p>It is the responsibility of the Project Engineers to:</p> <ul style="list-style-type: none"> ▪ Liaise with the HSE and Construction teams to ensure that all Safety incidence/hazards are reported correctly and acted upon; ▪ Issue site instructions and reports, and monitor engineering progress; ▪ Develop detailed works method statements; ▪ Ensure compliance with all technical and QA related matters; ▪ Ensure all site engineering issues are properly addressed and closed out (RFI's/TQ's, MOCs, variation requests etc); ▪ Develop work and turn over packs; ▪ Act as the key vendor liaison; and ▪ Ensure general engineering compliance to the SOW and specifications.
Supervisors
<p>It is the responsibility of the Supervisor to:</p> <ul style="list-style-type: none"> ▪ Liaising with HSE and construction teams to ensure works are carried out in line with site requirements; ▪ Managing fieldwork teams; ▪ Coordinating with key stakeholders; ▪ Scheduling and coordinating site plant and equipment; and ▪ Alignment of subcontractors and critical interfaces.
Other Staff and Contractors

Roles and Responsibilities

Additional supporting team members shall be based on site to varying degrees including:

- HSE Manager and supporting HSE Advisors and Assessors. (See Safety and health Plan C301-HS-PLN-0001 for expansion on roles and responsibilities);
- Project Planners, Cost Controller and Administrators;
- Commercial Manager and supporting Contracts Administrators; and
- Quality Manager and supporting QA / Quality Control (QC) Inspectors

It is the responsibility of all Employees to:

- Comply with all HSE and QA related matters;
- Ensure own work is in line with the issued management plans; and
- Report or action (as appropriate) identified breaches of regulatory requirements to management.

3.2 Work Packs

Work will proceed at individual WBS work areas when they are released for construction. The release will be accompanied by drawings and associated survey documents showing all relevant dimensions and levels. A verification survey will be carried out and will provide a cross check on the tasks to be undertaken. Within the WBS work packs are quality control documentation for progressive sign-off of the works, where the expectation will be for the tasks to be signed off in a timely and progressive manner.

WBS work areas will typically maintain the following structure:

- Scope of work;
- Work Method Statement;
- Model Shots;
- Drawings and Vendor Data;
- Lift Studies;
- Survey Requirements;
- Construction Schedule;
- Resource Requirements (Manpower/ Plant and Equipment/ Productivity);
- Specifications;
- QA/QC Documentation (ITP's and Check sheets);
- HSE Documentation; and
- Completions.

3.3 Schedule

The planning for the project will be based on the Work Breakdown Structure (WBS) activity codes. Schedule changes may occur during the project with agreement between MRWA and the Alliance, but the base line schedule will always exist and be reported against. Should re-baselining be required the relevant data will be updated and submitted for approval. Reporting of progress to MRWA will be as per the requirements of the contract. Planning for the project will be performed using Primavera (P6).

3.3.1 Schedule Basis and Development

The WBS forms the basis of the structure and format of the Schedule, and a 'Basis of Schedule' will be documented detailing the following:

- Methodology;

- Project Milestones;
- Interface Milestones;
- Critical Path;
- Risks and Opportunities;
- Structure; and
- Assumptions.

3.3.2 Monitoring of Bridge Fabrication Progress

Bridge fabrication progress will be measured based on physical progress for vendor manufacture and fabrication for each progress step in the completion of each segment. At end of each month progress and backup information in the form of photos etc. will be provided to support progress claims. Progress inspections will also be undertaken by MRWA to substantiate the progress claims.

3.3.3 Monitoring of Construction Progress

Construction progress will be measured based on physical progress defined by weighted values for each progress step in the completion of an activity. The weighted value assigned may be based on the number of man-hours involved in the completion of each step to accomplish the activity shown in the schedule.

The progress reports and information received from the supervisors and subcontractors will be used to manage, monitor, and control all construction activities in the schedule.

3.3.4 Overall Progress and Project Schedule

Overall progress S-curve will be produced and monitored periodically as per requirements. Baseline Early and Late curves will be highlighted in the S-curve so that progress can be monitored to keep the actual line above the late curve throughout the project. The Project schedule will be updated mid-month, and end of month with progress details and percentage completion status received from all departments and sub-contractors.

3.4 Aboriginal Participation

CLA believe that enduring relationships with local Indigenous groups and communities is essential to business success. We believe diversity makes our workplace a more rewarding and productive place to be and this diversity will allow us to work more effectively and competitively. We have an Aboriginal Participation Plan to engage Aboriginal employment and procurement and this will be tailored to meet specific project requirements:

- Local Aboriginal employment minimum requirement – at least 10% of the Contractor's Total Work Hours are undertaken by Aboriginal Persons;
- Aboriginal Business minimum requirement – works and/or services to a value of at least 3% of the GST exclusive Contract award value are undertaken by Aboriginal Businesses.

3.5 Work Packs

Work will proceed on individual work packs when they are released for construction. The release will be accompanied by drawings and associated survey documents showing all relevant dimensions and levels. A verification survey will be carried out and will provide a cross check on the tasks to be undertaken. Within the work pack are sheets for progressive sign-off of the works, where the expectation will be for the tasks to be signed off in a timely and progressive manner.

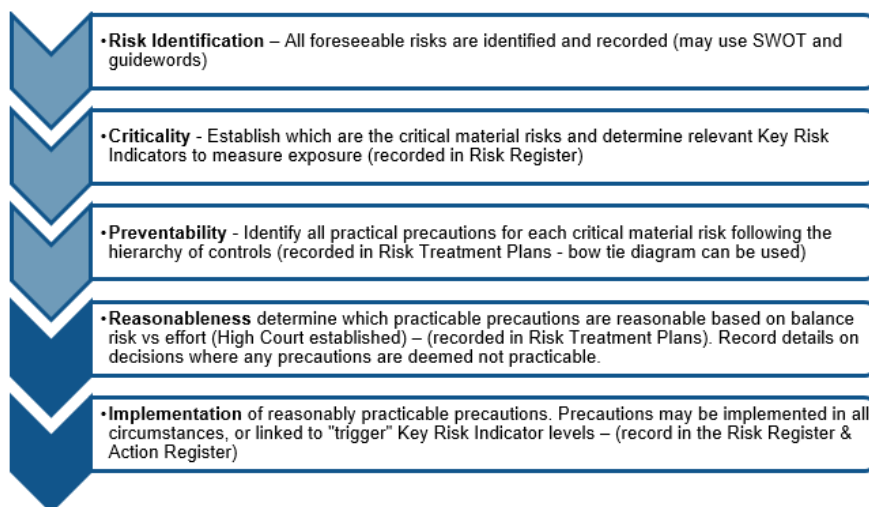
- Work packs will typically maintain the following structure:
- Scope of work;

- Work Method Statement;
- Model Shots;
- Drawings and Vendor Data;
- Lift Studies;
- Survey Requirements;
- Construction Schedule;
- Resource Requirements (Manpower/ Plant and Equipment/ Productivity);
- Specifications;
- QA / QC Documentation (ITP's and Check sheets);
- HSE Documentation; and
- Completions.

3.6 Risk Management

There are a wide range of risks that can impact the outcome of project objectives. In order to exercise due diligence, all 'reasonably practicable' treatments for identified risks will be implemented. This means that what can be done will be done unless it is reasonable in the circumstances to do something less.

This approach is consistent with the objectives of Workplace Health and Safety legislative models which include the obligation to ensure that workers and others are provided with the highest level of protection that is reasonably practicable.



4. BRIDGE FABRICATION

Bridge fabrication works is expected to be carried out at Civmec’s Fabrication Workshop Facilities in Henderson.

The Alliance will concurrently manage bridge fabrication and onsite works. The steel will be fabricated in accordance with Civmec’s in-house fabrication management procedures as the foundation for all manufacturing activities. Welding and assembly works will comply with Project specifications and

fabrication sequencing for steelwork will be in accordance with the construction sequence to ensure timely delivery of materials to site.

The bridge steelwork will comprise of box girder segments curved in both horizontal and vertical profiles and piers in the form of two digging sticks and a boomerang. Layout jigs in the profile of the bridge segments will be built to aid the fabrication and assembly in the workshop. These jigs will incorporate change of shape and camber of bridge segments and allow cable stay supports and base plates to be fabricated at the correct elevation and camber which will be confirmed by surveying.

Each individual item will be allocated a unique barcode at the shop drawing stage for traceability and tracking purposes.

4.1 Pre-Processing

Fabrication sequencing for steelwork will be in line with the construction sequence to ensure timely delivery of materials as required on site. The fabricator has Management procedures and work instructions that include but are not limited to, fabrication planning, management of labour and sub-contractors, equipment use and hire, qualification of personnel and training, standard work practices, material use and storage.

Each individual fabricated item will be allocated a unique number (Mark Number) at the shop drawing stage for traceability and tracking purposes. The method of tracking individual items through the fabrication process will be by Cimtec's production, tracking and traceability system (CIVTRAC) supported by a bar coding system and hand-held scanners. Pre-Processing activities include:

- Preparation of detail information for upload into CIVTRAC, including shop detail drawings, Weld Procedures, Inspection Test Plans;
- Nesting of material is performed and cutting lists generated;
- Processing of steel plate commences on the plasma cutting machine, plates to be prepped for welding on plasma, materials moved into workshop;
- Processing of angle, UB, PFC and SHS commences, materials moved into workshop;
- Proposed workshop layout for assembly, fabrication and welding of the various activities associated with the fabrication of the trough girders will be in the workshop; and
- All developed weld procedures will be supplied to the client for review prior to any welding being carried out on the project.

4.2 Materials Management

In general, the system CIVTRAC will track material flows in accordance with the following principles:

- CIVTRAC is the central system for management of all fabricated materials for the project;
- All fabricated items shall be assigned unique CIVTRAC barcode stickers which will track from fabrication through preassembly and eventual delivery;



Figure 2: A unique CIVTRAC barcode is affixed to all items

- Materials are receipted at each major step of the process and specifically after release from the workshop (prior to surface treatment), following surface treatment, upon receipt in the preassembly yard and prior to dispatch to the Alliance work site; and
- Traceability shall be maintained through CIVTRAC in accordance with the Contract requirements.

Material in production is tracked at the workface using handheld scanners and barcodes attached to the steel at the pre-cutting stage through fabrication, welding, inspection release, surface treatment, assembly, and delivery to site.

CIVTRAC allows each individual mark number to be tracked throughout the fabrication process and surface treatment process by barcoding and scanning, giving real-time reporting and tracking of the status and location of the component.

4.3 Welding

Welding procedures will be sourced from the weld procedure register in accordance with the appropriate codes and within the requirements of specification and submitted for final approval before being used on the job. A running register of all welding procedures will be maintained and updated throughout the job. Only welders that have passed the appropriate welding tests and have been approved can carry out production welding.

All required weld procedures, welder qualifications, ITPs, material/consumables approval, quality and safety documentation shall be completed and approved prior to the commencement of fabrication. NDT and dimensional checks will be performed progressively throughout fabrication in the workshop in accordance with approved procedures. Welder’s performance will be continuously monitored to ensure a high quality is maintained and repair rates or trends are captured immediately so appropriate action can be taken.

4.4 Fabrication

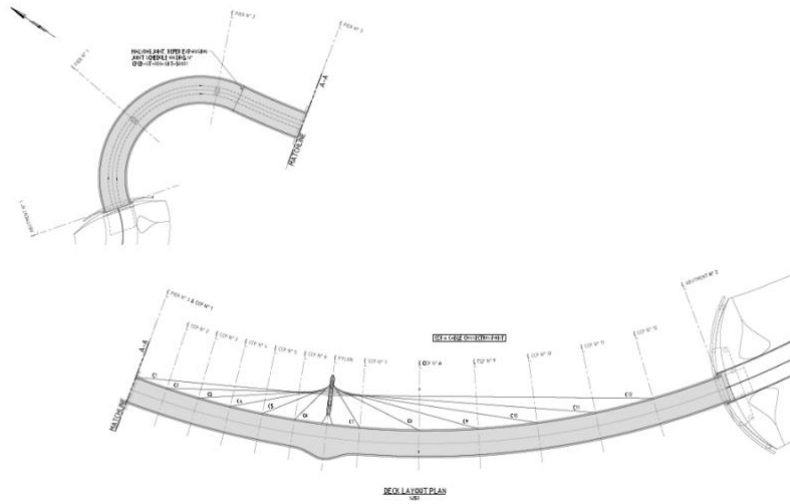
Bridge segment steelwork comprises of fabricated tapered box girders curved on plan and curved in vertical profile, transverse cross girder beams (fabricated and SHS sections) with 10mm plate deck and stiffeners and shear studs forming the soffit of the permanent deck between girders.

Table 2: Point Fraser Bridge Fabrication Overview

Grid	Deck Module No.	Segment No.
A1-P1	1	7
P1-P2	2	6
P2-P3	3	5

CONSTRUCTION MANAGEMENT PLAN

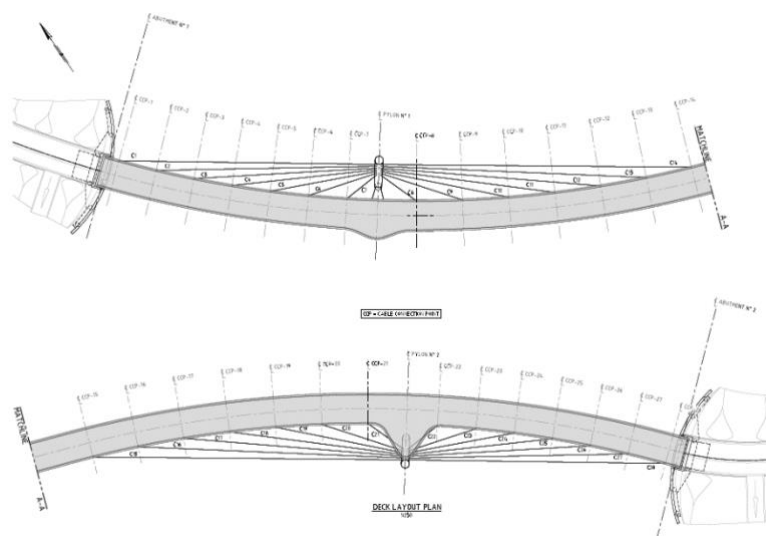
P3-P4	4	2
P4-P5	5	
P5-P6	6	
P6-P7	7	
P7-P8	8	1
P8-P9	9	
P9-P10	10	
P10-P11	11	3
P11-P12	12	



CONSTRUCTION MANAGEMENT PLAN

Table 3: McCallum Park Bridge Fabrication Overview

Grid	Deck Module No.	Segment No.
A1/C1-C2	1	7
C2-C3	2	
C3-C4	3	
C4-C5	4	
C5-C6	5	
C6-C7	6	6
C7-Pylon1	7	
Pylon1-C8	8	
C8-C9	9	5
C9-C10	10	
C10-C11	11	
C11-C12	12	4
C12-C13	13	
C13-C14	14	
C14-C15	15	
C15-C16	16	3
C16-C17	17	
C17-C18	18	
C18-C19	19	
19-C20	20	1
C20-C21	21	
C21-Pylon2	22	
Pylon2-C22	23	
C22-C23	24	2
C23-C24	25	
C24-C25	26	
C25-C26	27	
C26-C27	28	
C27-C28/A2	29	



Jig plates (shape of bridge) will be cut and installed at locations along the bridge roughly every 1 to 2m. Jig plates will aid the assembly and incorporating the change of shape and camber of bridge segment, allowing the base plate to drop in at the correct camber and elevation. The web plates will lean into jig plates at the correct angle ensuring the placement of the top flanges parallel to bottom flange.

Next the layout is surveyed, set out and marked for the standing jig plates to accommodate the length of the girders.



Figure 3: Example of Surveyed Jigs

Drop pre-marked flanges (for studs) to top of k-bracing webs and aid of jig plates to stop flanges from falling. Tack and align at site splice with correct fit up.

Finally, the bridge section in its complete shape with sides and internal fittings tacked/welded is removed from jigs and set up to complete welding.

Pylon fabrication will be undertaken using a similar jig process.

An NDT plan will identify the location and cover the required percentage. NDT will be carried out progressively to ensure all nominated locations are accessible, allowing full access for the NDT technician. The NDT plan shall be submitted for review prior to the commencement of fabrication.

Other fabrication scope includes handrails, including allowances to accommodate LED handrail lighting within handrail including drilling, tapping.

4.5 Trial Assembly

A trial assembly will be undertaken of adjacent bridge module segments (i.e. No. 1 & 2, 2 & 3 etc.) before they are transported to site. The aim of the trial assembly is to demonstrate correct bridge geometry, dimensional control for the fabrication process and correct fit-up in its weightless geometry and to ensure, camber, alignment and fit up of the field splices will be in line with expectations onsite.

The temporary supports for the girders during the trial assembly will have adequate capacity to support the girders safely under self - weight and will be positioned to replicate the expected onsite support conditions during final erection and fit up. As part of this process, segments will be supported in a manner consistent with the construction staging. Match and mark all field splices before disassembly. Joint survey with the client will be performed for the precambered girders to ensure that the fabricated girder geometry is in accordance with the pre-camber set-out information provided on the design drawings prior to dismantling. The works will also include signoff and verification before disassembly and surface treatment.

4.6 Surface Treatment / Weathering Steel Details

The steelwork of the bridge pylon and deck is using weathering steel. Surface preparation will be performed with a consistent and approved method to achieve the expected finish.

The base of the pylons (steel sections below 2.5m HAT) is to be coated (C5 - marine environment). It is proposed to apply Micaceous Iron Oxide (MIO) as part of an epoxy coating system, to give a rust appearance similar to weathering steel. The appearance will alter as the MIO rises to the surface as the coating ages.

4.7 Logistics and Transport to Site

Due to their length, width and mass, bridge pylons and bridge segments will be transported at night in sequence with onsite crane lifting activities. ‘Just in time deliveries’ are planned, commencing with segments to McCallum Park followed by Heirisson Island and finally Point Fraser.

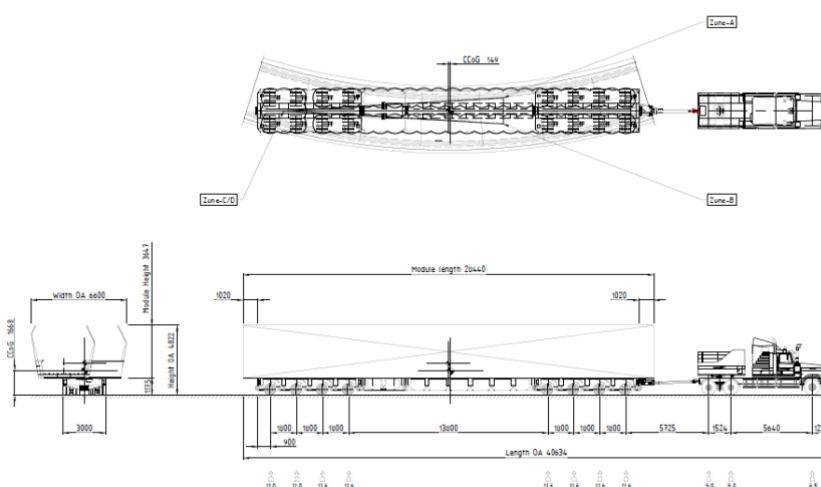


Figure 4: Typical Bridge Segment Transport Arrangement

5. SITE ESTABLISHMENT WORKS

5.1 Site Team

The project main site area will be established at McCallum Park with access from Garland Street. Temporary fencing will be installed to isolate the work zone from the public, with signage being erected to advise of the changes to footpaths and cycle paths during the work period.

Once the fence has been established an access road will be built with laydown and site office, crib room, stores and ablutions will be installed and set up for the construction team.

Erosion and Sediment controls will be set-up and maintained as per the Construction Environmental Management Plan.

Standard work hours for the project are 0700-1900 Monday to Saturday. The exceptions to this will be to implement the Riverside Drive temporary bypass link road and delivery of large bridge and pylon sections. These works will be carried out at night to minimise the impact to surrounding traffic.

Any work outside these hours requires approval from MRWA.

5.2 Daily Prestart Meetings

The project team will conduct a daily prestart meeting during which all activities for the day will be coordinated and discussed. The daily meeting will also provide a forum for open team communication and a review of the previous shift's activities.

5.3 Works by Others

Works anticipated to be completed by subcontracts will be defined as the design progresses. A preliminary listing is outlined in the below table:

Table 4: Subcontracted Works

Subcontract
Reticulation systems operation and maintenance
Telecommunication conduit redirection
Electrical installation
Piling - Land
Piling - River
Stay Cables installation
Survey - Dilapitation - Pre & Post
Survey - Dilapitation - Pre & Post
Geotech & Material Testing
Large Crane Hire (700T)
Dewatering
Heavy Haulage - Road deliveries
SPMT's / Gantry
Asphalt, Spray Seal & Prime Coat
Barges / Vessels
Landscaping (& Maintenance)
Scaffolding
Ground Improvements PVD (Wick Drains)
Ground Improvements CMC
Tree Lopping - Clear & Grubbing
Traffic Management
Temp Fencing Supply and Install
Earthworks incl. temp facilities laydown, access roads etc.

5.4 Site Access

Access to the three (3) site work locations is limited to the following points:

- The main site access will be via Garland Street into McCallum Park.
- The layby area of the Causeway northbound on Heirisson Island; and
- Riverside Drive into Point Fraser.

Detailed traffic guidance schemes for each location will be produced for the Alliance by a Roadworks Traffic Manager and agreed with the relevant authority before commencement.

5.5 Project Work Signs

All proposed locations for the signs must be marked on site plans and approved by MRWA prior to their installation. Including the expected time frames they will be installed at each location during the project duration.

- Signs and supports for roads, rivers and pathways will be fabricated and installed as per Main Roads Western Australia Standard drawings;
- The signs will be fabricated to a size 2.4m x 1.2m with the design to be provided by the MRWA; and
- All text displayed on the Project Works signs must comply with AS 1744 – Standard alphabets for road signs.

5.6 Traffic and Vessel Management

The Alliance traffic and vessel management will be detailed in:

- C301-PM-PLN-0006 Vessel Management Plan
- C301-HS-PLN-0006 Traffic Management Plan

5.7 Site Facilities

The Alliance will supply and maintain facilities on-site and will include offices, stores, toilets, washing facilities, and other facilities as required. Access to the Work Sites will be constructed by the Alliance NOP's and maintained in a dust-free condition throughout the duration of the project. Satisfactory on-site storage facilities will be provided for all materials required for the project, including hazardous materials.

The following is the proposed access road, PSP diversion and fence line for McCallum Park:



Figure 5: McCallum Park Construction Footprint

An alternative access may be required at the intersection of Garland St and Taylor St (shown in dotted red line above) pending final swept path analysis for the segments and pylon delivery.

No tree clearing is planned for the access tracks or temporary laydown at McCallum Park.

The use of generators within McCallum Park will require agreement by the LGA. The Alliance will apply to Western Power for a metered power supply that can be utilised as an alternative. The Alliance will ensure that appropriate fencing is erected at McCallum Park, Heirisson Island and Point Fraser when necessary throughout the works.

The Alliance will finalise the positioning of site facilities and all associated services including areas for waste storage, after finalising of landscape design layout.

6. EARTHWORKS

6.1 Survey Works and Setout

Prior to commencing works, the Alliance will install a survey control network consisting of markers on fixed objects along the full alignment of the bridges.

6.1.1 Bridge Works

The Alliance will establish from nearby RRM's two survey marks at each river crossing to define line and one survey mark to define level at each bridge site. The Alliance will be responsible for the protection and maintenance of these marks and will use only these marks for setting out the bridges. Setting out marks will be placed by the Alliance to an accuracy that ensures the construction tolerances of the structures.

6.2 Utilities and Services

All existing utilities and services shown on the drawings are indicative only and the Alliance will ascertain the exact location of the utilities prior to commencing works in the area. This includes locating and taking all necessary precautions when working in the vicinity of all utilities and services within the construction site. Relocation/alterations to services will be detailed below and arranged by the Alliance with the relevant utility owner.

Preliminary utility service information will be sourced from the Dial Before You Dig (DBYD) service to identify necessary service relocations within the project area.

Table 5: Service Register

Location	Service	Scope
Point Fraser	Western Power	Relocate
Point Fraser	Watercorp main line	Protect, potentially relocate
Point Fraser	Reticulation	Modify and relocate
Point Fraser	Atco gas	Redundant, test and leave in place or remove
Point Fraser	NBN	Relocate
McCallum Park	Telstra / NBN	Protect
McCallum Park	Reticulation	Relocate/protect
McCallum Park	Atco gas	Redundant, test and leave in place or remove
McCallum Park	Drain	Protect
McCallum Park	Sewer	Protect
Heirisson Island	Reticulation	Relocate/protect

The Alliance, prior to the commencement of works in the vicinity of a service, will ensure that all required alterations have been completed. Excavation work will only take place under the authority of a CLA Excavation Permit.

6.3 Vegetation Clearing and Demolition

- The Alliance will be undertaking the clearing activities on possession of site to facilitate access to work areas;
- The Alliance will complete vegetation clearing and pruning in accordance with Construction Environmental Management Plan, Project Approvals and Urban design and Landscaping IFC Drawings; (cf please refer Urban Landscape Design Framework for details of tree removal) To minimise concerns about vegetation damage outside the cleared area and to the roots of nearby preserved trees on site during excavation

activities, a preferred method of excavation in proximity to trees will be developed in consultation with an experienced arborist and approved, before being adopted on site prior to work commencing.

6.4 Ground Preparation

The extent of the ground improvement at each embankment location is shown below:

6.4.1 Ground Improvement McCallum Park

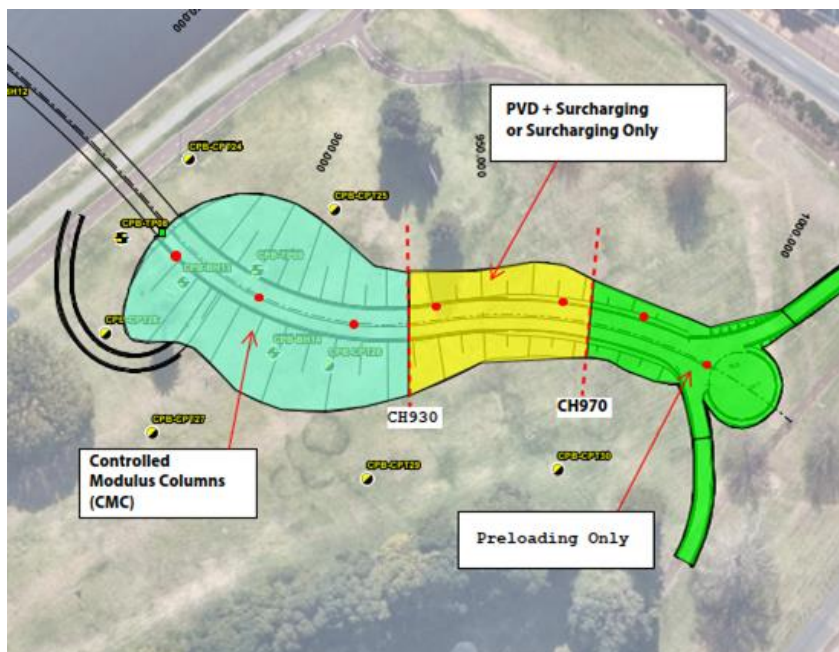


Figure 6: McCallum Park Ground Improvement Location

- Controlled Modulus Columns (CMC) to be installed in the area shown are 450mm dia in a 2m grid over the treatment area identified of 600m²;
- Perforated Vertical Drains (PVD) and surcharging loads are to be installed in the area shown for a period of approximately 3-6 months;
- Ground settlement monitoring will be done throughout the consolidation period;
- The total ground improvement identified for McCallum Park covers a 1,600m² area;
- A fill volume of material required will be approximately 3,600m³.

6.4.2 Ground Improvement Heirisson Island

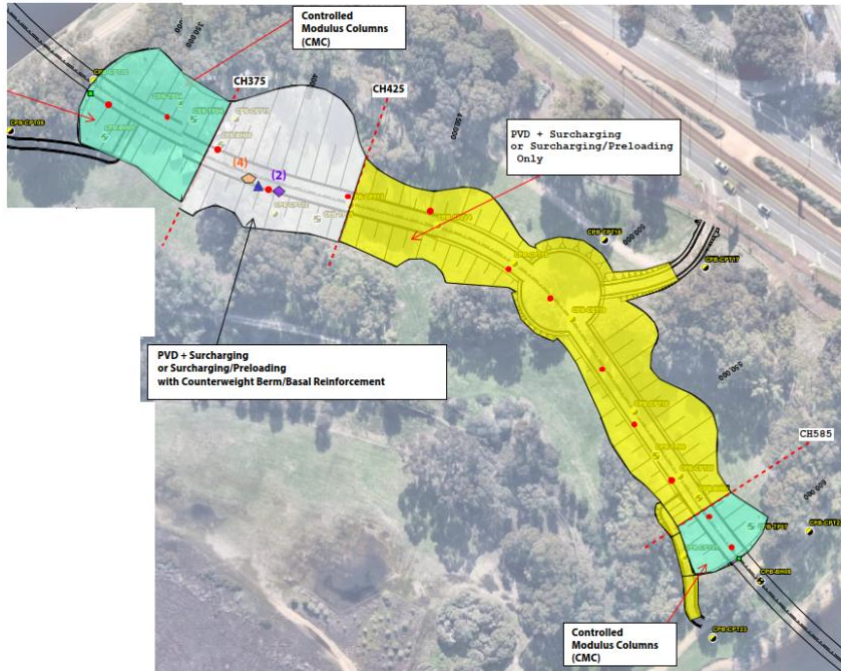


Figure 7: Heirisson Island Ground Improvement Location

- Controlled Modulus Columns (CMC) to be installed in the areas shown are 450mm dia in a 2m grid over both treatment areas identified for the first 30m behind the abutments;
- Perforate Vertical Drains (PVD) and surcharging loads are to be installed to a maximum fill height of 6m in the areas shown for a period of approximately 9-12 months;
- Ground settlement monitoring will be done throughout the consolidation period;
- The total ground improvement identified for Herisson Island covers a 6,600m² area;
- A fill volume of material required will be approximately 14,600m³.

6.4.3 Ground Improvement Point Fraser

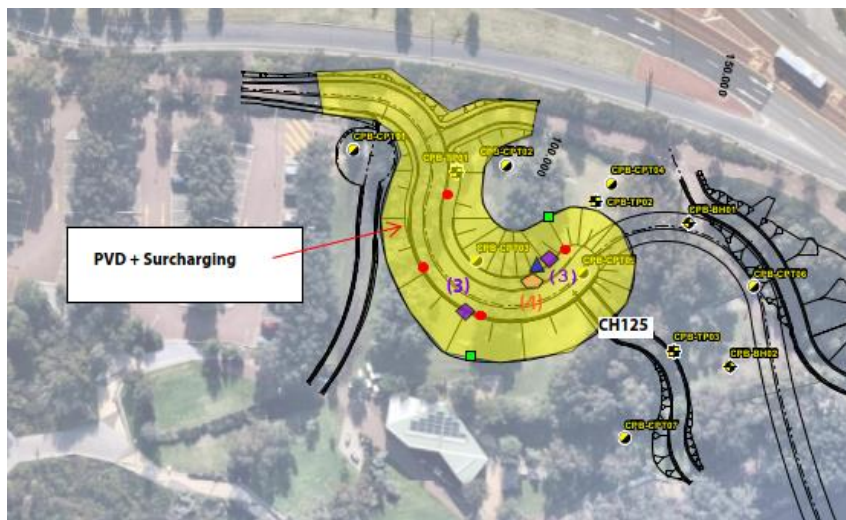


Figure 8: Point Fraser Ground Improvement Location

- Perforated Vertical Drains (PVD) and surcharging loads are to be installed to a maximum fill height of 4m in the areas shown for a period of approximately 9-12 months;

- Ground settlement monitoring will be done throughout the consolidation period;
- The total ground improvement identified for Point Fraser covers a 1,700m² area;
- A fill volume of material required will be approximately 4,000m³.

7. ABUTMENT CONSTRUCTION

The site team will ensure approvals and permits to work have been completed, submitted, authorised and issued for works to proceed;

7.1 Piling Services



Figure 9: Typical Bored Piling Set-up

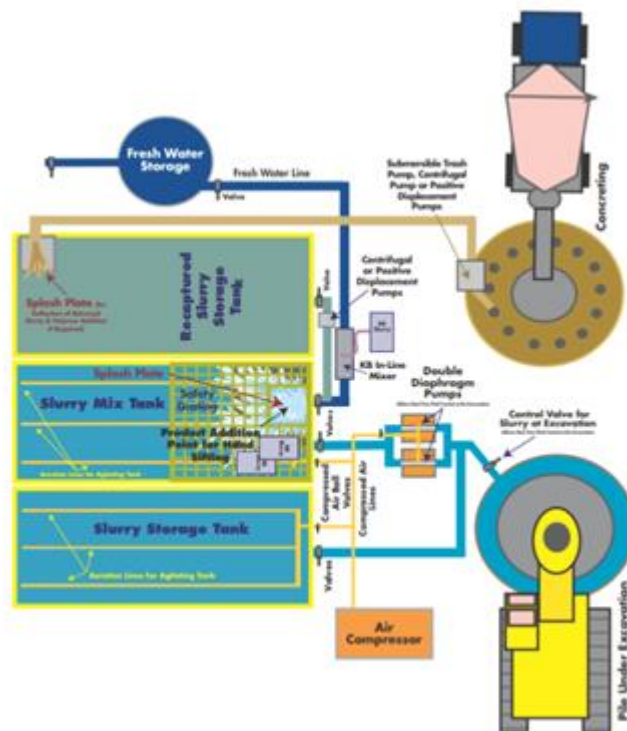


Figure 10: Typical Polymer Tank Set-up

To enable safe operation of the machinery we will prepare a level compact working surface at existing ground level with compacted crushed limestone/road base material to safely operate the piling rigs. Other works that would be required to facilitate piling scope includes:

- Survey/set out of individual piles;
- Preparation of a pile work platforms for pile installation;
- Provision of water supply for the work;
- Management of polymer slurry on site;
- Construction of sediment bunds;
- Removal from site of all spoil arising from the piling after neutralisation treatment on site or treatment of site; and
- Break back of excess concrete.

7.2 Production Piles

- Identify safe working zone around crane and auger;
- Confirm bund is installed and ready;
- Setup crane and auger over identified pile location;
- Laser align position for pile location using land based datum reference point;
- Set-up and drive temporary casing
- Commence pile boring works to the correct depth, manage spoil removal and progress;
- On completion, relocate and set up for the next pile;
- Install prefabricated cages into the bored hole;
- Ensure direction of the cages are correct and projection bar rings will enable cropping of piles to cut off level without spiral rings in the way;
- Sign off of that pile is ready for concrete to be poured;
- Pump concrete to S50MPa into pile cavity agitate until correct volume poured;
- Remove temporary casing;
- Complete concrete testing and pile testing in accordance with the specifications requirements;
- Follow the same sequence as above for all ten (10) piles;
- On completion clean up site area;
- Cutting tops off piles and prepare to incorporate into the abutment pile cap; and
- Ensure QA sign off on completion.

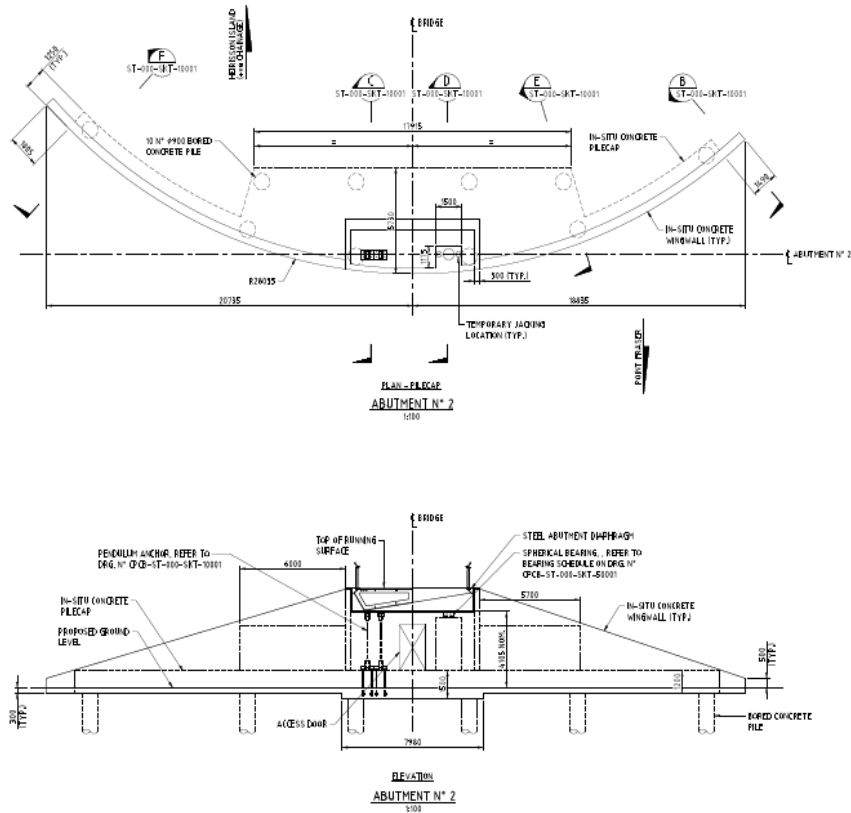


Figure 11: Abutment Arrangement

7.3 Pile-cap Footings

- Compact the soil and prepare area around piles for the abutment pile cap;
- Install 50mm blinding layer under the pile-cap footing area;
- Erect and secure the curved formwork for the pile cap;
- Install reo bar, all cast-in items, survey check and secure in place for sign off;
- Once approved pour pile-cap footing S40 concrete inside formwork and finish;
- Allow to cure and remove formwork; and
- Ensure QA sign off on completion.

7.4 Wing Walls

- Prepare top of pile cap ready for wing walls to be installed;
- Erect and secure wing wall and abutment formwork and supports. All formwork to comply with MRWA specification 821;
- Install reo cages, inserts, bearing dowel block-outs, cast-in items and secure in place, survey check for sign off;
- Once approved pour concrete wingwalls and abutment walls;
- Allow to cure and remove formwork;
- Apply bituthene 5000 waterproof membrane (300 wide) behind construction joint in abutment and walls;
- Back fill and compact to match the embankments; and
- Ensure QA sign off on completion.

8. MCCALLUM PARK BRIDGE 9505 WORKS

This section shall cover the detailed construction methodology and sequence for construction of the McCallum Park bridge works required for the Causeway Pedestrian and Cyclist Bridge project.

The Alliance will use their construction management procedures as the foundation for these construction activities. Those procedures will be supplemented with area specific requirements and risk assessments. The Alliance will ensure that all construction activities will be in accordance with project specification and that MRWA and all Stakeholders expectations are met.

In addition to the inhouse procedures and work instructions, the Alliance will utilise its inhouse procedures and work instructions to compliment these works.



Figure 12: McCallum Park Bridge Arrangement

8.1 Bridge Construction

- Works will commence with the completion of project risk assessment and associated workshop, a review of interfaces and scope with MRWA in order to ensure there are no scope gaps;
- The Alliance will check the listing of the equipment in line with MRWA and statutory documents, conduct verification of supplied items for the work and complete OSDR;
- The Alliance will ensure approvals and permits to work have been completed, submitted, authorised and issued for works to proceed;
- Survey check location of all piles and works to be carried out are to tolerance specifications provided, recorded and signed off;
- Construction of crane pads;
- Maintain detailed records of all preparation and work activities, for inspection; and
- Sign off the QA documentation associated with the work.

8.2 River Piling



Figure 13: Typical Driven Steel Tube Piling Set-up

The Alliance will install the pylon piles from a land-based crane configuration. This eliminates the requirements for temporary jetties or large barge-based equipment.

To enable safe operation of the machinery we will prepare a level compact working surface at existing ground level, with crane mats installed on top to safely operate the crane. Other works that will be required to facilitate piling scope includes:

- Survey/set out of individual piles;
- Mobilise crawler crane and set up onsite;
- Mobilise river barge for pile guidance; and
- Inspection and check of delivered piles for each location.

This setup will be carried out at McCallum Park and Heirisson Island to complete both sets of pylon piling works.

8.2.1 Production Pylon Piles

- Identify safe working zone around crane and piles;
- Locate barge, secure in position and set up guide for driven pile;
- Install silt curtain around piling area in the river;
- Ensure river and land-based spotters are in position;
- Attach identified pile to the crane and lift from the ground;
- Setup crane over identified pile location to be driven into river bed;

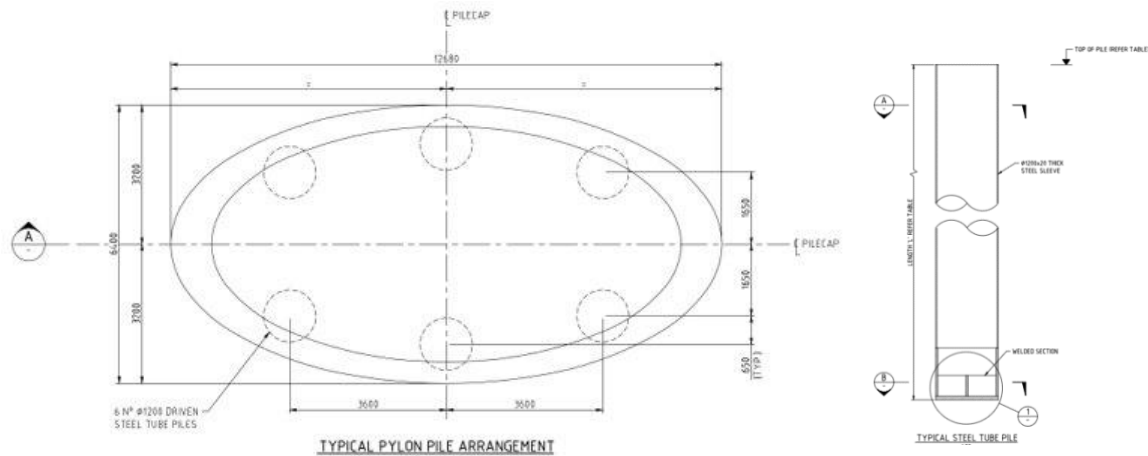


Figure 14 Typical pylon pile arrangement

- Use barge guide to ensure pile is located in its correct position;
- Laser align position in the river for pile location using land based datum reference point;
- On completion, relocate and set up for the next pile to be driven into the river bed;
- Follow the same sequence as above for all six (6) pile locations;
- On completion clean up site area, remove silt and curtain from the river; and
- Repeat the above sequence on Heirisson Island for the second set of pylon piles.

Table 6 Pile details

PILE DETAILS							
Location	Pylon	Diameter	No. of Piles	Top of Pile RL to AHD	Pile Length	Min Embedment into Kings Park Formation	Estimated top of Kings Park Formation to AHD
Heirisson	Pylon 1	1200	6	0.0	28.5	-	-29.0
McCallum	Pylon 2	1200	6	0.0	25.0	2.0	-23.0

8.2.2 Temporary Piers

- The first set of temporary pier piles and fender piles on the McCallum Park side will be completed using a similar set up for the pylon piles in section 8.2.1 above;
- The first set of temporary pier piles and fender piles on the Heirisson Island side will be completed using the same set up for the pylon piles in section 8.2.1 above;
- Once the pier piles are in place the portal frame will be lifted into position and secured to the temporary piles;
- The barge will be used to locate the portal frame onto the piles;
- Once in place the portal frame will be secured in place and made safe;
- Once they have been completed the final two sets of temporary portal frames, piles and fender piles will be installed from the barge;
- Prepare barge with piling crane, portal frame piles and fender piles for the works;

- Locate barge, secure in position and set up for temporary pile installation;
- Install silt curtain around piling area in the river;
- Ensure river spotters are in position;



Figure 15: Typical Piling Barge Set-up

- Setup pile rig over pier pile location to be driven into river bed;
- Laser align position in the river for pile location using land based datum reference point;
- When the portal frame pile is completed, install the three fender piles around it;
- On completion, relocate and set up for the final pier pile to be driven into the river bed;
- Laser align position in the river for pile location using land based datum reference point;
- When the pier pile is completed, install the three (3) fender piles around it;

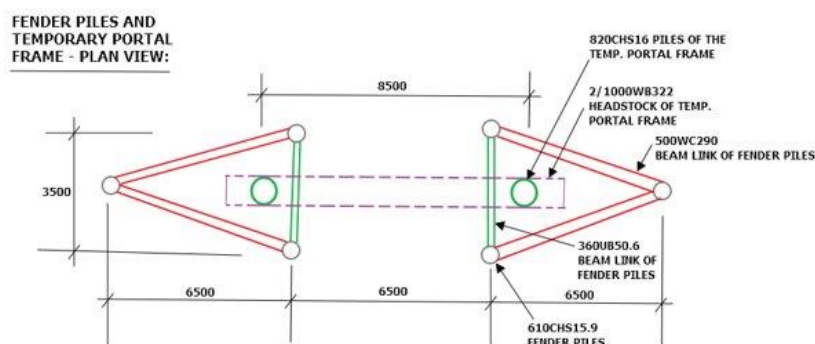


Figure 16: Typical Fender Arrangement

- Once the pier piles are in place, a separate crane barge will be used to lift the portal frames into position and secured to the temporary piles;



Figure 17: Crane Barge to Lift Portal Frames

- The barge will be used locate the portal frame onto the piles;
- Once in place the portal frame will be secured in place and made safe;
- The fenders will then be installed around the portal frame to protect them whilst in operation; and
- On completion clean up site area, remove silt and curtain from the river.

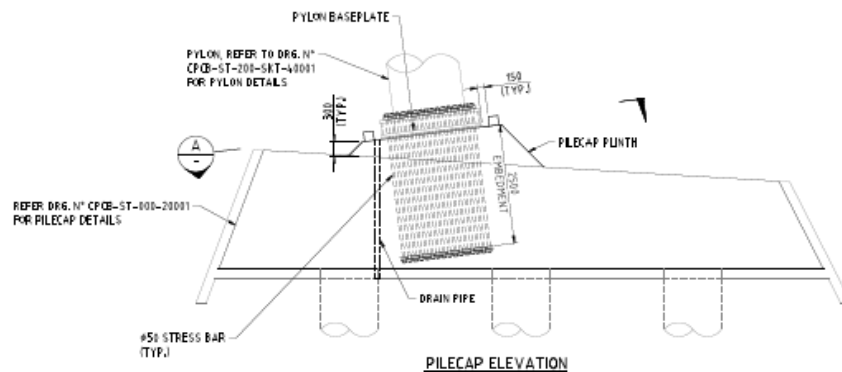
8.2.3 Pile Caps

- All pylon pile caps will be made identical utilising pre-cast shells (base and walls) made off-site;
- Site preparation at McCallum Park for the delivery and stillage supports for the pile cap shell sections;
- Crane and spreader bar required to unload pile cap shells;



Figure 18: Typical Pile Cap Shell Installation

- Set up barge with EWP and divers on board;
- Locate barge, secure in position;
- Ensure river and land based spotters are in position;
- One at a time, lower pile cap support brackets onto piles and lower into place in the water;
- Divers will be used to weld the support brackets into place on the piles;
- Ensure all pile support brackets and secured in place, and aligned within tolerance;
- Attach crane and spreader bar to the first pile cap shell half and trial lift;
- Check level and alignment, if adjustment required lower and re-set;
- Lift pile cap shell half into position and lower onto piles;
- Confirm position and guide pile cap into place from the barge;
- Once lowered in place and located on the pile support brackets, the divers will confirm in place;
- Release slings using barge based EWP;
- Attach crane and spreader bar to the second pile cap shell half and trial lift;
- Check level and aligned, if adjustment required lower and re-set;
- Lift pile cap shell half into position and lower onto piles;
- Confirm position and guide pile cap into place from the barge;
- Once lowered in place and located on the pile support brackets, the divers will confirm in place;
- The divers will connect the cast in connection brackets to secure the two halves together and seal the joints;
- Once completed the work platform will be attached to the pile cap shell and made safe for internal works to proceed;
- Install internal reo bar and cages into shell and secure in place;
- Install Pylon base plate arrangement (with 30 off 50mm diameter stress bars) 2500mm into the shell. Survey check and align base plate and secure in position;
- Install all inserts and cast in items and secure in place;
- Once signed off and approved concrete can be poured;
- Pump concrete into pile cap shell and complete pour;



- Once complete, relocate to Heirisson Island and repeat the complete sequence for the pile cap works on that side of the river;
- Clean up site on completion;

- Maintain detailed records of all preparation and work activities, for inspection; and
- Sign off the QA documentation associated with the work;

8.3 Bridge Installation

The Alliance will install bridge segments, where possible, from a land-based crane configuration. The centre three sections will be installed by jacking them into place from barge-based equipment.

To enable safe operation of the crane we will prepare a level compact working surface in accordance with the crane pad design. Typically crane mats will be installed on top to safely operate the crane and lifting equipment. Other works that will be required to facilitate piling scope includes:

- Clear site area for crane set-up and assembly;
- Mobilise 700T crane and all equipment, trailers, assembly crane, etc to set up onsite;
- Rigging equipment assembled ready for operation and checked;
- Mobilise river barge with EWP and jacking equipment on board; and
- Inspect and check bridge segment modules for each location.

This setup will be carried out at McCallum Park and Heirisson Island to complete both sets of pylon piling works.

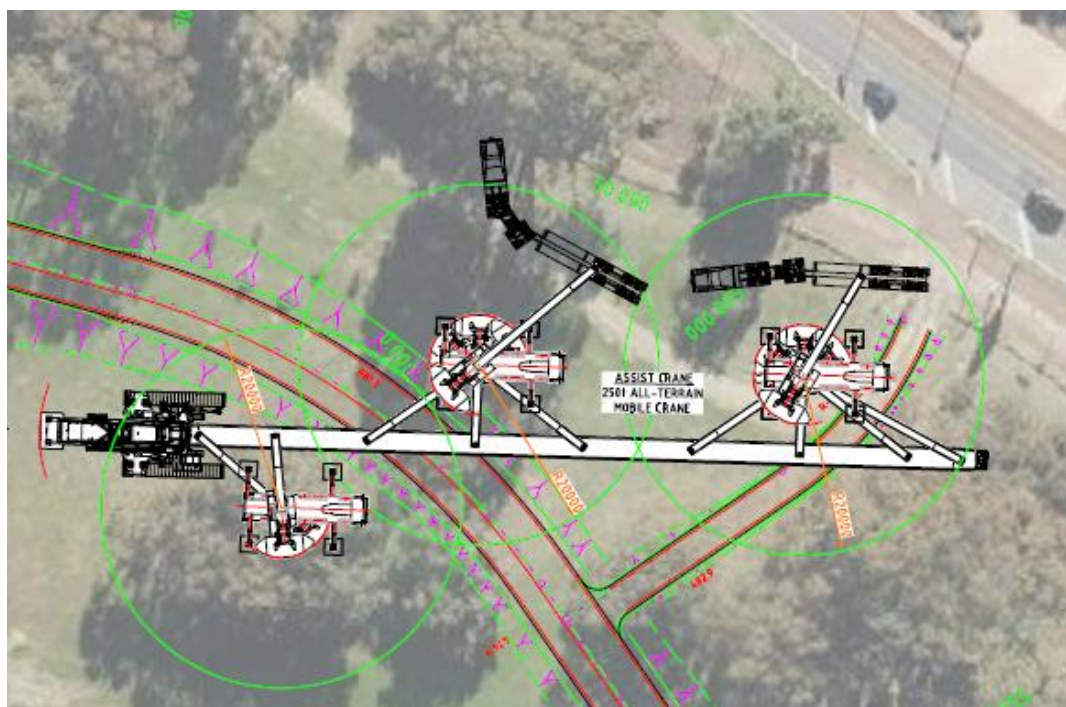


Figure 19: Indicative 700T Crane being set-up

8.3.1 McCallum Park Installation

- Once the 700T crane has been assembled remove all assistance vehicles and trailers from site;
- Check crane operation and set up for lifts;

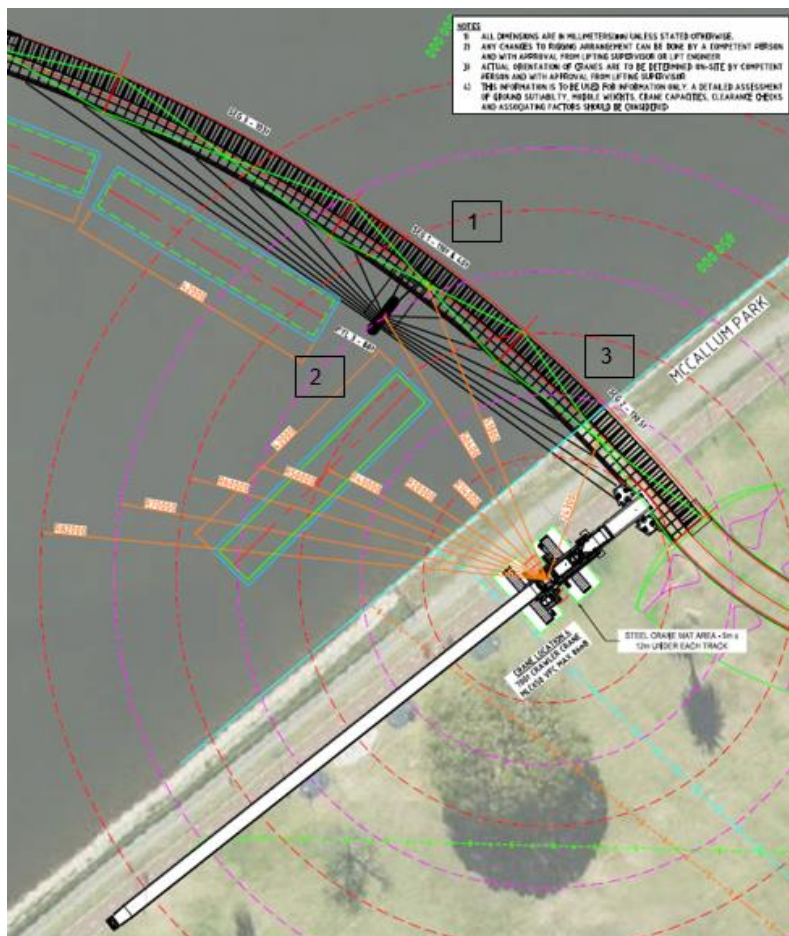


Figure 20: Bridge Segment and Pylon Installation Sequence

- Confirm all lifting plans have been checked and signed off for the works to proceed;
- Prepare site for first bridge segment delivery;
- Segment 1 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 1 and using EWP's attach the slings;
- Remove transport lashings from bridge segment;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position;

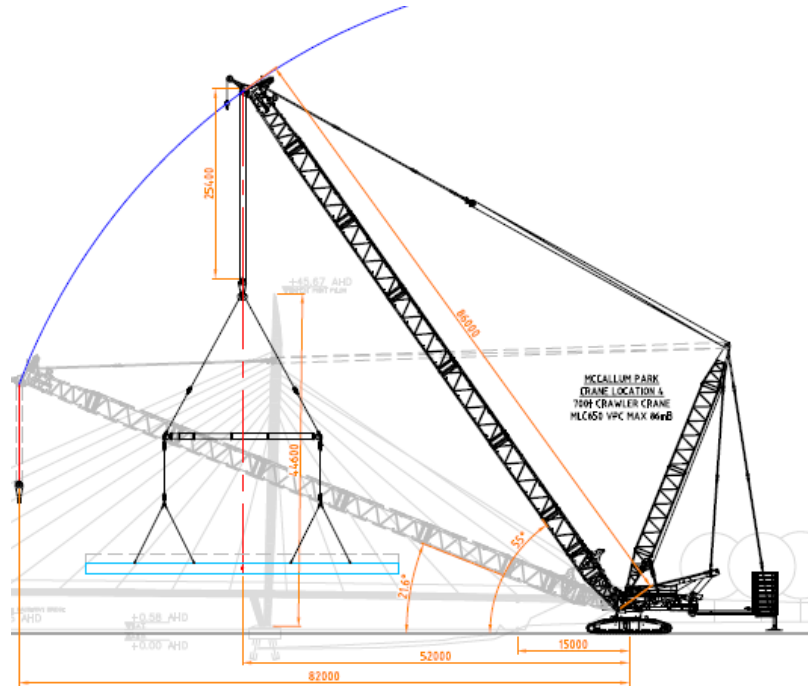


Figure 21: Bridge Segment Lifting Arrangement

- Lift bridge segment 1 and swing slowly into position over the portal frames;
- When in position lower gently onto the portal frame;
- Confirm segment is in the correct supported position on the portal frame;
- Survey check and adjust as required;
- Once confirmed and supported use EWP on the barge to remove slings;

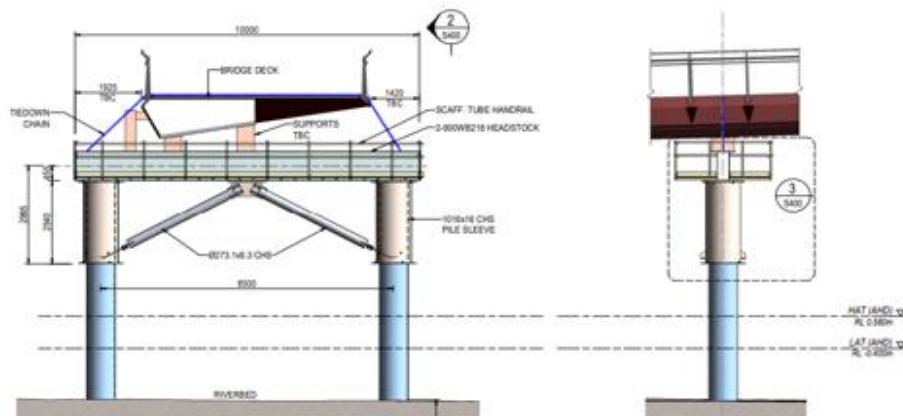


Figure 22: Bridge Segment on Portal Support Arrangement

- Set up 700T and 100T cranes for pylon dual lift;
- Change spreader bar and lifting equipment on 700T crane;
- Pylon to be delivered directly under crane hooks;
- Attach both cranes to pylon – 100T crane at base;

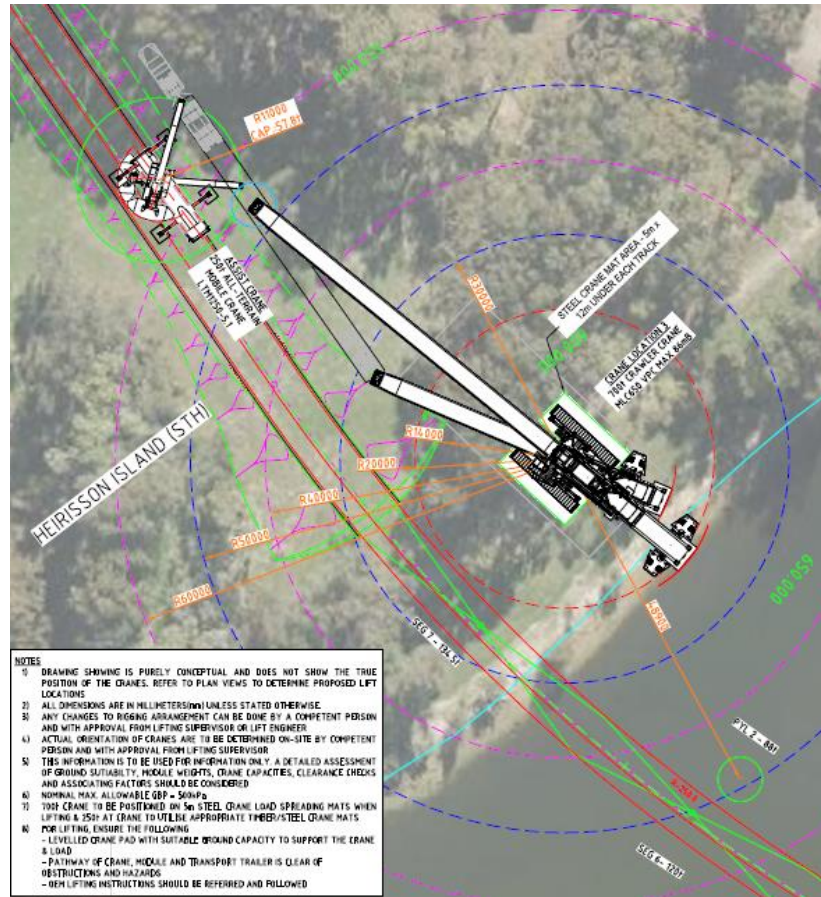


Figure 23: Typical Pylon Lifting Arrangement

- Remove transport lashings from pylon;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position at pile cap and crew on walkways ready;
- Lift pylon clear of transport and remove vehicle;
- Continue to lift with 700T crane only;
- When in vertical position lower 100T crane until load is taken by 700T crane;
- Detach 100T crane slings from pylon;
- Lift bridge pylon and swing slowly into position over the pile cap;
- When in position lower gently using guides to align the pylon base plate with the mating pile cap base plate;
- Bolt base plates together. Survey check and adjust as required;
- Insert all bolts and tighten in sequence to designated torque and secure pylon in place;
- Once confirmed and supported use EWP on the barge to remove slings;

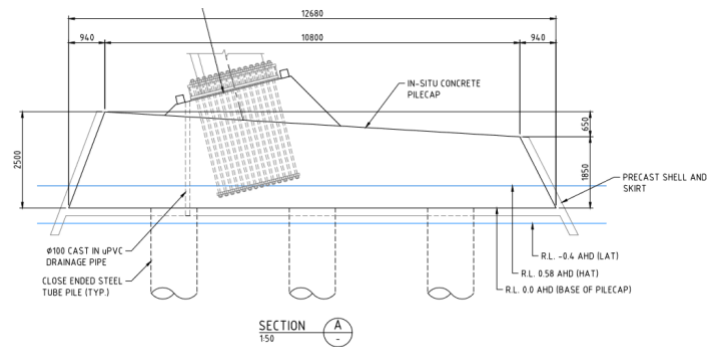


Figure 24: Typical Pylon Baseplate Connection

- Set up crane for pylon split section from segment 1;
- Attach crane to one half on the split section;
- Lift split section into position and attach to bridge segment 1, around pylon;
- Temporarily bolt into place on bridge segment;
- Attach crane to other half of the split section;

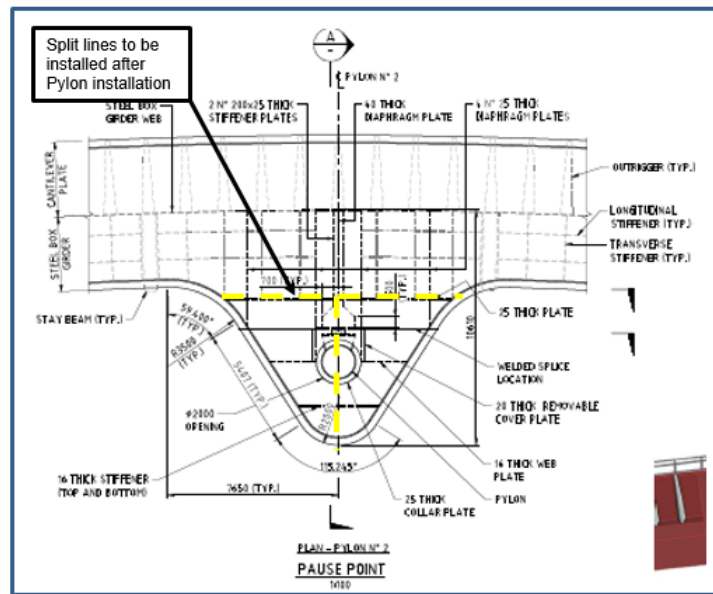


Figure 25: Arrangement Showing Split Sections Around Pylon

- Lift split section into position and attach to bridge segment 1, around pylon;
- Temporarily bolt into place on bridge segment and to other half;
- Confirm split sections are in the correct supported position on bridge segment 1;
- Once confirmed and supported use EWP on the barge and land to remove slings;
- Install hydraulic pull cylinders to the strong backs on each side where the two split sections meet;



Figure 26: Typical Hydraulic Pull Cylinder and Bolting Frame

- Adjust cylinders to achieve the required gap between split joints bridge segment;
- Survey check and adjust as required;
- Install temporary bolts and frames to hold in place;
- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joint to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Install spherical bearing between pylon and bridge segment, once in place install cover plate and secure;

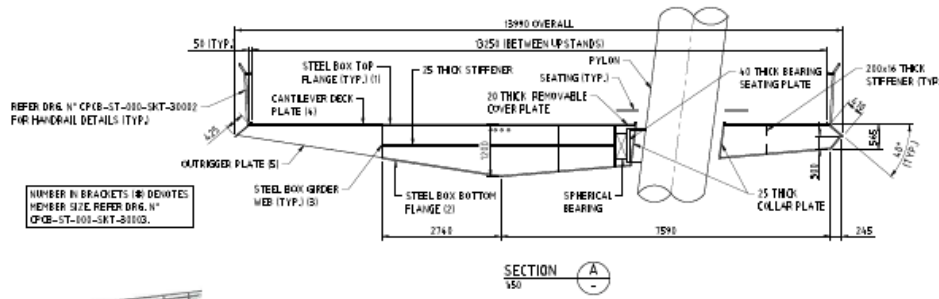


Figure 27: Typical Pylon Bridge Segment Interface – McCallum Park Pylon 2

- Set up crane for next segment lift;
- Relocate barge to portal frames for bridge segment 2;
- Segment 2 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 2 and using EWP’s attach the slings;
- Remove transport lashings from bridge segment;
- Install pendulum bearings into bridge segment at abutment end, and secure in place with anchor pins;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position;

- Remove all equipment and encapsulation;
- Reposition barge to next location or shore;
- Demobilise crane, disassemble and relocate to Heirisson Island;
- Clean up site on completion:
- Maintain detailed records of all preparation and work activities, for inspection; and
- Sign off the QA documentation associated with the work.

8.3.2 Heirisson Island Installation

- Once the 700T crane has been assembled remove all assistance vehicles and trailers from site;
- Check crane operation and set up for lifts;

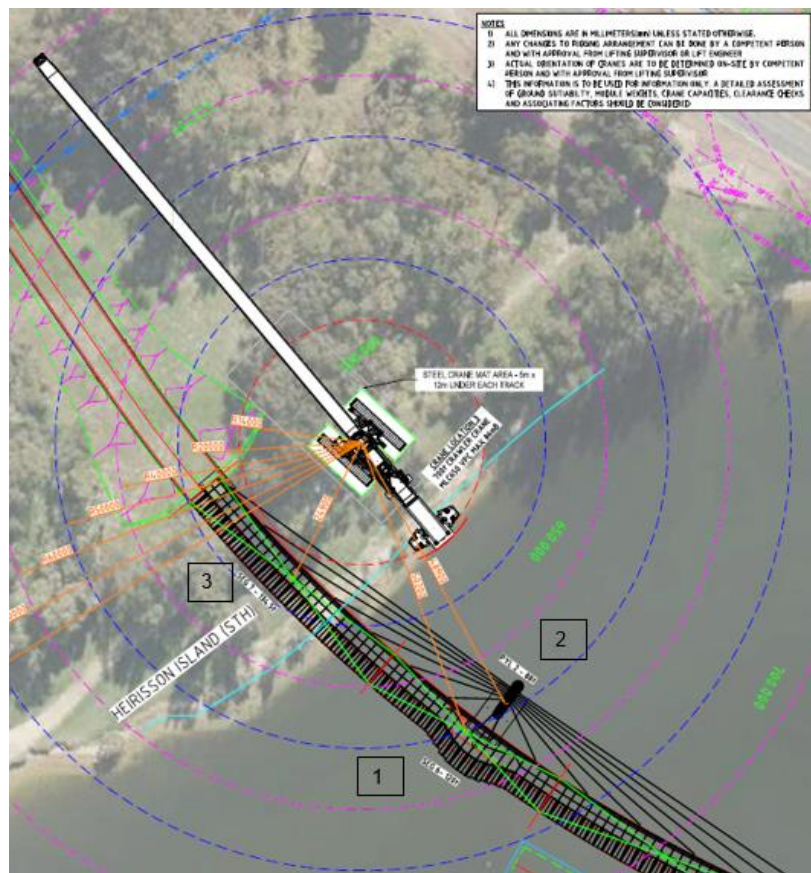


Figure 29: Bridge Segment Installation Sequence

- Confirm all lifting plans have been submitted and sign off for the works to proceed;
- Prepare site for first bridge segment delivery;
- Segment 6 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 6 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position;

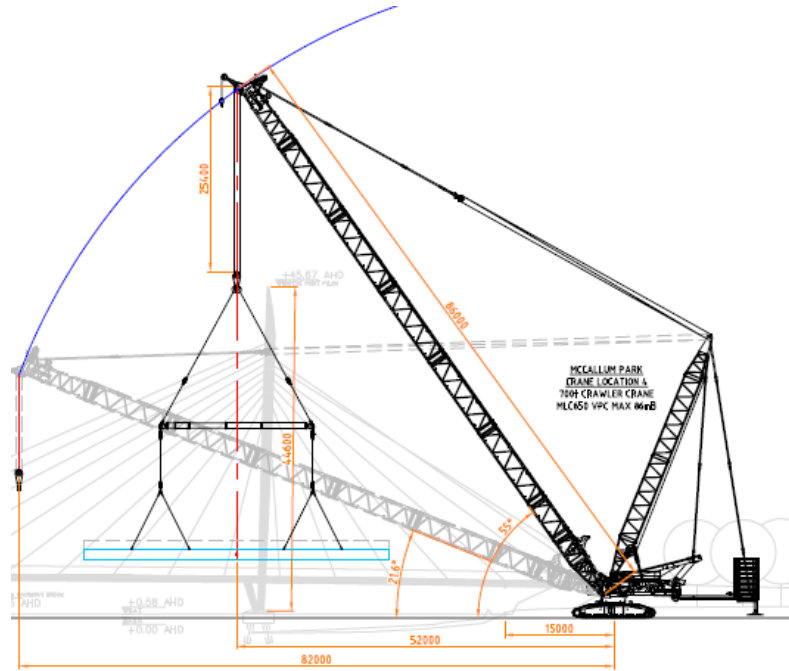


Figure 30: Bridge Segment Lifting Arrangement

- Lift bridge segment 6 and swing slowly into position over the portal frames;
- When in position lower gently onto the portal frame;
- Confirm segment is in the correct supported position on the portal frame;
- Survey check and adjust as required;
- Once confirmed and supported use EWP on the barge to remove slings;

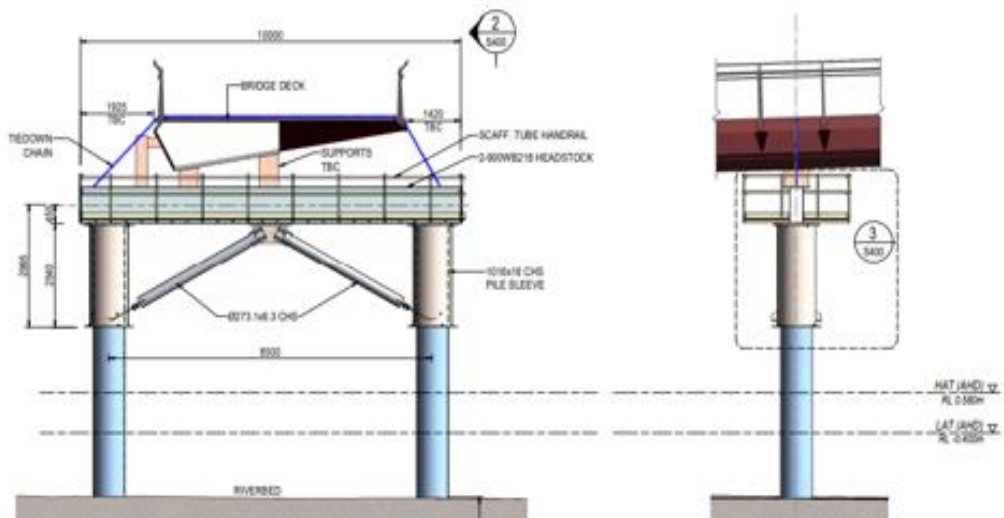


Figure 31: Bridge Segment on Portal Support Arrangement

- Set up 700T and 100T cranes for pylon dual lift;
- Change spreader bar and lifting equipment on 700T crane;
- Pylon to be delivered directly under crane hooks;
- Attach both cranes to pylon – 100T crane at base;

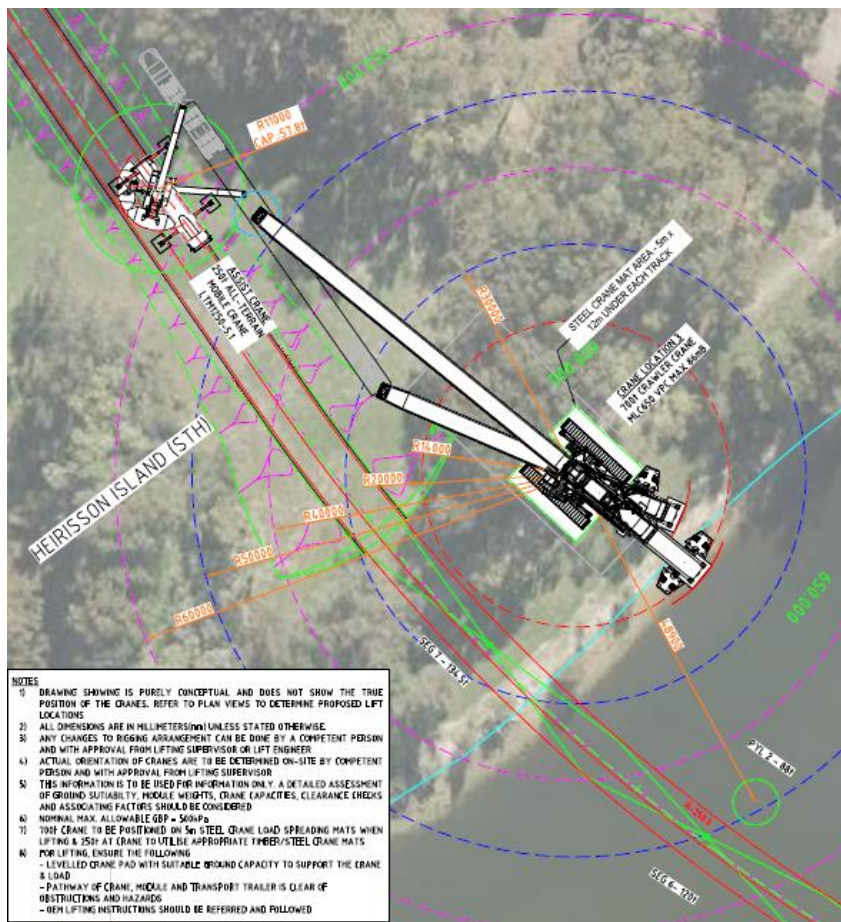


Figure 32: Typical Pylon Lifting Arrangement

- Remove transport lashings from pylon;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position at pile cap and crew on walkways ready;
- Lift pylon clear of transport and remove vehicle;
- Continue to lift with 700T crane only;
- When in vertical position lower 100T crane until load is taken by 700T crane;
- Detach 100T crane slings from pylon;
- Lift bridge pylon and swing slowly into position over the pile cap;
- When in position lower gently using guides to align the pylon base plate with the mating pile cap base plate;
- Bolt base plates together. Survey check and adjust as required;
- Insert all bolts and tighten in sequence to designated torque and secure pylon in place;

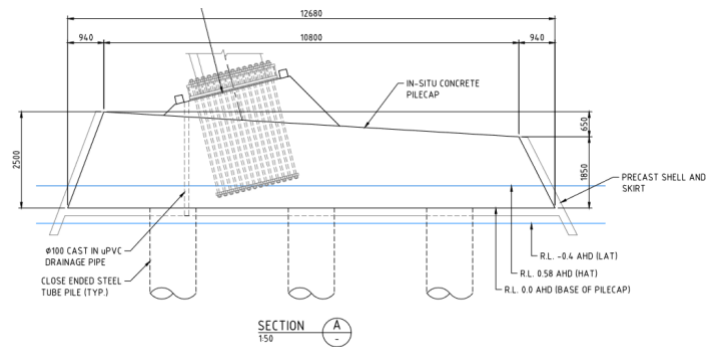


Figure 33: Typical Pylon Baseplate Connection

- Once confirmed and supported use EWP on the barge to remove slings;
- Lift cross beam into position between bridge segment and pylon;
- Secure in place ready for welding;
- Confirm survey check for correct alignment;
- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joint to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Install spherical bearing between pylon and bridge segment, once in place install cover plate and secure;

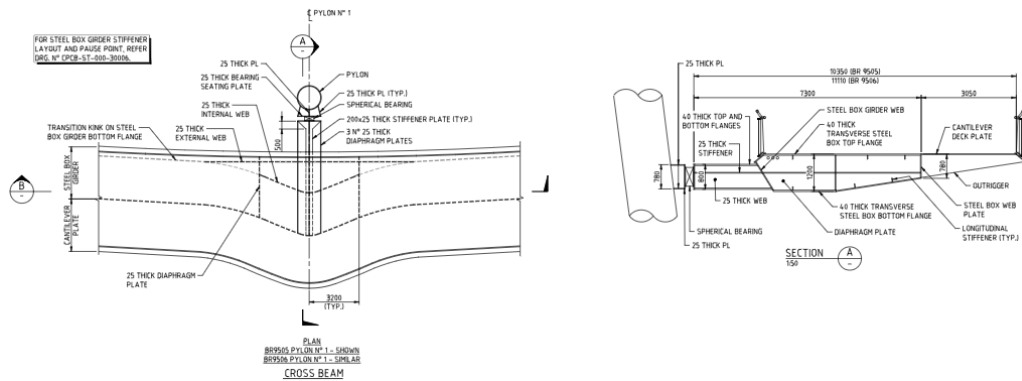


Figure 34: Typical Pylon Bridge Segment Interface

- Set up crane for next segment lift;
- Relocate barge to portal frames for bridge segment 7;
- Segment 7 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 7 and using EWP's attach the slings;
- Remove transport lashings from bridge segment;
- Install pendulum bearings into bridge segment at abutment end, and secure in place with anchor pins
- Trial lift and check level and aligned, if adjustment required lower and re-set;

- Remove all equipment and encapsulation;
- Reposition barge to next location or shore;
- Relocate 700T crane to the West side of Heirisson Island for Point Fraser Bridge lift works;
- Clean up site on completion:
- Maintain detailed records of all preparation and work activities, for inspection; and
- Sign off the QA documentation associated with the work.

8.3.3 Barge Installation

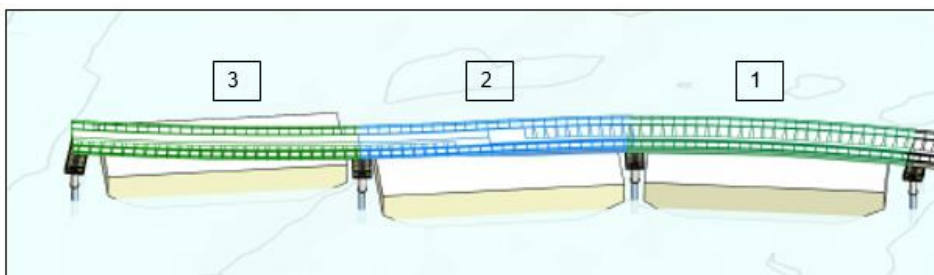


Figure 36: Barge Sequence

- Check 700T crane operation and set up for lift;
- Confirm all lifting plans have been submitted and sign off for the works to proceed;
- Prepare site for bridge Segment 3 delivery;
- Segment 3 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 3 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position and jacking supports are ready;
- Lift segment 3 into position over barge;
- Check bridge segment is spaced correctly between jack supports;
- Lower bridge segment onto barge jacking supports;
- Confirm position and barge balance, and barge operator acceptance of load;
- Using EWP disconnect slings from bridge segment;



Figure 37: Bridge Segment Loaded onto Barge

- Ensure bridge segment is jacked up to sufficient clearance height at each end;
- Untether barge and tow into position between the portal frames next to bridge segment 2;
- Once in position secure barge in place;
- Check clearances and lower bridge segment onto portal frames;
- Survey check alignment and adjust if required;
- Once in place lower barge jacking frame to position segment;
- Install hydraulic pull cylinders to the strong backs on both ends of the bridge segments 2 and 3;
- Adjust cylinders to achieve the required gap between bridge segments;
- Survey check and adjust as required;
- Install temporary bolts and frames to hold in place;



Figure 38: Typical Hydraulic Pull Cylinder and Bolting Frame

- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joints to the specified welding procedure and sequence;

- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Clean up site on completion:
- Return barge to shore for the next bridge segment;
- Check 700T crane set up for lift;
- Prepare site for bridge segment 4 delivery;
- Segment 4 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 4 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position and jacking supports are ready;
- Lift segment 4 into position over barge;
- Check bridge segment is spaced correctly between jack supports;
- Lower bridge segment onto barge jacking supports;
- Confirm position and barge balance, and barge operator acceptance of load;
- Using EWP disconnect slings from bridge segment;



Figure 39: Bridge Segment Loaded onto Barge

- Ensure bridge segment is jacked up to sufficient clearance height at each end;
- Untether barge and tow into position between the portal frames and next to bridge segment 3;
- Once in position secure barge in place;
- Check clearances and lower bridge segment onto portal frames;
- Survey check alignment and adjust if required;
- Once in place lower barge jacking frame to position segment;

- Install hydraulic pull cylinders to the strong backs on both ends of the bridge segments 3 and 4;
- Adjust cylinders to achieve the required gap between bridge segments;
- Survey check and adjust as required;
- Install temporary bolts and frames to hold in place;



Figure 40: Typical Hydraulic Pull Cylinder and Bolting Frame

- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joints to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Clean up site on completion:
- Return barge to shore for the next bridge segment;
- Check 700T crane set up for lift;
- Prepare site for bridge segment 5 delivery;
- Segment 5 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 5 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position and jacking supports are ready;
- Lift segment 5 into position over barge;
- Check bridge segment is spaced correctly between jack supports;
- Lower bridge segment onto barge jacking supports;
- Confirm position and barge balance, and barge operator acceptance of load;
- Using EWP disconnect slings from bridge segment;



Figure 41: Bridge Segment Loaded onto Barge

- Ensure bridge segment is jacked up to sufficient clearance height at each end;
- Untether barge and tow into position between the portal frames and bridge segment 4;
- Once in position secure barge in place;
- Check clearances and lower bridge segment onto portal frames;
- Survey check alignment and adjust if required;
- Once in place lower barge jacking frame to position segment;
- Install hydraulic pull cylinders to the strong backs on both ends of the bridge segments 4 and 5;
- Adjust cylinders to achieve the required gap between bridge segments;
- Survey check and adjust as required;
- Install temporary bolts and frames to hold in place;



Figure 42: Typical Hydraulic Pull Cylinder and Bolting Frame

- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joints to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;

- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Clean up site on completion:
- Demobilise barge;
- Maintain detailed records of all preparation and work activities, for inspection; and
- Sign off the QA documentation associated with the work.

8.4 Bridge Stay Cable Installation

Once the bridge segments have been installed, fully welded, inspected and signed off for acceptance the bridge stay cables can be installed.

- Clear site area for 450T crane set-up;
- Mobilise 450T crane and all equipment to set up onsite;
- Rigging equipment assembled ready for operation and checked;
- Prepare EWP, telehandler and bridge inspection vehicle; and
- Inspection and check delivered bridge stay cables are identified correctly for each location.

This setup will be carried out at McCallum Park and Heirisson Island to complete both sets of stay cable installation works.

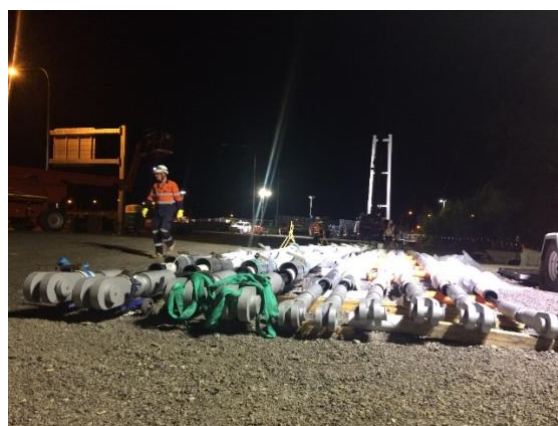
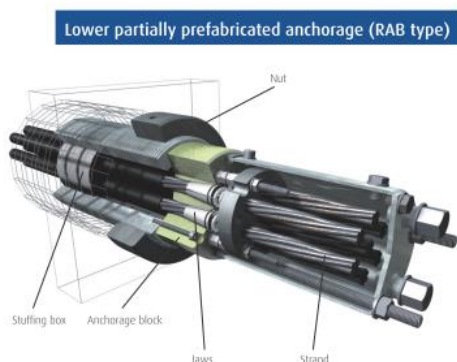


Figure 43: Typical Cable assembly and Preparation for Installation on Site

- Attach crane to first cable stay at the forked anchor end;
- Position EWP alongside the pylon and raised to the first stay connection point;
- Swing the stay cable into position;
- When near the pylon carefully lower to the connection plate;

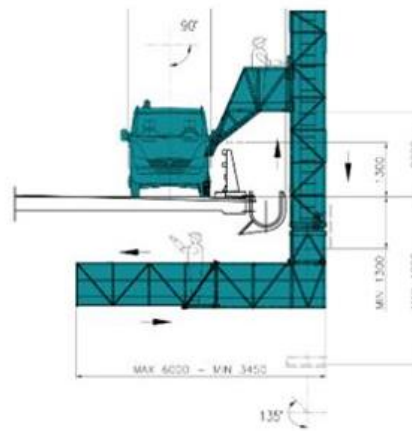
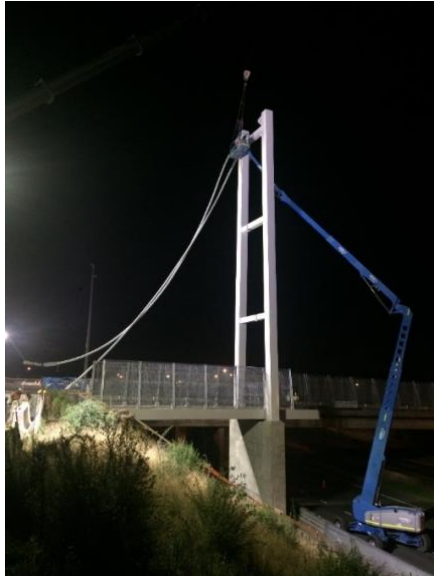


Figure 44: Typical EWP and Bridge Inspection Vehicle Set-up

- The EWP crew will then manoeuvre into position with a location bar and insert the anchor pin and lock the connection in place;
- Once secure the other end of the stay cable will be attached to the telehandler and driven along the bridge to its connection point;
- The bridge inspection vehicle will lower its inspection frame over the side of the bridge;
- The installation crew can then access the stay cable connection point;
- The telehandler will then lower the cable over the side for installation;
- Once the cable has been located and pinned into position the tensioning device will be installed around the cable;
- The cable will then be pre-tensioned to a pre-determined tension to support the bridge;



Figure 45: Typical Stay Cable Tensioning Device

- Once the stay cable is installed, inspected and check to confirm the tension is correct, the next stay cable can be installed;

- The above procedure will be repeated for all stay cables until they are all attached to the pylon and bridge connection points. Working from the shortest stay cables out to the longest, and from the pylon to shore first, then from the pylon to the furthest point along the bridge;
- Once complete repeat the same sequence for Heirisson Island;
- Once the portal frames have been removed and the bridge is supporting itself, the bridge will be surveyed and load checked;
- Then final adjustment and tensioning of the stay cables will be carried out where required;
- On completion clean the site and the bridge;
- Maintain detailed records of all preparation and work activities, for inspection; and
- Sign off the QA documentation associated with the work.

8.5 Portal Frame Removal

- Once the stay cable have all been installed and pre-tensioned, the barge can be mobilised to remove the temporary portal frames and piles;
- Ensure water based spotter is in place and river is being monitored;
- Working from one side to the other set up barge alongside the portal frame;
- Release holding chains and remove;
- Remove the bridge supports;
- Remove handrails and everything else from the deck;
- Remove the portal braces from underneath;
- Attach the crane to the portal frame deck and disconnect it from the pile sleeves;
- Remove the deck and lower onto the barge;
- Then remove the sleeves from each pile;
- Repeat this procedure until all portal frames have been removed;
- Once all portal frames have been removed set up the barge and crane to remove the temporary portal frame piles;
- Position the barge next to the pile;
- Attach the crane securely to the pile and extract the pile from the river bed;
- Lift out of the water onto the barge deck;
- Repeat this process until all temporary piles have been removed;
- NOTE: If a temporary pile cannot be removed, the intention is to have divers on board the barge who will be required to cut the pile off at the river bed so the rest of the pile can be removed;
- On completion demobilise the barge and all equipment;

9. POINT FRASER BRIDGE 9506 WORKS

This section shall cover the detailed construction methodology and sequence for construction of the McCallum Park bridge works required for the Causeway Pedestrian and Cyclist Bridge project.



Figure 46: Point Fraser Bridge Arrangement

9.1 River Piling

Refer to Section 8.2 for similar river piling construction method.

Table 7 Pile details

PILE DETAILS							
Location	Pylon	Diameter	No. of Piles	Top of Pile RL to AHD	Pile Length	Min Embedment into Kings Park Formation	Estimated top of Kings Park Formation to AHD
Point Fraser	Pylon 1	1200	6	0.0	30.0	-	-38.0

9.2 Heirisson Island Installation

- Once the 700T crane has been assembled remove all assistance vehicles and trailers from site;
- Check crane operation and set up for lifts;

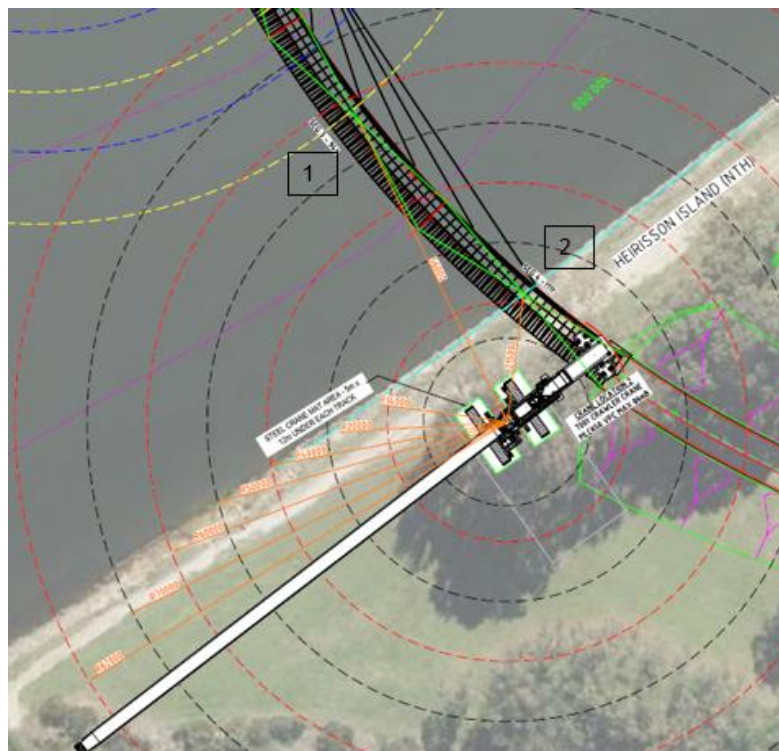


Figure 47: Bridge Segment Installation Sequence

- Confirm all lifting plans have been submitted and sign off for the works to proceed;
- Prepare site for first bridge segment delivery;
- Segment 3 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 3 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment;

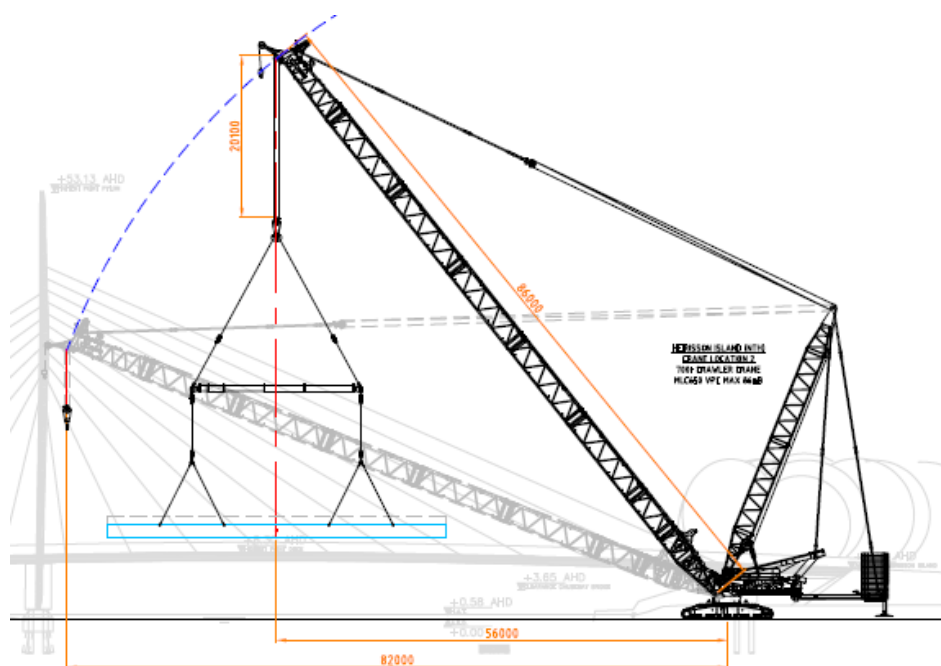


Figure 48: Bridge Segment Lifting Arrangement

- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position;
- Lift bridge segment 3 and swing slowly into position over the portal frames;

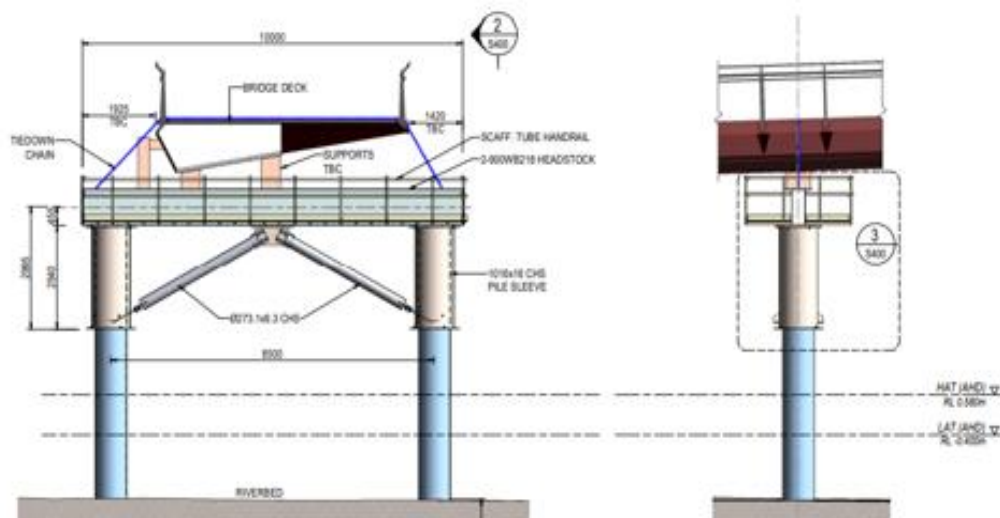


Figure 49: Bridge Segment on Portal Support Arrangement

- When in position lower gently onto the portal frame;
- Confirm segment is in the correct supported position on the portal frame;
- Survey check and adjust as required;
- Once confirmed and supported use EWP on the barge to remove slings;
- Set up crane for next segment lift;
- Relocate barge to portal frames for bridge segment 4;
- Segment 4 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 4 and using EWP's attach the slings;
- Remove transport lashings from bridge segment;
- Install pendulum bearings into bridge segment at abutment end, and secure in place with anchor pins
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position;
- Lift bridge segment 4 and swing slowly into position over the portal frame and abutment;
- When in position lower gently onto the portal frame next to segment 3, and Heirisson Island abutment spherical bearings;
- Install pendulum bearings into the base plate and install lower anchor pins;
- Confirm segment is in the correct supported position on the portal frame and the abutment pendulum and spherical bearings;

- Sign off the QA documentation associated with the work.

9.2.1 Point Fraser Installation

- Once the 700T crane has been assembled remove all assistance vehicles and trailers from site;
- Check crane operation and set up for lifts;
- Confirm all lifting plans have been submitted and sign off for the works to proceed;
- Prepare site for first bridge segment delivery;

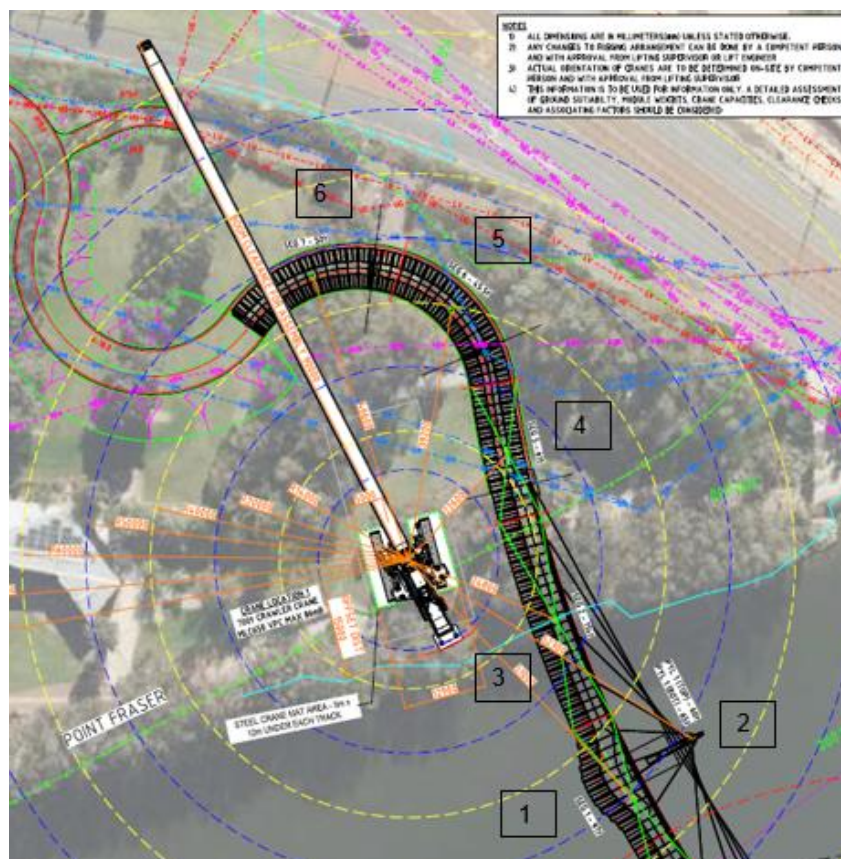


Figure 51: Bridge Segment Installation Sequence

- Segment 1 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 1 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position;
- Lift bridge segment 1 and swing slowly into position over the portal frames;
- When in position lower gently onto the portal frame next to segment 3;
- Confirm segment is in the correct supported position on the portal frame;

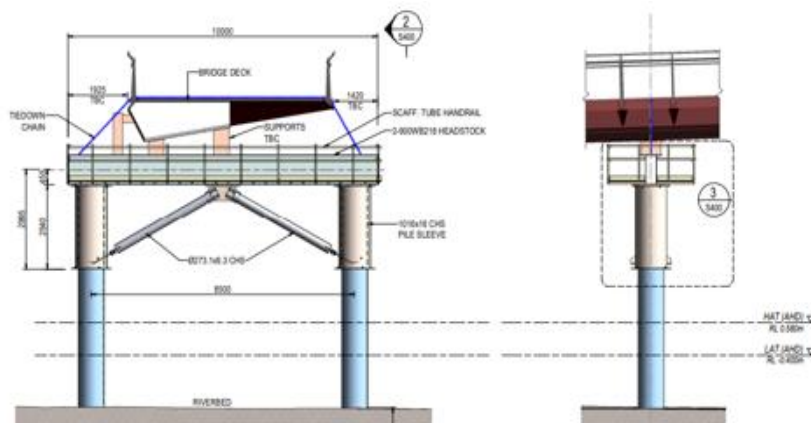


Figure 52: Bridge Segment on Portal Support Arrangement

- Survey check and adjust as required;
- Once confirmed and supported use EWP on the barge to remove slings;
- Install hydraulic pull cylinders to the strong backs on each side where the two segments meet on the portal frame;
- Adjust cylinders to achieve the required gap between bridge segments 1 and 3;
- Survey check and adjust as required;
- Install temporary bolts and frames to hold in place;



Figure 53: Typical Hydraulic Pull Cylinder and Bolting Frame

- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joint to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Set up 700T and 100T cranes for lower pylon dual lift;
- Change spreader bar and lifting equipment on 700T crane;
- Pylon lower section to be delivered directly under crane hooks;
- Attach both cranes to the lower pylon half – 100T crane at base;

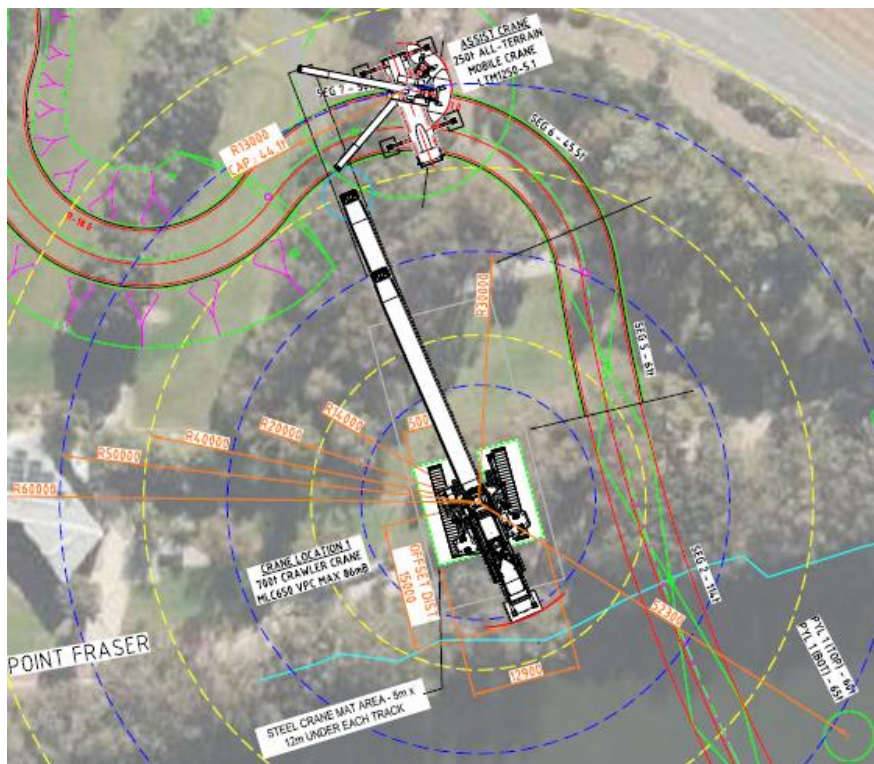


Figure 54: Typical Pylon Lifting Arrangement

- Remove transport lashings from lower pylon;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position at pile cap and crew on walkways ready;
- Lift pylon clear of transport and remove vehicle;
- Continue to lift with 700T crane only;
- When in vertical position lower 100T crane until load is taken by 700T crane;
- Detach 100T crane slings from pylon;
- Lift bridge pylon and swing slowly into position over the pile cap;
- When in position lower gently using guides to align the pylon base plate with the mating pile cap base plate;

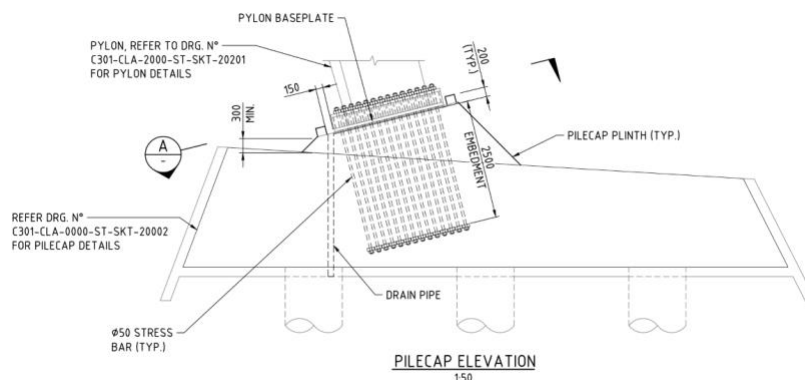


Figure 55: Typical Pylon Baseplate Connection

- Bolt base plates together. Survey check and adjust as required;
- Insert all bolts and tighten in sequence to designated torque and secure pylon in place;
- Once confirmed and supported use EWP on the barge to remove slings;
- Maintain detailed records of all preparation and work activities, for inspection;
- Install scaffold frame around top of lower pylon half;
- Set up 700T and 100T cranes for upper pylon dual lift;
- Change spreader bar and lifting equipment on 700T crane;
- Pylon upper section to be delivered directly under crane hooks;
- Attach both cranes to the upper pylon half – 100T crane at base;
- Remove transport lashings from lower pylon;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position at pile cap and crew on lower pylon scaffold ready;
- Lift pylon clear of transport and remove vehicle;
- Continue to lift with 700T crane only;
- When in vertical position lower 100T crane until load is taken by 700T crane;
- Detach 100T crane slings from pylon;
- Lift upper pylon and swing slowly into position over the lower pylon;
- When in position lower gently using guides to align the pylons halves together;
- Temporary bolt together. Survey check and adjust as required;
- Once confirmed and supported use EWP on the barge to remove slings;
- Set up Encapsulation for welding and grit blasting at splice location of upper and lower pylon sections;
- Complete welding of the pylon splice joint to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;

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- Remove all equipment and encapsulation;
- Insert all bolts and tighten in sequence to designated torque and secure pylon in place;
- On completion remove scaffolding from around pylon;
- Maintain detailed records of all preparation and work activities, for inspection;
- Lift cross beam into position between bridge segment and lower pylon;
- Secure in place ready for welding;
- Confirm survey check for correct alignment;
- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joint to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Install spherical bearing between pylon and bridge segment, once in place install cover plate and secure;

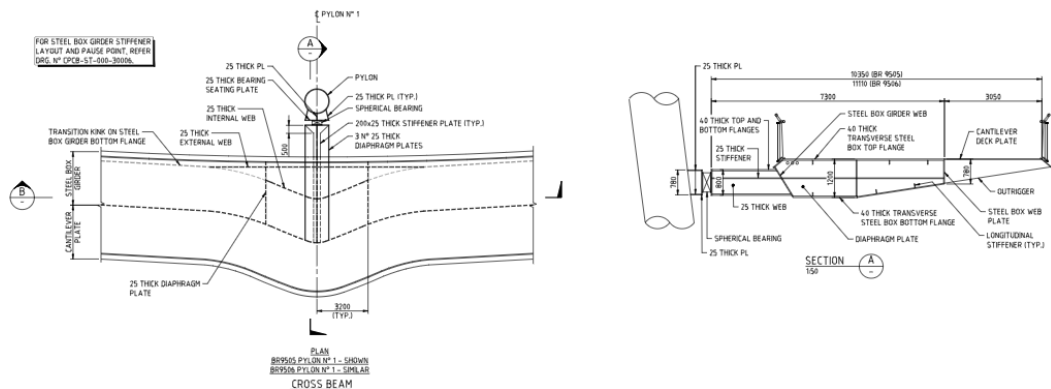


Figure 56: Typical Pylon Bridge Segment Interface

- Set up crane for next segment lift;
- Prepare barge for bridge segment 2;
- Segment 2 to be delivered to the crane under the hook;
- Locate spreader beam over bridge segment 2 and using EWP's attach the slings;
- Remove transport lashings from bridge segment;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure river and land-based spotters are in position;
- Check barge is in position;
- Lift bridge segment 2 and swing slowly into position over the land and river based portal frames;
- When in position lower gently onto the portal frames next to segment 1;
- Survey check to confirm segment 2 is in the correct supported position on the portal frames;
- Once confirmed and supported use EWP on the barge and land to remove slings;
- Install hydraulic pull cylinders to the strong backs on each side where the two segments meet on the portal frame;

- Adjust cylinders to achieve the required gap between bridge segments;
- Survey check and adjust as required;
- Install temporary bolts and frames to hold in place;



Figure 57: Typical Hydraulic Pull Cylinder and Bolting Frame

- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joint to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;
- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Set up crane for next segment lift;
- Segment 6 to be delivered to the crane under the hook;
- Locate slings over bridge segment 6 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment 6;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure land-based spotters are in position;

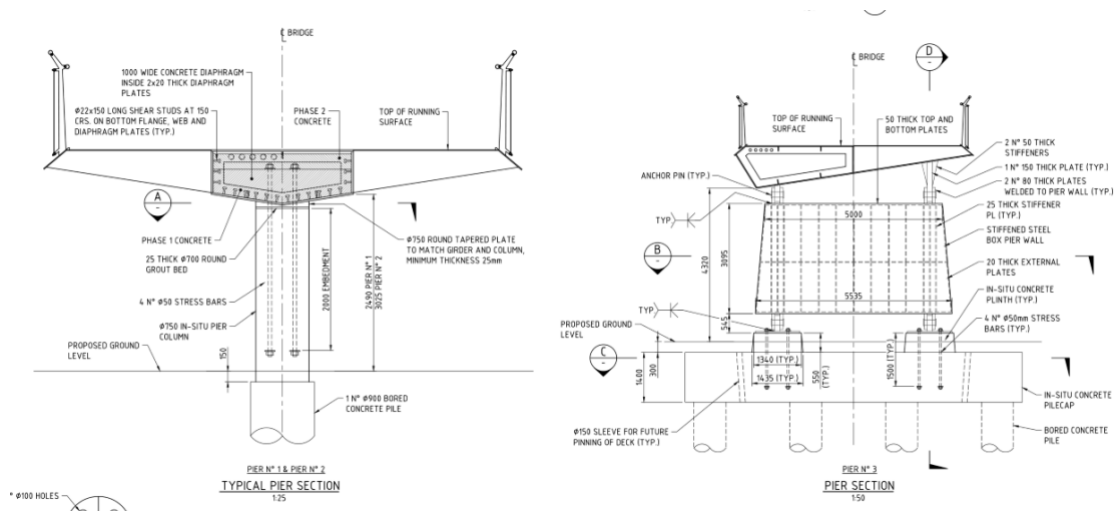


Figure 58: Pier Supports

- Lift bridge segment 6 and swing slowly into position over pier 1 and 2;
- When in position lower gently onto pier 1 and 2 column studs so the base plates locate;
- Once located survey check and secure in position;
- Lift pier 3 frame into position over pile cap base and pedestal location brackets;
- Lower into position over brackets and install anchor pins and secure in place;
- Support pier 3 in place horizontally;
- Set up crane for next segment lift;
- Segment 5 to be delivered to the crane under the hook;
- Locate slings over bridge segment 5 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment 5;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure land-based spotters are in position;
- Lift bridge segment 5 and swing slowly into position the portal frame and pier 2, between segments 2 and 6;
- When in position lower gently onto the portal frame and pier 1 column studs so the base plates locate;
- Once located survey check and secure in position;
- Once confirmed and supported use EWP on the barge and land to remove slings;
- Install hydraulic pull cylinders to the strong backs on each side where the two segments meet on the portal frame and on pier 2;
- Adjust cylinders to achieve the required gap between bridge segments;
- Survey check and adjust as required;
- Install temporary bolts and frames to hold in place;

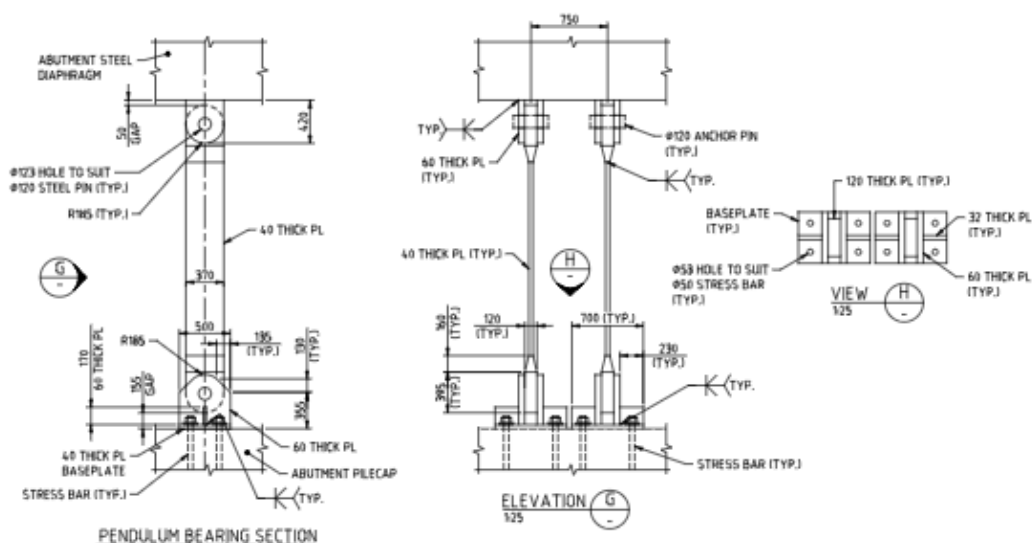


Figure 59: Typical Hydraulic Pull Cylinder and Bolting Frame

- Set up Encapsulation for welding and grit blasting;
- Complete welding of the bridge joint to the specified welding procedure and sequence;
- NDT welds and sign off on acceptance;

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- Grit blast and clean the welded area;
- Remove all equipment and encapsulation;
- Set up crane for next lift;
- Lift pier 3 up into position so the connect segment and pier connections points are aligned;
- Once aligned install the anchor pins and secure;
- Segment 7 to be delivered to the crane under the hook;
- Locate slings over bridge segment 7 and using EWP's attach the slings;
- Remove transport lashings from Bridge segment 7;
- Trial lift and check level and aligned, if adjustment required lower and re-set;
- Ensure land-based spotters are in position;
- Lift bridge segment 7 and swing slowly into position on the abutment and pier 1;
- When in position lower gently onto pier 1 next to segment 6, and Point Fraser abutment spherical bearings;
- Install pendulum bearings into the base plate and install the upper and lower anchor pins;
- Confirm segment is in the correct supported position on pier 1 and the abutment pendulum and spherical bearings;



- Once confirmed and supported use EWP on the barge and land to remove slings;
- When in position lower gently onto the portal frame and pier 1 column studs so the base plates locate;
- Once located survey check and secure in position;
- Once confirmed and supported use EWP on the barge and land to remove slings;
- Install hydraulic pull cylinders to the strong backs on each side where the two segments meet on the portal frame and on pier 2;
- Adjust cylinders to achieve the required gap between bridge segments;
- Survey check and adjust as required;

The Non-Slip waterproof surface treatment to be installed on footbridge deck and ramps (Matacyl WPM system or similar approved). Surface treatment on the deck will be installed in accordance with the Manufacturers requirements directly onto the steel deck surface. This scope will be subcontracted to a third-party specialist to complete. Prior to application, the surface must be clean, free from dust, grease, or other contaminants with blasting and priming of the deck completed prior to delivery to site.

10.2 Concrete Approach Slab Pour

In preparation for the four concrete pours, the ramps will be surveyed and marked out. The ground will be compacted, prepared and form work erected. Preparation works will be completed with care to ensure alignment of cast in end plates to achieve the expansion joint gap of 35mm. The ramp will rest on 15mm thick polystyrene bearing strip and tie into abutment back wall dowel. Approach ramps scope will be completed with:

- Cast end plate and shear studs into ramp slab;
- Install WABO compression seal;
- Install GRANOR WIZ FLEX or similar;
- Install Polyethylene foam backing rod;
- Form ends of ramp slab concrete on grade;
- Form ends of ramp slab to support cast in plates for expansion joint at abutments;
- Tie in approach ramps concrete;
- 150mm thick concrete cycle/footpath, Type 1 finish complete with sub base, damp proof membrane, SL81 reinforcement, N40 concrete, expansion joints, backfill and surface finish;
- Install ACO drains;
- Surface treatment and waterproof coating (as for the bridge); and
- Install handrail to each side of path.

To limit plastic shrinkage cracking, concrete shall be placed in the mornings while temperatures are still low. This work will occur outside of morning rush hour traffic to allow for unrestricted concrete truck movements around the bridge.

10.3 Concrete Stair Pour

As part of the finishing works there are four (4) sets of stairs to install;

- Bridge 9505 (McCallum Park) abutment approach end;
- Bridge 9505 (McCallum Park) abutment departure end;
- Bridge 9506 (Point Fraser) abutment approach end; and
- Bridge 9506 (Point Fraser) abutment departure end.

The top of the stairs will tie into the ramp concrete structure, whilst the base of the stairs will connect to the existing pathways. If required the base concrete plinth will be extended to connect the stairs to the existing paths.

In preparation for the four concrete pours, the stairs will be surveyed and marked out. The ground will be compacted, prepared and form work erected.

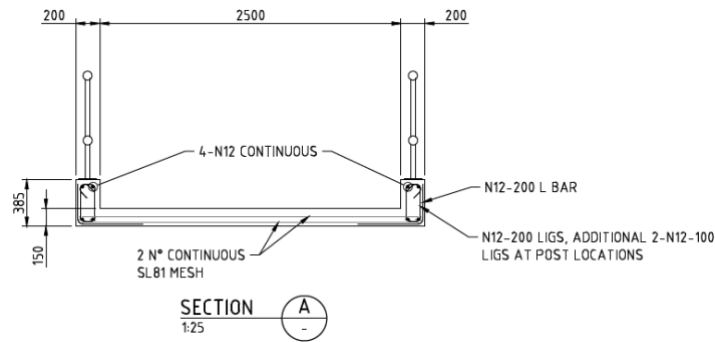


Figure 62: Typical Stair Section

The concrete stair installation scope will be completed with:

- Install WABO compression seal;
- Install GRANOR WIZ FLEX or similar;
- Form ends of stairs to support cast in plates for expansion joint at connection points;
- 150mm thick concrete stair, damp proof membrane, SL81 reinforcement, N40 concrete, expansion joints, backfill and surface finish;
- Surface treatment and waterproof coating (as for the bridge); and
- Install handrail to each side of path.

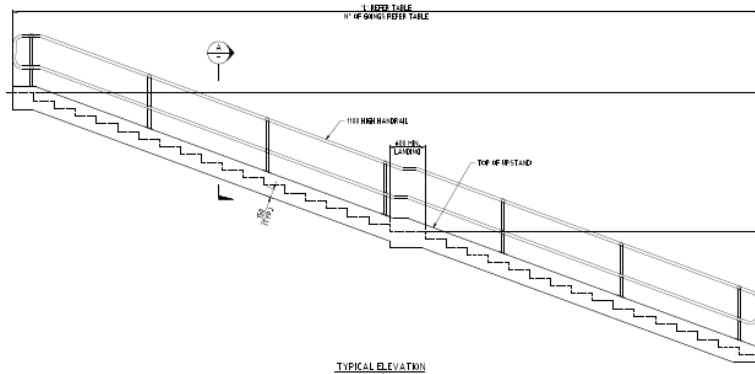


Figure 63: Typical Stair Elevation

10.4 Landscaping

- Re-use top-soil removed at start of works as base of landscaping if possible;
- Landscaping around all new earthworks, in line with the landscaping design and designated plant selection;
- Replace any damaged grass with same variety instant roll-on turf throughout entire grassed area; and
- Reinstatement of original paths along the foreshore;
- Installation of all new connecting paths, rest points and art installations; and
- Installation of seats and benches.

10.5 Electrical

10.5.1 Feature Lighting

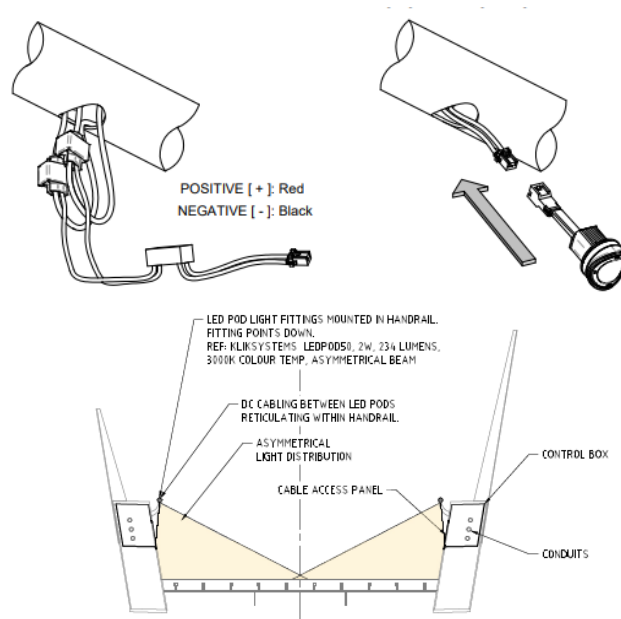
The bridge will have inbuilt decorative lighting installations to enhance the experience for pedestrian and cyclist bridge users. The lighting is to replay preprogrammed colour and intensity lighting sequences. The system is to be capable of being edited and changed to incorporate future lighting patterns.

10.5.2 Cabling

With the switchboard, underground conduit, power and communications pits installed, conduit and control boxes cast in concrete and conduits and control box block outs fabricated in the steel bridge the electrical team will commence power and communication cable pulling from switchboard and between the control boxes. Lighting power supply cabling is from Switchboard and LED transformers.

10.5.3 Handrail LED Pods (final light fitting TBC)

- The handrail will be pre-cored and deburred at our fabrication facilities;
- LED and fitting mount installed, and cabling connected in handrail;
- LED: Klinksystems LEDPOD50, 2W, 234 Lumens, 3000K Colour Temp, asymmetrical beam; and
- Test and commissioning of lighting including O&M manuals.



10.5.4 Strip Lighting

- Installation and commissioning of external LED strip lighting system.

10.5.5 Landscaping and Path Lighting

- Landscaping and path LED in-ground marker luminaires with wildlife friendly CREE XLAMP XP-E2 Amber LED or similar approved; and
- Test and commissioning of lighting system.

11. CONSTRUCTION VERIFICATION AND HANDOVER

An Asset Handover and Delivery Plan will be developed to outline the following:

- To bring all structures and systems to the point of being ready for commissioning

CONSTRUCTION MANAGEMENT PLAN

- To progressively verify and document the integrity of the work being carried out throughout construction
- To ensure a seamless transition from construction to commissioning works and ensure compliance with overall completions strategies, plan and requirements
- To provide a traceable process to confirm all scope works, changes and variations have been completed prior to handover
- To manage resources as efficiently as possible

A Construction Completions punch list will be generated through a walk down with relevant stakeholders prior to handover.

The handover process will include providing a pack containing the documentation required by MRWA. The final makeup of the handover pack is to be agreed with MRWA. The information in the handover pack will form the basis of the Project MDR.

After all the construction activities have been completed the remaining project activity is Contract Closeout.

The scope of Contract Closeout will be in accordance with the Contract requirements and will include as a minimum the following activities:

- Financial closeout including, the punch list, final costs and variations payment, and release of bonds;
- Issue of all vendor documentation and associated information (MDR);
- Delivery to Company of all operating spare parts and any surplus commissioning spares;
- Closeout of all subcontracts and purchase orders;
- Project Closeout Report; and
- Indigenous employment report.

APPENDIX 1 CONSTRUCTION SEQUENCE DRAWINGS

