DELIVERING FOR QUEENSLAND

Drafting and Design Presentation Standards Manual (DDPSM)

Volume 3: Structural Drafting Standards
Chapter 4 - Bridge drawings

January 2026

Queensland Government

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Feedback

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Contents

1 General

All project drawings shall be completed to the standards of detailing, accuracy, and completeness set out in this volume. A thorough check of all drawings shall be carried out to determine that they completely, accurately, and unambiguously convey all the information necessary to enable construction of the works.

The Department of Transport and Main Roads expects uniformity in appearance and detailing on the drawings across the entire project and all similar structural projects.

This chapter of the volume relates specifically to bridge drawings produced for departmental projects and is set out to align with the content and format of the *Design Criteria for Bridges and Other Structures* (DCBoS).

For other structures, refer to Chapter 5 of this volume.

Austroads *Guide to Bridge Technology – Part 5: Structural Drafting* Section 3 provides good guidance.

1.1 Typical order of bridge drawings

The following table lists a typical set of drawings, but not limited to, for a simple bridge.

Table 1.1 – Typical set of drawings for a simple bridge

Drawing or drawing subset	Typical drawing description
Cover sheet	As described in Section 2.
General Notes	Dedicated set of drawings, as described in Section 2. The use of these drawings is as an alternative to including notes in each drawing sub-set.
General Arrangement	First drawing in this sub-set is an overview of the work to be carried out, as described in Section 3. with, as a minimum: • the whole bridge in plan and elevation, and showing existing and new features • horizontal and vertical alignment, borehole locations, typical deck section, and • supporting details and notes.
Piles and pile layout	These drawings represent the foundations as described in Section 4, and show: • foundation layout and geological profile • pile identification and setting out, and borehole locations, and • supporting details and notes.

Drawing or drawing subset	Typical drawing description
Abutments	First part of the substructure drawings, as described in Section 4. Concrete details and reinforcement details.
Piers	Second part of the substructure drawings, as described in Section 4. Concrete details and reinforcement details.
Girders	First part of the superstructure drawings, as described in Section 5. These are the fabrication drawings for the type of girder required – PSC Super-T girders, winged planks, deck units, or steel girders.
Bridge deck	Second part of the superstructure drawings, as described in Section 5. The information is represented in the plan view of the whole deck, sections, tables, and details, for the deck set out and geometry, cross-girders if used, as well as the bridge barriers and deck drainage. Concrete details and reinforcement details are to be on separate drawings. Expansion joints, cover plates, drainage, and road furniture pertaining to the bridge deck, kerbs, or concrete bridge barriers should be included in this sub-set.
Relieving slabs	If required in the contract and discussed in Section 5. Certified project-specific relieving slab drawings are to be supplied by the designer based on SD2255 *Bridge approaches – Relieving Slab 3 metre span* and SD2256 *Bridge approaches – Relieving Slab 6 metre span*.
Barriers	These drawings provide the details for precast concrete parapets or steel post and rail, and with safety barriers, pedestrian balustrade, and so on as required (refer to Section 5).
Provision for maintenance	Specific access or details to perform maintenance over the life of the bridge (refer to Section 4).

1.2 Recommended scales for bridge drawings

The following table lists the scales recommended for the elements of typical bridge drawings.

Table 1.2 – Recommended scales for bridge drawings

Application	Scale
General Arrangements	
Plan / elevation for bridges up to 80 metres long	1:150 or 1:200
Plan / elevation for bridges over 80 metres long	1:250, 1:300 or 1:400

Application	Scale
Type abutments and piers	1:75 or 1:100
Section deck	1:30 or 1:40
Anchorage details	1:12.5 or 1:15
Abutments and piers	
Plan / elevation	1:30 or 1:40
Sections	1:15 / 1:20
Deck units and girders	
Plan / elevation	1:40
Sections of units and end details	1:12.5
Anchors and transverse stressing anchorage details	1:7.5
Cast-insitu cross-girders, decks and kerbs	
Plan / elevation	1:75 or 1:100
Sections	1:15
Bridge barriers	
Plan / elevation	1:75 or 1:100
Sections, post assemblies, joint assemblies and details	1:5, 1:7.5 or 1:10

2 Cover sheet and General Notes drawings

2.1 Cover sheet for bridge drawings

As demonstrated in example drawings following, the first sheet in a set of bridge drawings has:

- the full name of the project, the name of the bridge, and any package number if that bridge is part of a large project, for example BR03
- locality plan
- scheme submitted and financial approval box as per DDPSM Volume 1 Sections 1.6.2.2 and 3, and
- drawing index.

When the drawing set exceeds more than 40 drawings, the drawing index will be too long for the cover sheet and can be made into the second drawing in the set immediately after the cover sheet and before the General Notes drawings.

A table to list documentation such as survey data, associated departmental jobs, and auxiliary drawing numbers is to be included on either the cover sheet, the General Notes drawings, or on the first sheet of the General Arrangement (GA) drawings.

Table 2.3 lists the cover sheet's content.

2.2 Notes for bridge drawings

As stated in Section 5 of Chapter 2 of this volume, the notes specific to a drawing sub-set that may be given to a sub-contractor shall have those notes specific to that element or activity shown on the drawings. For bridge drawings, this is for, but not limited to:

- earthwork drawings critical to the bridge
- pile drawings
- construction sequence, installation or erection notes critical to a sub-set of drawings, and
- fabrication drawings for precast concrete and steelwork.

The remainder of the notes specific to the structure and general in nature to the entire set may be compiled together into a sub-set of dedicated General Notes drawings at the front of the drawings.

Traditionally, notes were shown on their relevant drawing, and this is the recommended practice for bridge drawings.

If using a sub-set of General Notes drawings, the following categories are usually shown, but not limited to:

- General Notes
- Referenced Transport and Main Roads Standard Drawings, in a table
- Abbreviations
- Services
- Materials, such as
  - concrete
  - reinforcing steel
  - steelwork
  - bolts, and
  - welding.
- Specific construction activities, such as:
  - monitoring details

  - widening, strengthening and rehabilitation details, and
  - deck.
- Design criteria, such as:
  - design vehicle loading combinations
  - design loads
  - design assumptions
  - site hazards / precautions
  - hydraulics, where required
  - design scour data, where required, and
  - concrete and durability requirements.

2.3 Consistency in presentation and detail

All the content on the drawings shall be consistent across the set without change, and the drawings shall be completed to the standards of detailing, accuracy, and completeness set out in this volume.

Table 2.3 provides the minimum drawing content that is to be shown on the cover sheet drawing.

Figure 2.3(a) to Figure 2.3(d) are example cover sheet drawings.

Typical content of a sub-set of General Notes drawings has not been tabulated here. Requirements for notes on drawings are discussed in Section 5 of Chapter 2 of this volume.

Example General Notes drawings are included as Figure 2.3(e) and Figure 2.3(f) immediately after the example cover sheet drawings.

Table 2.3 – Cover sheet drawing – project-specific drawings content

Requirement	Drawing or element description	Figure reference
Project name	The name of the bridge and any package number if that bridge is part of a large project. This bridge name is usually then used for the first title line in the title block.	Figure 2.3(a) Figure 2.3(b)
Locality plan	High quality resolution map that clearly shows the work site, road name, and ID, the nearby towns or road direction arrows naming those towns if out of view, the waterway named for bridges crossing a waterway, and north point.	Figure 2.3(a) Figure 2.3(b)

Requirement	Drawing or element description	Figure reference
Scheme approval box	As per Figure 1.6.2.3 of DDPSM Volume 1, AutoCAD block available from the plan sheets of *TMR AutoCAD Customisation*. The box is to be completed to show the information, signature, and date signed for the certifier, and for the department's Regional Director or Delegate's approval.	Figure 2.3(a)
Drawing index	Table matching the information in the title block of each drawing within the set: • drawing number, a unique departmental number as supplied by the department's Region's Plan Room • revision letter • date; for Revision A this is usually the date the drawing was signed by RPEQ, and for subsequent revisions the reissue date in the revisions box • drawing series number, as described in Section 3.4 of Chapter 2, unique to the drawing, and • drawing description, being the second and third drawing title lines.	Figure 3.5 in Chapter 2 Figure 2.3(a) Figure 2.3(c)

Figure 2.3(a) – Example cover sheet drawing containing drawing list

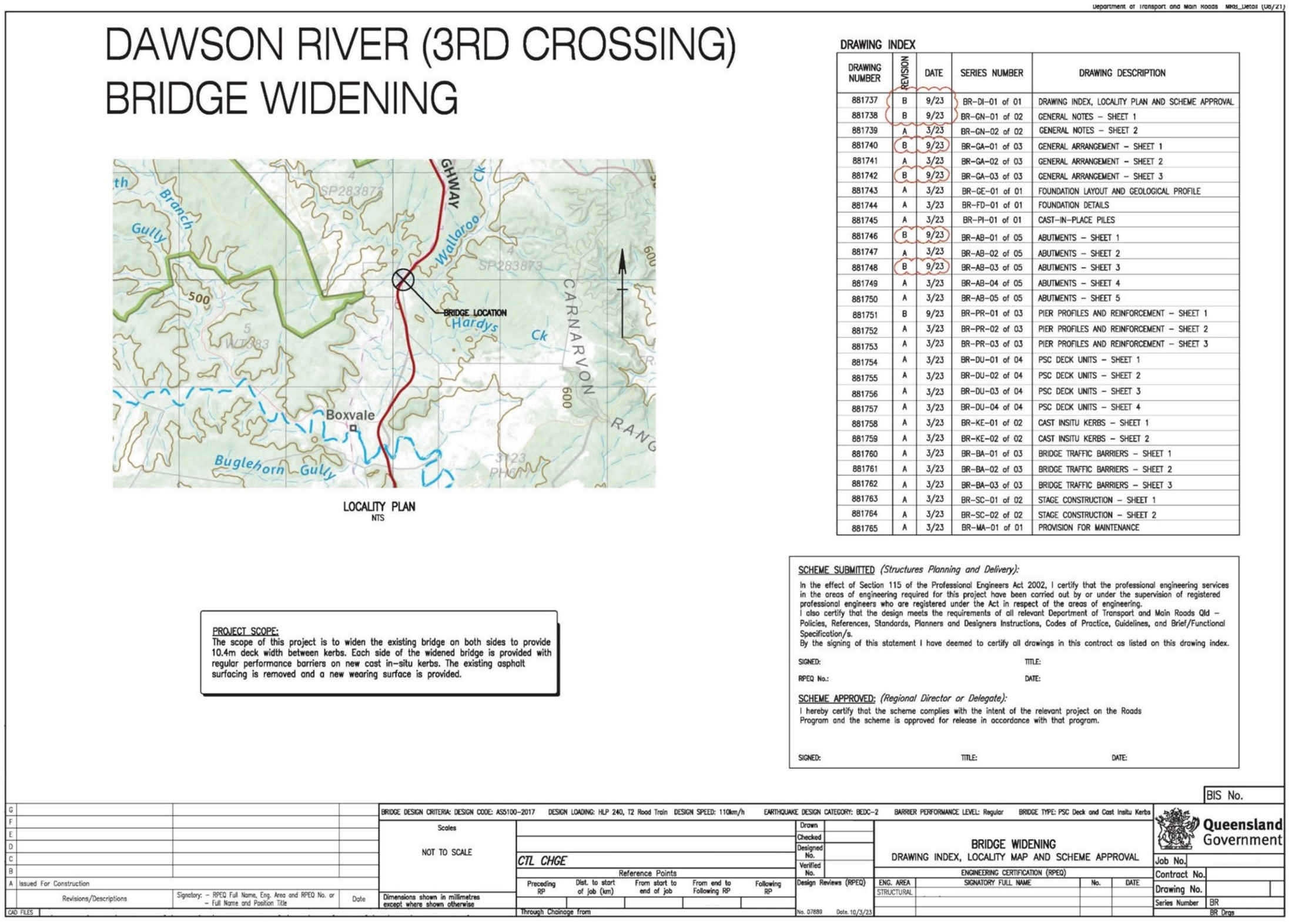
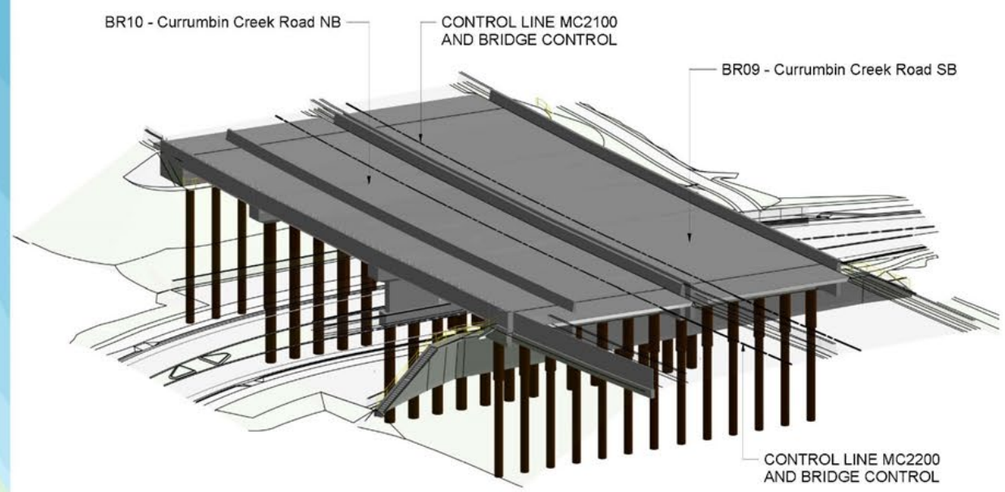


Figure 2.3(b) – Example cover sheet drawing where the drawing list is on the second drawing

M1 SOUTH - PALM BEACH TO TUGUN

BR09 - CURRUMBIN CREEK ROAD SB

LOCALITY PLAN



3D PERSPECTIVE
Not to Scale

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS 5100:2017 | DESIGN LOADING: SM1600 & HLP400 | DESIGN SPEED: 110 km/h | EARTHQUAKE CATEGORY: BEDC-3 | BARRIER PERFORMANCE LEVEL: MEDIUM | BRIDGE TYPE: RC DECK ON PSC DECK UNITS | BIS No.

Associated Job Nos	Survey Data	Horiz. Datum	GDA 94
Auxiliary Drg Nos		Horiz. Grid	MGA ZONE 56
		Height Origin	AHD DERIVED
		Survey Books	Refer NL-01

Scales

Dimensions Shown in millimetres except where shown otherwise

CITY OF GOLD COAST
PACIFIC MOTORWAY (12A)
CTL CHGE 72126 - 76453
Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP
19	0.9	4.33	2.78	24

Through Chainage from 72.13 km to 76.45 km

Drawn | Checked | Designed No. | Verified No.

Design Reviews (RPEQ) No. Date. / /

BR09 - CURRUMBIN CREEK ROAD SB
LOCALITY PLAN

ENGINEERING CERTIFICATION (RPEQ)

ENG AREA	NAME	SIGNATURE	NO.	DATE

A Issued for Construction

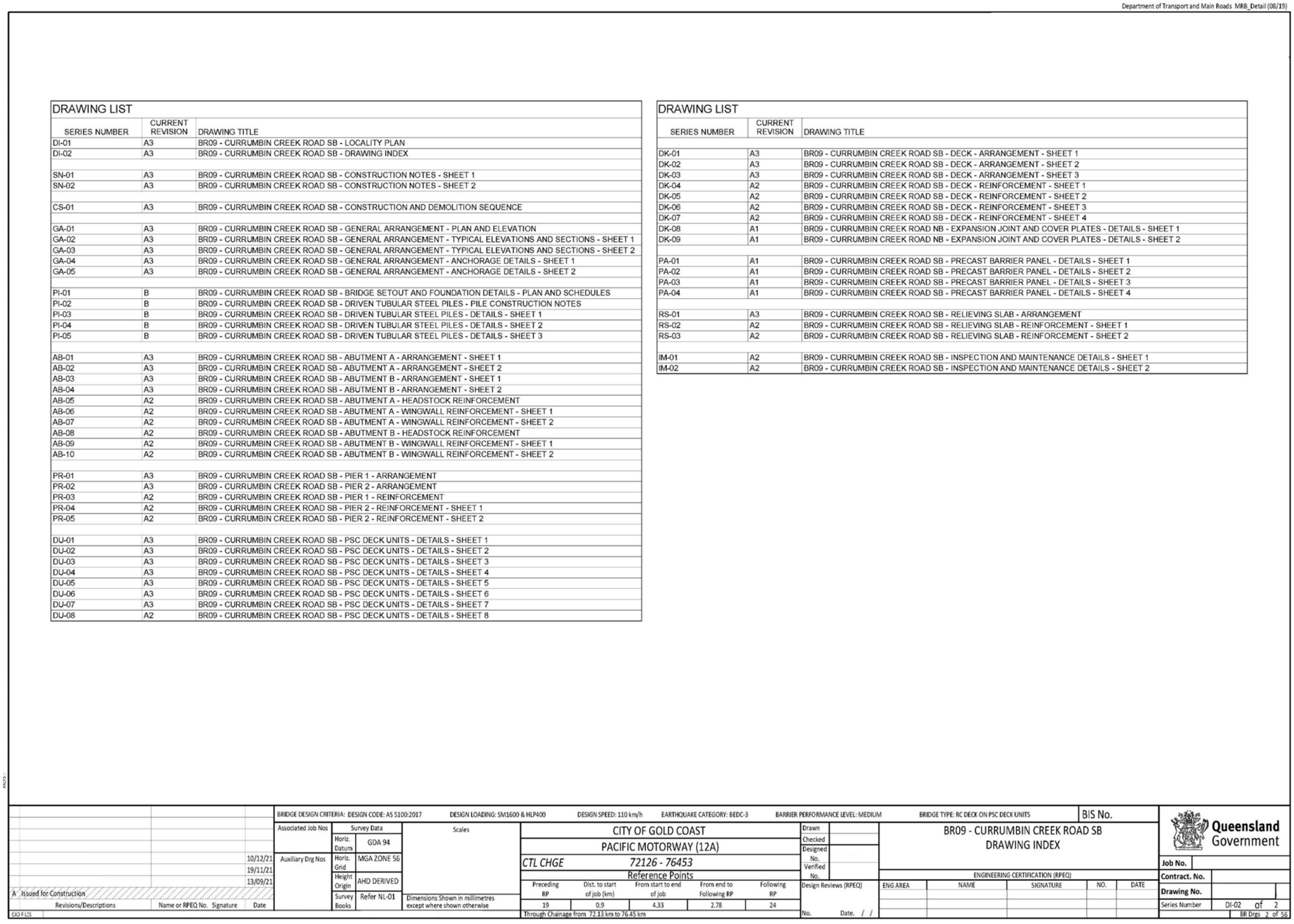
Revisions/Descriptions | Name or RPEQ No. Signature | Date

CAD FILES

Queensland Government

Job No.
Contract. No.
Drawing No.
Series Number DI-01 of 2
BR Drgs

Figure 2.3(c) – Example cover sheet drawing series number DI-02 of 2 being drawing list on second drawing of the sub-set



Department of Transport and Main Roads MRB_Detail (08/19)

DRAWING LIST

SERIES NUMBER	CURRENT REVISION	DRAWING TITLE
DI-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - LOCALITY PLAN
DI-02	A3	BR09 - CURRUMBIN CREEK ROAD SB - DRAWING INDEX
SN-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - CONSTRUCTION NOTES - SHEET 1
SN-02	A3	BR09 - CURRUMBIN CREEK ROAD SB - CONSTRUCTION NOTES - SHEET 2
CS-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - CONSTRUCTION AND DEMOLITION SEQUENCE
GA-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - GENERAL ARRANGEMENT - PLAN AND ELEVATION
GA-02	A3	BR09 - CURRUMBIN CREEK ROAD SB - GENERAL ARRANGEMENT - TYPICAL ELEVATIONS AND SECTIONS - SHEET 1
GA-03	A3	BR09 - CURRUMBIN CREEK ROAD SB - GENERAL ARRANGEMENT - TYPICAL ELEVATIONS AND SECTIONS - SHEET 2
GA-04	A3	BR09 - CURRUMBIN CREEK ROAD SB - GENERAL ARRANGEMENT - ANCHORAGE DETAILS - SHEET 1
GA-05	A3	BR09 - CURRUMBIN CREEK ROAD SB - GENERAL ARRANGEMENT - ANCHORAGE DETAILS - SHEET 2
PI-01	B	BR09 - CURRUMBIN CREEK ROAD SB - BRIDGE SETOUT AND FOUNDATION DETAILS - PLAN AND SCHEDULES
PI-02	B	BR09 - CURRUMBIN CREEK ROAD SB - DRIVEN TUBULAR STEEL PILES - PILE CONSTRUCTION NOTES
PI-03	B	BR09 - CURRUMBIN CREEK ROAD SB - DRIVEN TUBULAR STEEL PILES - DETAILS - SHEET 1
PI-04	B	BR09 - CURRUMBIN CREEK ROAD SB - DRIVEN TUBULAR STEEL PILES - DETAILS - SHEET 2
PI-05	B	BR09 - CURRUMBIN CREEK ROAD SB - DRIVEN TUBULAR STEEL PILES - DETAILS - SHEET 3
AB-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT A - ARRANGEMENT - SHEET 1
AB-02	A3	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT A - ARRANGEMENT - SHEET 2
AB-03	A3	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT B - ARRANGEMENT - SHEET 1
AB-04	A3	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT B - ARRANGEMENT - SHEET 2
AB-05	A2	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT A - HEADSTOCK REINFORCEMENT
AB-06	A2	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT A - WINGWALL REINFORCEMENT - SHEET 1
AB-07	A2	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT A - WINGWALL REINFORCEMENT - SHEET 2
AB-08	A2	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT B - HEADSTOCK REINFORCEMENT
AB-09	A2	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT B - WINGWALL REINFORCEMENT - SHEET 1
AB-10	A2	BR09 - CURRUMBIN CREEK ROAD SB - ABUTMENT B - WINGWALL REINFORCEMENT - SHEET 2
PR-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - PIER 1 - ARRANGEMENT
PR-02	A3	BR09 - CURRUMBIN CREEK ROAD SB - PIER 2 - ARRANGEMENT
PR-03	A2	BR09 - CURRUMBIN CREEK ROAD SB - PIER 1 - REINFORCEMENT
PR-04	A2	BR09 - CURRUMBIN CREEK ROAD SB - PIER 2 - REINFORCEMENT - SHEET 1
PR-05	A2	BR09 - CURRUMBIN CREEK ROAD SB - PIER 2 - REINFORCEMENT - SHEET 2
DU-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 1
DU-02	A3	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 2
DU-03	A3	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 3
DU-04	A3	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 4
DU-05	A3	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 5
DU-06	A3	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 6
DU-07	A3	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 7
DU-08	A2	BR09 - CURRUMBIN CREEK ROAD SB - PSC DECK UNITS - DETAILS - SHEET 8

DRAWING LIST

SERIES NUMBER	CURRENT REVISION	DRAWING TITLE
DK-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - DECK - ARRANGEMENT - SHEET 1
DK-02	A3	BR09 - CURRUMBIN CREEK ROAD SB - DECK - ARRANGEMENT - SHEET 2
DK-03	A3	BR09 - CURRUMBIN CREEK ROAD SB - DECK - ARRANGEMENT - SHEET 3
DK-04	A2	BR09 - CURRUMBIN CREEK ROAD SB - DECK - REINFORCEMENT - SHEET 1
DK-05	A2	BR09 - CURRUMBIN CREEK ROAD SB - DECK - REINFORCEMENT - SHEET 2
DK-06	A2	BR09 - CURRUMBIN CREEK ROAD SB - DECK - REINFORCEMENT - SHEET 3
DK-07	A2	BR09 - CURRUMBIN CREEK ROAD SB - DECK - REINFORCEMENT - SHEET 4
DK-08	A1	BR09 - CURRUMBIN CREEK ROAD NB - EXPANSION JOINT AND COVER PLATES - DETAILS - SHEET 1
DK-09	A1	BR09 - CURRUMBIN CREEK ROAD NB - EXPANSION JOINT AND COVER PLATES - DETAILS - SHEET 2
PA-01	A1	BR09 - CURRUMBIN CREEK ROAD SB - PRECAST BARRIER PANEL - DETAILS - SHEET 1
PA-02	A1	BR09 - CURRUMBIN CREEK ROAD SB - PRECAST BARRIER PANEL - DETAILS - SHEET 2
PA-03	A1	BR09 - CURRUMBIN CREEK ROAD SB - PRECAST BARRIER PANEL - DETAILS - SHEET 3
PA-04	A1	BR09 - CURRUMBIN CREEK ROAD SB - PRECAST BARRIER PANEL - DETAILS - SHEET 4
RS-01	A3	BR09 - CURRUMBIN CREEK ROAD SB - RELIEVING SLAB - ARRANGEMENT
RS-02	A2	BR09 - CURRUMBIN CREEK ROAD SB - RELIEVING SLAB - REINFORCEMENT - SHEET 1
RS-03	A2	BR09 - CURRUMBIN CREEK ROAD SB - RELIEVING SLAB - REINFORCEMENT - SHEET 2
IM-01	A2	BR09 - CURRUMBIN CREEK ROAD SB - INSPECTION AND MAINTENANCE DETAILS - SHEET 1
IM-02	A2	BR09 - CURRUMBIN CREEK ROAD SB - INSPECTION AND MAINTENANCE DETAILS - SHEET 2

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS 5100:2017 DESIGN LOADING: SM1600 & HLP400 DESIGN SPEED: 110 km/h EARTHQUAKE CATEGORY: BEDC-3 BARRIER PERFORMANCE LEVEL: MEDIUM BRIDGE TYPE: RC DECK ON PSC DECK UNITS BIS No.

Associated Job Nos

Auxiliary Drg Nos

Survey Data: Horiz. Datum GDA 94; Horiz. Grid MGA ZONE 56; Height Origin AHD DERIVED; Survey Books Refer NL-01

Scales

Dimensions Shown in millimetres except where shown otherwise

CITY OF GOLD COAST

PACIFIC MOTORWAY (12A)

CTL CHGE 72126 - 76453

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP
19	0.9	4.33	2.78	24

Through Chainage from 72.13 km to 76.45 km

Drawn

Checked

Designed No.

Verified No.

Design Reviews (RPEQ) No. Date. / /

BR09 - CURRUMBIN CREEK ROAD SB
DRAWING INDEX

ENGINEERING CERTIFICATION (RPEQ)

ENG AREA	NAME	SIGNATURE	NO.	DATE

Queensland Government

Job No.

Contract. No.

Drawing No.

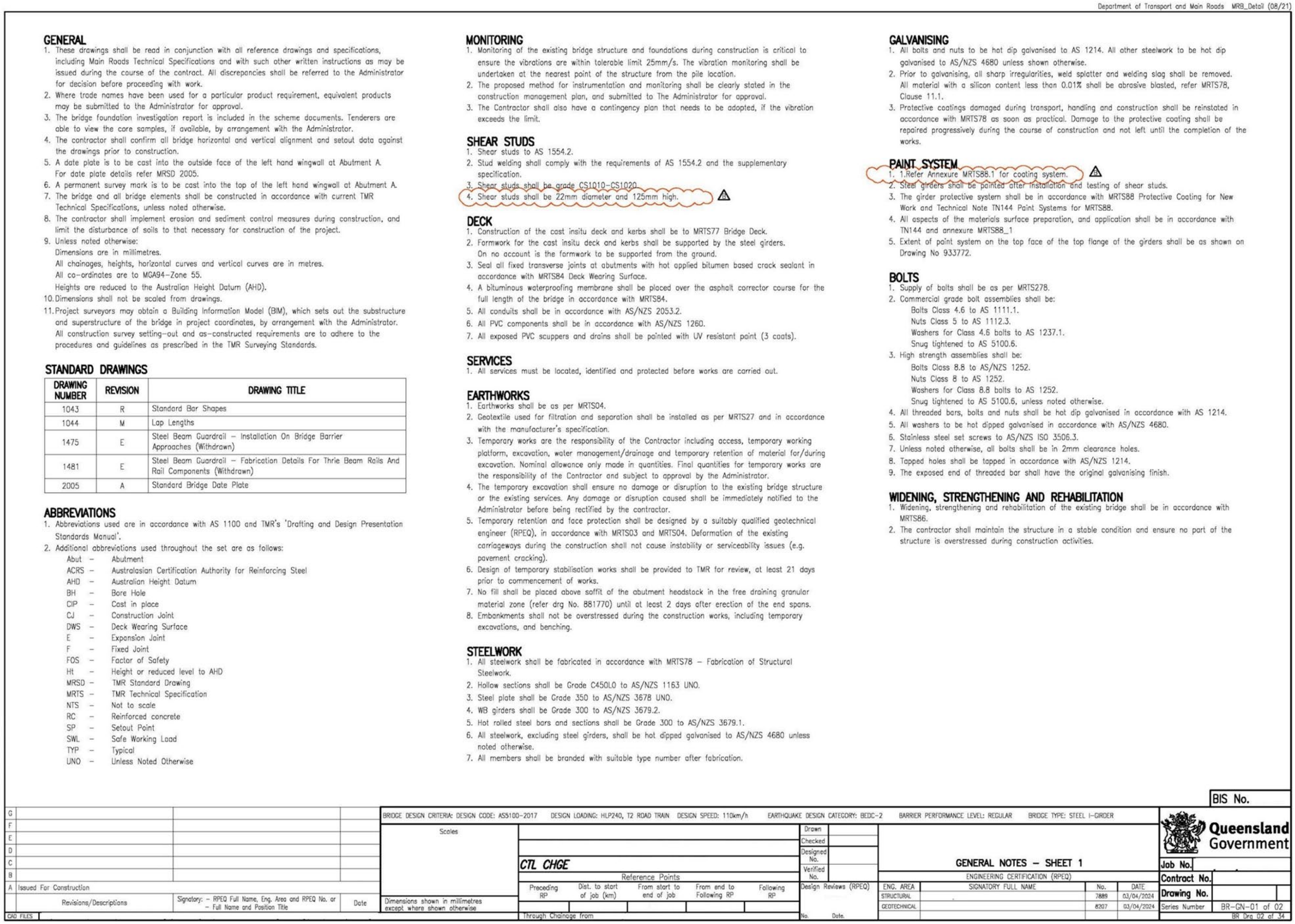
Series Number DI-02 of 2

BR Drgs 2 of 56

10/12/21			
19/11/21			
13/09/21			
A Issued for Construction			
Revisions/Descriptions	Name or RPEQ No.	Signature	Date

CAD FILES

Figure 2.3(d) – Example General Notes as drawing 1 of 2 drawings



Department of Transport and Main Roads MRB_Detail (08/21)

GENERAL

1. These drawings shall be read in conjunction with all reference drawings and specifications, including Main Roads Technical Specifications and with such other written instructions as may be issued during the course of the contract. All discrepancies shall be referred to the Administrator for decision before proceeding with work.
2. Where trade names have been used for a particular product requirement, equivalent products may be submitted to the Administrator for approval.
3. The bridge foundation investigation report is included in the scheme documents. Tenderers are able to view the core samples, if available, by arrangement with the Administrator.
4. The contractor shall confirm all bridge horizontal and vertical alignment and setout data against the drawings prior to construction.
5. A date plate is to be cast into the outside face of the left hand wingwall at Abutment A. For date plate details refer MRSD 2005.
6. A permanent survey mark is to be cast into the top of the left hand wingwall at Abutment A.
7. The bridge and all bridge elements shall be constructed in accordance with current TMR Technical Specifications, unless noted otherwise.
8. The contractor shall implement erosion and sediment control measures during construction, and limit the disturbance of soils to that necessary for construction of the project.
9. Unless noted otherwise:
   Dimensions are in millimetres.
   All chainages, heights, horizontal curves and vertical curves are in metres.
   All co-ordinates are to MGA94-Zone 55.
   Heights are reduced to the Australian Height Datum (AHD).
10. Dimensions shall not be scaled from drawings.
11. Project surveyors may obtain a Building Information Model (BIM), which sets out the substructure and superstructure of the bridge in project coordinates, by arrangement with the Administrator. All construction survey setting-out and as-constructed requirements are to adhere to the procedures and guidelines as prescribed in the TMR Surveying Standards.

STANDARD DRAWINGS

DRAWING NUMBER	REVISION	DRAWING TITLE
1043	R	Standard Bar Shapes
1044	M	Lap Lengths
1475	E	Steel Beam Guardrail – Installation On Bridge Barrier Approaches (Withdrawn)
1481	E	Steel Beam Guardrail – Fabrication Details For Thrie Beam Rails And Rail Components (Withdrawn)
2005	A	Standard Bridge Date Plate

ABBREVIATIONS

1. Abbreviations used are in accordance with AS 1100 and TMR's 'Drafting and Design Presentation Standards Manual'.
2. Additional abbreviations used throughout the set are as follows:

Abut	–	Abutment
ACRS	–	Australasian Certification Authority for Reinforcing Steel
AHD	–	Australian Height Datum
BH	–	Bore Hole
CIP	–	Cast in place
CJ	–	Construction Joint
DWS	–	Deck Wearing Surface
E	–	Expansion Joint
F	–	Fixed Joint
FOS	–	Factor of Safety
Ht	–	Height or reduced level to AHD
MRSD	–	TMR Standard Drawing
MRTS	–	TMR Technical Specification
NTS	–	Not to scale
RC	–	Reinforced concrete
SP	–	Setout Point
SWL	–	Safe Working Load
TYP	–	Typical
UNO	–	Unless Noted Otherwise

MONITORING

1. Monitoring of the existing bridge structure and foundations during construction is critical to ensure the vibrations are within tolerable limit 25mm/s. The vibration monitoring shall be undertaken at the nearest point of the structure from the pile location.
2. The proposed method for instrumentation and monitoring shall be clearly stated in the construction management plan, and submitted to The Administrator for approval.
3. The Contractor shall also have a contingency plan that needs to be adopted, if the vibration exceeds the limit.

SHEAR STUDS

1. Shear studs to AS 1554.2.
2. Stud welding shall comply with the requirements of AS 1554.2 and the supplementary specification.
3. Shear studs shall be grade CS1010-CS1020.
4. Shear studs shall be 22mm diameter and 125mm high. ⚠

DECK

1. Construction of the cast insitu deck and kerbs shall be to MRTS77 Bridge Deck.
2. Formwork for the cast insitu deck and kerbs shall be supported by the steel girders. On no account is the formwork to be supported from the ground.
3. Seal all fixed transverse joints at abutments with hot applied bitumen based crack sealant in accordance with MRTS84 Deck Wearing Surface.
4. A bituminous waterproofing membrane shall be placed over the asphalt corrector course for the full length of the bridge in accordance with MRTS84.
5. All conduits shall be in accordance with AS/NZS 2053.2.
6. All PVC components shall be in accordance with AS/NZS 1260.
7. All exposed PVC scuppers and drains shall be painted with UV resistant paint (3 coats).

SERVICES

1. All services must be located, identified and protected before works are carried out.

EARTHWORKS

1. Earthworks shall be as per MRTS04.
2. Geotextile used for filtration and separation shall be installed as per MRTS27 and in accordance with the manufacturer's specification.
3. Temporary works are the responsibility of the Contractor including access, temporary working platform, excavation, water management/drainage and temporary retention of material for/during excavation. Nominal allowance only made in quantities. Final quantities for temporary works are the responsibility of the Contractor and subject to approval by the Administrator.
4. The temporary excavation shall ensure no damage or disruption to the existing bridge structure or the existing services. Any damage or disruption caused shall be immediately notified to the Administrator before being rectified by the contractor.
5. Temporary retention and face protection shall be designed by a suitably qualified geotechnical engineer (RPEQ), in accordance with MRTS03 and MRTS04. Deformation of the existing carriageways during the construction shall not cause instability or serviceability issues (e.g. pavement cracking).
6. Design of temporary stabilisation works shall be provided to TMR for review, at least 21 days prior to commencement of works.
7. No fill shall be placed above soffit of the abutment headstock in the free draining granular material zone (refer drg No. 881770) until at least 2 days after erection of the end spans.
8. Embankments shall not be overstressed during the construction works, including temporary excavations, and benching.

STEELWORK

1. All steelwork shall be fabricated in accordance with MRTS78 – Fabrication of Structural Steelwork.
2. Hollow sections shall be Grade C450L0 to AS/NZS 1163 UNO.
3. Steel plate shall be Grade 350 to AS/NZS 3678 UNO.
4. WB girders shall be Grade 300 to AS/NZS 3679.2.
5. Hot rolled steel bars and sections shall be Grade 300 to AS/NZS 3679.1.
6. All steelwork, excluding steel girders, shall be hot dipped galvanised to AS/NZS 4680 unless noted otherwise.
7. All members shall be branded with suitable type number after fabrication.

GALVANISING

1. All bolts and nuts to be hot dip galvanised to AS 1214. All other steelwork to be hot dip galvanised to AS/NZS 4680 unless shown otherwise.
2. Prior to galvanising, all sharp irregularities, weld splatter and welding slag shall be removed. All material with a silicon content less than 0.01% shall be abrasive blasted, refer MRTS78, Clause 11.1.
3. Protective coatings damaged during transport, handling and construction shall be reinstated in accordance with MRTS78 as soon as practical. Damage to the protective coating shall be repaired progressively during the course of construction and not left until the completion of the works.

PAINT SYSTEM

1. 1.Refer Annexure MRTS88.1 for coating system. ⚠
2. Steel girders shall be painted after installation and testing of shear studs.
3. The girder protective system shall be in accordance with MRTS88 Protective Coating for New Work and Technical Note TN144 Paint Systems for MRTS88.
4. All aspects of the materials surface preparation, and application shall be in accordance with TN144 and annexure MRTS88_1
5. Extent of paint system on the top face of the top flange of the girders shall be as shown on Drawing No 933772.

BOLTS

1. Supply of bolts shall be as per MRTS278.
2. Commercial grade bolt assemblies shall be:
   Bolts Class 4.6 to AS 1111.1.
   Nuts Class 5 to AS 1112.3.
   Washers for Class 4.6 bolts to AS 1237.1.
   Snug tightened to AS 5100.6.
3. High strength assemblies shall be:
   Bolts Class 8.8 to AS/NZS 1252.
   Nuts Class 8 to AS 1252.
   Washers for Class 8.8 bolts to AS 1252.
   Snug tightened to AS 5100.6, unless noted otherwise.
4. All threaded bars, bolts and nuts shall be hot dip galvanised in accordance with AS 1214.
5. All washers to be hot dipped galvanised in accordance with AS/NZS 4680.
6. Stainless steel set screws to AS/NZS ISO 3506.3.
7. Unless noted otherwise, all bolts shall be in 2mm clearance holes.
8. Tapped holes shall be tapped in accordance with AS/NZS 1214.
9. The exposed end of threaded bar shall have the original galvanising finish.

WIDENING, STRENGTHENING AND REHABILITATION

1. Widening, strengthening and rehabilitation of the existing bridge shall be in accordance with MRTS86.
2. The contractor shall maintain the structure in a stable condition and ensure no part of the structure is overstressed during construction activities.

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A	Issued For Construction		
	Revisions/Descriptions	Signatory: – RPEQ Full Name, Eng. Area and RPEQ No. or – Full Name and Position Title	Date

CAD FILES

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS5100-2017 DESIGN LOADING: HLP240, T2 ROAD TRAIN DESIGN SPEED: 110km/h EARTHQUAKE DESIGN CATEGORY: BEDC-2 BARRIER PERFORMANCE LEVEL: REGULAR BRIDGE TYPE: STEEL I-GIRDER

Scales

Dimensions shown in millimetres except where shown otherwise

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn | Checked | Designed No. | Verified No.

Design Reviews (RPEQ) No. Date.

GENERAL NOTES – SHEET 1

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	SIGNATORY FULL NAME	No.	DATE
STRUCTURAL		7889	03/04/2024
GEOTECHNICAL		8207	03/04/2024

BIS No.

Queensland Government

Job No.

Contract No.

Drawing No.

Series Number BR-GN-01 of 02

BR Drg 02 of 34

Figure 2.3(e) – Example General Notes as drawing 2 of 2 drawings

Department of Transport and Main Roads MRB_Detail (08/21)

WELDING

1. Welding symbols in accordance with AS 1101.3.
2. Structural steel
   All welding to AS/NZS 1554.1.
   All welds, except location tack welds, shall be SP category.
   Welding consumables shall be controlled hydrogen type G493 to AS/NZS ISO 14341–B or T493 to AS/NZS ISO 17632–B unless noted otherwise.
   All welding shall be carried out in the fabrication yard. No field welding permitted UNO.
3. Reinforcing steel
   Welding of bar splices to AS/NZS 1554.3.
   All welds, except location tack welds shall be SP category.
   Tack welding for location purposes to AS/NZS 1554.3, clauses 3.3.1 and 3.3.3.
   Welding shall not be carried out within 75mm from any bent portion of the bar.
   Welding consumables shall be controlled hydrogen type G49X to AS/NZS ISO 14341–B or T49X to AS/NZS ISO 17632–B UNO.

CONCRETE

1. All concrete work shall be in accordance with MRTS70 Concrete.
2. All concrete to be Class S40/20 unless noted otherwise.
   Blinding concrete to be Class N20/20.
3. Contractor shall submit a procedure and plan for monitoring and procedure for ensuring compliance with requirements of Clause 15 of MRTS70 with regards to the control of temperature in large elements (exceeding 1m x 1m square or 1m in diameter) as required by MRTS70.
4. All exposed edges having a contained angle of less than 120° are to have 19 x 19 chamfers UNO.
5. Construction joints shall be used only as shown on the drawings. No construction joint shown on the drawings shall be omitted without the written approval from the Administrator.

REINFORCEMENT

1. All reinforcing steel shall be supplied and constructed in accordance with AS/NZS 4671 and MRTS71 Reinforcing Steel.
2. Deformed bars Grade D500N, round bars Grade R250N.
   Deformed wire Grade D500L, round wire Grade R500L.
3. All carbon reinforcing steel shall be ACRS certified.
4. Reinforcing steel bar shapes shall be as detailed on MRSD 1043.
5. Standard reinforcement abbreviations used on these drawings:
   ALT – Alternate EF – Each Face ES – Equally Spaced
   FF – Far Face NF – Near Face sps – Spaces
   TF – Top Face BF – Bottom Face galv – Hot dip galvanised
6. Bar development lengths shall be as per AS 5100–2017 unless noted otherwise. Bar lap lengths shall be as per table on MRSD 1044, unless noted otherwise. Laps and other splices in reinforcement shall only be made at the positions shown on the drawings unless alternative or extra locations are approved in writing by the Administrator.
7. Reinforcement notation:

   12–16A5R at 200 NF
   - No off
   - Bar diameter
   - Bar shape code
   - Bar mark
   - Grade of bar
   - Location
   - Spacing

   R only required for Grade R250N. If grade is not shown the bar is grade D500N.
8. Spacing of reinforcement in kerbs may be altered slightly, if necessary, to clear bridge traffic barrier post anchorages, draw pits, scuppers and scupper recesses.
9. Reinforcement shall be hot dip galvanised to AS/NZS 4680 where shown.
   Any bar designated to be galvanised, shall be bent to shape and cut to size prior to galvanising.
10. All reinforcement shall be firmly supported on concrete chairs at no greater than 1m centres both ways. All reinforcement shall be securely tied with tie wires and all tie ends shall be turned into the member clear of the cover zone. Placement and material of all chairs and spaces shall be in accordance with MRTS70.
11. Reinforcing bars shown on the drawings are represented diagrammatically and not necessarily in true projection. Reinforcing bars to be laid coplanar to maintain specified clear concrete cover.

CONCRETE AND DURABILITY REQUIREMENTS

1. Exposure classification, concrete class and cover to be as follows:

ELEMENT	EXPOSURE CLASSIFICATION	STRENGTH f'c (MPa)	MAX. AGGREGATE SIZE (mm)	MINIMUM COVER (mm) +
Abutments & Piers, Wingwalls	B2	S40	20	45, cast against forms 55, cast on blinding
CIP Piles	B2	S40	20	75
Diaphragm	B1	S40	20	30
Deck	B1	S40	20	30
Insitu Kerbs	B2	S40	20	45
Blinding Concrete	–	N20	20	–

+ Considering the age of existing bridge, the new widened portion of the bridge is designed for a design life of 50 years. Durability requirements (concrete strength and concrete cover) are therefore based on AS 3600–2018.

2. Steel durability criteria:

ELEMENT	ATMOSPHERIC CORROSIVITY CATEGORIES	ATMOSPHERIC CORROSIVITY ZONES	CORROSION PROTECTION
Steel Girder	C2–Low (ISO 9223–2012)	Arid/Urban inland (AS 4312–2019)	Coating system thickness and design in accordance with AS2312.1 and MRTS88
Steel Traffic Rail	C2–Low (ISO 9223–2012)	Arid/Urban inland (AS 4312–2019)	Coating thickness and mass in accordance with AS/NZS 4680–2006

DESIGN LOADS

1. Design standards and loads are in accordance with AS 5100.2–2017 and TMR – Design Criteria for Bridges and Other Structures (February 2021)

LOAD EFFECT	DESCRIPTION		
Concrete unit weight (including steel reinforcement)	25kN/m³ Insitu		
Asphalt deck wearing surface allowance	22kN/m³ Insitu 100 thick asphalt surfacing allowed for load calculations		
Live loading	Design Vehicle 1. HML AAB Quad T2 Road Train 2. 48t Crane 3. 79.5t Crane 4. HLP 240 in centre of design lanes.		Accompanying Vehicle 1. HML AAB Quad T2 Road Train 2. HML AAB Quad T2 Road Train 3. HML AAB Quad T2 Road Train 4. Nil
Dynamic load allowance	1.4 for HML AAB Quad T2 Road Train, 48t Crane and 79.5t crane 1.1 for HLP 240		
Braking load	0.45 mass of single 79.5t crane = 351 kN		
Design traffic speed	110km/hr		
Flood loads	Flood event	1% AEP	0.05% AEP
	Peak water height (m)	450.05	450.69
	Peak velocity (m/s)	3.025	3.06
	Design scour height (m) (governed by geotechnical threshold) Abut A / Piers / Abut B	446.70 / 440.94 / 440.34 / 441.50	
Debris	Material depth = 3.0m; Piers and Spans		
Regional wind speed	48m/s (ULS); 37m/s (SLS)		
Bridge earthquake design category	BEDC–2		
Average bridge temperature range	+49°C, 3°C		
Average bridge temperature	Minimum 15°C and maximum 35°C at the time of girder erection.		
Barrier performance level	Regular		

Girder Unpropped Construction Loading **	Stage 1
	• Live loading consisting of:
	  • A 10 kN concentrated load applied anywhere along the girder; OR
	  • A uniformly distributed load acting on the form work supported by the beam taken as 0.4 kPa pressure.
	
	Stage 2
	• Refer Stage 1
	
	Stage 3
	• Dead loading acting on the steel girder as per Stage 1, plus the dead load of fresh concrete on the tributary area, and any additional dead load of concrete due to ponding.
	• Live loading consisting of a uniformly distributed load acting on the form work supported by the beam taken as 0.8 kPa pressure.
	
	** Note: Diaphragm must be poured and provided sufficient time to achieve specified strength for unpropped girder construction. HOLD POINT.
	Construction stages are as per defined stages of AS/NZS 2327. For further information refer Supplementary Specification.		

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A	Issued For Construction			
	Revisions/Descriptions	Signatory: – RPEQ Full Name, Eng. Area and RPEQ No. or – Full Name and Position Title	Date	
CAD FILES				

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS5100–2017 DESIGN LOADING: HLP240, T2 ROAD TRAIN DESIGN SPEED: 110km/h EARTHQUAKE DESIGN CATEGORY: BEDC–2 BARRIER PERFORMANCE LEVEL: REGULAR BRIDGE TYPE: STEEL I–GIRDER

Scales

Dimensions shown in millimetres except where shown otherwise

CTL CHGE

Reference Points

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Through Chainage from

Drawn
Checked
Designed No.
Verified No.
Design Reviews (RPEQ)
No. Date.

GENERAL NOTES – SHEET 2

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	SIGNATORY FULL NAME	No.	DATE
STRUCTURAL			

BIS No.

Queensland Government

Job No.
Contract No.
Drawing No.
Series Number BR–GN–02 of 02
BR Drg 03 of 34

3 General Arrangement drawings

3.1 General

Drawings show the overall representation of the bridge to be constructed. The level of detail provided on the GA drawings at each design phase is expected to increase as the project progresses from concept through to detailed design. Austroads *Guide to Bridge Technology – Part 5: Structural Drafting* Section 3.2 also provides further guidance.

3.2 Consistency in presentation and detail

As stated in Section 1 of Chapter 2 of this volume, all the content on the drawings shall be consistent across the set without change, and the drawings shall be completed to the standards of detailing, accuracy, and completeness set out in this volume.

There is an expectation by Transport and Main Roads as the asset owner of uniformity in appearance and detailing on the drawings across all similar structural projects.

This is particularly important for GA drawings because the content is laid out to display similar information consistently and with an increasing level of detail at each project phase – from initial design (or concept) to detail design. Transport and Main Roads GA drawings typically follow the arrangement:

- plan and elevation on the first GA sheet, continuing onto subsequent sheets for long bridges
- benchmark or permanent survey mark information is always shown in the top left-hand corner of the first GA drawing
- a legend explaining the symbols on the plan and elevation, such as foundation boreholes, joint types and road furniture
- The catchment area for bridges over waterways is shown at the bottom right-hand side of the plan view, and
- any drawing-specific notes are typically shown at the bottom right-hand side of the drawing.

3.3 Typical content required on the General Arrangement drawings

Typical GA drawing content to be shown in views, sections, details, diagrams, and notes on the project drawings are explained in this section of the volume:

- plan
- elevation
- typical deck sections
- horizontal curve and vertical curve alignment details

- anchorage details
- construction sequences
- typical abutments and piers elevations and sections
- heavy load platform (HLP) vehicle diagram, and
- other details as required by the designer.

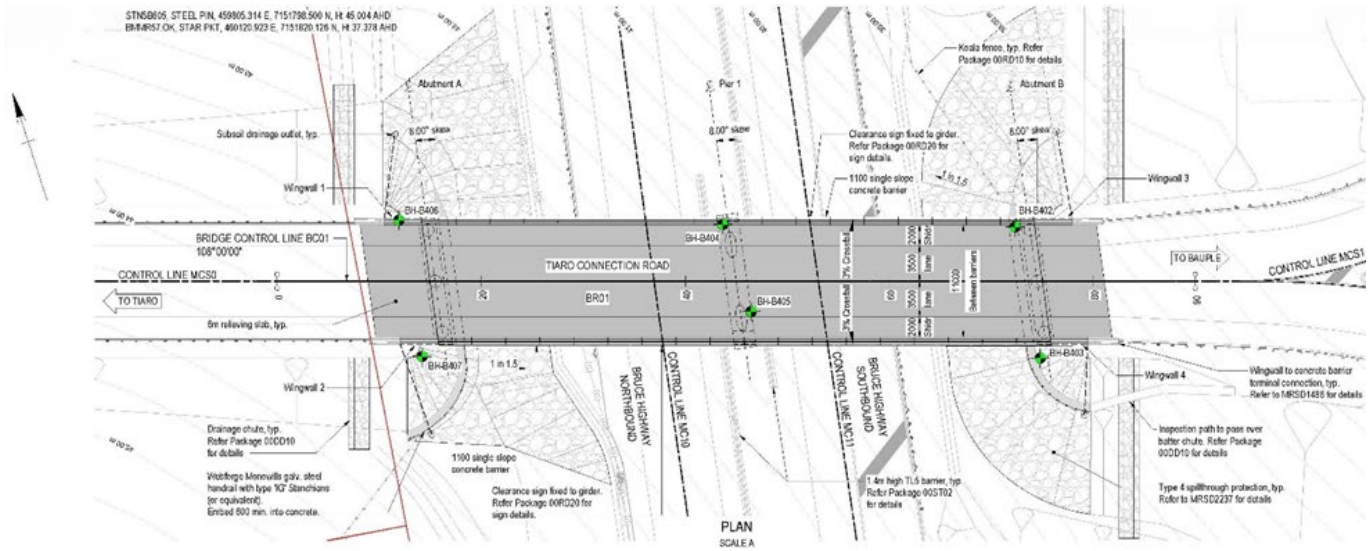
A table to list documentation such as survey data, associated departmental jobs, and auxiliary drawing numbers is to be included on the first sheet of the GA drawings if not already shown on the General Notes or cover sheet drawings.

Table 3.5 provides the minimum drawing content that to be shown on the GA drawings and lists example figures and drawings included in this section.

3.3.1 Plan view

The GA plan provides a comprehensive visual representation of the bridge's design, layout, and integration with its surroundings. It ensures accurate alignment between plan and elevation views, highlighting key structural, geometric, and site features essential for design approval, construction, and stakeholder collaboration. While typically presented as a single drawing, multiple sheets may be required for longer bridges to capture all necessary details effectively.

Figure 3.3.1 – Example General Arrangement drawing – plan



3.3.2 Elevation view

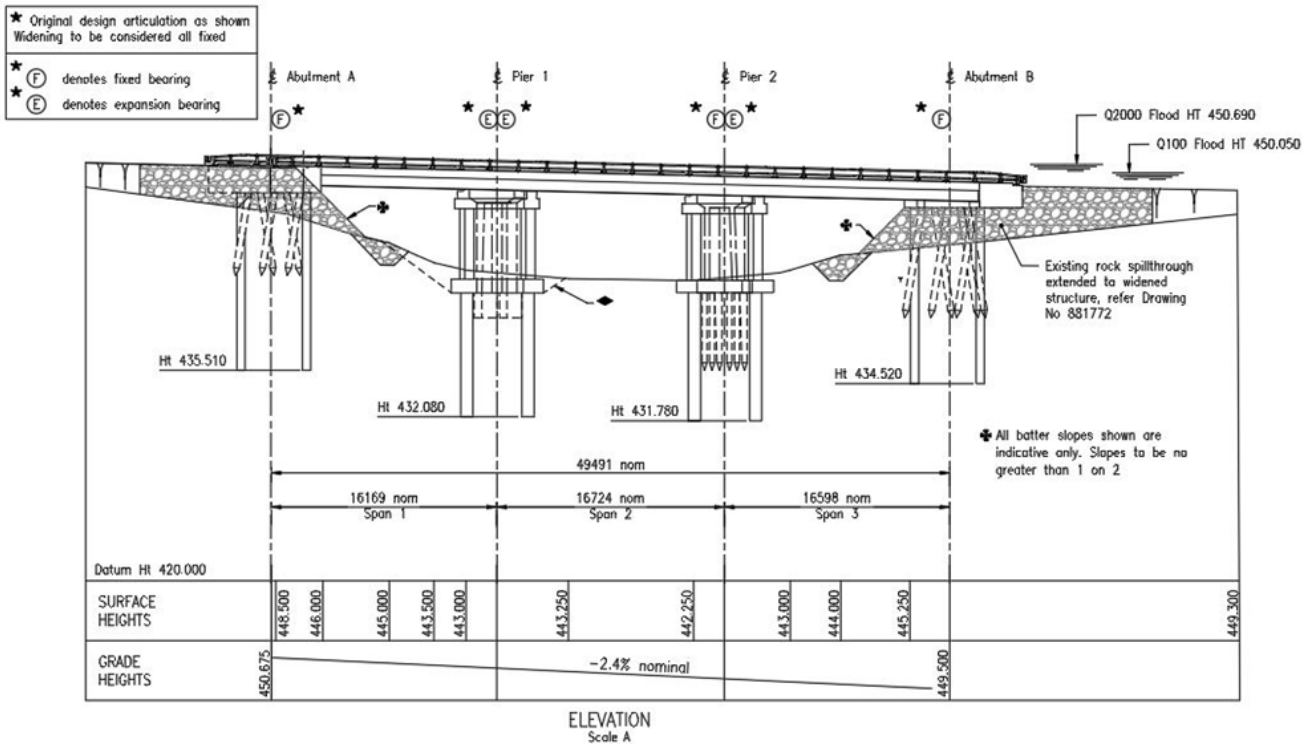
The GA elevation view shall show the whole bridge from kerb to kerb superimposed over a longitudinal section of the natural surface along the bridge control line, including the road surface, substructure, superstructure, and abutment protection. It provides essential information to understand the bridge's clearance, articulation, and its relationship to the surrounding terrain.

For skewed bridges, the elevation view may become complex and, in such cases, can be replaced with a sectional elevation if it offers clearer details. Additionally, when available, a perspective or 3D view can supplement the plan and elevation to assist in visualising complex features.

For a bridge spanning a navigable waterway, to obtain the relevant permits, the following additional hydraulic information shall be shown:

- mean high water springs (MHWS)
- mean low water springs (MLWS)
- highest astronomical tide (HAT)
- the clear distance between the abutments and piers
- the vertical distance between HAT and the underside of the deck units / girders, and
- the calculated scour levels as determined by the designer.

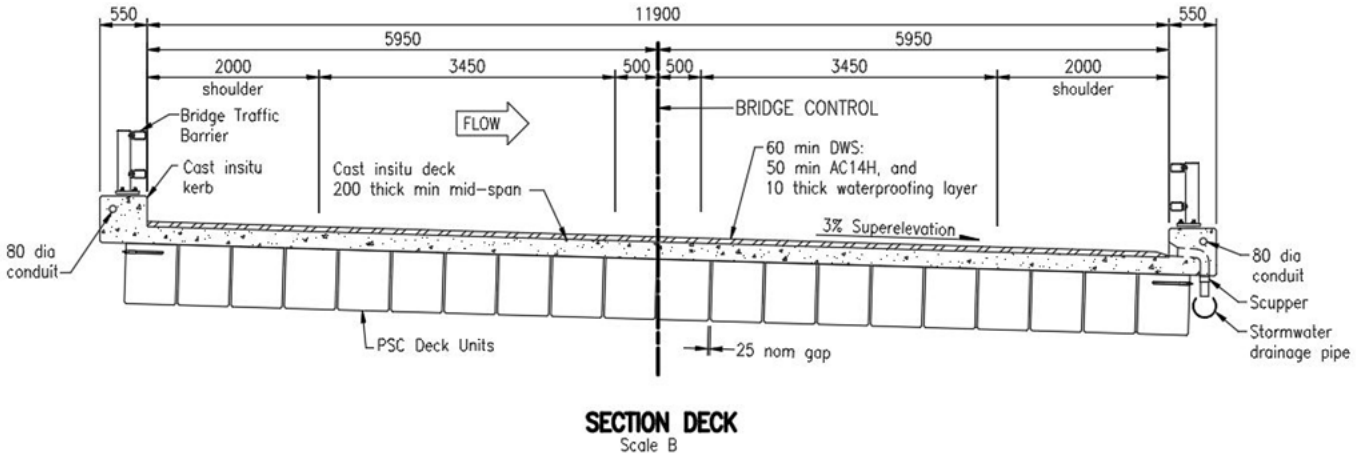
Figure 3.3.2 – Example General Arrangement drawing – elevation



3.3.3 Deck section

The section deck is a typical cross-section taken through the bridge superstructure. Where there are different superstructures, a typical section shall be shown for each superstructure type.

Figure 3.3.3 – Example deck section



3.3.4 Deck wearing surface

Deck wearing surface (DWS) on bridges is discussed in the DCBoS and in Chapter 3, and with regards to bridge superstructure drawings in Section 6 of this chapter.

The minimum thickness of DWS and a breakdown of layers shall be shown on the deck section (refer to the DCBoS).

Mass of DWS is traditionally given in the GA notes. Refer to Chapter 3 of this volume for theory and worked examples for calculating DWS thickness and mass.

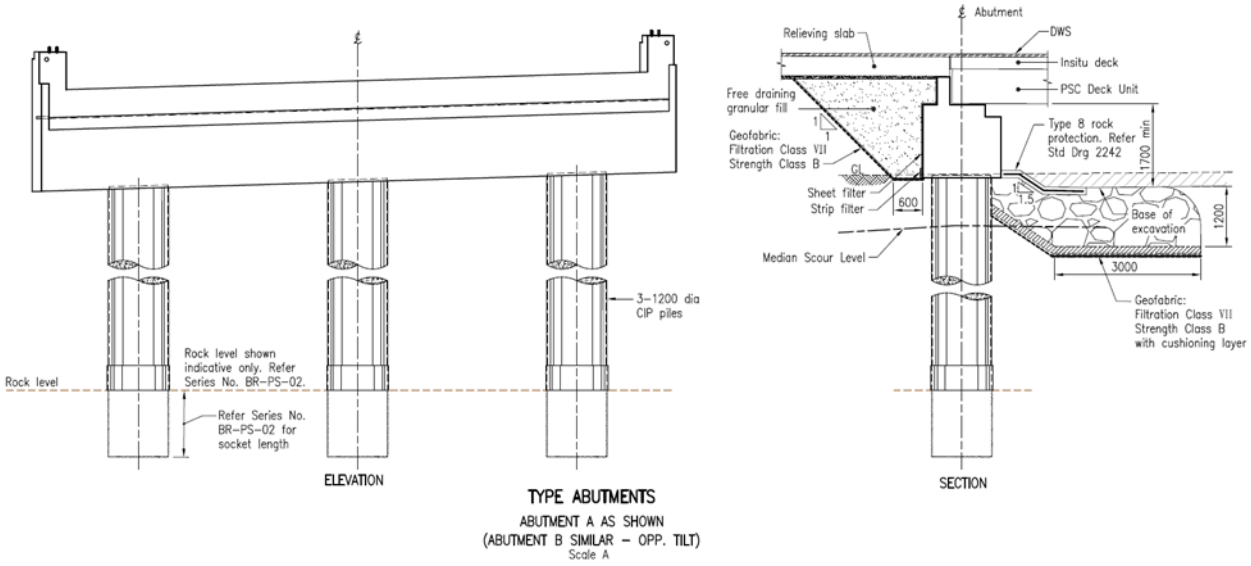
3.3.5 Abutment and pier elevations and sections

The elevation and section views for the abutments and piers provide key details such as the number, type, and size of piles supporting the structure, along with references to specific pile drawings, the outline of the headstock, and the interaction with the bridge elements supported.

For widenings, strengthenings, and other rehabilitation activities, the elevation shall clearly distinguish between new work and the existing bridge, highlighting broken-back areas and minimum clear distances where applicable.

The abutment section is used to show the scour protection required, detailing the types and dimensions, as well as the minimum clearance height for inspection and maintenance. Typical details are available in the department’s suite of abutment protection Standard Drawings.

Figure 3.3.5 – Example type abutments



3.3.6 Anchorage details

For deck unit bridges, anchorage details at abutments and piers shall be clearly shown on the GA drawings and shall show the assembly specifications for the anchorage systems at both the abutments and piers.

Connection details for girder or winged plank restraint at abutments and piers may be shown in the GA drawings. Restraint blocks are usually detailed on the substructure drawings and shown with the corresponding cross-girder details on the deck drawings.

Figure 3.3.6(a) – Example anchorage details for deck unit bridge

Note: This example is for a pier with a continuous joint and with bearings and provision for jacking.

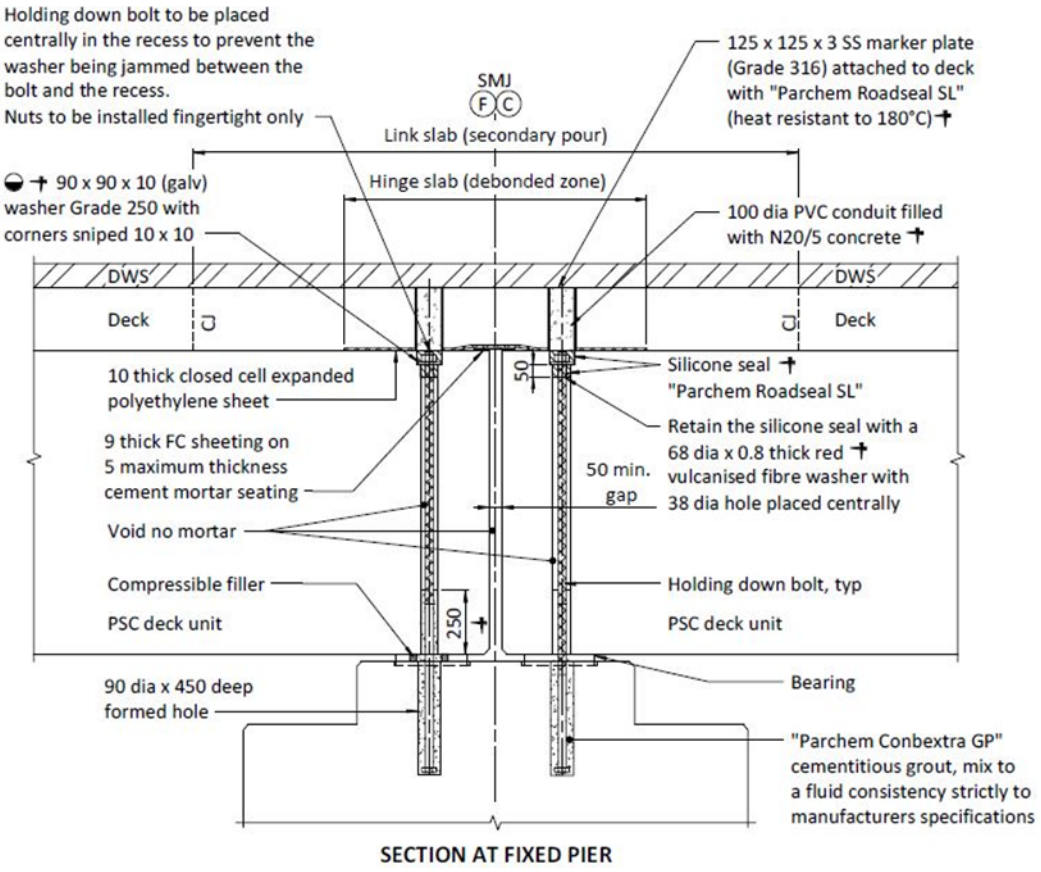
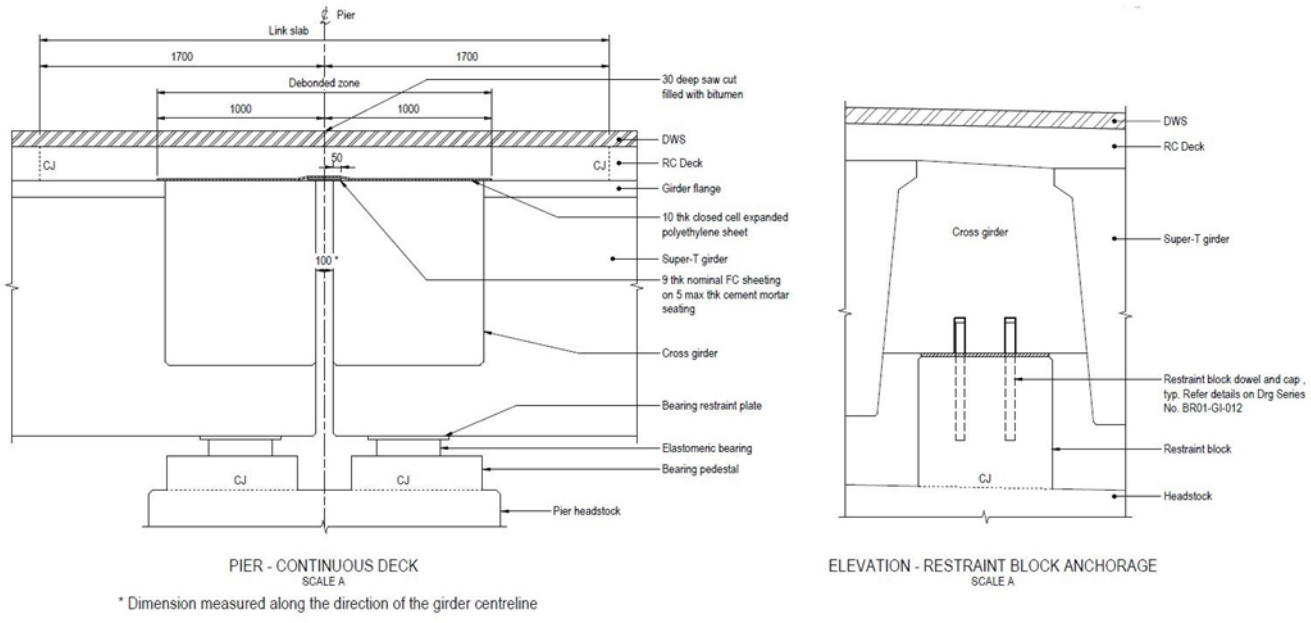


Figure 3.3.6(b) – Example restraint details for girder bridge



3.3.7 Alignment details

All bridge scheme drawings shall contain adequate alignment information to define the bridge site alignment independently of road design or survey drawings.

The horizontal and vertical curve details illustrate possible implications on the structure, for example a horizontal curve within 200 m of the bridge may have implications on the superelevation of the structure or possible implications on the width of the structure.

The horizontal and vertical alignment diagrams shall be shown on the GA drawings.

Figure 3.3.7(a) – Example horizontal alignment diagram

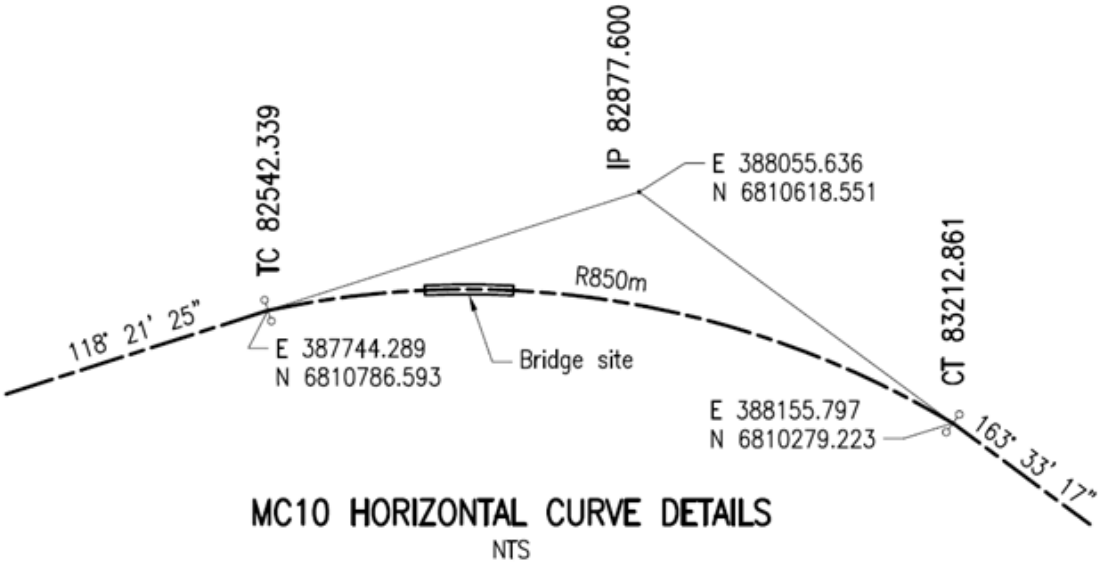
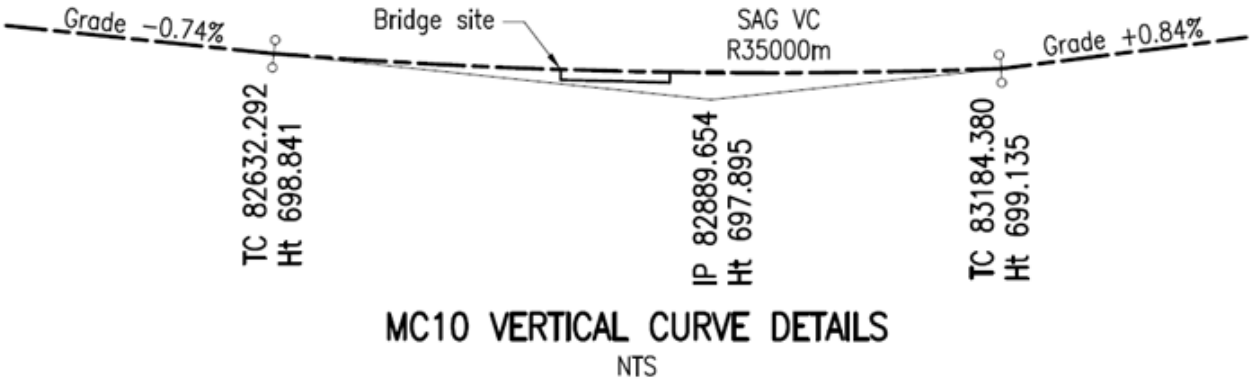


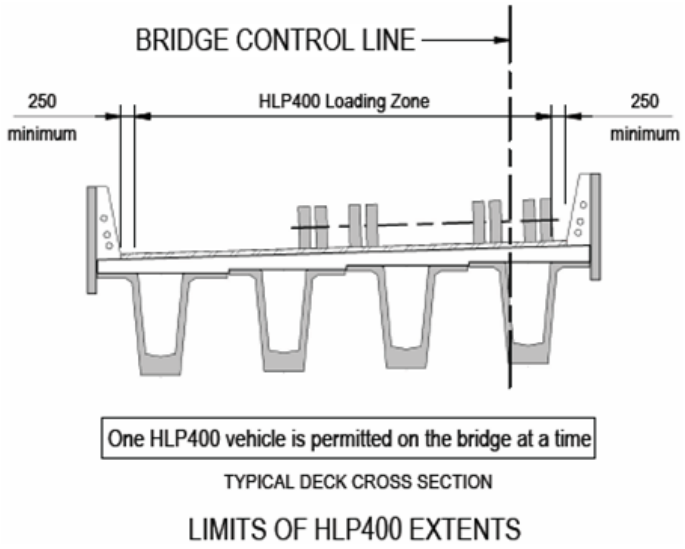
Figure 3.3.7(b) – Example vertical alignment diagram



3.3.8 Limits of heavy load platform vehicle diagram

As per the DCBoS, all bridges designed with HLP capability, and/or any other loading vehicles with conditions, shall have a diagram in the drawings showing the allowable deviation of the position of the vehicle on the bridge.

Figure 3.3.8 – Example heavy load platform vehicle diagram



3.4 Presentation of General Arrangement drawings

Table 3.4 provides the minimum drawing content that shall be presented on the set of project-specific drawings for the elements listed in Section 3 of this chapter. Typical drawing elements, such as views, details, schedules, and diagrams, are also included, and each is cross-referenced to figures extracted from example drawings.

Table 3.4 – General Arrangement drawings – project-specific drawings content

Requirement	Drawing or element description	Figure reference
GA plan	The plan view shall be aligned vertically above the elevation view on the same drawing. As a minimum, the features should include: • Outline of the structure. • Waterway name, if applicable. • Crossfall or superelevation. • Width between kerbs / barriers. • Major towns in each direction. • Contours of the existing surface and labels, marked at 0.25 m intervals with heights marked at 1 m intervals. • Property boundaries and fences. • Public utilities and services, labelling any services to be relocated, including if it is in or out of the contract. • Abutment and pier centrelines. • Relieving slabs.	Figure 3.3.1 Figure 3.4(a)

Requirement	Drawing or element description	Figure reference
	• Approach and departure guardrail / extruded concrete barriers. • Stream flow, including tidal stream flow, if applicable. • North point. • Civil control line and chainages, for example, road, rail or shared path control lines. – The civil control line name is to be shown on the left-hand side of the plan view, along with the bridge control. The horizontal alignment, bearing, or radius shall also be shown. • Extents of estimated scour, if applicable, and • Existing structures, to be shown in a dashed line, and with details such as span lengths, bridge width, and composition and existing nominal deck height.	
GA elevation	The elevation gives details of grade heights, surface heights, and chainages along the bridge control. If this view is shown along any other alignment, the line of section is to be clearly noted. Features may include, but are not limited to: • Outline of the structure. • Individual span lengths and overall length of the structure between abutments. • Articulation of the bridge. Fixed bearing, continuous joint, or expansion bearing shall be shown at the centreline of the abutments and piers, along with an explanation of the symbols used as shown below (placed on the left of the view): – F – denotes fixed bearing – E – denotes expansion bearing, and – C – denotes continuous joint. • Excavation to clear waterway, if applicable. • Minimum vertical clearances for overpass bridges. • Existing surface cross-section taken along the control line. • Existing structures. • Datum height. • Table of grade heights and vertical alignment details. Heights shall be shown at abutments and piers.	Figure 3.3.2 Also refer to full GA drawings in Figure 3.4(a), Figure 3.4(d), Figure 3.4(e), Figure 3.4(i)

Requirement	Drawing or element description	Figure reference
	• Table of surface heights. Show heights at major changes in grade, and at abutment and pier centrelines. • Table of chainages. Show chainages for each surface height, and at abutment and pier centrelines. • Hydraulic information, including flood velocities and flood immunity heights, with additional details as where required, and • Estimated scour levels.	
Deck sections	Where there are different superstructures, a typical section shall be shown for each superstructure type, and components to be shown include, but are not limited to: • bridge control • deck units / girders, nominal gaps between the deck units / girders • transverse stressing units • reinforced concrete (RC) deck • grade height • DWS and bituminous waterproof membrane • crossfall or superelevation • width between kerbs (overall width and dimensions to the bridge control) • width of footways • flow arrow, if applicable • scuppers and drainage • barriers, and • Jacking points for girder bridges.	Figure 3.3.3 Also refer to full GA drawings in Figure 3.4(b), Figure 3.4(f), Figure 3.4(j)

Requirement	Drawing or element description	Figure reference
Horizontal curve alignment details	Where a bridge is on a horizontal curve, the following information is to be shown on a horizontal curve detail: • bearings before and after the curve • radius of the curve • tangent points (including chainage and co-ordinates) • intersection points (including chainage and co-ordinates) • location of the bridge in relation to the curve, and • any other curve that may have an impact on the structure (within approximately 200 m of the abutments).	Figure 3.3.7(a) Also refer to full GA drawing in Figure 3.4(b)
Vertical curve alignment details	**Vertical curve alignment** Where a bridge is on a vertical curve, the following information is to be shown on a vertical curve detail: • grade before and after the curve • radius of the curve and direction of the curve (sag or crest) • tangent points (including chainage and heights) • intersection points (including chainage and heights) • location of the bridge in relation to the curve, and • •any other curve that may have an impact on the structure within approximately 200 m of the abutments.	Figure 3.3.7(b) Also refer to full GA drawing in Figure 3.4(b)
Anchorage details	Anchorage details at abutments and piers for deck unit bridges may include, but are not limited to: • abutment and pier headstocks, deck units, girders, relieving slabs, RC deck, DWS etc • detail of the anchorage system used, for example, dowels, threaded rod or holding down bolts on deck unit bridges or restraint mechanism on girder bridges • additional corrosion protection details for holding down bolts • positioning of jacks for future bridge maintenance • limits of mortar seating and its nominal thickness • bearings and recesses for bearings	Figure 3.3.6(a)

Requirement	Drawing or element description	Figure reference
	• areas to be grouted or left clear of grout • expansion joints, and • compressible filler.	
Abutment and pier elevations and sections (type abutments and piers)	Elevation and section, or end elevation if more appropriate, may include, but is not limited to: • number, type and size of piles supporting each structure, or reference to a pile drawing • outline of the headstock • a clear delineation between new work and the existing bridge, including broken back areas • minimum clear distance should be added where applicable • abutment protection types and dimensions, and • minimum clearance height dimensions for inspection and maintenance.	Figure 3.3.5 Also refer to full GA drawing in Figure 3.4(b), Figure 3.4(f), Figure 3.4(j)
Limits of HLP vehicle diagram (or other restricted vehicle loading diagrams)	Show the following details: • pictorial cross section of deck • allowable restricted vehicle dimensions from the bridge control to the outside of vehicle, and • minimum clear distance from the restricted vehicle to the kerb face.	Figure 3.3.8 Also refer to full GA drawing in Figure 3.4(a)

Figure 3.4(a) – Example General Arrangement drawing 1 of 3 showing plan and elevation views for a deck unit bridge

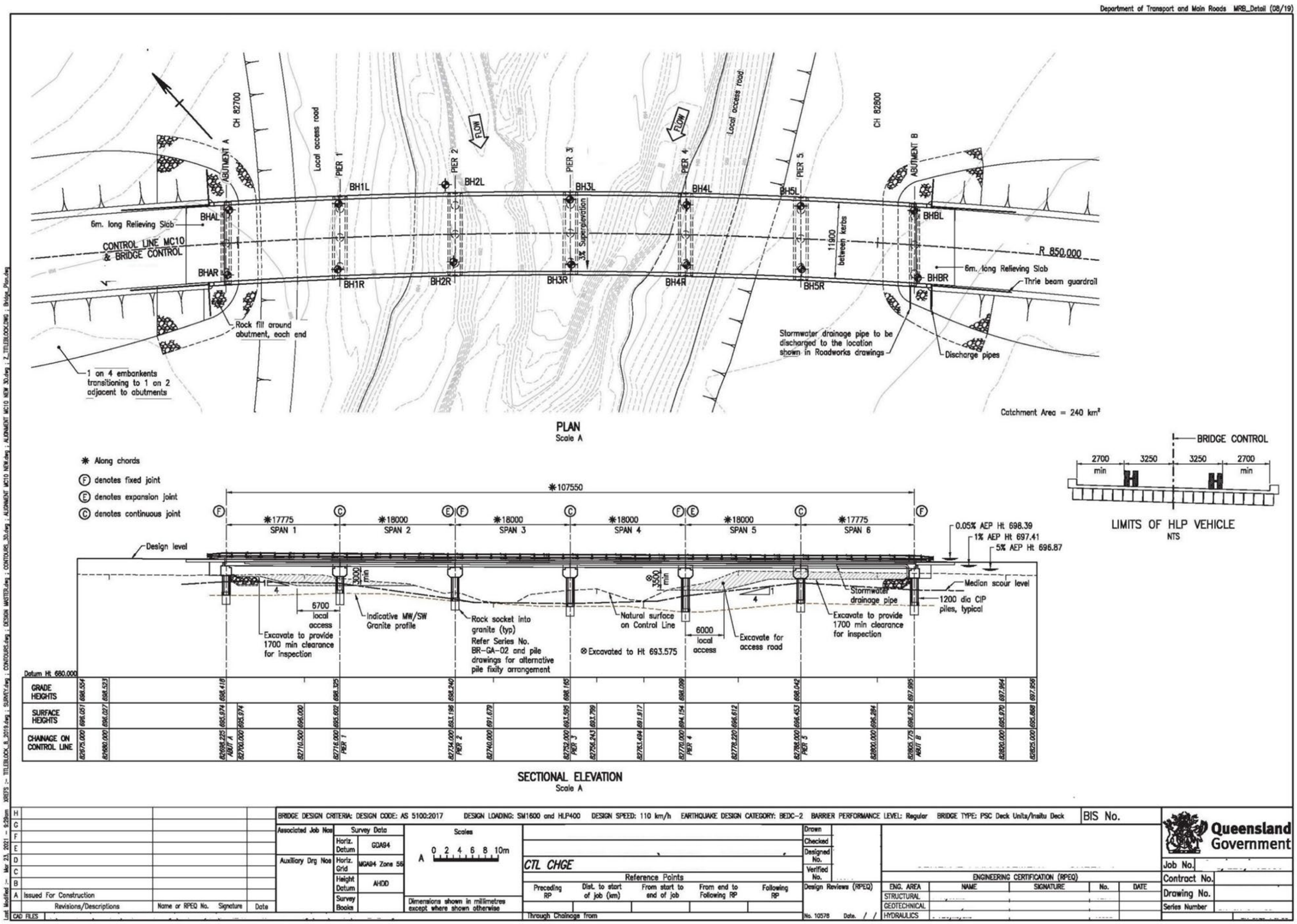


Figure 3.4(b) – Example General Arrangement drawing 2 of 3 showing type abutment and pier elevations and sections, and horizontal and vertical curve diagrams

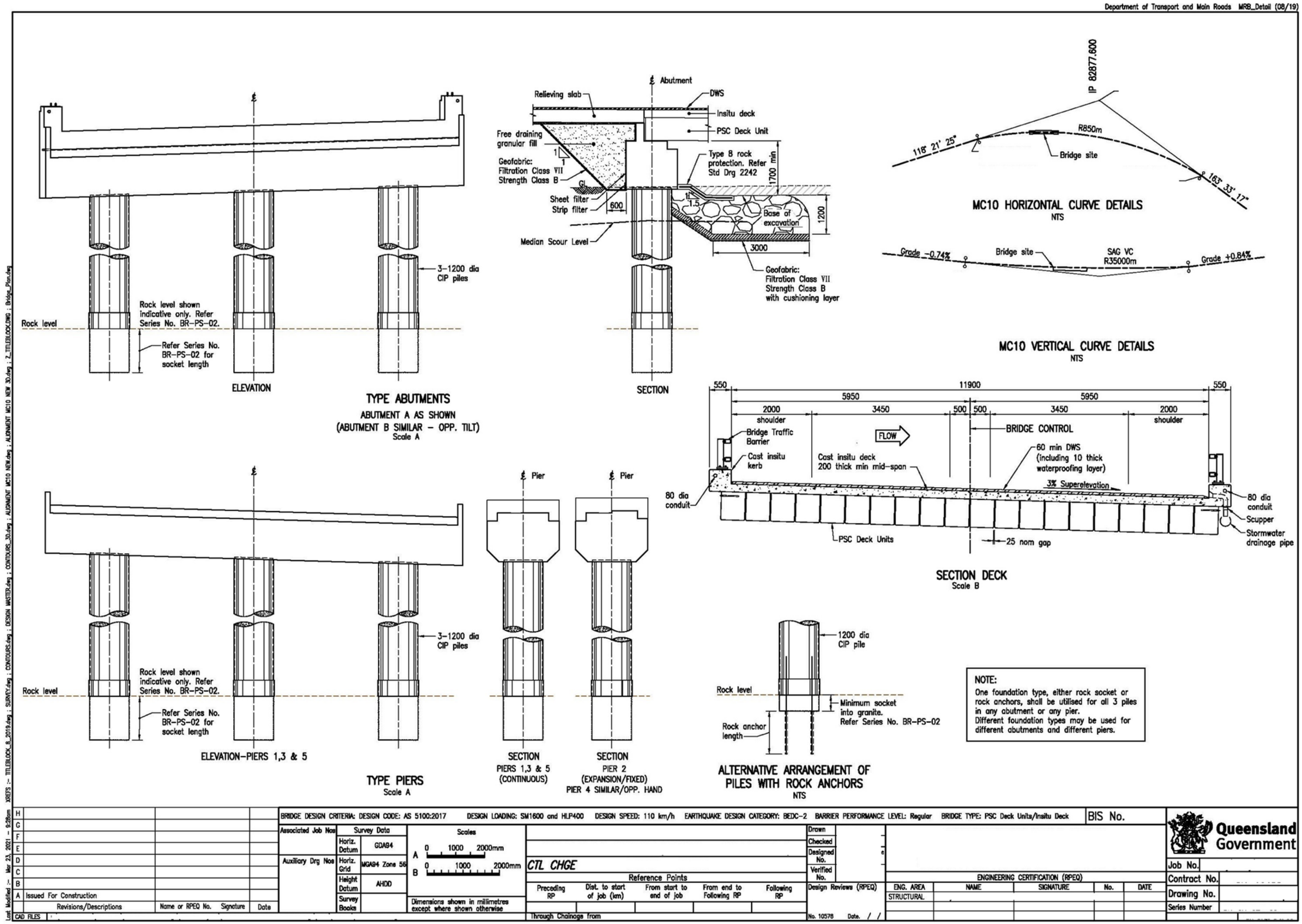


Figure 3.4(c) – Example General Arrangement drawing 3 of 3 showing deck unit layout and anchorage details

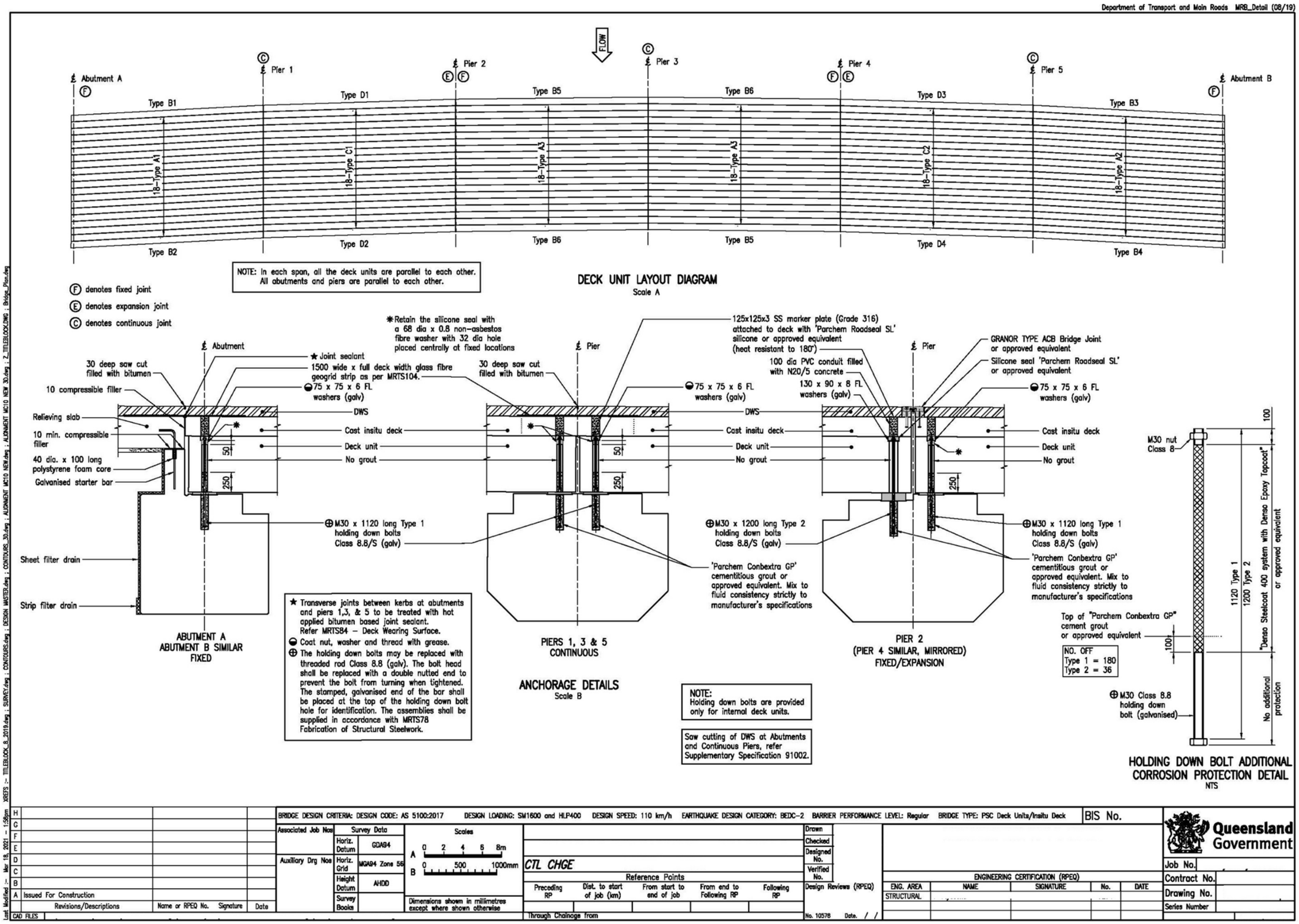


Figure 3.4(d) – Example General Arrangement drawing 1 of 5 for Super-T girder bridge

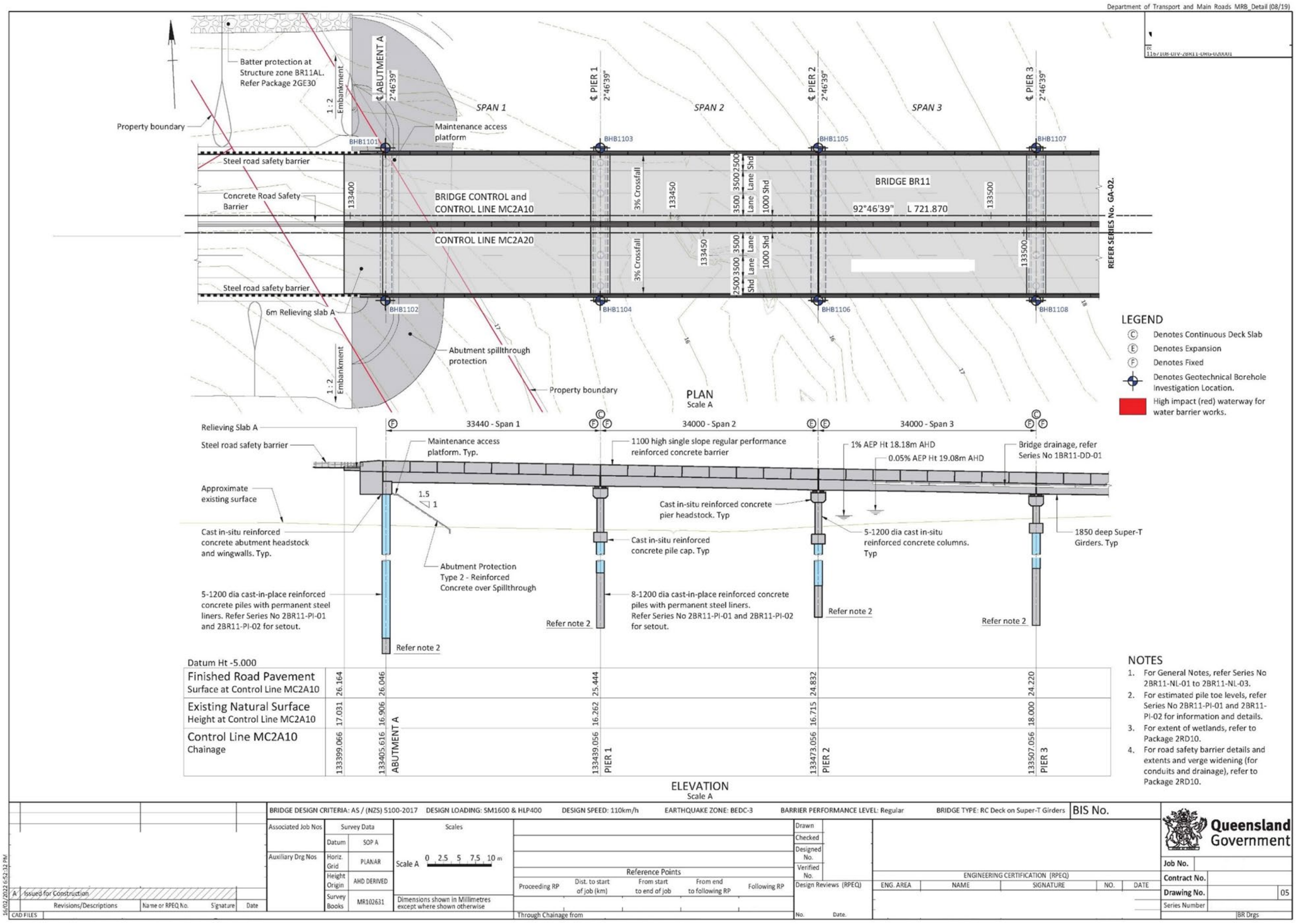


Figure 3.4(e) – Example General Arrangement drawing 2 of 5 for Super-T girder bridge

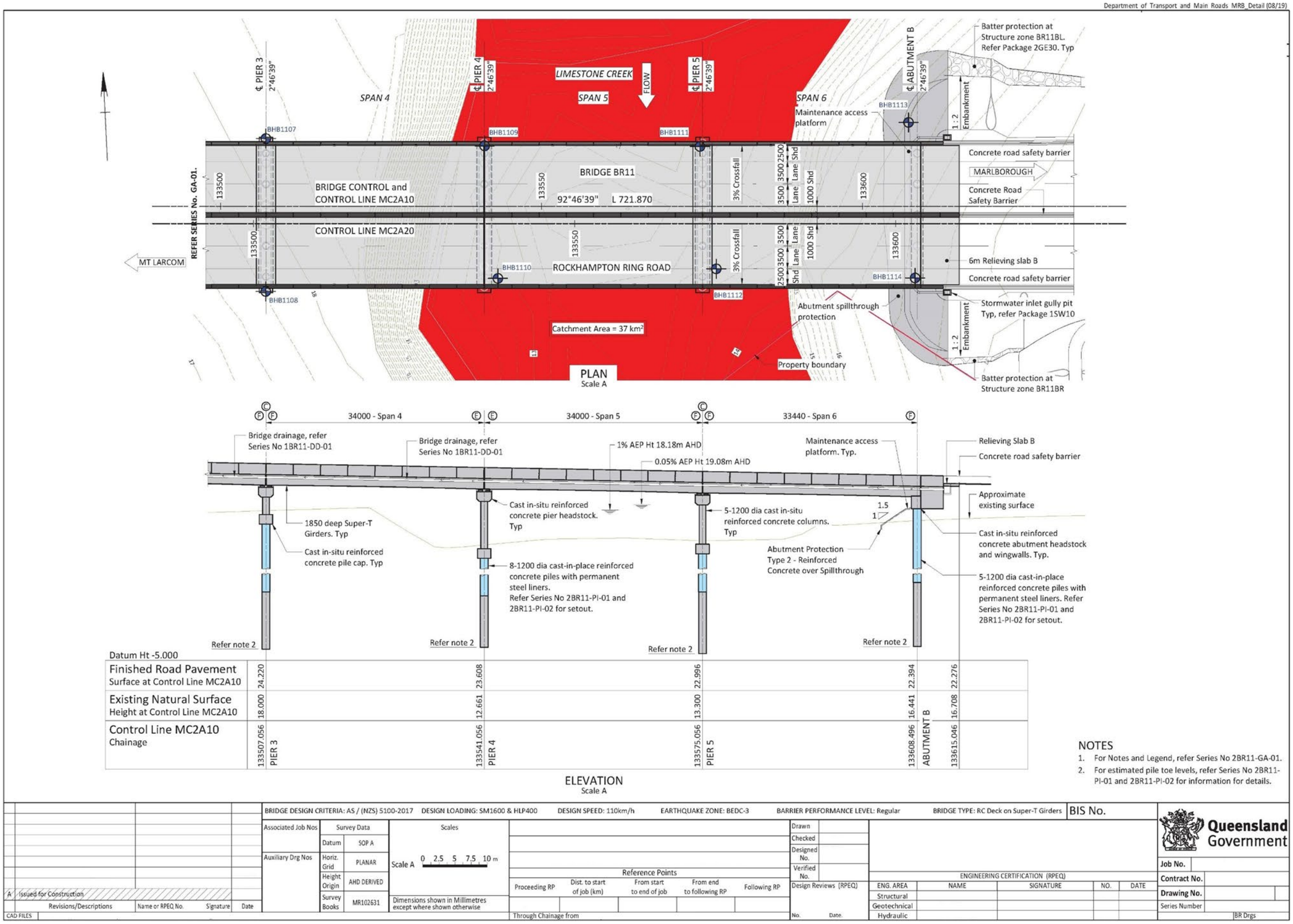


Figure 3.4(f) – Example General Arrangement drawing 3 of 5 for Super-T girder bridge

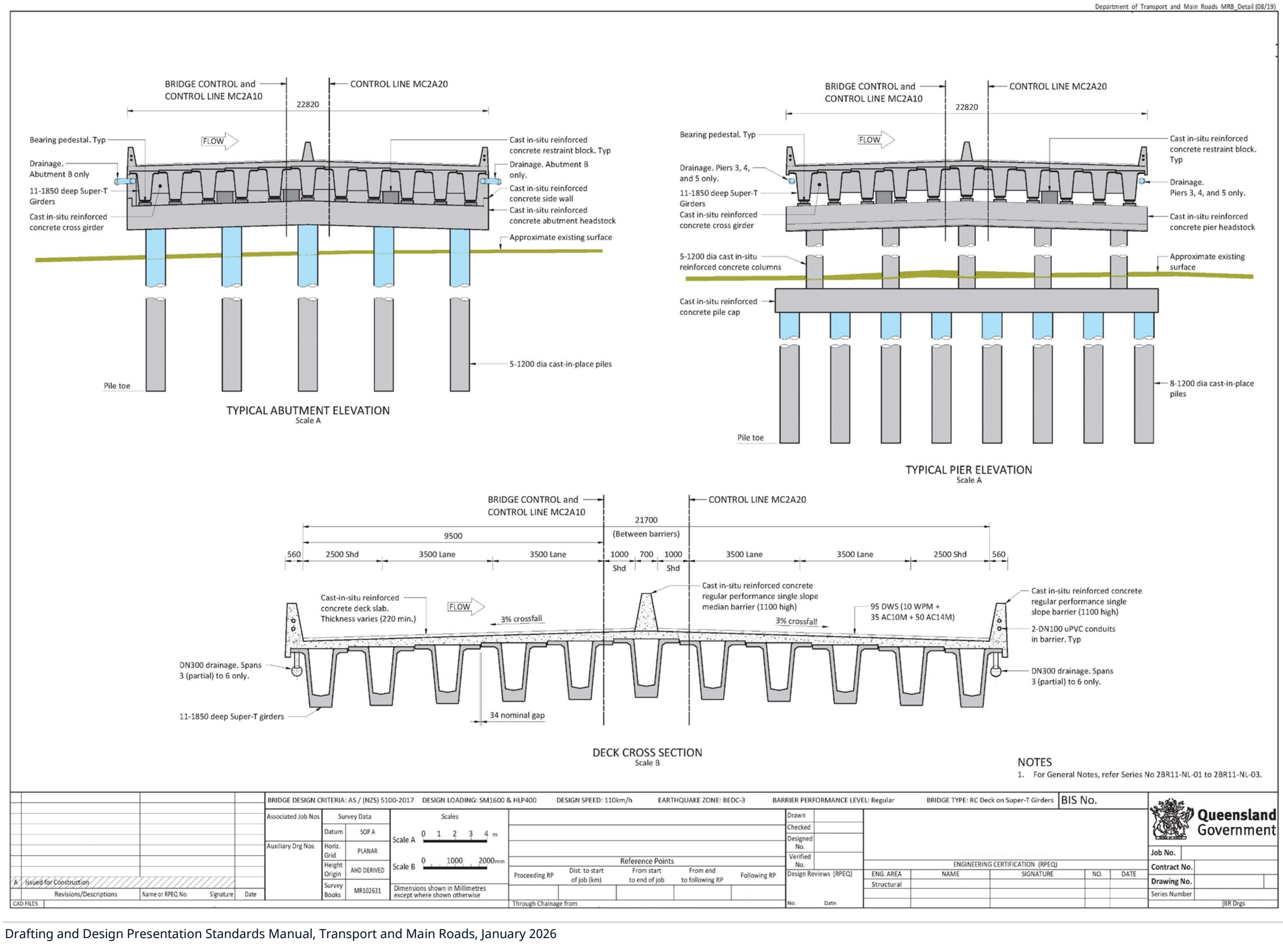


Figure 3.4(g) – Example General Arrangement drawing 4 of 5 for Super-T girder bridge

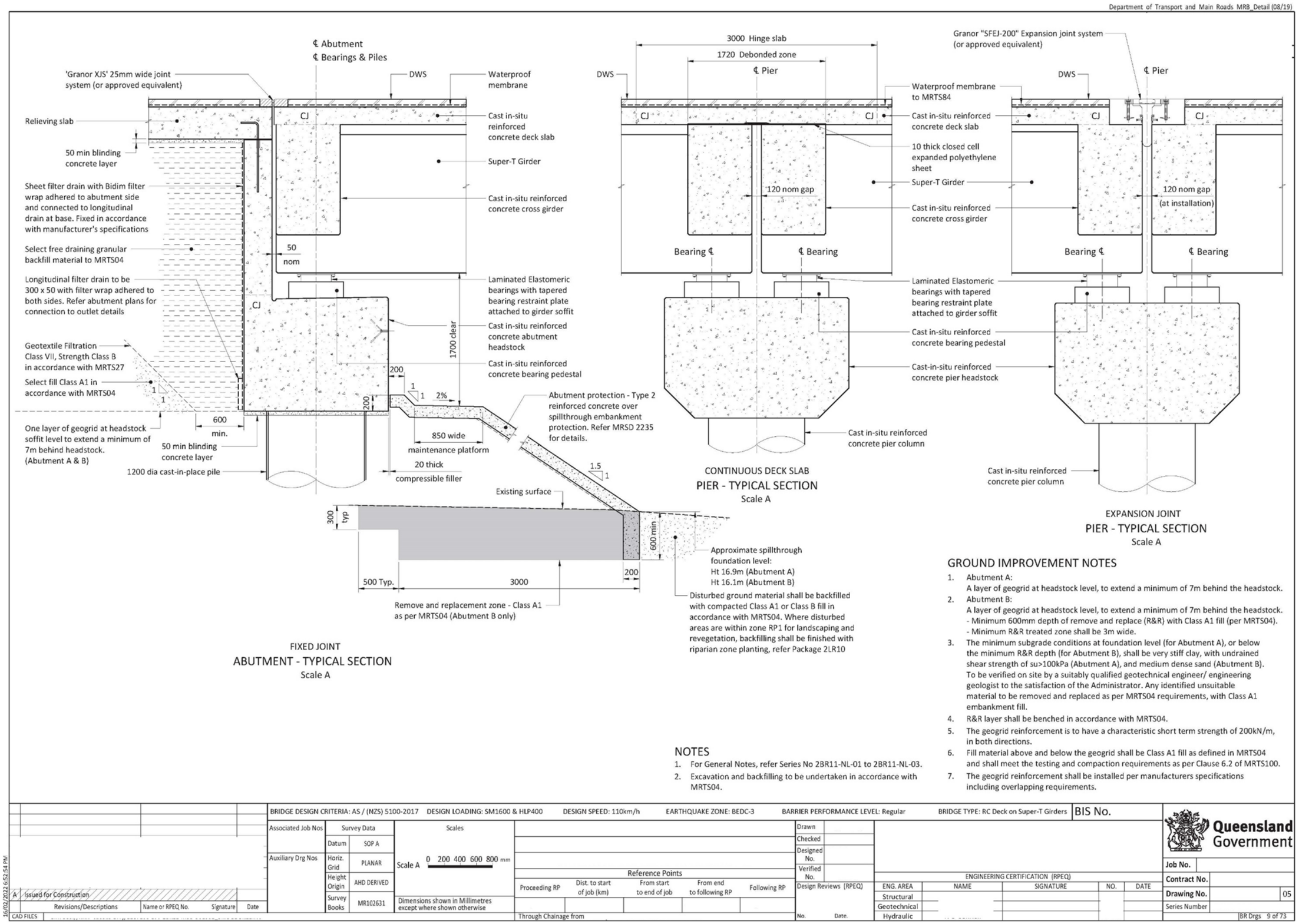


Figure 3.4(h) – Example General Arrangement drawing 5 of 5 for Super-T girder bridge

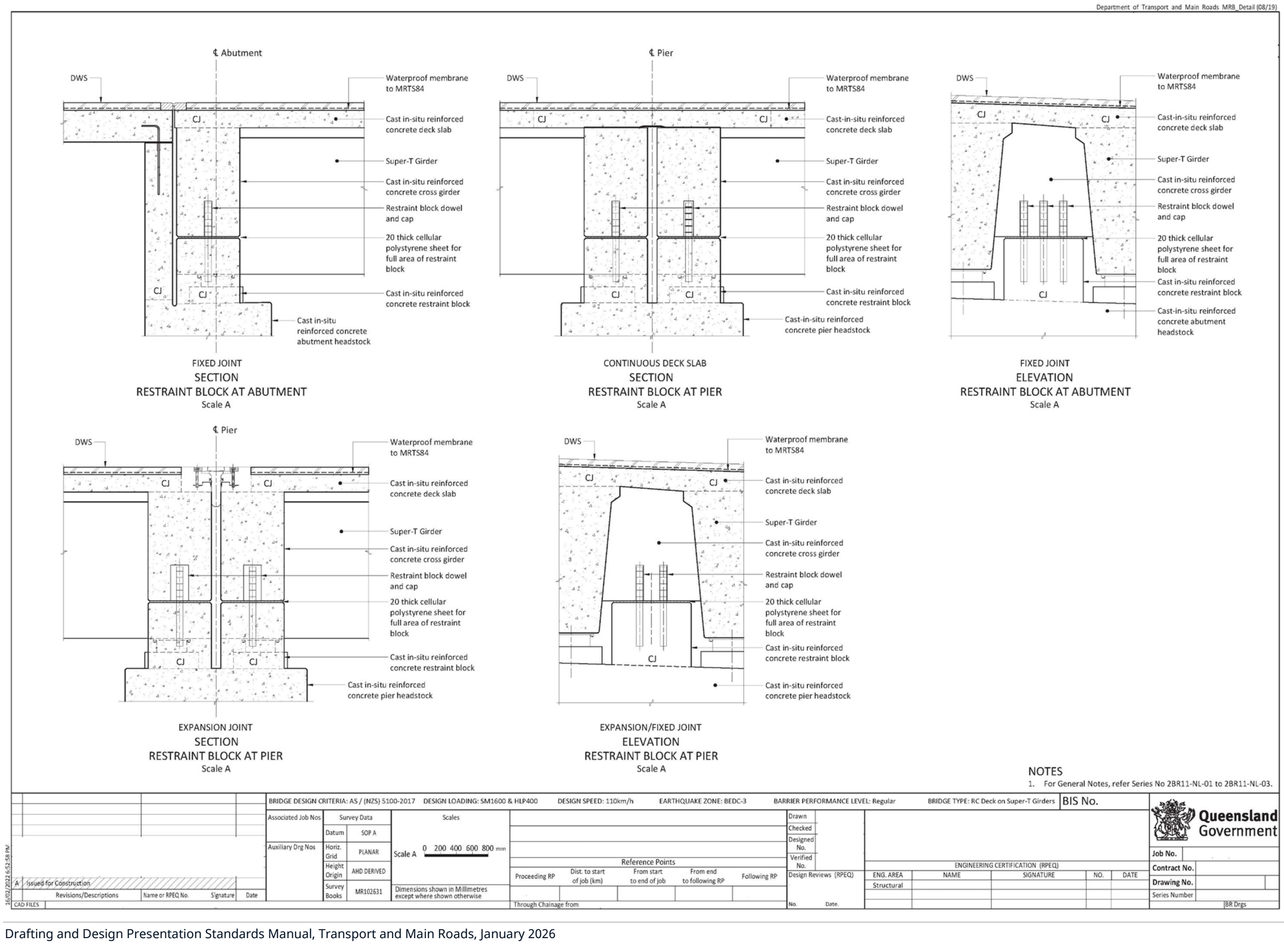


Figure 3.4(i) – Example General Arrangement drawing 1 of 3 for winged plank bridge

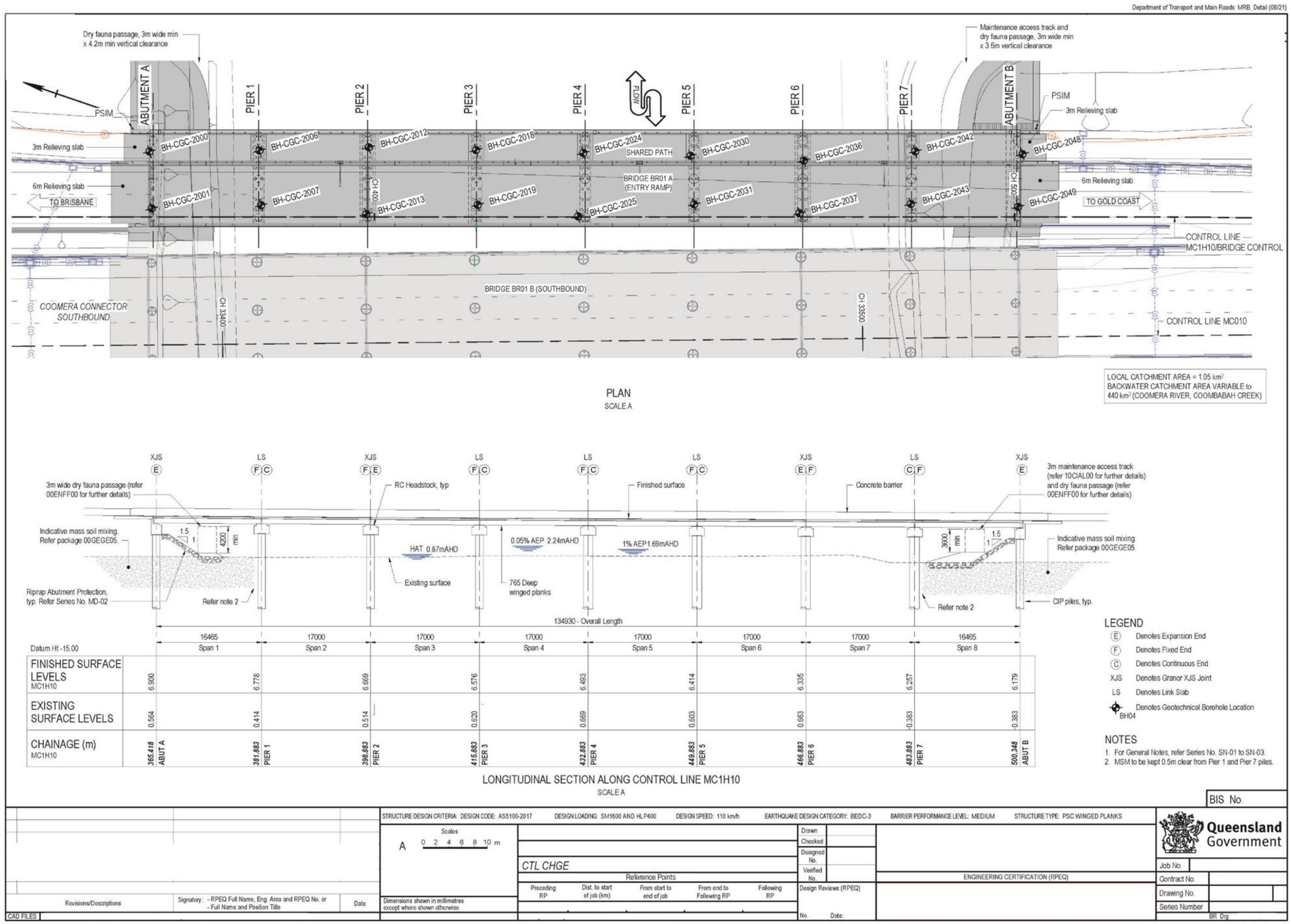


Figure 3.4(j) – Example General Arrangement drawing 2 of 3 for winged plank bridge

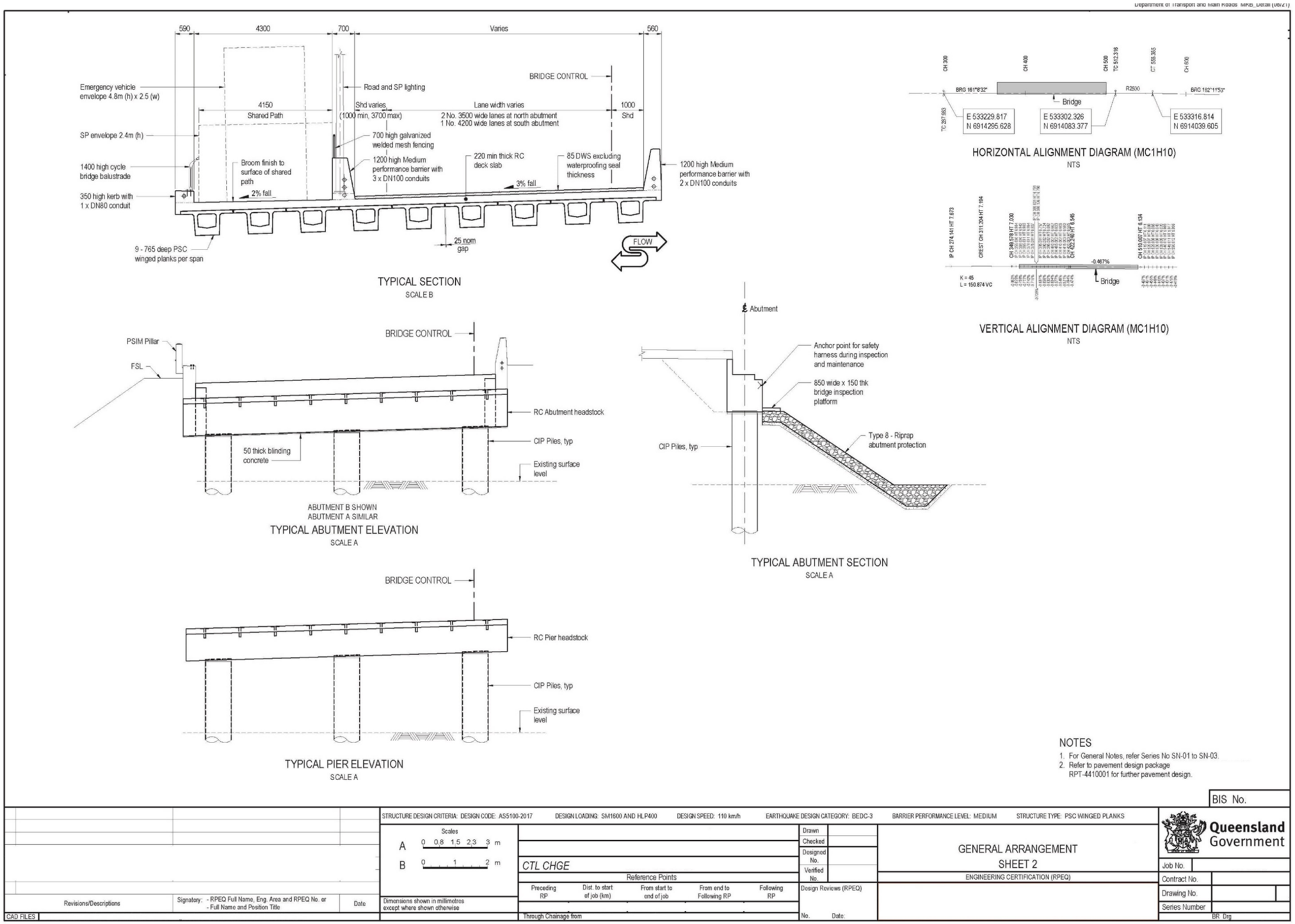
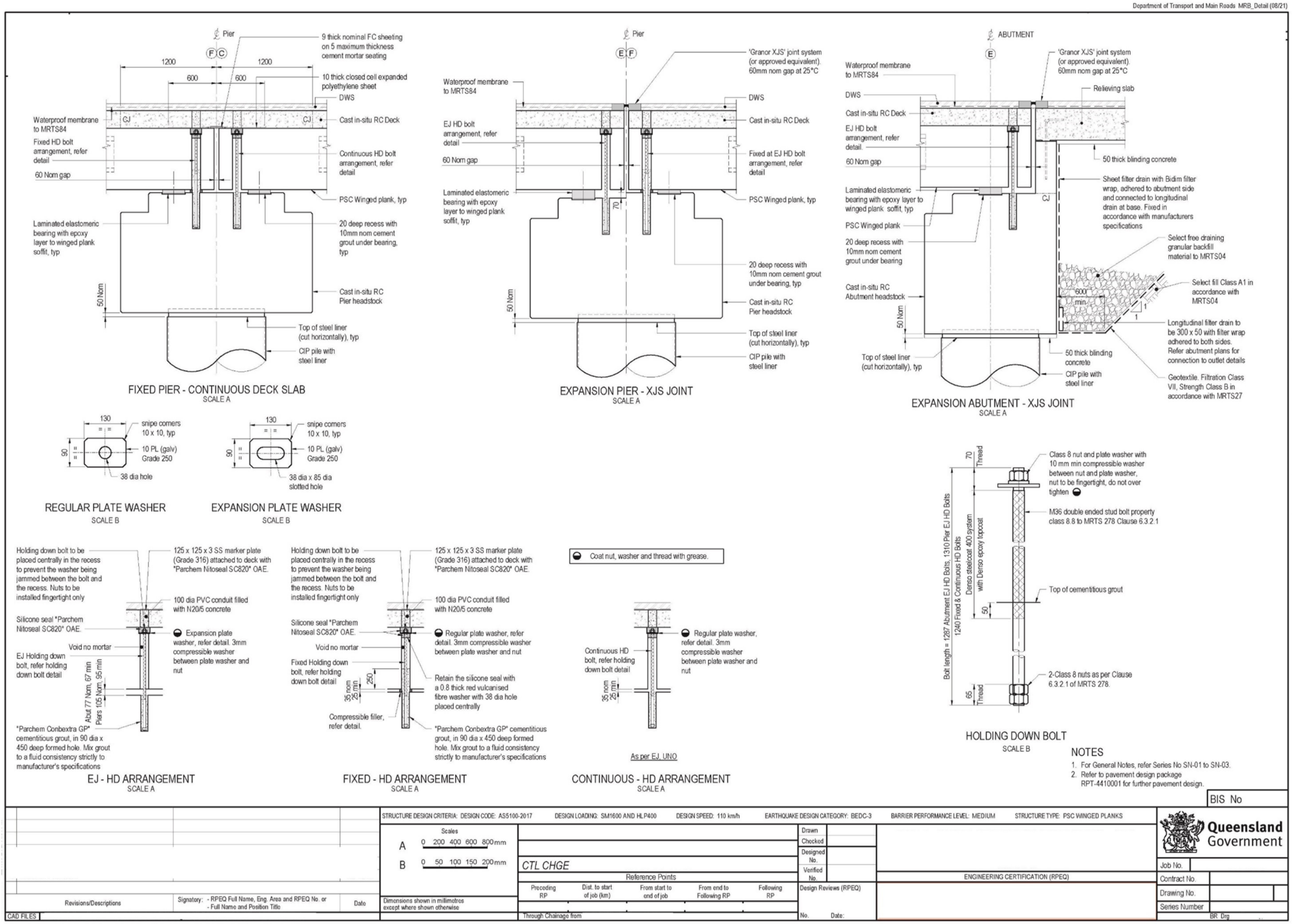


Figure 3.4(k) – Example General Arrangement drawing 3 of 3 for winged plank bridge



4 Substructure drawings

4.1 General

The bridge substructure are those elements that support the superstructure. The substructure generally comprises of following main elements:

- Foundations - piles, pile caps, and spread footings.
- Piers – components that support the superstructure between the ends of a bridge such as headstocks, walls and columns.
- Abutments – components that support the superstructure at the end of a bridge, such as headstocks, walls, and columns.
- Wing walls or approach walls – components that retain and support the road embankment at the approaches to each end of the bridge, and
- Bearings, if specified.

Piles, footings, pile caps, headstocks, abutment and pier structures, bearing pedestals, bearing recesses, and restraint blocks are some of the elements that shall be detailed in the drawings.

4.2 Foundation drawings

The most common types of foundations used in departmental bridge construction are:

- driven piles, such as prestressed concrete 550 octagonal (PSC) piles as per MRTS73 *Manufacture of Prestressed Concrete Members and Stressing Units*, SD 2021 *550 Octagonal PSC Piles – Earthquake Classification BEDC-1 Exposure Classification B2 (Drawing 1 of 3 to Drawing 3 of 3)* or SD 2022 *550 Octagonal PSC Piles – Earthquake Classification BEDC-1 Exposure Classification C1 and C2 (Drawing 1 of 3 to Drawing 3 of 3)*, and SD 2023 *550 Octagonal PSC Piles – Spliced Pile Details (Drawing 1 of 4 to Drawing 4 of 4)* for splice details when required
- cast-in-place piles as per MRTS63 *Cast-In-Place Piles*
- driven steel tubular piles as per MRTS64 *Driven Tubular Steel Piles (with reinforced concrete pile shaft)*, and
- spread footings used with blade wall abutments and/or piers.

Where raked piles are used, a note shall be added to the drawing stating that the location shown is at the underside of the headstock / pile cap into which the pile is bonded. Raked piles are also to have the slope of the rake noted together with an arrow showing the direction of the rake.

4.2.1 Foundation layout and geological profile

The following details are to be provided in addition to the pile details and may be supplied on a separate drawing or merged with the pile drawings (depending on the complexity):

- borehole and pile location plan, using the plan view from the first GA drawing with the foundation boreholes
- sections or profile to demonstrate the borehole data and soil strata, and a Legend for the hatch patterns, symbols and line types, and
- the notes at the bottom right-hand side of the drawing.

This drawing may also show the pile identification and setting out diagram instead of just the borehole and pile location plan (refer to Section 4.2.2 of this Chapter for details).

The following table lists the content specific to a dedicated foundation layout and geological profile drawing.

Table 4.2.1 – Foundation layout and geological profile drawings content

Requirement	Drawing or element description	Figure reference
Borehole and pile location plan	Plan view made from: • the GA drawings, or • pile identification and setting out diagram on the pile drawings. Plan view recommended to show as a minimum: • existing features and contours • borehole locations • layout of piles about the bridge control, and • direction labels.	Figure 4.2.1(a)
Sections or profile	To depict the borehole data and soil strata.	Figure 4.2.1(b)
Legend	A guide for the hatch patterns, notations symbols, and line types used on a drawing.	Figure 4.2.1(a) Figure 4.2.1(b)
Notes	Notes referencing source information such as borehole logs, pile schedules, and other details on the drawings and within the reports.	Figure 4.2.1(b)

Figure 4.2.1(a) – Example foundation layout geological profile drawing

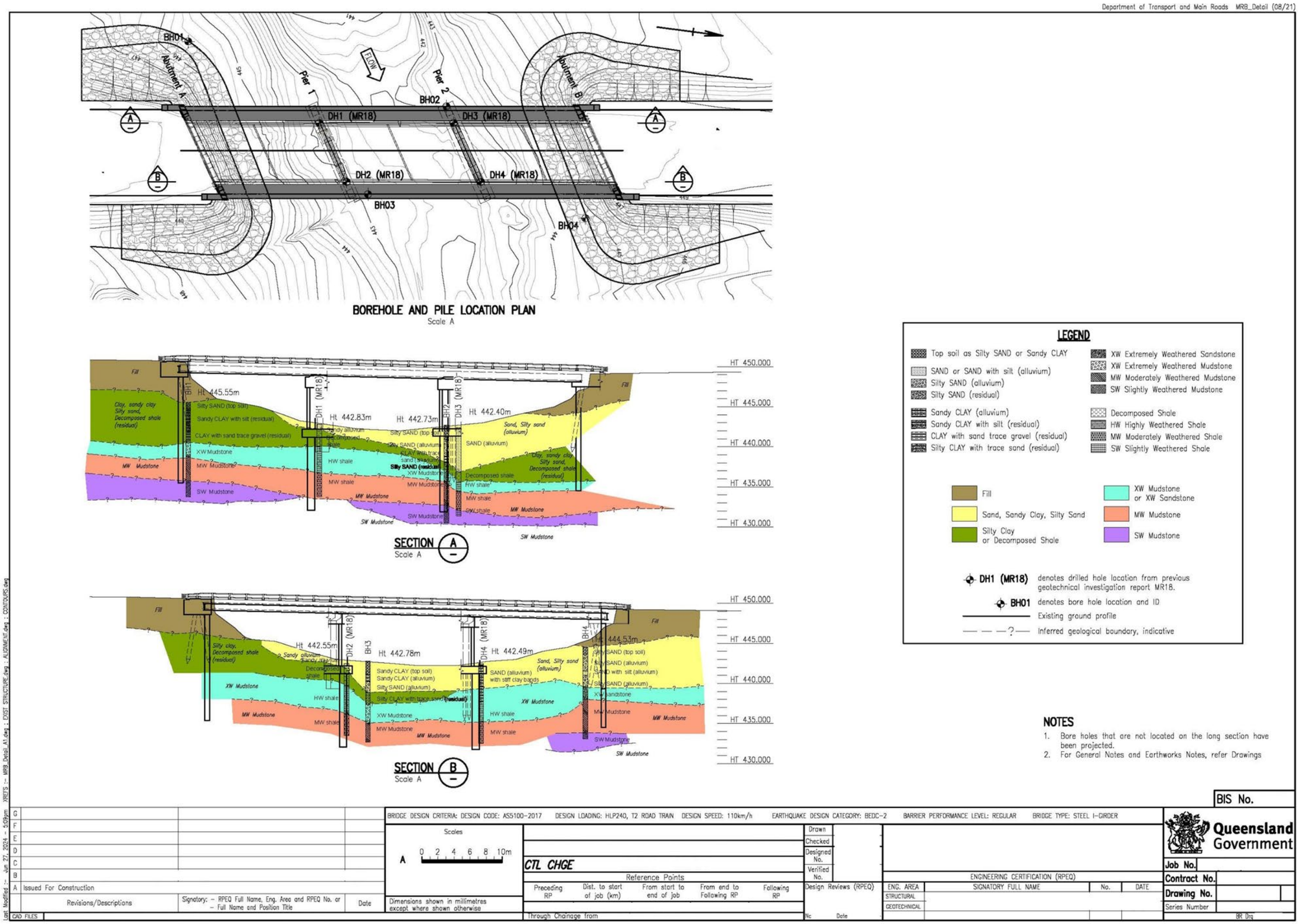
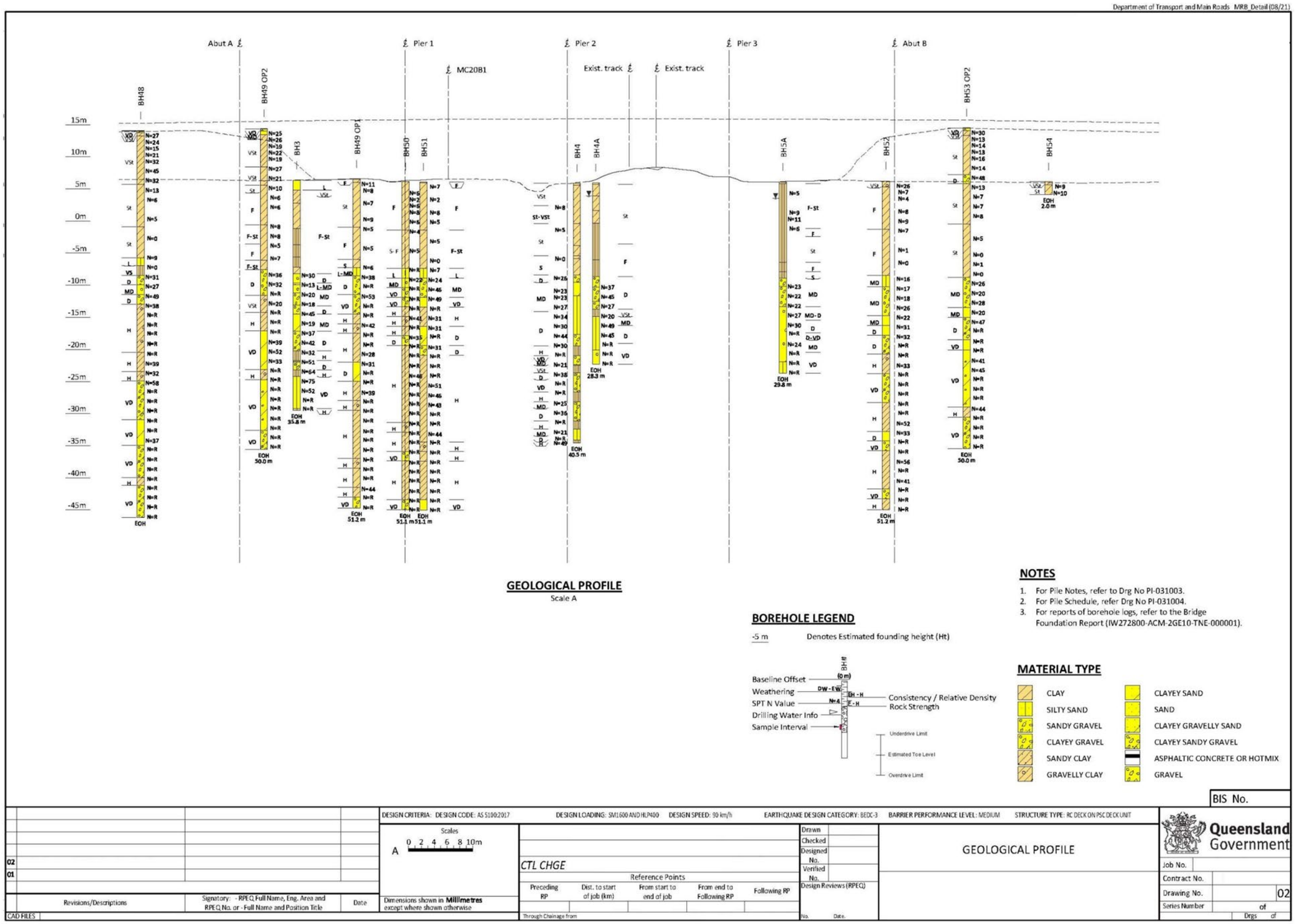


Figure 4.2.1(b) – Example foundation layout geological profile drawing



4.2.2 Pile identification and setting out diagram

Pile identification and setting out of the piles is generally shown as the first drawing in the pile drawings set.

The pile identification and setting out diagram may be drawn not to scale if doing so benefits clarity. If done in this way, the diagram is to have reasonable proportions to ensure readability.

The diagram is to show the following details:

- bridge control and its bearing, or the radius of the horizontal curve
- the centreline of the pile group at abutments and piers is to be defined by a bearing, and the intersection of that centreline with the bridge control line is to be identified by a co-ordinate, and also road chainage if on horizontal curve
- pile identification mark for each individual pile
- dimensions to locate each pile
- relationship of footings to bridge control and abutment and pier centrelines
- relationship of stage construction to bridge control
- existing contours
- borehole locations
- existing foundations / piles, including existing pile rakes, if applicable
- any pre-existing underground elements that could impact the design or construction (for example, services, footings, or slabs)
- relative location of any overhead powerlines likely to impact or restrict driving not otherwise identified on the general arrangement
- foundations / piles of adjacent bridges, if applicable, and
- any other known infrastructure that could be affected.

4.2.3 Pile identification nomenclature

All piles shall be identified by a pile identification mark shown adjacent to the pile it represents.

Each pile shall have a unique pile mark, assigned in a consistent pattern, with increasing chainage and from the far-left side to the far-right side along abutment centrelines and set out from to pier centrelines, starting at Abutment A and looking toward Abutment B.

A simple method of pile identification uses the bridge element label and numbers for each pile at that location, as per the following:

- an alphanumeric character or number that represents the element of the bridge, for example, A for Abutment A, B for Abutment B, and 1 for Pier 1, 2 for Pier 2 and so on
- a “/” separator, followed by
- a sequential number given to each pile counting from the left-hand side of the bridge.

For example, piles for a 3-span bridge at Abutment A would be A/1, A/2; at Pier 1 would be 1/1, 1/2 likewise; at Pier 2 would be 2/1, 2/2, and at Abutment B would be B/1, B/2.

Alternatively, for structures where the pile marks are to align with coding requirements of the department's *Building Information Modelling (BIM) for Bridges* manual and *Structures Inspection Manual* (SIM), each pile mark may begin with a prefix that represents the specific component, such as "CP" for cast-in-place piles, "PP" for precast piles, "SP" for driven tubular steel piles. For a complete list of recommended component codes, refer to Table 8 in Chapter 2 of this volume.

Pile marks aligned with BIM should be formatted with a hyphen ("-") separating the component ID, location, and the pile number. The format of the mark is component ID-location-pile number:

- component ID = component code for the element of the foundation as per Table 8 of Chapter 2
- location = a 2-letter abbreviation that represents the location of the element, for example, AA for Abutment A, AB for Abutment B, and P1 for Pier 1, and
- pile number = a 2-digit sequential number given to each pile counting from the left-hand side of the bridge, for example 01, 02 and so on.

The spacing of the first pile from the bridge control along the centreline of the group of piles shall be dimensioned from the bridge control line. The spacing of each subsequent pile along the centreline of the group of piles shall be dimensioned from the previous pile. This is further highlighted in Figure 4.2.3(a) as dimensions A and B respectively. These are then translated into the diagram in the next Figure 4.2.3(b).

Figure 4.2.3(a) – Diagram to explain the dimensioning of piles

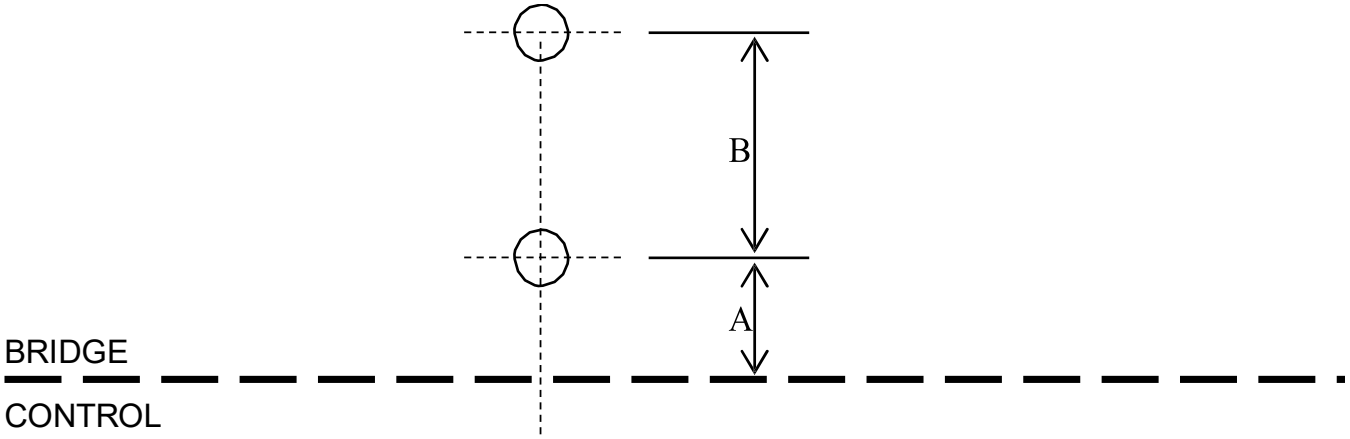
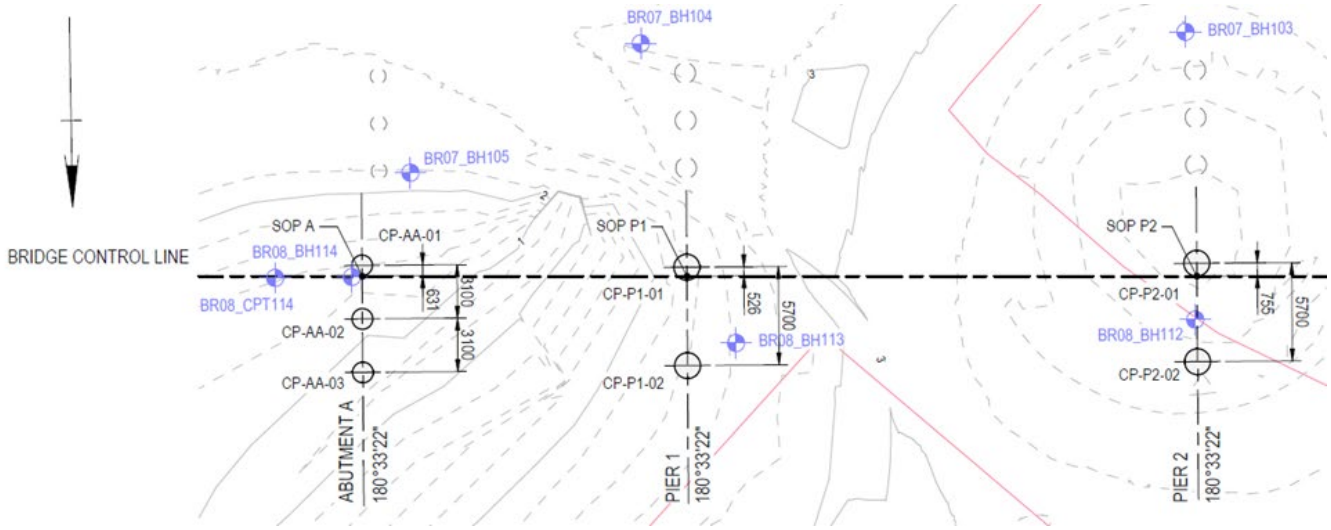


Figure 4.2.3(b) – Pile identification and setting out diagram

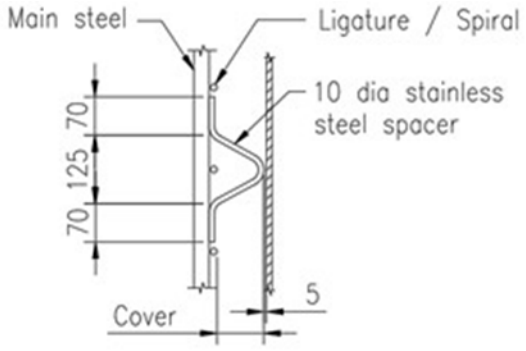


PILE IDENTIFICATION AND SETTING OUT DIAGRAM

4.2.4 Typical pile and footing details

The following figures provide standard details for pile drawings, and project examples for footings.

Figure 4.2.4(a) – Example stainless steel spacer



1 set of 4 stainless steel spacers (equally spaced around circumference of the cage) to be welded securely to main steel at intervals of 4000 maximum on welded cages and 2500 maximum on unwelded cages. There must be at least 2 sets of stainless steel spacers per cage. Spacers shall be placed approximately in line and straddle the ligature / spiral bas shown.

SPACER DETAIL
NTS

Figure 4.2.4(b) – Example stiffening band

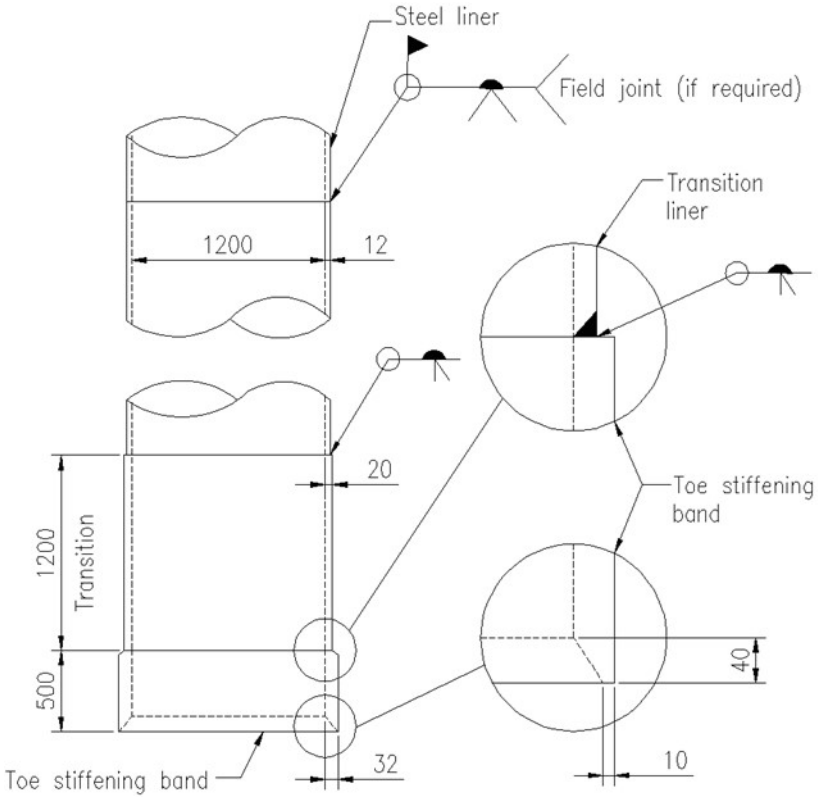


Figure 4.2.4(c) – Example spread footing setting out diagram

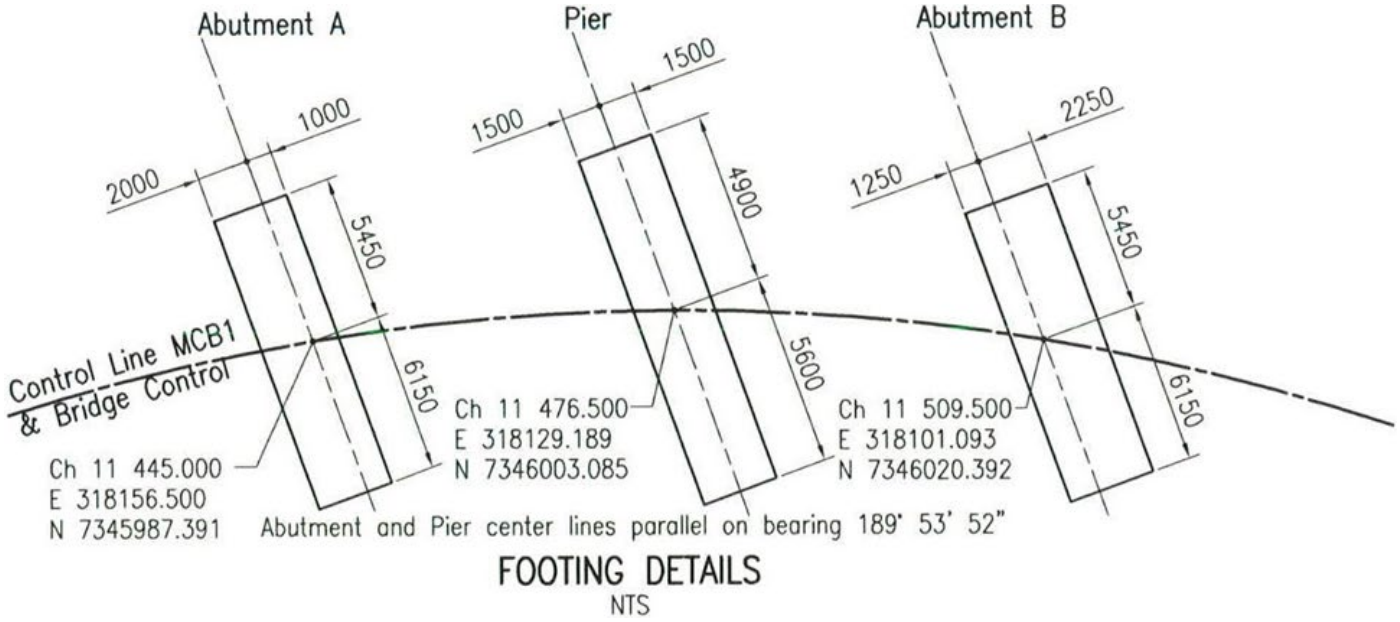
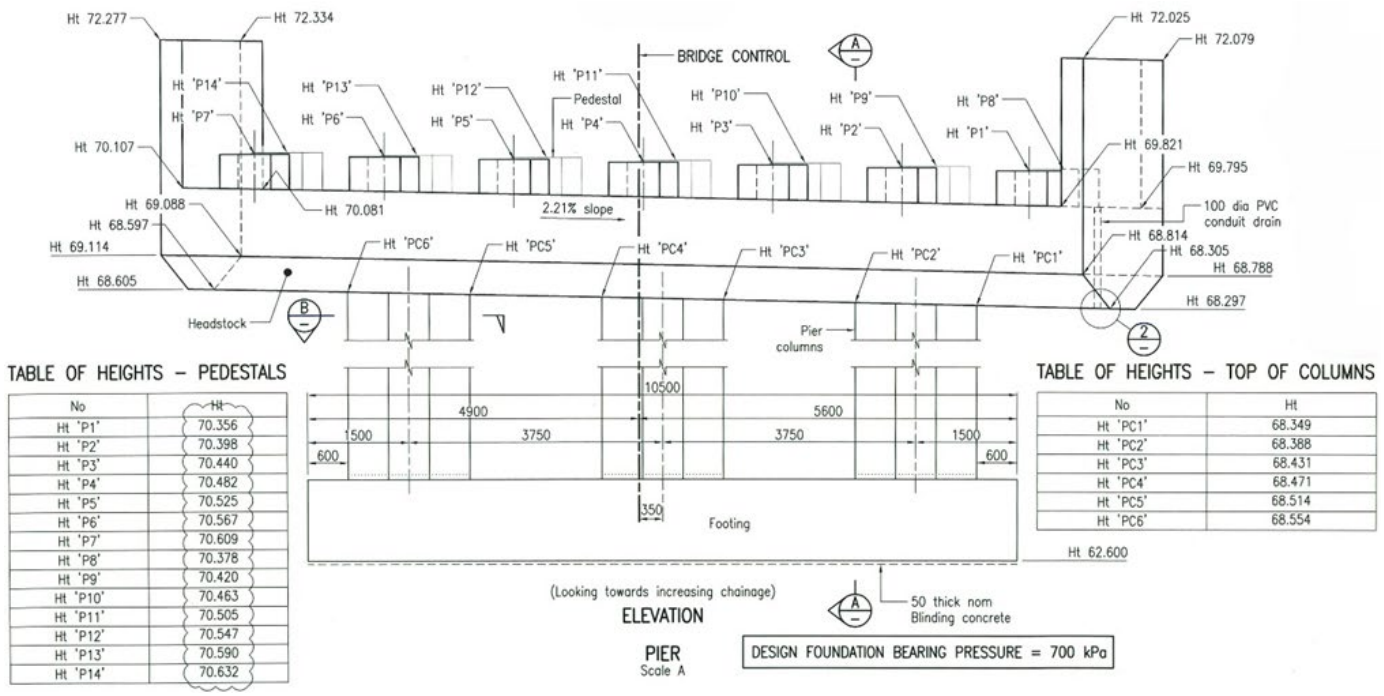


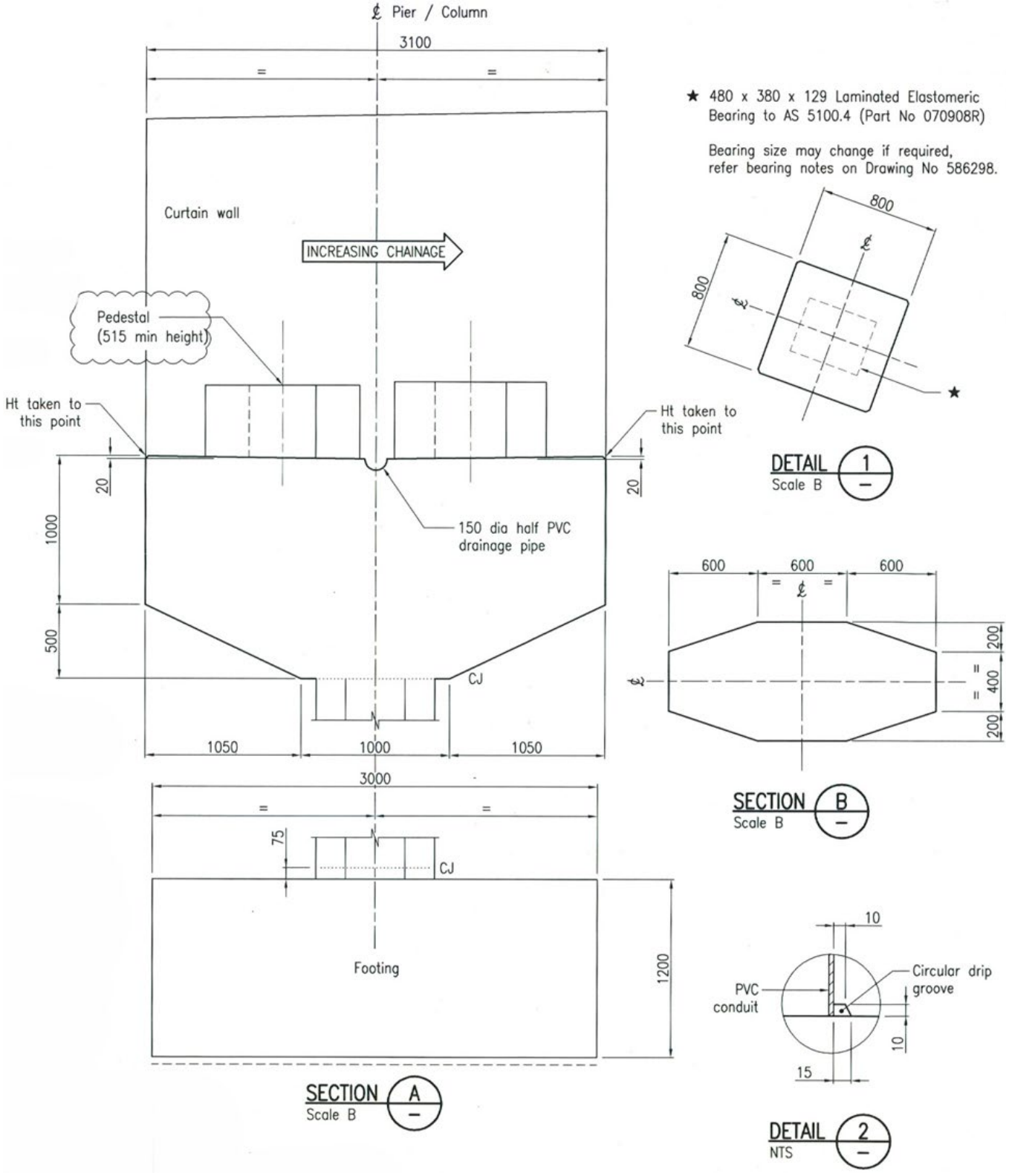
Figure 4.2.4(d) – Example pier on columns with spread footing shown in elevation



No	Ht
Ht 'P1'	70.356
Ht 'P2'	70.398
Ht 'P3'	70.440
Ht 'P4'	70.482
Ht 'P5'	70.525
Ht 'P6'	70.567
Ht 'P7'	70.609
Ht 'P8'	70.378
Ht 'P9'	70.420
Ht 'P10'	70.463
Ht 'P11'	70.505
Ht 'P12'	70.547
Ht 'P13'	70.590
Ht 'P14'	70.632

No	Ht
Ht 'PC1'	68.349
Ht 'PC2'	68.388
Ht 'PC3'	68.431
Ht 'PC4'	68.471
Ht 'PC5'	68.514
Ht 'PC6'	68.554

Figure 4.2.4(e) – Example sections showing pier on columns with spread footing



4.2.5 Typical content required on the foundation drawings

The following table lists the content specific to, but not limited to, a typical set of pile drawings.

Table 4.2.5 – Pile-specific drawings content

Requirement	Drawing or element description	Figure reference
Pile identification and setting out diagram	A diagram that depicts layout of piles about the bridge control, as pile identification numbers (ID), dimensions, chainages, eastings and northings, direction labels. Usually includes a legend to explain the symbols and labels.	Figure 4.2.3(b) Example drawings Figure 4.2.5(a) or Figure 4.2.5(c)
Pile schedule for cast-in-place piles	A table to show the following, as required: • location, pile ID, pile type, and diameter • pile cut-off height • estimated height at toe of liner, at top of socket, at toe of pile • minimum design pile length • estimated total rock socket length • anticipated founding material at pile toe, and • borehole reference. Notes to explain the tabulated content.	Figure 4.2.5(a)
Pile schedule for driven steel tubular piles	A table to show the following, as required: • location, pile ID, pile type, and diameter • pile cut off height • estimated height at toe of pile • estimated height at plug • estimated height at base of concrete shaft • overdrive, underdrive values • overall pile length, and • borehole reference. Notes to explain the tabulated content.	Figure 4.2.5(f)

Requirement	Drawing or element description	Figure reference
Pile schedule for driven PSC piles	An example of minimum information for this schedule is shown on SD 2021 *550 Octagonal PSC Piles – Earthquake Classification BEDC-1 Exposure Classification B2 (Drawing 1 of 3 to Drawing 3 of 3), SD 2022 550 Octagonal PSC Piles – Earthquake Classification BEDC-1 Exposure Classification C1 and C2 (Drawing 1 of 3 to Drawing 3 of 3), and SD 2023 550 Octagonal PSC Piles – Spliced Pile Details (Drawing 1 of 4 to Drawing 4 of 4).* Other information usually included in this table, as required: • location, pile ID, pile type, and diameter • pile cut-off height • estimated height at toe of pile • pile length • estimated founding material at pile toe • calculated ultimate pile loads • required ultimate geotechnical axial capacity • head bars – Type 1 and head bars – Type 2 • mass of pile • overdrive, underdrive values, and • borehole reference. Notes to explain the tabulated content.	Figure 4.2.5(c) Note: PSC schedule above CIP schedule
Pile design loads schedule	A table to show the following: • location and pile ID • ultimate axial loads as compression and tension • serviceability axial loads as compression and tension • ultimate loads as longitudinal moment, transverse moment, longitudinal shear and transverse shear, and • serviceability loads as longitudinal moment, transverse moment, longitudinal shear and transverse shear. Notes to explain the tabulated content.	Figure 4.2.5(a) Figure 4.2.5(f)

Requirement	Drawing or element description	Figure reference
Pile details	Elevation and sections showing: • pile set out point at top of pile, diameter, heights, length, and so on, as per pile schedule • headstock soffit treatment • pile reinforcement • steel liner details, if required • cathodic protection details, if required • typical details of welded lap slice, spacers, liner and stiffening bands, each as required Notes including cross-references to relevant associated drawings.	Figure 4.2.5(b) Figure 4.2.5(e) Figure 4.2.5(g)
Spread footings	Details of spread footings shown on abutment and pier drawings may include, but are not limited to: • layout of footings about the bridge control (this may be on a GA drawing) • dimensions of footing (this may be on a GA drawing) • dimensions of the abutment and pier columns or blade walls • reinforcement details • height of soffit of footing • rock anchors, if required • blinding concrete, and • design foundation bearing pressures.	Figure 4.2.5(h) Figure 6.5.4.6 Figure 6.5.4.7 Figure 6.5.4.8

Figure 4.2.5(a) – Example drawing for pile setting out diagram, schedules and notes

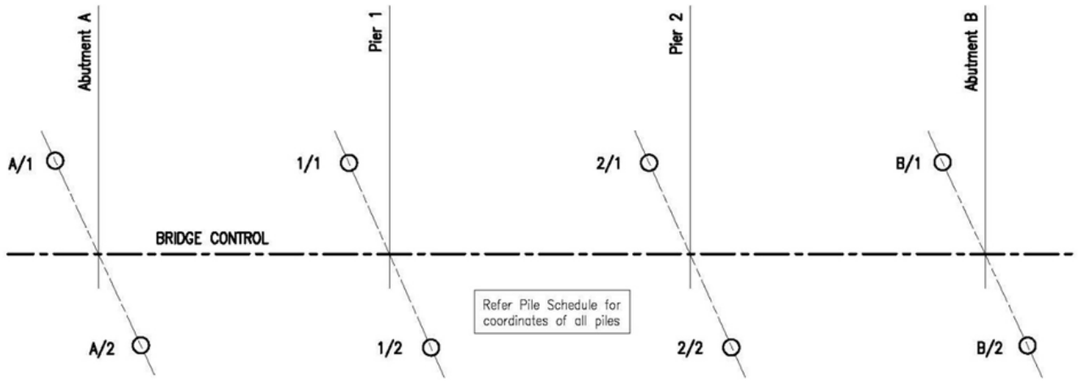
Department of Transport and Main Roads MRB_Detail (08/21)

CAST–IN–PLACE PILE SCHEDULE

LOCATION	PILE MARK	EASTING	NORTHING	PILE SIZE (mm)	PILE CUT OFF Ht 'B'	ESTIMATED TOE OF PILE Ht 'A'	INDICATIVE TOE OF PERMANENT LINER Ht 'C'	PILE LENGTH 'L1' (m)	ESTIMATED SOCKET LENGTH 'D' (m)	ESTIMATED SOCKET MATERIALS	FOUNDING MATERIAL	BORE HOLE REF.	CONSTRUCTED TOE OF PILE Ht 'A'
ABUTMENT A	A/1	670700.889	7168549.295	600 DIA	448.713**	435.510	439.010	13.203**	3.5	MW Mudstone	SW Mudstone	BH1	
	A/2	670710.275	7168555.223		448.747**	435.510	439.010	13.237**	3.5	MW Mudstone	SW Mudstone		
PIER 1	1/1	670698.715	7168565.401	900 DIA	441.270**	432.080	435.080	9.840**	3.0	MW Mudstone	MW Mudstone	BH3	
	1/2	670708.218	7168571.142		441.270**	432.080	435.080	9.840**	3.0	MW Mudstone	MW Mudstone		
PIER 2	2/1	670696.600	7168581.994	900 DIA	441.270**	431.780	434.780	9.840**	3.0	MW Mudstone with HW bands	SW Mudstone	BH2	
	2/2	670706.135	7168587.780		441.270**	431.780	434.780	9.840**	3.0	MW Mudstone with HW bands	SW Mudstone		
ABUTMENT B	B/1	670694.485	7168598.443	600 DIA	447.564**	434.520	438.020	13.044**	3.5	MW Mudstone	MW Mudstone	BH4	
	B/2	670703.954	7168604.236		447.545**	434.520	438.020	13.025**	3.5	MW Mudstone	MW Mudstone		

Refer Drawing Nos. 933743 & 933744 for dimensional parameters A, B, C, D, L1 as per above table

**Indicative level provided, verify onsite based on as constructed exiting foundation level



Abutment centrelines to match existing headstocks

PILE IDENTIFICATION AND SETTING OUT DIAGRAM

NTS

PILE DESIGN LOADS

Locality	◒ Serviceability Pile Loads						◒ Ultimate Pile Loads					
			AT TOP OF PILE Ht 'A'						AT TOP OF PILE Ht 'A'			
	Compression (kN)	Tension (kN)	Longitudinal Moment (kNm)	Transverse Moment (kNm)	Longitudinal Shear (kN)	Transverse Shear (kN)	Compression, E_d (kN)	Tension (kN)	Longitudinal Moment (kNm)	Transverse Moment (kNm)	Longitudinal Shear (kN)	Transverse Shear (kN)
Abutment A	550	–	80	165	90	90	830	–	105	280	145	110
Pier 1	1150	–	230	125	2	55	1640	–	300	210	5	67
Pier 2	940	–	180	280	25	160	1420	–	300	365	35	200
Abutment B	550	–	70	125	60	20	830	–	120	215	100	80

◒ The tabulated serviceability and ultimate design actions are the maximum values at the top of the pile, the values are not necessarily coincident.

MATERIAL PARAMETERS FOR CAST–IN–PLACE PILES

ROCK TYPE	ROCK STRENGTH	DESIGN UNIAXIAL ✱ COMPRESSIVE STRENGTH (MPa)	ULTIMATE END BEARING (MPa)	ULTIMATE SHAFT ADHESION (MPa) ★
MW Mudstone with HW bands	Very Low to Low	0.6	1.5	240
MW Mudstone	Very Low to Low	1.4	3.5	370
SW Mudstone	Low to Medium	3.0	7.5	540

✱ Design Uniaxial Compressive Strength (UCS) Vs Point Load Index (Is50) ratio of 12 was considered in the design.

★ Ultimate shaft adhesion is for wet conditions, considering 0.7 reduction factor.

PILING NOTES

1. For general notes refer to Drawings No 881767 & 881768.
2. For pile details refer to Drawings No 933743 & 933744.
3. All piles shall be constructed in accordance with MRTS63.
4. Refer Department of Transport and Main Roads Report No. FG23009–R–1 for results of geotechnical investigation.
5. Refer Geotechnical Foundation Design Report (Report No FG23009–R–2) for details on geotechnical conditions and design basis.
6. E_d is the design action effect as determined in AS2159–2009 "Piling – Design and Installation".
7. $R_{d,ug}$ as defined in AS2159–2009.
8. Estimated pile toe corresponds to design ultimate geotechnical strength being greater than or equal to ultimate design action effect ($E_d < \phi_g R_{d,ug}$). Where ϕ_g of 0.55 has been adopted for design.
9. The design rock strengths shown in the material parameters table are for foundation design purpose only and shall not be used for any other purposes.
10. It is the Contractor's responsibility to select appropriate construction methodology, piling rig and equipment, and prepare temporary access for the required plants to install the piles.
11. Piles shall be constructed as per MRTS63. The Contractor's method statement for constructing the piles shall be submitted to the Administrator for acceptance not less than 28 days prior to construction of piles and shall meet the requirements, hold points and special requirements as outlined in MRTS63.
12. Pile toe founding levels may vary subject to actual site geotechnical conditions. Any variation to the founding levels from levels shown on the drawing shall be approved by the Geotechnical Assessor in consultation with the Designer prior to concrete placement. The Geotechnical Assessor shall meet the qualifications as stipulated in Clause 11.2 of MRTS63.
13. Final pile toe levels, rock socket lengths and conditions, including cleanliness, shall be inspected and certified by the Geotechnical Assessor in accordance with MRTS63 and submitted to the Administrator prior to concreting.
14. Pile integrity testing shall be undertaken in accordance with AS2159–2009. Integrity testing shall be undertaken on the first pile constructed at each foundation.
15. The Contractor is responsible for design and installation of the steel liner including liner installation methods, liner toe levels, liner thickness and liner driving shoe thickness to suit the ground conditions, and any necessary measures required to maintain the stability of the hole during construction.
16. Strictly, no excavation of the pile shaft ahead of the liner is allowed. This is mainly due to the potential detrimental effect on adjacent existing foundation. Excavation shall be fully supervised by the Geotechnical Assessor, paying attention to the excavation stability and the depth of advancement of the liner toe.
17. Rockfill will likely be encountered within the existing embankment. The Contractor shall have necessary plant and equipment to install the liners in this material. Preboring shall not affect the hole stability.
18. The excavations or pre–auger for proposed Pier 1 foundations shall not be lower than the as–constructed existing footing top levels (WP)
19. The proposed piles are adjacent to existing piles or footings. No hole collapse or socket collapse is allowed at piers and abutments. If occurred, the contractor should pour lean mix into collapsed holes immediately, and re–auger through the temporarily filled socket to form the permanent socket.

BIS No.

G			
F			
E			
D			
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B			
A	Issued For Construction		
	Revisions/Descriptions	Signatory: – RPEQ Full Name, Eng. Area and RPEQ No. or – Full Name and Position Title	Date

CAD FILES

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS5100–2017 DESIGN LOADING: HLP240, T2 ROAD TRAIN DESIGN SPEED: 110km/h EARTHQUAKE DESIGN CATEGORY: BEDC–2 BARRIER PERFORMANCE LEVEL: REGULAR BRIDGE TYPE: STEEL I–GIRDER

Scales: NOT TO SCALE

Dimensions shown in millimetres except where shown otherwise

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn | Checked | Designed No. | Verified No.

Design Reviews (RPEQ) No. Date.

PILE SCHEDULE

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	SIGNATORY FULL NAME	No.	DATE
STRUCTURAL			
GEOTECHNICAL			

Queensland Government

Job No.

Contract No.

Drawing No.

Series Number of

BR Drg

Figure 4.2.5(b) – Example cast-in-place pile drawing

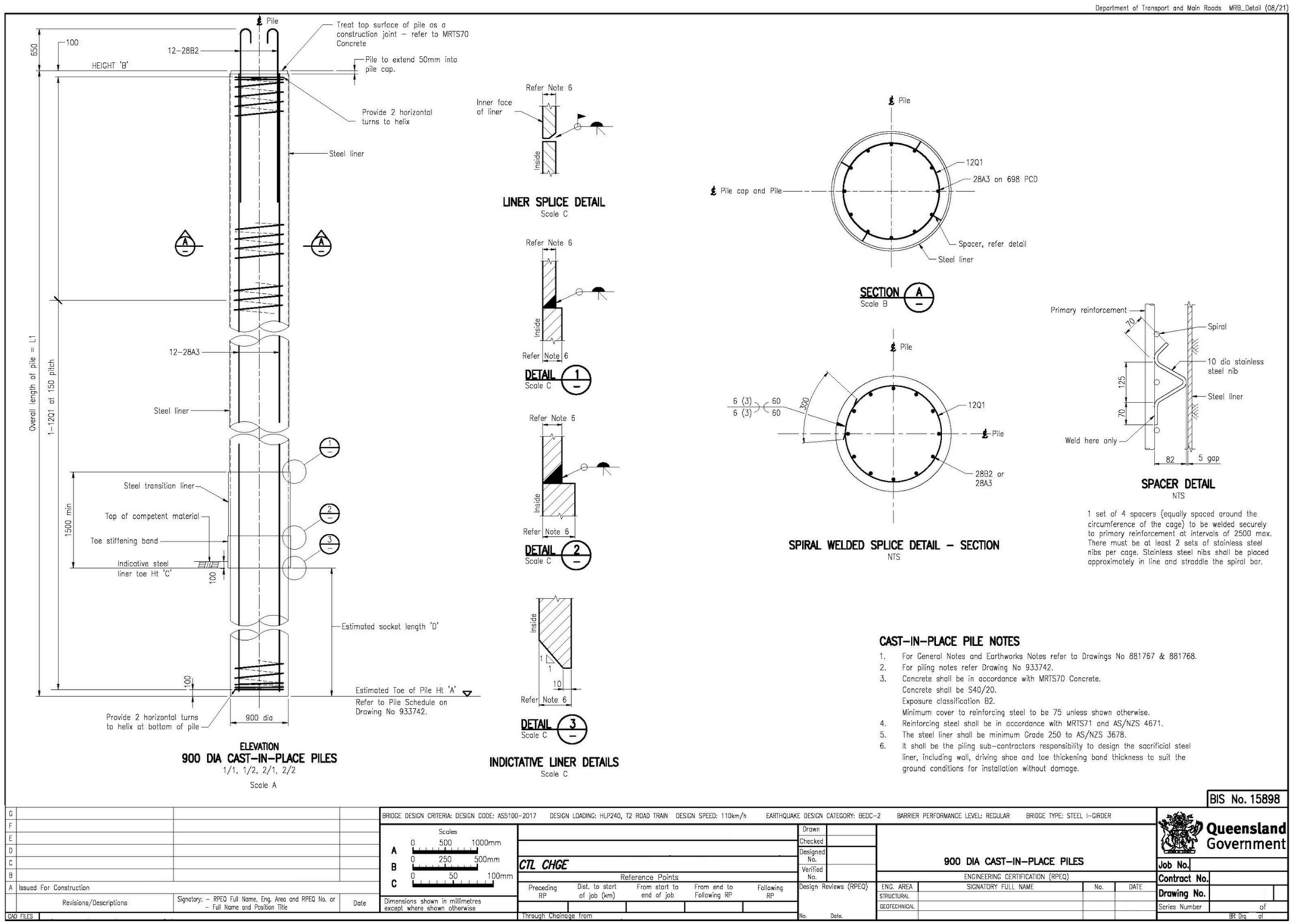
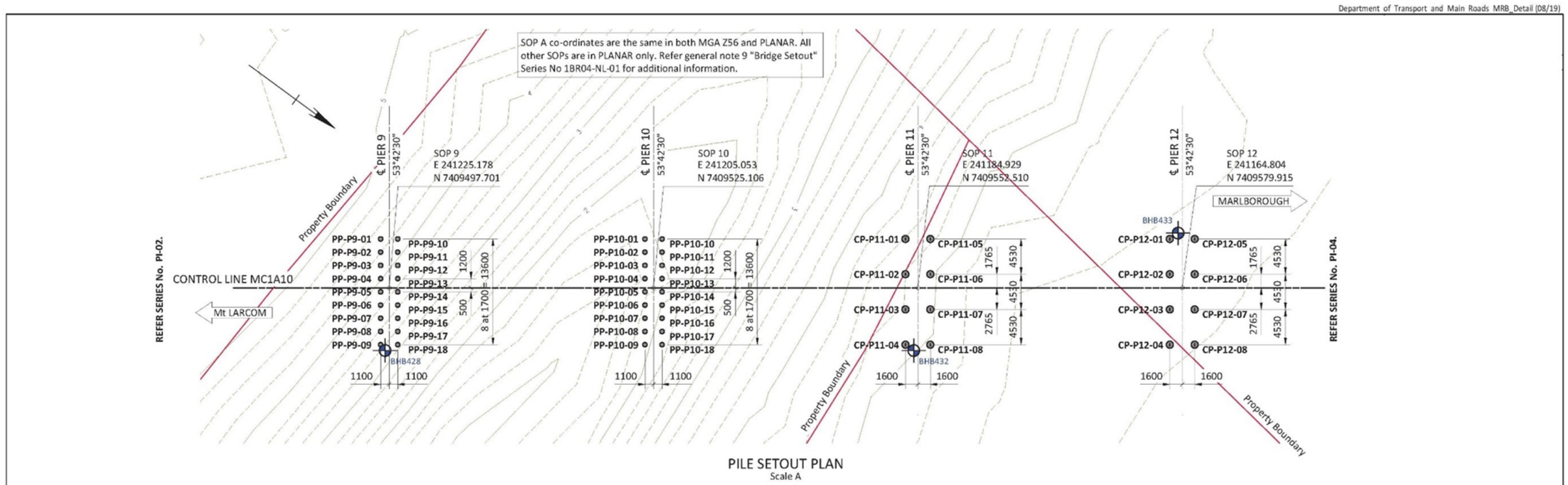


Figure 4.2.5(c) – Example prestressed concrete pile layout and schedule drawing



PSC PILE SCHEDULE

Location	Pile ID	Pile Size	No. Off	Estimated Toe of Pile Ht "A"	Pile Length 'L' (m)*	Estimated Founding Material at Pile Toe	Borehole Reference	Calculated Ultimate Pile Loads			Required Ultimate Geotechnical Axial Capacity Rd.ug (kN)	Headbars - Type 1			Headbars - Type 2			Mass of 1 Pile (tonne)	Overdrive Allowance (m)	Underdrive Allowance (m)
								Maximum Axial Compression Load (kN)#	Maximum Axial Tension Load (kN)#	Maximum Bending Moment (kN.m)		Diameter (mm)	No. Off	Length (m)	Diameter (mm)	No. Off	Length (m)			
Pier 9	PP-P9-01 to PP-P9-18	550 Octagonal	18	-12.3	16.4	Very Dense Gravel/XW Tuff	BHB428	2200	NA	285	3385	28	4	10.8	28	4	12	11.1	2	3
Pier 10	PP-P10-01 to PP-P10-18	550 Octagonal	18	-15.8	18.4	Very Dense Gravel	Seismic Survey SR2	1950	NA	285	3000	28	4	10.8	28	4	12	12.4	2	3

* 'L' includes an allowance for stripping back of 1.2m and overdrive allowance.
\# Denotes self weight of pile not included.

CAST-IN-PLACE PILE SCHEDULE

Location	Pile ID	Pile Diameter (mm)	Top of Pile Ht 'B' (m AHD)	Estimated Toe of Liner Ht 'C' (m AHD)	Estimated Top of Socket Ht 'E' (m AHD)	Estimated Toe of Pile Ht 'A' (m AHD)	Minimum Design Pile Length 'L' (m)	Estimated Total Rock Socket Length 'D' (m)	Borehole Reference	Anticipated Pile Socket Material
Pier 11	CP-P11-01 to CP-P11-08	900	2.400	-15.400	-15.400	-18.100	20.500	2.700	BHB432	MW or better rock (Tuff), with minimum Is(50) = 0.50MPa (shaft), minimum Is(50) = 1.50MPa (base).
Pier 12	CP-P12-01 to CP-P12-08	900	3.500	-12.700	-12.700	-15.000	18.500	2.300	BHB433	MW or better rock (Tuff), with minimum Is(50) = 0.50MPa (shaft), minimum Is(50) = 1.50MPa (base).

NOTES
1. For Notes and Legend, refer Series No 1BR04-PI-01.

CIP PILE SCHEDULE NOTES
1. Pile socket lengths have taken into account the wet pile conditions, with the assumption that dry pile may not be possible at all locations.
2. Pile socket lengths have considered the competency of socket materials near toe levels. The actual ground conditions, particularly the depth of acceptable socket materials and rock quality within socket in terms of strength and weathering shall be verified on site.
3. At Pier 12, the presence of an XW seam, located centrally within the pile socket (up to 450mm in thickness) has been considered in the design. The Geotechnical Assessor shall ensure that there is sufficient competent rock material in the vicinity of the pile toe.

BRIDGE DESIGN CRITERIA: AS(/NZS) 5100-2017 DESIGN LOADING: SM1600 & HLP400 DESIGN SPEED: 110km/h EARTHQUAKE ZONE: BEDC-3 BARRIER PERFORMANCE LEVEL: Regular BRIDGE TYPE: RC Deck on Super-T Girders BIS No.

05
04
03
02
A Issued for Construction
Revisions/Descriptions Name or RPEQ No. Signature Date
CAD FILES

Associated Job Nos
Auxiliary Drg Nos
Survey Data: Datum SOP A; Horiz. Grid PLANAR; Height Origin AHD (DERIVED); Survey Books

Scales
Scale A 0 2.5 5 7.5 10 m
Dimensions shown in Millimetres except where shown otherwise

CTL CHGE
Reference Points
Proceeding RP | Dist. to start of job (km) | From start to end of job | From end to following RP | Following RP
Through Chainage from

Drawn
Checked
Designed No.
Verified No.
Design Reviews (RPEQ) No. Date.

PILING
SETOUT PLAN AND SCHEDULE - SHEET 3
ENGINEERING CERTIFICATION (RPEQ)
ENG. AREA | NAME | SIGNATURE | NO. | DATE
Structural
Geotechnical

Queensland Government
Job No.
Contract No.
Drawing No.
Series Number
BR Drgs of

Figure 4.2.5(d) – Example prestressed concrete pile notes and lifting drawing

Department of Transport and Main Roads MRB_Detail (08/19)

NOTES

1. For General Notes, refer Series No 1BR04-NL-01, 1BR04-NL-02 & 1BR04-NL-03.
2. Piles to be manufactured to MRTS73.
3. Installation of piles to be in accordance with MRTS65.
4. Concrete to be in accordance with MRTS70 and MRTS73.
   - refer Series No 1BR04-NL-02 for concrete class, exposure classification and reinforcement cover.
   - Strength at transfer to be 35 MPa minimum.
5. REINFORCEMENT AND STRAND SUPPORT:
   - For Reinforcement Notes, refer Series No 1BR04-NL-01.
   - Multiple spacers are permitted to be used at each support location in the following zones to maintain the correct strand pattern and reinforcing arrangement.
   - Zones with headbars: Spacers Type 1 shall be used to maintain the correct strand pattern and headbar formation during casting. Spacer Type 1 shall be located at 4000 maximum centres to form headbar cage. Minimum 2 off Spacer Type 1 shall be used.
   - Spacer Type 1 are permitted to be substituted with Type 2. Where substitutions are made, headbars shall be tied to the inside of the Type 2 Spacers. Strand and headbar bundle to be tied to main helix, at maximum 900 centres, typical.
   - Zone where there are no headbars: Spacers Type 2 shall be used to maintain the correct strand pattern formation during casting. Minimum 1 off Spacer Type 2 shall be used, located 4000 from the pile toe.
   - Additional Spacers shall be placed at 4000 maximum centres.
6. Strands shall be to MRTS73 and AS/NZS4672.1, and testing requirements to AS/NZS4672.2. 7 wire ordinary-15.2 1830 Relax 2 pretensioning force at stressing = 196kN per strand. Products and suppliers of prestressing strand must be a registered product and supplier in accordance with MRTS73.
7. Grey iron casting Grade HBW195 to AS1830.
8. Steelwork shall be fabricated to MRTS78. Bolts class 4.6 to AS1111.1.
9. Stainless steel and fabrication to MRTS78A.
10. After lifting hoop is no longer required, cut-off flush with top of precast pile, apply three coats of approved surface tolerant epoxy compound to provide a minimum film thickness of 0.3mm dry or 0.6mm wet.
11. The lifting arrangement shown on this drawing is suitable for lifting at casting yard and stockpiling on site. Lifting hoops shall be a proprietary product installed and used in accordance with manufacturers specifications. The nominated lifting hoops have been sized assuming the use of protection pulleys. For all other lifting situations, including pitching, the pile shall be designed to meet the project specific lifting arrangements and be RPEQ certified.
12. Lifting of precast piles to be in accordance with MRTS73. The minimum dynamic factor shall be 1.5. Minimum factor of safety (FOS) for lifting anchors and concrete pull out shall be 4.0.
13. Transport and storage of piles shall be in accordance with MRTS65.
14. Optional safety lug shall be cast into pile surface for choker chain to use during pile pitching. Requirement, dimensions and location shall be confirmed subject to Pile Driving Contractor risk assessment. Safety lug shall be ground flush with surface of the pile after pile pitching operations have been undertaken and completed. Apply 3 coats surface tolerant epoxy to precast pile surface once safety lug has been removed.
15. Optional pile headband may be used. Requirements and details shall be confirmed subject to Pile Driving Contractor risk assessment. The minimum requirements are as shown on the Piling Details drawing.
16. During storage, piles shall be supported by a stability frame. For details of the stability frame refer MRSD 2021 and MRTS65.

PILING NOTES

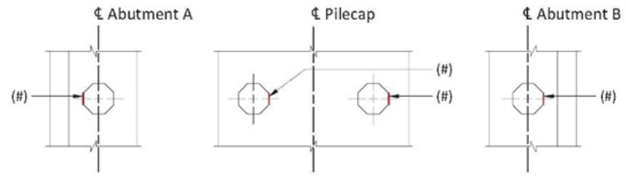
1. Design pile loads specified on the drawing apply to the piles and pile layout as designed. Unless noted otherwise on the relevant bridge drawings, changes to the piles and pile layout, which significantly alter the behaviour of the pile individually or as a group, may alter these pile loads or the behaviour of the whole structure and may not be acceptable.
2. No changes to the pile spacing/size/Type shall be made without approval of the Administrator.
3. A geotechnical reduction factor of 0.65 is applied for the ultimate geotechnical capacity.
4. Piles shall be driven to achieve the required resistance and minimum pile penetration (inclusive of underdrive allowance in the pile schedule) in accordance with MRTS65.
5. Details of pile driving procedure including handling and pitching, the pile hammer, dynamic testing, the pile cushion material and other equipment to be employed for this operation, shall be submitted to the Administrator. This shall constitute the relevant hold points as per MRTS65.
6. End of drive pile set has been assessed based on the results of a Wave Equation Analysis model. The calculated set and associated net driving energies are presented in Section 2 of annexure MRTS65.1. It is noted that these energies are based on a theoretical analysis of the behaviour of the piling equipment, pile and ground conditions. Accordingly, the values are to be used as a guide for the driving of the Test Piles.
7. First pile of the pile group for each foundation shall be dynamically tested using High Strain Dynamic Testing (HSDT) over the full length of the drive to determine driving stresses, impact energy and geotechnical capacity in addition to establish pile driving parameters for installation of the rest of the piles in the pile group.
8. If piles encounter refusal above design toe level, onsite engineer shall provide all records to the Administrator for review. If required they shall be load tested to verify their capacity. For piles exhibiting larger set values at design toe levels;
   - Option 1: If feasible, they shall be driven below the estimated founding level until satisfactory set value is reached and details shall be provided to the Administrator.
   - Option 2: Upon reaching the founding level, pile load testing with HSDT analysis shall be undertaken in consultation with the Administrator to verify the capacity.
9. All piles shall have pile velocity, set and temporary compression measured during end of drive, and as a minimum for the last 10 blows using the Piling Monitor.
10. If the design pile penetration has been reached or exceeded, but set not yet attained, the Contractor may request a restrike of the pile. In this case piling shall cease for at least 12 hours and the pile restruck using the nominated driving energy as detailed in Clause 3 of Annexure MRTS65.1 for a minimum of a total of 15 blows. The set shall then be determined over the last 10 blows. If the required set is achieved, the pile shall be accepted.
11. Refer to Technical Note - Bridge Foundation Design 1167108-DJV-1GE04-TNE-000001 Appendix B for details of interpreted geotechnical conditions and design basis.
12. In accordance with MRTS65, pile driving shall be planned to avoid heave of already driven piles. Piles that already been driven at the same abutment or pier shall be monitored before and after driving to check for heave of piles. If the heave of any piles that have already been driven exceeds 5 mm, the piles shall be subject to a minimum 15 blow restrike with monitoring of pile driving (PM) to confirm set and capacity has still been achieved.
13. Abutment piles shall be installed after completion of all fill earthworks.

PILE TESTING NOTES

1. As per TMR geotechnical design standard - minimum requirements, the minimum number of piles to be HSDT tested shall be the greater of:
   a. 15% of piles in abutment/pier bent.
   b. minimum one pile per abutment/pier.
2. All dynamic testing shall conform to the requirement of MRTS68.
3. Monitoring of pile driving shall be undertaken on all piles as per MRTS68.

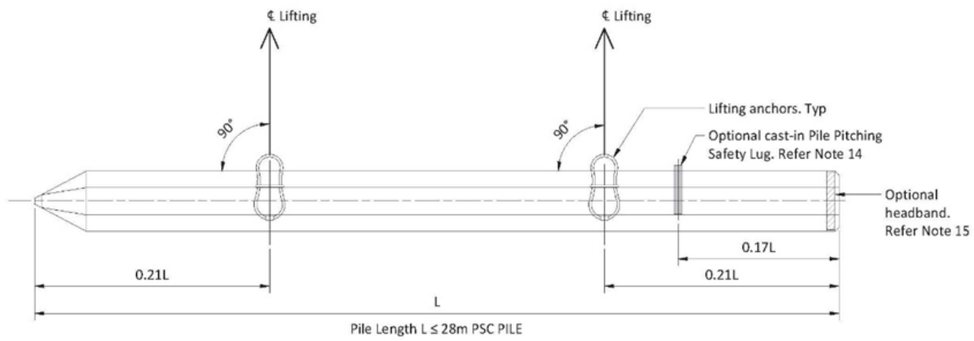
PRE-BORING NOTES

1. During the initial stages of driving, do not bend or spring piles into position but effectively hold and guide the pile.
2. Pre-boring depth to facilitate pitching shall be kept as minimum as possible, however, shall not exceed 3m to comply with MRTS65. The slightly oversized pre-bore hole shall comply with the requirements of Clause 6 of MRTS65.
3. To ensure that the pile is properly supported laterally and will develop skin resistance in the pre-bored hole, before driving, backfill any space remaining between the pile and the sides of the pre-bored hole with a suitable granular material or grout, to the satisfaction of the Administrator.
4. Record the diameter, use of any temporary support and Height (Ht) of the bottom of all pre-bored holes shall be kept as part of the pile driving record.



(#) - Denotes pile setout face. Piles to be orientated as shown.
For details, refer Series No 1BR04-PI-10 Section E

OCTAGONAL PSC PILE ORIENTATION DIAGRAM
NTS



LIFTING DIAGRAM
NTS

BRIDGE DESIGN CRITERIA: AS(/NZS) 5100-2017 | DESIGN LOADING: SM1600 & HLP400 | DESIGN SPEED: 110km/h | EARTHQUAKE ZONE: BEDC-3 | BARRIER PERFORMANCE LEVEL: Regular | BRIDGE TYPE: RC Deck on Super-T Girders | BIS No.

Revisions/Descriptions	Name or RPEQ No.	Signature	Date
05			
04			
03			
02			
A Issued for Construction			

CAD FILES

Associated Job Nos | Auxiliary Drg Nos

Survey Data: Datum SOP A; Horiz. Grid PLANAR; Height Origin AHD (DERIVED); Survey Books MR102631

Scales

Dimensions shown in Millimetres except where shown otherwise

CTL CHGE

Reference Points

Proceeding RP	Dist. to start of job (km)	From start to end of job	From end to following RP	Following RP

Through Chainage from

Drawn | Checked | Designed No. | Verified No.

Design Reviews (RPEQ) No. Date.

PILING
OCTAGONAL PSC PILE NOTES

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	NAME	SIGNATURE	NO.	DATE
Structural				
Geotechnical				

Queensland Government

Job No. | Contract No. | Drawing No. | Series Number | BR Drgs of

Figure 4.2.5(e) – Example prestressed concrete pile details drawing

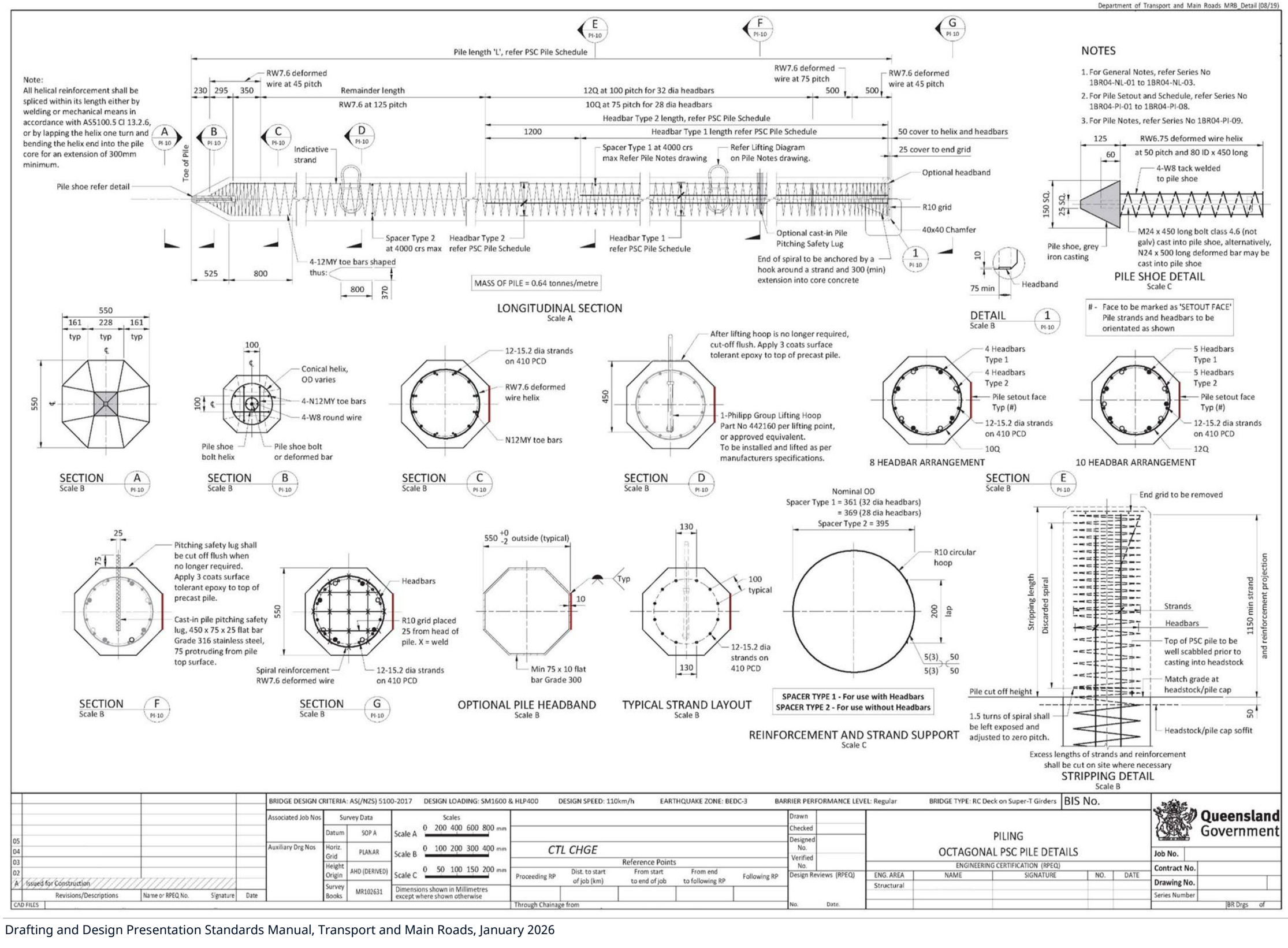


Figure 4.2.5(f) – Example driven tubular steel pile schedule drawing

Department of Transport and Main Roads MRB_Detail (08/21)

DRIVEN TUBULAR STEEL PILE SCHEDULE

Location	Reference borehole	Estimated Pile toe height 'A' (Ht)	Estimated base of plug height 'B' (Ht)	Pre-bore height (Ht)	Estimates base of shaft height 'C' (Ht)	Overdrive allowance (m)	Underdrive allowance (m)	ID	Size	No. Off	Pile Reinforcement Type	Pile cut-off height 'E' (Ht)	Overall pile length 'L' (m) #	Transition length 'Lt' (m) #	As constructed toe height (Ht)
Abutment A	BH3	-30.60	-10.10		-8.60			A1-3	1200 dia.	3	Type 2	8.400	A1: 43.11 A2: 43.23 A3: 43.35		
Pier 1	BH51	-39.70	-13.65		-12.15			P1-1 to 1-4	1200 dia.	4	Type 2	4.850	44.55		
Pier 2	BH4 and BH4A	-37.50	-13.65		-12.15			P2-1 to 2-5	1200 dia.	5	Type 2	4.850	42.35		
Deflection Wall - Pier 2	BH4 and BH4A	-35.2	-18.20		-16.70			DW2-1 to 2-4	1350 dia.	4	N/A	4.300	39.50		
Pier 3	BH5 and BH5A	-30.20	-13.65		-12.15			P3-1 to 3-5	1200 dia.	5	Type 2	4.850	35.05		
Deflection Wall - Pier 3	BH5 and BH5A	-35.2	-18.20		-16.70			DW3-1 to 3-4	1350 dia.	4	N/A	4.300	39.50		
Abutment B	BH52	-37.70	-5.90		-4.40			B1-3	1200 dia.	3	Type 1	8.450	B1: 50.39 B2: 50.54 B3: 50.69		

PILE DESIGN LOADS

Location	Serviceability pile loads (S)						Ultimate pile loads (S*)					
	Compression (kN)	Tension (kN)	Longitudinal Shear (kN) Fx	Transverse Shear (kN) Fy	Transverse Bending (kNm) Mx	Longitudinal Bending (kNm) My	Compression (kN)	Tension (kN)	Longitudinal Shear (kN) Fx	Transverse Shear (kN) Fy	Transverse Bending (kNm) Mx	Longitudinal Bending (kNm) My
Abutment A	4050	0	90	30	110	210	5550	0	140	430	2960	520
Pier 1	5250	0	50	10	110	390	7150	0	860	130	190	2743
Pier 2	4950	0	40	60	290	220	6650	0	70	610	1890	70
Deflection Wall - Pier 2	1400	0	0	0	0	0	6750	2900	1280	-710	-4660	2540
Pier 3	5060	0	30	50	280	40	6650	0	90	470	1780	440
Deflection Wall - Pier 3	1400	0	0	0	0	0	6750	2900	1280	-710	-4660	2540
Abutment B	4160	0	390	150	340	450	5500	0	650	1660	3980	520

NOTES

1. For NOTES, refer to Drg No PI-031003.
2. The tabulated serviceability and ultimate design actions are the maximum values at the top of the pile, the values are not necessarily coincident. Note pile self weight (steel tube or concrete shaft) is not included.
3. For DTS pile details and manufacture notes, refer Drg No PI-031005 to PI-031007.

BIS No.

03			
02			
01			
	Revisions/Descriptions	Signatory: - RPEQ Full Name, Eng. Area and RPEQ No. or - Full Name and Position Title	Date

CAD FILES

DESIGN CRITERIA: DESIGN CODE: AS 5100:2017 DESIGN LOADING: SM1600 AND HLP400 DESIGN SPEED: 90 km/h EARTHQUAKE DESIGN CATEGORY: BEDC-3 BARRIER PERFORMANCE LEVEL: MEDIUM STRUCTURE TYPE: RC DECK ON PSC DECK UNIT

Scales

Dimensions shown in Millimetres except where shown otherwise

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn
Checked
Designed No.
Verified No.
Design Reviews (RPEQ)
No. Date.

PILE SCHEDULE

Queensland Government

Job No.
Contract No.
Drawing No.
Series Number
of
PI Drgs

Figure 4.2.5(g) – Example driven tubular steel pile details drawing

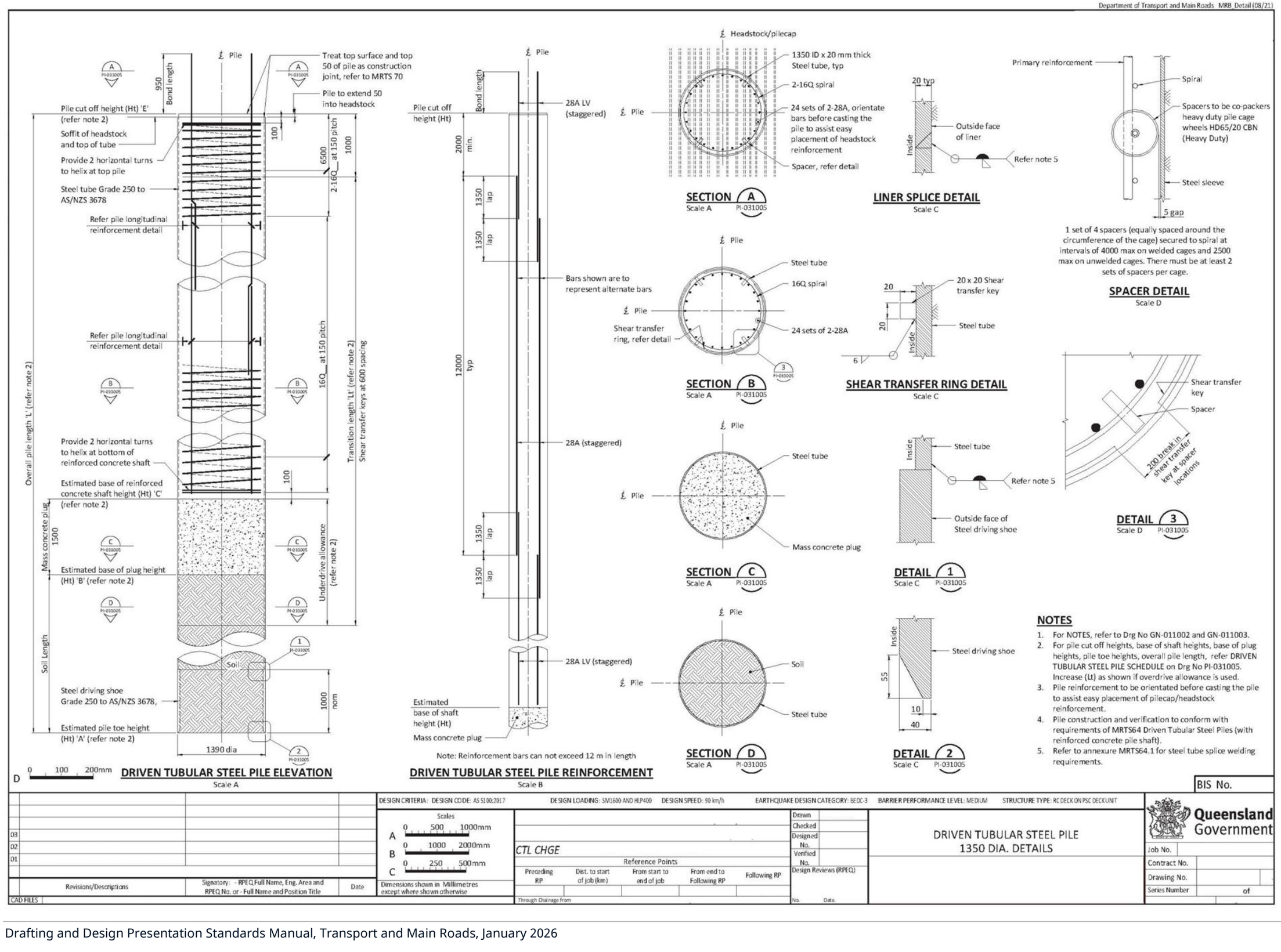


Figure 4.2.5(h) – Example concrete drawing for pier on spread footing

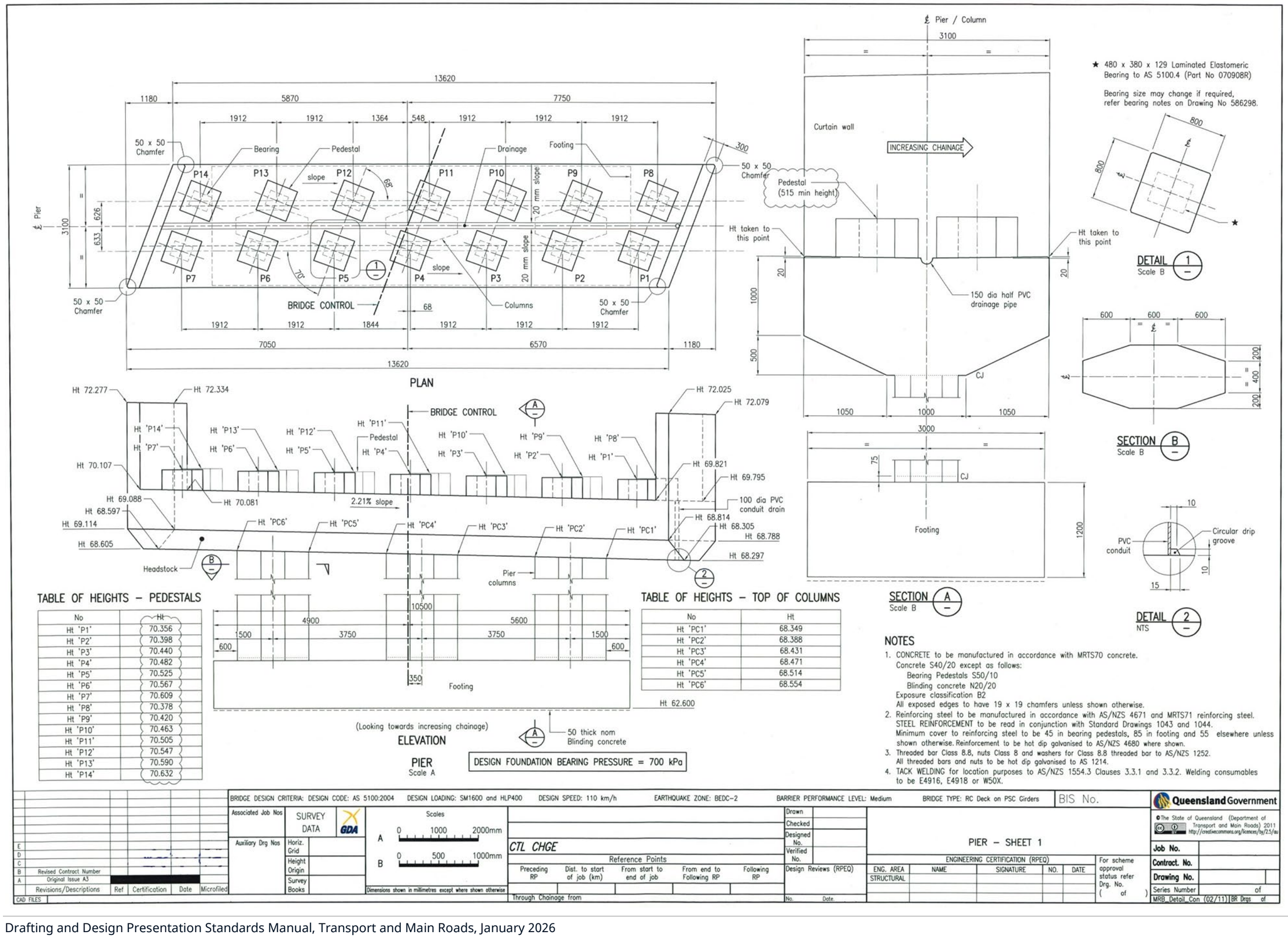


TABLE OF HEIGHTS – PEDESTALS

No	Ht
Ht 'P1'	70.356
Ht 'P2'	70.398
Ht 'P3'	70.440
Ht 'P4'	70.482
Ht 'P5'	70.525
Ht 'P6'	70.567
Ht 'P7'	70.609
Ht 'P8'	70.378
Ht 'P9'	70.420
Ht 'P10'	70.463
Ht 'P11'	70.505
Ht 'P12'	70.547
Ht 'P13'	70.590
Ht 'P14'	70.632

TABLE OF HEIGHTS – TOP OF COLUMNS

No	Ht
Ht 'PC1'	68.349
Ht 'PC2'	68.388
Ht 'PC3'	68.431
Ht 'PC4'	68.471
Ht 'PC5'	68.514
Ht 'PC6'	68.554

NOTES

1. CONCRETE to be manufactured in accordance with MRTS70 concrete.
   Concrete S40/20 except as follows:
   Bearing Pedestals S50/10
   Blinding concrete N20/20
   Exposure classification B2
   All exposed edges to have 19 x 19 chamfers unless shown otherwise.
2. Reinforcing steel to be manufactured in accordance with AS/NZS 4671 and MRTS71 reinforcing steel.
   STEEL REINFORCEMENT to be read in conjunction with Standard Drawings 1043 and 1044.
   Minimum cover to reinforcing steel to be 45 in bearing pedestals, 85 in footing and 55 elsewhere unless shown otherwise. Reinforcement to be hot dip galvanised to AS/NZS 4680 where shown.
3. Threaded bar Class 8.8, nuts Class 8 and washers for Class 8.8 threaded bar to AS/NZS 1252.
   All threaded bars and nuts to be hot dip galvanised to AS 1214.
4. TACK WELDING for location purposes to AS/NZS 1554.3 Clauses 3.3.1 and 3.3.2. Welding consumables to be E4916, E4918 or W50X.

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS 5100:2004 DESIGN LOADING: SM1600 and HLP400 DESIGN SPEED: 110 km/h EARTHQUAKE ZONE: BEDC-2 BARRIER PERFORMANCE LEVEL: Medium BRIDGE TYPE: RC Deck on PSC Girders

BIS No.

Queensland Government

Associated Job Nos | SURVEY DATA | GDA

Auxiliary Drg Nos | Horiz. Grid | Height Origin | Survey Books

Scales A 0 1000 2000mm B 0 500 1000mm

Dimensions shown in millimetres except where shown otherwise

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn | Checked | Designed No. | Verified No. | Design Reviews (RPEQ) No. Date.

PIER – SHEET 1

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	NAME	SIGNATURE	NO.	DATE
STRUCTURAL				

For scheme approval status refer Drg. No. (of)

Job No. | Contract. No. | Drawing No. | Series Number of | MRB_Detail_Con (02/11) BR Drgs of

	Revisions/Descriptions	Ref	Certification	Date	Microfiled
B	Revised Contract Number				
A	Original Issue A3				

CAD FILES

4.3 Piers and abutments

4.3.1 General

The substructure at each end of a bridge is called the abutment, with the first abutment along the gazettal as ABUTMENT A and the other abutment as ABUTMENT B.

For a bridge with multiple spans, the intermediate substructures are called piers. For a 2-span bridge, the pier is shown as PIER. For bridges with spans of 3 or more, each pier is identified by a number, for example PIER 1, PIER 2 and so on, starting from Abutment A.

For a bridge that either diverges into 2 structures or merges into one, the elements may be referred to as Pier 3-1 and Pier 3-2, Abutment B-1 and Abutment B-2 and so on.

Abutment and piers are headstocks that support the bridge superstructure and may have bearing pedestals and bearings for bridge articulation. Girder and winged plank bridges will also have restraint blocks on the headstocks that work with cross-girders between these beams.

Abutments have:

- a ballast wall to retain the embankment and pavement materials, and to support the relieving slab, and
- wing walls to retain the embankment, provide anchorage for the bridge barrier and with cast-in conduits that traverse the bridge via concrete barrier or kerb.

Features common to both abutments and piers are:

- bearing shelf where the beams (girders, winged planks, or deck units) of the superstructure sit on bearings or mortar and are restrained or anchored
- bearing pedestals set out along the bearing shelf, one for each beam, where required
- restraint blocks, where and as required, between the girders or winged planks
- formed holes set out along the bearing shelf, one for each deck unit, for the holding down bolt connecting the deck unit to the headstock, where required
- recesses, to accommodate a bearing set out into the bearing shelf and between the formed holes, where and as required
- jacking shelf, where required, and
- sidewalls, used to provide a separation from the embankment and the superstructure and joints at abutments, and, if required at piers, to hide the bearing shelf and to improve aesthetics.

Joint articulation for deck unit bridges is planned to be detailed on a new Standard Drawing. This new Standard Drawing is being developed from Section 13.4 and Figure 13.4-1 to Figure 13.4-7 in the former Chapter 13 of the previous version of this volume and aligns with the DCBoS and Technical Specifications.

Examples of girder bridge abutments and piers are shown in the following Figure 4.3.1(a) and Figure 4.3.1(b).

Headstocks can be complex and have many elements of various shapes and angles, so depicting them in additional perspective or 3D views is useful for showing the features clearly.

Figure 4.3.1(a) – Example of girder bridge abutment drawn in perspective view

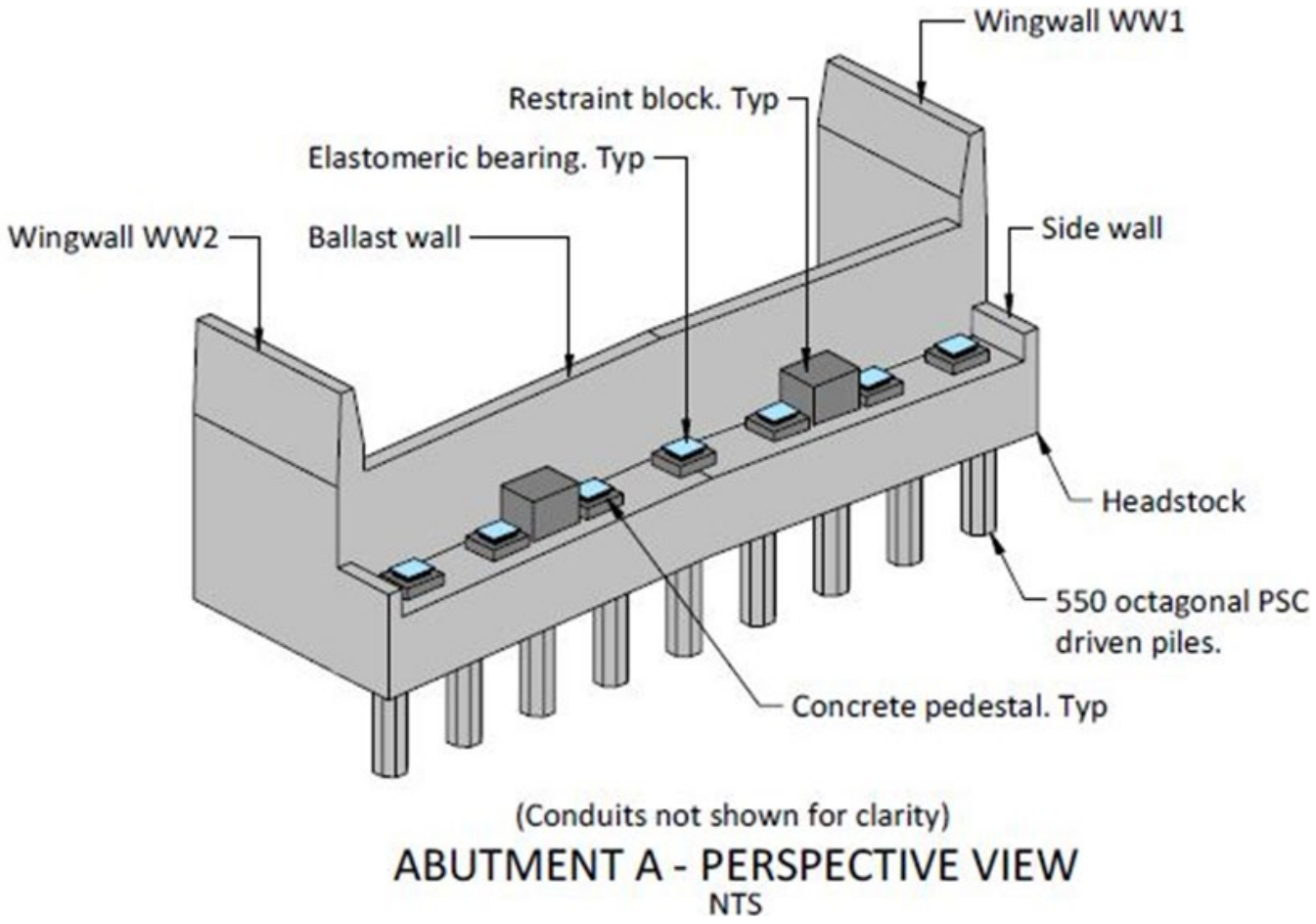
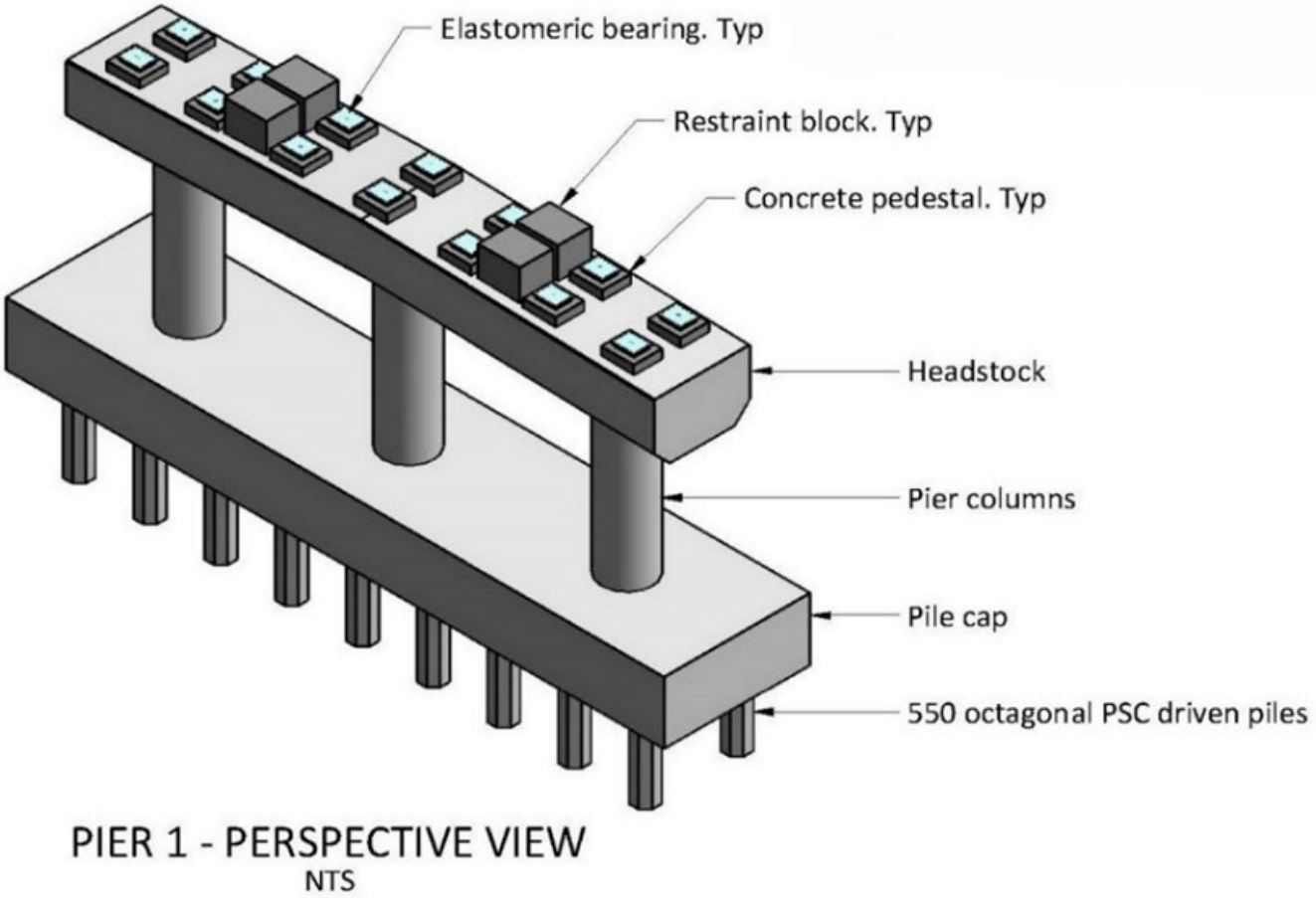


Figure 4.3.1(b) – Example of a girder bridge pier drawn in perspective view



4.4 Headstock layout

All headstocks are set out from a nominated set out point (SOP), being the intersection between the bridge control and the headstock centreline at the road surface height.

The abutment headstock centreline is usually the centreline of the piles, formed holes, and bearings.

Formed holes and bearings on the bearing shelf are usually set out parallel to the headstock centreline, while the abutment wing walls are set out in relation to the bridge control.

For superelevated bridges, the headstock is offset to maintain the correct position of the superstructure. The offset is applied along the headstock / formed hole / bearing centrelines.

Refer to Chapter 3 of this volume for complex bridge set-out guidance.

Enough dimensions shall be supplied, such that a drawing may be readily understood, without the requirement of further calculation. Each feature shall be easily established by a longitudinal and transverse dimension parallel and normal to the abutment centreline, and not solely by an offset dimension and a dimension along a bearing or by coordinates alone.

Figure 4.4(a) – Example of abutment plan and elevation views

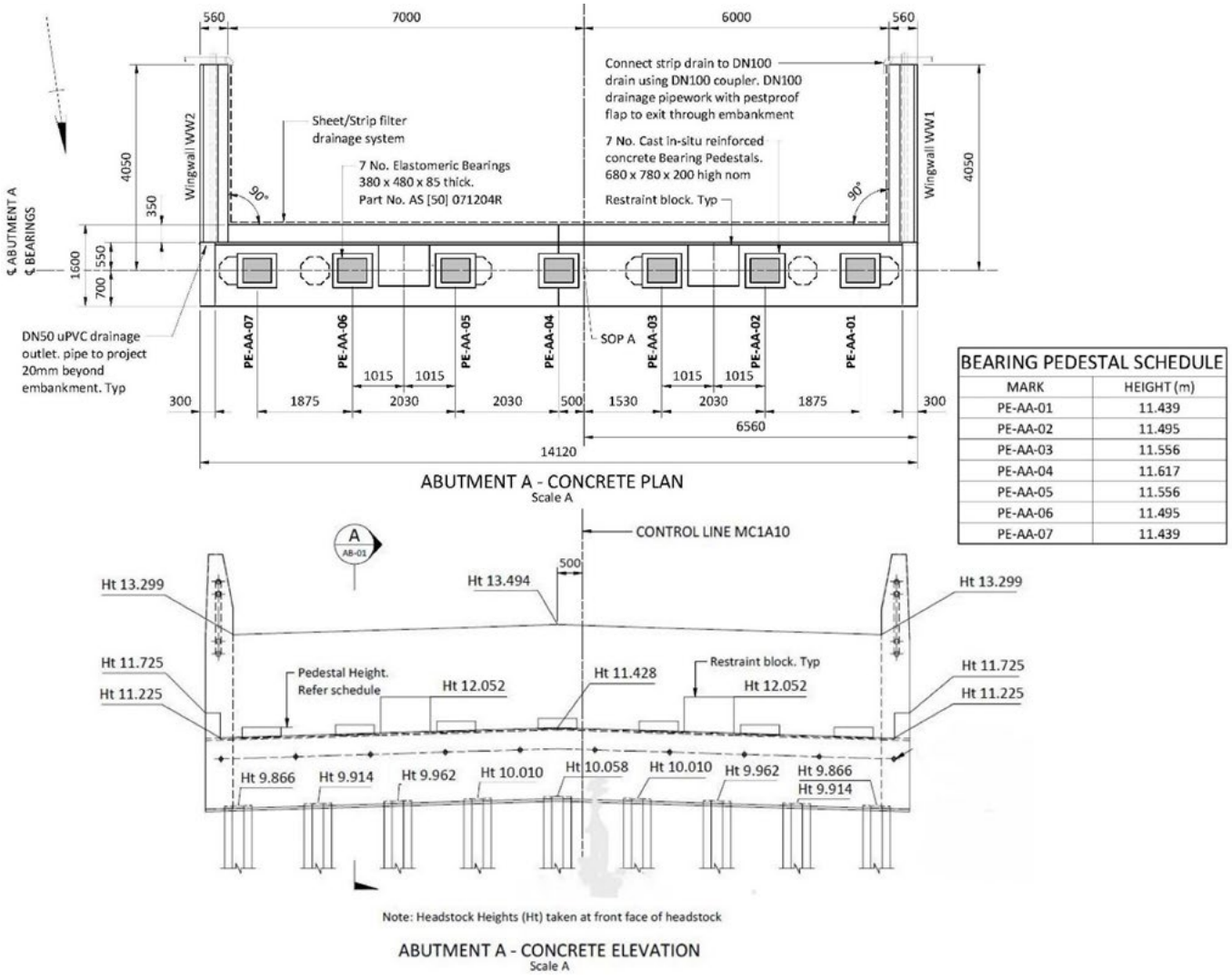


Figure 4.4(b) – Example of girder bridge abutment in section showing bearing pedestal

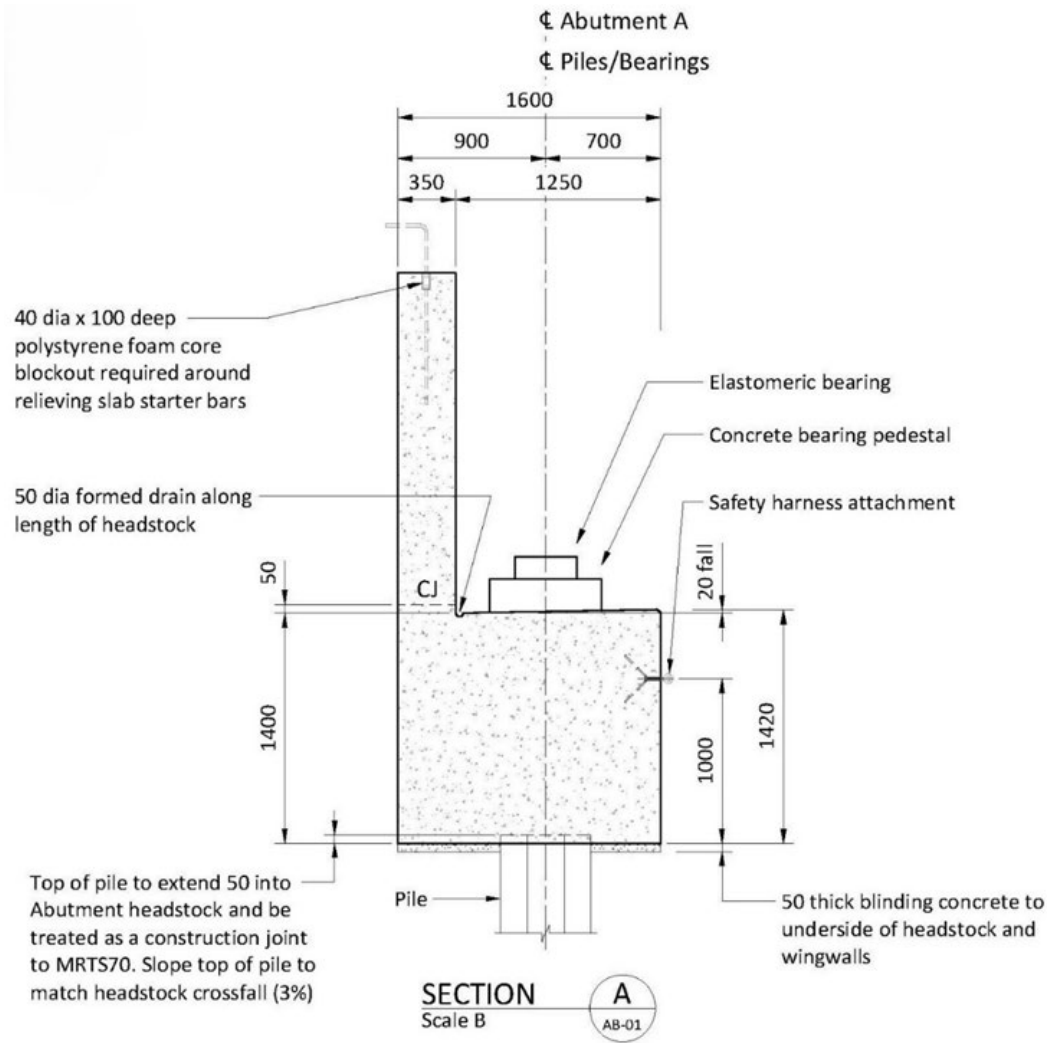
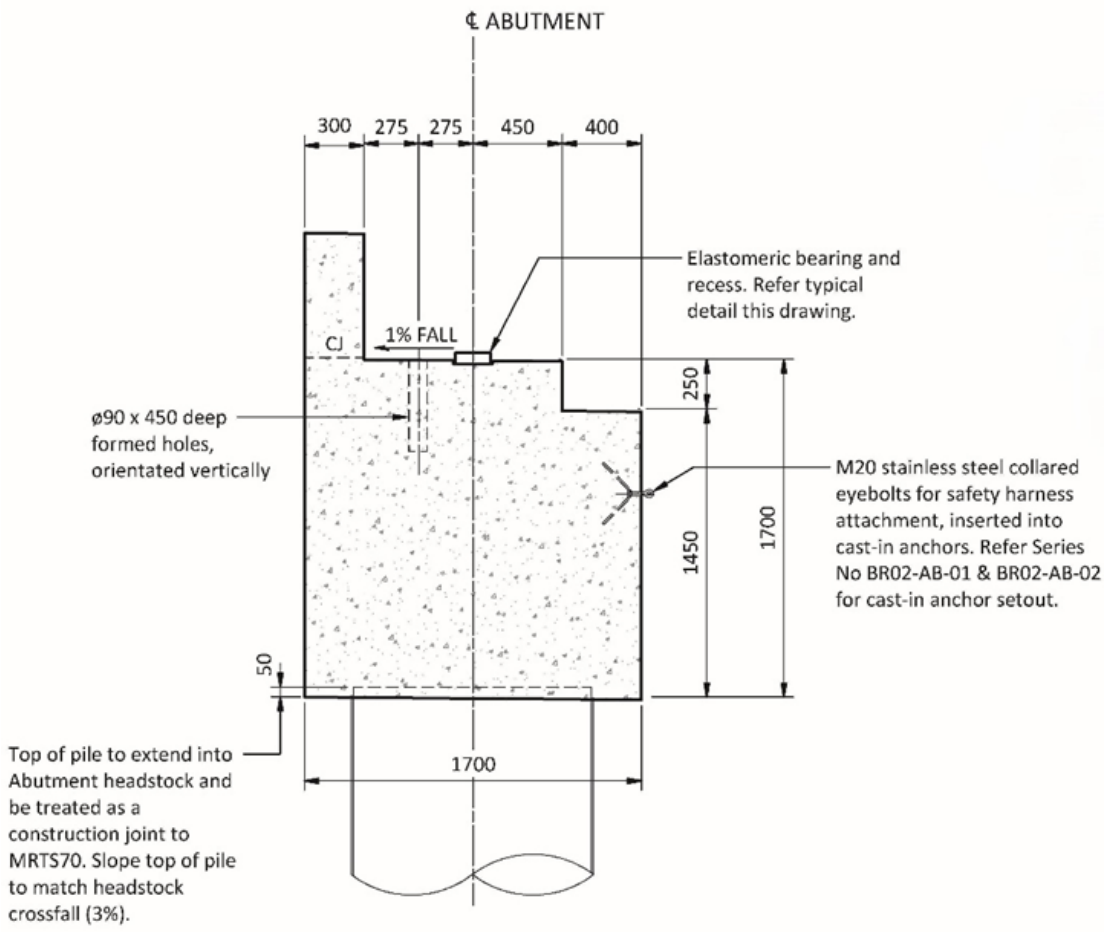


Figure 4.4(c) – Example of deck unit with reinforced concrete deck bridge abutment in section with bearing



4.5 Bearings and provision for bridge jacking

As per the DCBoS, the required bearing functionality shall be determined based on the bridge articulation design. All drawings and details shall be in accordance with Section 4.8 of DCBoS and MRTS81 *Bridge bearings*.

Girder bridges always sit on bearings rather than cement mortar seating. Therefore, provision for jacking shall be made for all girder bridges.

Abutments and piers of a deck unit bridge shall incorporate provisions for future jacking wherever bearing replacement is deemed necessary during the design life of the structure by the design engineer.

Jacking shelves shall have appropriate details for the intended jack size and location and minimum dimensions from concrete edges.

Similarly, the bearing shall sit at least 175 mm from the edge of the bearing shelf on a square bridge. On a skewed bridge, this distance may be reduced because only one corner of the bearing is not within tolerance.

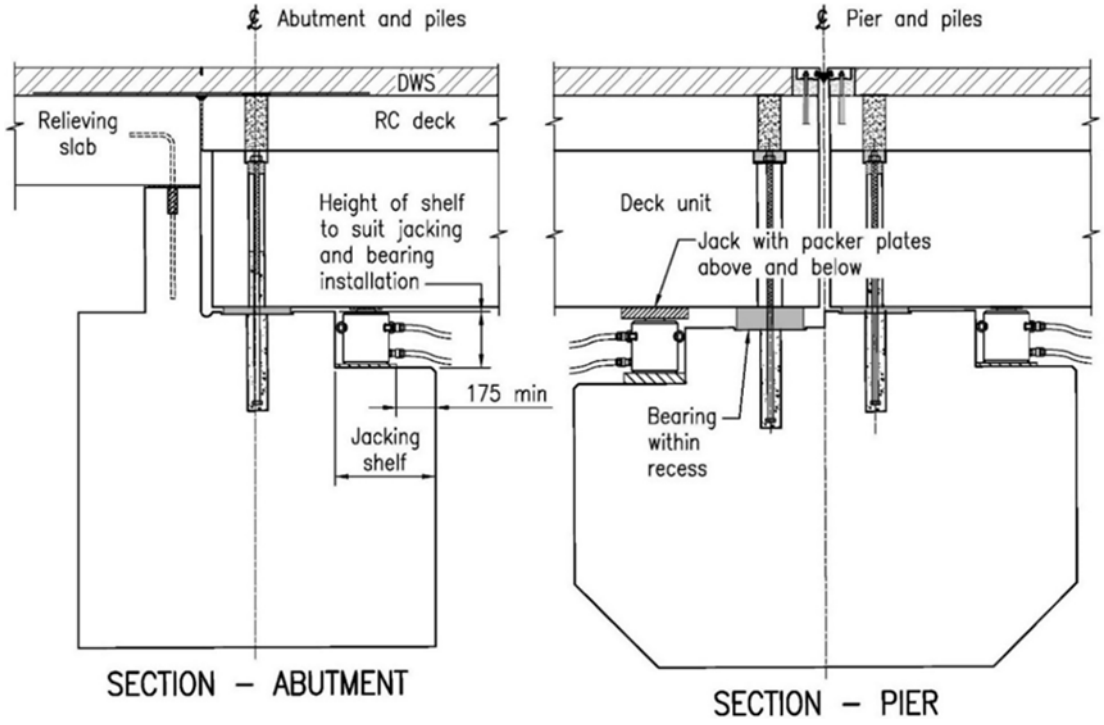
Elastomeric bearings shall be used in the following instances:

- bridges with an insitu reinforced concrete deck
- where expansion joints are required, and
- bridges with transversely stressed deck units 21 m long or greater.

Drawings are to show the number off, dimensions, part numbers, positions, and orientations of all bearings.

For further details, refer to the following Figure 4.5 and Section 4.16 of this chapter.

Figure 4.5 – Example of deck unit jacking shelf for abutment and pier



4.6 Abutment headstock profiles

The end slope of abutment headstocks shall be perpendicular to the top face of the kerb or wing wall (refer to Figure 4.6).

For bridges with cast-insitu kerbs:

- where the bridge has a crossfall or superelevation up to and including 3%, the top face of the kerbs and abutment wing walls shall remain level (Type 1 or Type 2), and
- for superelevation greater than 3%, the top face of the wing walls shall follow the superelevation (Type 3).

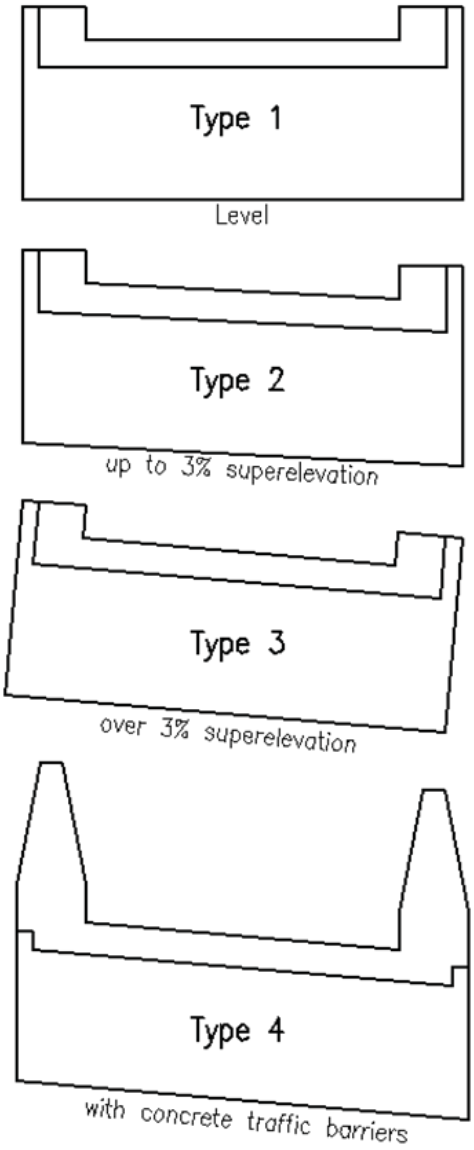
For bridges with concrete traffic barriers:

- regardless of crossfall or superelevation, the barriers shall remain vertical, and the top face shall be level (Type 4), and
- for bridges with cast-insitu kerbs: the top face of the kerbs and abutment wing walls are level on bridges with a crossfall or superelevation up to and including 3% (Type 1 or Type 2).

For bridges with a superelevation greater than 3%, the top face of the wing walls follows the superelevation (Type 3).

For bridges with concrete traffic barriers: The barriers shall be installed vertically, and their top surface shall remain level (Type 4) irrespective of the crossfall or superelevation of the deck.

Figure 4.6 – Abutment headstock elevation options



4.6.1 Abutment headstock heights

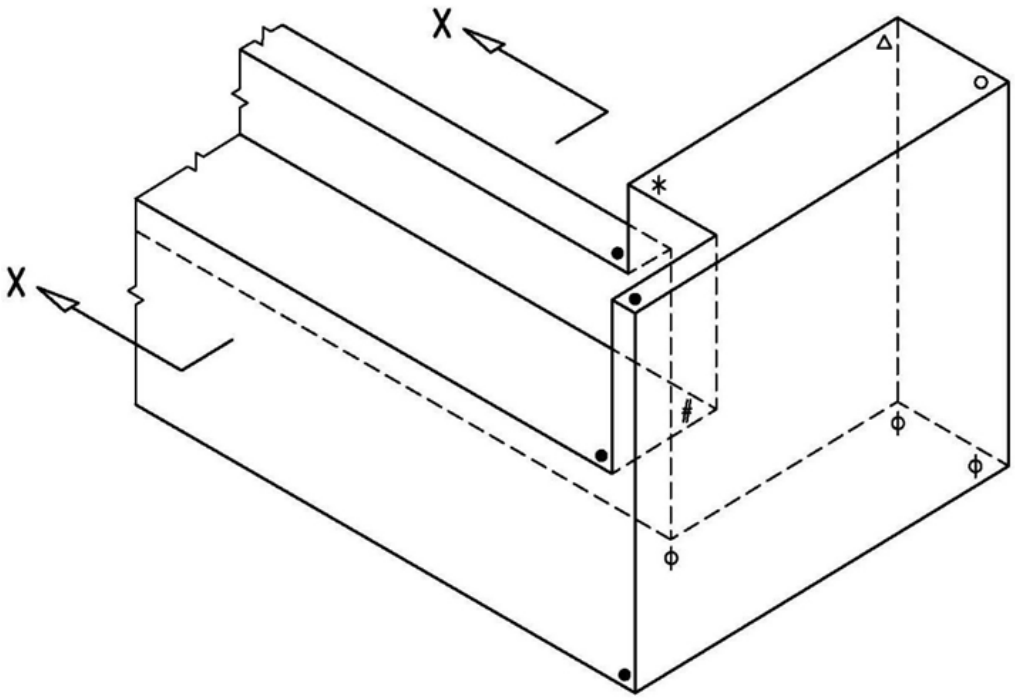
Heights shall be shown to specific points on the horizontal faces of an abutment to clearly define the headstock. These points vary depending on the geometric conditions such as grade, superelevation, skew, and so on.

Abutments within a vertical curve require special consideration in determining Heights, while at the same time ensuring that the DWS thickness is not reduced below the minimum allowed either at the ends or at the centre of the span.

Figure 4.6.1 defines the points, the respective conditions at each point, and indicates where heights are required to be shown, noting the following:

- The soffit of all headstocks shall be horizontal through Section X-X and set to the resultant crossfall.
- The soffit of wing walls shall be coplanar with the soffit of the headstock.
- Conditions 1, 4 and 7 require heights to be shown on one side of the abutment only. For all other conditions, heights shall be shown on both sides of each abutment.
- Conditions 4 to 6 require a height at a point marked thus '#' on the bearing shelf, when that bearing shelf is to be sloped due to grade (refer to Figure 4.11 for deck unit bridges for further details), and
- A headstock for a girder bridge with a jacking shelf only requires height(s) at the point marked '#' when the bridge is skewed.

Figure 4.6.1 – Abutment heights notation



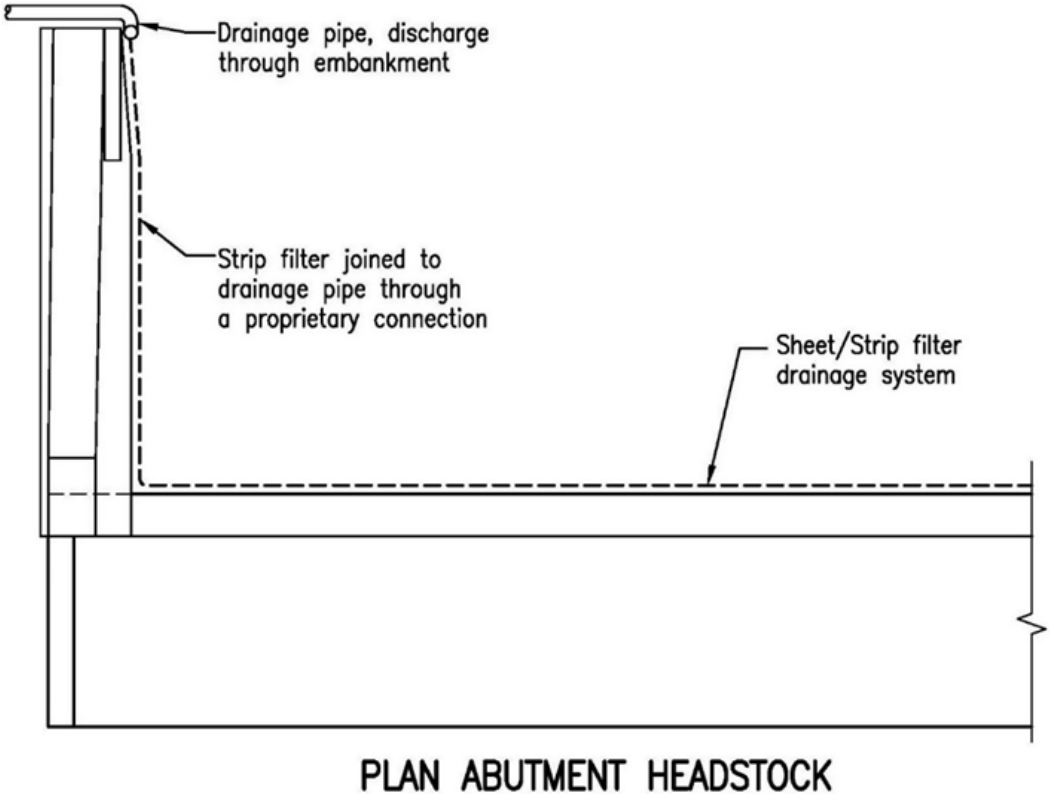
1.	Square on level grade – no superelevation	•					
2.	Square on level grade – with superelevation ≤3%	•					
3.	Square on level grade – with superelevation >3%	•		*			
4.	Square on longitudinal grade – no superelevation	•	o	*			
5.	Square on longitudinal grade – with superelevation ≤3%	•	o	*			
6.	Square on longitudinal grade – with superelevation >3%	•	o	*	Δ		
7.	Skewed on level grade – no superelevation	•					
8.	Skewed on level grade – with superelevation ≤3%	•				ϕ	#
9.	Skewed on level grade – with superelevation >3%	•		*		ϕ	#
10.	Skewed on longitudinal grade – no superelevation	•	o	*		ϕ	#
11.	Skewed on longitudinal grade – with superelevation ≤3%	•	o	*		ϕ	#
12.	Skewed on longitudinal grade – with superelevation >3%	•	o	*	Δ	ϕ	#

4.6.2 Abutment headstock drainage

The embankment behind an abutment headstock generally requires drainage to prevent hydrostatic pressure being applied to the abutment. The usual drainage system is a sheet filter placed above a strip filter placed behind the headstock and wing walls. Drainage pipes are then connected to strip drains through proprietary connections and drained through the embankment, at the end of the wing walls, either side of the headstock. In some circumstances, such as blade walls, weepholes may also be required.

For an example of the details required on the abutment drawings, refer to Figure 4.6.2.

Figure 4.6.2 – Example abutment headstock drainage



Note: Headstocks may include a bearing shelf drain at the front of the ballast wall and weepholes through the sidewalls; this example does not include those details.

4.6.3 Abutment wing walls

There are a number of interfaces at bridge ends that need careful detailing and consideration to identify and avoid possible clashes. This includes, but is not limited to, the interaction and fitment of, where used, anchorages for post and rail traffic barrier, approach and departure guardrail systems, drainage system, signage infrastructure, intelligent transport systems infrastructure, conduits, and cable joining pits.

Examples of these interfaces at bridge ends are provided in the following figures:

- Figure 4.6.3(c) Wing wall recess for anchorage at end post of post and rail traffic barrier
- Figure 4.6.3 (d) Thrie beam guardrail connecting to bridge concrete traffic barrier, and
- Figure 4.6.3(e) Thrie beam guardrail connecting to bridge steel traffic barrier.

Points to consider when designing the length of a wing wall include:

- Conduits on bridges are allowed a maximum elbow bend of 22.5° so that the services can be easily pulled through the conduit.
- Conduits shall exit the back of the wing wall 600 mm minimum below ground. This distance may be reduced to 300 mm if the conduits are covered with a concrete protective strip.
- Rear face of wing walls to be behind the sloped faces transitioning to the abutment protection, and
- The wing is to be at least the minimum length required for the barrier systems to reach full height before the abutment centreline.

The following figure shows the standard dimensioning method of the wing walls of a skewed deck unit bridge, and the diagram for calculating non-standard wing wall lengths for a skewed girder bridge.

Figure 4.6.3(a) – Example of wing wall dimensioning

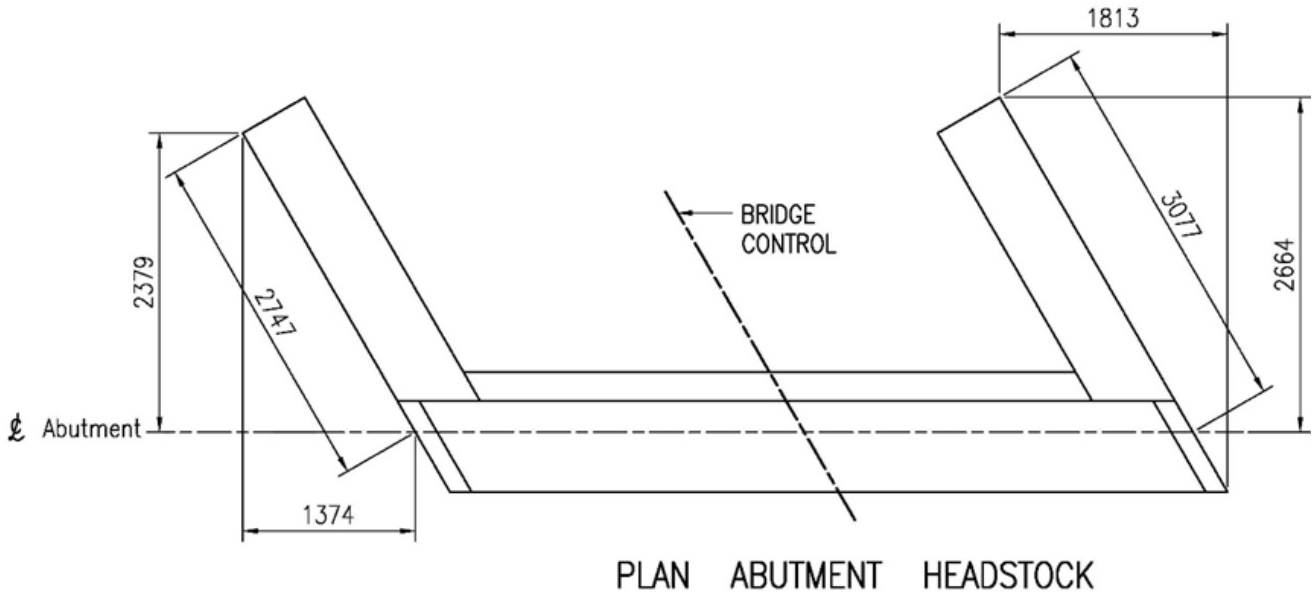


Figure 4.6.3(b) – Diagram for calculating non-standard wing wall lengths – girder bridge

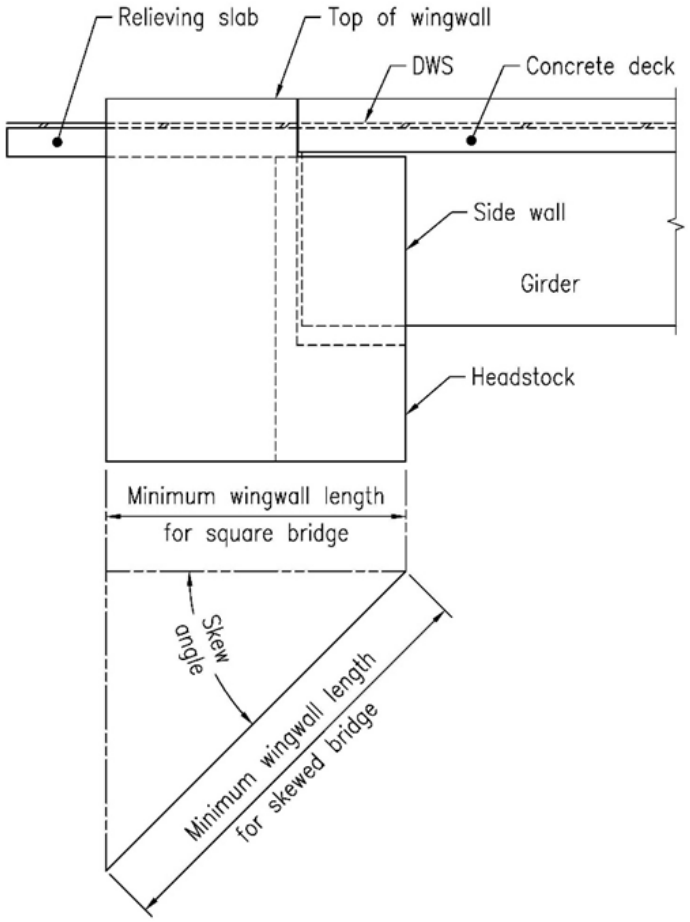


Figure 4.6.3(c) – Wing wall recess for anchorage at end post of post and rail traffic barrier

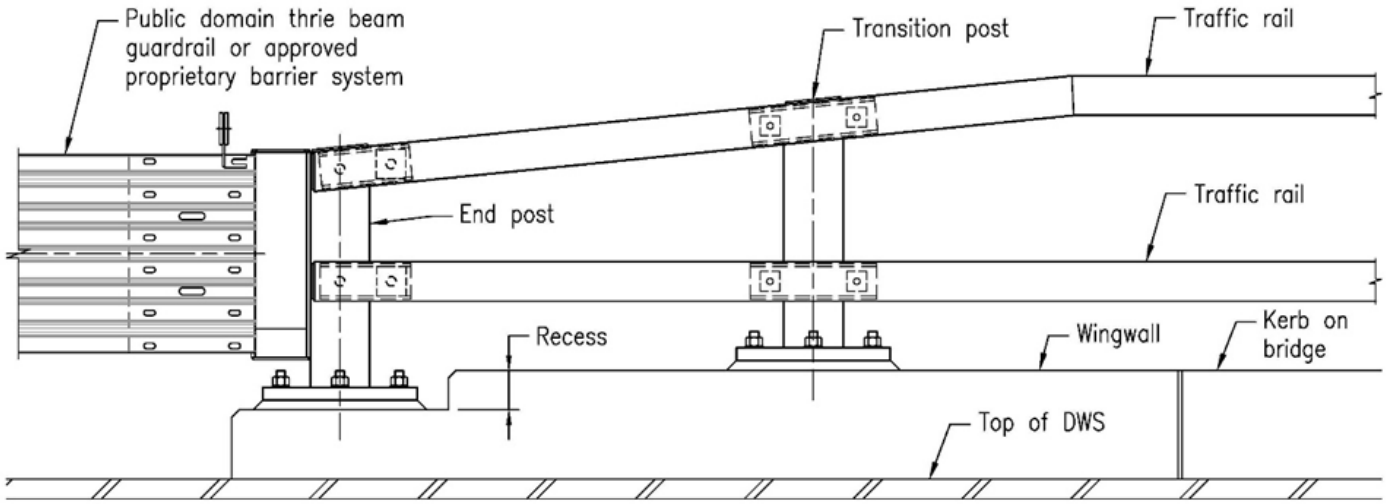


Figure 4.6.3(d) – Conduit treatment and guardrail connection for post and rail traffic barrier

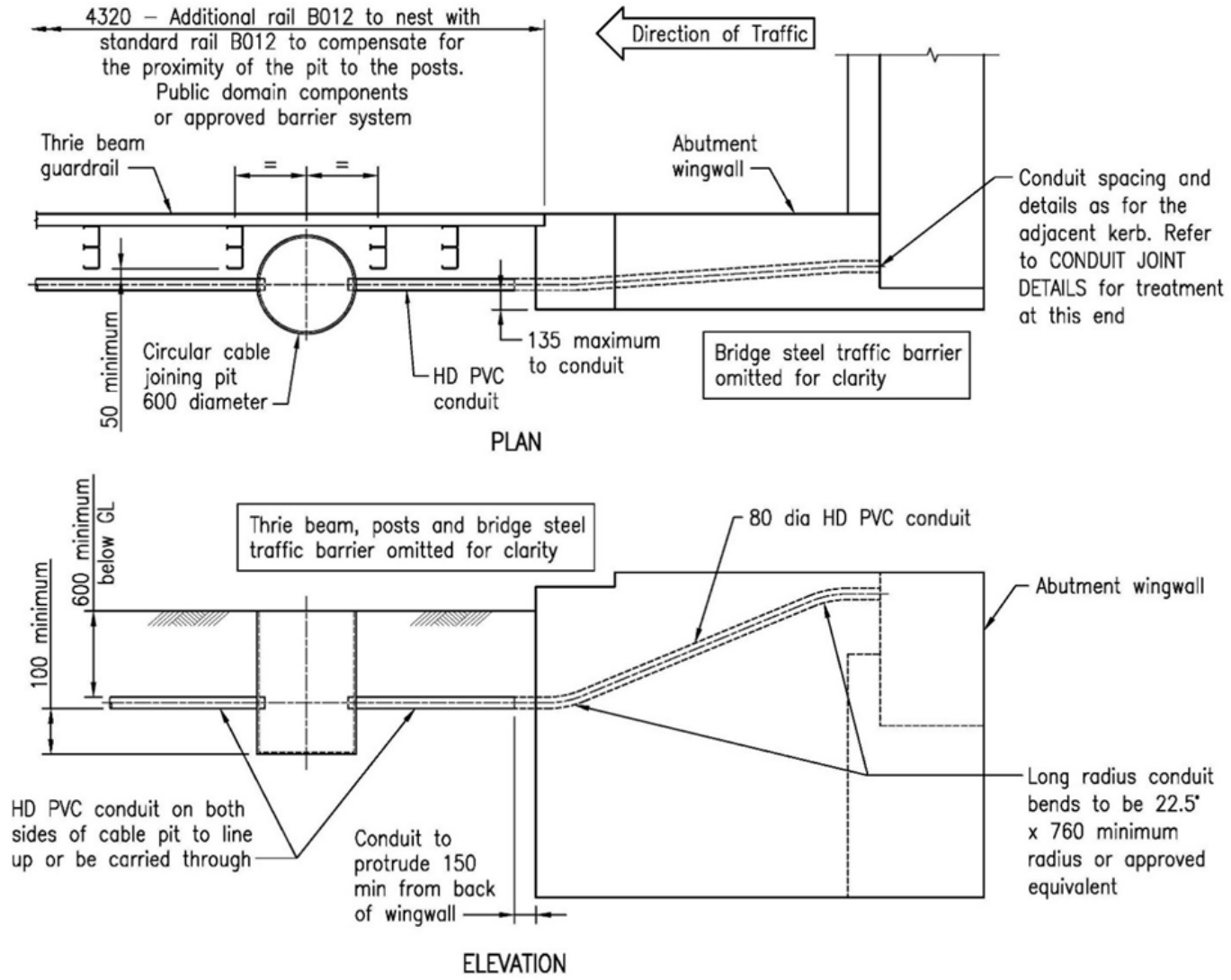
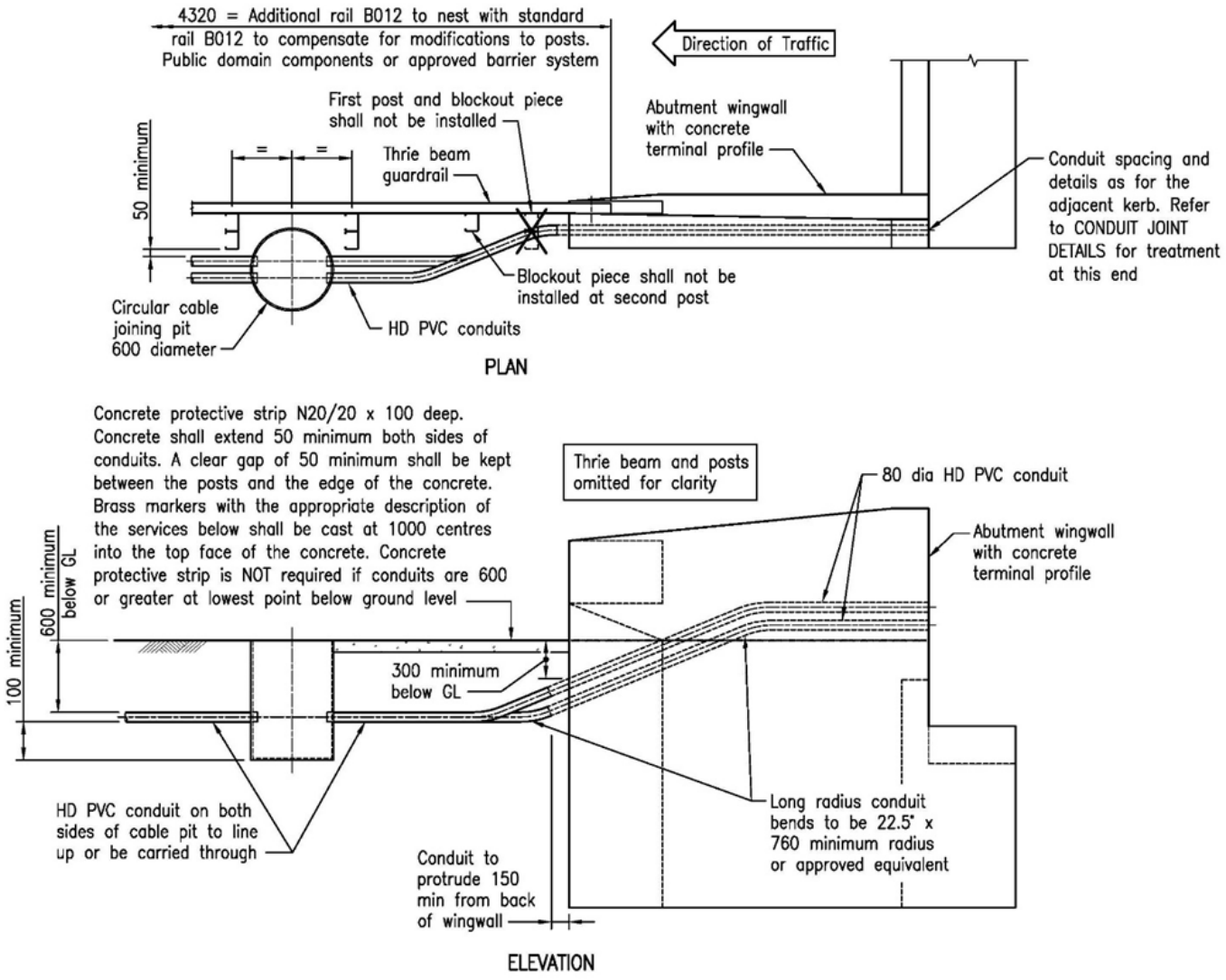


Figure 4.6.3(e) – Conduit treatment and guardrail connection for concrete traffic barrier



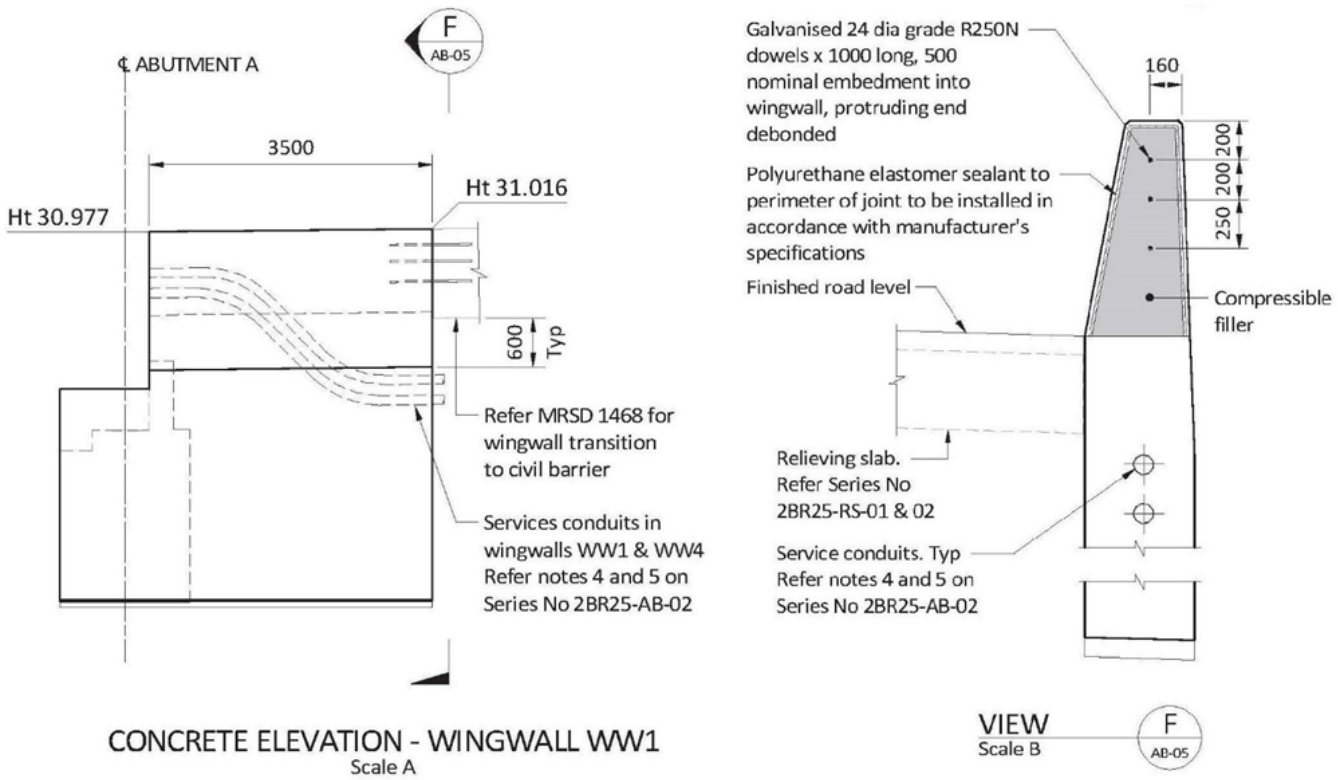
4.6.4 Wing wall with concrete traffic barrier connection to extruded barrier

Bridges with concrete traffic barriers may connect to a concrete extruded barrier rather than a guardrail. In this case, the concrete traffic barrier profile shall continue across the wing wall length, with an appropriate construction joint, and have dowel bars protruding for the median barrier to connect to.

Dowelled joints are not to be used at abutment barriers or pier barrier joints where they can interfere with future jacking operations.

Refer to SD1468 *Single Slope Concrete Barrier – Extruded Median Barrier – Barrier, Reinforcing and Expansion Joint Details (Sheet 1 of 2 and Sheet 2 of 2)* for guidance and the following Figure 4.6.4.

Figure 4.6.4 – Example of wing wall connection to extruded barrier

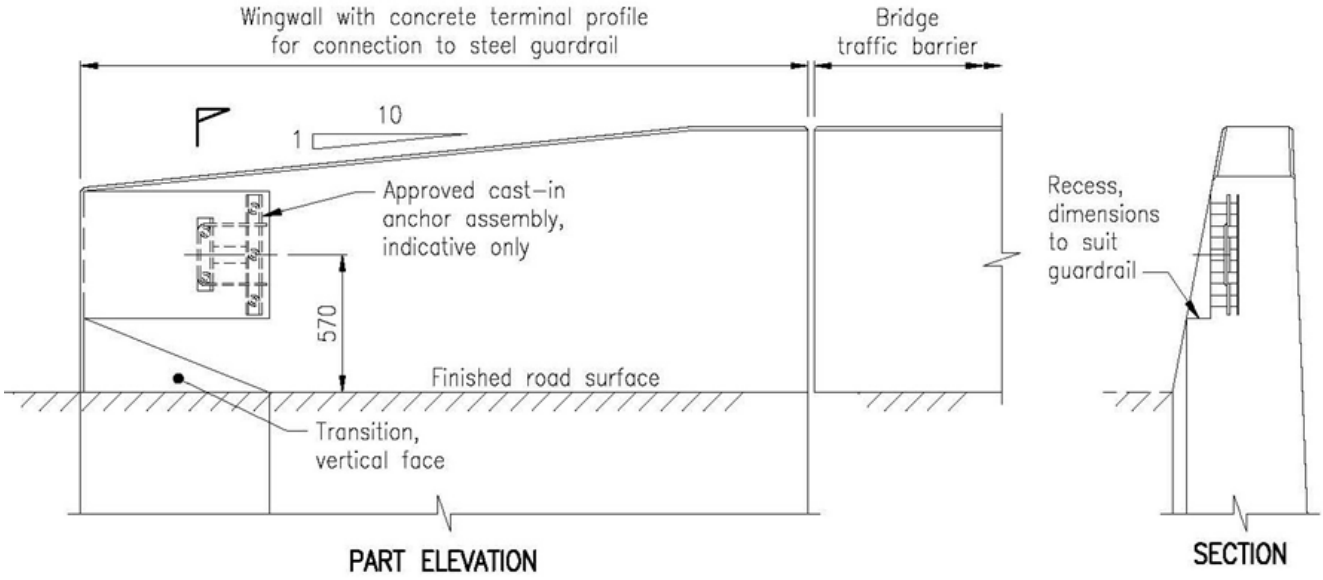


4.6.5 Wing wall concrete traffic barrier connection to guardrail

Bridges with concrete traffic barriers can connect to an approved propriety steel guardrail system. The department's steel guardrail and connection Standard Drawings have been withdrawn and instead the designer selects an appropriate barrier system from the department's *Approved Products List*. Proprietary barriers and public domain barriers are permitted in accordance with *Road Planning and Design Manual 2nd Edition* (RPDM) and MRTS14 *Road Furniture*, including anchors cast-into the concrete barrier terminal at each wing wall for connecting the steel guardrail.

The height of the concrete barrier terminal shall transition no steeper than 1 on 10 to match in with the top of the connecting steel guardrail (refer to SD1468 *Single Slope Concrete Barrier – Extruded Median Barrier – Barrier, Reinforcing and Expansion Joint Details (Sheet 1 of 2 and Sheet 2 of 2)* and SD1486 *Single Slope Concrete Barrier – Concrete Terminal for Barrier with Thrie Beam Guardrail Connection (Drawing 1 of 2 and Drawing 2 of 2)* for guidance).

Figure 4.6.5 – Example wing wall connection to steel guardrail



4.7 Pier headstock profiles

Where there is no sidewall to piers for a deck unit bridge:

- the bearing shelf shall extend minimum 100 mm from edge of the outer deck unit, and
- the side of the headstock shall be parallel with the deck units on overpass bridges or on creek bridges where this dimension exceeds 800 mm.

4.7.1 End slope of pier headstocks

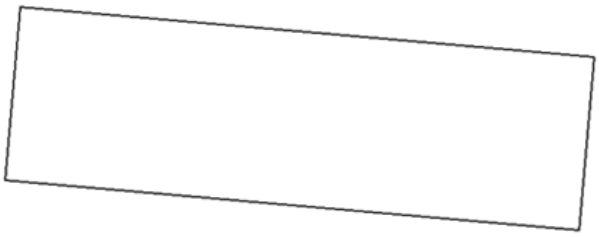
Resultant superelevation is the slope of the headstock after superelevation, vertical grade, and skew are accounted for (refer to Figure 4.7.1).

Pier headstocks with a resultant superelevation up to and including 3% have vertical ends.

Pier headstocks with a superelevation greater than 3% have ends sloped perpendicular to the top of headstock.

Figure 4.7.1 – End slope of pier headstocks

Pier headstocks with resultant superelevation up to and including 3%



Pier headstocks with resultant superelevation greater than 3%

4.7.2 Pier headstock heights

Heights shall be shown at specific points on the horizontal faces of each pier to clearly define the headstock. These points can vary depending on the geometric conditions such as grade, superelevation, skew and so on.

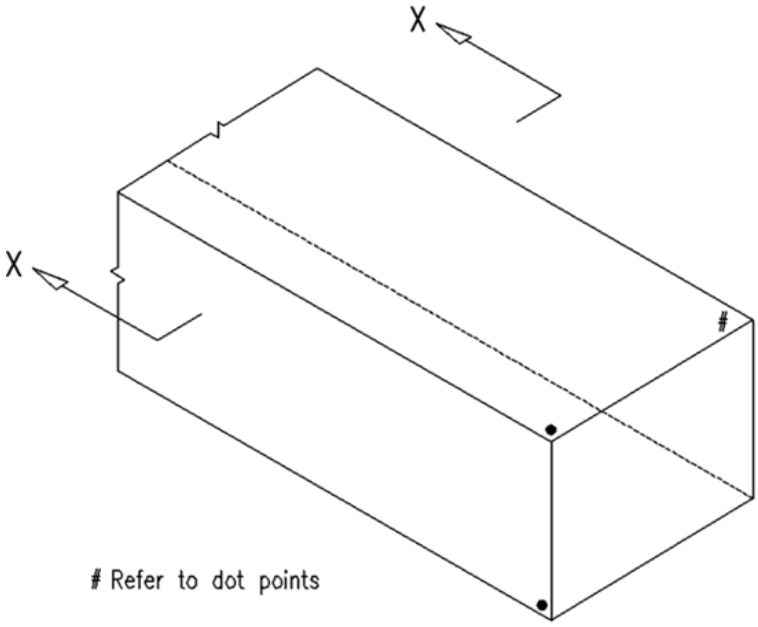
Piers within the limits of a vertical curve require special consideration in determining Heights, while at the same time ensuring that the DWS thickness is not reduced below the minimum allowed either at the ends or at the centre of the span.

Figure 4.7.2 defines these points for a simple rectangular headstock, the respective conditions at each point, and indicates where heights are required to be shown. Headstocks that are not rectangular in the plan view or have a step down for deeper beams on one side require separate consideration.

Note the following:

- the soffit of all headstocks shall be horizontal through Section X-X, and set to the resultant crossfall
- conditions 1, 3 and 5 require heights to be shown on one side of the pier only
- conditions 3, 4, 7 and 8 will require a height at a point marked thus ‘#’ when the bearing shelf needs to be sloped due to grade (refer to Figure 4.11 for deck unit bridges for further details)
- ‘#’ is only needed on a girder bridge when the bridge is skewed, and
- A headstock with jacking shelves requires additional height(s) to be shown.

Figure 4.7.2 – Pier heights notation



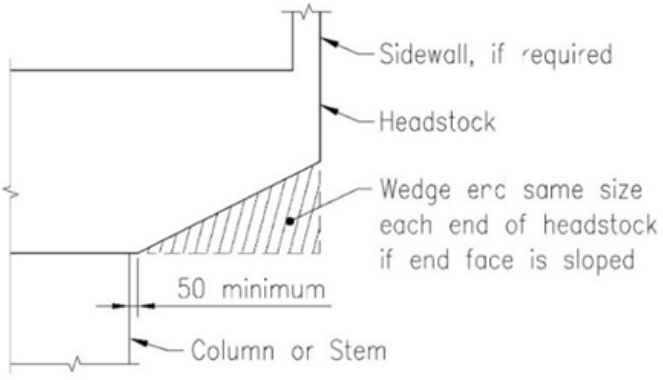
1. Square on level grade – no superelevation •
2. Square on level grade – with superelevation •
3. Square on longitudinal grade – no superelevation •
4. Square on longitudinal grade – with superelevation •
5. Skewed on level grade – no superelevation •
6. Skewed on level grade – with superelevation •
7. Skewed on longitudinal grade – no superelevation •
8. Skewed on longitudinal grade – with superelevation •

4.7.3 Tapering of pier headstocks

Pier headstocks that are supported by columns or a solid blade stem are often tapered from the outer column or stem to the end of the headstock. The wedge end at each headstock end face should be same size if those faces are perpendicular to the bearing shelf (refer to the following Figure 4.7.3).

A 50 mm minimum clearance is required from the column or stem before the taper commences.

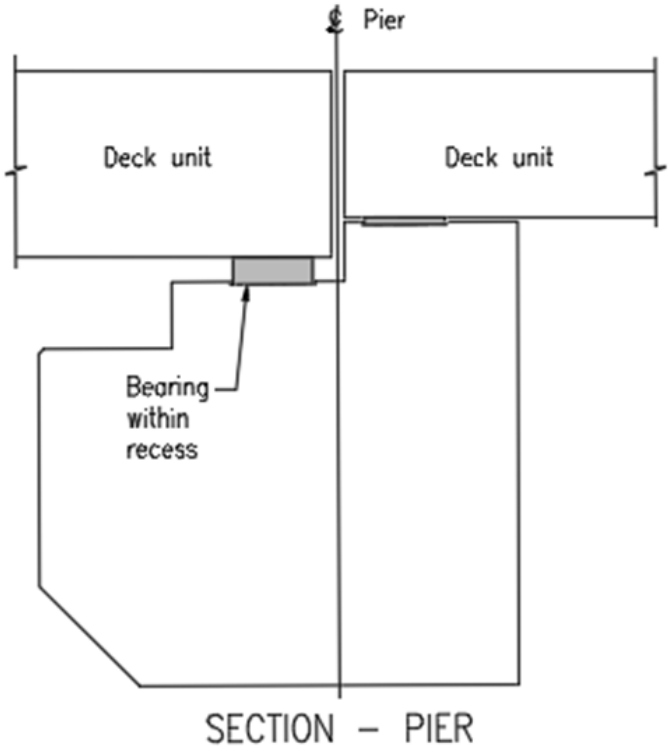
Figure 4.7.3 – Example tapered pier headstock profile



4.7.4 Stepped pier headstocks

A pier headstock shall be stepped when it supports beams of different depths on adjacent spans, or where bridge articulation at the pier requires bearings of different thicknesses. The depth of the step shall be calculated to ensure that the top of the beams align (refer to the following Figure 4.7.4).

Figure 4.7.4 – Example stepped pier headstock



4.8 Alignment of elastomeric bearings

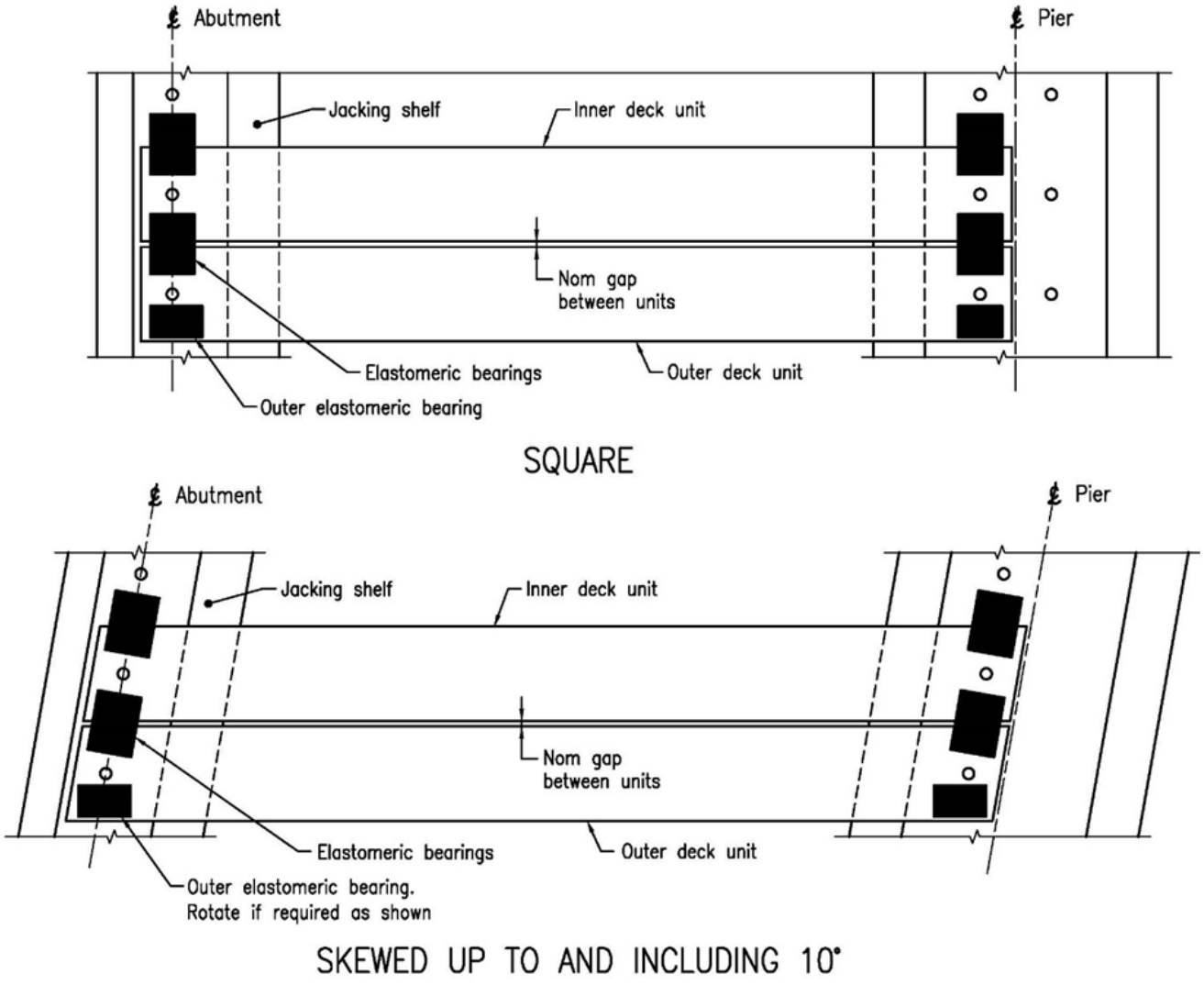
4.8.1 Alignment of bearings on deck unit bridges

On square bridges, and those skewed up to and including 10° and have a maximum nominal gap of 40 mm between each deck unit, bearings shall be positioned parallel to the headstock (refer to Figure 4.8.1(a)).

The bearings shall also be positioned between the deck unit holding down bolts so that the bearings are loaded by the 2 adjacent deck units. Placing the bearings between the holding down bolts rather than in front of them allows for a substantial reduction of the headstock width.

Smaller bearings, typically a non-standard size, are placed under the outer deck units. Because of the limited space available to position these bearings, they need not be parallel with the headstock. If the small outer bearings cannot accommodate the forces applied by a composite deck and/or long span lengths, the alignment of bearings for a bridge skewed more than 10° should be considered.

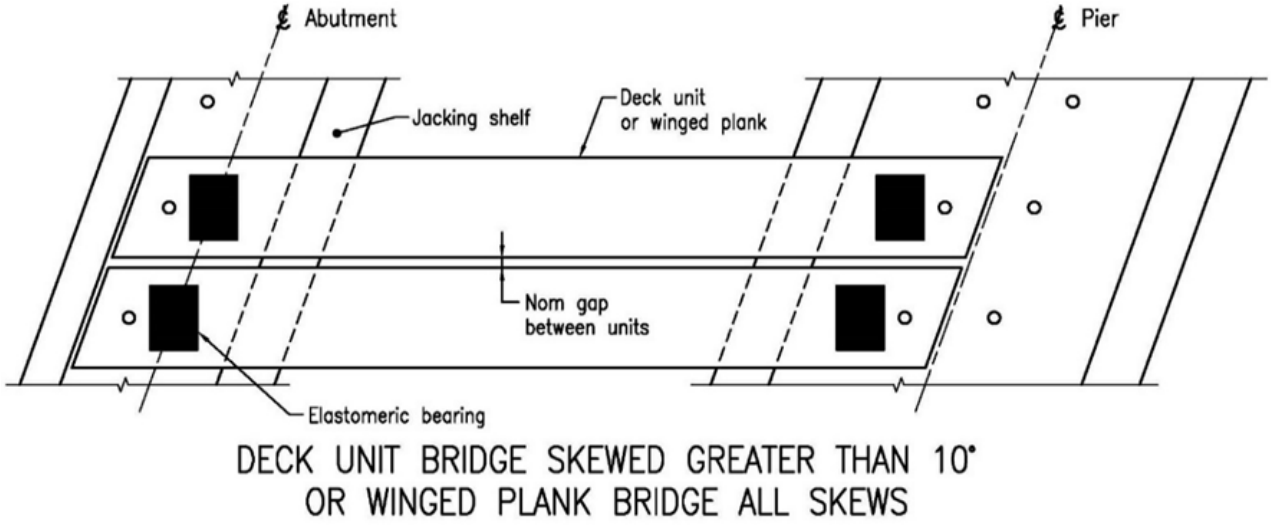
Figure 4.8.1(a) – Alignment of bearings on deck unit bridges skewed ≤ 10°



On deck unit bridges skewed more than 10° or with a nominal gap between the deck units greater than 40 mm, and for winged plank bridges at all joints and for all skews, the bearings shall be positioned in front of the holding down bolt holes, and square to the longitudinal axis of the deck unit or winged plank (refer to Figure 4.8.1(b)).

For deck units, this arrangement avoids unequal loading of each half of the bearing which would happen if it was positioned between the deck units.

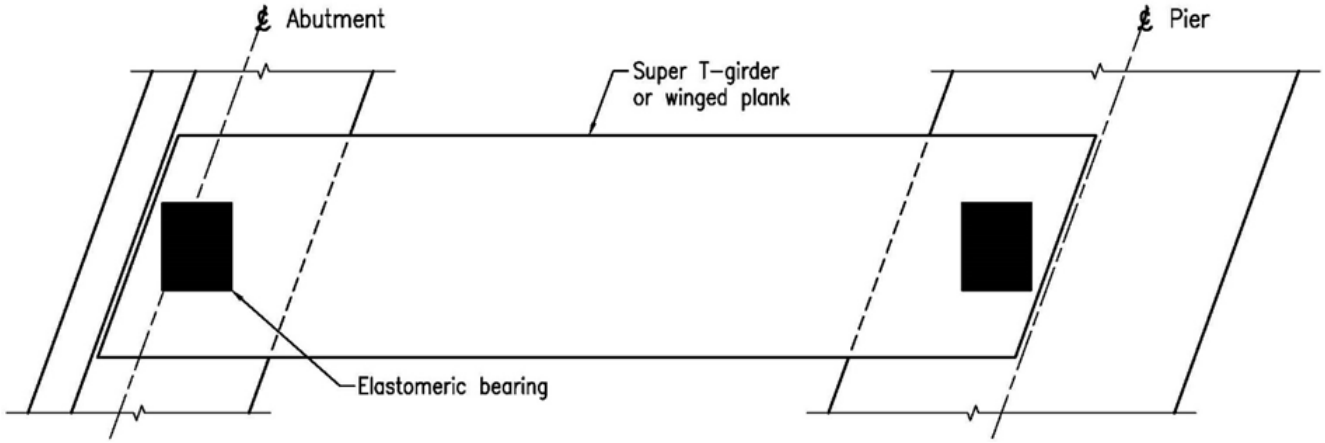
Figure 4.8.1(b) – Example of alignment of bearings on deck unit bridge skewed > 10°



4.8.2 Alignment of bearings on Super-T girder bridges

At all joints and for all skews, the bearings shall be parallel with the girders, as shown in Figure 4.8.2.

Figure 4.8.2 – Alignment of bearings on girder bridges



4.9 Holding down bolt formed holes for deck unit and winged plank bridges

The formed holes for holding down bolts shall be 90 mm in diameter, 450 mm deep, perpendicular to the bearing shelf, and shall be shown in the headstock elevation and section views.

4.9.1 Formed hole centreline spacings and offset

Where there are unit holding down bolts the spacing of the matching formed holes along the headstock (the dimensions labelled ‘X’ in the following Figure 4.9.1) is determined by the width of the beams, gaps between the beams and the skew of the bridge.

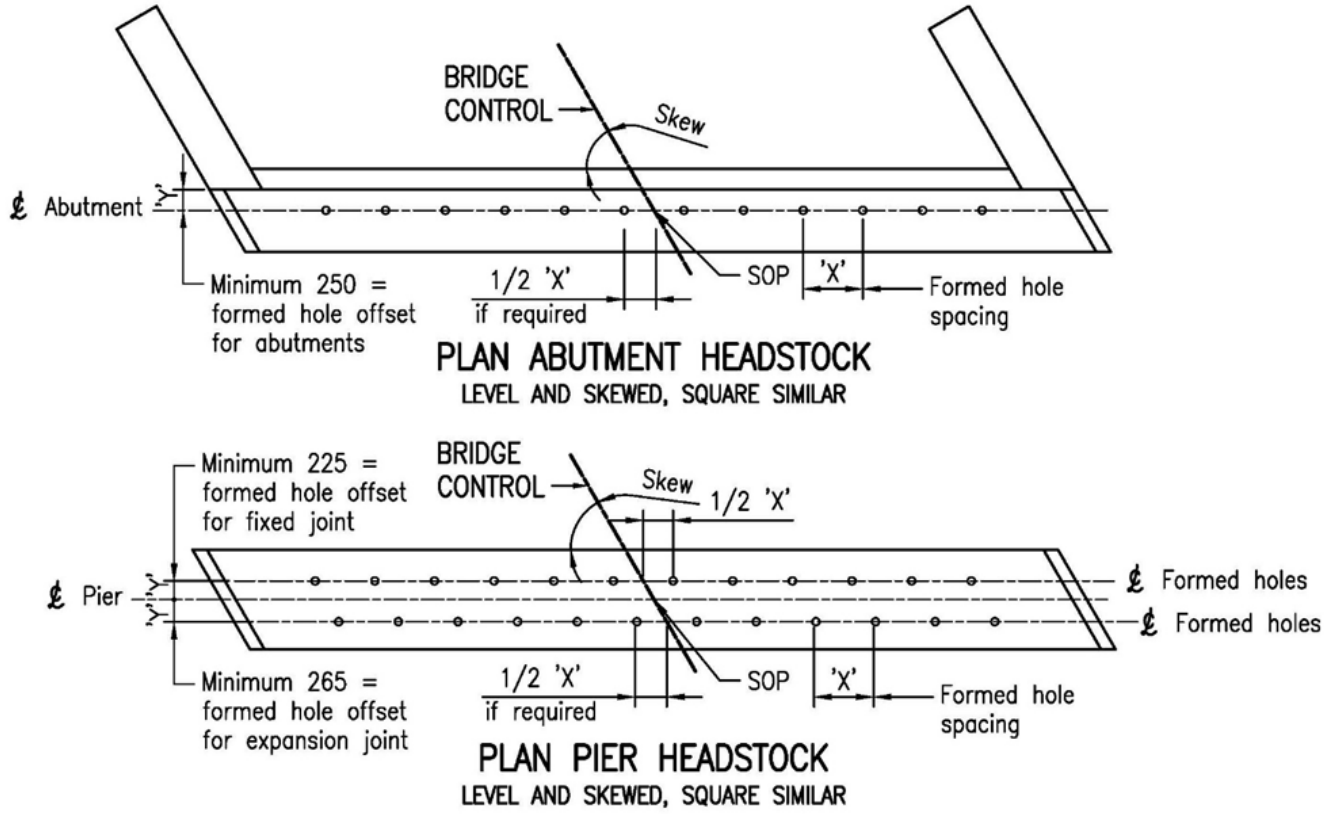
The formula for dimension ‘X’ = (width of deck unit + gap between units) ÷ (cosine of skew angle).

On abutment headstocks, centreline (CL) formed holes may be parallel to the abutment CL. The formed hole offset, dimension labelled ‘Y’, being offset for the CL formed holes to the ballast wall, is dependent on having minimum 50 mm clear gap from closest corner of beam to the ballast wall and then locate the centre of the holding down bolt hole of the beam when set to suit the gap. Minimum ‘Y’ is 250 mm.

On pier headstocks, the formed hole offsets, dimensions labelled ‘Y’, are dependent on having minimum 50 mm clear gap between beam ends and then locate the centre of the holding down bolt hole of the beams when set to suit half of the gap. Minimum ‘Y’ for fixed joint is 225 mm, and 265 mm for expansion joint.

If the deck unit bridge is on a horizontal curve, the skew angle can vary between the units and the abutment and pier headstocks.

Figure 4.9.1 – Example of formed hole spacings and offset from headstock centreline

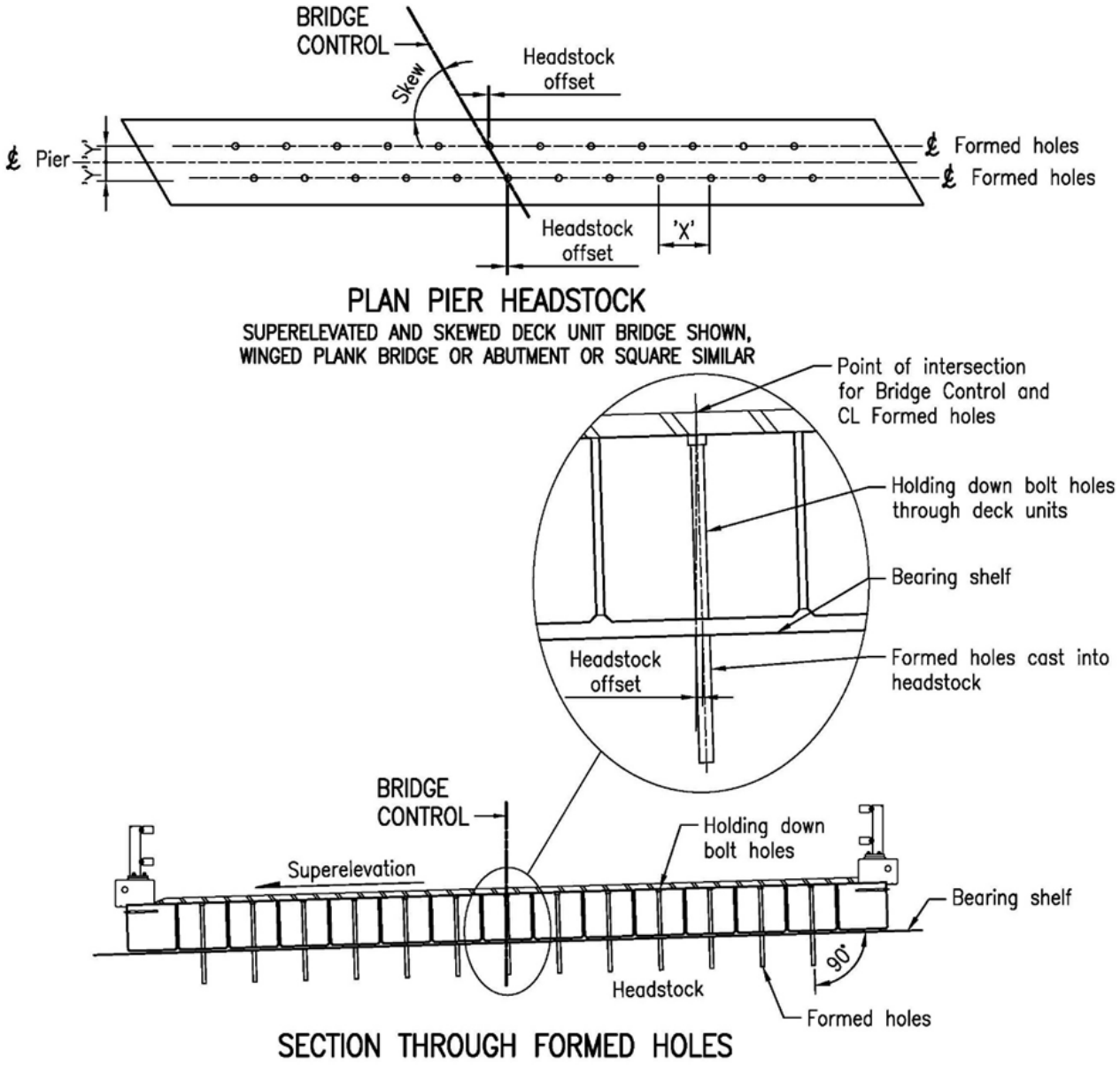


4.9.2 Square and skewed superelevated bridges

On superelevated bridges, the headstock is offset to maintain the correct position of the superstructure and is applied along the formed hole centreline (refer to Figure 4.9.2).

The formula for the headstock offset = (depth from top of DWS to the bearing shelf of the headstock) x (% of superelevation) ÷ (cosine of skew angle).

Figure 4.9.2 – Example of headstock offset required for superelevation



4.10 Headstock sidewalls

For a deck unit bridge, sidewalls are usually 150 mm wide. a clear gap of 20 mm is required between the cast-insitu kerb or bridge barrier and the sidewall (refer to Figure 4.10(a)).

For deck unit bridges, the sidewalls shall not interfere with the transverse stressing of the deck units, and the sidewall may be terminated to provide sufficient working room for jacking operations (refer to Figure 4.10(b)).

Figure 4.10(a) – Example of clear gap at abutment sidewalls

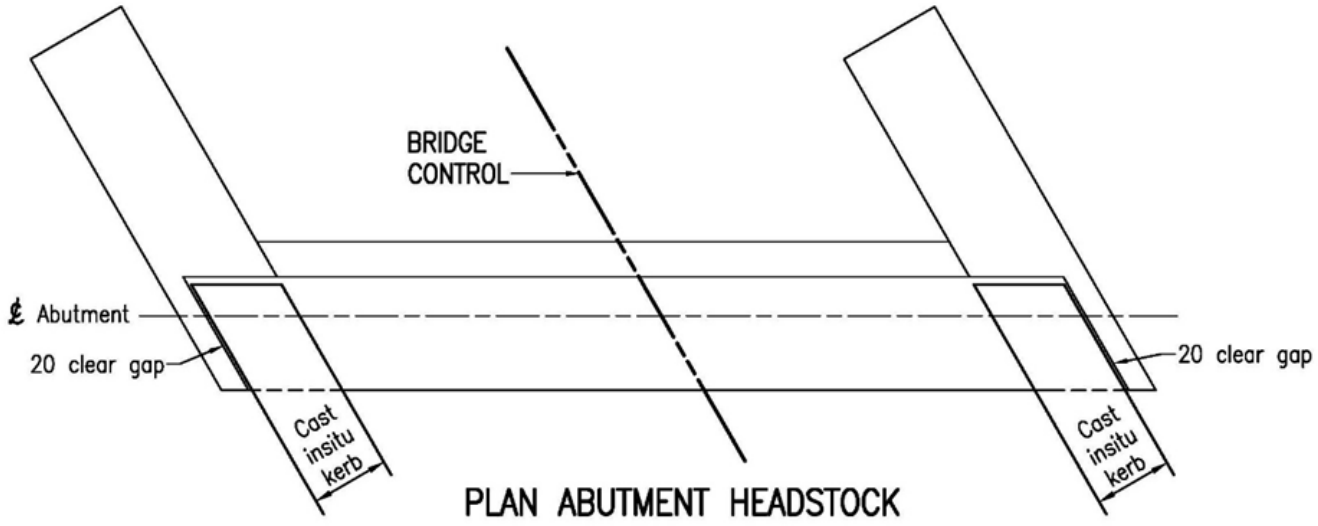
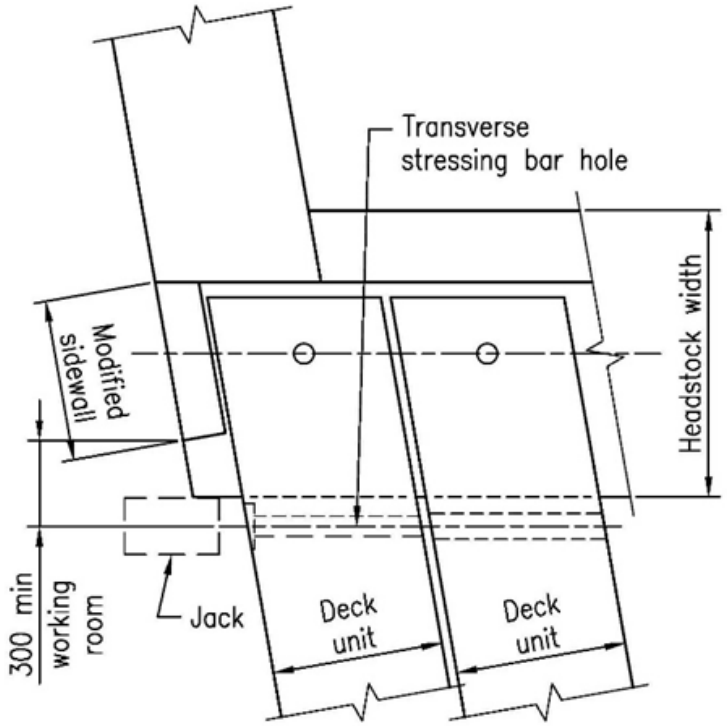


Figure 4.10(b) – Abutment sidewall and transverse stressing jack clearance



4.11 Mortar seating for deck unit bridges

The requirements are described here and shown in Figure 4.11.

A minimum gap of 15 mm required between top of the headstock and deck unit soffit shall be specified on the project drawings.

This minimum gap shall be achieved at the minimum clearance point between the soffit of the deck units and any point on the abutment and pier headstocks, usually the front edge and also considering, but not limited to, the following factors:

- hog of deck units
- bridge geometry, such as, skew, grade, vertical curve, and horizontal curve
- fanning out of deck units for road geometry requirements
- slope of headstock, and
- change in deck profile (design live and dead loads, creep, and shrinkage).

The resultant grade of the deck unit soffit is determined by the approach and departing seating heights, and the curve of the deck unit hogs. The pinch points for the least clearance can be at the higher side of the deck units on the front face of the superelevated headstocks.

With respect to headstock clearance, the following shall apply:

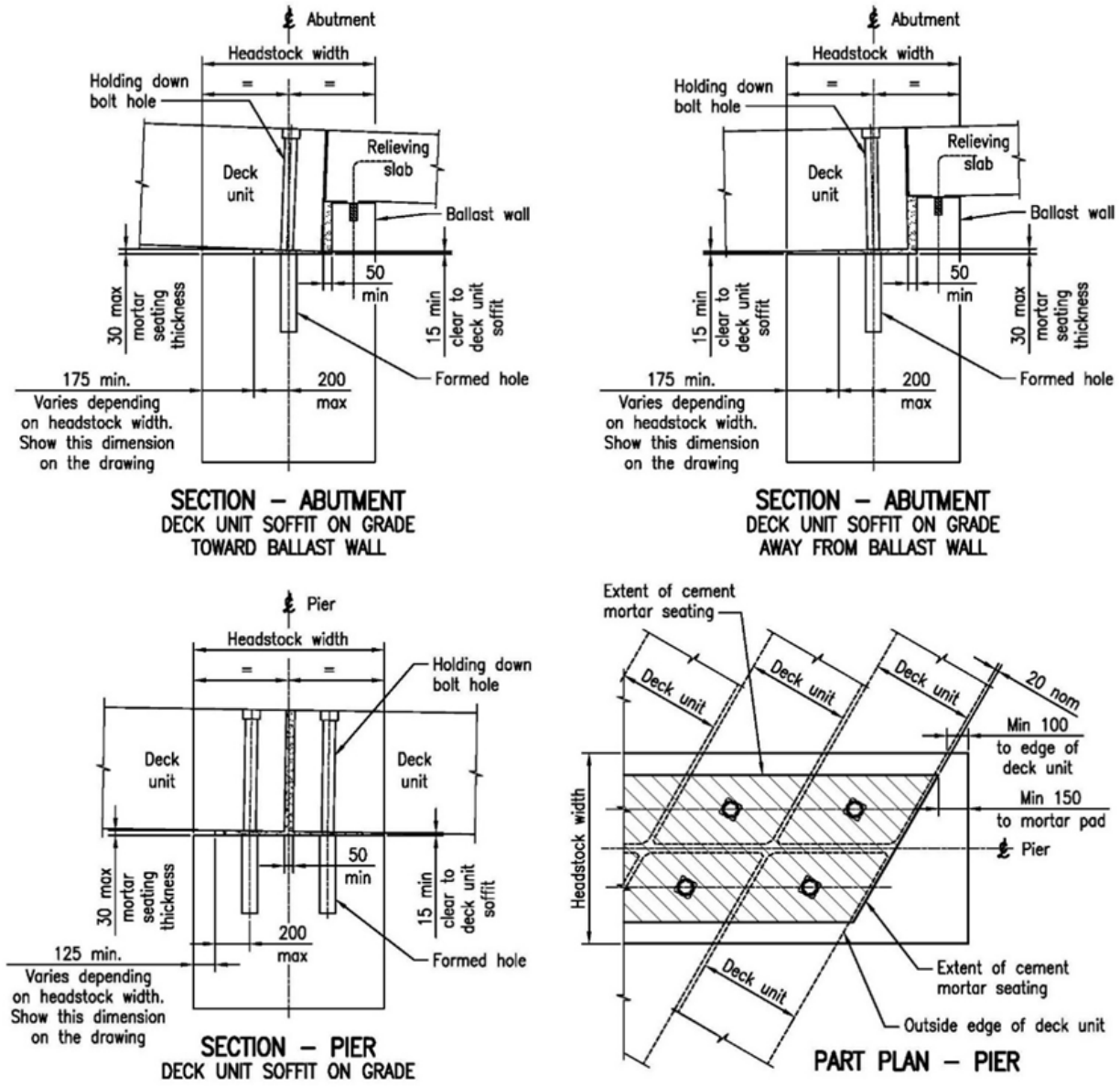
- mortar seating depth may be varied to a maximum thickness of 30 mm to accommodate geometric issues on less complex designs, and
- in cases where a greater thickness of mortar seating would be required to achieve minimum clearance, the bearing shelf of the headstock is sloped to match the resultant grade.

With respect to abutment ballast wall clearance, the following shall apply:

- Ballast walls are generally designed with a nominal clearance of 50 mm from the end of the deck units to the front face of the wall. Where extreme geometry applies, such as large grades and deeper units, the gap may be increased to achieve a minimum gap of 20 mm.

The extent of the mortar seating bed placed under deck units shall extend 200 mm from the formed holes towards the front face of the headstock and not be placed any closer than 125 mm to the front of pier headstocks, and 175 mm to the front of abutment headstocks, in any application. This dimension shall be shown on the drawings.

Figure 4.11 – Mortar seating limits for deck unit bridges



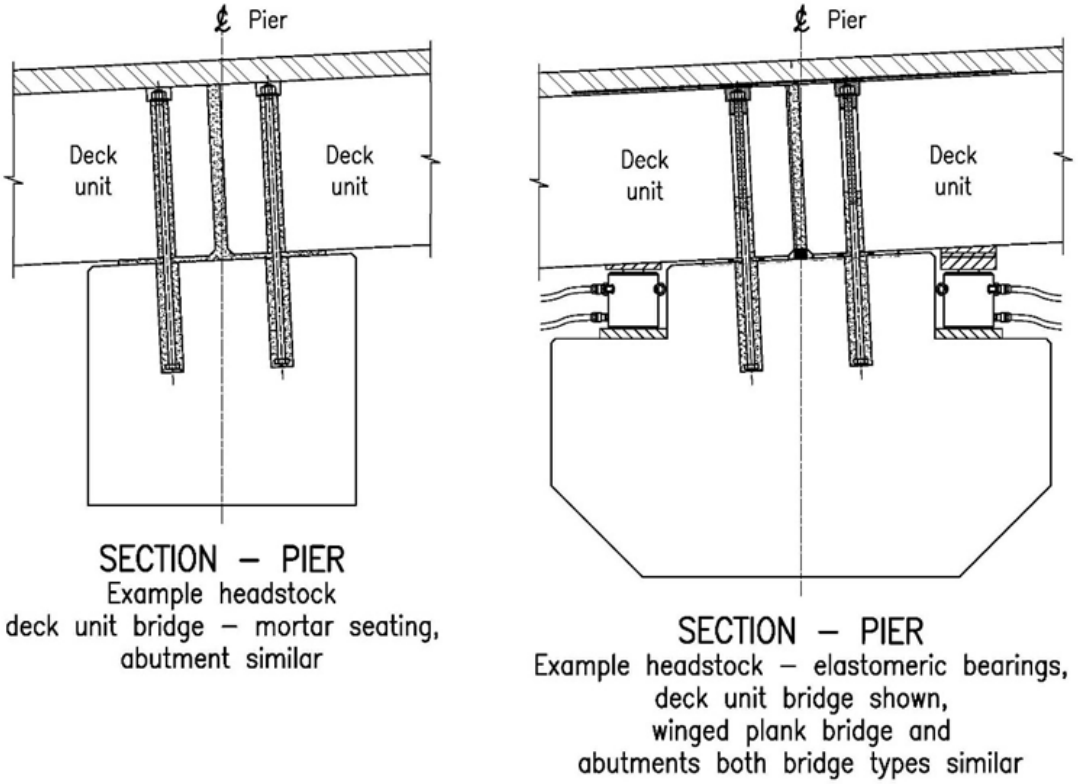
4.12 Deck unit bridge with sloped headstock bearing shelves

4.12.1 Headstock sloped bearing shelf for mortar seating

As explained in Section 4.11, the bearing shelf may need to be sloped to ensure that the mortar seating thickness does not exceed 30 mm. Even when the bearing shelf complies with these guidelines for mortar seating, it may still need to be sloped to allow the deck unit holding down bolts to fit inside the deck unit holding down bolt holes (refer to mortar seating example in Figure 4.12.1).

The 75 x 75 x 6 thick washer for the holding down bolt is required to sit inside the 100 x 100 x 55 deep recess in the top of the deck unit. Therefore, the bolt can only be off-centre a maximum of 12 mm at the top. If the bolt is closer than this, the formed hole in the headstock shall be made perpendicular to the deck unit. Consequently, the bearing shelf shall be sloped parallel with the grade of the bridge at that particular point. The possibility of this becoming an issue increases as the deck units get deeper on bridges with a vertical grade / curve.

Figure 4.12.1 – Example headstocks with sloped bearing shelf



4.12.2 Headstock sloped bearing shelf for elastomeric bearings

Section 4.7 of the DCBoS defines the circumstances where elastomeric bearings are required. On bridges with elastomeric bearings, the bearing shelf shall be sloped parallel with the grade of the bridge at that particular point. This is because the holding down bolts are required to sit centrally in the deck unit holding down bolt holes to suit future jacking requirements of the deck units. This design works for grades up to 5% (refer to mortar seating example in Figure 4.11).

4.13 Bearings and recesses

As per the DCBoS and MRTS62 *Bridge Substructure*, the requirements for deck unit and winged plank bridges are:

- elastomeric bearings shall be placed in a 10 mm deep recess
- a minimum clear gap of 15 mm, which is to be specified on the project drawings, between top of the headstock and deck unit soffit., shall be achieved, and
- the bearing thickness shall be limited to 25 mm, while being thick enough to achieve the required clearance.

4.14 Super-T girder bridge headstock layout considerations

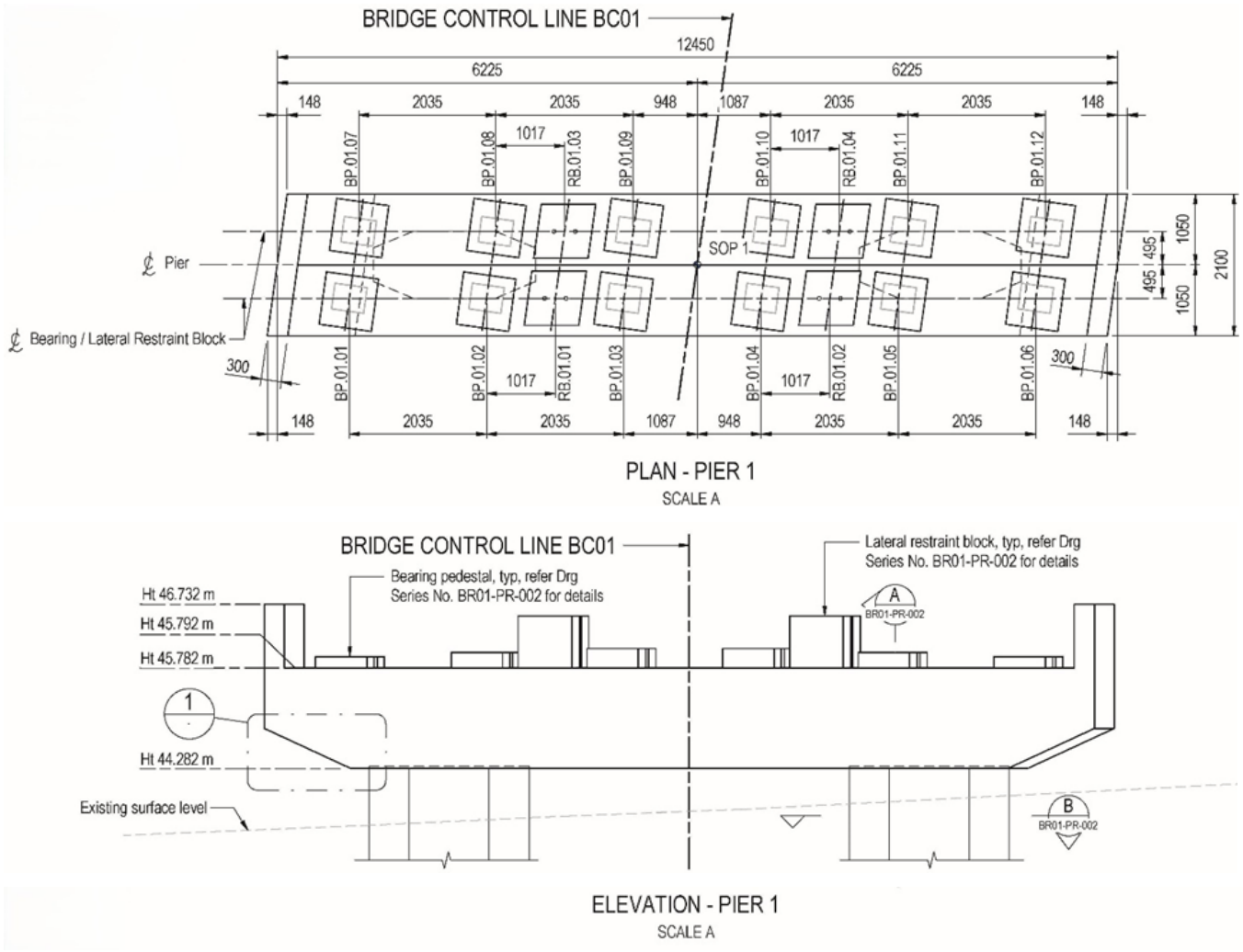
All headstocks for Super-T girder bridges are set out from a nominated point, called the SOP, being the intersection between the bridge control and the headstock centreline at the road surface height. All bearings, wing walls etc are to be set out along a line from this point perpendicular to the headstock centreline.

For an example of abutment headstock set out for square bridge, and example heights schedule, refer to Figure 4.4(a).

For an example of pier headstock set out for skewed bridge, refer to Figure 4.14(a).

Please note the elevation view in Figure 4.14(a) has been edited. The elevation of the headstock has been truncated to show only the relevant details.

Figure 4.14(a) – Example of pier plan and elevation views for skewed bridge



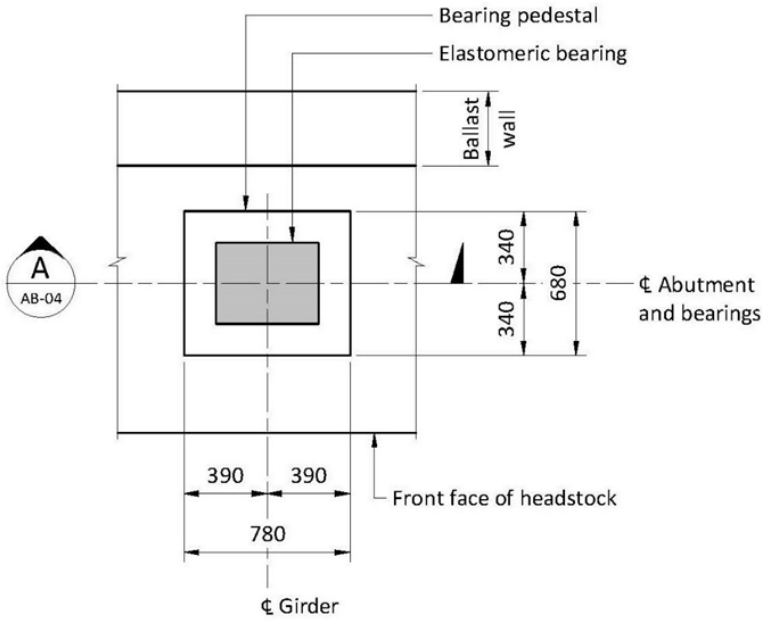
Bearings are installed on a reinforced concrete pedestal. The top of the pedestal and the bearings shall be level in all directions; refer to Figures 4.14(b) to 4.14(e) for examples of pedestal and restraint block set-out and concrete details). Note: Dimensions shown may vary depending on bearing sizes and project-specific requirements.

The following are also typical for Super-T girder headstocks:

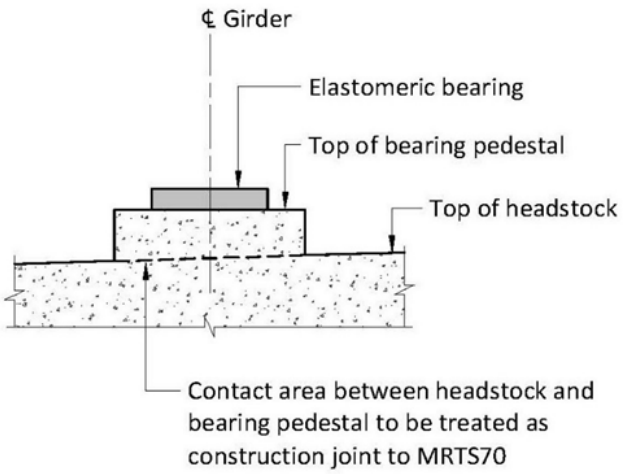
- girders are placed vertically in all situations
- girders are typically placed with a 30 mm gap between top flanges longitudinally
- a tapered steel plate between the bearing and the girder allows for vertical grade and hog
- a height shall be shown on the drawings at the top of every pedestal

- a girder restraint system such as concrete restraint blocks positioned between some of the pedestals, and
- 300 mm wide sidewalls which should finish flush with the outside of the concrete kerb of the deck or barrier panel, and with minimum 50 mm clear gap to the soffit of the deck.

Figure 4.14(b) – Example abutment pedestal concrete details for square bridge



PLAN
BEARING PEDESTAL SETOUT
Scale A



SECTION A
Scale A
AB-04

Figure 4.14(c) – Example abutment restraint block concrete details for square bridge

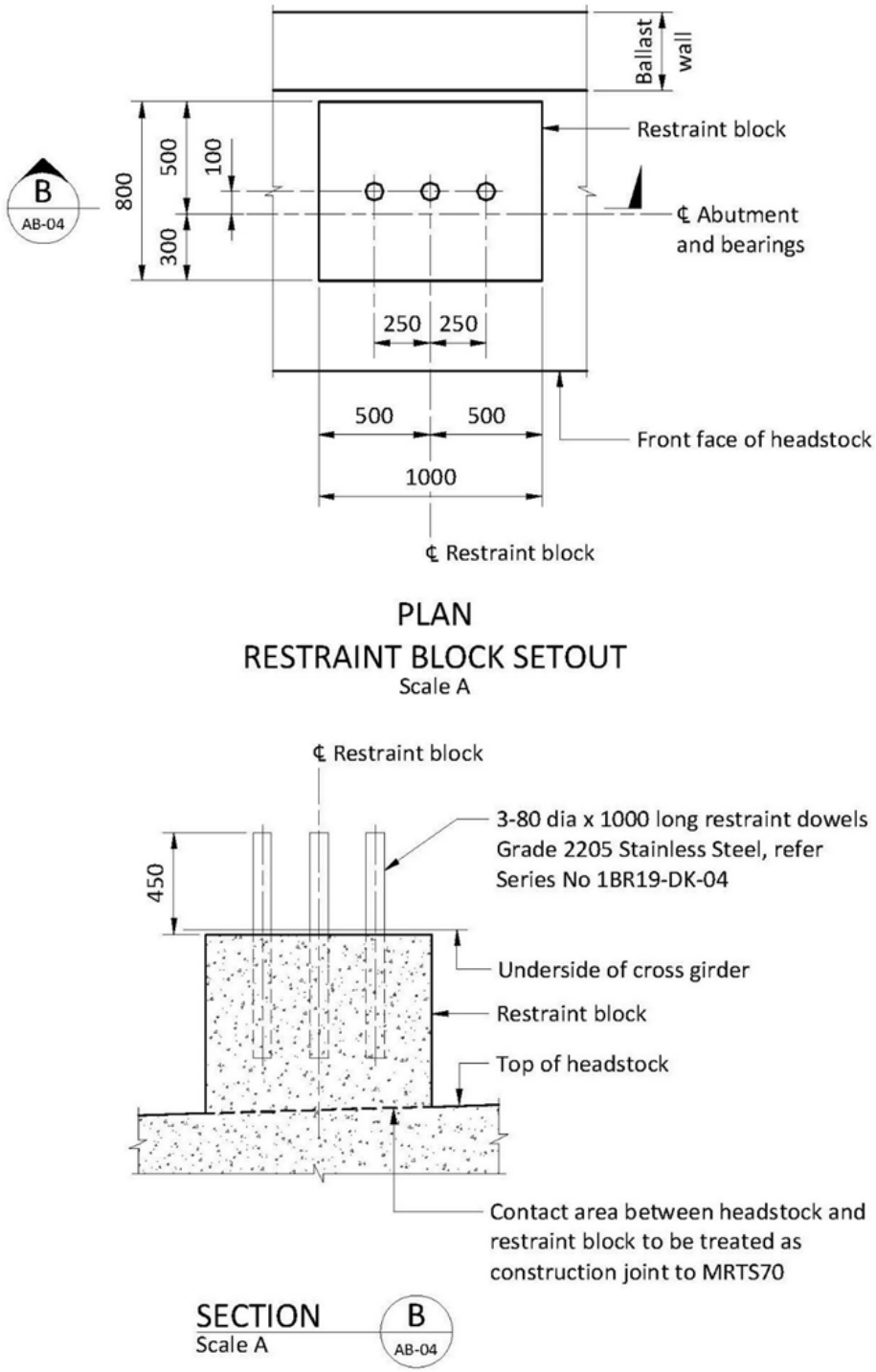


Figure 4.14(d) – Example pier pedestal concrete details for skewed bridge

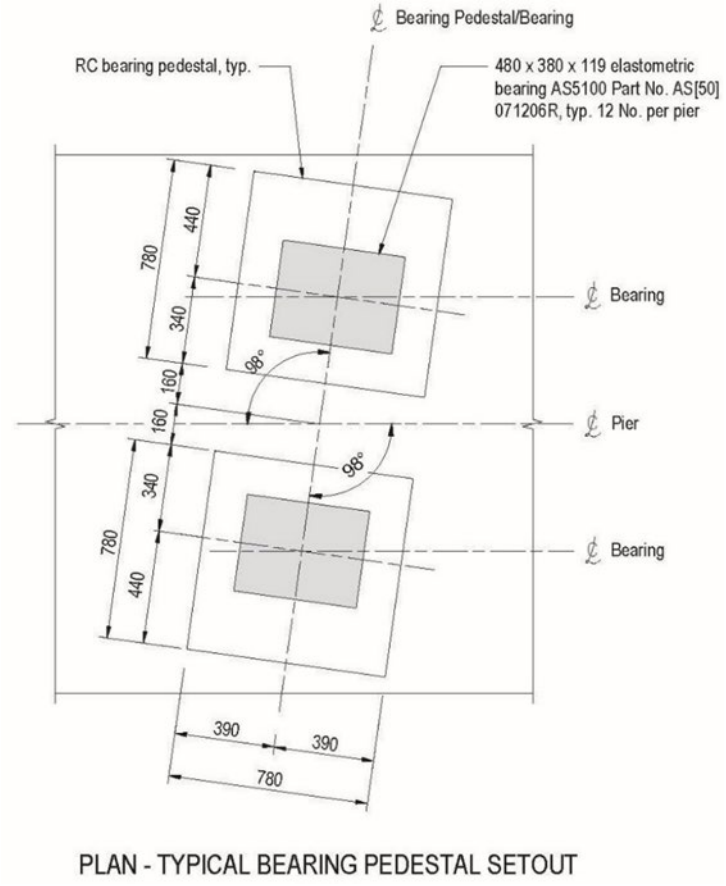
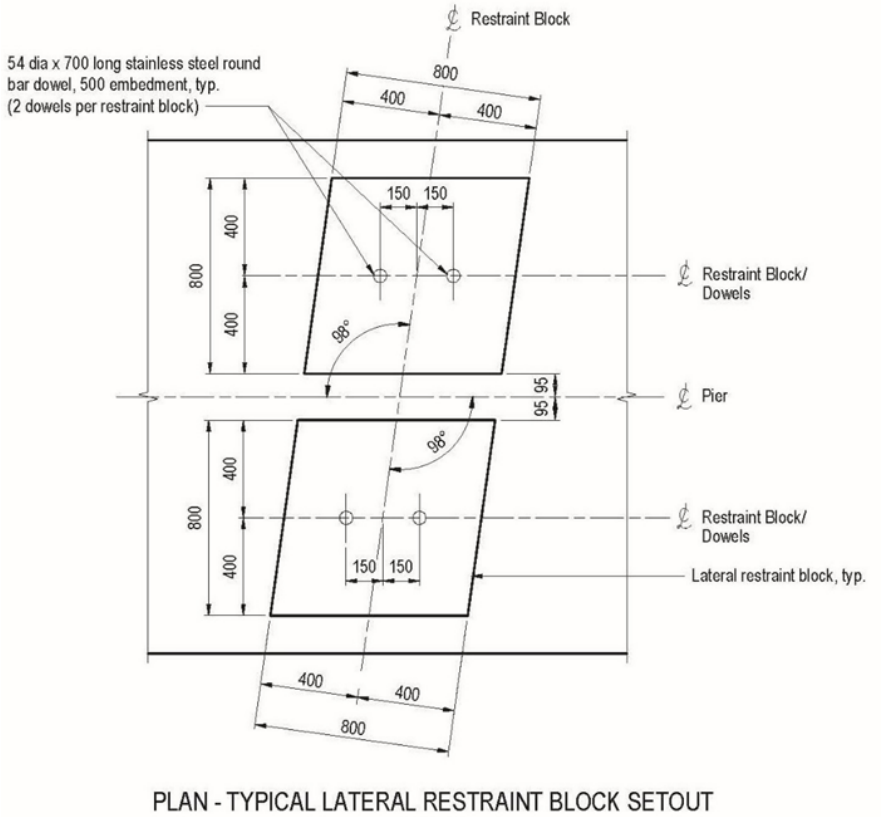


Figure 4.14(e) – Example pier restraint block concrete details for skewed bridge



4.15 Typical content required on the drawings

The following tables list the content specific to, but not limited to, typical abutment, pier and provision for jacking, and maintenance drawings.

Provision for jacking and maintenance drawings usually appear toward the end of the bridge drawings.

Table 4.15(a) – Abutments – specific drawings content

Requirement	Drawing or element description	Figure reference
Abutment concrete detailing	Plan, elevation, and sections of Abutment A and Abutment B on separate drawings, showing the following: • arrangement and set out of Headstock, wing walls, and ballast wall, with bridge control, headstock centreline, SOP, dimensions and heights, construction joints, filter drainage system, and conduits • set out, dimensions and heights bearing pedestals, restraint blocks, jacking shelves, details of bearings for girder superstructure • set out and dimensions of formed holes for hold down anchors, jacking shelves, and details of bearings or mortar pads for deck unit superstructure • for bridges crossing a waterway, include flow arrow and direction arrows, and • for bridges NOT crossing a waterway, include north point.	Various examples in Figure 4.15(a) to Figure 4.15(s)

Requirement	Drawing or element description	Figure reference
Abutment reinforcement detailing	Reinforcement detailing of Abutment A and Abutment B are shown on separate drawings for bridges with complex geometry. For simple bridges where Abutment B is the mirror of Abutment A, the reinforcement detailing of Abutment A only is shown on the drawings and clearly annotated as such. Elevation, sections, plans and views to show: • reinforcement for the connection with the piles into the headstock in the pile bond detail • headstock and ballast wall reinforcement, and also for bearing pedestals and restraint blocks, with any construction joints and formed holes and so on, and • reinforcement for the wing walls and sidewalls with any construction joints, the wing walls are to show the location of conduits and barrier anchorages.	Various examples in Figure 4.15(a) to Figure 4.15(s)

Table 4.15(b) – Piers – specific drawings content

Requirement	Drawing or element description	Figure reference
Pier concrete detailing	Plan, elevation and sections of fixed piers and expansion piers on separate drawings, showing the following: • arrangement and set out of the headstock with bridge control, headstock centreline, SOP, dimensions and heights, and variations to the profile such as a step down to one half of the headstock required for deeper girders or deck units in a span • set out, dimensions and heights bearing pedestals, restraint blocks, jacking shelves, details of bearings for girder superstructure • set out and dimensions of formed holes for hold down anchors, jacking shelves, and details of bearings or mortar pads for deck unit superstructure • for bridges crossing a waterway, include flow arrow and direction arrows, and • for bridges NOT crossing a waterway, include north point.	Various examples in Figure 4.15(a) to Figure 4.15(s)

Requirement	Drawing or element description	Figure reference
Pier reinforcement detailing	Reinforcement detailing of fixed piers and expansion piers are shown on separate drawings. Where a subsequent pier is the mirror of another, the reinforcement detailing of the first pier only is shown on the drawings and clearly annotated as such. Elevation, sections, plans and views to show: • the reinforcement for the connection with the piles into the headstock in the pile bond detail, and • the headstock reinforcement, bearing pedestals and restraint blocks.	Various examples in Figure 4.15(a) to Figure 4.15(s).

Figure 4.15(a) – Example abutment drawings for Super-T girder square bridge – Drawing AB-01 – concrete plan and elevation

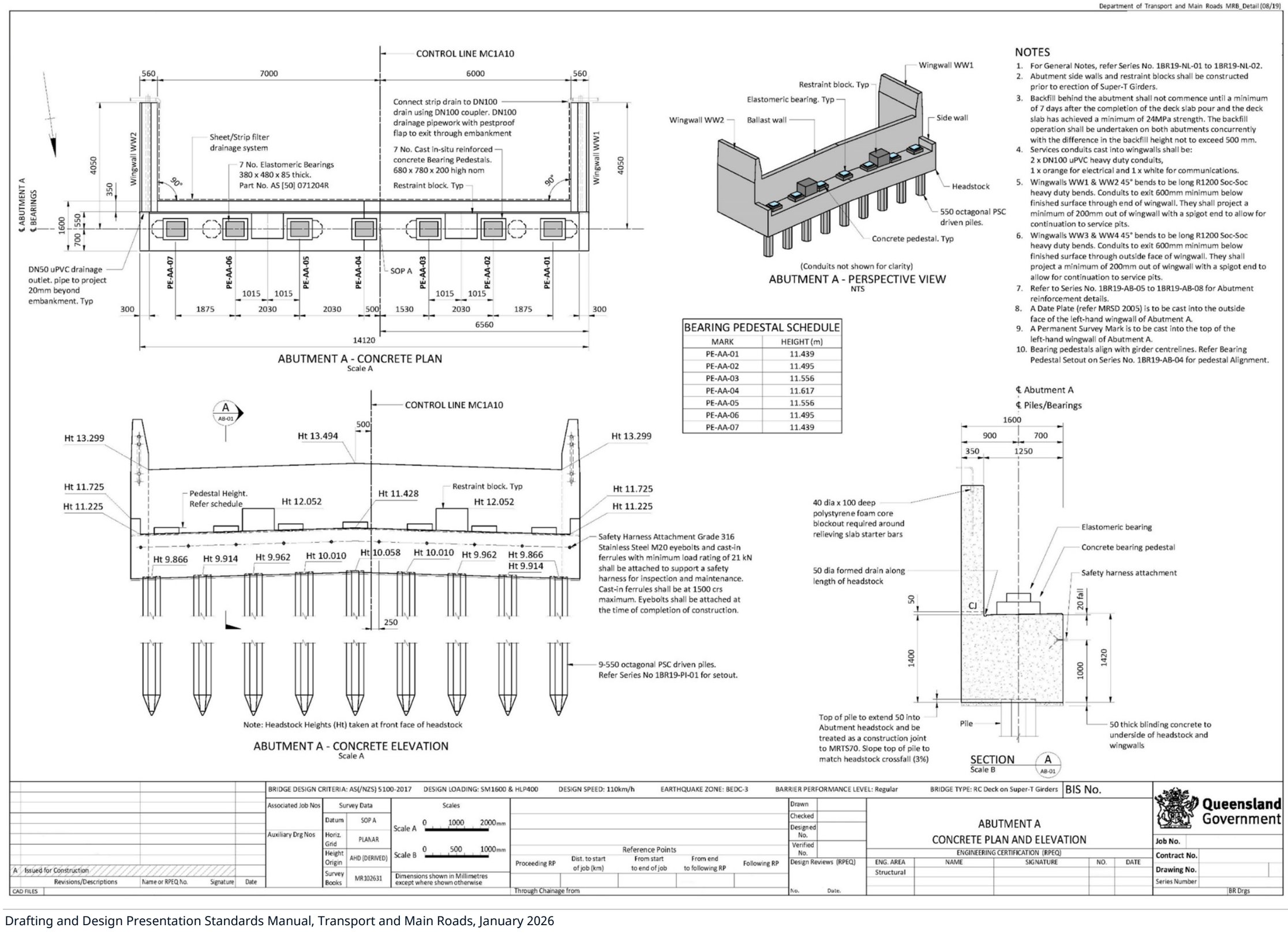


Figure 4.15(b) – Example abutment drawings for Super-T girder square bridge – Drawing AB-02 – concrete details – Sheet 1

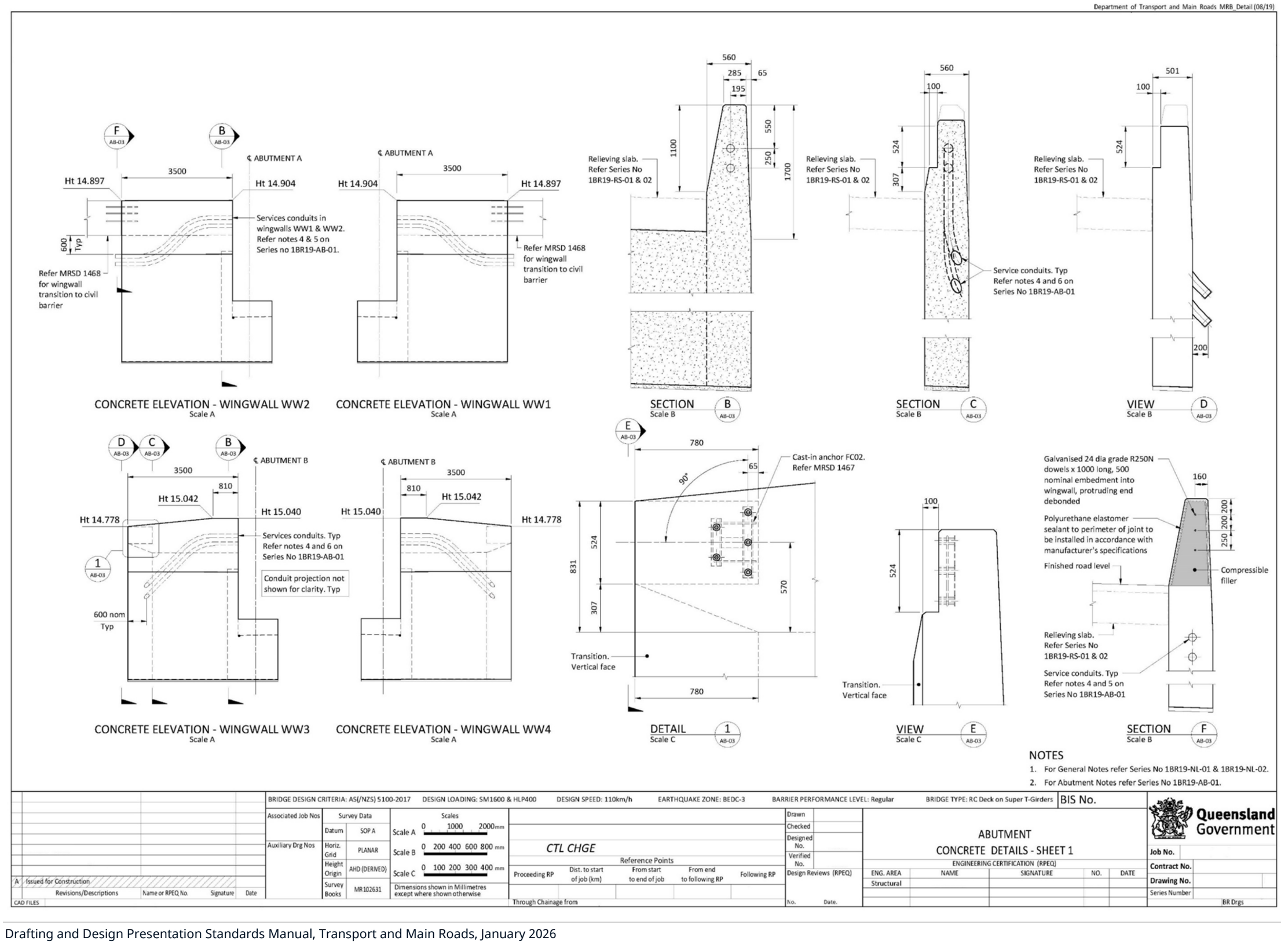


Figure 4.15(c) – Example abutment drawings for Super-T girder square bridge – Drawing AB-04 – concrete details – Sheet 2

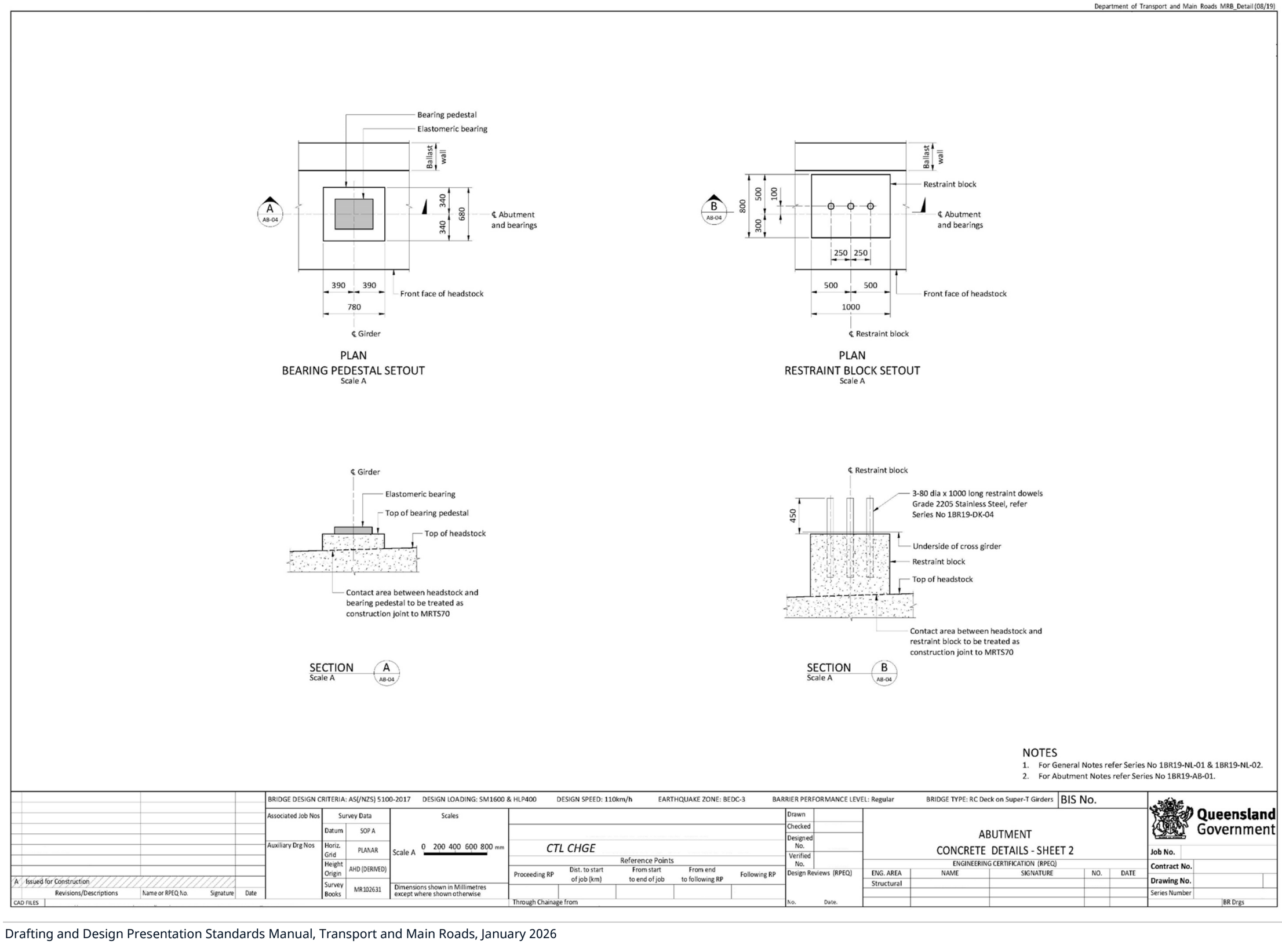


Figure 4.15(d) – Example abutment drawings for Super-T girder square bridge – Drawing AB-05 – reinforcement details – Sheet 1

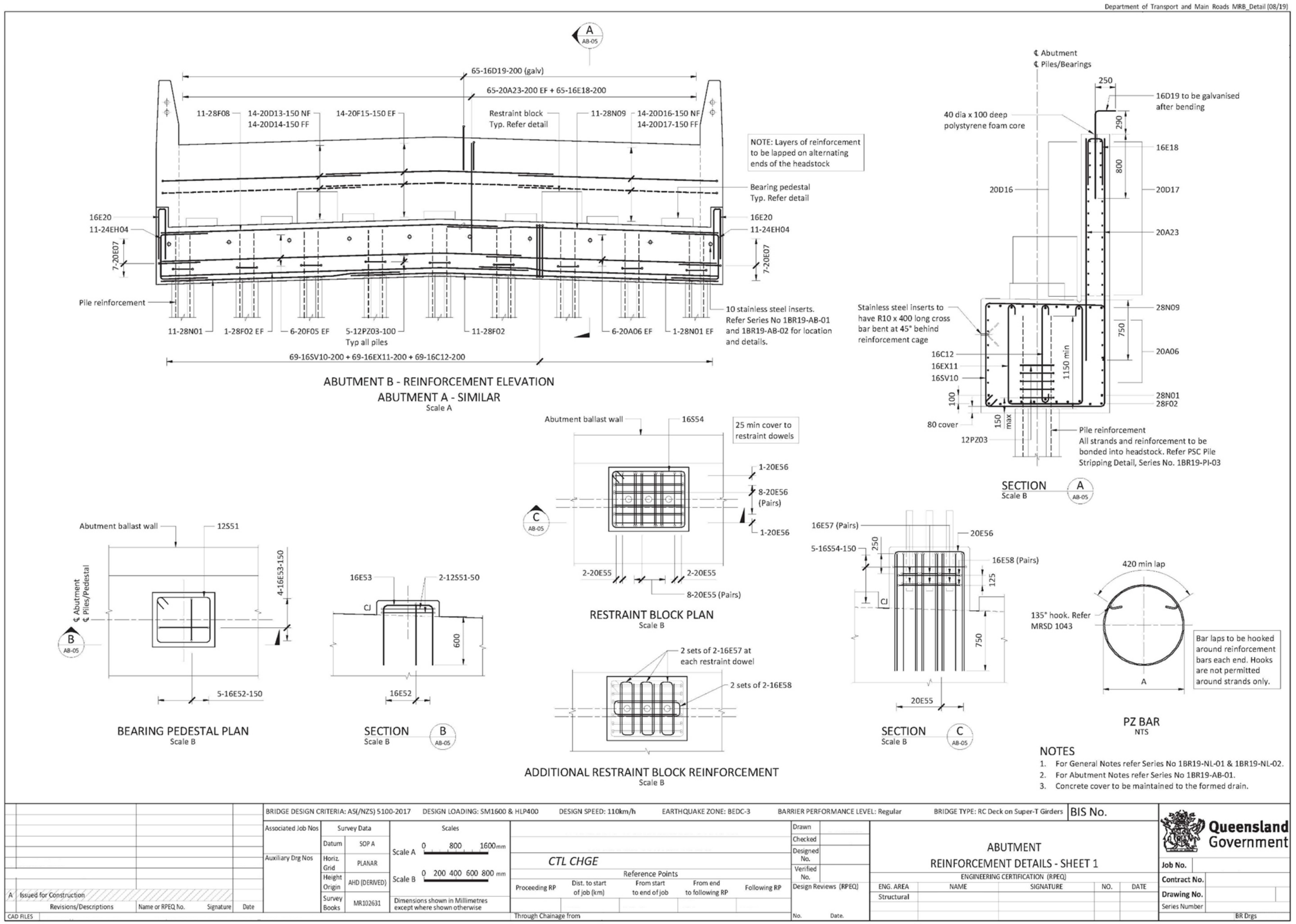


Figure 4.15(e) – Example abutment drawings for Super-T girder square bridge – Drawing AB-06 – reinforcement details – Sheet 2

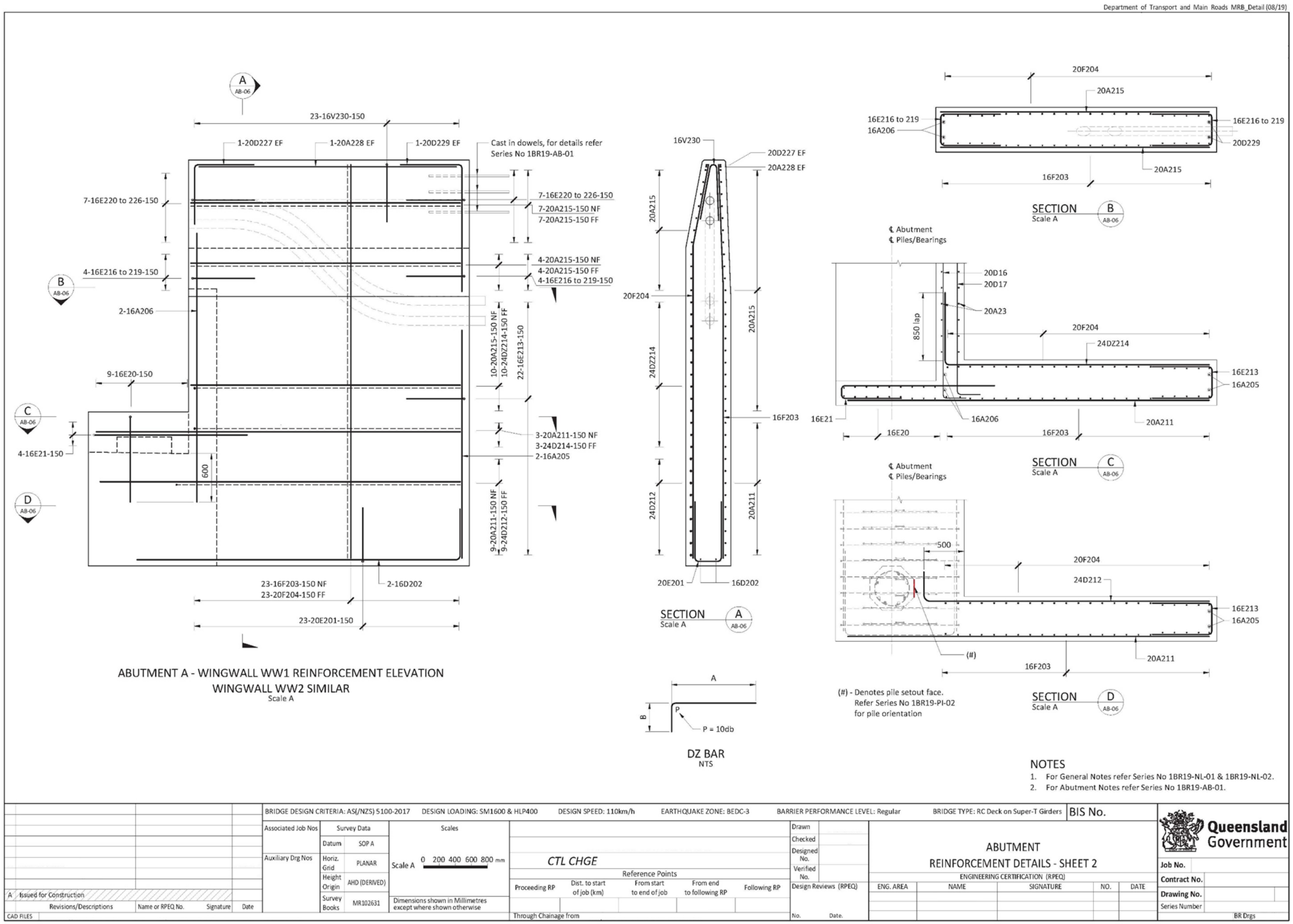


Figure 4.15(f) – Example pier drawings for Super-T girder skewed bridge – Drawing PR-01 – concrete plan and elevation

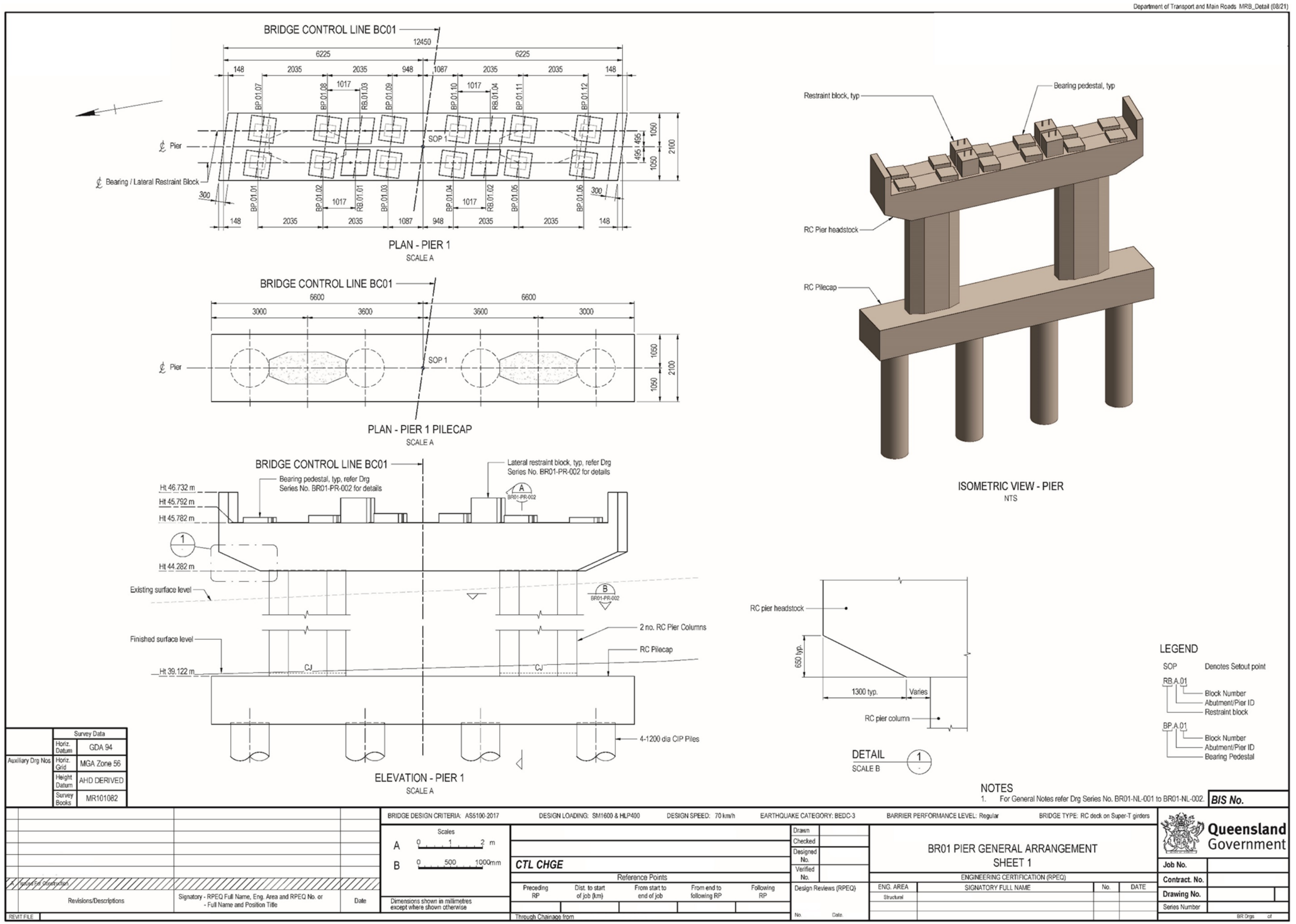


Figure 4.15(g) – Example pier drawings for Super-T girder skewed bridge – Drawing PR-02 – concrete details

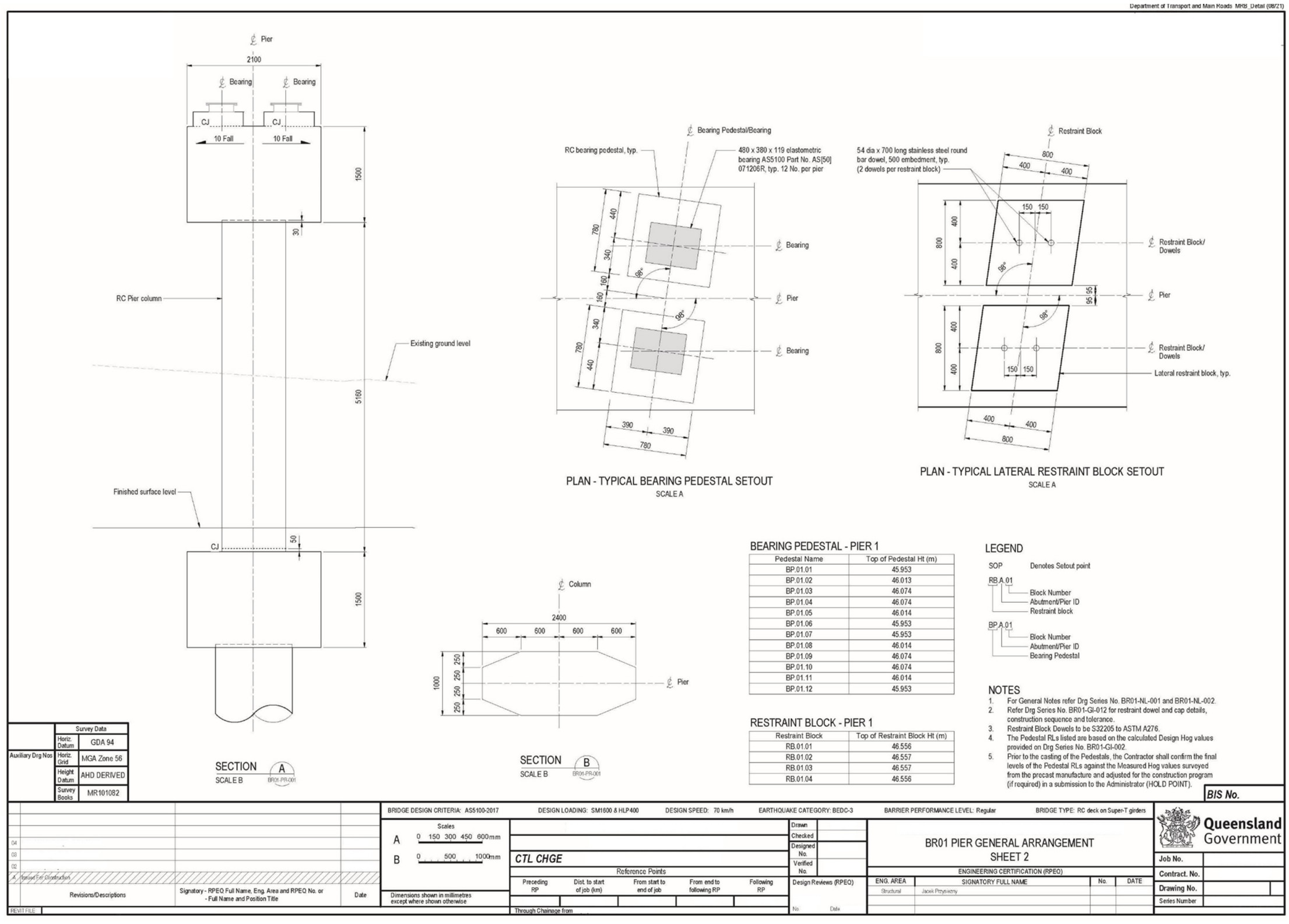


Figure 4.15(h) – Example pier drawings for Super-T girder skewed bridge – Drawing PR-03 – reinforcement details – Sheet 1

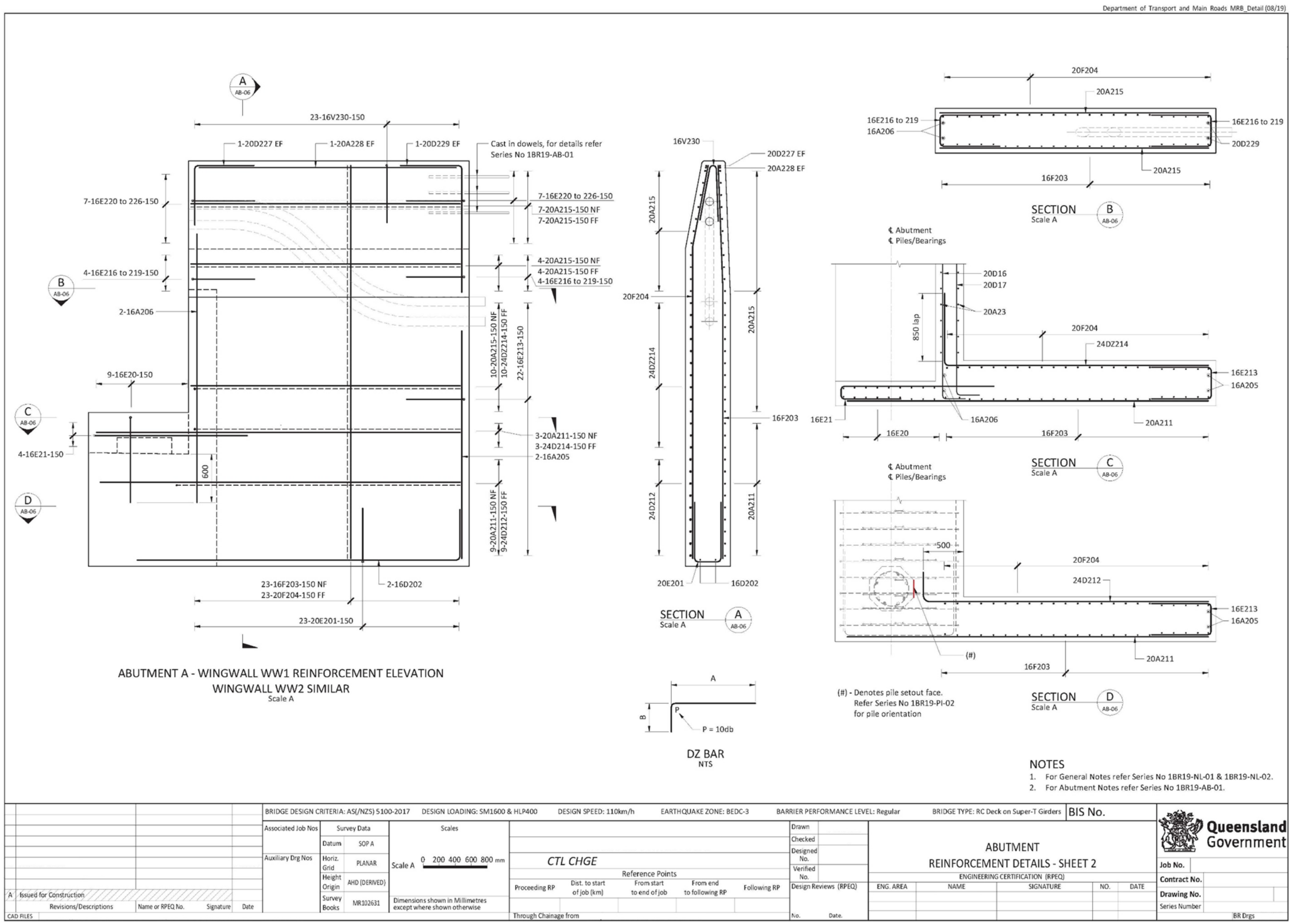


Figure 4.15(i) – Example pier drawings for Super-T girder skewed bridge – Drawing PR-04 – reinforcement details – Sheet 2

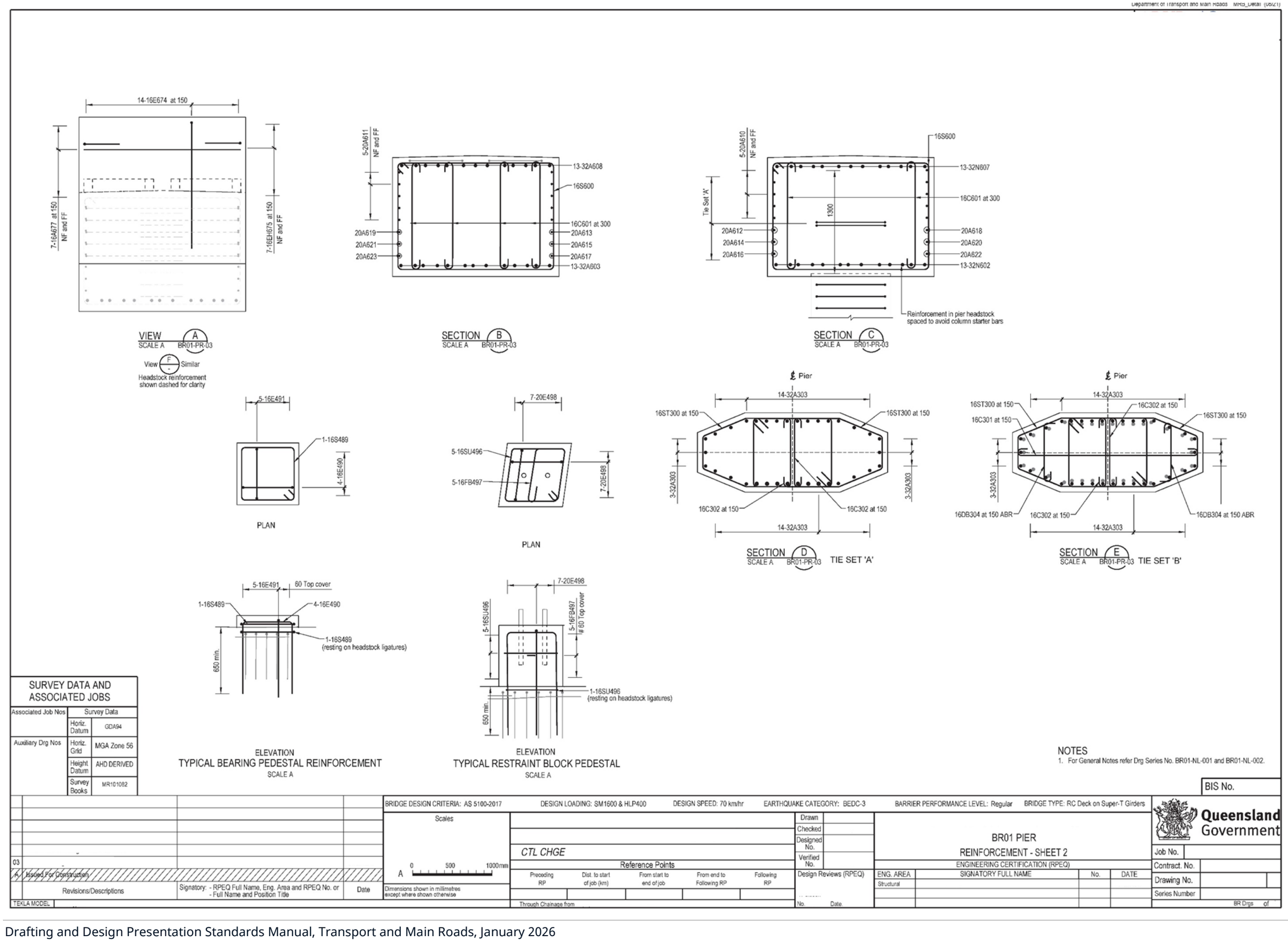


Figure 4.15(j) – Example abutment drawings for deck unit skewed bridge – Sheet 1 – concrete plan and elevation

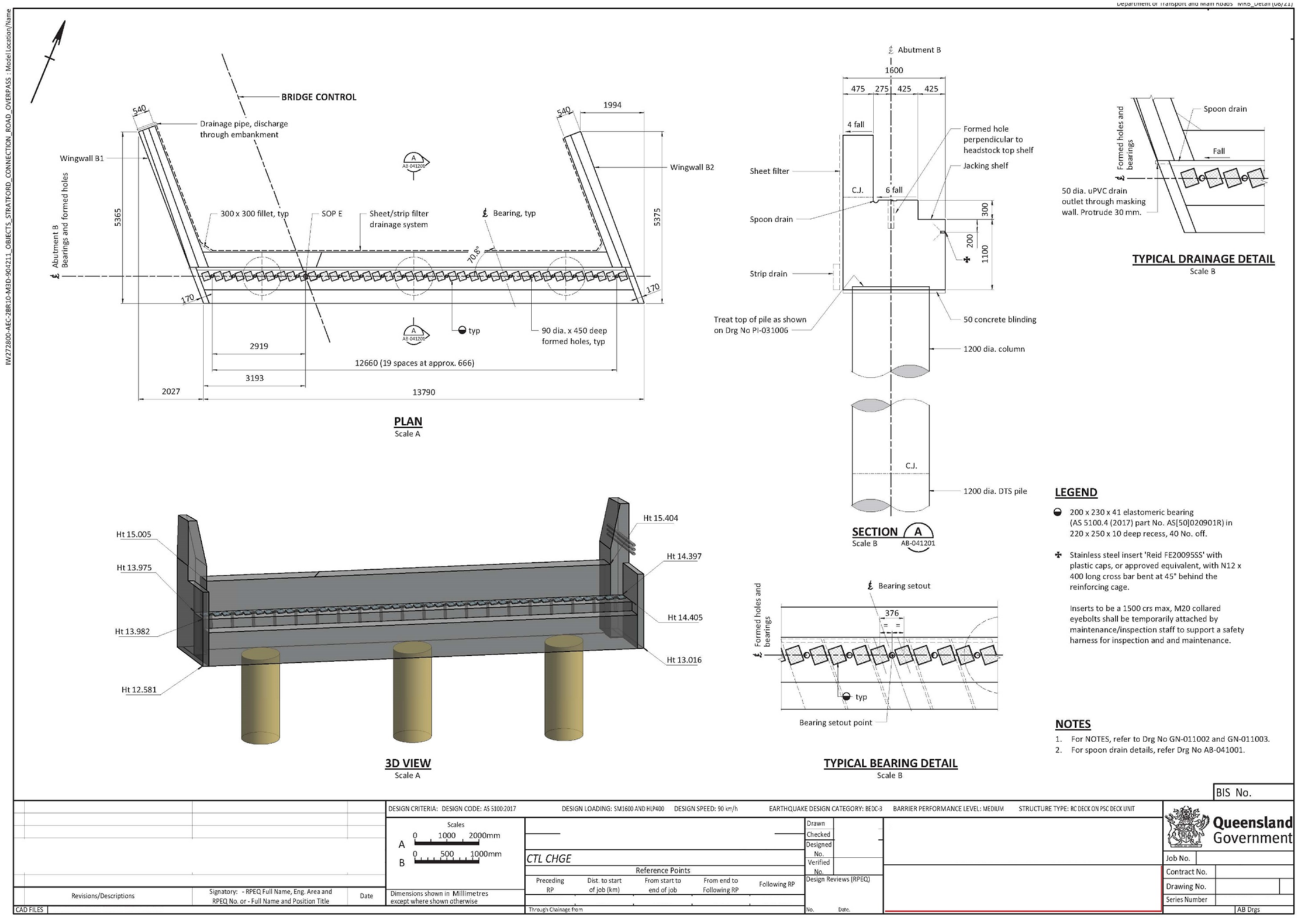


Figure 4.15(k) – Example abutment drawings for deck unit skewed bridge – Sheet 2 – concrete details

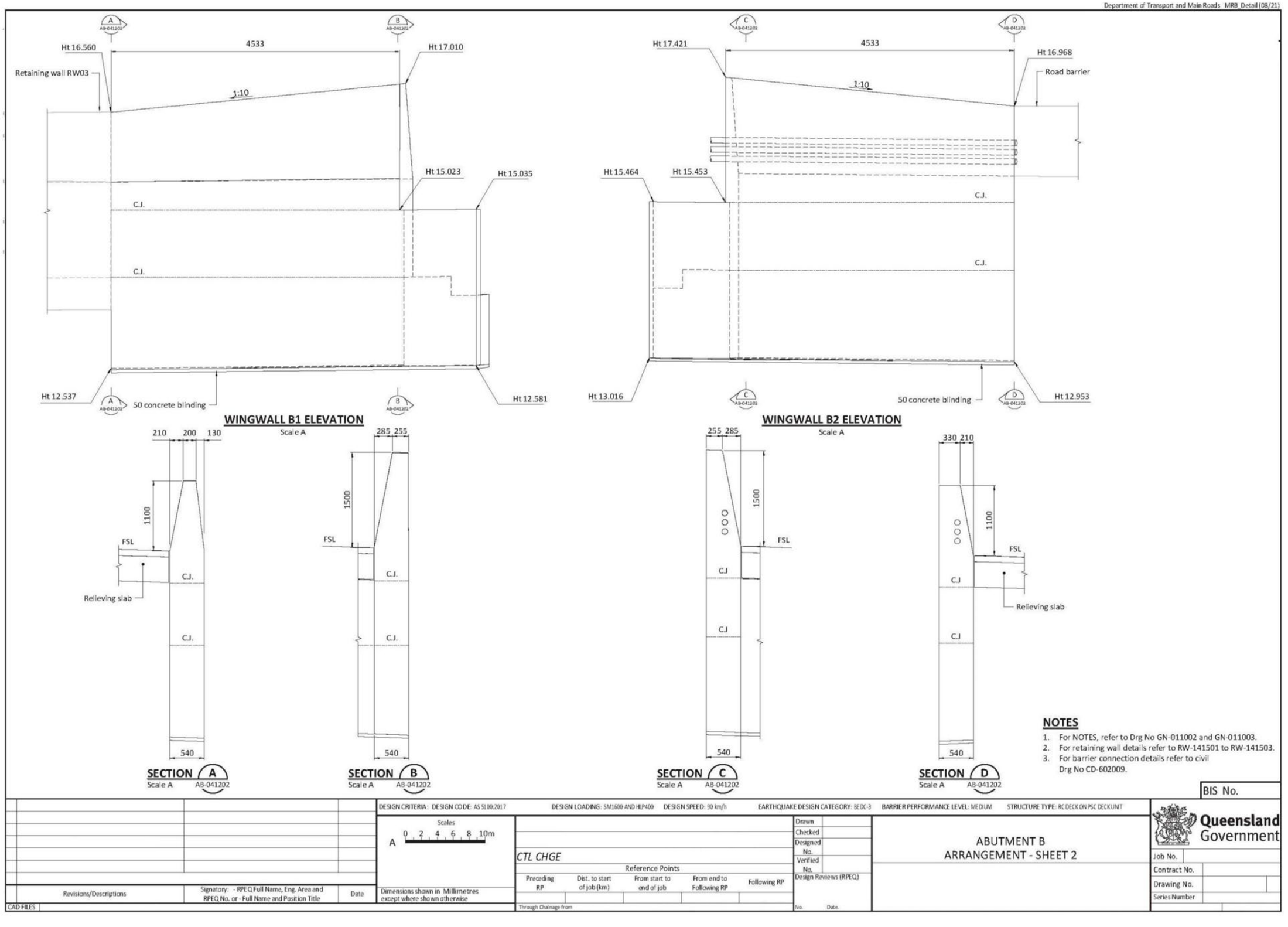


Figure 4.15(l) – Example abutment slope protection drawing for deck unit skewed bridge

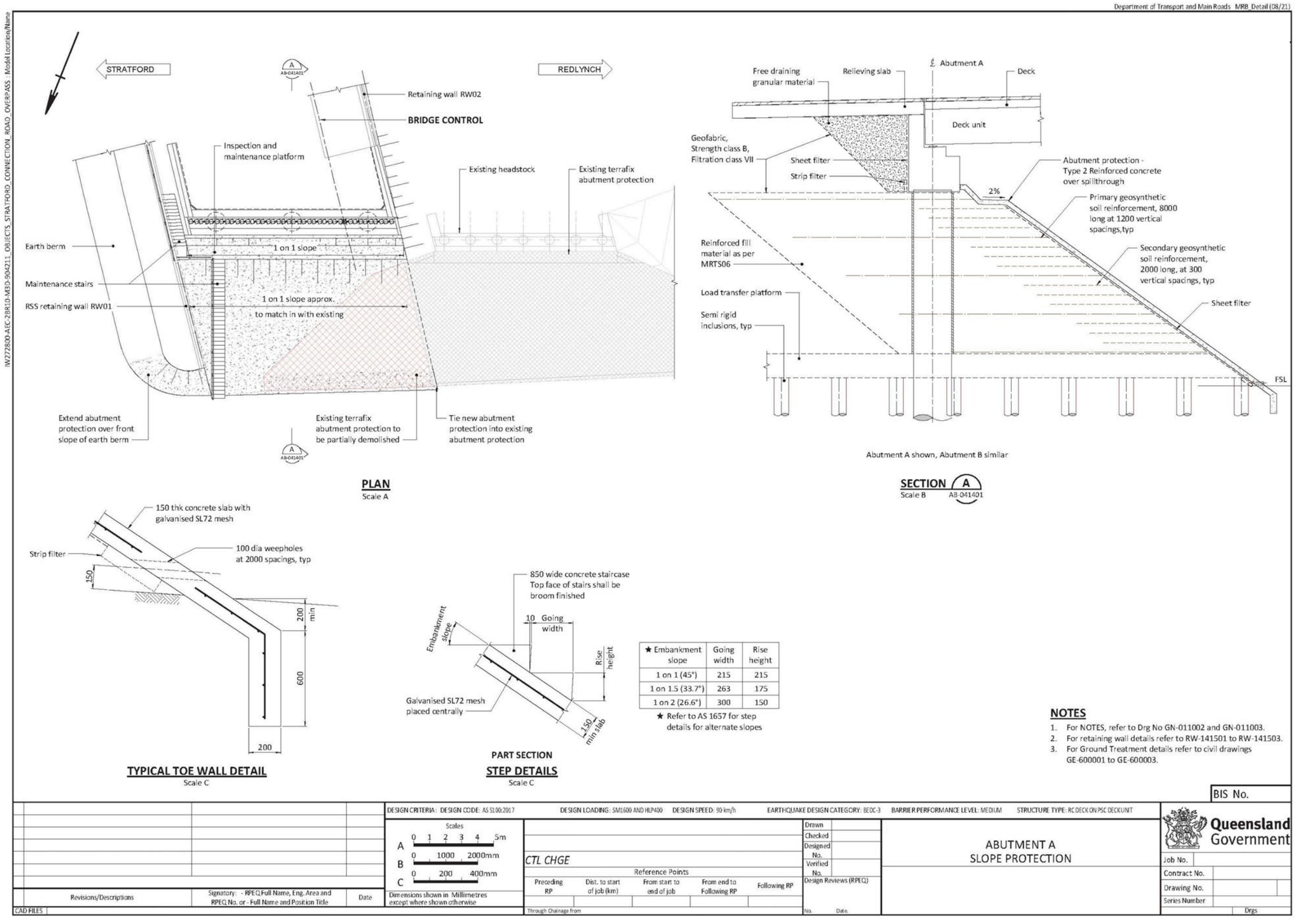


Figure 4.15(m) – Example pier drawings for deck unit skewed bridge – Sheet 1 – plan views

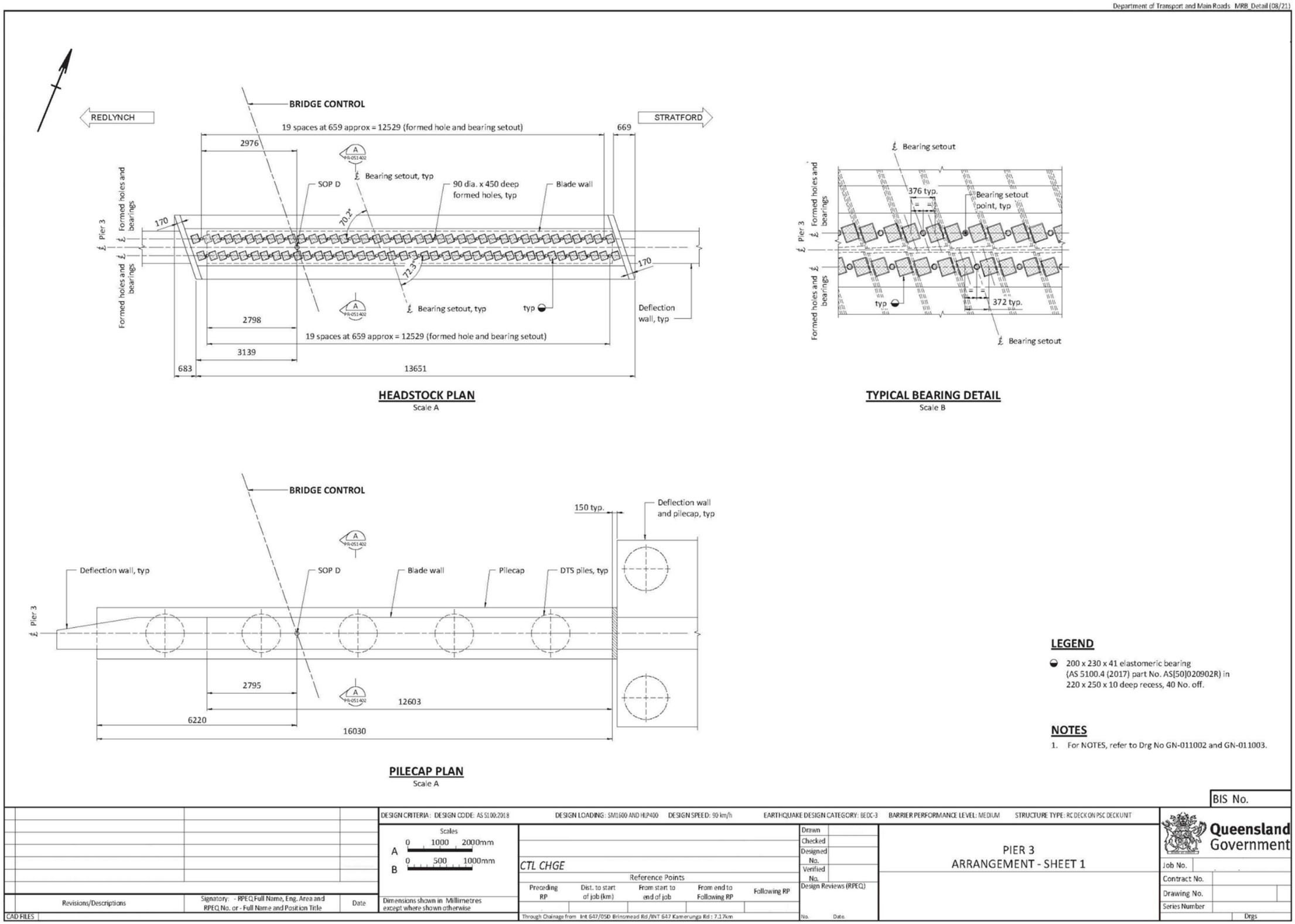


Figure 4.15(n) – Example pier drawings for deck unit skewed bridge – Sheet 2 – elevation and section

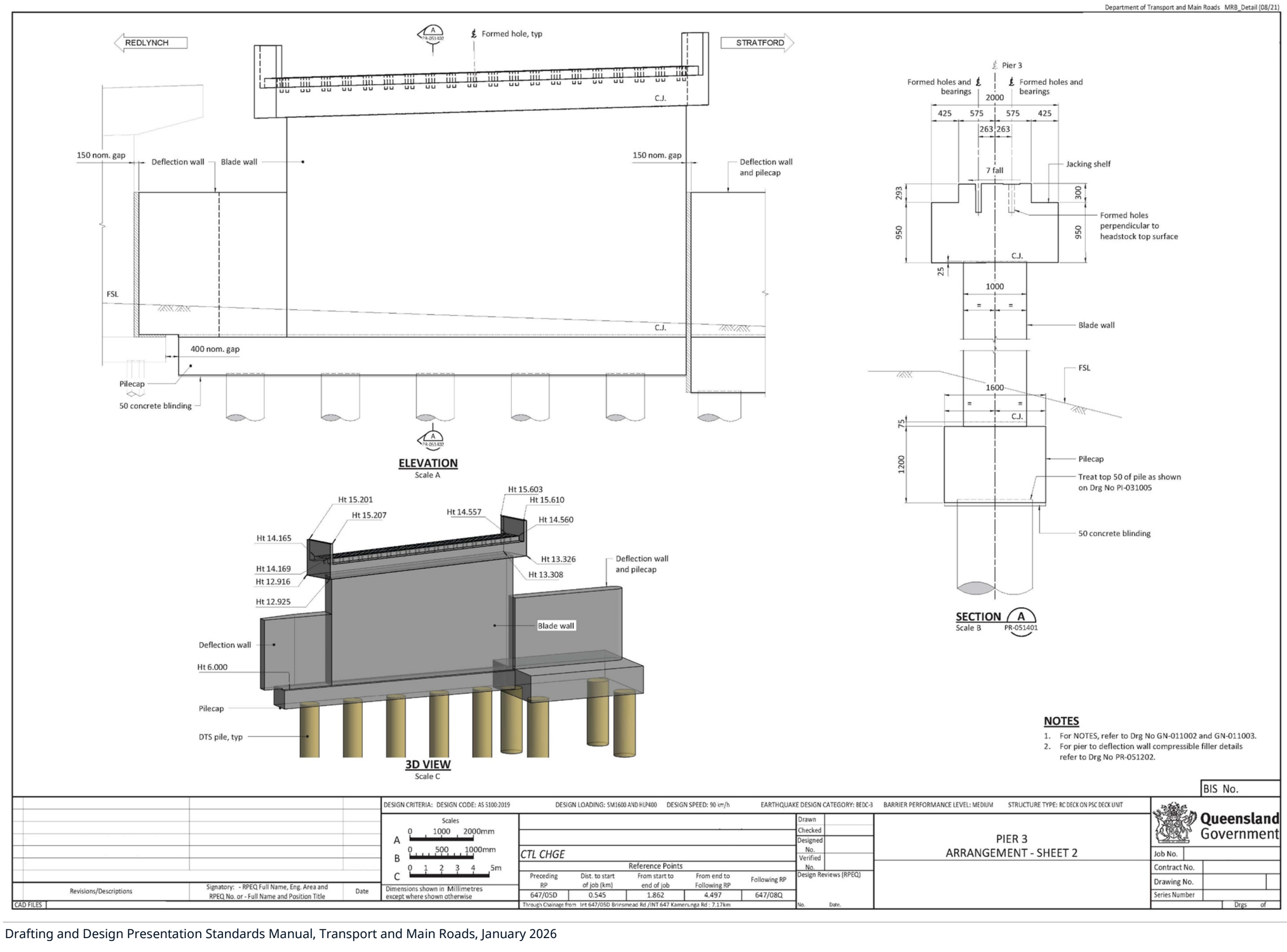


Figure 4.15(o) – Example pier drawings for deck unit skewed bridge – deflection wall plan, elevation views and section

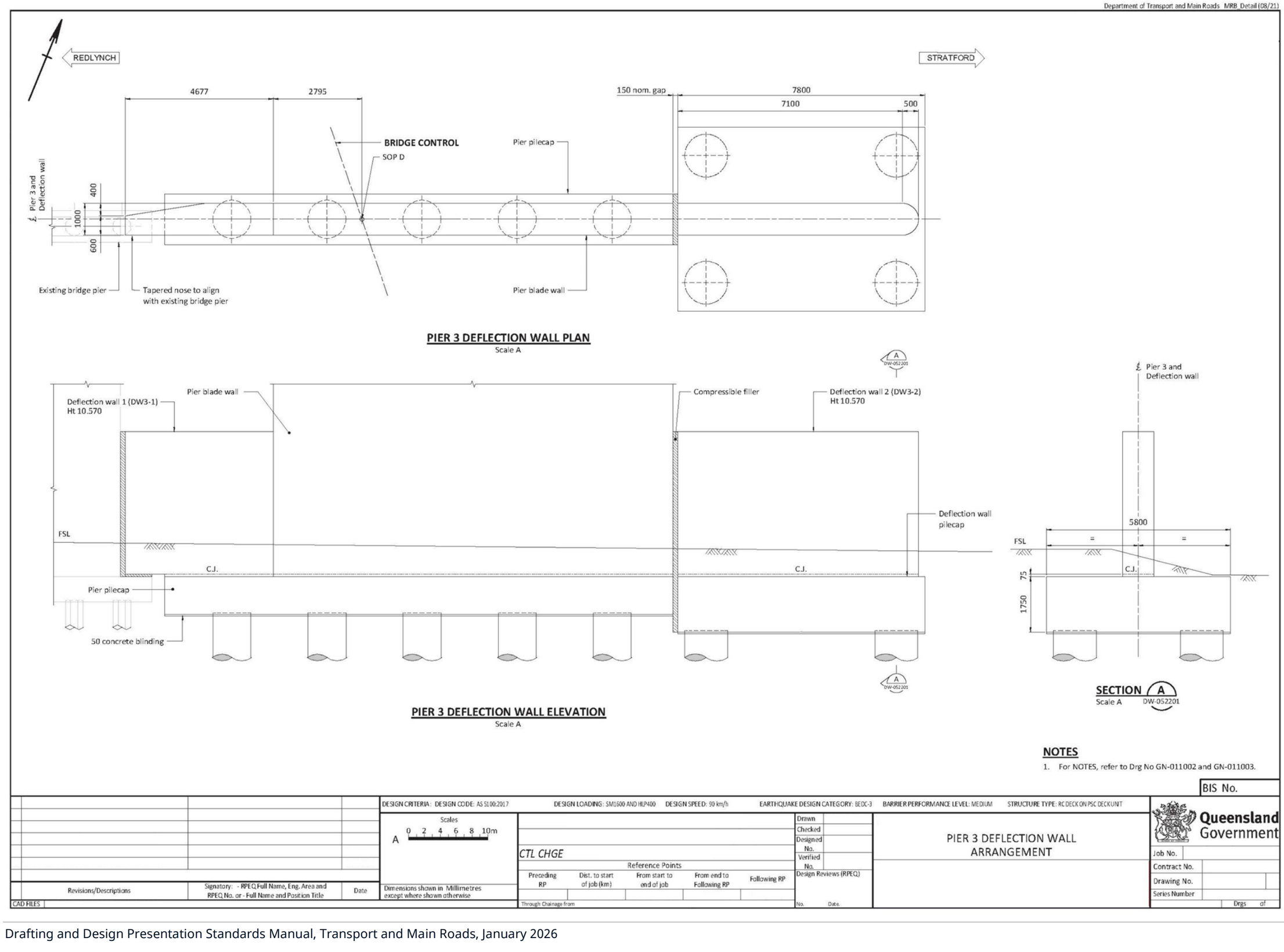


Figure 4.15(p) – Example abutment drawings for deck unit square bridge – Sheet 1 – views, section and concrete details

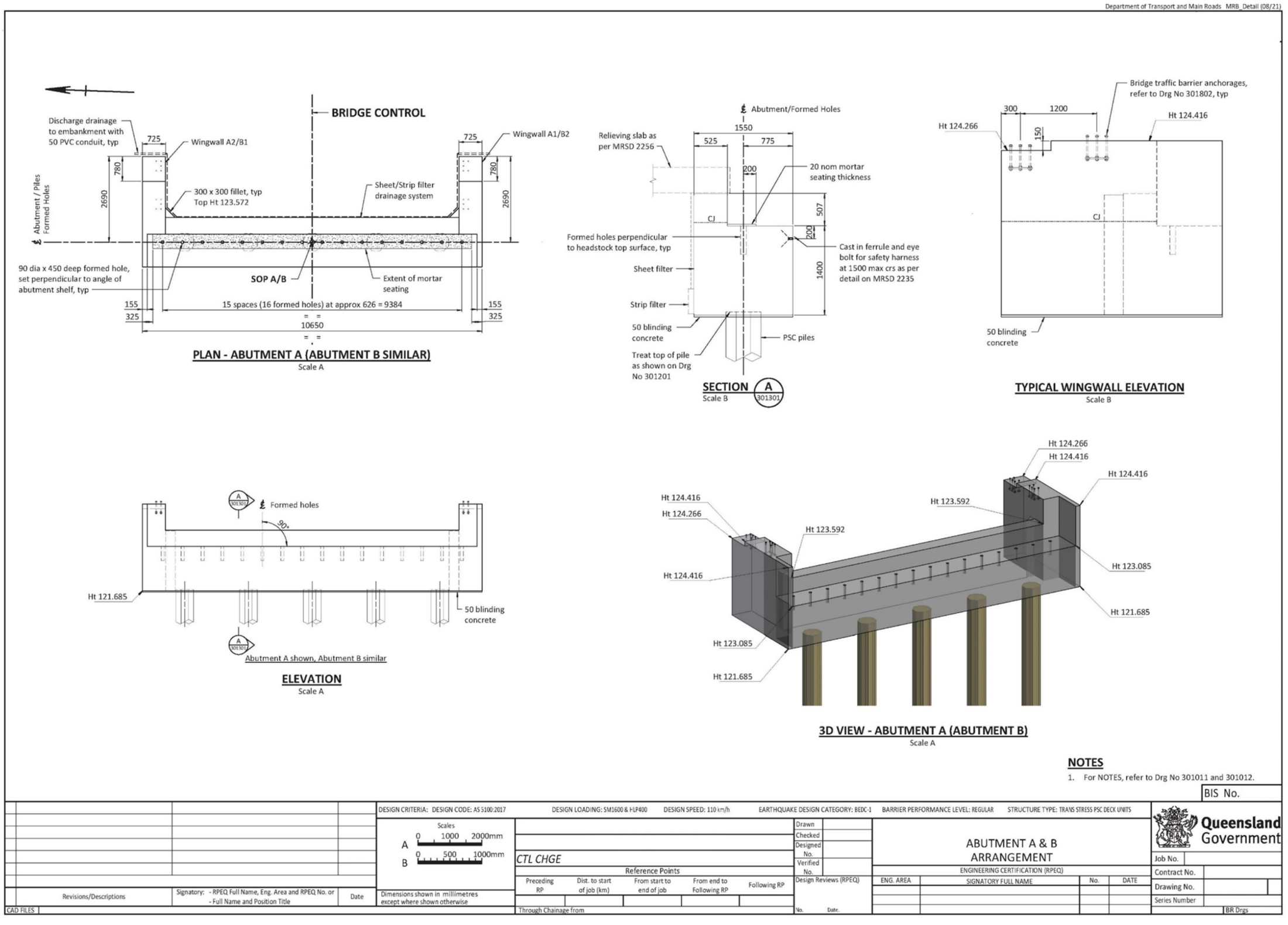


Figure 4.15(q) – Example abutment drawings for deck unit square bridge – Sheet 2 – reinforcement details

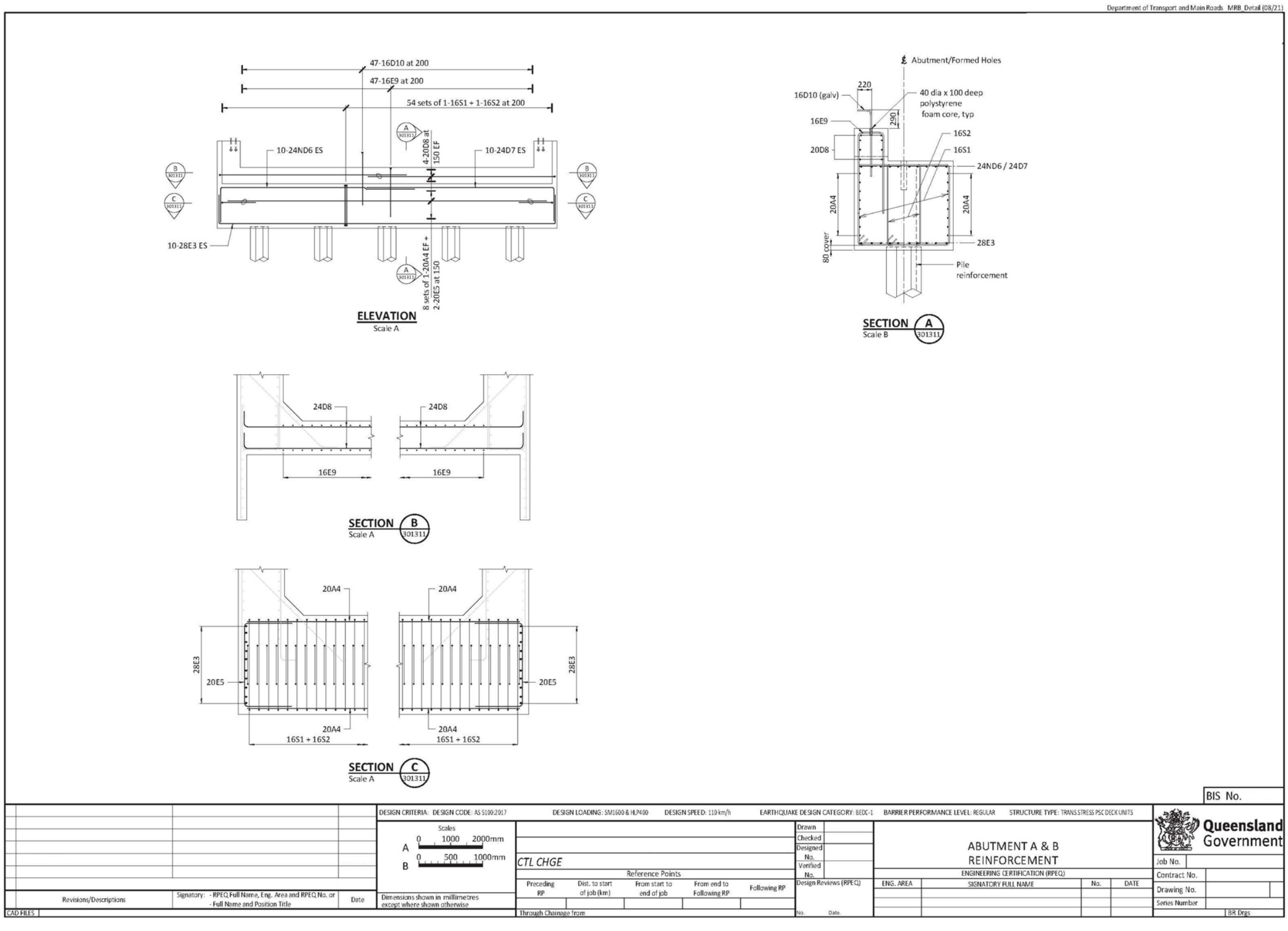


Figure 4.15(r) – Example abutment drawings for deck unit square bridge – Sheet 2 – wing wall reinforcement

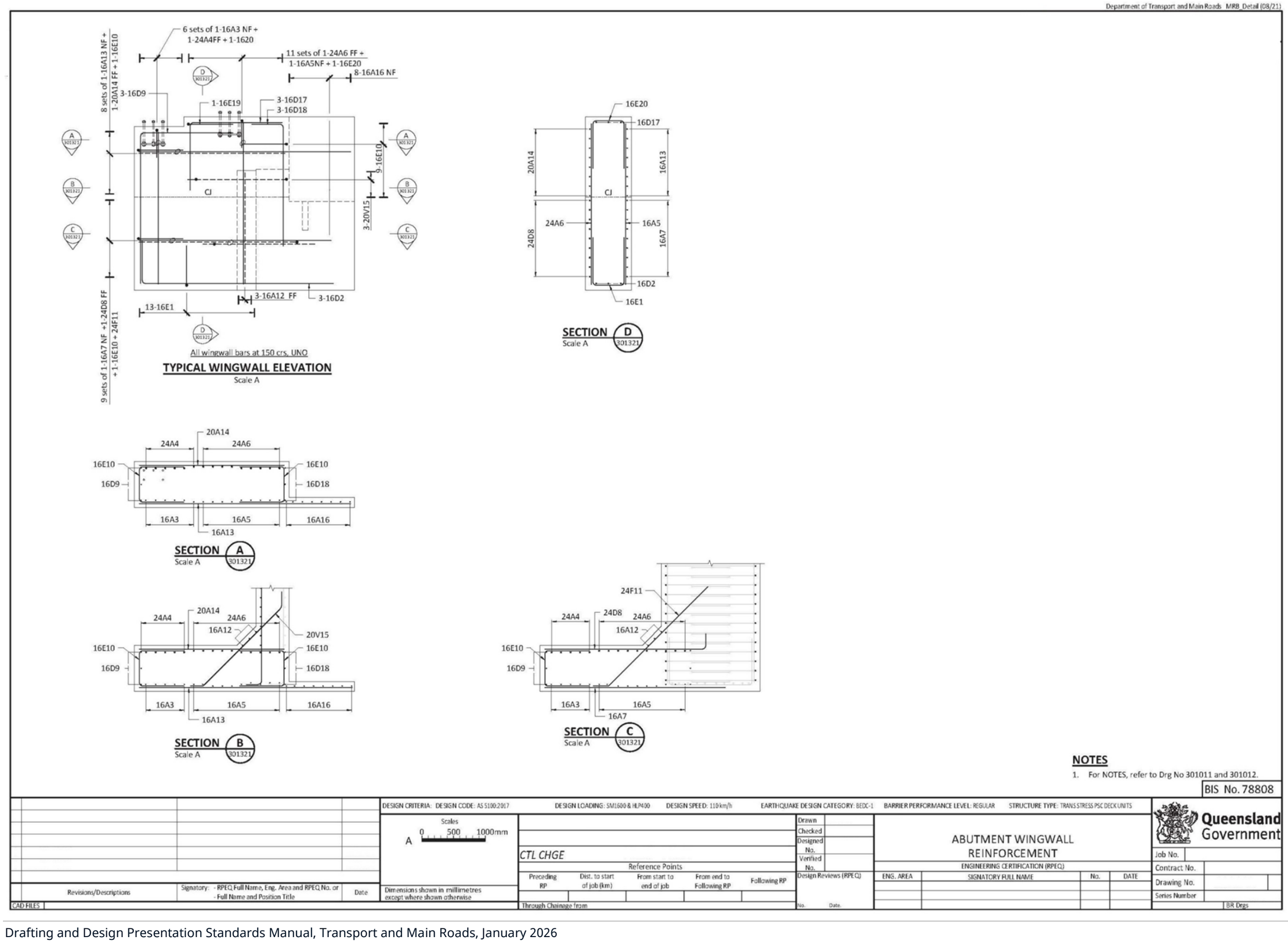
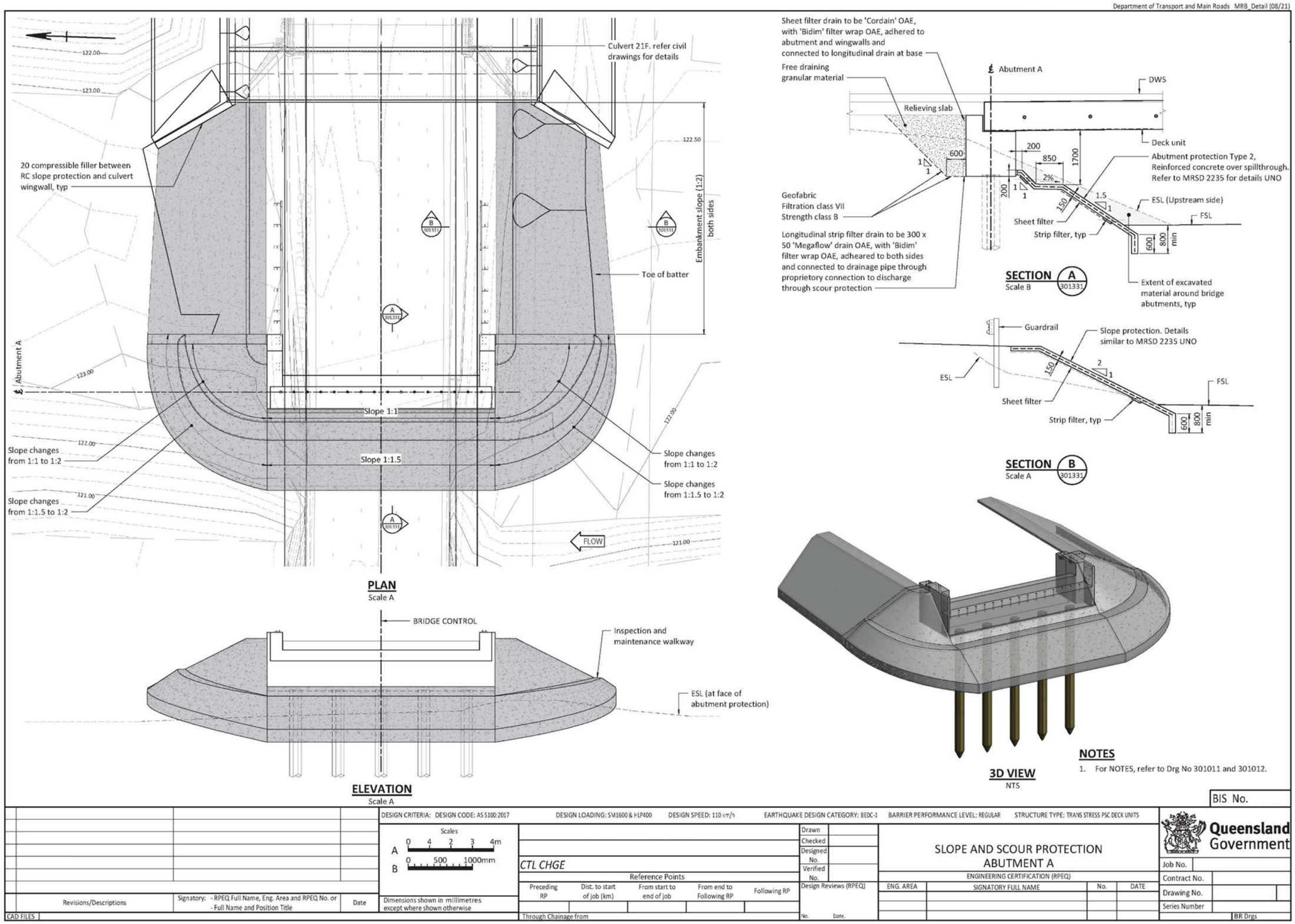


Figure 4.15(s) – Example abutment drawings for deck unit square bridge – Sheet 4 – abutment protection



4.16 Provision for maintenance and inspection

The DCBoS discusses asset management considerations, and the provision for inspection and maintenance of departmental structures.

All details that are related to safe access, security, inspection, and maintenance of the bridge and its components shall be detailed throughout the drawings. This includes security fencing, anchors, access ladder connections, fall protection, maintenance vehicle access, and so on.

Whenever there is provision for future bridge jacking, a dedicated drawing shall be included in the bridge drawings. The following details and notes are to be on the drawing:

- methodology of jacking operations
- assumed jack details
- jack locations during jacking
- details of under-bridge access for the bridge, appropriate for future inspection and maintenance of the abutments and headstocks
- design assumptions for the process
- site preparation and access
- assumed bearing replacement procedure, and
- temporary works required to support jacking operations.

Example drawings are provided after Table 4.16.1.

The following figures are typical examples of jacking details for bridge drawings.

Figure 4.16(a) – Example jack location details

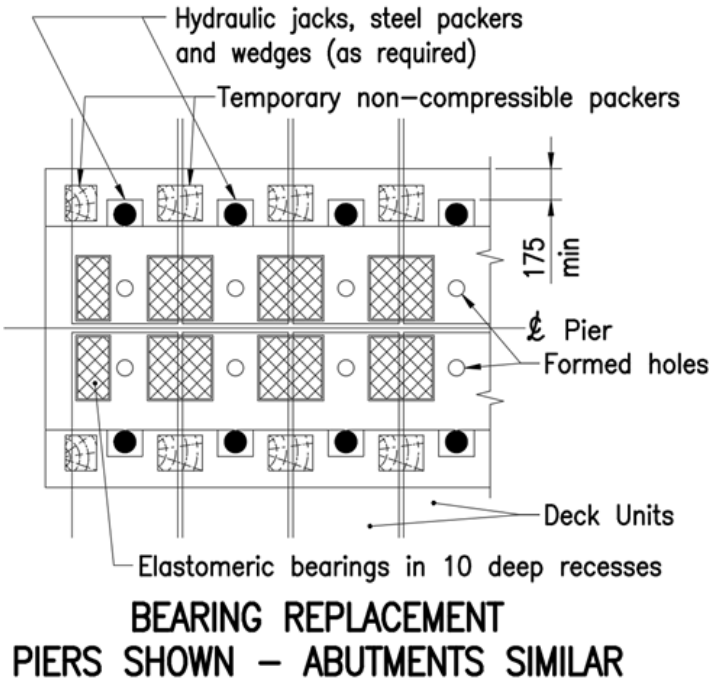


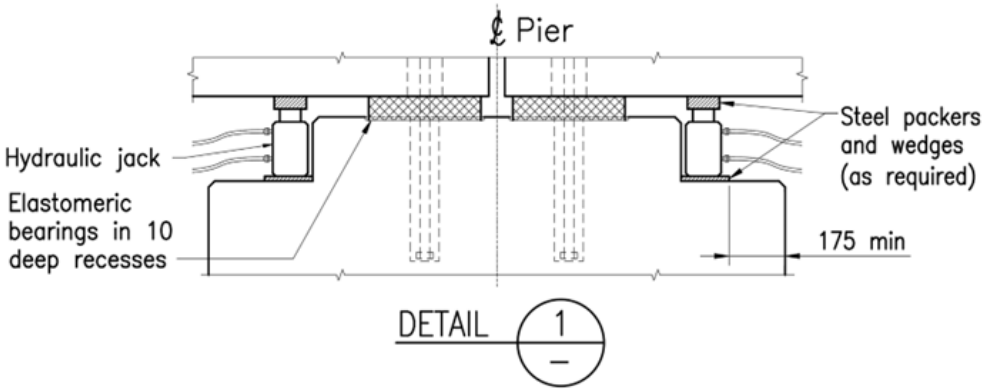
Figure 4.16(b) – Example jack details

JACK DETAILS – CORRECT AT TIME OF DRAWING ISSUE

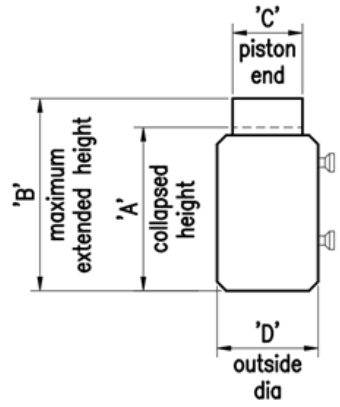
MANUFACTURER	MODEL No	Jack Capacity (tonnes)	Stroke (mm)	Dimensions			
				'A' (mm)	'B' (mm)	'C' (mm)	'D' (mm)
ENERPAC	CLRG–502 Double–Acting High Tonnage Jack	45	50	162	212	70	130

Alternative jacks may be substituted if approved by Department of Transport and Main Roads (Bridge and Marine Engineering Section).

◒ Jack SWL shall be at least twice the actual load.

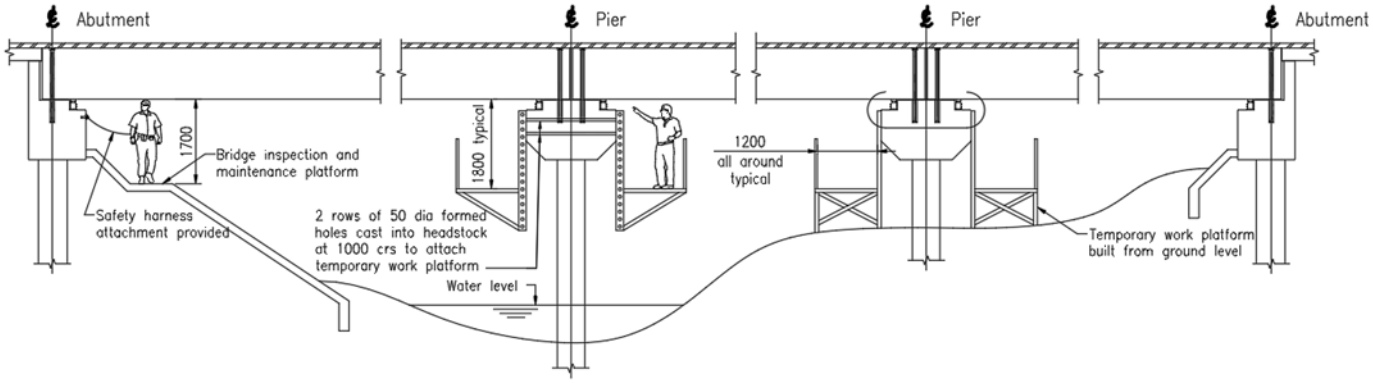


PIERS SHOWN – ABUTMENTS SIMILAR



JACK DIMENSIONS

Figure 4.16(c) – Example bearing replacement access details



4.16.1 Typical content required on the drawings

The following tables list the content specific to but not limited to Provision for jacking and maintenance drawings which usually appear toward the end of the bridge drawings.

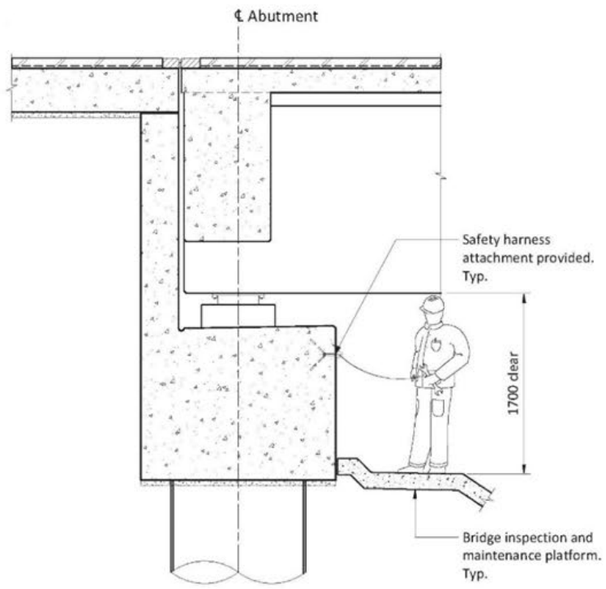
Refer to example drawings after the table.

Table 4.16.1 – Provision for jacking and maintenance – specific drawings content

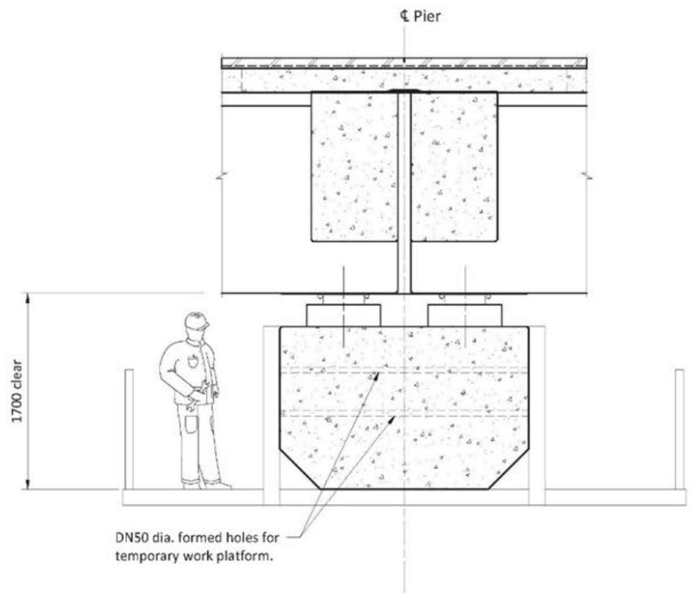
Requirement	Drawing or element description	Figure reference
Details of under-bridge access	Elevation showing under-bridge access at abutments, locations for temporary work platforms at piers.	Figure 4.16(c) Figure 4.16.1(a) Figure 4.16.1(e)
Bearing replacement details	Part plan and/or elevation showing: • set up at headstocks, and • location and spacing of jacks and temporary props.	Figure 4.16.1(b) Figure 4.16.1(c) Figure 4.16.1(d)
Assumed jack details	Dimensions of the approved jack, its manufacturer, model number, capacity, and minimum stroke.	Figure 4.16(b)
Details of temporary props and brackets	Sections and details of fabrication of temporary props, steel packers, wedges, brackets, and so on, to suit the assumed jack, where required, used to accommodate any slope on the bearing shelf and hog / grade of the girders / deck units.	Figure 4.16(a) Figure 4.16.1(e)
Notes	• Design assumptions for the process • Site preparation and access • Assumed bearing replacement procedure • Before jacking information • Trial lift information, and • Bearing replacement lift information.	Figure 4.16.1(a) Figure 4.16.1(d) Figure 4.16.1(e)

Figure 4.16.1(a) – Example inspection and maintenance drawing – notes and details – Super-T girder bridge

Department of Transport and Main Roads MRB_Detail (08/19)



ABUTMENT - INSPECTION ELEVATION
Scale A



PIER - INSPECTION ELEVATION
Scale A

NOTES

1. For General Notes refer Series No 2BR11-NL-01 to 2BR11-NL-03.

DESIGN ASSUMPTIONS

1. Jacking shall be limited to 20mm maximum.
2. Maximum differential displacement between all jacks shall be kept to a maximum of 2.0mm and 0.5mm between adjacent jacks.
3. Suitable gauges for the measurement of superstructure movement shall be installed by the Contractor. The gauge shall be accurate to ±0.01mm.
4. Bridge shall be closed to traffic during all jacking operations and bearing replacement.
5. Temporary work platforms shall support a 5kPa live load.
6. Actual jack loads based on:
   a. Permanent effects
   b. one emergency vehicle, assumed to be a T44 vehicle travelling at 10 km/h (DLA=0.1)
7. All girders at each pier or abutment location are to be lifted simultaneously. At the pier, the girders on both sides of the pier shall be lifted simultaneously. Jacking shall occur at one headstock at a time.

SITE PREPARATION AND ACCESS

1. The Contractor engaged to undertake the bearing replacement shall provide temporary work platforms for access to the pier headstocks.
2. Clear access paths to the pier bases and fixed scaffolding access to work platform shall be provided.
3. Drawings of the temporary work platforms and access method shall be submitted to the asset owner for approval prior to installation.
4. For safe site access, refer to civil drawings for details.

BEARING REPLACEMENT PROCEDURE

This is the process for bearing replacement proposed by the original bridge designer (including assumptions). A written method statement for bearing replacement shall be submitted to the asset owner for approval prior to proceeding with works.

BEFORE JACKING

1. Install temporary traffic management devices as required.
2. Install temporary work platforms.
3. Loosen any bridge furniture before jacking (e.g. expansion joints, cover plates etc). Loosen services after obtaining written approval from the service owner.
4. Clean bearing shelves to ensure they are free of vegetation, debris and unnecessary grease.
5. Girders shall be restrained longitudinally by installation of packers at ends of girders.

TRIAL LIFT

A trial lift is required for bearing replacement as this allows for the identification of potential problems and may lead to a redesign, changes to the work procedure or equipment. The height of the trial lift shall be determined by the TMR (Bridge Design) engineer in charge.

6. The bridge shall be closed to traffic prior to and during jacking.
7. Install hydraulic jacking equipment under the cross girders according to manufacturer's instruction and written specification. Use steel shim non-compressible packers as required. Tilt saddles shall be used on all lifting jacks.
8. Jack the bridge as directed by the TMR (Bridge Design) engineer in charge. Ensure the maximum bearing pressure of the jack on the concrete does not exceed 20MPa. A minimum plate size of 450 x 450mm is required.
9. Dimension of the existing bearing shall be confirmed.
10. Lower the bridge back to the original position.
11. Remove temporary packers

BEARING REPLACEMENT LIFT

12. Repeat steps 1-8 of Bearing Replacement Procedure.
13. Lock off jack such that when lowered, the soffit of the bearing restraint keeper plates will clear the top of the bearing by 2-3mm at the closest point.
14. Carefully remove old bearing ensuring the concrete surfaces do not get damaged. A patch repair may be required if the surface is damaged.
15. Install new elastomeric bearing as per MRTS75 and instruction by the TMR (Bridge Branch) engineers in charge.
16. Lower the PSC girders carefully on to the bearings.
17. Remove the jacking equipment.
18. Replace barrier joints and sealants as per the original design and tighten bridge furniture and services as required.
19. Open bridge to traffic.

A	Issued for Construction			
	Revisions/Descriptions	Name or RPEQ No.	Signature	Date

CAD FILES: BIM 360://RRR - Jacobs Only/1167108-DJV-2BR11-M3D-901001_BRIDGE BR11.rvt

BRIDGE DESIGN CRITERIA: AS / (NZS) 5100-2017 DESIGN LOADING: SM1600 & HLP400 DESIGN SPEED: 110km/h EARTHQUAKE ZONE: BEDC-3 BARRIER PERFORMANCE LEVEL: Regular BRIDGE TYPE: RC Deck on Super-T Girders BIS No.

Associated Job Nos	Survey Data	
	Datum	SOP A
Auxiliary Drg Nos	Horiz. Grid	PLANAR
	Height Origin	AHD DERIVED
	Survey Books	MR102631

Scales: Scale A 0 500 1000mm
Dimensions shown in Millimetres except where shown otherwise

CTL CHGE

Reference Points

Proceeding RP	Dist. to start of job (km)	From start to end of job	From end to following RP	Following RP

Through Chainage from

Drawn | Checked | Designed No. | Verified No.

Design Reviews (RPEQ) No. Date.

INSPECTION AND MAINTENANCE DETAILS - SHEET 1

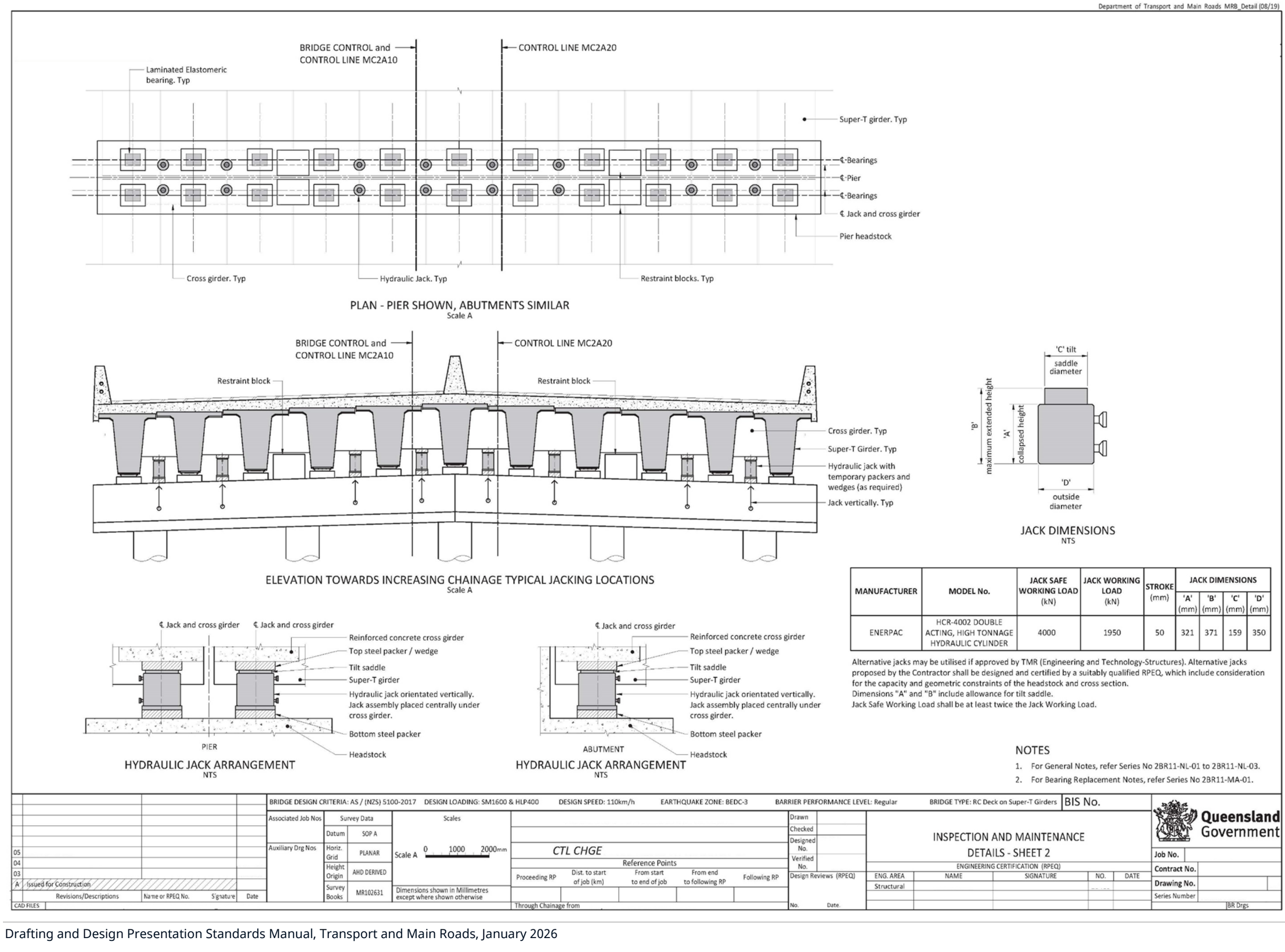
ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	NAME	SIGNATURE	NO.	DATE
Structural				

Queensland Government

Job No.
Contract No.
Drawing No.
Series Number
BR Drgs of

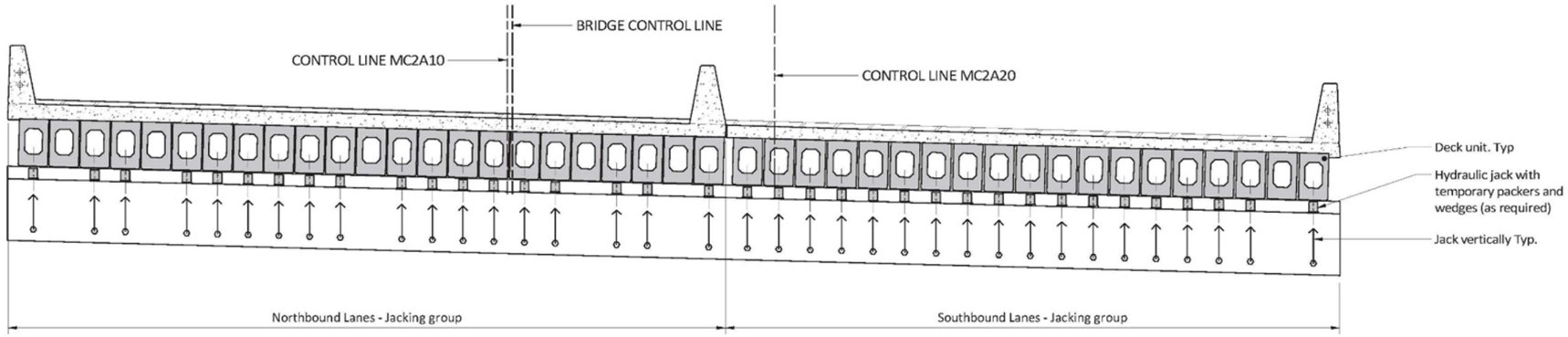
Figure 4.16.1(b) – Example inspection and maintenance drawing – plan and elevation views and jack details – Super-T girder bridge



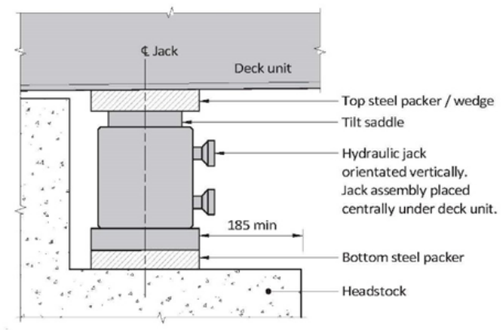
MANUFACTURER	MODEL No.	JACK SAFE WORKING LOAD (kN)	JACK WORKING LOAD (kN)	STROKE (mm)	JACK DIMENSIONS			
					'A' (mm)	'B' (mm)	'C' (mm)	'D' (mm)
ENERPAC	HCR-4002 DOUBLE ACTING, HIGH TONNAGE HYDRAULIC CYLINDER	4000	1950	50	321	371	159	350

Figure 4.16.1(c) – Example inspection and maintenance drawing – plan and elevation views and jack details – deck unit bridge

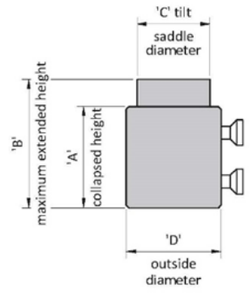
Department of Transport and Main Roads MRB_Detail (08/19)



ELEVATION TOWARDS INCREASING CHAINAGE TYPICAL JACKING LOCATIONS
Scale A



HYDRAULIC JACK ARRANGEMENT
NTS



JACK DIMENSIONS
NTS

MANUFACTURER	MODEL No.	JACK SAFE WORKING LOAD (kN)	JACK WORKING LOAD (kN)	STROKE (mm)	JACK DIMENSIONS 'A' (mm)	'B' (mm)	'C' (mm)	'D' (mm)
ENERPAC	HCR-1002 DOUBLE ACTING, HIGH TONNAGE HYDRAULIC CYLINDER	1000	450	50	202	252	75	175

Alternative jacks may be utilised if approved by TMR (Engineering and Technology-Structures). Alternative jacks proposed by the Contractor shall be designed and certified by a suitably qualified RPEQ, which include consideration for the capacity and geometric constraints of the headstock and cross section.
Dimensions "A" and "B" include allowance for tilt saddle.
Jack Safe Working Load shall be at least twice the Jack Working Load.

BRIDGE DESIGN CRITERIA: AS(/NZS) 5100-2017 | DESIGN LOADING: SM1600 & HLP400 | DESIGN SPEED: 110km/h | EARTHQUAKE ZONE: BEDC-3 | BARRIER PERFORMANCE LEVEL: Regular | BRIDGE TYPE: RC Deck on PSC Deck Units | BIS No.

Associated Job Nos | Auxiliary Drg Nos | Survey Data: Datum SOP A; Horiz. Grid PLANAR; Height Origin AHD (DERIVED); Survey Books MR102631

Scales: Scale A 0 1000 2000mm
Dimensions shown in Millimetres except where shown otherwise

CTL CHGE
Reference Points: Proceeding RP | Dist. to start of job (km) | From start to end of job | From end to following RP | Following RP
Through Chainage from

Drawn | Checked | Designed No. | Verified No. | Design Reviews (RPEQ) No. Date.

INSPECTION AND MAINTENANCE DETAILS - SHEET 2

ENGINEERING CERTIFICATION (RPEQ): ENG. AREA | NAME | SIGNATURE | NO. | DATE

A Issued for Construction
Revisions/Descriptions | Name or RPEQ No. | Signature | Date
CAD FILES

Queensland Government

Job No. | Contract No. | Drawing No. | Series Number | BR Drgs

Figure 4.16.1(d) – Example inspection and maintenance drawing for widened steel girder bridge

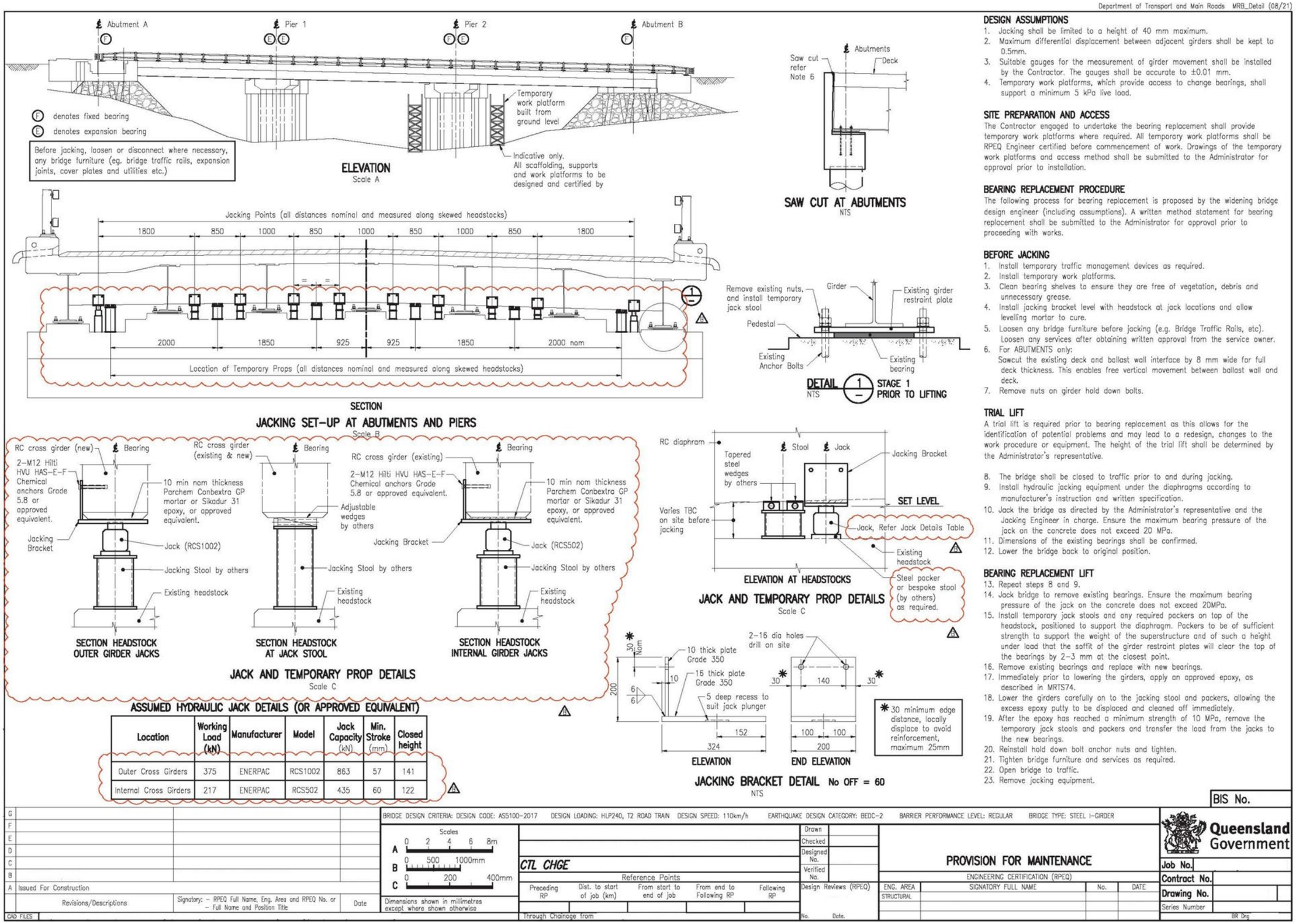
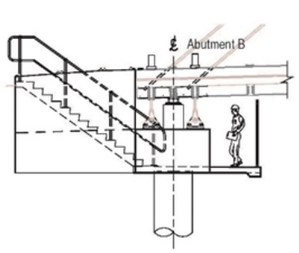
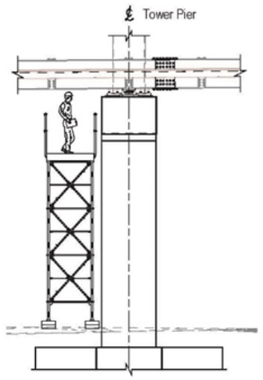
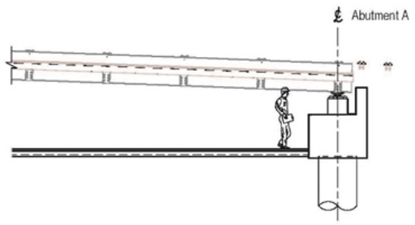


Figure 4.16.1(e) – Example inspection and maintenance drawing for cable stayed velobridge

Department of Transport and Main Roads MRB_Detail (08/19)

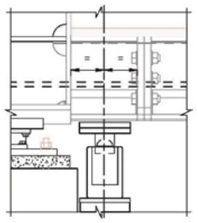




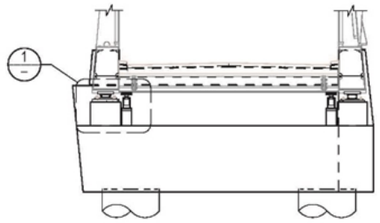


ELEVATION - TYPICAL BEARING REPLACEMENT ACCESS
Not to Scale

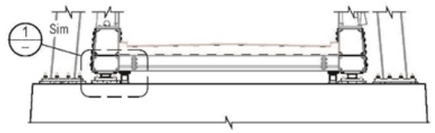
Bearing replacement access diagram is indicative only. Method of temporary access via platform or otherwise to be designed and certified by a suitably qualified temporary works engineer



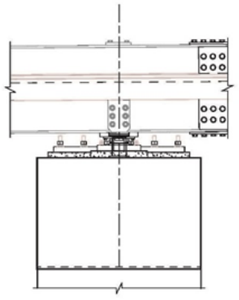
DETAIL 1
Not to Scale



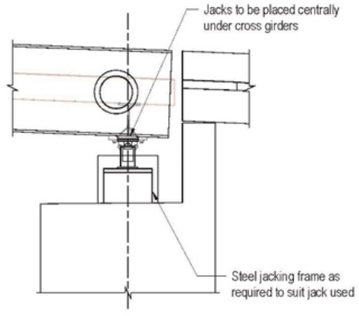
ELEVATION - ABUTMENT A BEARING REPLACEMENT
Not to Scale



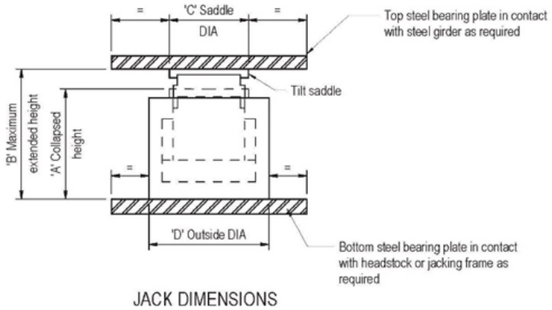
ELEVATION - TOWER PIER BEARING REPLACEMENT
Not to Scale



SECTION - TOWER PIER
Not to Scale



SECTION - ABUT A
Not to Scale



JACK DIMENSIONS
Not to Scale

ASSUMED HYDRAULIC JACK DETAILS

Bearing Location	Working Load - Max (kN)	Manufacturer	Model	Jack Capacity (kN)	Stroke	Jack Dimensions			
						A	B	C	D
ABUTMENT A	120	ENERPAC	HCL-502 Single-Acting, Gravity Return high tonnage cylinders fitted with tilt saddles in contact with deck unit	550	50	188	238	71	130
TOWER PIER	270	ENERPAC	HCL-502 Single-Acting, Gravity Return high tonnage cylinders fitted with tilt saddles in contact with deck unit	550	50	188	238	71	130

Alternative jacks may be substituted if approved by TMR (Bridge Design).
Alternative jacks proposed by the Contractor shall be designed and certified by a suitably qualified RPEQ, which shall include consideration for the capacity and geometric constraints of the headstock and deck unit.
Jack capacity shall be at least twice the working load.
The maximum pressure of the jack on the concrete must be limited to 21 MPa through the use of spreader plates.
Jack dimensions include allowance for tilt saddle (24mm high).

INSPECTION AND MAINTENANCE NOTES

DESIGN ASSUMPTIONS

1.1 Jacking shall be 20 mm ±2 mm lift.
1.2 Maximum differential displacement between all jacks shall be kept to a maximum of 0.5 mm.
1.3 Electronic displacement transducers and mechanical dial gauges for the measurement of superstructure movement shall be furnished and installed by the contractor. The gauges shall be accurate to ±0.01 mm.
1.4 Temporary work platforms shall be designed to support a 5 kPa live load.
1.5 Actual jack loads based on:
a) Permanent effects only

SITE PREPARATION AND ACCESS

2.1 The contractor engaged to undertake the bearing replacement shall provide temporary work platforms as required. Clear access paths to the abutments and fixed scaffolding access to work platforms at the pier, shall also be provided.
2.2 Drawings of the temporary work platforms and access method shall be submitted to the asset owner for approval prior to installation.

BEARING REPLACEMENT PROCEDURE (ABUTMENT AND TOWER PIER)

The following process for bearing replacement is proposed by the original bridge designer (including assumptions). The contractor shall submit a written method statement for bearing replacement to the asset owner for approval prior to proceeding with the works. The written method statement shall include details of all temporary works requirements including lateral restraint position during jacking.

JACKING

3.1 Install temporary traffic management devices (eg. barriers), as required.
3.2 Install temporary work platforms.
3.3 Loosen any deck furniture in advance of jacking (eg. cover plates, expansion joints, handrails, balustrades, etc.).
3.4 Check with services providers about services crossing the bridge and the effect of jacking on them (eg. bridge lighting, fibre optic cables, ITS, etc.).
3.5 Clean bearing shelves to ensure they are free of vegetation, debris and unnecessary grease. Remove the anti-uplift components of the bearing

TRIAL LIFT

A trial lift is required prior to bearing replacement as this allows for the identification of potential problems and may lead to a redesign, changes to the work procedure or equipment. The height of the trial lift shall be determined by the TMR (Engineering and Technology Structures) engineer in charge.

3.6 The bridge shall be closed to users prior to and during jacking.
3.7 Install hydraulic jacking equipment under the steel cross girders in accordance with manufacturer's hydraulic jacking system instructions and written specification. Use of steel shims non-compressible packers as required. Tilt saddles shall be used on all lifting jacks.
3.8 Jack and lift bridge as required. Ensure maximum bearing pressure on concrete does not exceed 21MPa.
3.9 Dimensions of the existing bearings shall be confirmed on site.
3.10 Lower bridge back to original position.

BEARING REPLACEMENT LIFTS

3.11 Repeat steps 3.6, 3.7 and 3.8.
3.12 Carefully remove old bearing ensuring the concrete surfaces do not get damaged. A patch repair may be required if the surface is damaged.
3.13 Install new bearings as per design and instructions by the asset owner.
3.14 Lower the steel cross girders carefully. Tighten the bridge furniture and services as required.
3.15 Open bridge to users.

BEARING REPLACEMENT PROCEDURE (ABUTMENT B)

The following process for bearing replacement is proposed by the original bridge designer (including assumptions). The contractor shall submit a written method statement for bearing replacement to the asset owner for approval prior to proceeding with the works. The written method statement shall include details of all temporary works requirements including lateral restraint position during replacement.

RELEASING OF TIE DOWNS

4.1 Follow steps 3.1 to 3.4
4.2 Attach jack to each tie down and perform lift off test to determine existing tension in tie down
4.3 Release the forces in the ties until the bearings are no longer under load (release ties on both sides of the bridge simultaneously).
4.4 Carefully remove old bearings ensuring the concrete surfaces do not get damaged. A patch repair may be required if the surface is damaged.
4.5 Install new bearings as per design and instructions by the asset owner.
4.6 Restress tie downs to the loads determined during step 4.2.
4.7 Tighten bridge furniture and services
4.8 Open bridge to users.

NOTES

For CONSTRUCTION NOTES, refer Series No BR-SN-01 and BR-SN-02.

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS 5100:2017 | DESIGN LOADING: REFER NOTES | DESIGN SPEED: 30 km/h | EARTHQUAKE ZONE: BEDC-2 | BARRIER PERFORMANCE LEVEL: N/A | CABLE STAYED BRIDGE AND RC RAMP | BIS No.

Associated Job Nos | Survey Data | Horiz. Datum | Horiz. Grid | Height Origin: AHD DERIVED | Survey Books | Scales | Dimensions Shown in millimetres except where shown otherwise

Auxiliary Drg Nos

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn | Checked | Designed No. | Verified No.

Design Reviews (RPEQ) No. Date. / /

INSPECTION AND MAINTENANCE CABLE STAYED BRIDGE

ENGINEERING CERTIFICATION (RPEQ)

Queensland Government

Job No. | Contract. No. | Drawing No. | Series Number | of | BR Drgs of

Revisions/Descriptions | Name or RPEQ No. | Signature | Date

CAD FILES | Project Numbers: GHD 41-12557661

5 Superstructure drawings

5.1 General

This section provides the minimum drawing requirements to present the superstructure for departmental bridges that are considered as standard and of usual configuration, as defined in the DCBoS.

The following types of superstructure elements are discussed in this chapter:

- Transversely stressed deck units as detailed on Standard Drawings
- Deck units with reinforced concrete deck slab
- Super-T girders, with reinforced concrete deck slab
- Winged planks as described in the DCBoS, with reinforced concrete deck slab
- Steel box girders and steel I-beams as described in the DCBoS
- Cast-insitu kerbs, and
- Bridge barriers and attached road furniture.

5.2 Consistency in presentation and detail

The department has published several Standard Drawings for superstructure elements and these drawings provide typical standard details that are recommended for use as the basis for project-specific drawings to ensure consistency in presentation and detail, and to minimise production costs.

5.3 Girder layout diagrams and nomenclature

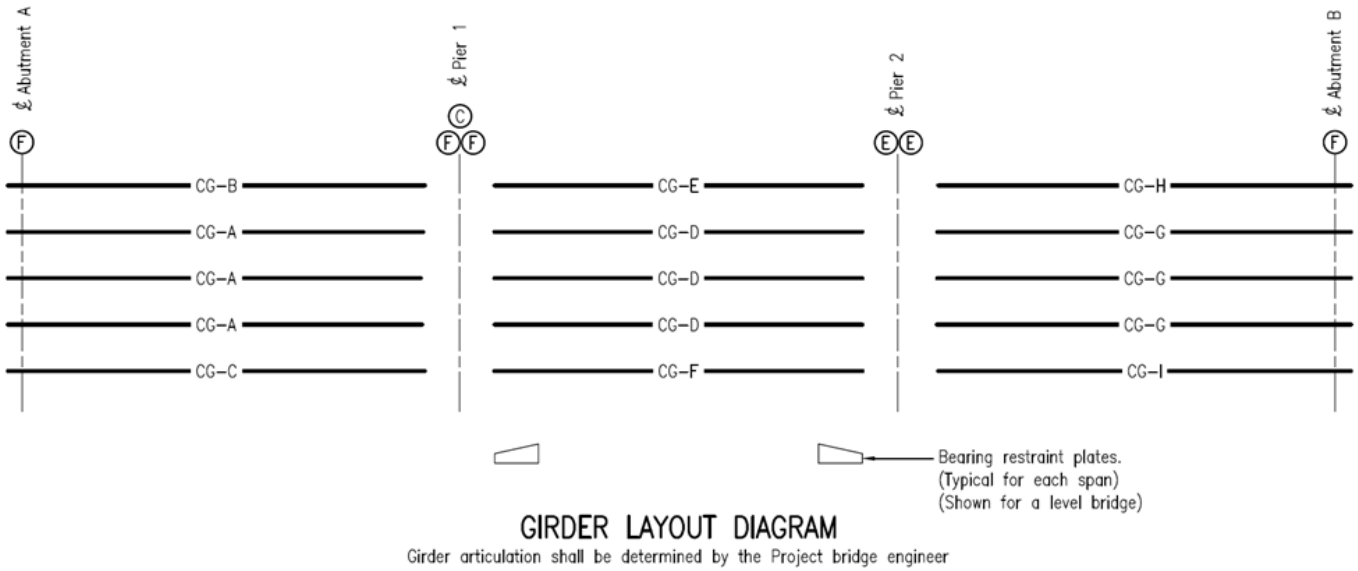
Each girder mark begins with a prefix that represents the specific component, such as CG for concrete girder or DU for deck unit. For a complete list of girder component codes, refer to Table 8 in Chapter 2 of this volume.

Girder marks should be formatted with a hyphen ("-") separating the component ID from the girder type. For example, a deck unit (DU) of Type A should be designated as "DU-A" on the layout plan.

5.3.1 Simply supported girder marking nomenclature

Simply supported girders shall be clearly marked to indicate both the girder type and its placement, as shown in Figure 5.3.1. Type marks such as A / B / C and so on shall be consistent with the naming conventions used in the unit or girder drawings elevation and plan views. If multiple instances of the same girder occur within a single span, they can be represented as a running dimension, with the number of girders indicated in front of the girder mark.

Figure 5.3.1 – Simply supported girder marking example

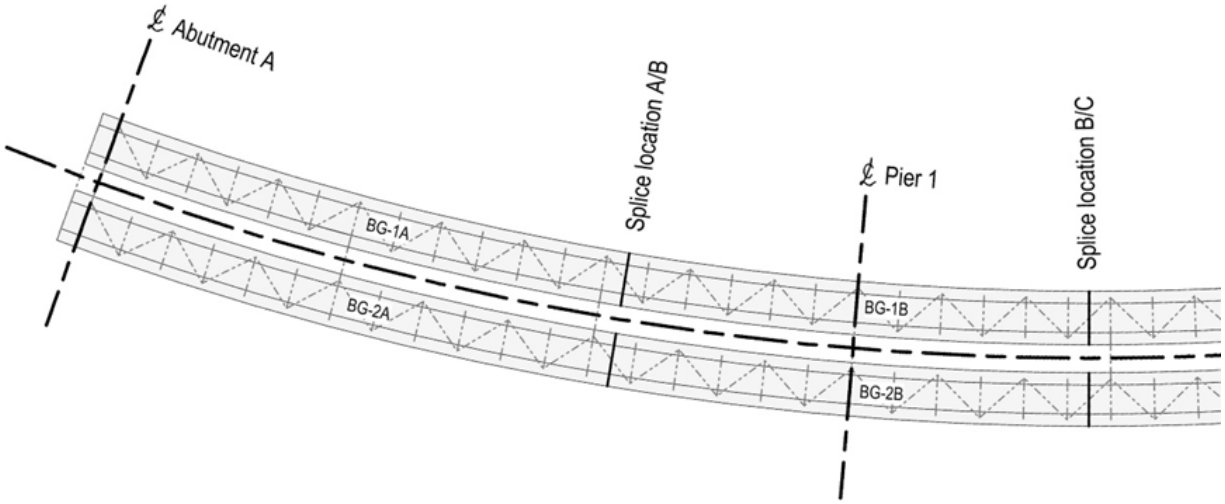


5.3.2 Continuous girder marking nomenclature

For continuous girders, where marking by span is impractical, girders should be marked from left to right when viewed along the chainage, as shown in Figure 5.3.2.

To differentiate between girder locations and splice locations, it is recommended to use a numerical positioning number combined with an alphanumeric type mark. For example, box girder BG-1A can be spliced with box girder BG-1B, which can be designated as splice A / B. This naming convention facilitates clear identification of both girder types and their splice connections.

Figure 5.3.2 – Example continuous girder plan marked left to right – steel box girder bridge



5.4 Drilling of holes

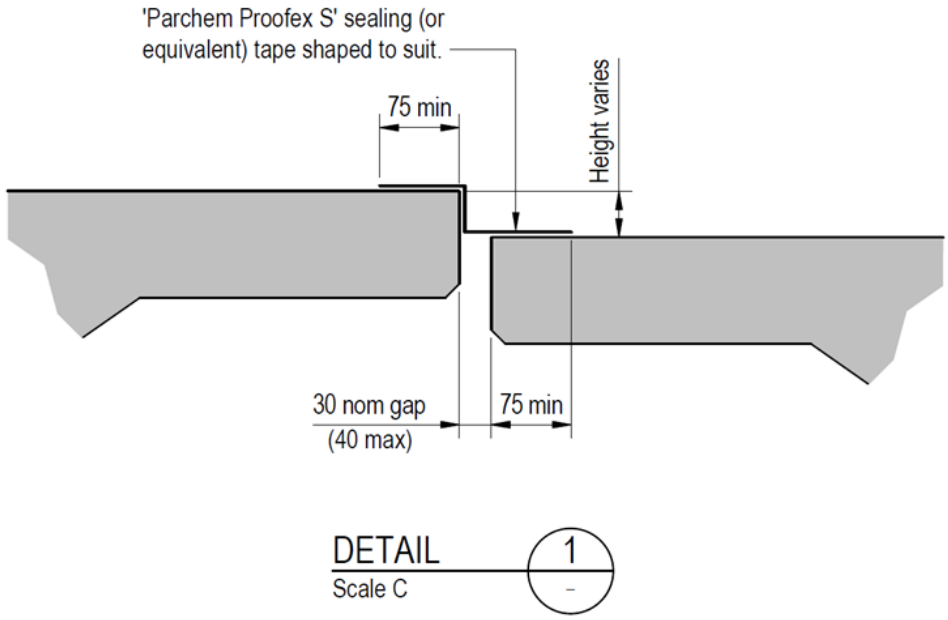
Drilling holes into deck units, winged planks. and Super-T girders is not permitted. All ferrules and attachments shall be cast in.

5.5 Gaps between girders

5.5.1 Transverse gaps between girders

To ensure adequate tolerance for girder installation, a nominal gap of 30 mm ±10 mm (design engineer to confirm) should be maintained between girder flanges or deck units. During construction, this gap should be covered with approved high-strength, waterproof tape in accordance with MRTS77 *Bridge Deck* to prevent any deck concrete from leaking between the girders. For an example of waterproof tape detail and nominal gap, refer to Figure 5.5.1.

Figure 5.5.1 – Example transverse gap with waterproof tape



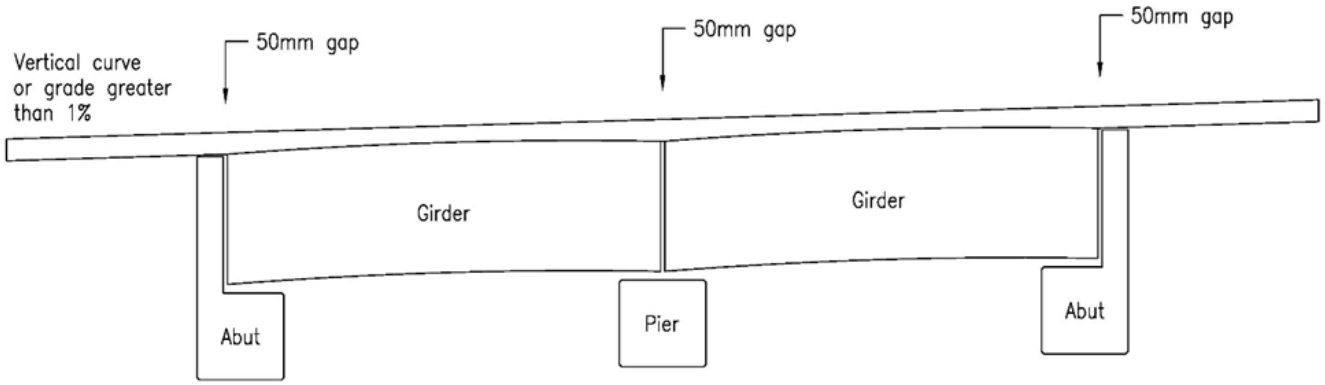
5.5.2 Longitudinal gaps between girders

A nominal gap of 50 mm is maintained between the ends of girders on adjacent spans, and between the girders and the abutment ballast wall. Girders are lowered vertically into position, requiring their ends to be vertical upon installation for adequate clearance.

Designers should ensure that girders have nominally vertical ends and consider factors like grade, vertical curves, and potential rotation due to the 100-day design hogs. For grades over 1%, the ends of the girders should be inclined to achieve vertical alignment. In bridges with vertical curves, the incline may vary between spans and can be rounded to the nearest 5 mm.

When using deep girders with grades and skews, it is important to allow for extra clearance at the abutment ballast walls to address discrepancies in girder end kicks. Additionally, extra-wide flanges may pose geometric challenges, especially on curved bridge decks.

Figure 5.5.2 – Example longitudinal gaps between girders



5.6 Design hog

The design hog is shown at 3 stages after the PSC girder is cast, allowing for progressive measurement to verify it is performing as designed. These design hog values are to be presented in a table on the design drawings. The minimum ages to be shown are:

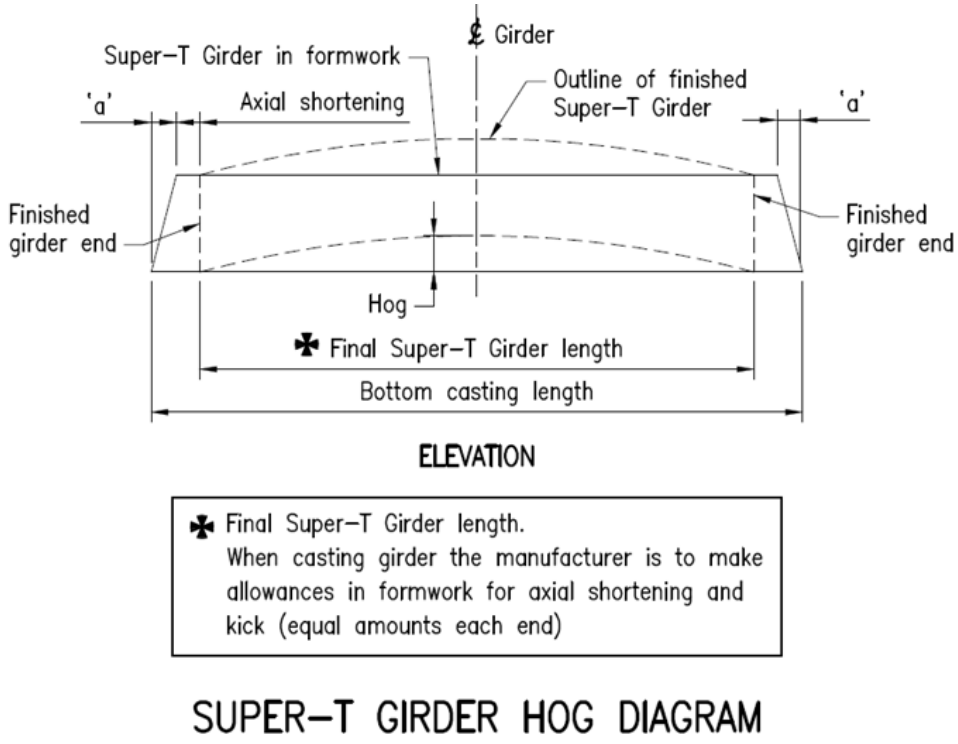
- at transfer
- at 30 days
- at 60 days, for Super-T girders only, and
- at 100 days.

For PSC girders, the 100-day hog and deck pre-camber, are used to calculate the deck profile and therefore, in turn, are used to calculate the headstock heights.

5.7 Formwork kick

The formwork kick shall be calculated based on the design hog to ensure the ends of the PSC girder are vertical at 100 days. A diagram similar to the example at Figure 5.7 showing the kick shall be shown on the drawing. Where there are multiple kick values, it is recommended to produce a table showing the calculations.

Figure 5.7 – Example formwork hog and kick diagram



5.8 Deck units and winged planks

5.8.1 Formwork and services anchors

All outer PSC deck units and winged planks have a single row of cast in formwork anchors, as per the deck unit Standard Drawings. This row of anchors may also be used for future services attachment, dependent on design load, and, if required, a second row may be cast in near the bottom of the deck unit between strands.

Anchors should not be placed directly over or near transverse stressing bar locations on deck units to avoid clashes of formwork or services with the transverse stressing units.

5.8.2 Transversely stressed deck units

The sub-set of drawings for transversely stressed PSC deck units should be presented in a similar manner to the published Standard Drawings, and additional guidance set out in this volume.

Transversely stressed units are to be spaced with 25 mm gaps between units.

5.8.3 Transverse stressing bar assembly schedule

A schedule of the transverse stressing bar assembly shall be shown in a table on the drawings. The schedule should show at a minimum:

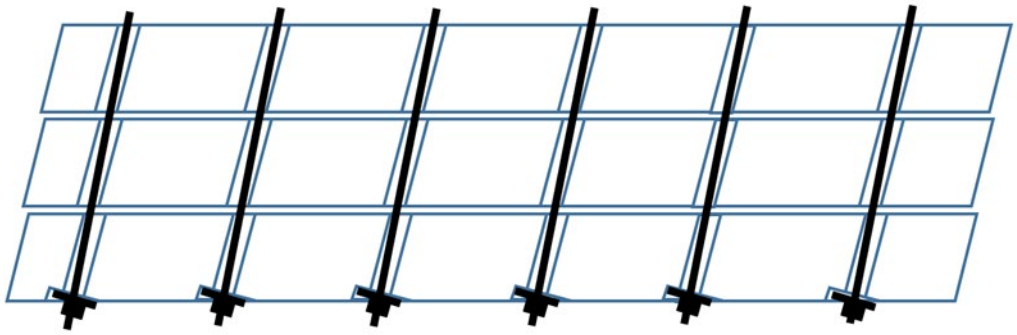
- stress bar assembly type
- length of the stressing bar
- combined mass of the stressing bar assembly, including anchorages (tonnes)
- number of stressing assemblies, and
- total mass of the stressing assemblies (tonnes).

When calculating the length of the transverse stressing bars, perform the base calculation, and round up to nearest 50 mm, and then add an additional 50 mm to the length, including any skew effect.

5.8.4 Transversely stressed deck units around curves

When deck unit bridges are built around a horizontal curve, the combination of skew, radius of curve, and span length contribute to the ends of the deck units having a ‘saw tooth’ profile, shown diagrammatically in Figure 5.8.4.

Figure 5.8.4 – Sawtooth effect at transverse stressing bars



Under this saw tooth effect, the stressing bars within the stressing bar holes will not be in the same horizontal plane as the nominated skew, and a 3D assembly may be modelled to check for appropriate tolerances and constructability. The size of the stressing bar holes for the inner deck units may be altered to accommodate this variation as follows:

- ≥ 0.5° variation, use standard 70 mm diameter hole, and
- 0.5 to 2° variation, use 140 x 70 mm diameter slotted hole.

When this variation is found to be > 2°, an RC deck design is recommended.

5.8.5 Skew angle considerations for deck units

On bridges skewed > 30°, the acute angle corners of deck units shall be truncated, typically 50 mm.

For transversely stressed deck units, the recess for each bearing plate shall be normal to the stressing bar hole and formed to match the skew.

5.8.6 Shear keys for transversely stressed deck unit bridges

Bridges with a skew from 30° to 45° may have shear keys to address longitudinal shear, and the details shall be designed by the bridge designer.

Generally, each shear key is 225 mm wide, 12 mm deep, extending from the top of the unit down the side to 75 mm above the bottom, and are spaced at approximately 1 m centres along the unit length.

5.9 Deck units with reinforced concrete deck slab

Deck unit bridges with an RC deck require project-specific deck unit design.

The sub-set of deck unit drawings can be organised in a similar way to the transversely stressed PSC deck unit Standard Drawings.

For bridges with skews ≤ 30°, the ligatures and the starter bars in the deck units may be skewed in the same plane as the deck reinforcement.

For skews > 30°, the starter bars and deck reinforcement are to be placed normal to the control line.

Refer to the diagrams in Figure 5.9(a) and Figure 5.9(b).

Figure 5.9(a) – Reinforcement for skews ≤ 30°

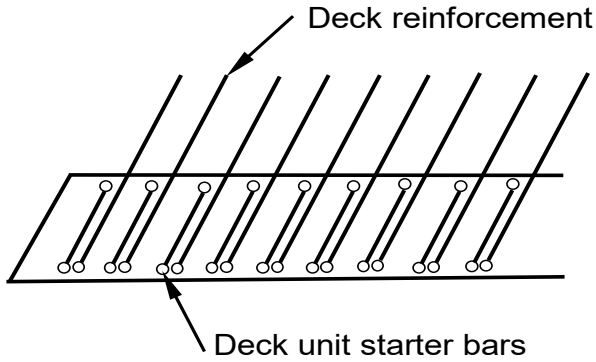
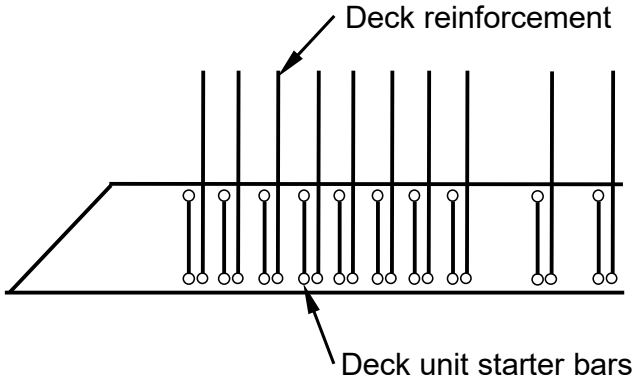


Figure 5.9(b) – Reinforcement for skews > 30°



5.10 Winged planks with reinforced concrete deck slab

Winged plank bridges require project-specific design.

The sub-set of drawings for winged planks can be organised in a similar way to deck units with an RC deck described above, and with the appropriate details for the holding down bolt holes at abutments and piers as discussed in the DCBoS.

Winged planks shall be detailed in accordance with Section 4.9.7 of the DCBoS.

5.11 Prestressed concrete deck unit and winged plank girder schedules

All PSC concrete girders shall be shown in a table on the drawings. The schedule should include the following as a minimum:

- girder type
- mass of girder type (tonnes approximate)

- end skew dimensions (if applicable)
- number of girder types, and
- total mass (tonnes).

5.12 Typical content required on prestressed deck unit and winged plank drawings

Table 5.12 provides the minimum drawing content that should be presented on the set of project-specific drawings for superstructure elements listed above, along with typical drawing elements, such as schedules, and each is cross-referenced to the figures extracted from the example drawings.

Where the drawing for the element forms a sub-set to be given to a sub-contractor, the set shall show all those details and notes specific to that element or activity, so that the sub-contractor has a full appreciation of the contract requirements.

Figure 5.12(a) to Figure 5.12(q) are example drawings.

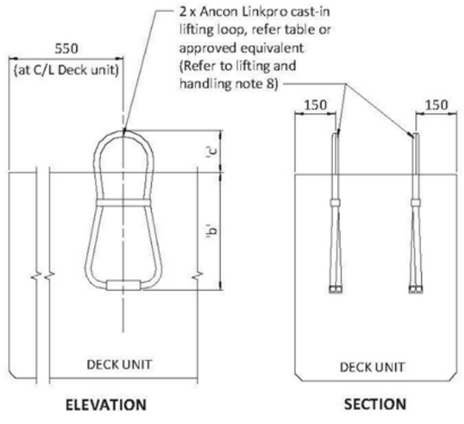
Table 5.12 – Prestressed deck unit or winged plank – project-specific drawings content

Requirement	Drawing or element description	Figure reference
General arrangement	Typical section through the deck, labelling all features.	Figure 5.12(g)
Notes	Notes to suit the superstructure element, along with lifting and handling notes. For deck unit drawings sub-sets, refer to the published Standard Drawings as a basis.	Figure 5.12(a) Figure 5.12(g) Figure 5.12(l)
Layout diagram	A plan that depicts the arrangement of the units / planks, with the designation for each unique type, showing skew to ends, and centrelines of abutments and piers, and of the bridge control. (A section may suffice for simpler layouts.)	Figure 5.12(g) Figure 5.12(k)
Schedule	A table to show the following for each PSC deck unit or winged plank type: • the count for each • the mass of each, and • the total mass of each type.	Figure 5.12(g) Figure 5.12(l)

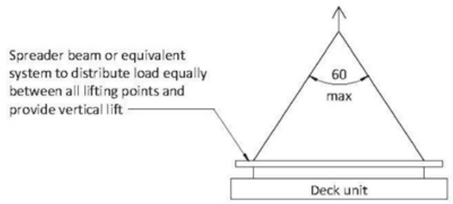
Requirement	Drawing or element description	Figure reference
Transverse stressing unit schedule (if required)	A table to show the following for transversely the stressed PSC deck units: • length of stressing bar • the mass of the stressing bar and its anchorages • the number of stressing units, and • the total mass of stressing units.	Figure 5.12(a)
Hog schedule	A table to show the design hog at transfer, at 30 days, and at 100 days.	Figure 5.12(a) Figure 5.12(g) Figure 5.12(l)
Formwork kick or hog diagram	A diagram that depicts design hog and end incline values for finished PSC deck unit or winged plank.	Figure 5.12(a) Figure 5.12(g) Figure 5.12(l)
Lifting	• Lifting diagrams to show precast yard and on-site lifting arrangements, and • Lifting anchor details.	Figure 5.12(a) Figure 5.12(g) Figure 5.12(l)
Concrete profiles and reinforcement details	Plan, elevation and sections for each type of deck unit or winged plank. The shared notes, sections and details grouped together within the set, and notes and details specific to each type on separate drawings within the set.	Figure 5.12(c) to Figure 5.12(f) Figure 5.12(h) to Figure 5.12(j) Figure 5.12(m) to Figure 5.12(q)
Restraint system at plank ends	For PSC deck units with RC deck and for winged planks, (if not included in the GA drawings), details for restraint at abutments and piers to suit the articulation, including holding down bolt and formed holes.	Figure 3.4(c)

Figure 5.12(a) – Example transversely stressed deck unit bridge drawings – Sheet 1

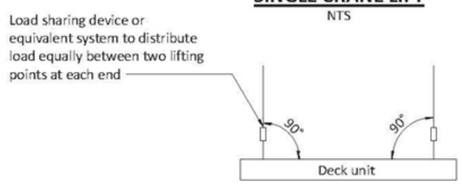
Department of Transport and Main Roads MRB_Detail (08/21)



LIFTING LOOP DETAIL
NTS

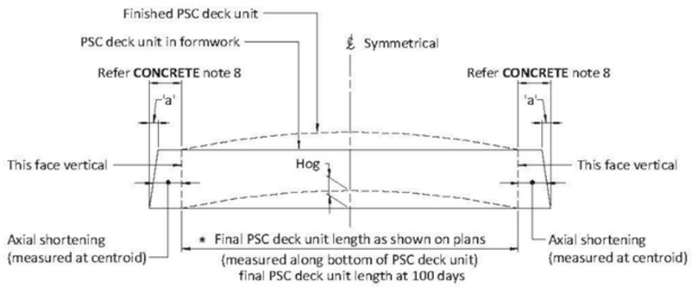


LIFTING DIAGRAM SINGLE CRANE LIFT
NTS



LIFTING DIAGRAM DUAL CRANE LIFT
NTS

ANCON LINKPRO LIFTING LOOPS			
Deck Unit Type	Product Code	'b'	'c'
A to C	LP20	545	205
D to F	LP20	545	205



ELEVATION

FORMWORK KICK OVER DIAGRAM
NTS

TRANSVERSE STRESSING UNIT SCHEDULE

LENGTH (m)	MASS # (tonnes)	No OFF	TOTAL MASS # (tonnes)
10.55	0.07	18	1.26

including transverse stressing anchorages

HOG SCHEDULE		
PSC Deck Unit Type	A to C	D to F
Hog At Transfer	24 ± 5	26 ± 5
Hog At 30 Days	35 ± 7	38 ± 8
Hog At 100 Days	44 ± 9	47 ± 10
Hog At 150 Days	47 ± 10	51 ± 10
Deflection Under Kerb, DWS and Barrier	7 ± 1	7 ± 1
Residual Hog after 150 day	39 ± 10	43 ± 10

DESIGN KICK DIMENSION 'a' SCHEDULE		
PSC Deck Unit Type	A to C	D to F
At Casting	10	10
At Transfer	5	5
At 30 Days	3	2
At 100 Days	1	1
At 150 Day	0	0

LEGEND

* Denotes final PSC deck unit length, refer to FORMWORK KICK OVER DIAGRAM.
✤ Denotes Top of PSC deck unit to be treated as a construction joint, refer CONCRETE Note 7 on this drawing

PSC DECK UNIT HOGS

1. The calculated hog of PSC deck units, shown in the HOG SCHEDULE, assumes the following:
   - Density = 26 kN/m³
   - Elastic modulus at transfer = 32800 MPa ± 20%
   - No load except for deck unit self weight.
2. The tolerances, shown in the HOG SCHEDULE, have been used to design the bridges and set levels. They are not to be used for acceptance. Refer to MRTS73 Manufacture of Prestressed Concrete Members and Stressing Units for acceptance criteria.
3. The design hog for the application of acceptance criteria shall be the median value shown in the HOG SCHEDULE.

NOTES

1. For NOTES, refer to Drg No 962123 and 962124.

PSC DECK UNITS

1. PSC deck units to be manufactured in accordance with to MRTS73 Manufacture of Prestressed Concrete Members and Stressing Units.

CONCRETE

1. Concrete to conform to MRTS70 Concrete.
2. Concrete Class to be S50/20.
3. Strength at transfer to be 40 MPa minimum.
4. Exposure classification B2.
5. Concrete shall be cast in rigid forms and subjected to intense vibration utilising a combination of internal and external vibrators.
6. All chamfers where shown to be 25 x 25 maximum unless shown otherwise.
7. Top surface of deck units under kerbs shall be treated as a construction joint with the remainder of units having a broom finish, refer to MRTS70 Concrete.
8. When casting PSC deck units the manufacturer shall make allowance in formwork for axial shortening (equal amounts each end) as determined by manufacturer and formwork kick 'a'.

REINFORCING STEEL

1. Reinforcing steel to be read in conjunction with MRSD 1043 and MRSD 1044.
2. Reinforcing steel to be in accordance with MRTS71 Reinforcing Steel.
3. Deformed bars Grade D500N.
4. Round bars Grade R250N.
5. Minimum cover to reinforcing steel and strands to be 40 unless shown otherwise.
6. All carbon reinforcing steel to be Australasian Certification Authority for Reinforcing and Structural Steels (ACRS) certified.

STRANDS

1. Strands to MRTS73 Manufacture of Prestressed Concrete Members and Stressing Units and AS/NZS 4672.1-7-2007 wire ordinary-15.2-1830-Relax 2 and testing requirements to AS/NZS 4672.2-2007.
2. Pretensioning force at stressing = 196 kN per strand.
3. Ends of strands to be coated with three coats minimum of approved surface tolerant epoxy after grinding flush with ends of PSC deck units. Each coat to be a minimum of 0.3 mm dry thickness.
4. All strands to be Australasian Certification Authority for Reinforcing Steel and Structural Steels (ACRS) certified.

STEELWORK

1. Steelwork to be fabricated to MRTS78 Fabrication of Structural Steelwork.
2. Hot rolled steel bar to AS/NZS 3679.1-2016.
3. Bolts Class 4.6 to AS 1111.1-2015.
4. Material for couplers for anchors to AS 1444-2007 (R2017).
5. Threads for couplers to AS 1275-1985 (R2017).
6. All anchors, bolts and nuts to be hot dip galvanised to AS/NZS 1214-2016. All other steelwork to be hot dip galvanised to AS/NZS 4680-2006 unless shown otherwise. Prior to galvanising, all weld splatter and welding slag is to be removed.
7. All steelwork to be Australasian Certification Authority for Reinforcing Steel and Structural Steels (ACRS) certified.

TRANSVERSE STRESSING BARS

1. Transverse stressing bars to MRTS73 Manufacture of Prestressed Concrete Members and Stressing Units and AS/NZS 4672.1-bar-29-1030-P, or -bar-32-1030-P (with 300 minimum coarse thread at each end) and testing requirements to AS/NZS 4672.2-2007
2. Transverse stressing force at lock off shall be 350 kN.
3. All transverse stressing bars to be Australasian Certification Authority for Reinforcing Steel and Structural Steels (ACRS) certified.

TACK WELDING

1. Tack welding for location purposes to MRTS71 Reinforcing Steel.
2. Welding consumables to be G49X or T49X.
   Welding consumables to AS/NZS ISO 17632-2022 or AS/NZS 14341-2022.

LIFTING AND HANDLING

1. PSC deck units to be lifted by means of lifting loops only.
2. The calculated mass of PSC deck units as shown is based on an assumed concrete density of 2700 kg/m³.
3. The lifting loops have been sized based on the following assumptions:
   a. The sling angle factor is 1.0.
   b. Suction factor for demoulding is 1.2 based on a smooth, well-oiled steel casting bed.
   c. Dynamic factor is 2.0 based on non-tracked mobile lifting equipment (including rubber tyred) travelling with the suspended load on a prepared even surface.
   d. Factor of safety of 4.0
4. The contractor shall ensure the factors above are appropriate for lifting arrangements at casting yard and site, otherwise the contractor shall obtain a lifting loop design from the manufacturer that is RPEQ certified and suitable for the contractors proposed lifting arrangements in accordance with MRTS73 Manufacture of Prestressed Concrete Members and Stressing Units.
5. Additional reinforcement may be required in the vicinity of the lifting loop. This shall be confirmed by the lifting loop manufacturer and submitted to the Designer for approval prior to fabrication of the PSC deck unit.
6. Shackle pin through lifting loops shall be in accordance with lifting loop manufacturer's specification.
7. Deck units shall be braced for stability in accordance with the contractor's Temporary Works design details. Units shall be braced, as necessary to ensure horizontal and rotational restraint prior to transverse stressing. The design of the bracing/restraint system shall include provision for direct and eccentric load effects from any attached walkways, safety rails or formwork system. Imposed torsion and stability shall be checked by an RPEQ Temporary Works Engineer to suit the Contractor's Safe Work Method Statement and shall be submitted to the Administrator for review and approval at least 21 days prior to manufacture of the deck units.
8. Lifting loops shall be cut off after erection of deck units is complete and treated in accordance with MRTS74 Supply and Erection of Prestressed Concrete Deck and Kerb Units.

BIS No.

DESIGN CRITERIA: DESIGN CODE: AS 5100-2017 DESIGN LOADING: SM1600 AND HLP400 DESIGN SPEED: 110 km/h EARTHQUAKE DESIGN CATEGORY: BEDC-2 BARRIER PERFORMANCE LEVEL: Regular STRUCTURE TYPE: Trans stress PSC deck units

Scales

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn
Checked
Designed No.
Verified No.
Design Reviews (RPEQ) No. Date

PSC DECK UNITS
NOTES AND TYPICAL DETAILS

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	SIGNATORY FULL NAME	No.	DATE
Structural			

Queensland Government

Job No.
Contract No.
Drawing No.
Series Number
BR Drgs

Revisions/Descriptions	Signatory: - RPEQ Full Name, Eng. Area and RPEQ No. or - Full Name and Position Title	Date

Dimensions shown in millimetres except where shown otherwise

CAD FILES

Figure 5.12(b) – Example transversely stressed deck unit bridge drawings – Sheet 2

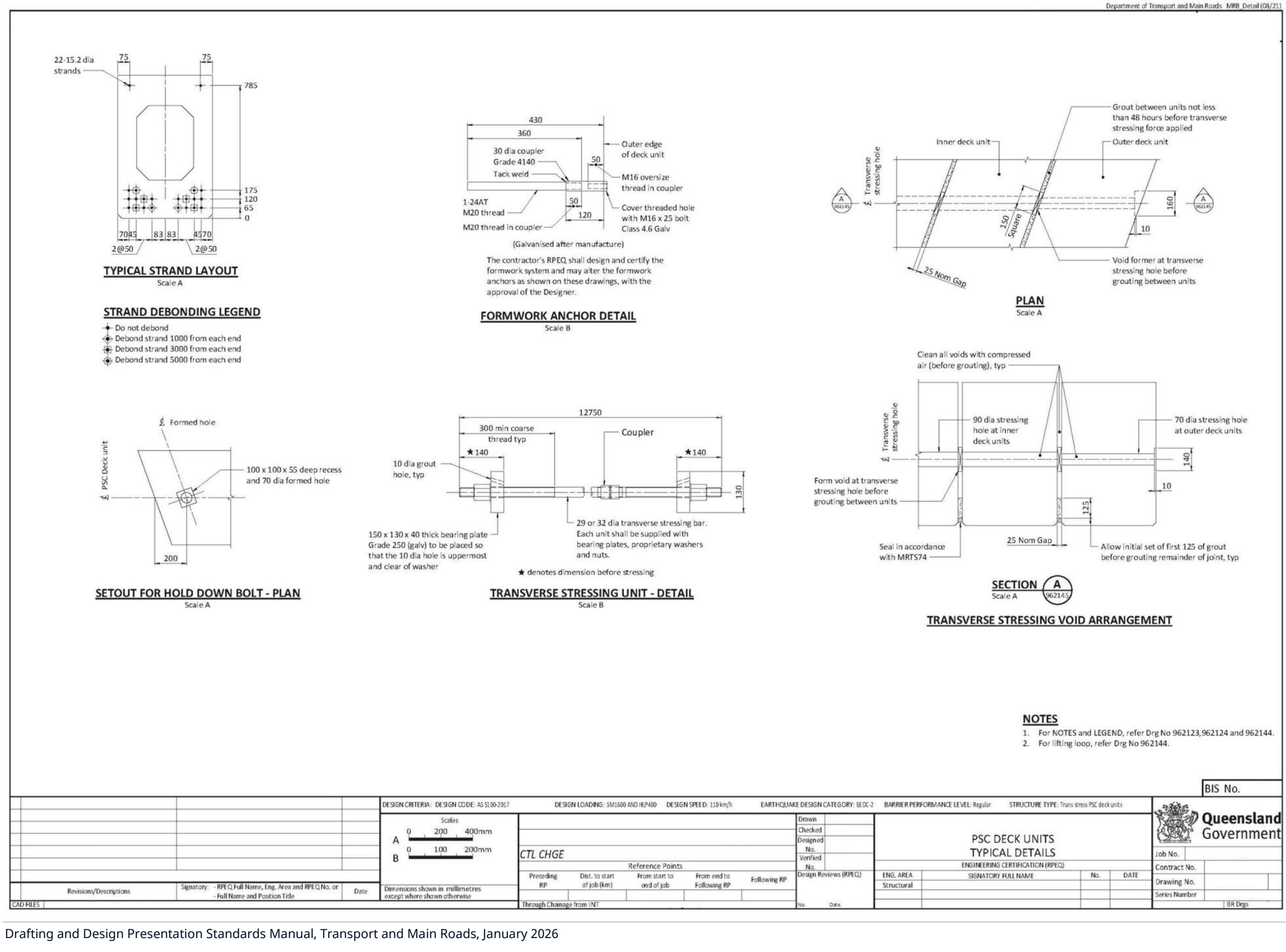


Figure 5.12(c) – Example transversely stressed deck unit bridge drawings – Sheet 3

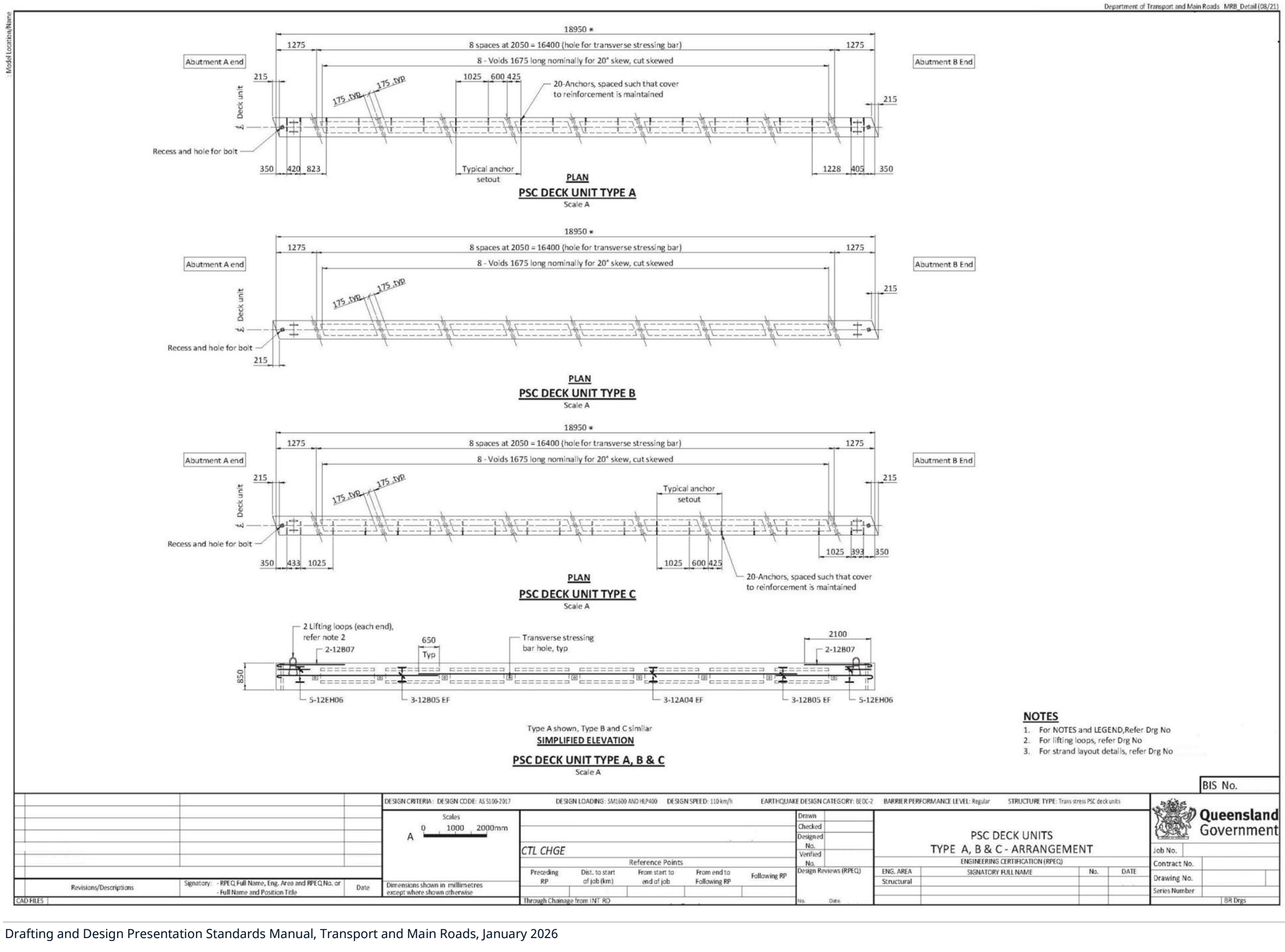


Figure 5.12(d) – Example transversely stressed deck unit bridge drawings – Sheet 4

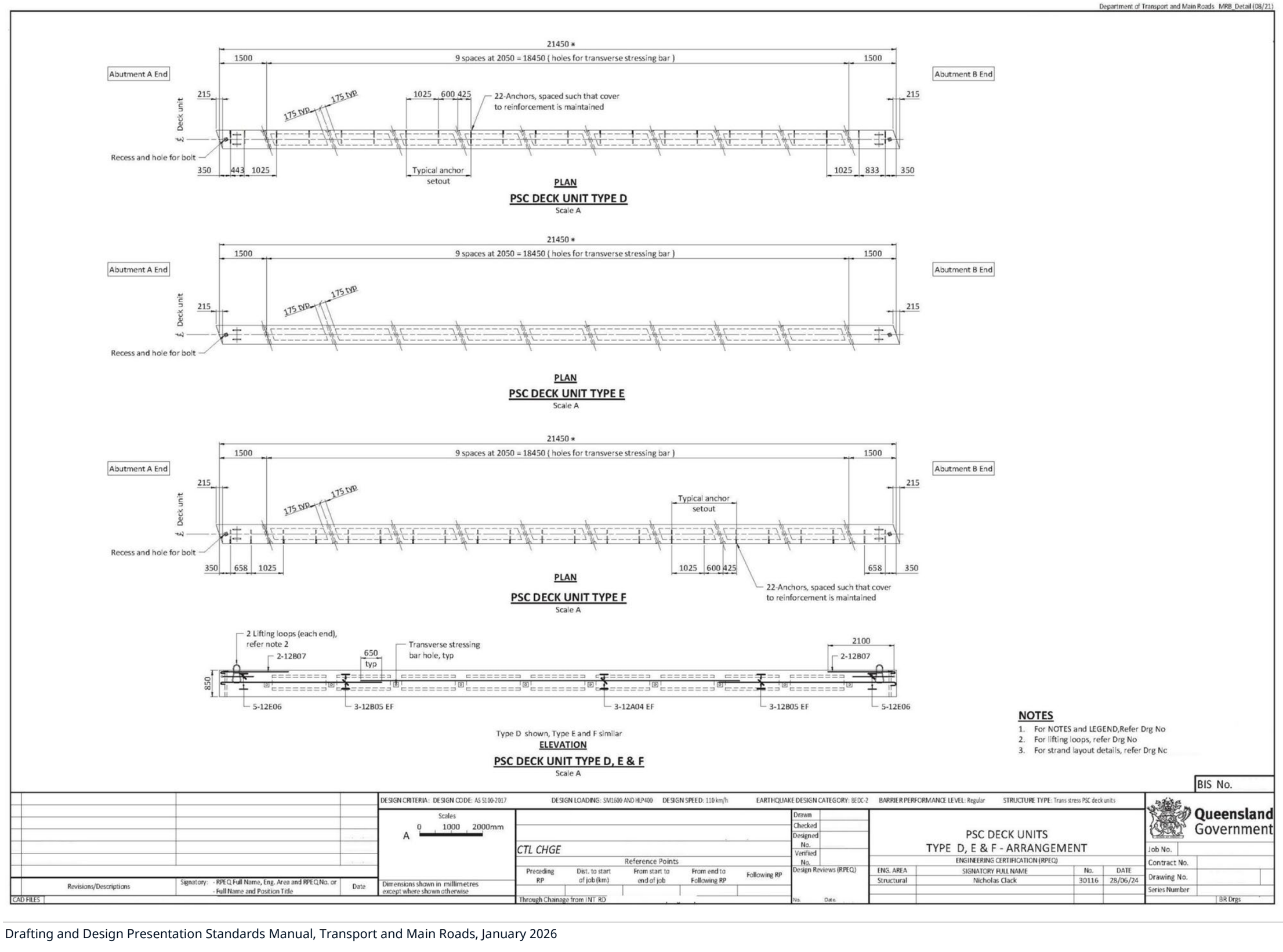


Figure 5.12(e) – Example transversely stressed deck unit bridge drawings – Sheet 5

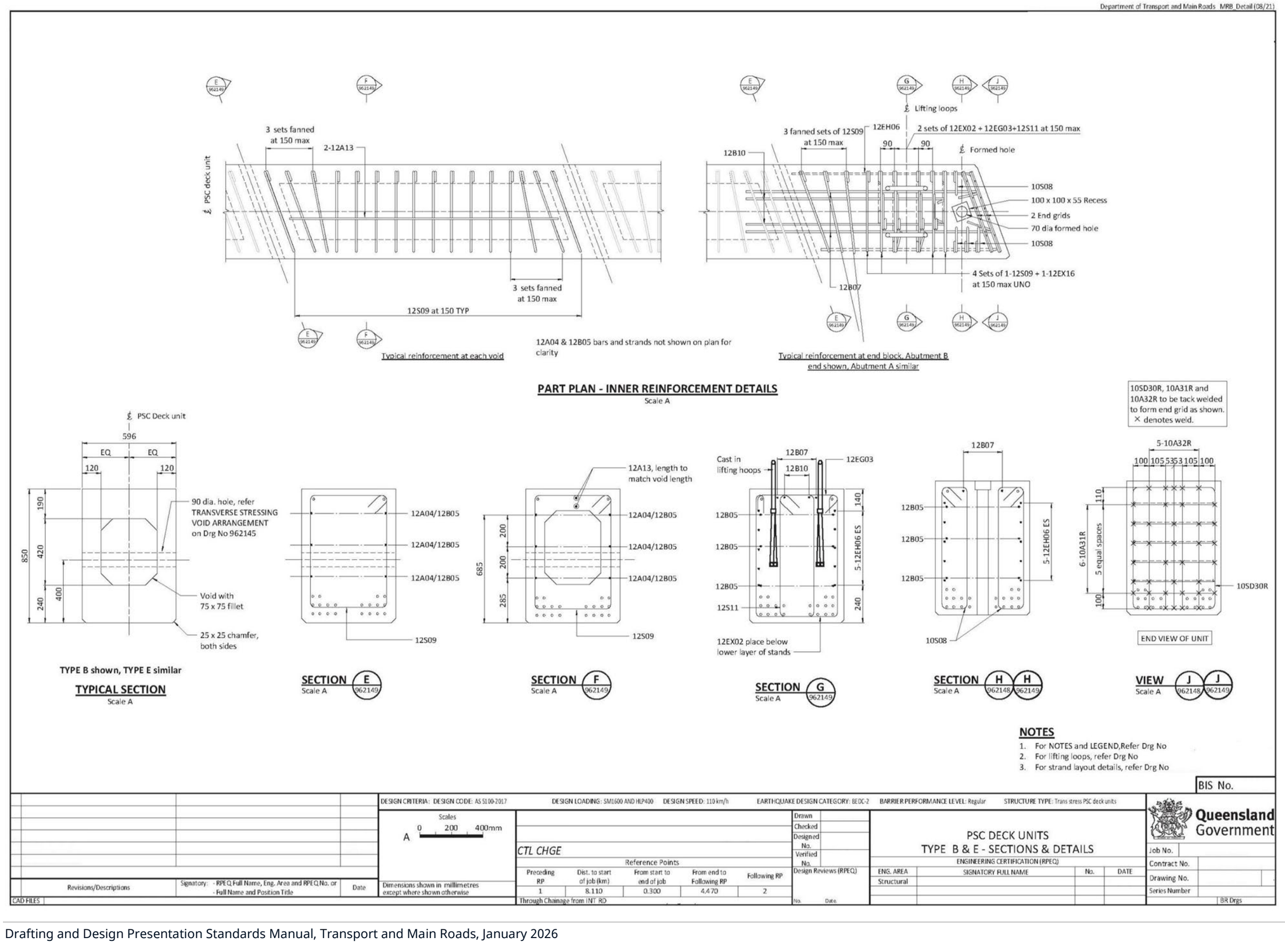


Figure 5.12(f) – Example transversely stressed deck unit bridge drawings – Sheet 6

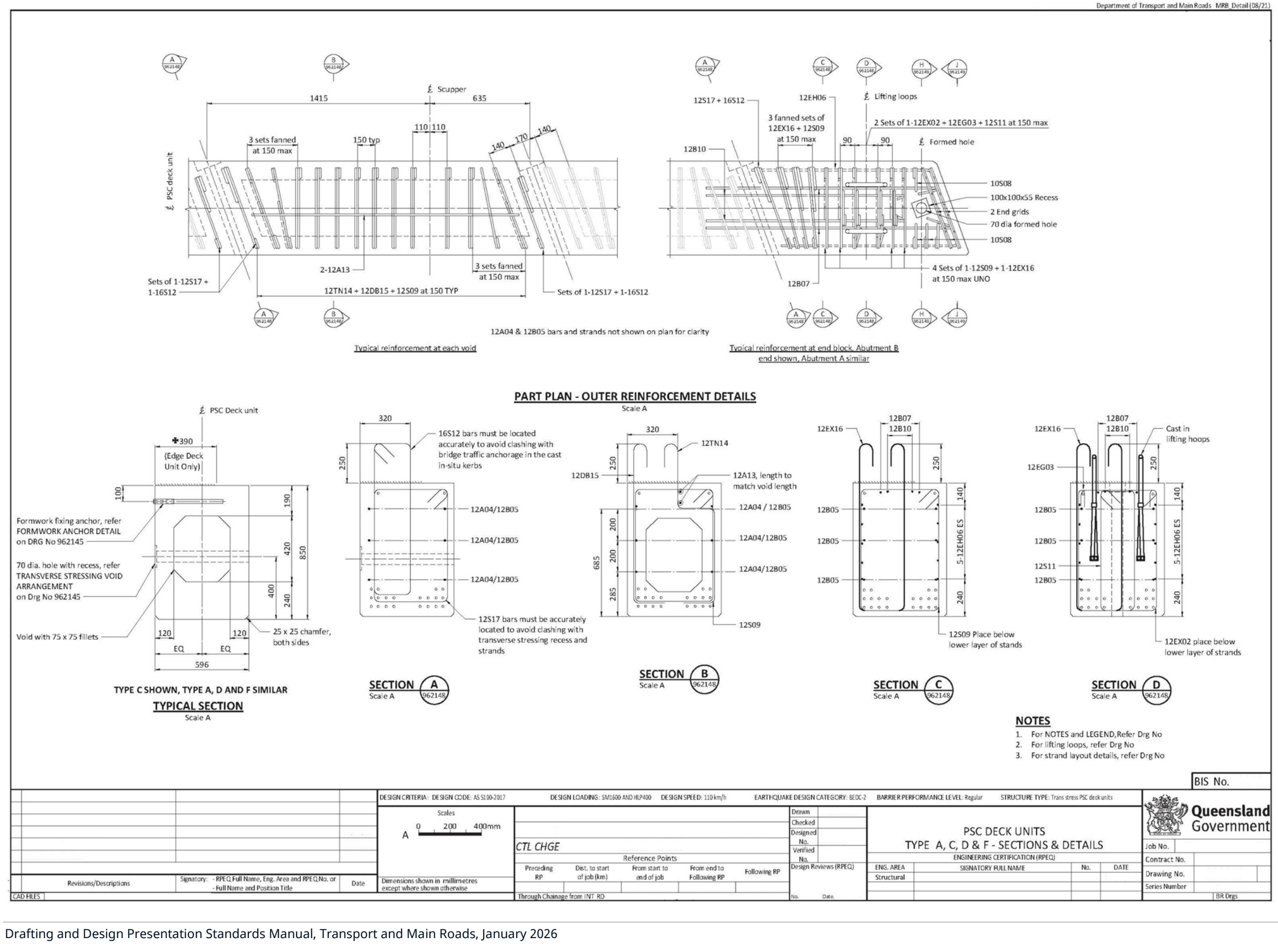
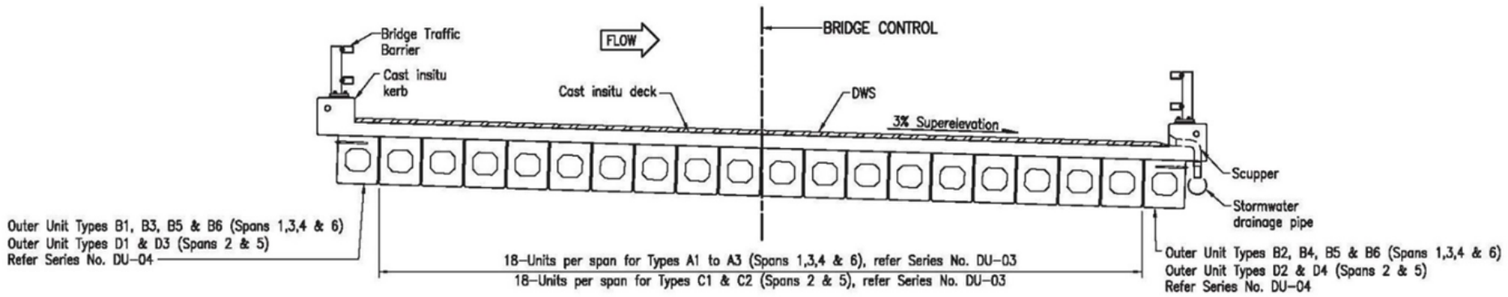


Figure 5.12(g) – Example deck unit with reinforced concrete deck bridge drawings – Sheet 1

Department of Transport and Main Roads MRB_Detail (08/19)



TYPICAL SECTION THROUGH BRIDGE

GENERAL ARRANGEMENT FOR DECK UNITS

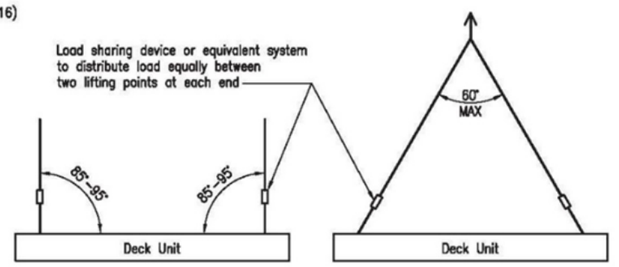
(For DECK UNIT LAYOUT DIAGRAM, refer to Drg No. 872716)

DECK UNIT SCHEDULE

TYPE OF DECK UNIT	MASS (tonnes)	No OFF	TOTAL MASS (tonnes)
A1	16.1	18	289.8
A2	16.1	18	289.8
A3	16.1	36	579.6
B1	16.1	1	16.1
B2	16.1	1	16.1
B3	16.1	1	16.1
B4	16.1	1	16.1
B5	16.1	2	32.2
B6	16.1	2	32.2
C1	16.1	18	289.8
C2	16.1	18	289.8
D1	16.1	1	16.1
D2	16.1	1	16.1
D3	16.1	1	16.1
D4	16.1	1	16.1

HOG SCHEDULE

DESIGN HOG (mm)		
Transfer	30 days	100 days
25	30	40

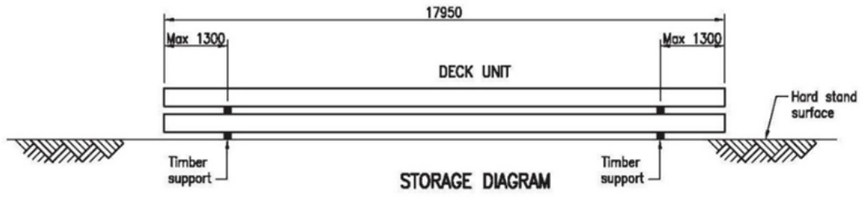


LIFTING DIAGRAM IN PRECAST YARD OR ON SITE

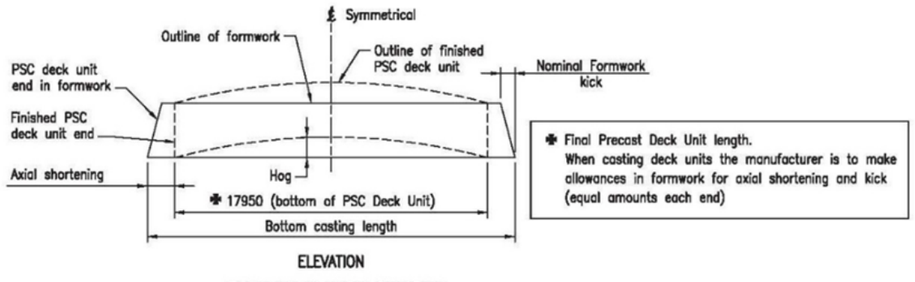
ALTERNATIVE LIFTING DIAGRAM ON SITE (NOT IN PRECAST YARD)

CAST-IN HOOP LIFTING DETAILS

Deck Unit Length (mm)	17950
Unit Weight (t)	16.1
Cast in Hoop	Philipp Art No. 442125 (galv)
Required WLL (FOS=4) per Hoop (t)	8.1
Dynamic Load Factor (at transfer)	1.2
Dynamic Load Factor (at 50MPa)	2.0
Lift Angle	Refer LIFTING DIAGRAM
Crane Type	Gantry (precast yard)/Rubber Tyred Mobile Crane (on site)



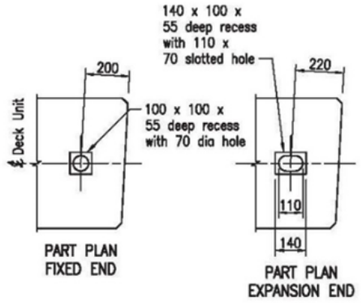
STORAGE DIAGRAM



ELEVATION

FORMWORK KICK DIAGRAM

✙ Final Precast Deck Unit length.
When casting deck units the manufacturer is to make allowances in formwork for axial shortening and kick (equal amounts each end)



PART PLAN FIXED END

PART PLAN EXPANSION END

HOLD DOWN BOLT DETAILS
(Used for Types A & C only)

PSC DECK UNIT NOTES

1. For General Notes, refer Series No. BR-GN-01 & BR-GN-02.
2. PSC DECK UNITS shall be manufactured to MRTS73, supplied and erected to MRTS74.
3. CONCRETE shall be in accordance with MRTS70.
   Concrete S50/20.
   Strength at transfer shall be 40MPa.
   Exposure classification B2.
   Concrete shall be cast in rigid forms and subjected to intense vibration.
   All chamfers where shown to be 25 x 25 unless shown otherwise.
4. REINFORCING STEEL shall be read in conjunction with Standard Drawings 1043 and 1044. Reinforcing steel shall be in accordance with MRTS71 and AS/NZS 4671.
   Deformed bars Grade D500N. Round bars Grade R250N.
   Minimum cover to reinforcing steel and strands shall be 40 for all sides.
   All carbon reinforcing steel shall be ACRS certified.
5. STRANDS shall be to AS/NZS 4672.1 – 7 wire ordinary–15.2–1750–Relax 2 and testing requirements to AS/NZS 4672.2.
   Pretensioning force at stressing = 187.5kN per strand.
   Ends of strands to be coated with three coats minimum of approved surface tolerant epoxy after grinding flush with ends of units. Each coat shall be a minimum of 0.3mm dry or 0.6mm wet film thickness.
6. STEELWORK shall be fabricated to MRTS78.
   Steel plate Grade 250 minimum to AS/NZS 3678.
   Bolts Class 4.6 to AS 1111.1.
   Bolts Class 8.8 to AS/NZS 1252.
   All bolts and nuts shall be hot dip galvanised to AS 1214.
   All other steelwork shall be hot dip galvanised to AS/NZS 4680.
   Prior to galvanising, all weld splatter and welding slag to be removed.
7. VOIDS shall be cellular polystyrene Grade SL to AS 1366.3.
8. WELDING symbols to AS 1101.3.
   All welds, except location tack welds, shall be SP category.
   Tack welding for location purposes to AS/NZS 1554.3.3.1 and 3.3.2.
   Welding shall not be carried out within 75 from any bent portion of the bar.
   Welding consumables shall be controlled hydrogen type: G49X to AS/NZS 14341-B or T49X to AS/NZS ISO 17632-B unless shown otherwise.
9. CAST-IN LIFTING ANCHORS shall be galvanised.
   For all lifting notes refer to "Lifting Notes" on this Drawing.
   For all lifting hoop notes refer to "Cast-in Lifting Hoop Notes" on this Drawing.
10. PVC DRAINAGE PIPES shall be to AS/NZS 1260.
11. FINAL DECK UNIT DIMENSIONS: When casting units the manufacturer shall make allowance in formwork for end formwork kick due to hog and axial shortening (equal amounts each end) so that the units assume the detailed dimensions, shown in this drawing, at 100 days.
12. HOG DIFFERENTIAL: Deck units shall be cast in a span by span configuration, with no more than 3 weeks elapsed between all units in the same span. This is to minimise hog differentials between internal and edge units at the time of erection.
    Each Unit to be clearly marked with its Span and Unit type.
13. Refer to Clause 7.3.6 of MRTS70 for acceptable tolerance of hog in deck units.

CAST-IN LIFTING HOOP NOTES

H1. LIFTING shall be with minimum pin diameter as per manufacturer's specifications.
H2. HOOP FINISH: After lifting hoop is no longer required, cut-off and grind flush with top of deck unit, apply three coats of approved non-abrasive surface tolerant epoxy to provide a minimum dry film thickness of 0.3 mm dry or 0.6mm wet.
H3. CAST-IN LIFTING ANCHORS AND HOOPS shall be in accordance with the notes and details on this drawing. If alternative anchors or hoops are requested, they must be designed and certified by an RPEQ structural engineer and submitted to the Administrator for approval by the Design Engineer.

LIFTING NOTES

L1. Maximum dynamic load factor used for this design is 2.0.
L2. Proprietary lifting anchors shall be a TMR approved product.

H				
G				
F				
E				
D				
C				
B				
A	Issued For Construction			
	Revisions/Descriptions	Name or RPEQ No. Signature	Date	

CAD FILES

BRIDGE DESIGN CRITERIA: DESIGN CODE: AS 5100:2017 DESIGN LOADING: SM1600 and HLP400 DESIGN SPEED: 110 km/h EARTHQUAKE DESIGN CATEGORY: BEDC-2 BARRIER PERFORMANCE LEVEL: Regular BRIDGE TYPE: PSC Deck Units/Insitu Deck

BIS No.

Associated Job Nos | Survey Data: Horiz. Datum GDA94 | Scales: NOT TO SCALE

Auxiliary Drg Nos | Horiz. Grid MGA94 Zone 56 | Height Datum AHD0 | Survey Books

Dimensions shown in millimetres except where shown otherwise

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn | Checked | Designed No. | Verified No.

Design Reviews (RPEQ) No. ..... Date. / /

PSC DECK UNITS – SHEET 1

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	NAME	SIGNATURE	No.	DATE
STRUCTURAL				

Queensland Government

Job No.
Contract No.
Drawing No.
Series Number
BR Drgs

Figure 5.12(h) – Example deck unit with reinforced concrete deck bridge drawings – Sheet 2

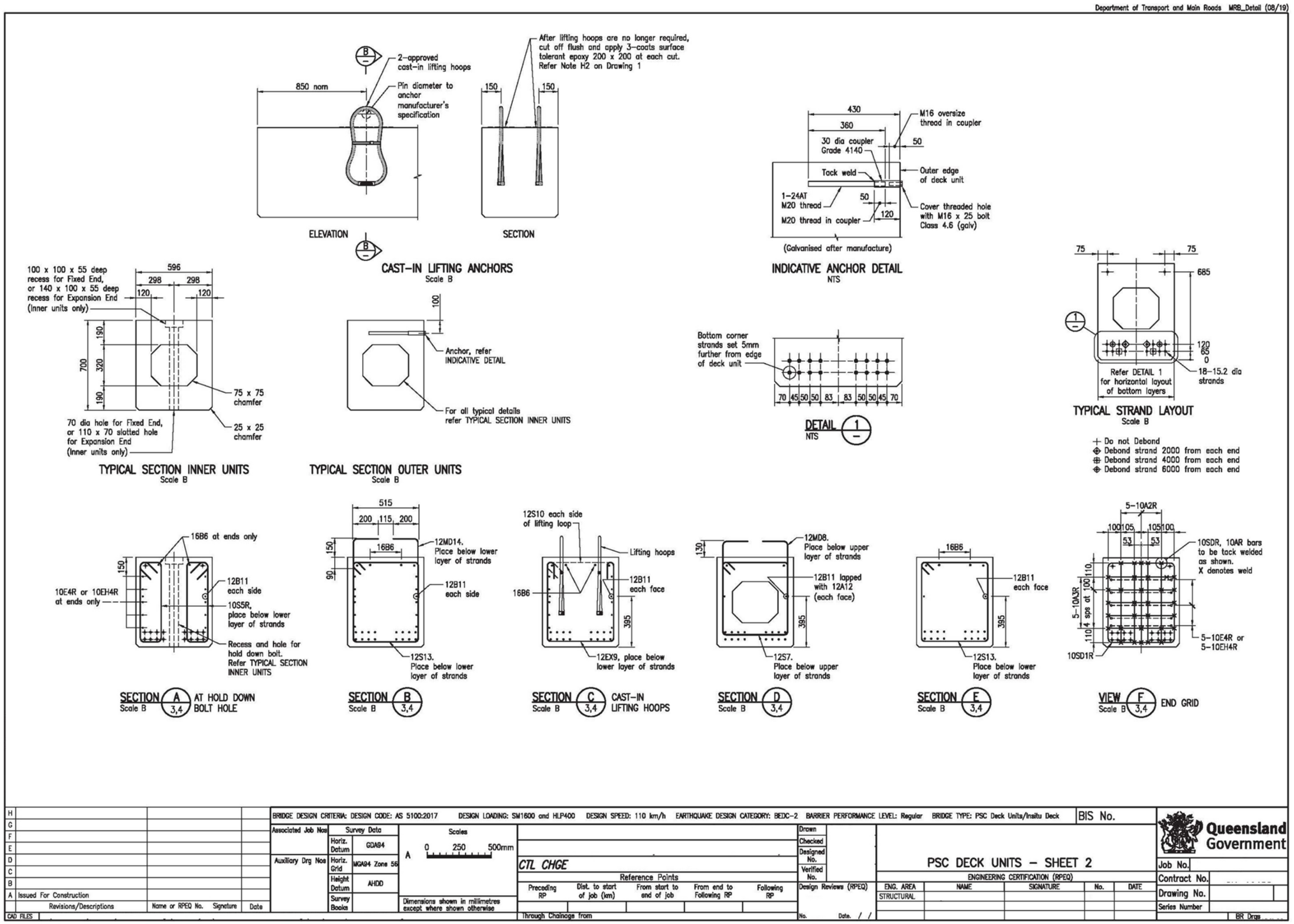


Figure 5.12(i) – Example deck unit with reinforced concrete deck bridge drawings – Sheet 3

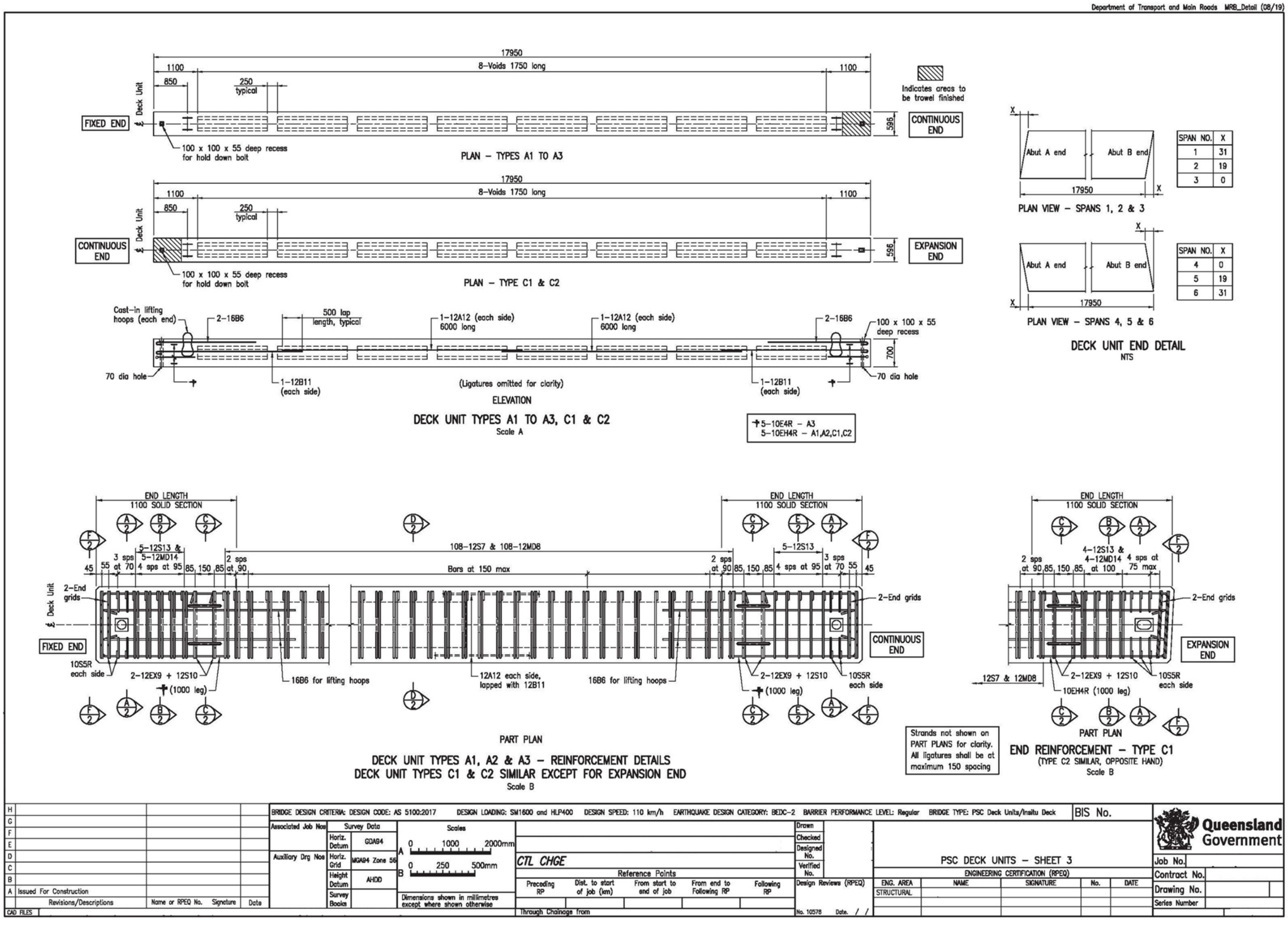


Figure 5.12(j) – Example deck unit with reinforced concrete deck bridge drawings – Sheet 4

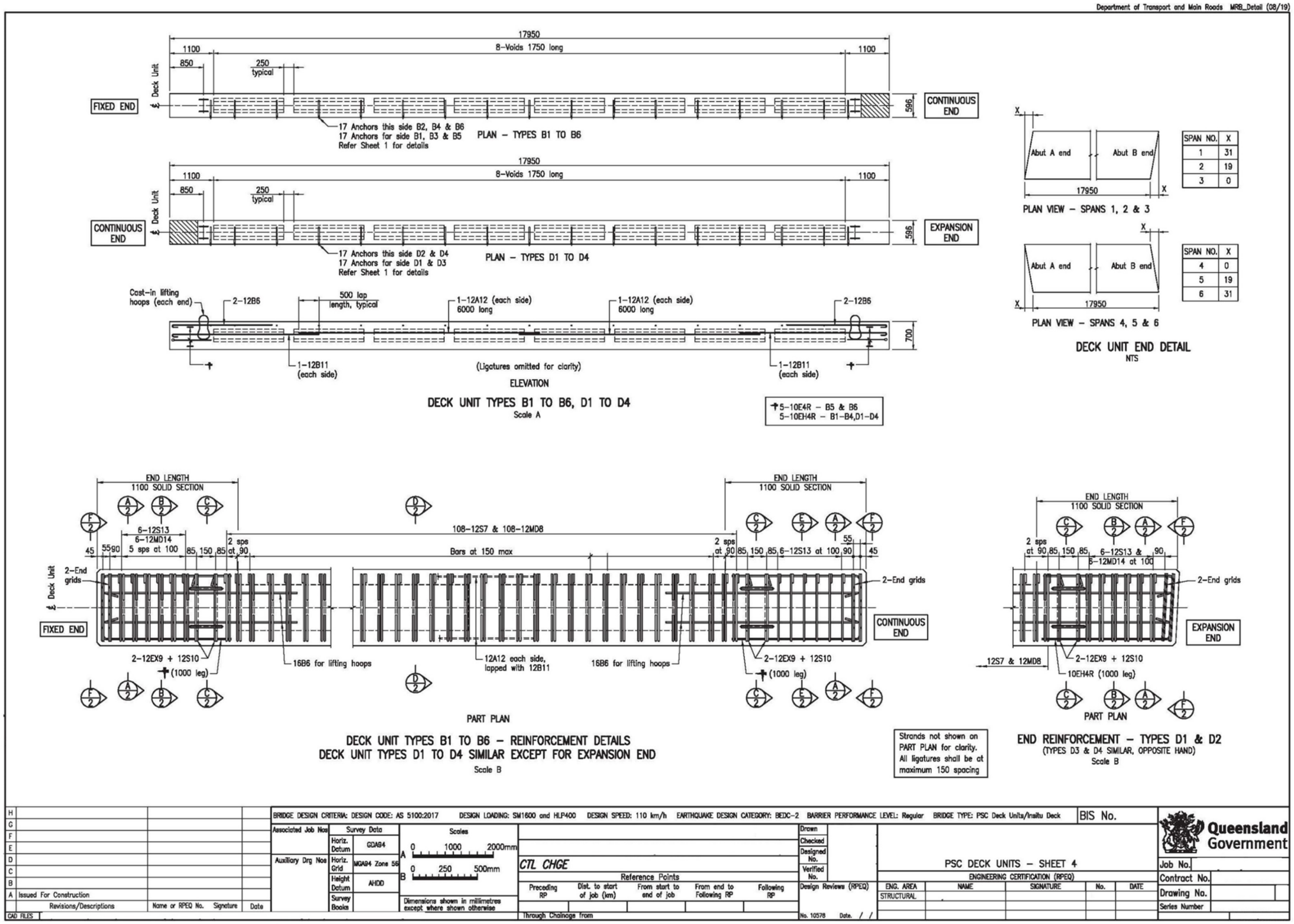


Figure 5.12(k) – Example winged plank bridge drawings – layout and notes

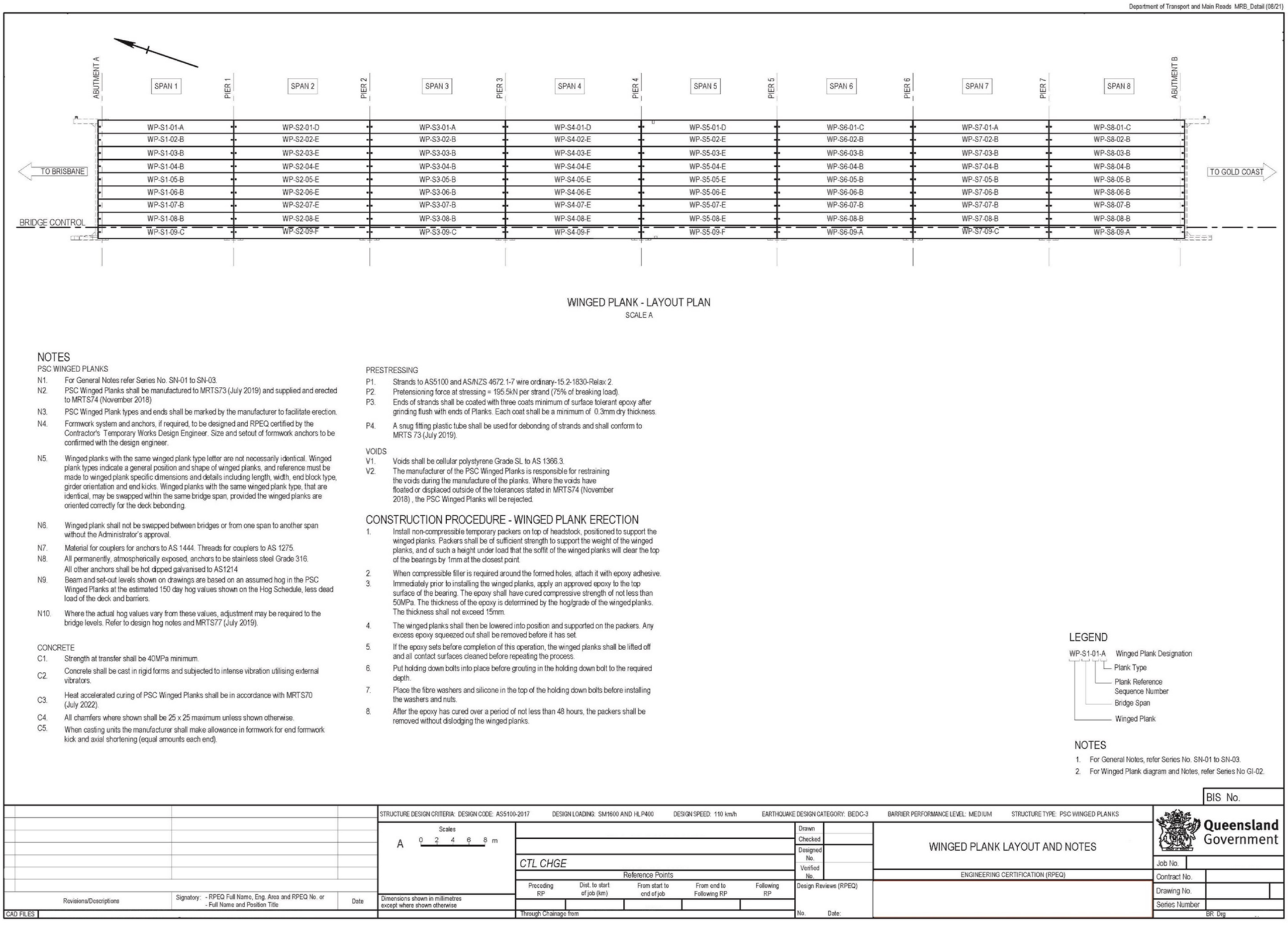
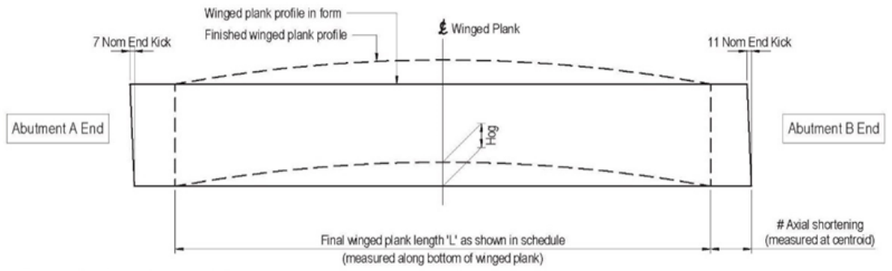


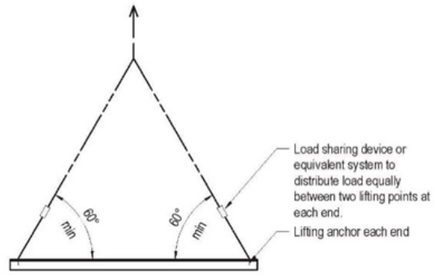
Figure 5.12(l) – Example winged plank bridge drawings – Sheet 1

Department of Transport and Main Roads MRB_Detail (08/21)

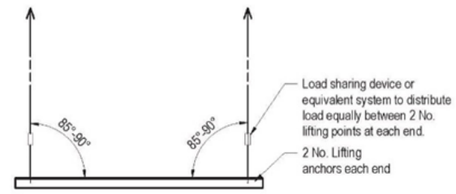


When casting winged plank Precaster is to determine and make allowance in formwork for axial shortening and end kick.

HOG DIAGRAM
NTS



SINGLE CRANE LIFTING DIAGRAM
NTS



DOUBLE CRANE LIFTING DIAGRAM
NTS

PSC WINGED PLANK DESIGN HOGS

D1. To determine the positive limit of hog of the winged plank, the following parameters have been assumed:
   a. Loss due to relaxation at transfer = 5%
   b. The modulus of elasticity of the concrete = 25,600 Mpa

D2. The calculated hog has been determined using the following:
   a. φcc,b = 2.2
   b. Age at loading = 7.0 days*
   c. Location factor = 0.5
   d. Strength factor = 1.0
   The losses due to elastic shortening, creep, shrinkage and development of strength over time have been considered in the hog calculations.
   * The hypothetical age at loading is adjusted to account for steam curing.

D3. The upper bound and lower bound hogs have been determined by varying the elastic modulus at transfer. Median hog is calculated assuming Ec = 32,800 Mpa. Lower bound hog is calculated assuming Ec = 39,360 Mpa.

D4. The positive expected variance in design hog at 150 days has been used to set bridge levels.

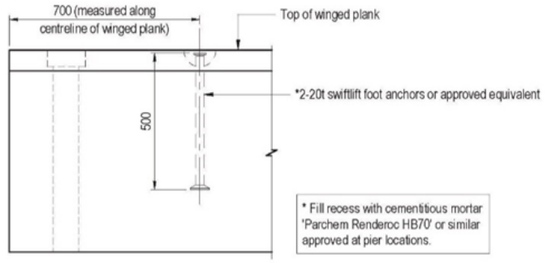
D5. The expected variance in the Design Hog Schedule shall not to be used for the application of acceptance/rejection of winged plank hog in accordance with MRTS73(July 2019). The acceptance/rejection of design hog shall be in accordance with MRTS73(July 2019) and based on the median hog value shown in the Design Hog Schedule.

DESIGN HOG OF PSC GIRDERS

GIRDER ID	HOG (mm) AT				DEFLECTIONS (mm)		RESIDUAL HOG
	TRANSFER	28 DAYS	100 DAYS	150 DAYS	UNDER DECK SLAB	UNDER DWS AND BARRIERS	
Girders 01 -09 (all spans)	25±3	35±5	42±6	44±6	7±2	4±1	33±14

PSC WINGED PLANKS SCHEDULE

LOCATION	BEAM NO.	BEAM LENGTH 'L' (mm)	BEAM MASS (t)
SPAN 1	CG-1-01-A	16940	22.258
	CG-1-02-B TO CG-1-08-B	16940	22.258
	CG-1-09-C	16940	22.258
SPAN 2	CG-2-01-D	16940	22.258
	CG-2-02-E TO CG-2-08-E	16940	22.258
	CG-2-09-F	16940	22.258
SPAN 3	CG-3-01-A	16940	22.258
	CG-3-02-B TO CG-3-08-B	16940	22.258
	CG-3-09-C	16940	22.258
SPAN 4	CG-4-01-D	16940	22.258
	CG-4-02-H TO CG-4-08-E	16940	22.258
	CG-4-09-F	16940	22.258
SPAN 5	CG-5-01-D	16940	22.258
	CG-5-02-E TO CG-5-08-E	16940	22.258
	CG-5-09-F	16940	22.258
SPAN 6	CG-6-01-C	16940	22.258
	CG-6-02-B TO CG-6-08-B	16940	22.258
	CG-6-09-A	16940	22.258
SPAN 7	CG-7-01-A	16940	22.258
	CG-7-02-B TO CG-7-08-B	16940	22.258
	CG-7-09-C	16940	22.258
SPAN 8	CG-8-01-C	16940	22.258
	CG-8-02-B TO CG-8-08-B	16940	22.258
	CG-8-09-A	16940	22.258



LIFTING ANCHOR DETAIL
SCALE A

LIFTING AND HANDLING NOTES

L1. For the calculated mass of each Winged Plank refer to the Winged Plank Schedule. The mass calculation is based on a concrete density of 2700kg/m3. Owing to fabrication methods and tolerances, the mass of the Winged Plank may vary from that noted on the Schedule.

L2. The Manufacturer shall calculate and mark the actual mass of each PSC Winged Plank in accordance with MRTS72 (July 2019).

L3. Lifting anchors shown on plan and elevation are sized for the calculated mass and in accordance with MRTS73 (July 2019) with a dynamic factor of 1.7 based on tracked mobile lifting equipment travelling with the suspended load on a prepared even surface. The Manufacturer may propose alternative lifting devices for consideration.

L4. The Precast Manufacturer shall be responsible for the final design and RPEQ Certification of the lifting device should the Winged Plank mass or lifting mass required to be increased during the manufacturing process. The final RPEQ Certification for lifting device shall be sent to the Design Engineer for review prior to manufacturing the Winged Planks.

L5. During storage, transport and handling, the PSC Winged Planks shall be kept in an upright position and supported no more than 700mm from each end. The Contractor shall be responsible for ensuring the stability of PSC Winged Planks during storage, transport, handling and erection.

L6. PSC Winged Planks shall be lifted by the lifting anchors noted, provided the angle between the sling and the centreline of the PSC Winged Plank is not less than 60°.

L7. PSC Winged Planks to be supplied and installed in accordance with MRTS74 (July 2018) .

L8. PSC Winged Planks shall be braced for stability in accordance with the Contractor's Temporary Works design details. Planks shall be braced, as necessary, to ensure horizontal and rotational restraint prior to and during casting and installation of the composite deck slab. The design of the bracing/restraint system shall include provision for direct and eccentric load effects from any attached walkways, safety rails or formwork systems. The Temporary Works design shall be undertaken, by an RPEQ Temporary Work Engineer, to suit the Contractor's Safe Work Method Statement and shall be submitted to the Design Engineer, for review and approval at least 21 days prior to casting of Winged Plank.

BIS No.

STRUCTURE DESIGN CRITERIA: DESIGN CODE: AS5100-2017 DESIGN LOADING: SM1600 AND HLP400 DESIGN SPEED: 110 km/h EARTHQUAKE DESIGN CATEGORY: BEDC-3 BARRIER PERFORMANCE LEVEL: MEDIUM STRUCTURE TYPE: PSC WINGED PLANKS

Scales
A 0 100 200 300 400mm

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to Following RP	Following RP

Through Chainage from

Drawn
Checked
Designed
No.
Verified
No.

Design Reviews (RPEQ)
No. Date:

WINGED PLANK DETAILS
SHEET 1
ENGINEERING CERTIFICATION (RPEQ)

Queensland Government

Job No.
Contract No.
Drawing No.
Series Number

Revisions/Descriptions	Signatory: - RPEQ Full Name, Eng. Area and RPEQ No. or - Full Name and Position Title	Date

Dimensions shown in millimetres except where shown otherwise

CAD FILES

Figure 5.12(m) – Example winged plank bridge drawings – Sheet 2

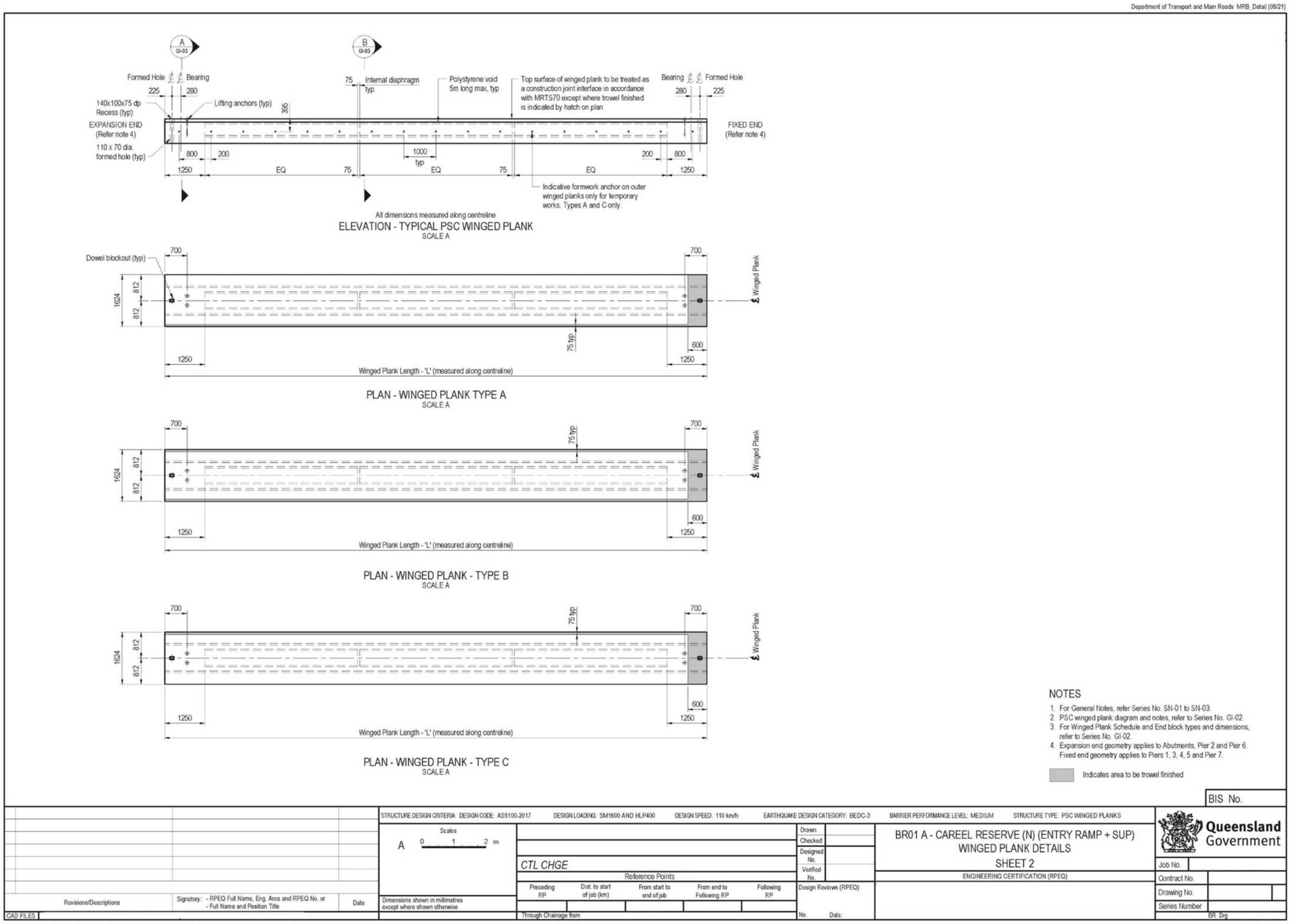


Figure 5.12(n) – Example winged plank bridge drawings – Sheet 4

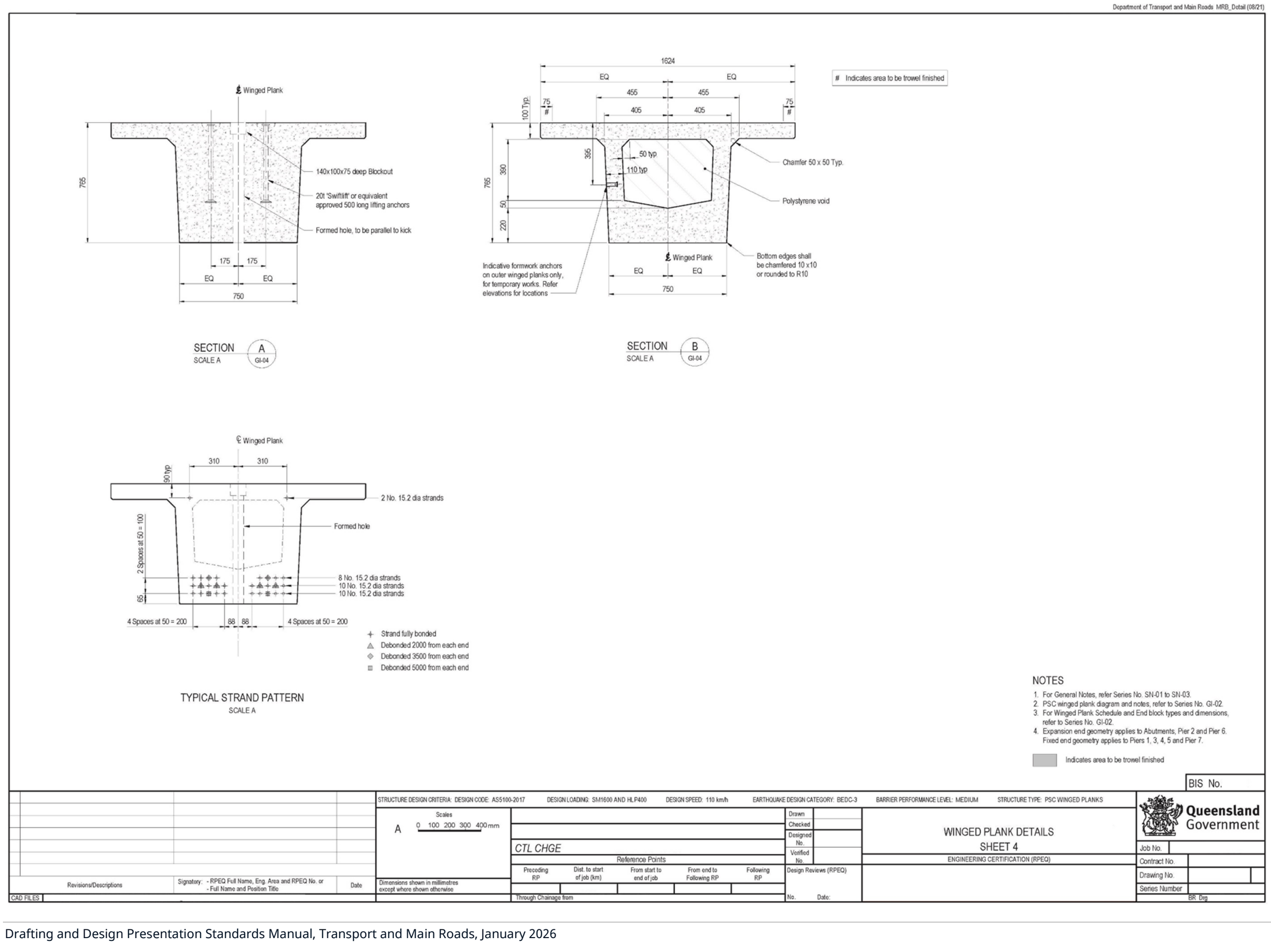


Figure 5.12(o) – Example winged plank bridge drawings – Sheet 5

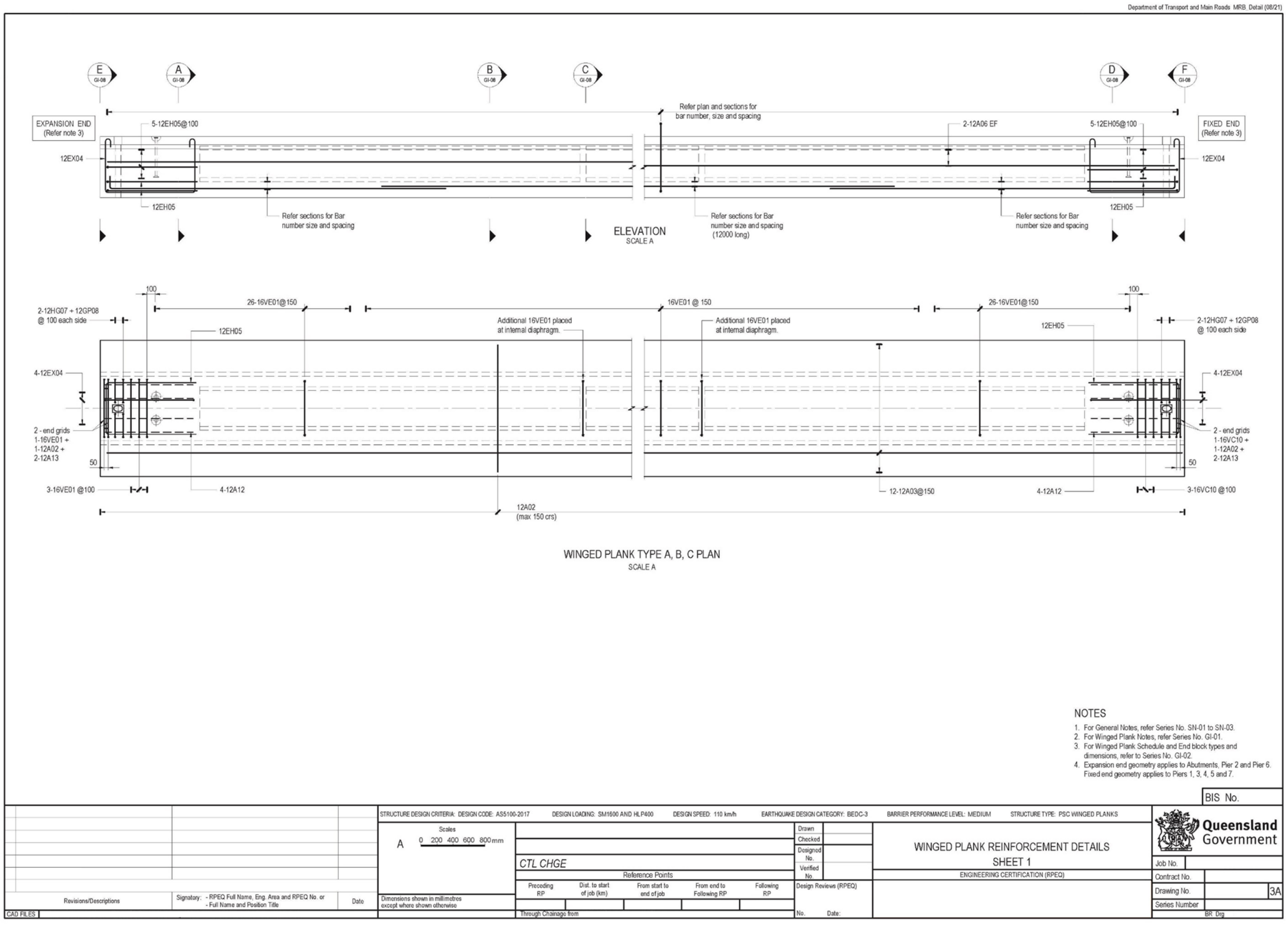


Figure 5.12(p) – Example winged plank bridge drawings – Sheet 6

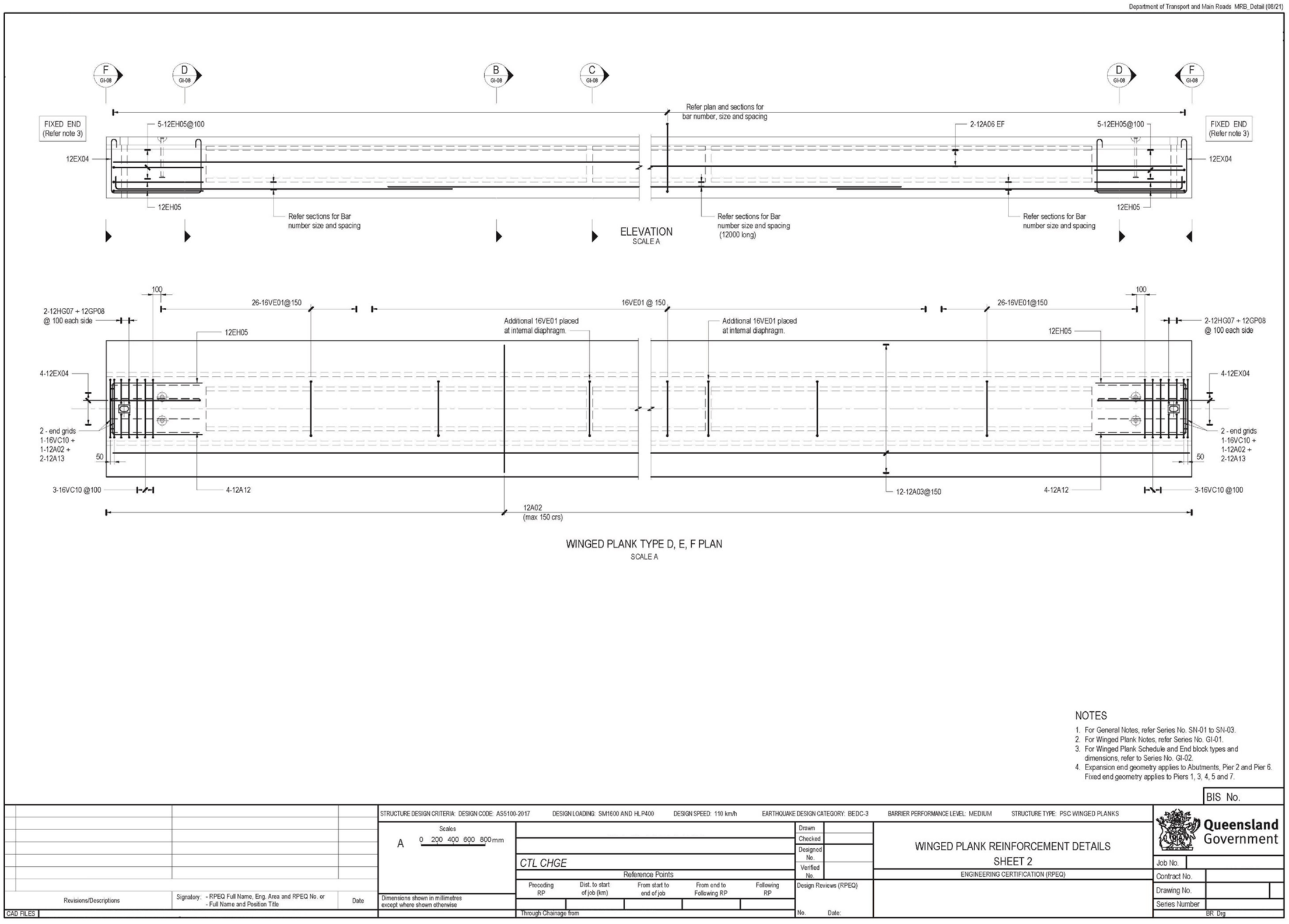
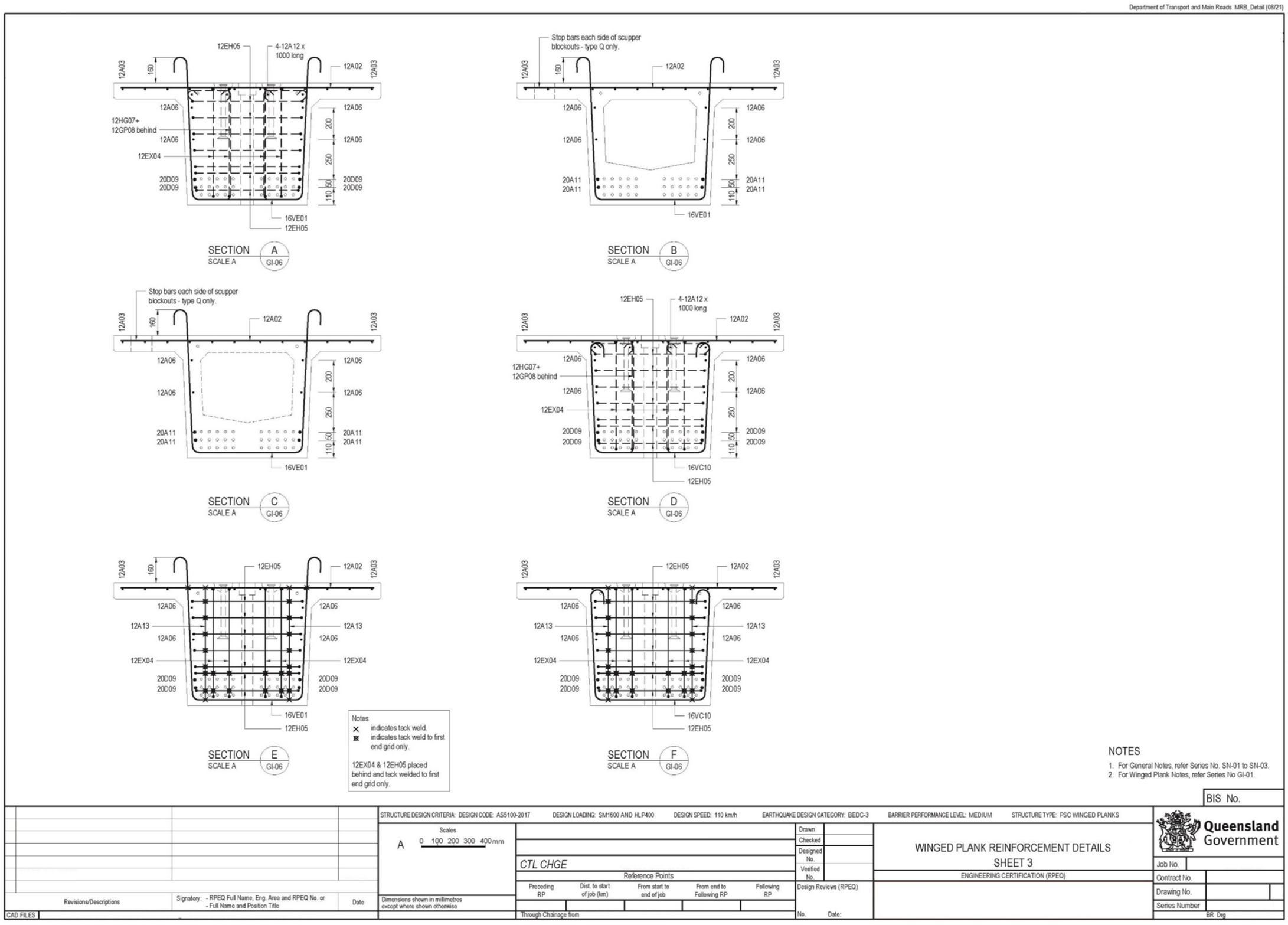


Figure 5.12(q) – Example winged plank bridge drawings – Sheet 7



5.13 Super-T girders

All Super-T girder bridges are designed to support a cast-insitu concrete deck.

The set of drawings for Super-T girder bridges with skews ≤ 30° and simple bridge geometry can closely follow the published Standard Drawing, and additional guidance set out in this volume.

Super-T girders shall be detailed in accordance with Section 4.9.4 of the DCBoS, and any future published Standard Drawings.

5.13.1 Super-T girder schedules

Super-T girders can be more complicated than other girders and require more information to be shown in the schedule. Super-T girder schedules shall show as a minimum:

- girder type
- girder length
- end block length
- void arrangement
- flange widths
- end skew dimensions (if applicable)
- denotation of scupper voids
- denotation of hanger holes
- end block types
- number of girders, and
- mass of girder (tonnes approximate).

5.13.2 Super-T girder flange widths

Whenever possible, the flanges on outer girders are to be made the same width as those on the internal girders to keep the number of girder types to a minimum. On bridges with a horizontal curve, the outer flange of the outer girders should be curved to match the road alignment. When setting out the bridge, the drafter shall ensure that the flanges are wide enough to fit holes for formwork anchors and drainage scuppers.

5.13.3 Super-T girder voids

Voids shall be made from standard 5 m and 2.5 m long forms. Voids are separated longitudinally by a diaphragm of concrete 150 mm wide containing one set of steel reinforcement. The length of the solid end blocks at the ends of the girder are measured along the girder centreline. In general, the minimum length of the solid end block shall not be less than the girder depth (refer to Section 4.9.4.3 of the DCBoS for acceptable section dimensions and void arrangements).

5.13.4 Super-T girder void drainage

Drain holes are required between the voids and in the end blocks to drain the voids prior to deck casting.

If the bridge is subject to flooding, large diameter drain holes, size and spacing as specified by the bridge engineer may be required at the base and top of the voids to allow the voids to fill with water as a way of preventing the bridge from potential floatation.

5.13.5 Bearing restraint plates

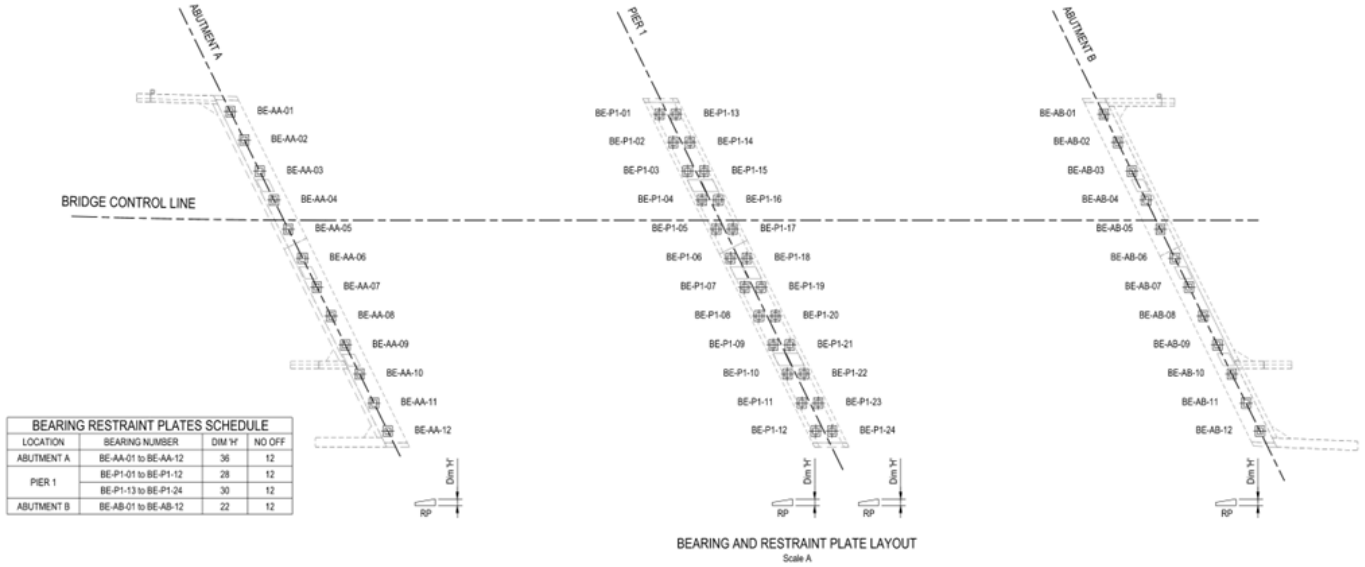
Girders supported on elastomeric or pot bearings require a bearing restraint plate above each bearing to stop the bearing moving from its designed position. Because the vertical load from the girder is required to be applied evenly across the bearing, the plate is tapered to nullify the effect of the girder hogging.

Standard details for restraint of elastomeric bearings, in accordance with Section 4.8.6 of the DCBoS, will be provided in a new departmental PSC girder Standard Drawing.

Plates cast in or welded to girders, for example, the top attachment plate, shall be the only plates shown on the girder fabrication drawings. All other plate details associated with the bearing shall not be shown on those girder drawings because the casting yard fabricating the girders would not be fabricating the steelwork. Rather, the details shall be shown on the bridge bearing drawing series (refer to Table 8 in Chapter 2 of this volume for series numbers).

If a bridge has different types or dimensions of plates, a layout diagram is required to show the orientation of the plates (refer to Figure 5.13.5).

Figure 5.13.5 – Layout diagram for bearing restraint plates



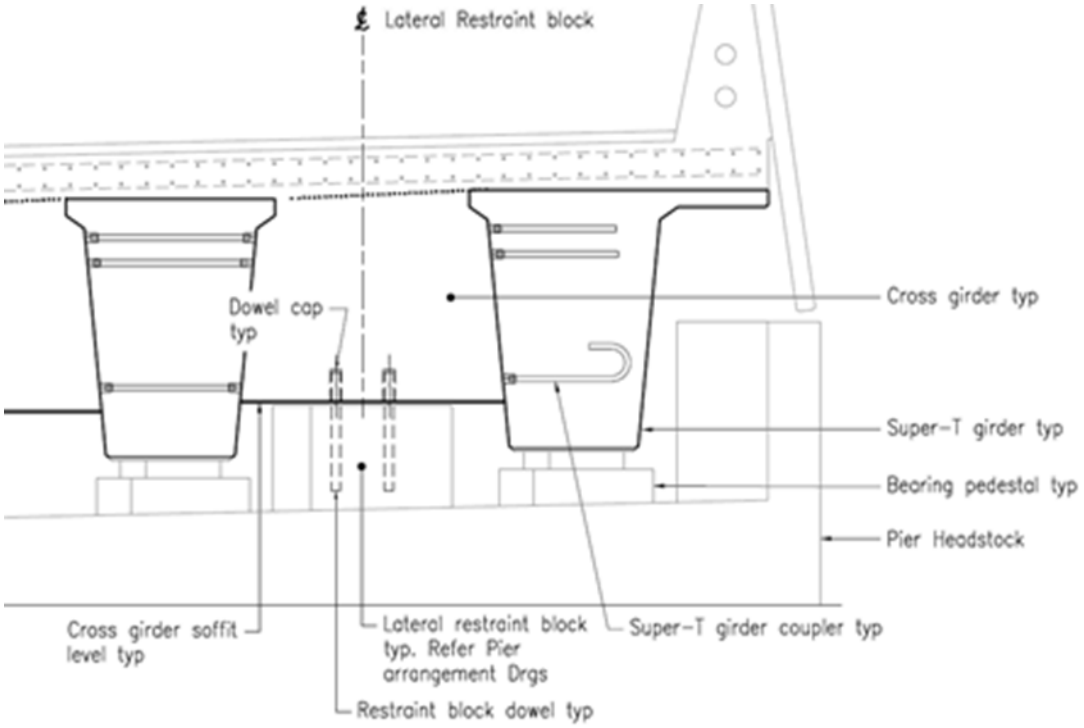
5.13.6 Restraint blocks

Where restraint blocks are used, the number and sizes of dowels and restraint blocks are to be determined by the designer to accommodate the required loads. Typically, it is expected that cross-girders will be deeper than the restraint blocks and dowels will be cast into the restraint blocks deeper than they project into the cross-girders, as shown in Figure 5.13.6 below.

Sufficient details are to be shown for orientation, sizing, reinforcing, dowel caps, dowels, locations, and correct installation dimensions and orientation.

Restraint blocks are to be supplied on both ends of each span so that the deck infill pour is not engaged to carry larger loads than otherwise required.

Figure 5.13.6 – Typical restraint block



5.13.7 Cross-girders

All Super-T girder bridges require cross-girders cast at the ends of each span to strengthen the structure and provide lateral / torsional resistance to the girders. They also stabilise girders during deck casting and curing and facilitate jacking during maintenance.

Cross-girders shall be documented in the deck drawings. Cross-girder dimensions and reinforcement are project-specific, dependent on span and girder width.

The couplers for the cross-girder starter bars shall be detailed in the girder drawings.

To reduce reinforcement congestion and improve bearing access, a narrower and higher cross-girder than typical maybe used, along with an increase in height of the bearing pedestal.

At fixed and expansion joints, cross-girder reinforcement bonds into the concrete deck. At continuous deck joints the cross-girder reinforcement cannot do this as the deck is de-bonded with sheets of approved polyethylene. Refer to Figure 5.13.7(a) for typical cross-girder design, and Figure 5.13.7(b) for alternate designs, where girder ends may be cut out to simplify reinforcement.

For bridges subject to flooding, air escape holes shall be cast into the cross-girders to reduce air entrapment and uplift as floodwaters rise.

Figure 5.13.7(a) – Example cross-girder design at abutment

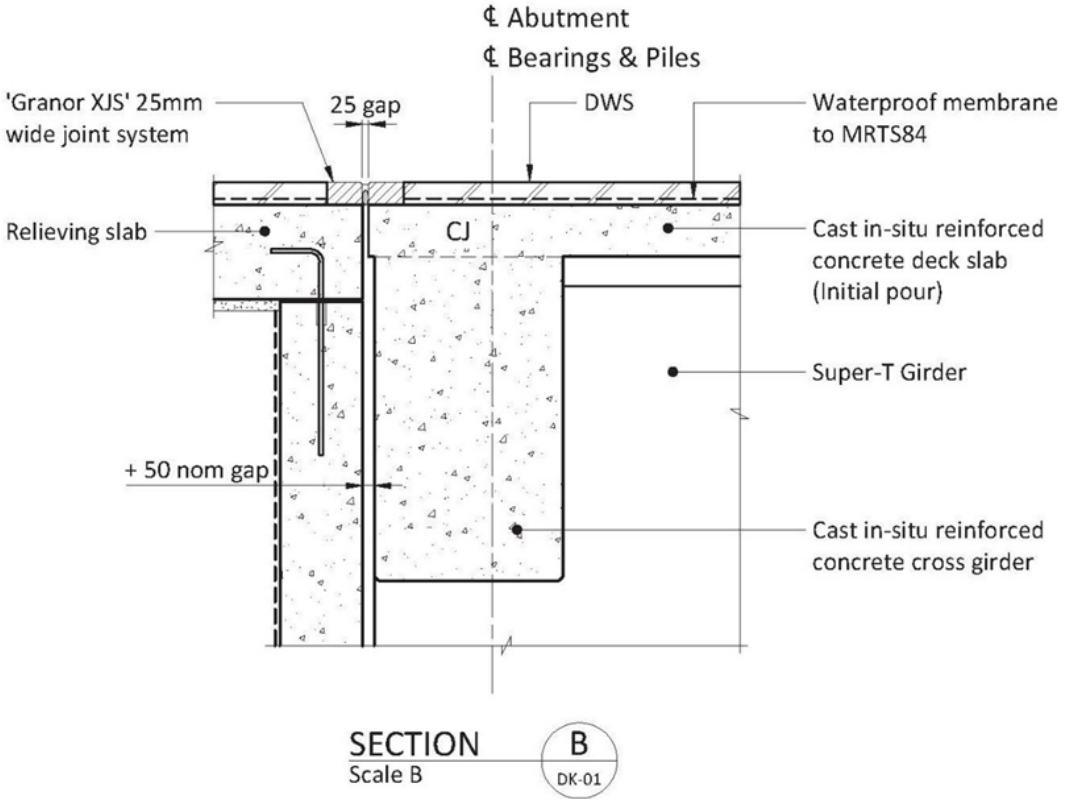


Figure 5.13.7(b) – Example cross-girder design at continuous joint at pier

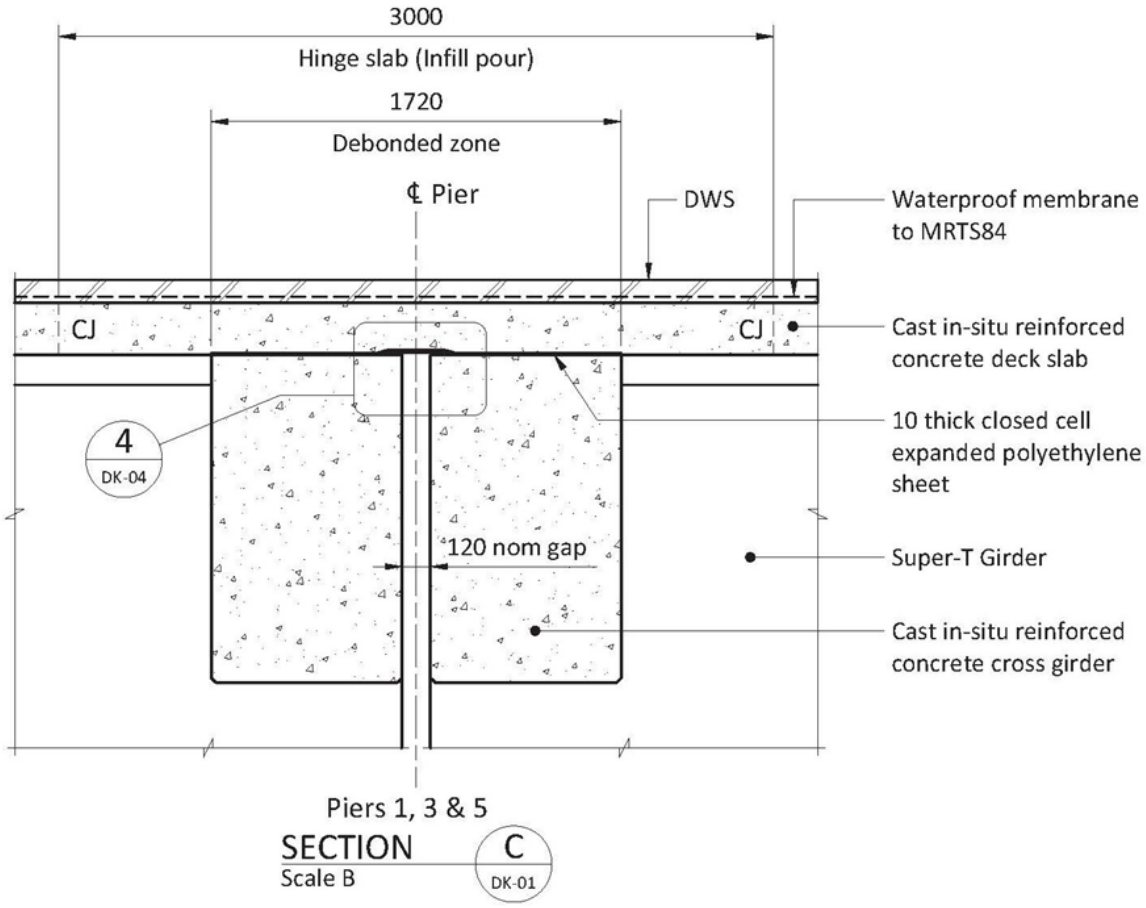
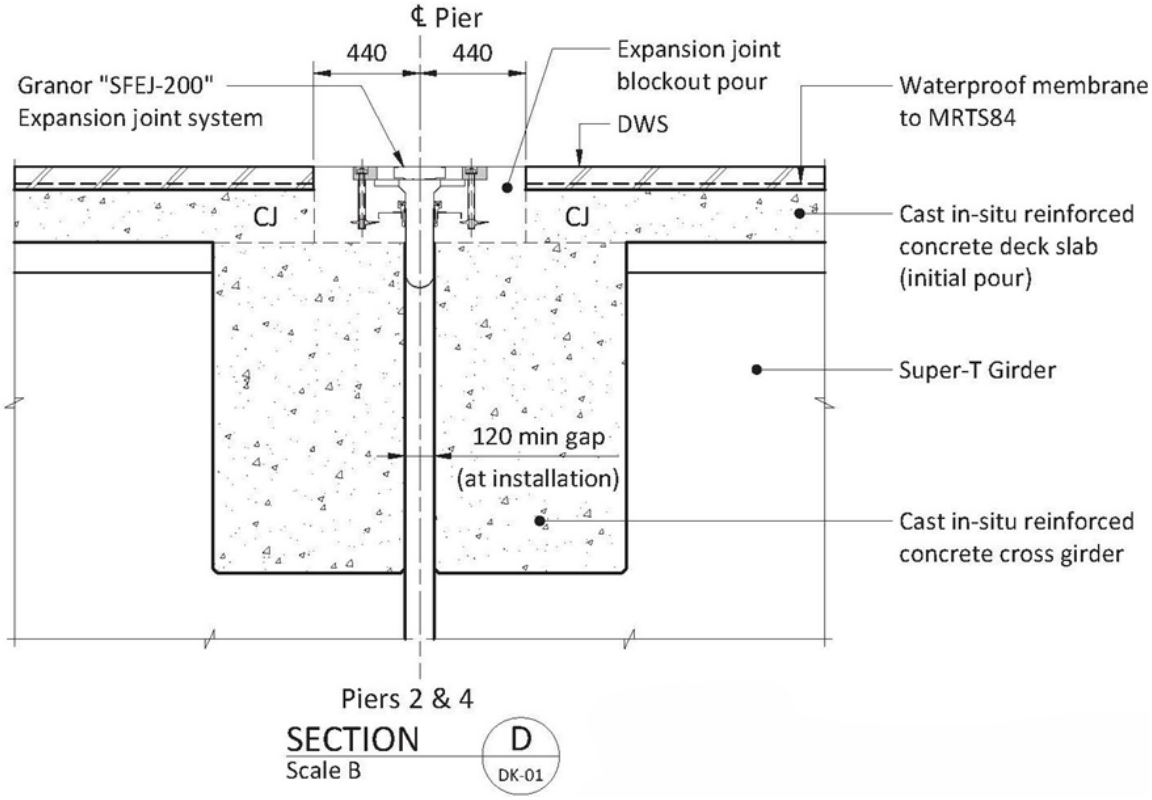


Figure 5.13.7(c) – Example cross-girder design at continuous joint at pier



5.14 Girder schedules

All girders require a schedule to be shown in the bridge girder drawings. The following section will outline the minimum requirements for PSC and steel girders.

For girder mass calculations, the specific density in tonnes per cubic meter (t/m³) shall be used, with value determined by the design engineer.

5.15 Typical content required on the Super-T girder drawings

Table 1.5.15 provides the minimum drawing content that should be presented on the set of project-specific drawings for superstructure elements listed above, along with typical drawing elements, such as schedules, and each is cross-referenced to the figures extracted from the example drawings.

Where the drawing for the element forms a sub-set to be given to a sub-contractor, the set shall show all those details and notes specific to that element or activity, so that the sub-contractor has a full appreciation of the contract requirements.

Figure 5.15(a) to Figure 5.15(l) are example drawings.

Table 5.15 – Super-T girders – project-specific drawings content

Requirement	Drawing or element description	Figure reference
General Arrangement	Typical section through the deck, labelling all features.	Figure 3.4(f)
Notes	Notes to suit the superstructure element, along with lifting and handling notes, as per the published Standard Drawing.	Figure 5.15(a)
Layout diagram	A diagram that depicts the arrangement of the girders, with the designation for each unique type. showing skew to ends, centrelines of abutments and piers, and of the bridge control.	Figure 5.15(a)
Schedule	A table to show the following for each girder: • girder type • girder length • end block length • void arrangement • flange widths • end skew dimensions (if applicable) • denotation of scupper voids • denotation of hanger holes • end block types • number of girders, and • mass of girder (tonnes approximate).	Figure 5.15(b)
Hog schedule	A table to show the design hog for girders at: • transfer • 30 days • 60 days, and • 100 days.	Figure 5.15(b)
Formwork kick or hog diagram	A diagram that depicts design hog and end incline values for finished PSC girders.	Figure 5.15(b)
Lifting diagrams	Diagrams to show precast yard and on-site lifting arrangements.	Figure 5.15(b)

Requirement	Drawing or element description	Figure reference
Concrete profiles and reinforcement details	Plan, elevation and sections for each type of girder. The shared notes, sections and details, including restraint details, grouped together within the set, and notes and details specific to each type on separate drawings within the set.	Figure 1.5.15(c) to Figure 1.5.15(l)
Cross-girders	Elevation and sections showing the reinforcing.	Figure 1.6.13.9(j) Figure 1.6.13.9 (k)

Figure 5.15(a) – Example restraint plate and bearing assembly details for Super-T girder bridge drawings – Sheet 1

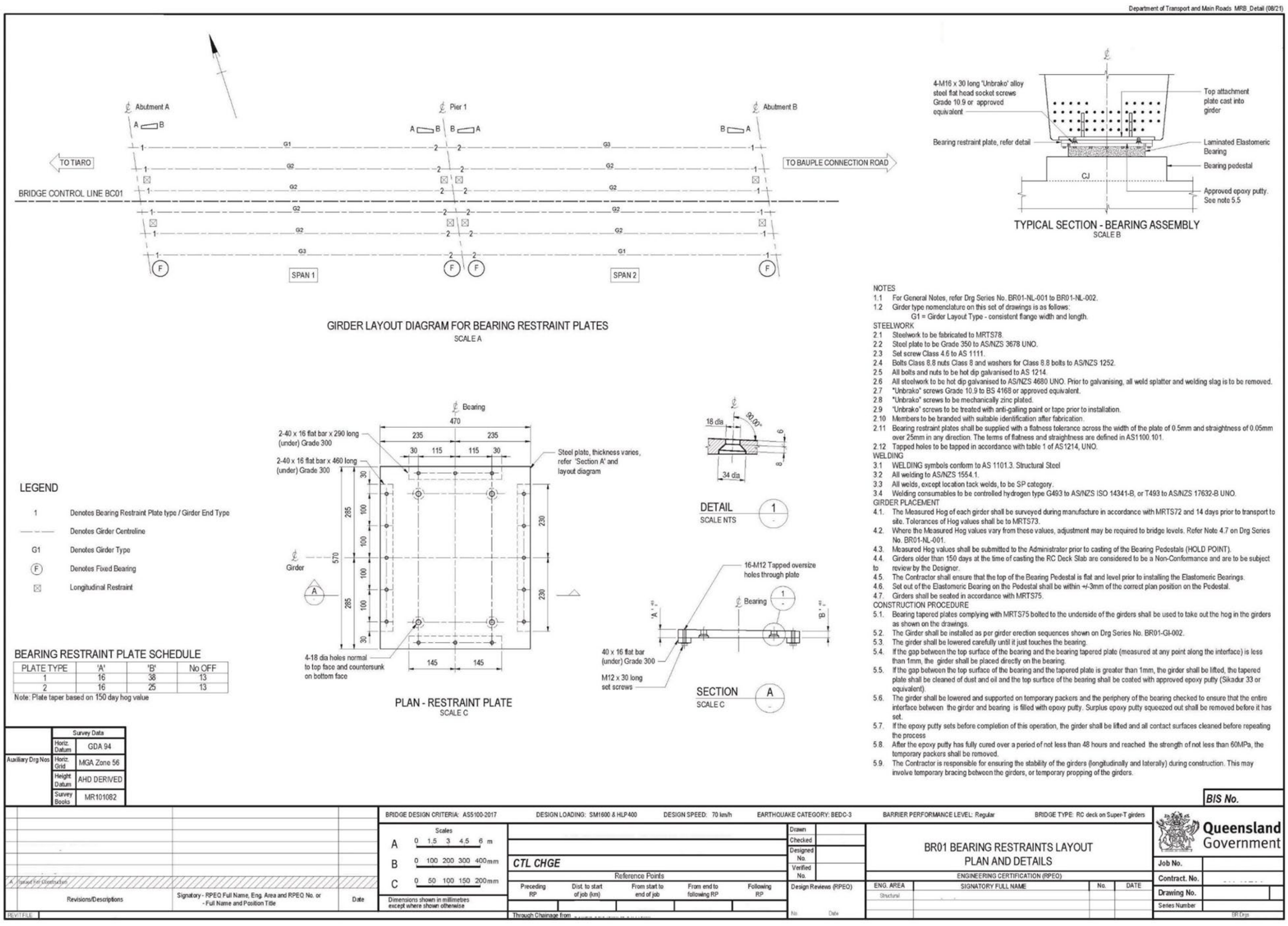
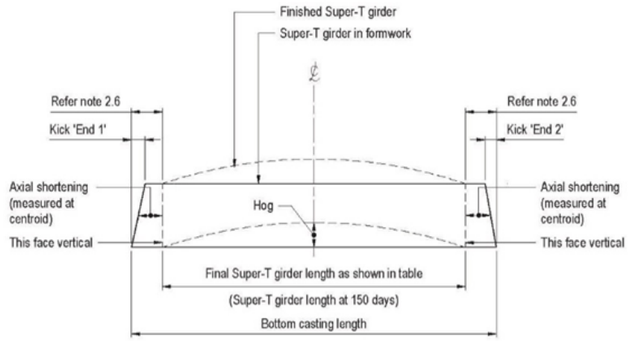
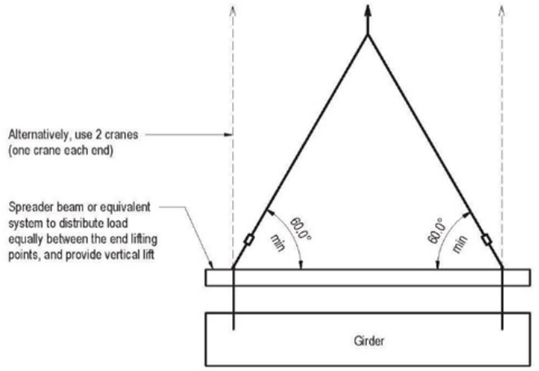


Figure 5.15(b) – Example notes, details and schedules for Super-T girder bridge drawings – Sheet 2

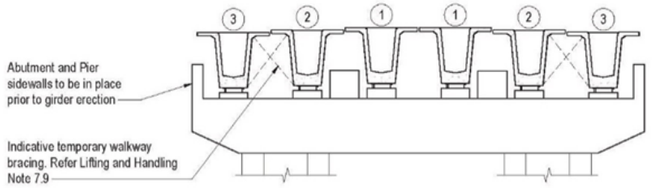
Department of Transport and Main Roads MRB_Detail (08/21)



ELEVATION
FORMWORK KICK OVER DIAGRAM
NTS
* Refer to Design Kick table for girder end location



VERTICAL LIFTING DIAGRAM
NTS



GIRDER ERECTION SEQUENCE
SCALE A

(1) Denotes order of girder erection. The Contractor may submit an alternative girder installation sequence for approval.

The Contractor is to submit an installation procedure to the Administrator with regard to ensuring the stability of the Super-T girder during construction in accordance with MRTS75 Clause 7.1.

NOTES
1.1 For General Notes, refer Drg Series No. BR01-NL-001 and BR01-NL-002.
1.2 For Girder Layout Plan, refer Drg Series No. BR01-GI-001.
1.3 Girders to be manufactured to MRTS73.

CONCRETE
2.1 Concrete shall be class S50/20 and conform to MRTS70.
2.2 Strength at transfer shall be 40MPa minimum.
2.3 Exposure classification B2.
2.4 Concrete shall be cast in rigid forms and subjected to intense vibration utilising external vibrators.
2.5 Top surface of all girders and where cross girders located to be treated as CJ to MRTS70 UNO.
2.6 When casting girders the Manufacturer shall make allowance in formwork for axial shortening (equal amounts each end) as determined by Manufacturer and formwork kick "End 1" and "End 2".

REINFORCING STEEL
3.1 Reinforcing steel shall be read in conjunction with MRSD1043.
3.2 Reinforcing steel shall be in accordance with AS/NZS 4671 and MRTS71.
3.3 Deformed bars Grade D500N. Round bars Grade R250N.
3.4 Minimum cover to reinforcing steel and strands shall be 40mm UNO.
3.5 All reinforcing steel shall be Australian Certification Authority for Reinforcing Steel (ACRS) and registered to MRTS71.
3.6 Welding consumables shall be B-G49X or B-T49X to AS/NZS ISO 17632 or AS/NZS 14341.

STRANDS
4.1 Strands shall be to AS/NZS 4672.1-7 wire ordinary-15.2-1830-Relax 2 and testing requirement to AS/NZS 4672.2.
4.2 For strands construction requirements refer to MRTS73.
4.3 Pretensioning force at stressing = 196kN per strand.
4.4 Ends of strands shall be coated with three coats minimum of surface tolerant epoxy after grinding flush with ends of girders. Each coat shall be a minimum of 0.3mm dry thickness.
4.5 A snug fitting plastic tube shall be used for debonding of strands.
4.6 This snug fitting tube shall be fastened to the strand in such a manner that the efficiency of the bond-break shall not be impaired by the entry of cement mortar, and such that it shall not move along the strand during placement of concrete.

COUPLERS
5.1 Couplers shall be a Proprietary Cast-in item to MRTS72.
5.2 Couplers shall be exposed prior to delivery on site.

VOIDS
6.1 Alternative void arrangements to those shown in the drawings may be submitted to the Administrator for approval in accordance with MRTS73. Minimum end block length of 2.05m is required.

LIFTING & HANDLING
7.1. Refer to the Girder Schedule for the calculated mass of each girder. The mass calculation is based on a concrete density of 2700kg/m3. Owing to fabrication methods and tolerances, the mass of the girder may vary from that noted on the Schedule.
7.2. The Manufacturer shall verify the actual mass of each girder.
7.3. Lifting loops shown on plan and elevation are sized for the calculated mass and in accordance with MRTS73 with a dynamic factor of 1.7. The Manufacturer may propose alternative lifting devices to the Administrator for consideration.
7.4. The precast Manufacturer shall be responsible for the final design and RPEQ Certification of the lifting device should the girder mass or lifting mass required to be increased during the manufacturing process.
7.5. Storage, transport and handling the girders shall comply with MRTS75.
7.6. Girders shall be kept in an upright position and supported no more than 600mm from each end.
7.7. The Contractor shall be responsible for the stability of the girder during storage, transport, handling and erection.
7.8. Girders shall be braced for stability in accordance with the Contractor's Temporary Works design details. Girders shall be braced, as necessary, to ensure horizontal and rotational restraint prior to and during casting and installation of the composite deck slab. The design of the bracing/restraint system shall include provision for direct and eccentric load effects from any attached walkways, safety rails or formwork systems. The Temporary Works design shall be undertaken, by an RPEQ Temporary Works Engineer, to suit the Contractor's Safe Work Method Statement and shall be submitted to the Administrator, for review and approval at least 21 days prior to deck unit erection.
7.9. Indicative walkway bracing shown should be provided such that the torsional capacity of the precast section is not exceeded.
7.10. Girders shall be lifted by means of lifting loops only.
7.11. Formwork Anchors and holes for transport tie-down, if required, to be confirmed by the Contractor's Temporary Works Designer. Size and setout to be confirmed with the Administrator.

GIRDER SCHEDULE

GIRDER DESIGN TYPE	GIRDER DEPTH	GIRDER LENGTH 'L'	GIRDER WIDTH 'W'	No. OFF 5000 LONG VOIDS	No. OFF 2500 LONG VOIDS	No. OFF	MASS EACH (tonne)	END BLOCK TYPE	
								ABUTMENT END	PIER END
Type G1	1525	29900	1985	5	0	2	64	A	D
Type G2	1525	29900	1985	5	0	8	64	B	E
Type G3	1525	29900	1985	5	0	2	64	C	F

DESIGN HOG

GIRDER DESIGN TYPE	TRANSFER (mm)	30 DAYS (mm)	100 DAYS (mm)	150 DAYS (mm)
Type G1, G2 and G3	49	77	93	97

DESIGN KICK

GIRDER DESIGN TYPE	KICK 'End 1' (mm)				KICK 'End 2' (mm)			
	TRANSFER	30 DAYS	100 DAYS	150 DAYS	TRANSFER	30 DAYS	100 DAYS	150 DAYS
G1, G2 & G3	18	25	29	30	6	12	16	17

	Survey Data	
Auxiliary Drg Nos	Horiz. Datum	GDA 94
	Horiz. Grid	MGA Zone 56
	Height Datum	AHD DERIVED
	Survey Books	MR101082

BIS No.

BRIDGE DESIGN CRITERIA: AS5100-2017 DESIGN LOADING: SM1600 & HLP400 DESIGN SPEED: 70 km/h EARTHQUAKE CATEGORY: BEDC-3 BARRIER PERFORMANCE LEVEL: Regular BRIDGE TYPE: RC deck on Super-T girders

Scales
A 0 0,8 1,5 2,3 3 m

Dimensions shown in millimetres except where shown otherwise

CTL CHGE

Reference Points

Preceding RP	Dist. to start of job (km)	From start to end of job	From end to following RP	Following RP

Through Chainage from

Drawn
Checked
Designed No.
Verified No.

Design Reviews (RPEQ)
No. Date

BR01 SUPER-T GIRDERS
NOTES AND TYPICAL DETAILS

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	SIGNATORY FULL NAME	No.	DATE
Structural			

Queensland Government

Job No.
Contract. No.
Drawing No.
Series Number

Revisions/Descriptions	Signatory - RPEQ Full Name, Eng. Area and RPEQ No. or - Full Name and Position Title	Date
A Issued For Construction		

REVIT FILE

Figure 5.15(c) – Example Super-T girder bridge drawings – Sheet 3

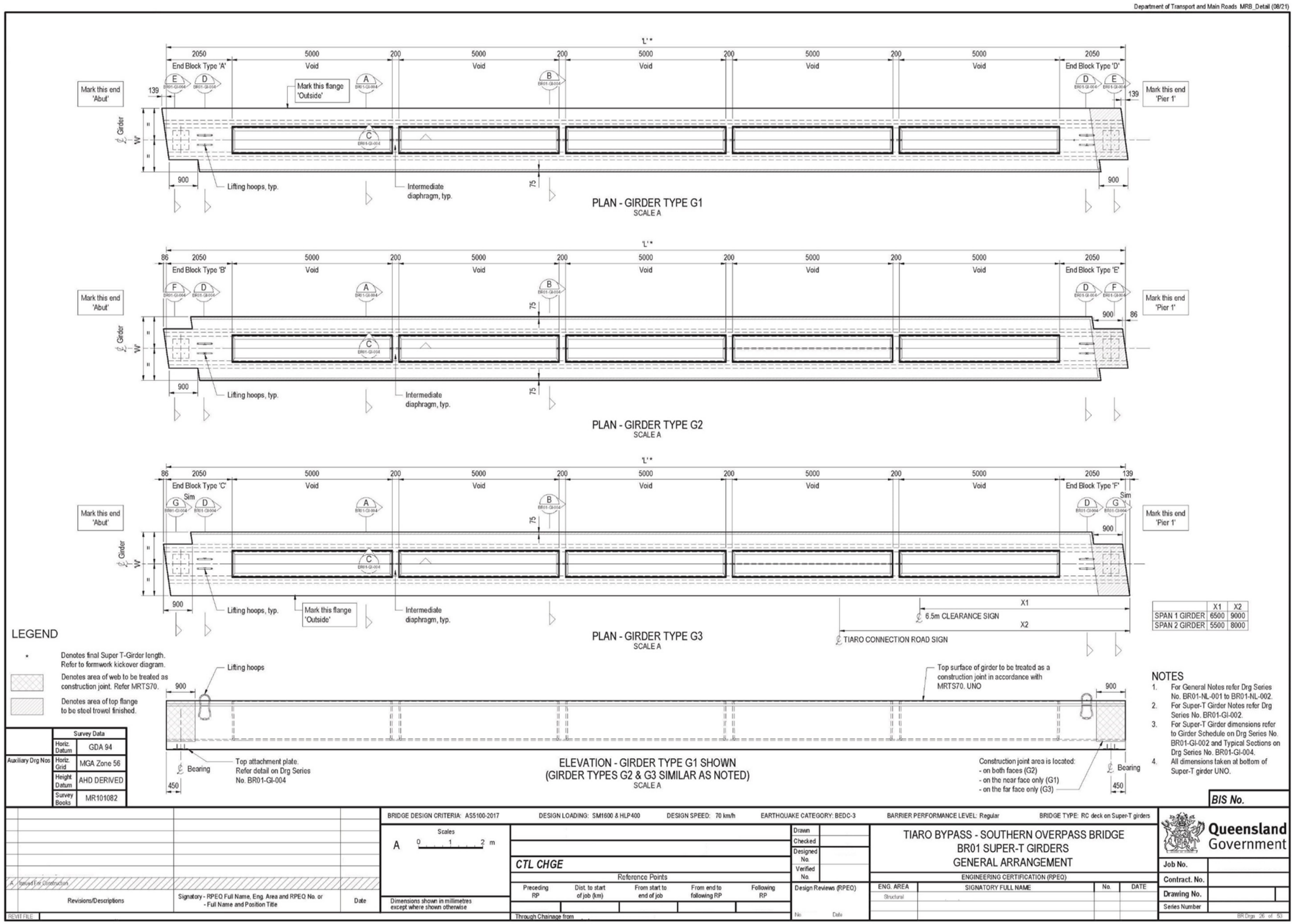


Figure 5.15(d) – Example Super-T girder bridge drawings – Sheet 4

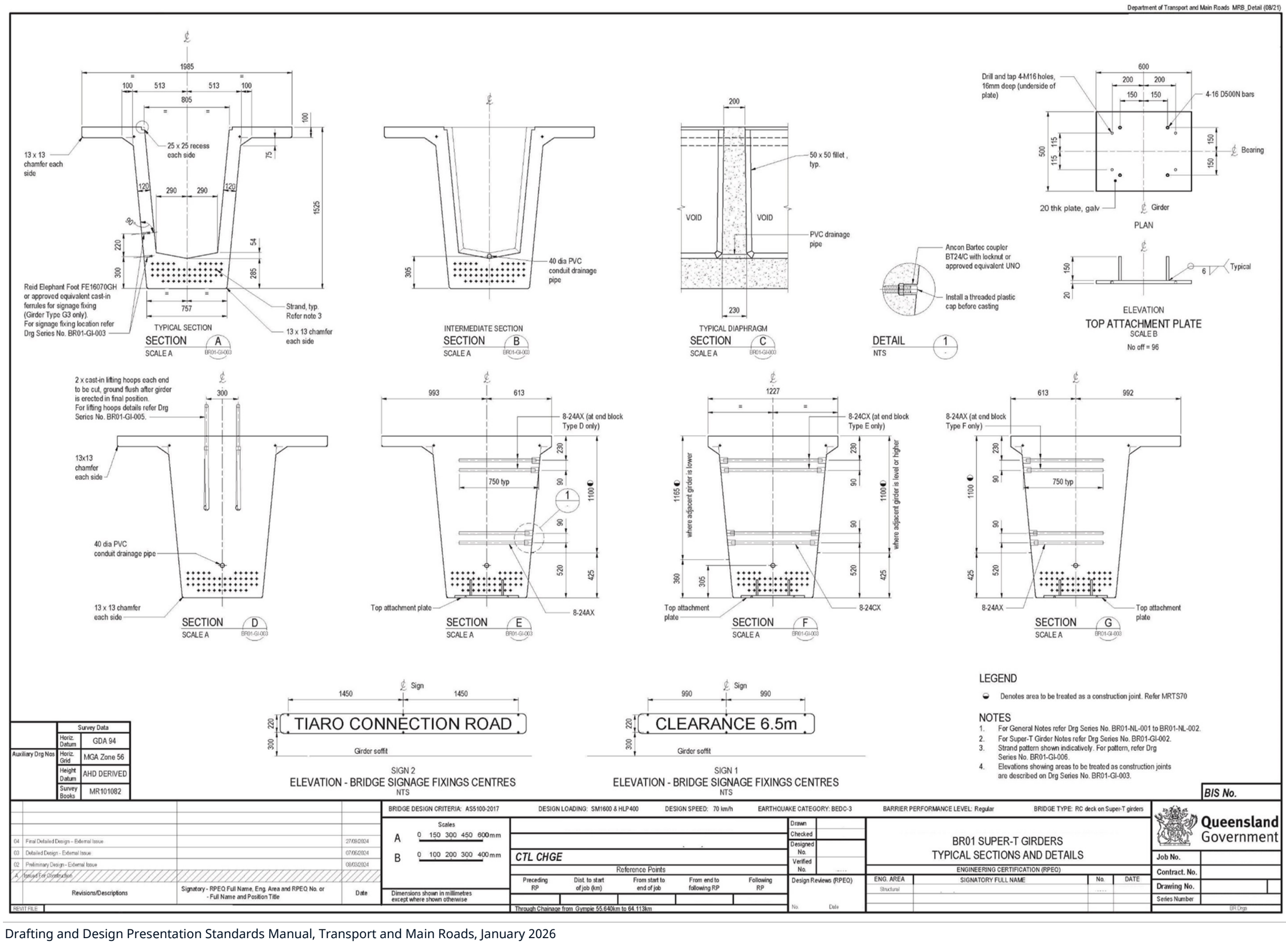


Figure 5.15(e) – Example Super-T girder bridge drawings – Sheet 5

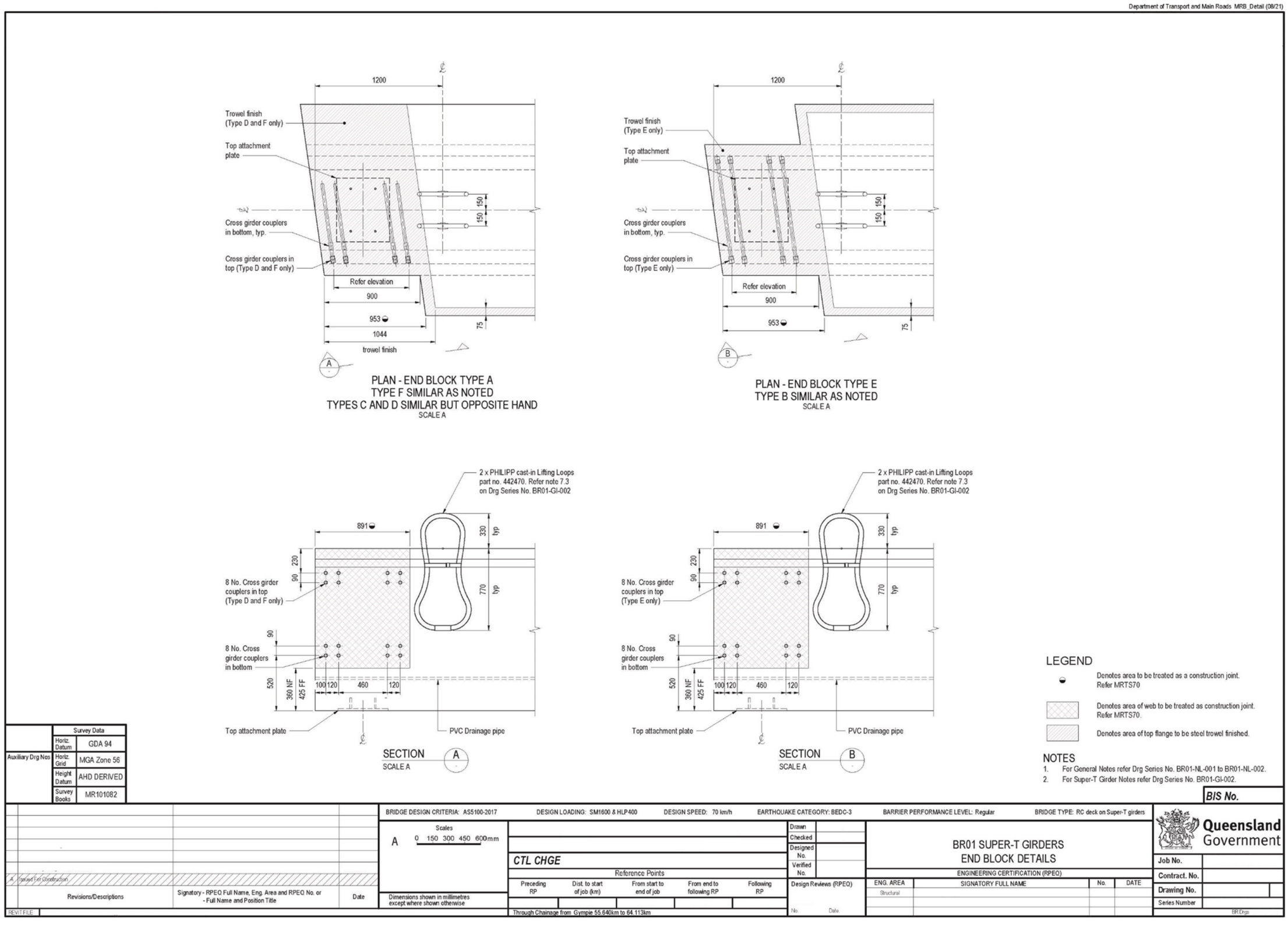
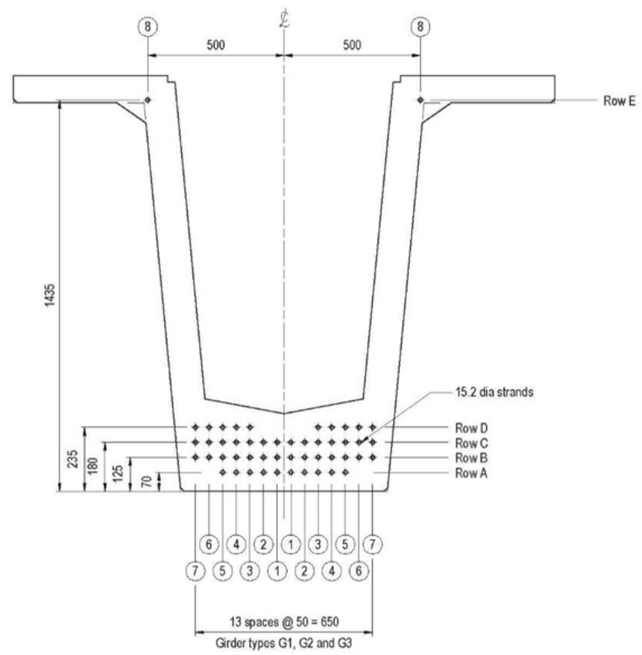


Figure 5.15(f) – Example Super-T girder bridge drawings – Sheet 6

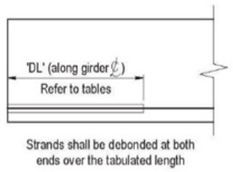
Department of Transport and Main Roads MRB_Detail (08/21)



STRAND PATTERN ARRANGEMENT
SCALE A

STRAND DEBONDING TABLE - GIRDER TYPES G1, G2 AND G3

STRAND NO.	DEBONDING LENGTH 'DL' (mm)								STRANDS PER ROW
	1	2	3	4	5	6	7	8	
E								0	2
D			0	9000	0	7000	0		10
C	3000	0	11000	0	5000	0	7000		14
B	0	9000	0	5000	0	3000	0		14
A	5000	0	7000	0	3000				10
							TOTAL PER GIRDER		50



STRAND DEBONDING DETAIL
NTS

	Survey Data	
Auxiliary Drg Nos	Horiz. Datum	GDA 94
	Horiz. Grid	MGA Zone 56
	Height Datum	AHD DERIVED
	Survey Books	MR101082

LEGEND
No Strand
0 Strand with no debonding
2000 Strand with debonding

NOTES
1. For General Notes refer Drg Series No. BR01-NL-001 to BR01-NL-002.

BIS No.

BRIDGE DESIGN CRITERIA: AS5100-2017 DESIGN LOADING: SM1600 & HLP400 DESIGN SPEED: 70 km/h EARTHQUAKE CATEGORY: BEDC-3 BARRIER PERFORMANCE LEVEL: Regular BRIDGE TYPE: RC deck on Super-T girders

Scales A 0 100 200 300 400mm
Dimensions shown in millimetres except where shown otherwise

CTL CHGE
Reference Points
Preceding RP | Dist. to start of job (km) | From start to end of job | From end to following RP | Following RP
Through Chainage from

Drawn | Checked | Designed No. | Verified No.
Design Reviews (RPEQ) No. Date:

BR01 SUPER-T GIRDERS
STRAND AND DEBONDING
ENGINEERING CERTIFICATION (RPEQ)
ENG. AREA | SIGNATORY FULL NAME | No. | DATE
Structural

Queensland Government

Job No.
Contract. No.
Drawing No.
Series Number

A Issued For Construction
Revisions/Descriptions | Signatory - RPEQ Full Name, Eng. Area and RPEQ No. or - Full Name and Position Title | Date

REVIT FILE BR Drgs

Figure 5.15(g) – Example Super-T girder bridge drawings – Sheet 7

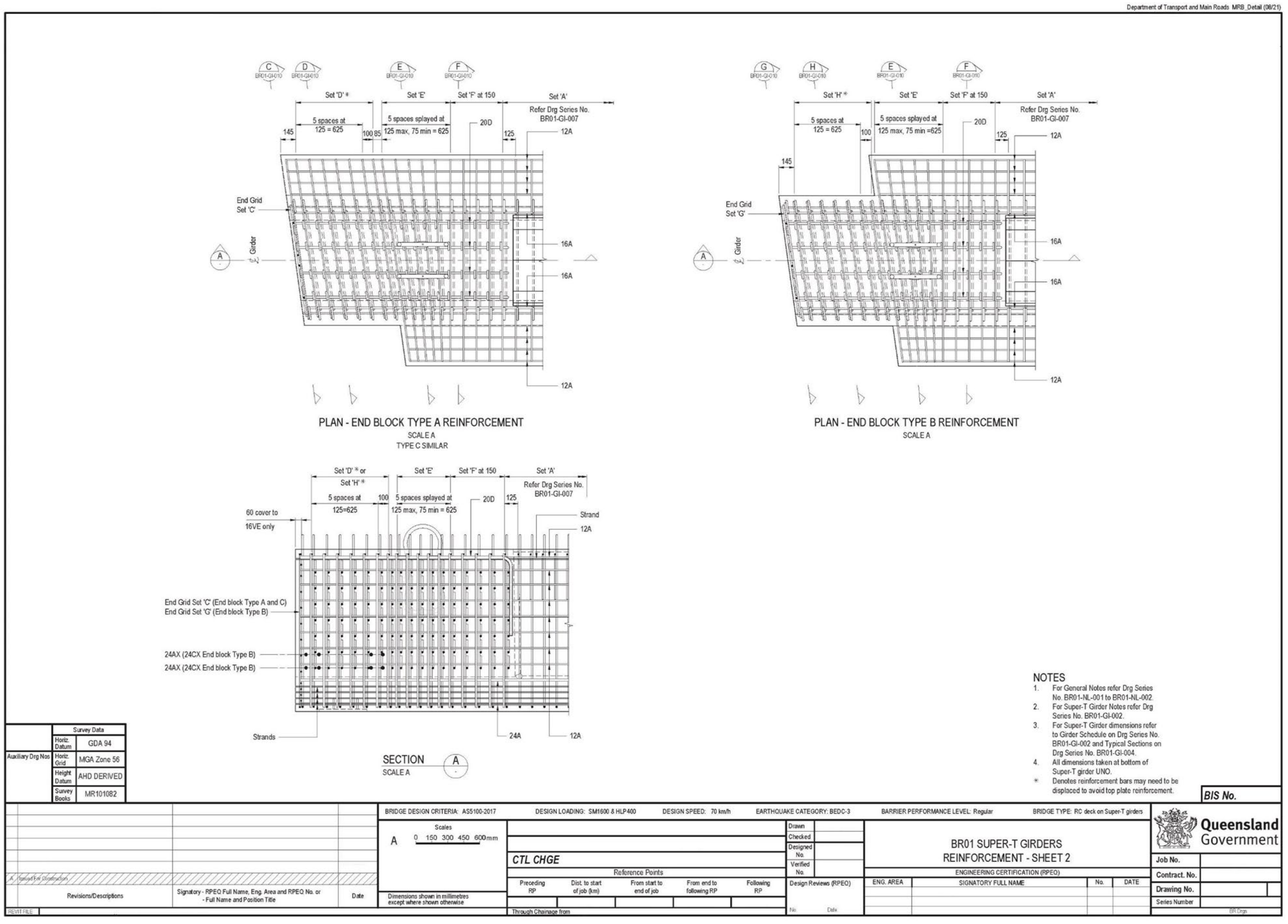


Figure 5.15(h) – Example Super-T girder bridge drawings – Sheet 8

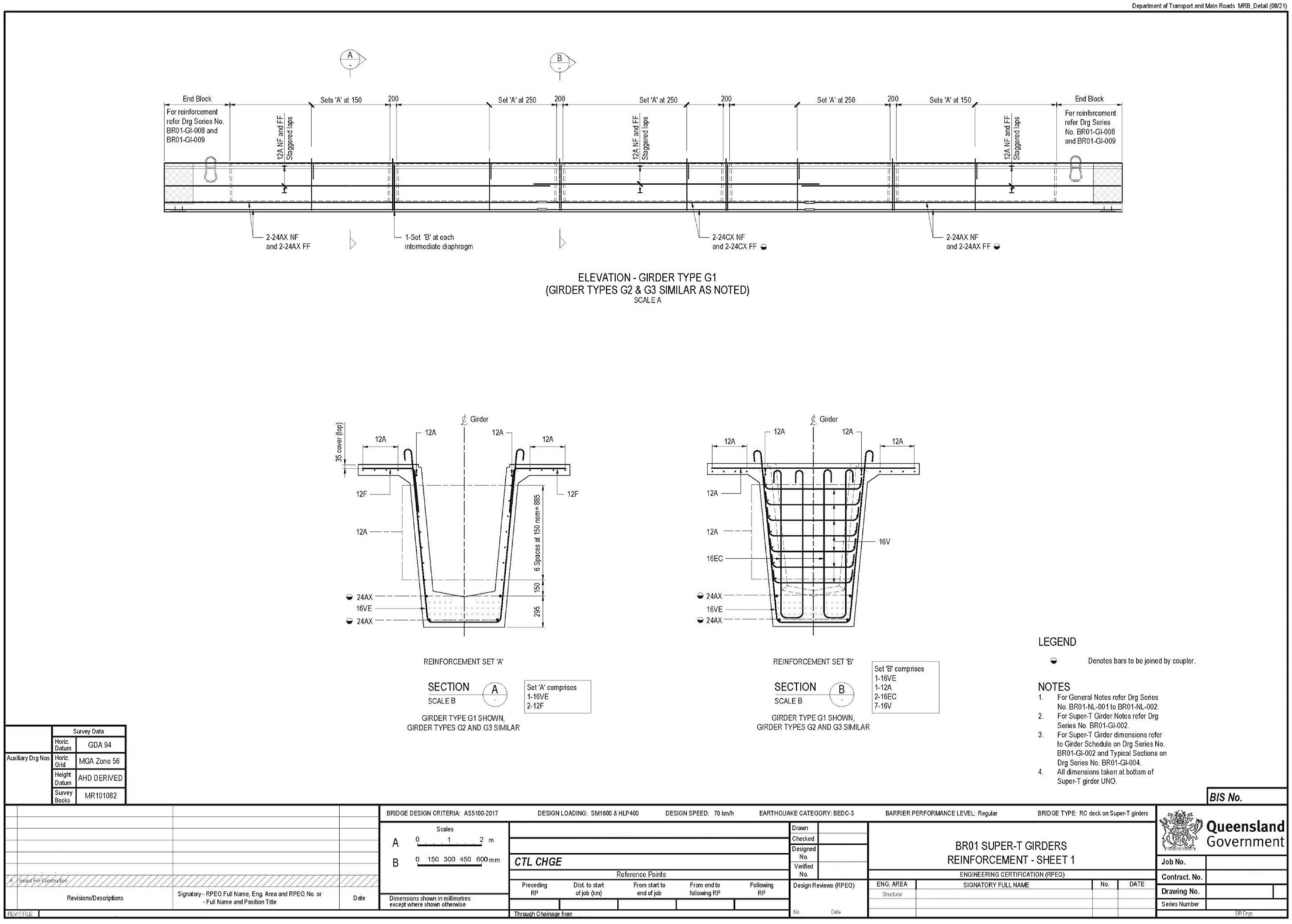


Figure 5.15(i) – Example Super-T girder bridge drawings – Sheet 9

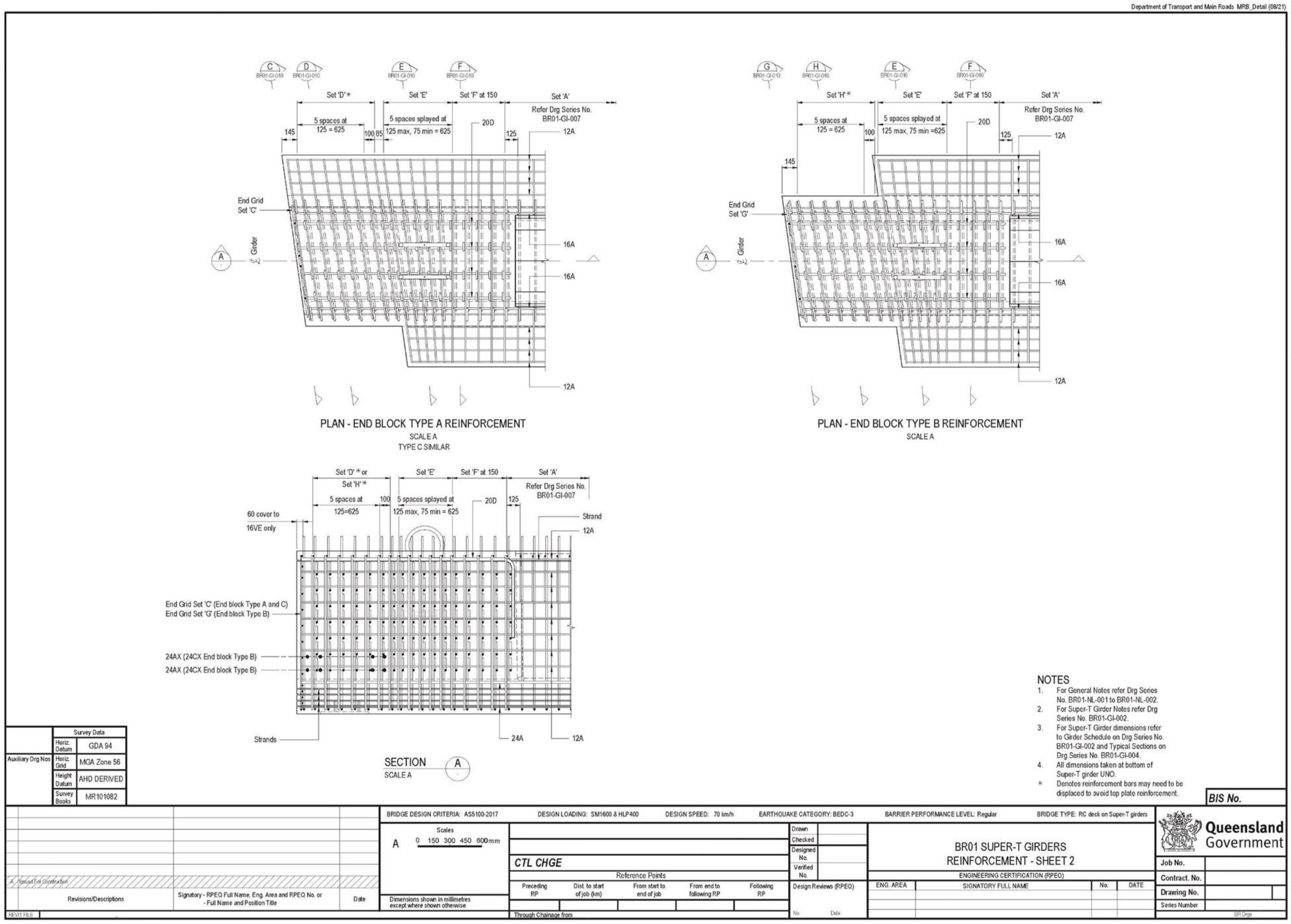


Figure 5.15(j) – Example Super-T girder bridge drawings – Sheet 10

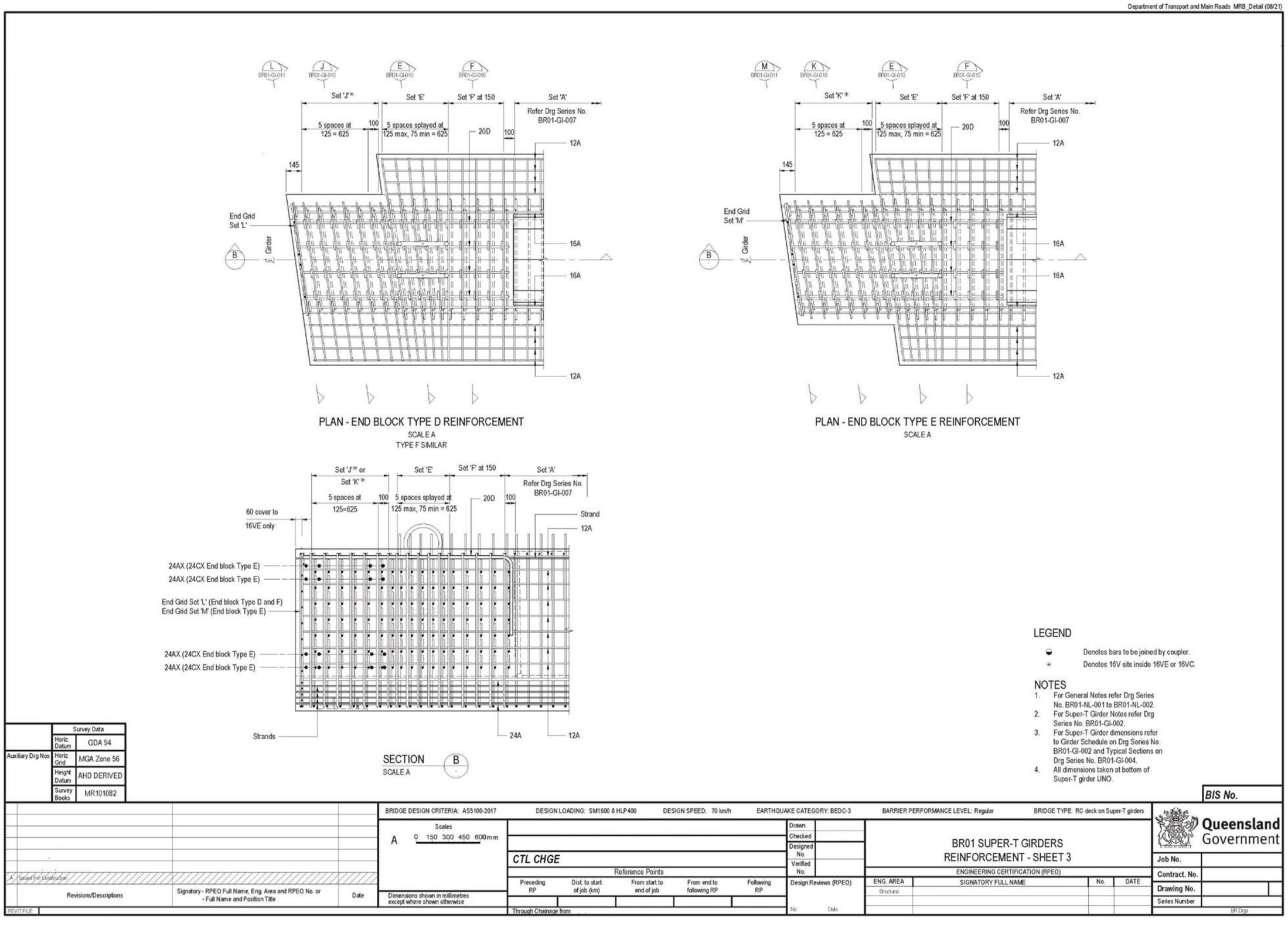


Figure 5.15(k) – Example Super-T girder bridge drawings – Sheet 11

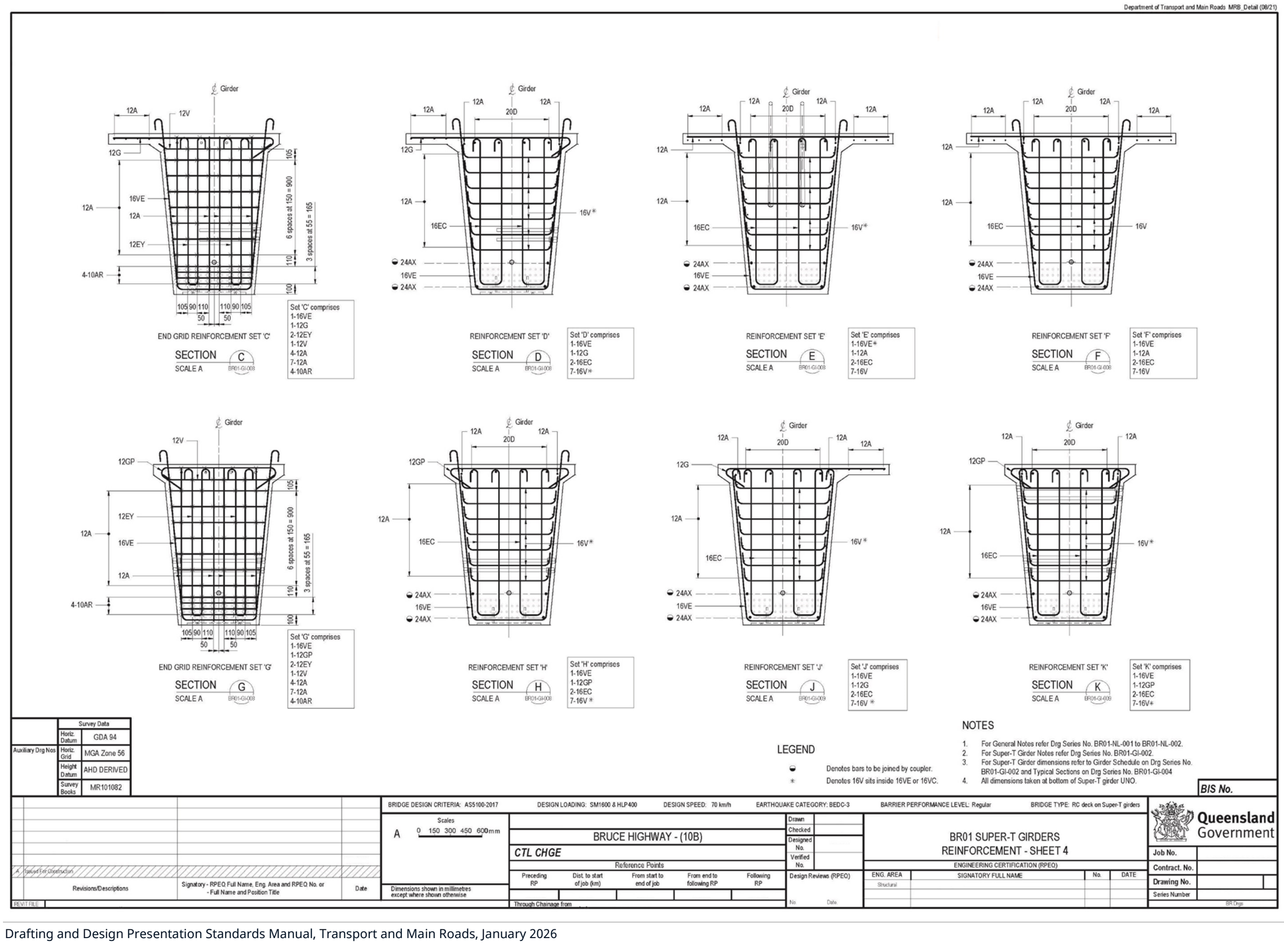
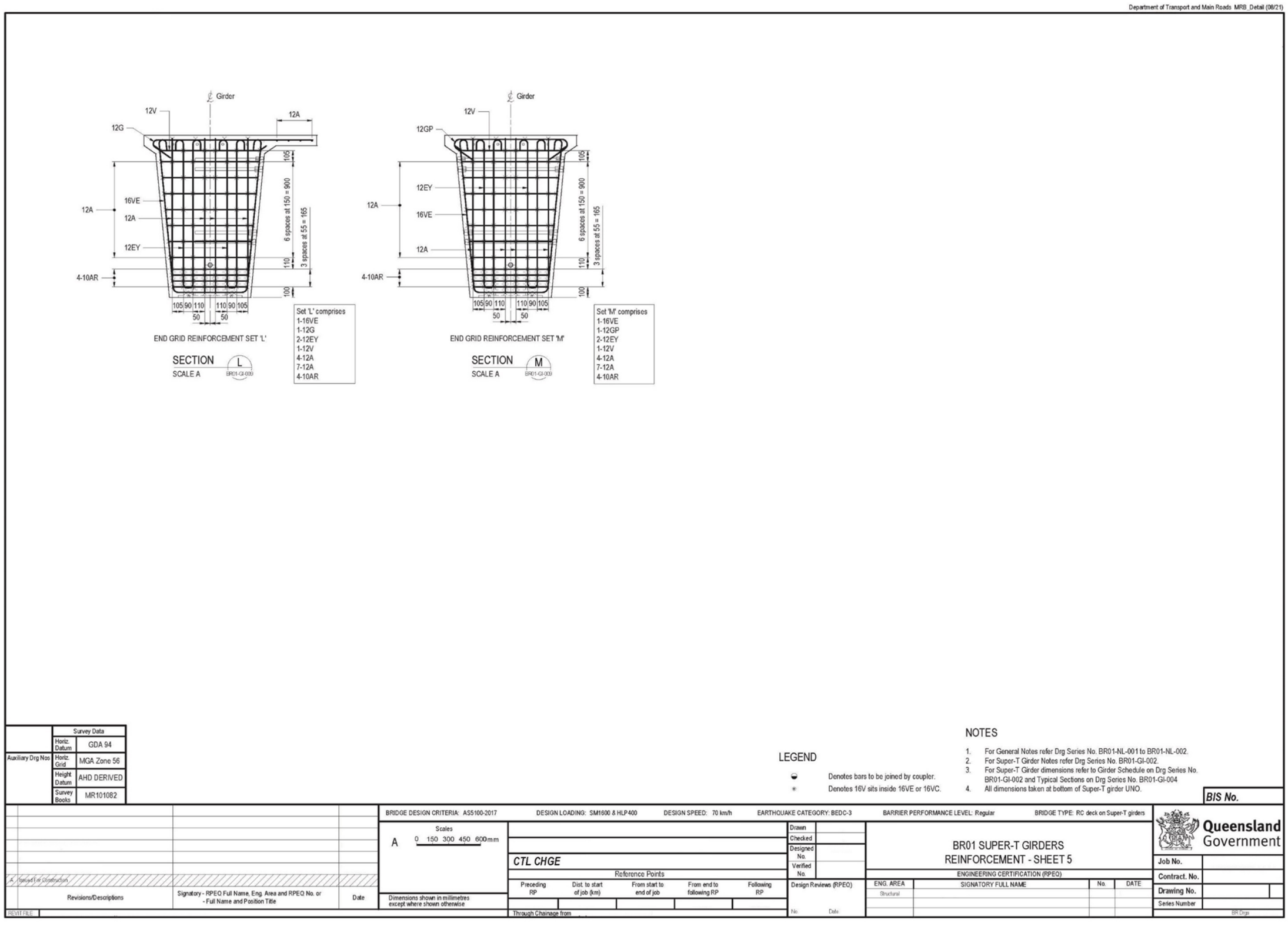


Figure 5.15(l) – Example Super-T girder bridge drawings – Sheet 12



5.16 Wide flange I-girders

Wide flange I-girders are approved for use in Queensland bridge designs. Wide flange I-girders offer an alternative design option for bridge superstructure. A design guide is available for reference from suppliers.

Potential advantages for using wide flange I-girders include:

- span lengths up to 47m, and
- wider girders to reduce the number of girders required in any given deck section.

Transport and Main Roads does not have a large catalogue of wide flange I-girder designs to draw on for reference in this volume, however the principles for Super-T girders (Sections 5.13 to 5.15) should be followed.

5.17 Steel box and steel I-beam girders

All structural steel shall be in accordance with Section 4.19 of the DCBoS. All structural steelwork drawings shall include enough detail for the complete fabrication of each item or provide sufficient information for the fabricator to create detailed shop drawings. Generally, one or 2 views with enlarged details of complex sections will suffice. For items that will be bolted or welded in the field, assembly layout drawings should be created to clearly depict all components in their final positions within the structure.

5.17.1 Steel box girders

As stated in Section 4.9.9 of the DCBoS, steel box girder construction is permitted in exceptional circumstances with, departmental acceptance by the Deputy Chief Engineer (Structures).

Steel box girder detailing typically involves complex assembly and geometry. Therefore, all steel box girder details shall be drawn to scale and shall not presented diagrammatically. A 3D assembly of the girders should be modelled to verify the details of all the components, checking for, but not limited to, appropriate tolerance, pre-camber requirement, constructability, accessibility, and ease of inspection.

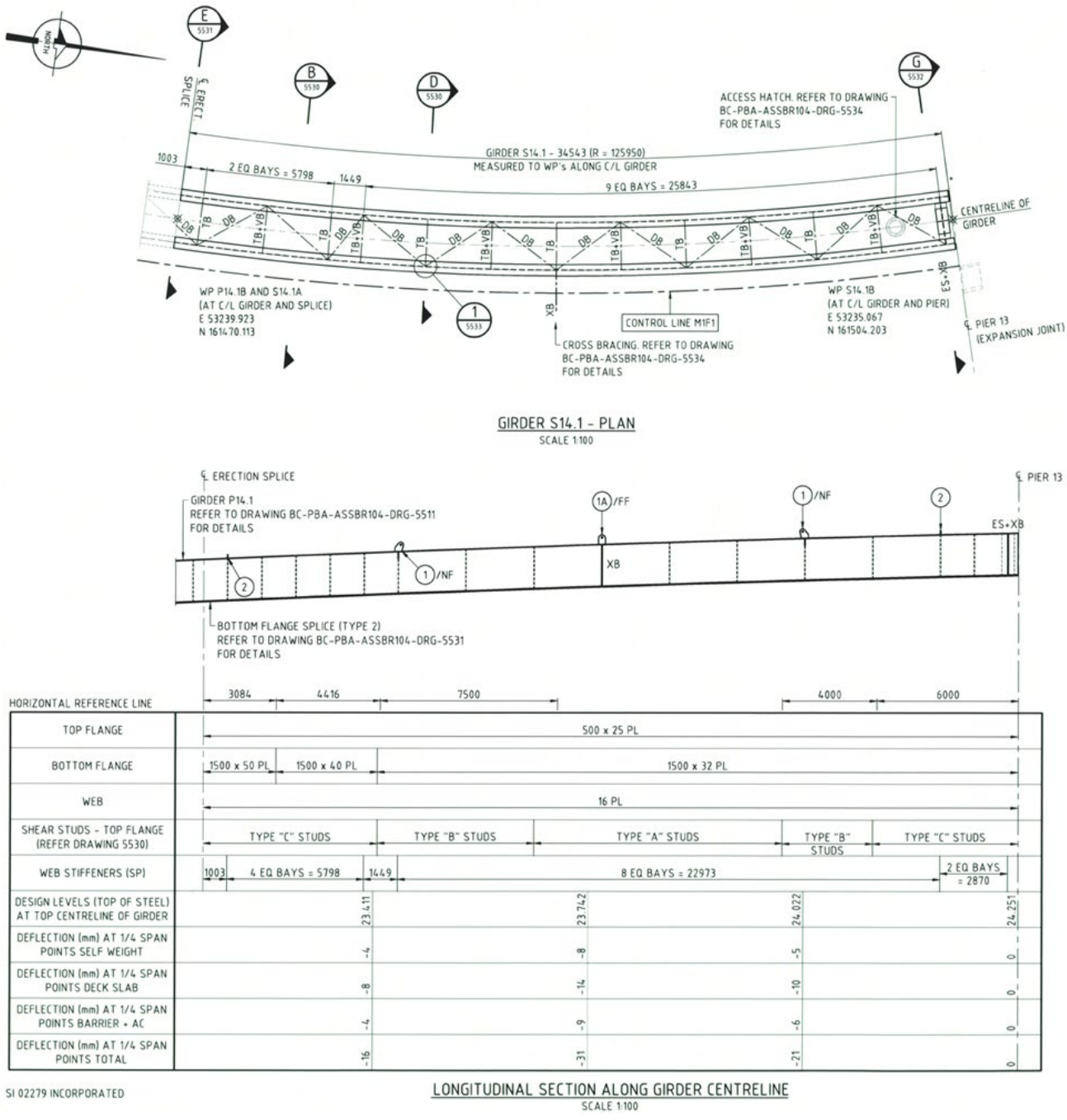
At a minimum, these drawings shall include the following, clearly detailing the set out and assembly of the girder and its components:

- steel girder marking plan
- steel girder schedule
- steel girder segment layout / arrangement
- steel girder details

- lifting diagrams
- connection details
- assembly details
- weld details, and
- finish treatments.

Table 5.18(a) specifies the minimum requirements for steel box girder drawings, and an example box girder layout is provided in Figure 5.17.1 for reference.

Figure 5.17.1 – Example box girder layout drawing



5.17.2 Steel I-beams

As stated in Section 4.9.8 of the DCBoS, steel I-beams are generally acceptable when widening an existing steel I-beam bridge superstructure and shall be galvanised, where possible. For new bridges, they shall be subject to department approval by the Director (Planning and Delivery).

5.17.3 Steel box and steel I-beam schedules

Due to the nature of steel girders, especially steel box girders, much of the detailing effort will be in the girder fabrication drawings. A schedule should be shown on the girder layout plan and include, at a minimum, the following:

- girder type
- length along steel girder / box centreline, and
- mass of girder type (tonnes approximate).

5.18 Typical content required on steel girder drawings

Table 5.18(a) and 5.18(b) provide the minimum drawing content that should be presented on the set of project-specific drawings for superstructure elements listed above, along with typical drawing elements, such as schedules, and each is cross-referenced to the figures extracted from the example drawings.

Table 5.18(a) details a minimum set of requirements for steel box girder details.

Table 5.18(b) details a minimum set of requirements for steel I-beam girder details.

Table 5.18(a) – Steel box girder – Project-specific drawings content

Requirement	Drawing or element description	Figure reference
Steel girder layout diagram	A bridge or girder plan that depicts the arrangement of steel girders within the bridge geometry or layout.	Figure 5.18(b)
Steel girder schedule	A table to show the following for each steel girder type: • girder marks • girder length along centreline, and • total mass of each type.	Layout shown on Figure 5.18(d)

Requirement	Drawing or element description	Figure reference
Steel girder details	Steel girder detail drawings shall include the following elements: • girder elevation, plan and sections: – sections for each unique feature, such as stiffener plates etc – dimensions and layout details for girder and girder features such as studs, holes, and stiffener plates – bearing or base plate sizes, locations, and drilling patterns, and – any tapering of the girders or bearing plates (labelled as base plates on the example). • weld details: – typical weld details for studs and stiffeners, and – weld details for any doubler and gusset plates. • shear stud details, and • camber diagram.	Figure 5.18(d)
Notes	Notes to suit the element, along with design criteria, materials, durability, and lifting and handling notes.	Figure 5.18(b) and Figure 5.18(d)

Figure 5.18(a) – Example steel box girder marking plan

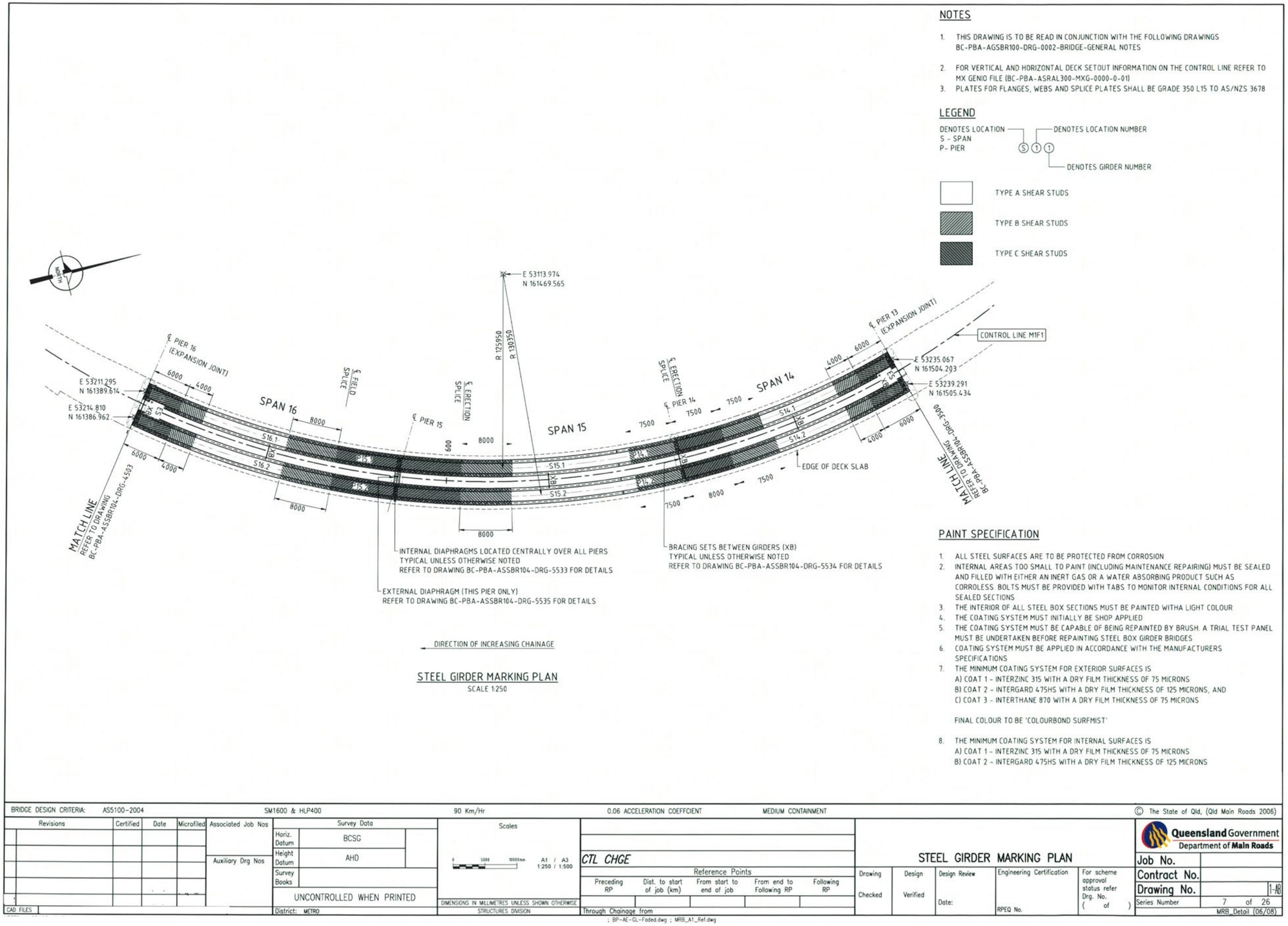


Figure 5.18(b) – Example steel box girder bridge drawings – girder arrangement – Sheet 2

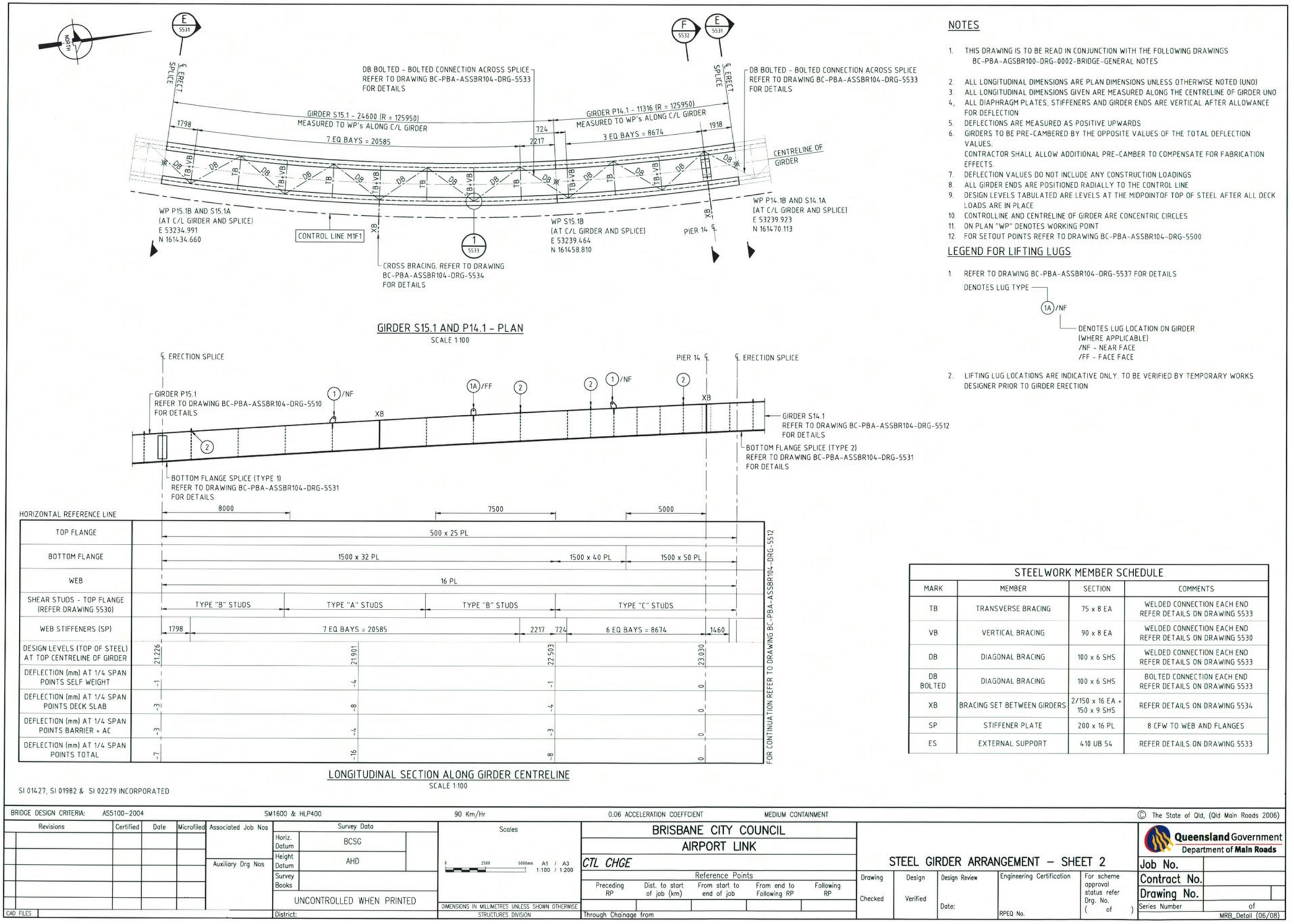


Figure 5.18(c) – Example steel box girder bridge drawings – steel girder details – Sheet 1

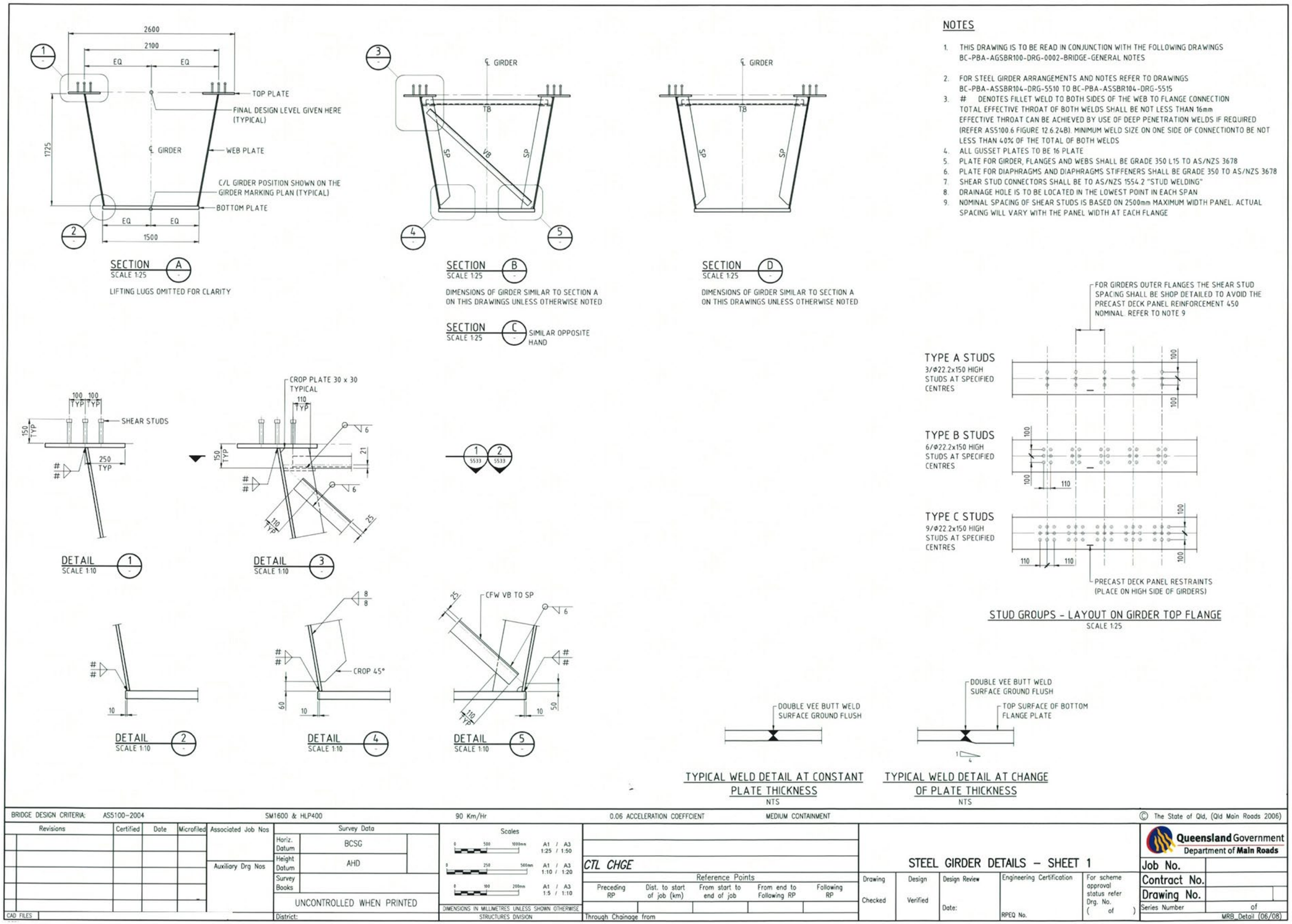


Figure 5.18(d) – Example steel box girder bridge drawings – steel girder details – Sheet 2

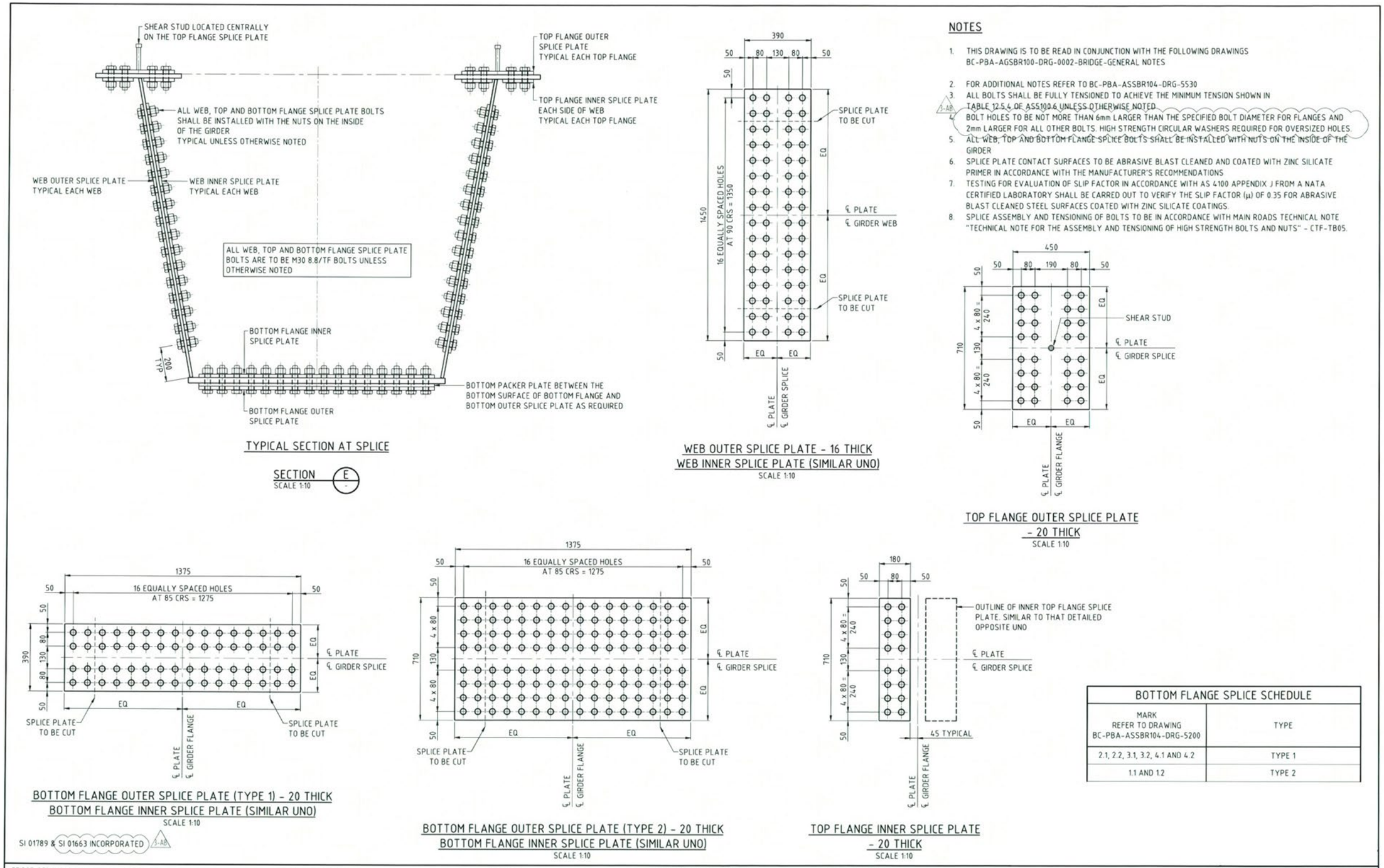


Figure 5.18(e) – Example steel box girder bridge drawings – steel girder details – Sheet 3

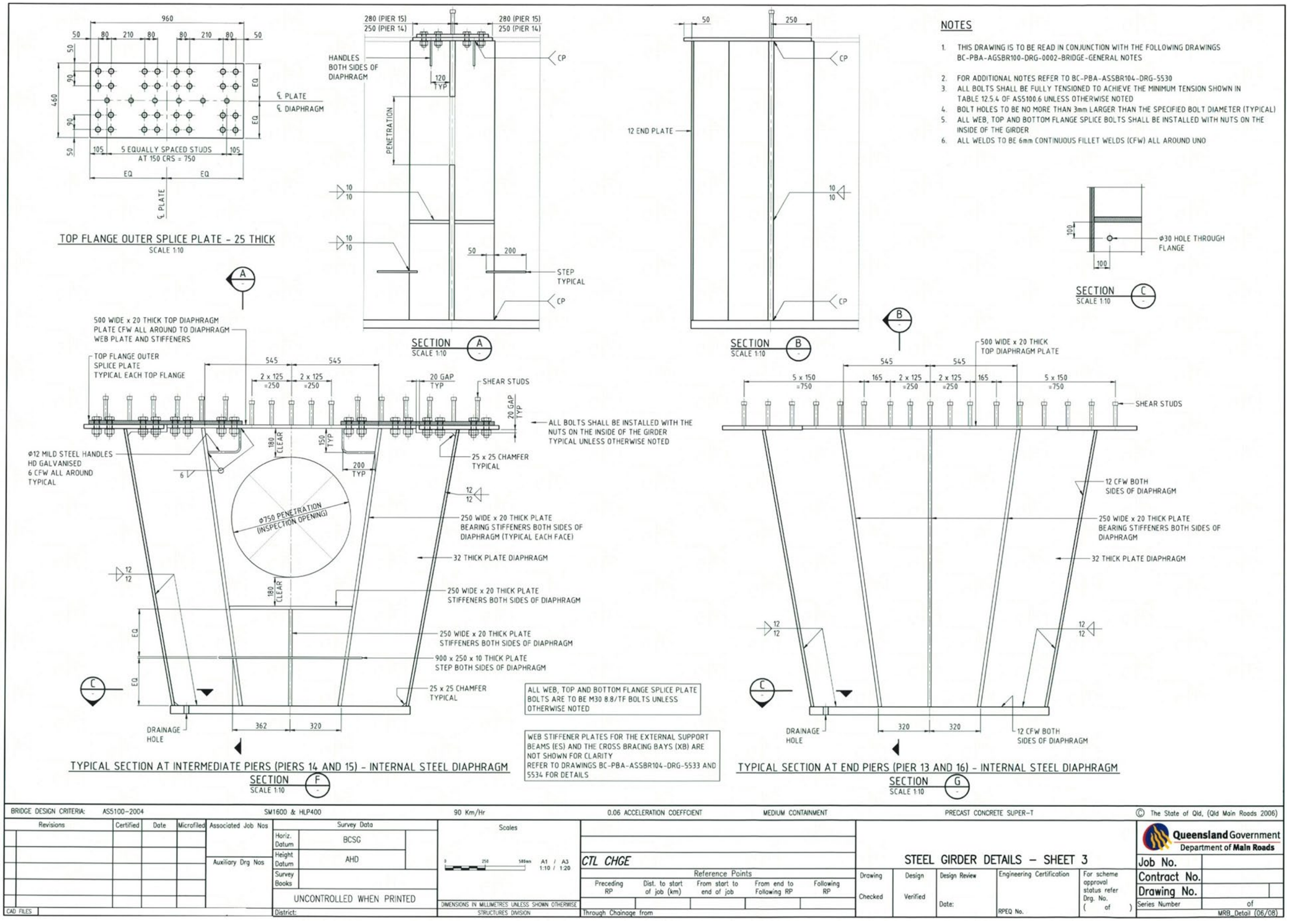


Figure 5.18(f) – Example steel box girder bridge drawings – steel girder details – Sheet 4

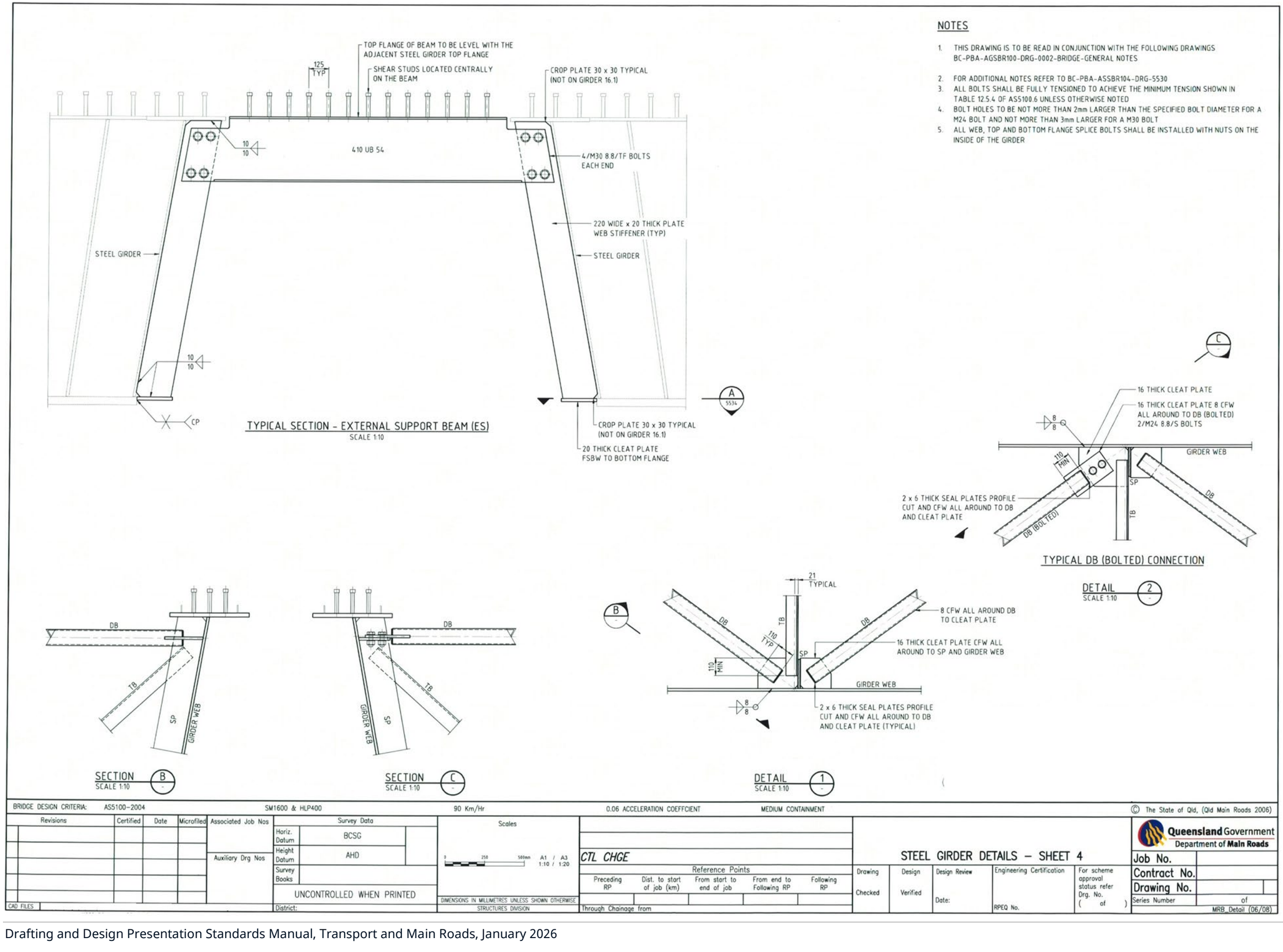


Figure 5.18(g) – Example steel box girder bridge drawings – steel girder details – Sheet 5

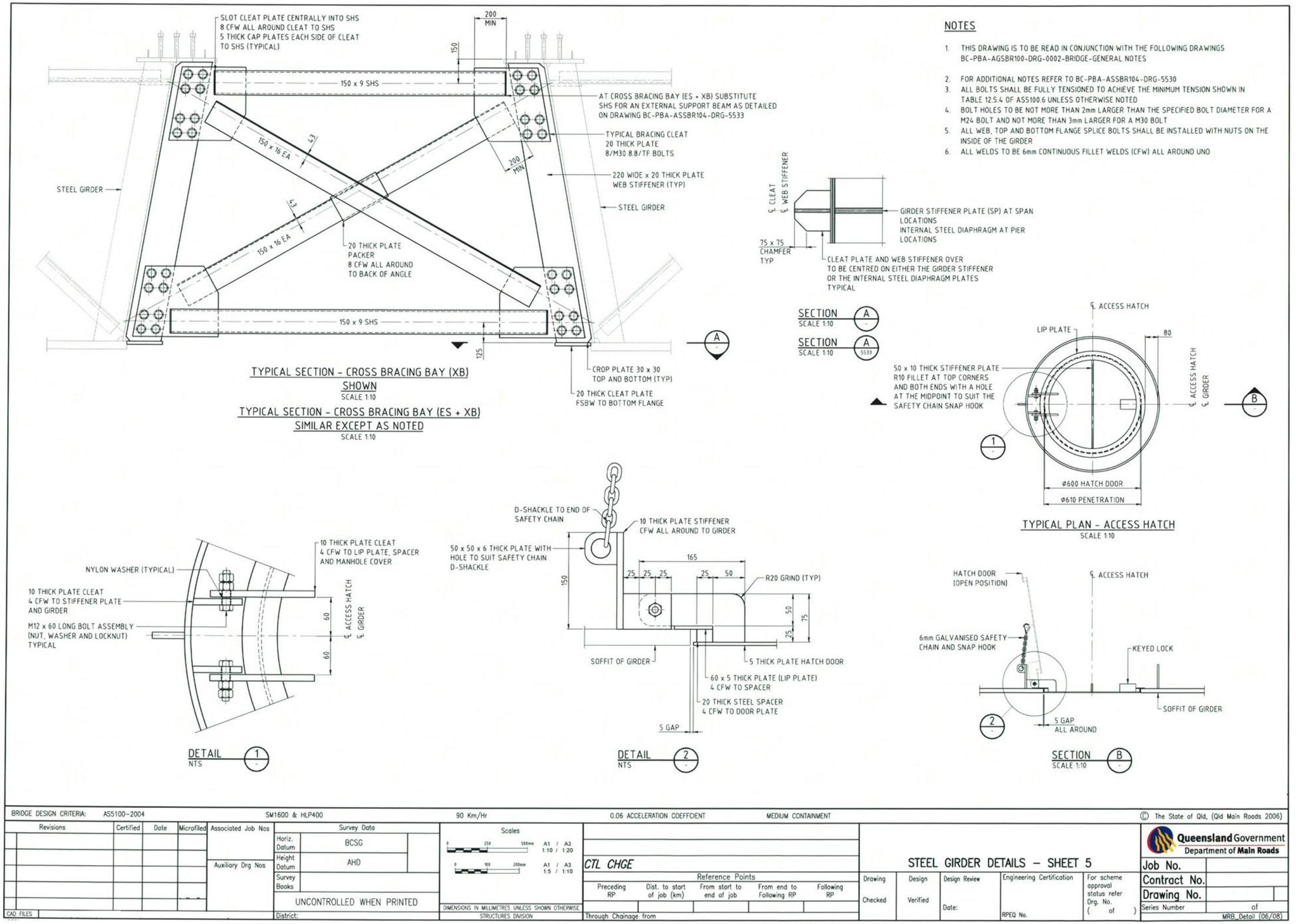


Figure 5.18(h) – Example steel box girder bridge drawings – steel girder details – Sheet 6

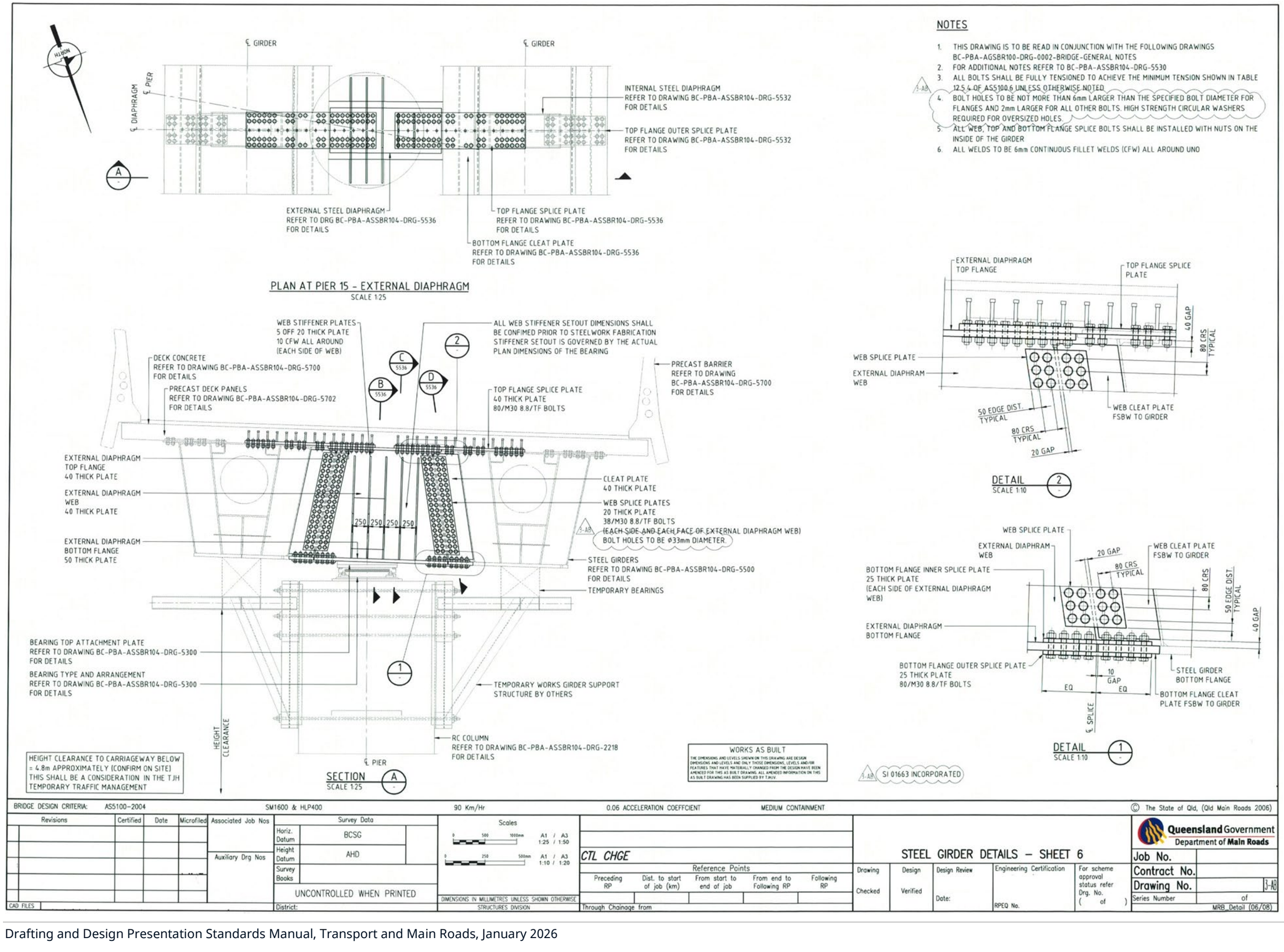


Figure 5.18(i) – Example steel box girder bridge drawings – steel girder details – Sheet 7

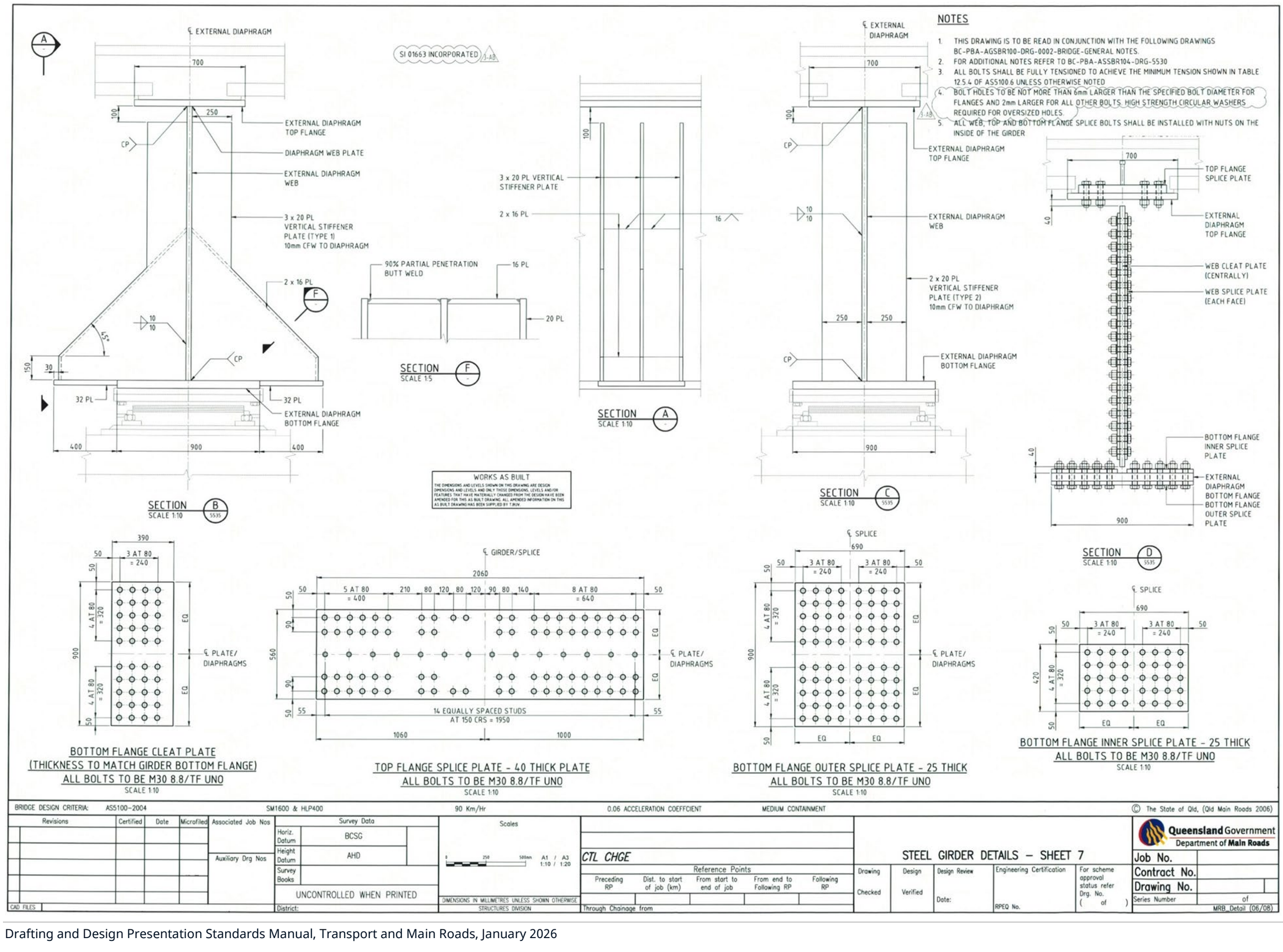


Table 5.18(b) – Steel I-beam – project-specific drawings content

Requirement	Drawing or element description	Figure reference
Notes	Notes to suit the element, along with design criteria, materials, durability, and lifting and handling notes.	Figure 5.18(l)
Steel girder marking plan	A plan that depicts the arrangement of steel I-beams with the designation for each girder, showing skew to ends, splice locations, centrelines of abutments and piers, chainages, and the bridge control. This drawing should also contain any steel surface protection notes. A steel girder schedule with the following: • girder segment mark • girder length along centreline, and • approximate weight (tonnes).	Figure 5.18(m)
Steel girder schedule	A table to show the following for each steel girder type: • girder marks • girder length along centreline, and • total mass of each type.	Figure 5.18(m)
Steel girder segment layout / arrangement and details	Steel girder segment layouts detail the assembly and set out the steel girders required for fabrication, including: • plan and developed long sections of box girder along the centreline dimensioning and set out for: – girder lengths, skew angles and design levels at centreline of girder – transverse, vertical, diagonal and external bracing spaces and types – stiffeners – shear stud arrangements, and – lifting locations. • Pre-camber / deflection values • base plate / restraint details, and • a steel member schedule with members only relating to that girder.	Figure 5.18(k)
Welding details	Welding sizes, type and locations for all welded steel connections. Welding materials and applicable standards. Specifications relevant to welding and testing.	Figure 5.18(m)

Requirement	Drawing or element description	Figure reference
Lifting diagrams	Diagrams to show site lifting arrangements.	No example supplied
Erection sequence	Any pre-camber requirements etc.	Figure 5.18(m)

Figure 5.18(j) – Steel I-beam drawings – widening of existing bridge – General Arrangement – Sheet 1

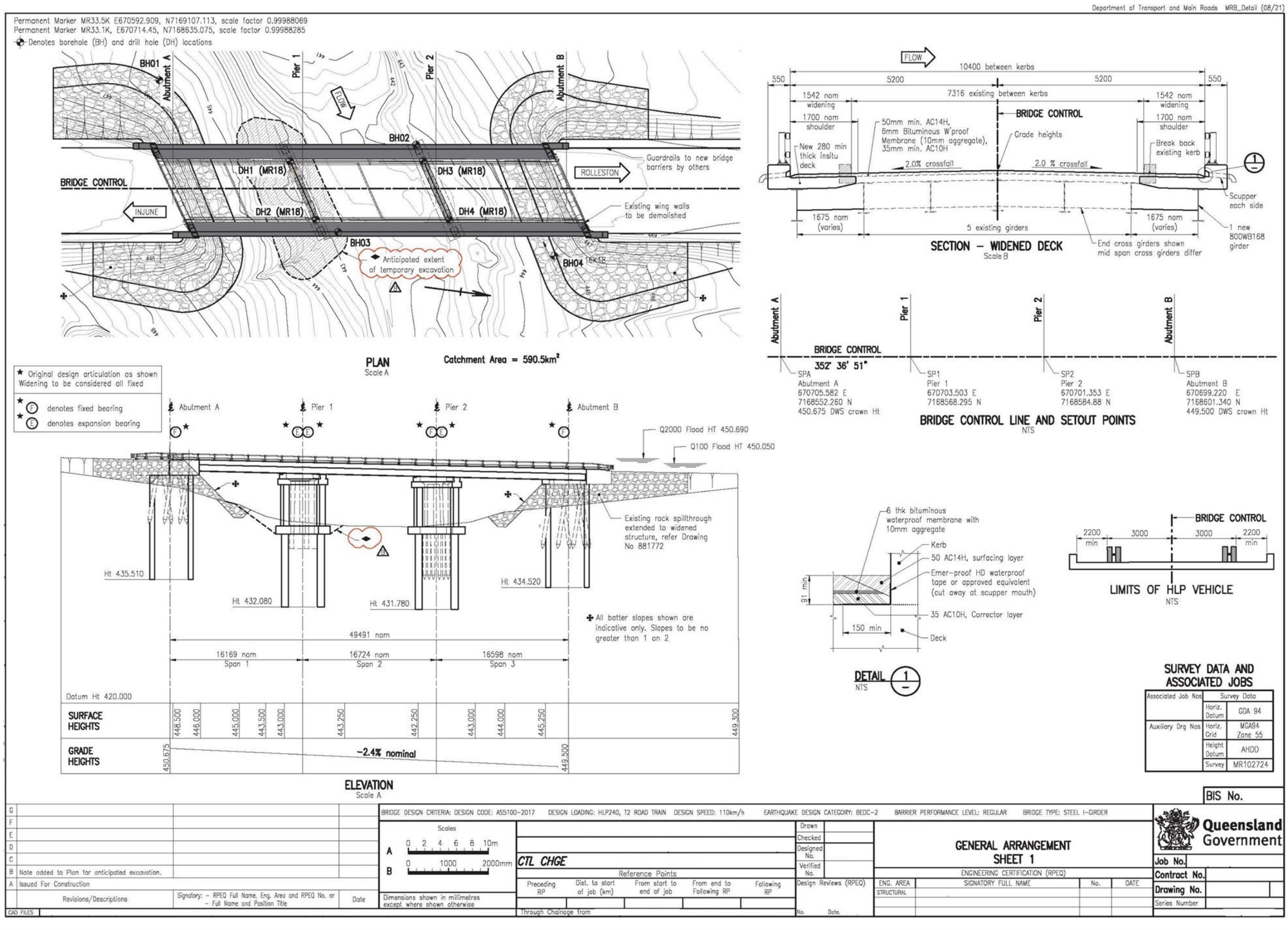


Figure 5.18(k) – Steel I-beam drawings – widening of existing bridge – General Arrangement – Sheet 3

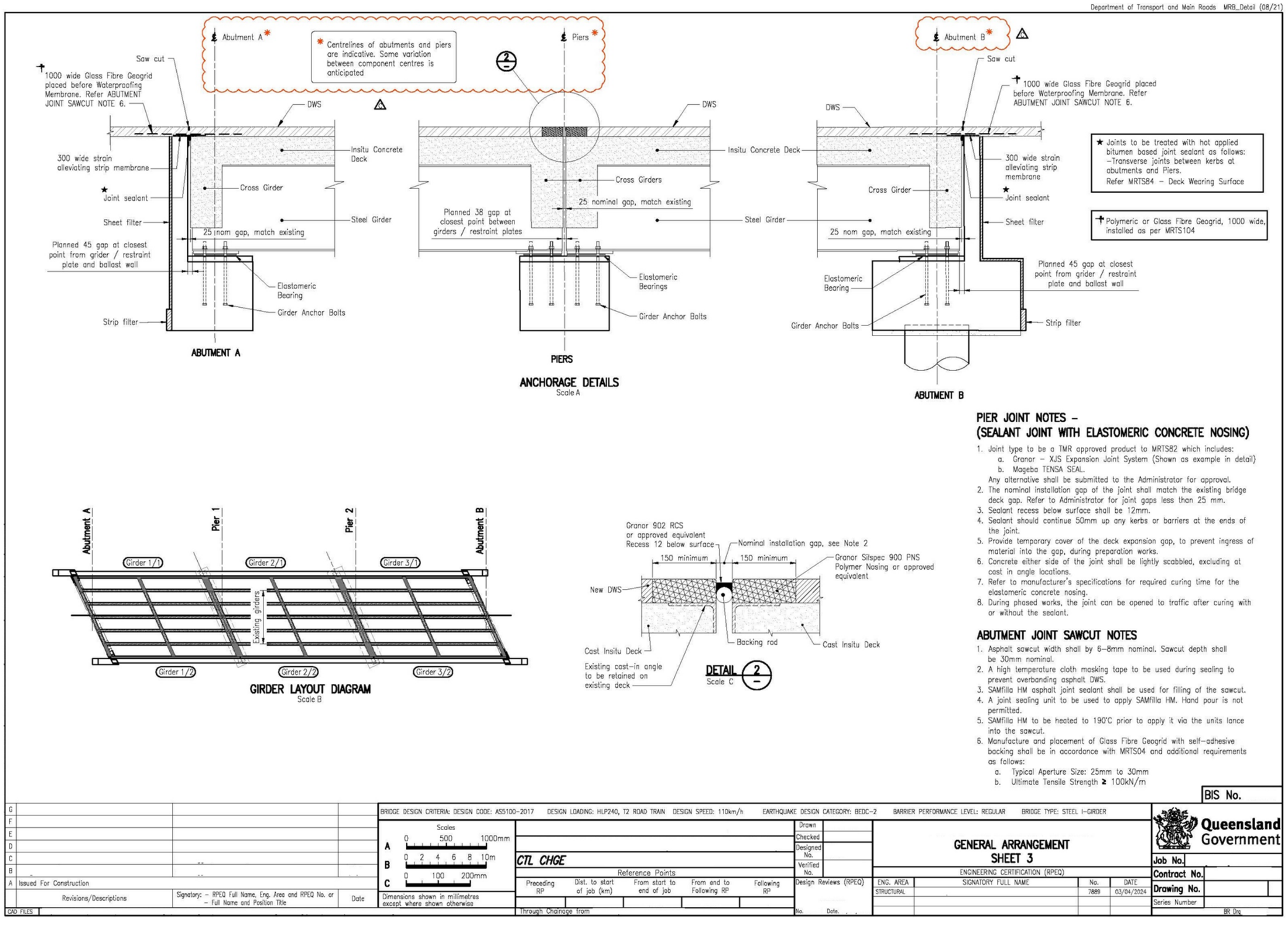


Figure 5.18(l) – Steel I-beam drawings – widening of existing bridge – notes – Sheet 1

Department of Transport and Main Roads MRB_Detail (08/21)

GENERAL

1. These drawings shall be read in conjunction with all reference drawings and specifications, including Main Roads Technical Specifications and with such other written instructions as may be issued during the course of the contract. All discrepancies shall be referred to the Administrator for decision before proceeding with work.
2. Where trade names have been used for a particular product requirement, equivalent products may be submitted to the Administrator for approval.
3. The bridge foundation investigation report is included in the scheme documents. Tenderers are able to view the core samples, if available, by arrangement with the Administrator.
4. The contractor shall confirm all bridge horizontal and vertical alignment and setout data against the drawings prior to construction.
5. A date plate is to be cast into the outside face of the left hand wingwall at Abutment A.
   For date plate details refer MRSD 2005.
6. A permanent survey mark is to be cast into the top of the left hand wingwall at Abutment A.
7. The bridge and all bridge elements shall be constructed in accordance with current TMR Technical Specifications, unless noted otherwise.
8. The contractor shall implement erosion and sediment control measures during construction, and limit the disturbance of soils to that necessary for construction of the project.
9. Unless noted otherwise:
   - Dimensions are in millimetres.
   - All chainages, heights, horizontal curves and vertical curves are in metres.
   - All co-ordinates are to MGA94–Zone 55.
   - Heights are reduced to the Australian Height Datum (AHD).
10. Dimensions shall not be scaled from drawings.
11. Project surveyors may obtain a Building Information Model (BIM), which sets out the substructure and superstructure of the bridge in project coordinates, by arrangement with the Administrator. All construction survey setting-out and as-constructed requirements are to adhere to the procedures and guidelines as prescribed in the TMR Surveying Standards.

STANDARD DRAWINGS

DRAWING NUMBER	VERSION	DRAWING TITLE
1043	R	Standard bar shapes
1044	M	Lap lengths
1475	E	Steel beam guardrail – installation on bridge barrier approaches (withdrawn)
1481	E	Steel beam guardrail – fabrication details for thrie beam rails and rail components (withdrawn)
2005	A	Standard bridge date plate

ABBREVIATIONS

1. Abbreviations used are in accordance with AS 1100 and TMR's 'Drafting and Design Presentation Standards Manual'.
2. Additional abbreviations used throughout the set are as follows:

Abut	–	Abutment
ACRS	–	Australasian Certification Authority for Reinforcing Steel
AHD	–	Australian Height Datum
BH	–	Bore Hole
CIP	–	Cast in place
CJ	–	Construction Joint
DWS	–	Deck Wearing Surface
E	–	Expansion Joint
F	–	Fixed Joint
FOS	–	Factor of Safety
Ht	–	Height or reduced level to AHD
MRSD	–	TMR Standard Drawing
MRTS	–	TMR Technical Specification
NTS	–	Not to scale
RC	–	Reinforced concrete
SP	–	Setout Point
SWL	–	Safe Working Load
TYP	–	Typical
UNO	–	Unless Noted Otherwise

MONITORING

1. Monitoring of the existing bridge structure and foundations during construction is critical to ensure the vibrations are within tolerable limit 25mm/s. The vibration monitoring shall be undertaken at the nearest point of the structure from the pile location.
2. The proposed method for instrumentation and monitoring shall be clearly stated in the construction management plan, and submitted to The Administrator for approval.
3. The Contractor shall also have a contingency plan that needs to be adopted, if the vibration exceeds the limit.

SHEAR STUDS

1. Shear studs to AS 1554.2.
2. Stud welding shall comply with the requirements of AS 1554.2 and the supplementary specification.
3. Shear studs shall be grade CS1010–CS1020.
4. Shear studs shall be 22mm diameter and 125mm high ⚠1

DECK

1. Construction of the cast insitu deck and kerbs shall be to MRTS77 Bridge Deck.
2. Formwork for the cast insitu deck and kerbs shall be supported by the steel girders. On no account is the formwork to be supported from the ground.
3. Seal all fixed transverse joints at abutments with hot applied bitumen based crack sealant in accordance with MRTS84 Deck Wearing Surface.
4. A bituminous waterproofing membrane shall be placed over the asphalt corrector course for the full length of the bridge in accordance with MRTS84.
5. All conduits shall be in accordance with AS/NZS 2053.2.
6. All PVC components shall be in accordance with AS/NZS 1260.
7. All exposed PVC scuppers and drains shall be painted with UV resistant paint (3 coats).

SERVICES

1. All services must be located, identified and protected before works are carried out.

EARTHWORKS

1. Earthworks shall be as per MRTS04.
2. Geotextile used for filtration and separation shall be installed as per MRTS27 and in accordance with the manufacturer's specification.
3. Temporary works are the responsibility of the Contractor including access, temporary working platform, excavation, water management/drainage and temporary retention of material for/during excavation. Nominal allowance only made in quantities. Final quantities for temporary works are the responsibility of the Contractor and subject to approval by the Administrator.
4. The temporary excavation shall ensure no damage or disruption to the existing bridge structure or the existing services. Any damage or disruption caused shall be immediately notified to the Administrator before being rectified by the contractor.
5. Temporary retention and face protection shall be designed by a suitably qualified geotechnical engineer (RPEQ), in accordance with MRTS03 and MRTS04. Deformation of the existing carriageways during the construction shall not cause instability or serviceability issues (e.g. pavement cracking).
6. Design of temporary stabilisation works shall be provided to TMR for review, at least 21 days prior to commencement of works.
7. No fill shall be placed above soffit of the abutment headstock in the free draining granular material zone (refer drg No.) until at least 2 days after erection of the end spans.
8. Embankments shall not be overstressed during the construction works, including temporary excavations, and benching.

STEELWORK

1. All steelwork shall be fabricated in accordance with MRTS78 – Fabrication of Structural Steelwork.
2. Hollow sections shall be Grade C450L0 to AS/NZS 1163 UNO.
3. Steel plate shall be Grade 350 to AS/NZS 3678 UNO.
4. WB girders shall be Grade 300 to AS/NZS 3679.2.
5. Hot rolled steel bars and sections shall be Grade 300 to AS/NZS 3679.1.
6. All steelwork, excluding steel girders, shall be hot dipped galvanised to AS/NZS 4680 unless noted otherwise.
7. All members shall be branded with suitable type number after fabrication.

GALVANISING

1. All bolts and nuts to be hot dip galvanised to AS 1214. All other steelwork to be hot dip galvanised to AS/NZS 4680 unless shown otherwise.
2. Prior to galvanising, all sharp irregularities, weld splatter and welding slag shall be removed. All material with a silicon content less than 0.01% shall be abrasive blasted, refer MRTS78, Clause 11.1.
3. Protective coatings damaged during transport, handling and construction shall be reinstated in accordance with MRTS78 as soon as practical. Damage to the protective coating shall be repaired progressively during the course of construction and not left until the completion of the works.

PAINT SYSTEM

1. Refer Annexure MRTS88.1 for coating system. ⚠1
2. Steel girders shall be painted after installation and testing of shear studs.
3. The girder protective system shall be in accordance with MRTS88 Protective Coating for New Work and Technical Note TN144 Paint Systems for MRTS88.
4. All aspects of the materials surface preparation, and application shall be in accordance with TN144 and annexure MRTS88_1
5. Extent of paint system on the top face of the top flange of the girders shall be as shown on Drawing No

BOLTS

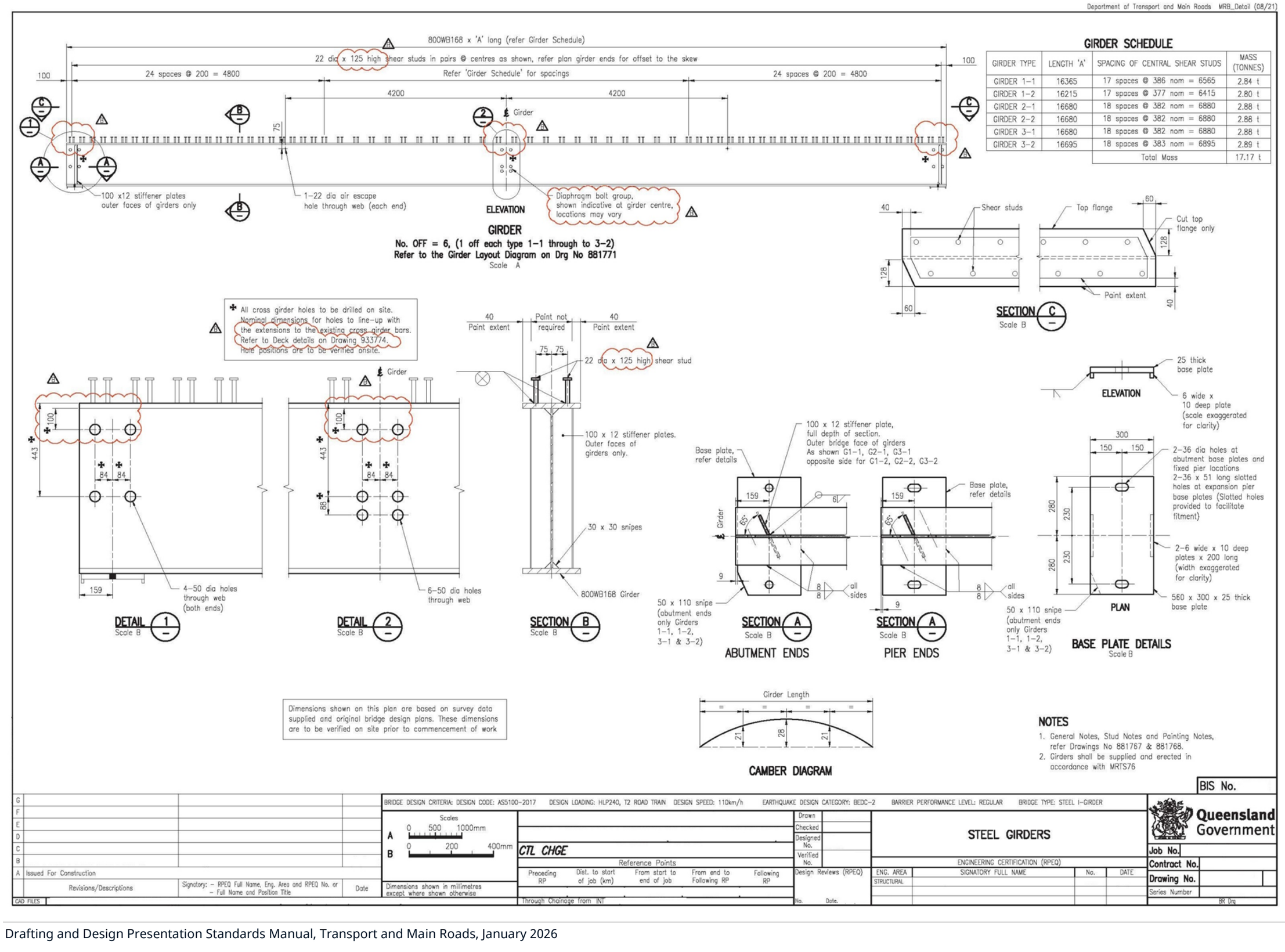
1. Supply of bolts shall be as per MRTS278.
2. Commercial grade bolt assemblies shall be:
   - Bolts Class 4.6 to AS 1111.1.
   - Nuts Class 5 to AS 1112.3.
   - Washers for Class 4.6 bolts to AS 1237.1.
   - Snug tightened to AS 5100.6.
3. High strength assemblies shall be:
   - Bolts Class 8.8 to AS/NZS 1252.
   - Nuts Class 8 to AS 1252.
   - Washers for Class 8.8 bolts to AS 1252.
   - Snug tightened to AS 5100.6, unless noted otherwise.
4. All threaded bars, bolts and nuts shall be hot dip galvanised in accordance with AS 1214.
5. All washers to be hot dipped galvanised in accordance with AS/NZS 4680.
6. Stainless steel set screws to AS/NZS ISO 3506.3.
7. Unless noted otherwise, all bolts shall be in 2mm clearance holes.
8. Tapped holes shall be tapped in accordance with AS/NZS 1214.
9. The exposed end of threaded bar shall have the original galvanising finish.

WIDENING, STRENGTHENING AND REHABILITATION

1. Widening, strengthening and rehabilitation of the existing bridge shall be in accordance with MRTS86.
2. The contractor shall maintain the structure in a stable condition and ensure no part of the structure is overstressed during construction activities.

G				BRIDGE DESIGN CRITERIA: DESIGN CODE: AS5100–2017 DESIGN LOADING: HLP240, T2 ROAD TRAIN DESIGN SPEED: 110km/h EARTHQUAKE DESIGN CATEGORY: BEDC–2 BARRIER PERFORMANCE LEVEL: REGULAR BRIDGE TYPE: STEEL I–GIRDER						BIS No.	
F											
E				Scales		Drawn				Queensland Government	
D						Checked					
C					CTL CHGE	Designed No.		GENERAL NOTES – SHEET 1		Job No.	
B					Reference Points	Verified No.		ENGINEERING CERTIFICATION (RPEQ)		Contract No.	
A	Issued For Construction				Preceding RP / Dist. to start of job (km) / From start to end of job / From end to Following RP / Following RP	Design Reviews (RPEQ)		ENG. AREA / SIGNATORY FULL NAME / No. / DATE		Drawing No.	
	Revisions/Descriptions	Signatory: – RPEQ Full Name, Eng. Area and RPEQ No. or – Full Name and Position Title	Date	Dimensions shown in millimetres except where shown otherwise	Through Chainage from	No. Date		STRUCTURAL		Series Number	BR–GN–01 of 02
CAD FILES								GEOTECHNICAL			BR Drg 02 of 34

Figure 5.18(m) – Steel I-beam drawings – widening of existing bridge – girder fabrication details



6 Bridge decks

6.1 General

New transversely stressed deck unit bridges generally have cast-insitu kerbs. Some existing transversely stressed deck unit bridges may have precast kerb units or cast-insitu parapets. Bridges with a cast-insitu deck may incorporate cast-insitu kerbs with fabricated steel bridge traffic barriers, cast-insitu parapets, or partially insitu parapets with precast shells. Cast-insitu decks are used on all girder and winged plank bridges.

Cast-insitu decks are typically used in the following circumstances:

- Multi-span bridges on small radius horizontal curves and/or vertical curves
- Pedestrian / cycleway bridges where deck units are widely spaced
- Skews greater than 40°
- Very wide bridges where the deck wearing surface (DWS) would be otherwise too deep, and
- PSC girder and winged plank bridges.

Decks are coated with bituminous waterproofing membrane to stop water permeating through the concrete deck and damaging the deck reinforcement and any bridge components below.

The barrier on a deck is typically either a steel bridge traffic barrier bolted to concrete kerb, or a full height concrete traffic barrier (refer to Section 6.13 of this chapter for bridge barriers and kerbs).

Decks joints at piers and abutments may be fixed, expansion, or continuous.

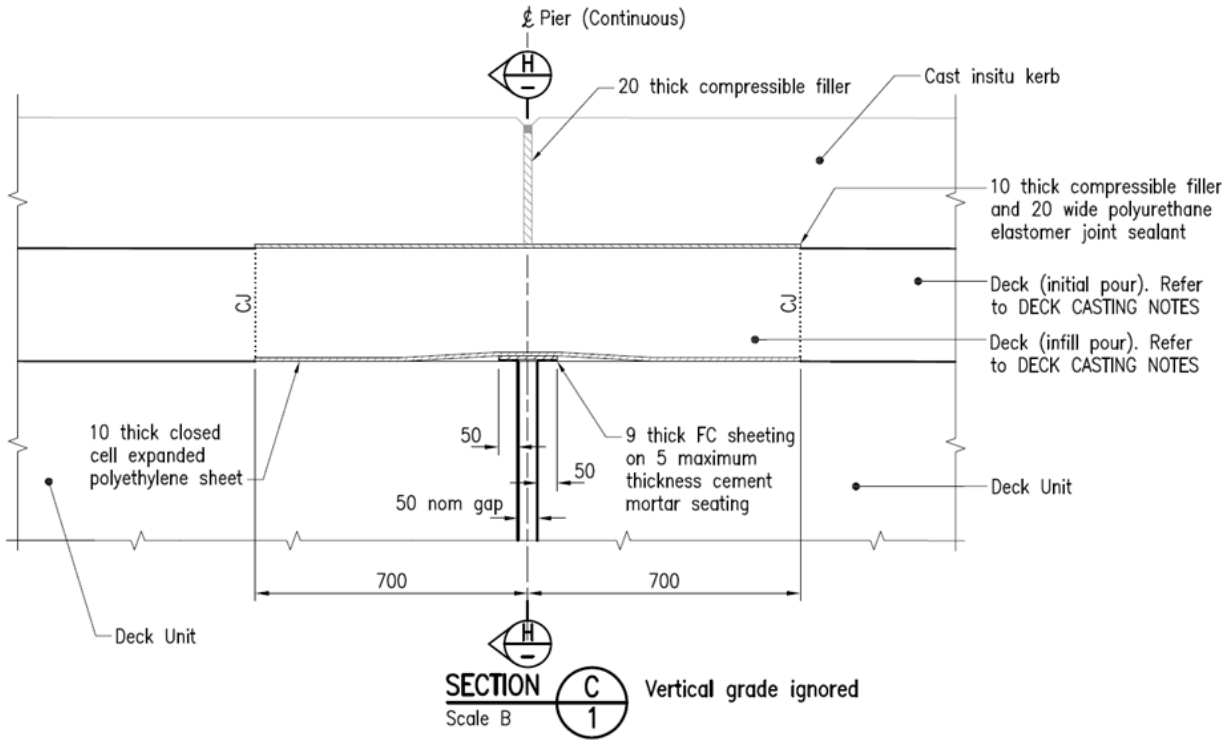
At fixed joint abutments, an appropriate approved small movement joint system shall be installed.

At expansion piers or abutments, or expansion / fixed joint piers, an expansion joint is required to span and seal the gap between spans and accommodate deck expansion and contraction and live load movements (refer to Section 7 of this chapter for expansion joint details).

6.2 Continuous deck with DWS

At fixed piers, the deck is to be continuous over the pier, utilising a short intermediate pour which is de-bonded from the girders / units. The infill pour is separated from the deck units or girders using a sheet of closed-cell expanded polyethylene, as shown in Figure 6.2.

Figure 6.2 – Continuous deck joint example



6.3 Continuous deck without DWS

When DWS is not used, the deck infill pour is typically offset a further distance either side of the pier centre.

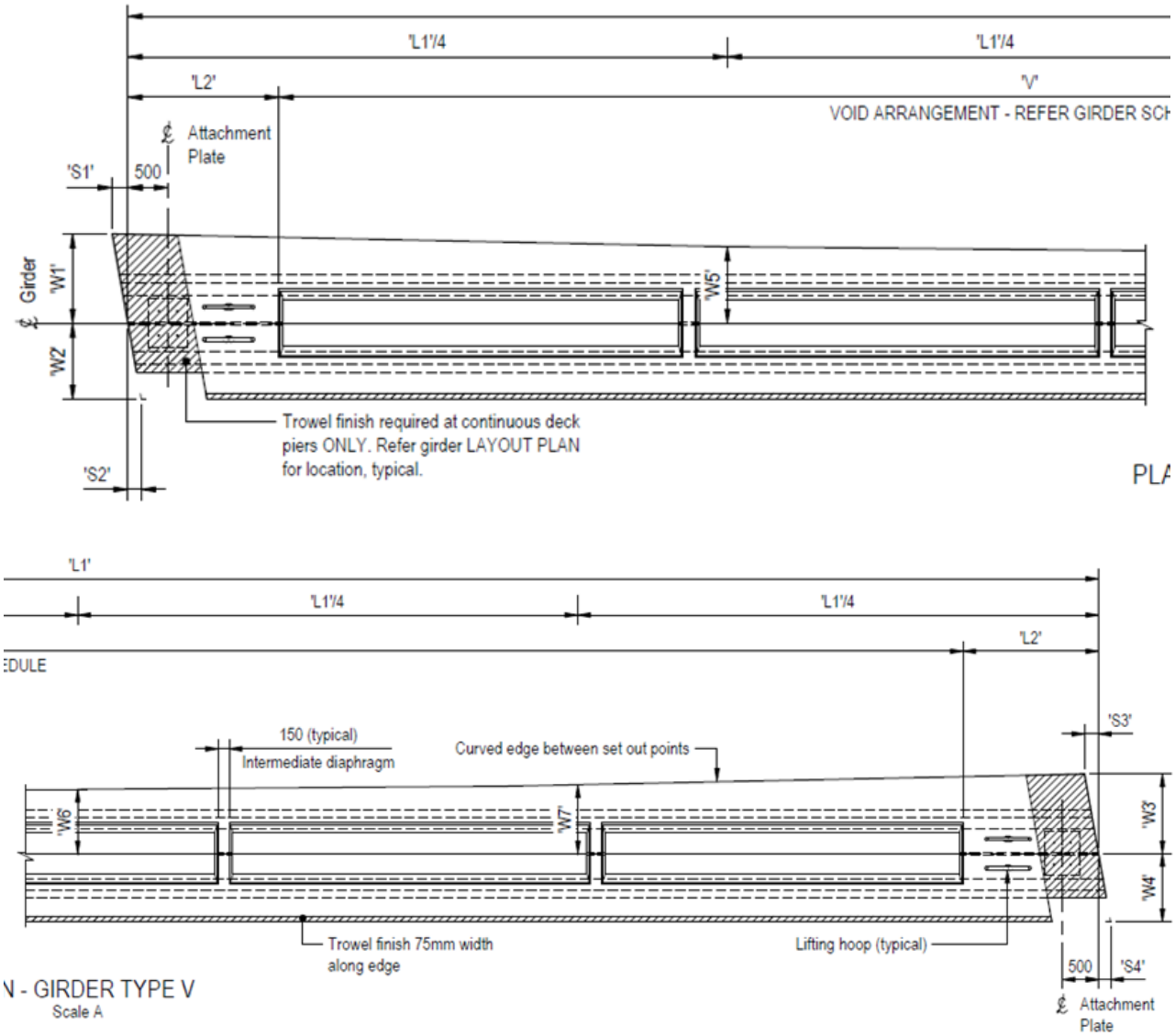
6.4 Limits of deck overhang

The deck overhang referred to in this section is the overhang in section from the outside of the deck to the outer girders. The concrete / steel girders supporting the deck should be set out so that the maximum overhang on both sides of the bridge provides adequate tolerance to fit any drainage system, but also to minimise the overhangs to be within the maximum permissible girder widths. On a curved bridge, the overhangs will vary along the span. Deck reinforcement will be designed to accommodate kerb impact loadings for the maximum deck overhang.

Further, bridge decks on curves will result in the RHS and LHS kerbs / barriers being cast on concentric circular curves, creating a varying overhang of the deck outside the line girders or deck units. The girders or units should be positioned such that the deck overhang at the centre of span on one side of the bridge and the overhang at the ends of the span on the opposite side of the bridge should be approximately equal.

When Super-T girders are used, the outer flange of the outer girders are cast to match the curved alignment, as shown in Figure 6.4

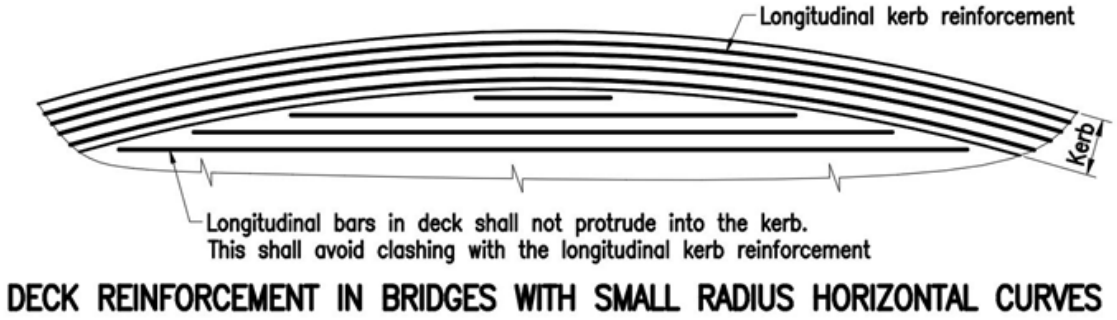
Figure 6.4 – Example of curved Super-T girder flange



6.5 Steel reinforcement layout around curves

Longitudinal reinforcement is placed in a straight line in each span to follow the line of the starter bars protruding from the deck units / girders. On small radii at the extremities of the deck adjacent to the kerbs, the longitudinal steel may be cut to avoid clashing with the curved longitudinal bars in the kerbs. Transverse reinforcement is designed to transfer loads (refer to Figure 6.5).

Figure 6.5 – Diagram demonstrating treatment of longitudinal deck and kerb reinforcement in a bridge with a small radius horizontal curve

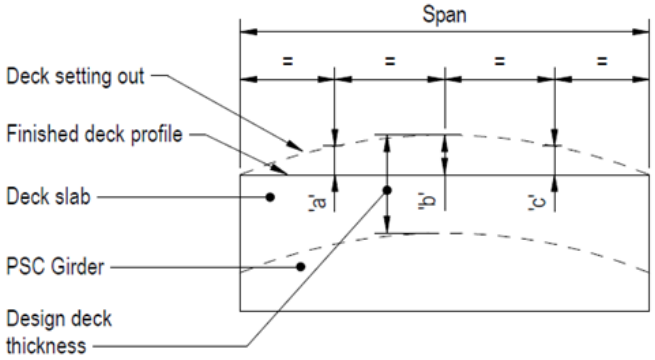


6.6 Pre-camber

When a deck is poured onto deck units or girders, the mass of the concrete deck, barriers, and DWS causes a downwards deflection to the girders or deck units, effectively reducing the girders or beams camber. The values of the downward deflections are referred to as pre-camber. The pre-camber values are to be calculated by the design engineer and shown on the deck drawings in a pre-camber diagram and a tabulated set of values where a multi-span bridge has varying values. When the bridge is being constructed, the deck is cast to consider the downwards deflection by the calculated pre-camber values. An example pre-camber diagram and tabulated values are shown in Figure 6.6.

Figure 6.6 – Pre-camber schedule and diagram example

PRE-CAMBER SCHEDULE			
SPAN	'a'	'b'	'c'
1	2	3	2
2	15	21	15
3	15	21	15
4	12	17	12
5	38	54	38
6	38	54	38
7	14	19	14
8	21	29	21
9	21	29	21
10	19	27	19
11	22	31	22
12	20	29	20



Deck formwork heights to be set with an upward camber to the dimensions shown above to compensate for the downward deflection of the girders due to the mass of the deck, barriers and DWS.
Note: the hog in the girders preclude their use as a datum for setting out formwork heights. There is no allowance in the adjacent profile for vertical curve in the road Control Line.

PRE-CAMBER DIAGRAM
Not To Scale

6.7 Deck thickness

When calculating the deck thickness at the abutments and piers, the pre-camber and hog are considered. For a level bridge or a bridge on a grade, the deck thickness at the abutments and piers is the minimum deck thickness at midspan, plus the hog, minus the pre-camber.

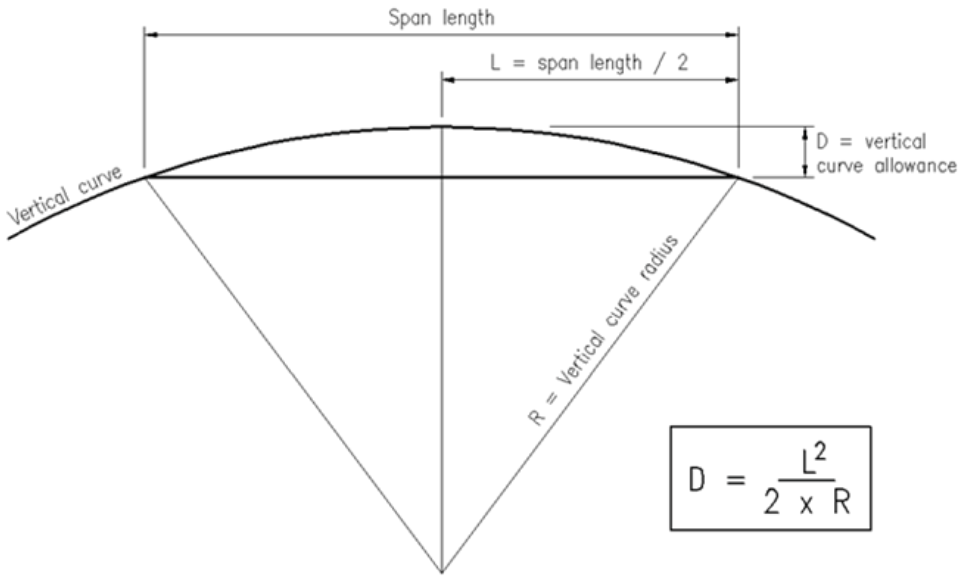
For a bridge on a sag VC, the formula is similar, with additional thickness at the piers and abutments due to the sag VC.

For a bridge on a crest VC, the minimum deck thickness may be at either the mid-span or at the abutments and piers, depending on the value of the crest VC. Additional thickness due to the crest VC may be at either the abutments / piers or the mid-spans.

For example, if a crest VC rises 65 mm over a deck unit span where the deck unit hog is 35 mm, the maximum DWS thickness will be at mid span. Conversely, if the VC rise is 15 mm and the deck unit hog is 35 mm, the DWS will be deepest at the ends of the span

Refer to Figure 6.7 for calculating the value of the VC rise.

Figure 6.7 – Vertical curve allowance



6.8 Deck heights

The bridge deck drawings shall provide deck heights at regular intervals, sufficient for construction.

As stated in Section 4.9.18 of the DCBoS, typically final bridge deck levels, and minimum cast-insitu deck thicknesses shall be designed and set, assuming the cast-insitu deck is cast at 100 days from casting the deck units or girders with this assumption noted on the drawings.

Level bridges require a control line height, crossfall, or superelevation details, and deck cross section dimensions.

All coordinates are planar unless noted otherwise, as discussed in Chapter 3 of this volume.

Bridges on a grade require the control line height at all abutments and piers, crossfall or superelevation details, and deck cross section dimensions. Because the grade is constant, the heights along the bridge can be easily calculated by the construction crew.

Bridges on a VC require that heights to be given every few metres because they cannot be easily calculated in the field.

The spacing of the heights depends on the VC radius. The smaller the radius, the closer the height spacing. Heights can either be given at set chainages, for example, every 5 m, or each span or pour can be divided into equal length segments and heights given at these spacings. Additional heights shall be given at the abutment and pier centrelines, end of deck, and pour extent limits. Deck crossfall or superelevation details and deck cross-section dimensions are also required.

For complex deck surfaces, such as curved, skewed, varying crossfall, and superelevation, a 3D assembly should be modelled to verify the heights and alignment with the road approaches. Bridges with a varying crossfall / superelevation also require the deck heights to be given on the drawings for the same reason and following the same methodology as a bridge on a VC.

The deck heights may be shown either on the deck plan, or in a dedicated deck height schedule.

On the deck plan, heights shall be given at right angles to the bridge control for square and skewed bridges, and radially if the bridge is on a horizontal curve. They should start and finish at a chainage that wholly includes the relieving slabs.

For an example of deck height set out plan, refer to Figure 6.8(a).

For an example of deck height schedule, refer to Figure 6.8(b).

Figure 6.8(a) – Example deck heights plan set out

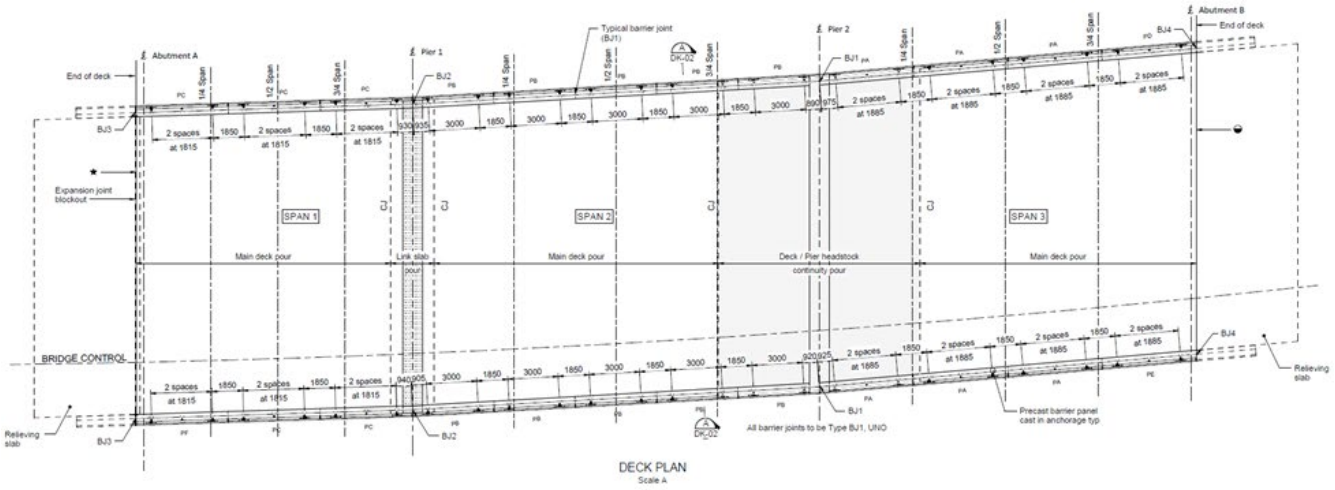


Figure 6.8(b) – Example of deck height schedule

DECK HEIGHT SCHEDULE - CONTROL LINE MC 2100										
LOCATION	CHAINAGE	OFFSET TO Ht 'A'	RL Ht 'A'	OFFSET TO Ht 'B'	RL Ht 'B'	RL Ht 'C'	OFFSET TO Ht 'D'	RL Ht 'D'	OFFSET TO Ht 'E'	RL Ht 'E'
Abutment A blockout	75550.640	15.100	8.310	14.628	8.310	8.675	3.094	8.752	3.566	8.752
Abutment A CL	75550.840	15.102	8.311	14.630	8.311	8.676	3.092	8.753	3.564	8.753
1/4 Span 1	75554.840	15.131	8.325	14.659	8.325	8.690	3.063	8.766	3.535	8.766
1/2 Span 1	75558.840	15.140	8.339	14.669	8.339	8.704	3.054	8.780	3.525	8.780
3/4 Span 1	75562.840	15.130	8.354	14.658	8.353	8.718	3.064	8.794	3.536	8.794
Pier 1 CL	75566.840	15.100	8.369	14.627	8.369	8.732	3.095	8.809	3.567	8.808
1/4 Span 2	75572.895	15.167	8.389	14.695	8.389	8.753	3.027	8.828	3.500	8.828
1/2 Span 2	75578.950	15.189	8.410	14.717	8.410	8.774	3.006	8.849	3.478	8.849
3/4 Span 2	75585.005	15.164	8.432	14.692	8.432	8.795	3.030	8.870	3.502	8.870
Pier 2 CL	75591.065	15.095	8.456	14.622	8.456	8.817	3.100	8.893	3.572	8.893
1/4 Span 3	75596.615	15.155	8.475	14.682	8.474	8.836	3.040	8.911	3.513	8.911
1/2 Span 3	75602.170	15.177	8.494	14.704	8.494	8.856	3.019	8.930	3.492	8.930
3/4 Span 3	75607.725	15.160	8.515	14.686	8.515	8.875	3.036	8.950	3.509	8.950
Abutment B CL	75613.285	15.104	8.536	14.630	8.536	8.895	3.092	8.971	3.565	8.970
EOD Abutment B	75613.560	15.100	8.537	14.627	8.537	8.896	3.096	8.972	3.569	8.971

6.9 Deck wearing surface heights

DWS on bridges is discussed in Section 4.11 of the DCBoS, and in Chapter 3 of this volume. Refer to Chapter 3 for theory and worked examples of DWS mass calculations.

If DWS heights are required to be shown on the deck drawings, then the requirements are similar to deck heights as discussed in Section 6.8 of this chapter. The drawings shall provide enough information, either on a plan view or in a table.

For transversely stressed deck units without a reinforced concrete deck slab, use the same principles outlined above to determine the location requirements for DWS heights.

Enough information to be able to inform the profile and heights of the DWS is required on the bridge drawing set, without reference to the civil drawings package. This assists in the future understanding of the bridge when planning assessment, repairs, and rehabilitation.

6.10 Deck drainage

As per Section 4.10 of the DCBoS, bridges over roadways and railways typically have a drainage collection and pipework disposal system to drain the deck without discharging onto people and traffic below the bridge.

Collection of drainage water over streams may not be required unless specified in the Environmental Management Plan (EMP).

The discharge points of such a system should be beyond the abutment embankment protection to limit potential damage to the embankment protection caused by runoff, and also to provide for removal of debris that gets trapped within the system.

6.11 Drainage scuppers

Scuppers shall comply with MRTS77 *Bridge Deck*. Standard scupper details are available on the following Standard Drawings:

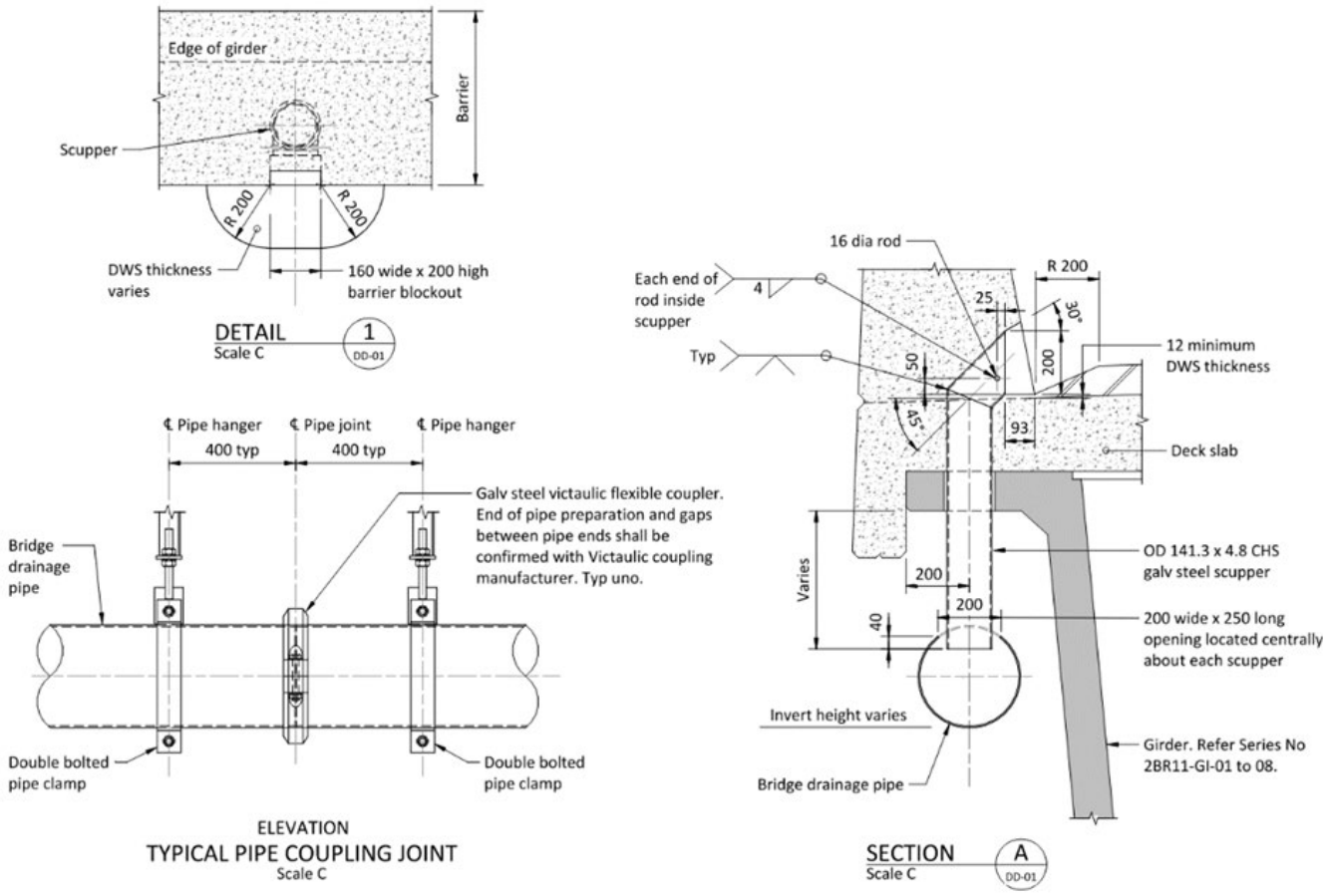
- Transversely stressed deck units: Refer to SD2045 *Bridge Kerbs – Standard Details of Cast Insitu Kerbs for Transversely Stressed PSC Deck Units* for scupper recesses in cast-insitu kerbs; and for scupper details through the deck unit, refer to SD2050 *Precast Units – 10m PSC Deck Unit (Drawing 1 of 6 to Drawing 6 of 6)* to SD2065 *Precast Units – 25m PSC Deck Unit (Drawing 1 of 6 to Drawing 6 of 6)*.
- Cast-insitu decks: SD1145 *Standard P.V.C. Scupper – Details for Cast Insitu Deck* provides details of a standard PVC scupper for cast-insitu decks.
- Scupper spacing is based on hydraulic design analysis to ensure effective drainage of the structure.
- Scuppers requiring penetrations through girders shall be set out in the girder drawings.
- Scuppers not requiring girder penetrations shall be set out in the deck drawings.
- Suspended drainage systems shall be outlined and detailed in the bridge drainage drawings. Hanger anchorages are to be accurately located and documented in either the bridge deck or girder drawings, depending on their position, and
- Scuppers may not be necessary for a short bridge on a grade.

For an example of a drainage system consisting of scuppers and pipework fixed externally to the bridge structure, refer to Figure 6.12.

6.12 Environmental drainage

Where required in the EMP, the bridge shall be incorporate a drainage collection and pipework disposal system that prevents stormwater or spillages on the deck from discharging directly to the waterway below the bridge.

Figure 6.12 – Example suspended drainage system



6.13 Bridge traffic barriers

Bridge traffic barriers shall conform to the requirements set out in Section 4.12 of the DCBoS.

The most common barrier types on departmental bridges are as follows:

- single slope reinforced concrete barriers, and
- post and rail bridge traffic barriers, safety rails, and balustrades.

Road user safety, afflux reduction, functionality and appearance, use of pre-cast concrete barriers, transition between road and bridge barriers, retrofit of barriers, and attachments to barriers on bridges are discussed in the DCBoS.

6.13.1 Single slope reinforced concrete barriers

As stated in the DCBoS, concrete traffic barriers and median barriers on bridges shall be cast integral with the bridge deck using reinforcing steel.

Concrete traffic barriers shall be used on overpass bridges. Concrete barriers may also be required on bridges along major roads or those with tight horizontal curves. The barrier slope to the road face shall be 1 in 5.25 in accordance with SD1468 *Single Slope Concrete Barrier – Extruded Median Barrier – Barrier, Reinforcing and Expansion Joint Details (Sheet 1 of 2 and Sheet 2 of 2)* and SD2190 *Bridge Barriers – Precast Bridge Barrier Panel – General Arrangement*, as shown in Figure 6.13.1(a).

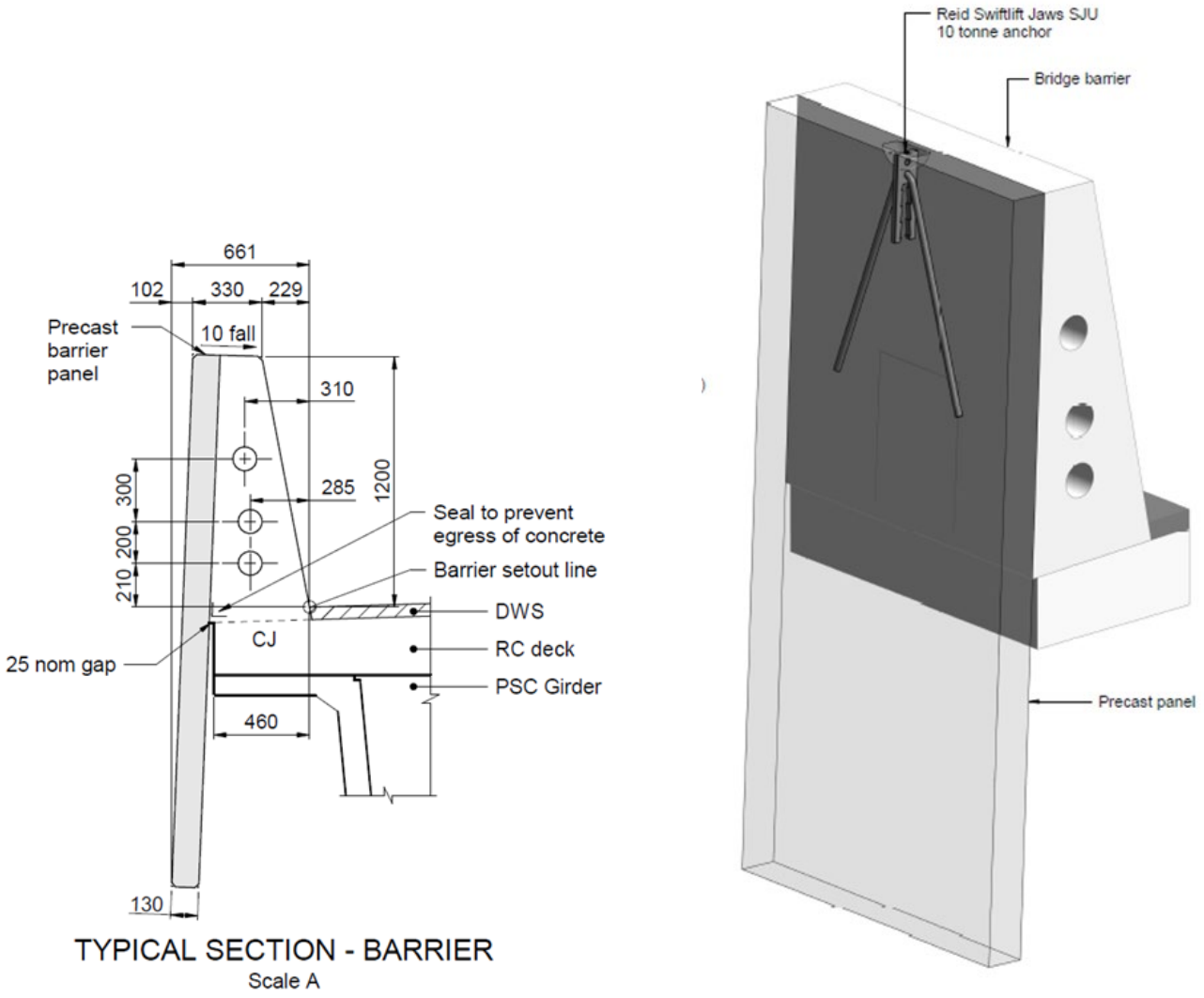
Figure 6.13.1(a) – Single slope barrier detail

For single-slope concrete barriers, pre-cast panels should be used to reduce construction time and minimise road or railway closures. SD2190 *Bridge Barriers – Precast Bridge Barrier Panel – General Arrangement* sets out the requirements for these panels.

The cast-insitu portion of the barrier should be wide enough to allow proper concrete vibration. The back face of the barrier is pre-cast and erected on the bridge deck, while the front face is cast-insitu (refer to Figure 6.13.1(b)).

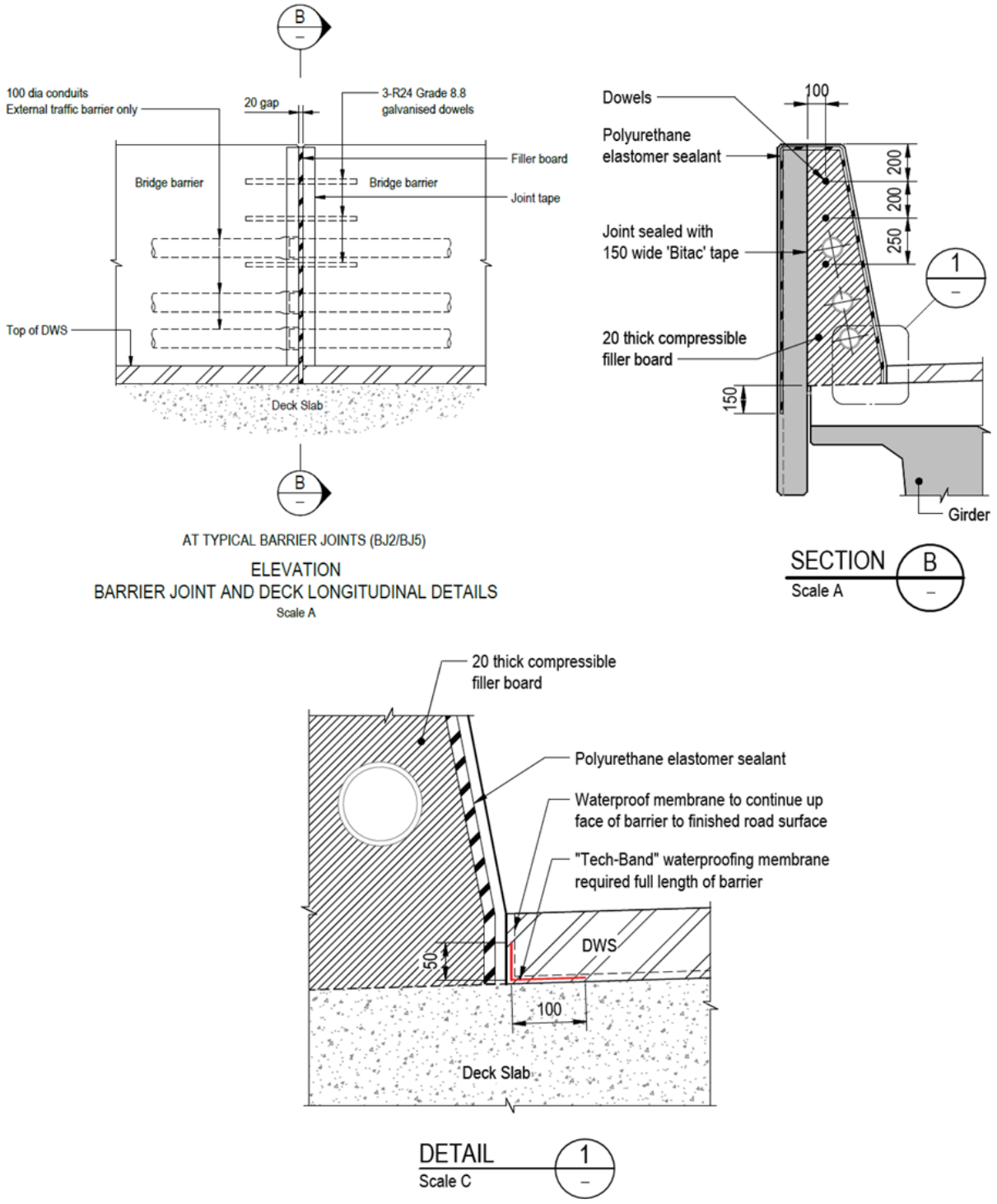
Pre-cast barrier brackets are used to locate the panel on the deck during casting of the internal insitu face (refer to Section 6.13.2 of this chapter for pre-cast panel brackets and anchorages).

Figure 6.13.1(b) – Barrier with pre-cast panel example



Crack control joints are generally spaced 4 m apart, as per SD1468 *Single Slope Concrete Barrier – Extruded Median Barrier – Barrier, Reinforcing and Expansion Joint Details (Sheet 1 of 2 and Sheet 2 of 2)* (refer to Figure 6.13.1(c) for an example of a typical barrier joint).

Figure 6.13.1(c) – Barrier joints



6.13.2 Precast panel brackets and anchorages

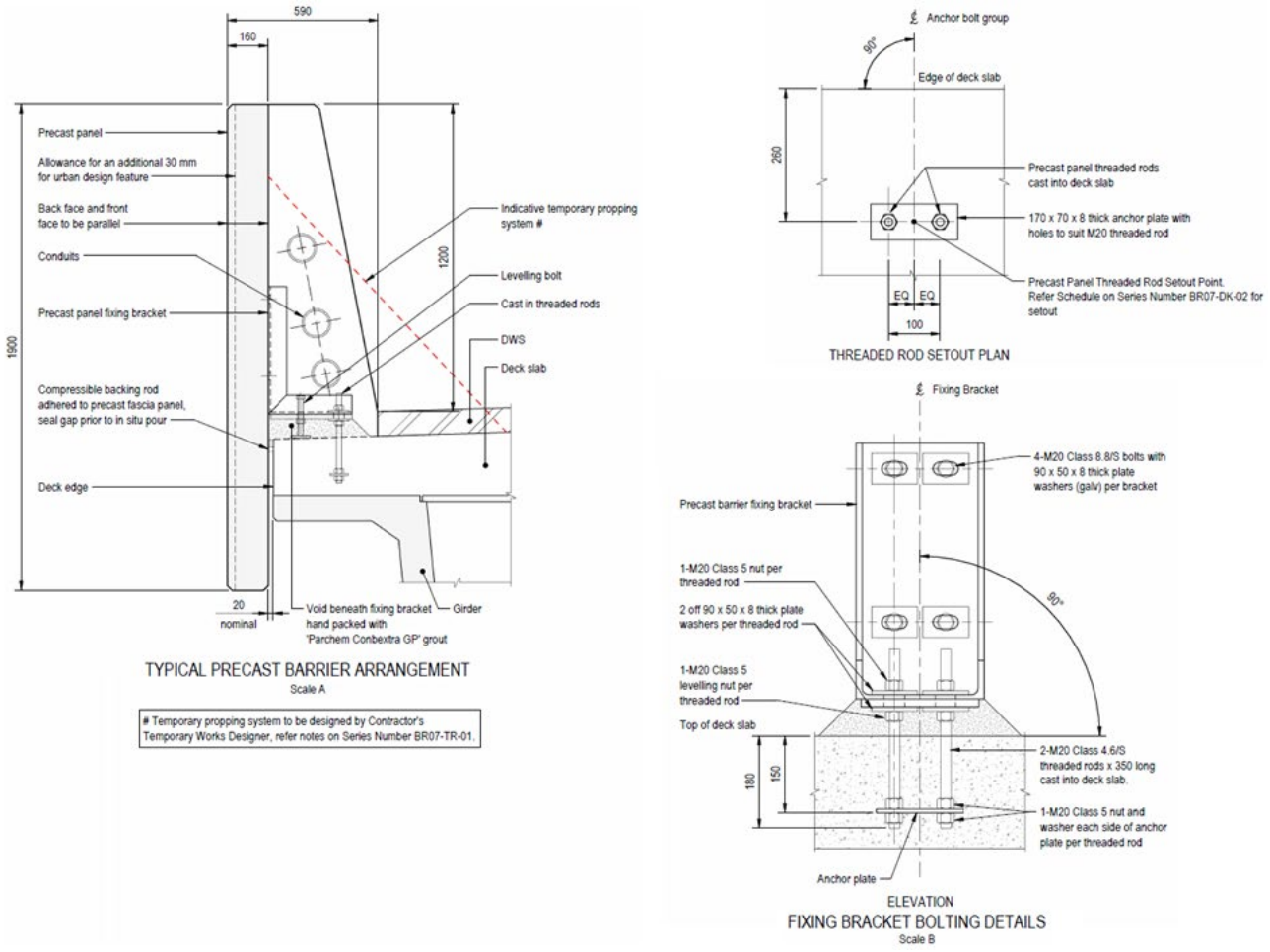
The detailing of the panel bracket shall include enough detail for the complete fabrication of each item or provide sufficient information for the fabricator to create detailed shop drawings. Generally, one or 2 views with enlarged details of complex sections will suffice. Assembly layout drawings should be created to clearly depict all components in their final positions within the structure.

Precast barrier brackets should be positioned perpendicular to the longitudinal grade of the deck and allow for height adjustment while securely attaching to the deck; typically this is achieved using a leveling bolt.

The cast-in anchorages for these brackets shall be clearly set out on the concrete deck layout plan. A diagram showing the typical set out dimensions should be included to provide clear guidance for correct positioning and orientation. Coordinates for setting out the bracket anchorages are acceptable, provided they include sufficient information to ensure the brackets are accurately oriented in both the transverse and longitudinal directions.

An example of a precast panel bracket assembly is shown in Figure 6.13.2.

Figure 6.13.2 – Precast panel bracket assembly example



6.13.3 Cast-Insitu Kerbs

Standard cast-insitu kerbs shall comply with SD2200 *Bridge Traffic Barriers – Post and Rail Traffic Barriers Regular Performance Level (Drawing 1 of 5 to Drawing 5 of 5)* and/or SD2045 *Bridge Kerbs – Standard Details of Cast Insitu Kerbs for Transversely Stressed PSC Deck Units*.

Transversely stressed deck unit bridges without a reinforced concrete deck slab have starter bars protruding from the deck units at kerb locations to bond the kerb to the deck units. Additional ligatures are to be designed at bridge traffic barrier post anchorage locations.

The top face of the kerb shall be level on bridges with a crossfall or superelevation up to and including 3%. For bridges with a superelevation greater than 3%, the top face of the kerb follows the superelevation.

6.13.4 Post and rail traffic barrier

Refer to SD2200 *Bridge Traffic Barriers – Post and Rail Traffic Barriers Regular Performance Level (Drawing 1 of 5 to Drawing 5 of 5)*, SD2203 *Bridge Traffic Barriers – Bridge Balustrade for Pedestrian Only Path (Drawing 1 of 2 and Drawing 2 of 2)* and SD2204 *Bridge Traffic Barriers – Bridge Balustrade for Pedestrian Only Path (Drawing 1 of 2 and Drawing 2 of 2)* for standard details for steel bridge traffic barriers, pedestrian safety rails, and balustrades. Currently, the department has not published a dedicated Standard Drawing for bicycle or shared path safety rails.

The set of drawings should be presented in a similar manner to the published Standard Drawings, and additional guidance set out in this volume.

6.13.5 Bridge traffic barrier post anchorage locations

For bridges with regular performance post and rail traffic barriers, the spacing of the post anchorages shall be in accordance with the criteria in the relevant Standard Drawing. A drafting check for this should be done to detect any clashes between kerb starter bars and post anchorages, and the location of kerb starter bars may be altered to avoid any detected clashes.

A diagram showing the typical set out dimensions should be included on the barrier or deck drawings. Coordinates for setting out of post anchorages are acceptable in addition to these dimensions.

6.13.6 Junction boxes

Junction boxes shall be installed on bridges under the following conditions:

- Where light poles are present on the bridge
- At intervals not exceeding 120 m, as specified in Clause 10.2 of MRTS91 *Conduits and Pits*, and
- ITS installations such as CCTV cameras, VMS signs, navigational lighting, and so on.

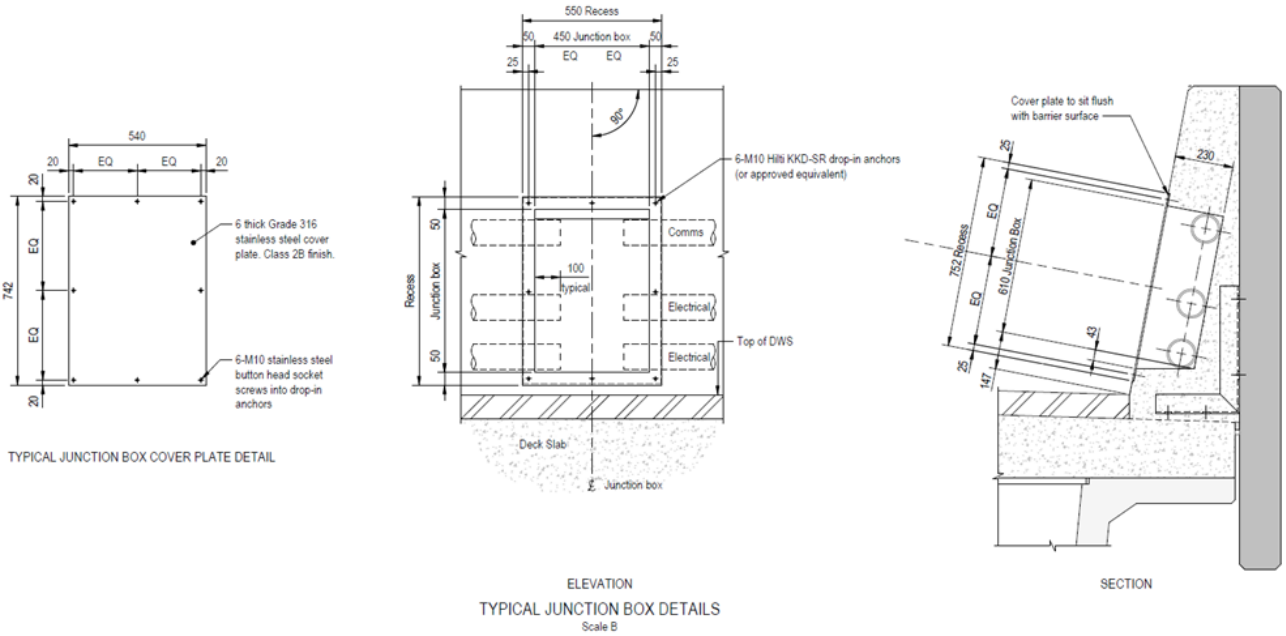
Additional considerations:

- Junction boxes may need to be placed at closer intervals on bridges with tight horizontal curves or at abutments with tight radius bends to accommodate cable pulling, and
- Coordination with electrical engineers is essential to confirm the constructability and practicality of the design.

Junction boxes should be located as close as practical to the light pole while avoiding clashes with anchorages and ensuring sufficient space for conduit bends. Junction boxes shall be appropriately sized to accommodate conduit bell mouths and shall have a stainless steel cover plate as per the DCBoS and MRTS77 *Bridge Deck*.

Concrete inserts for attaching the cover plates should be cast into the bridge's concrete traffic barriers or kerbs. An example of a junction box including a cover plate is shown in Figure 6.13.6.

Figure 6.13.6 – Junction box example

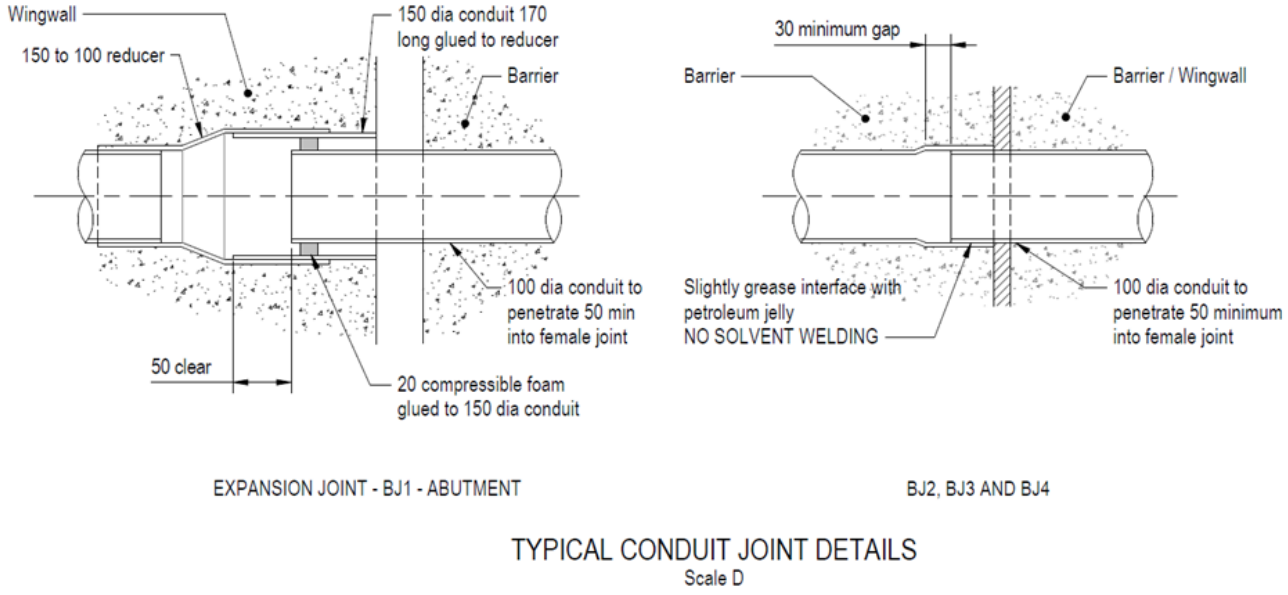


6.13.7 Conduits

Most bridges require conduits to support Intelligent Transport Systems (ITS) and electrical services for current or future use. All conduits shall comply with MRTS91 *Conduits and Pits*, with service provisions detailed in the project-specific requirements.

A minimum clear distance between conduits should be 50 mm clear typically, increasing to 100 mm when reinforcement is placed between them. Conduit joint designs shall accommodate bridge movement and construction tolerances. An example of conduit joint details is shown in Figure 6.13.7.

Figure 6.13.7 – Conduit joint example

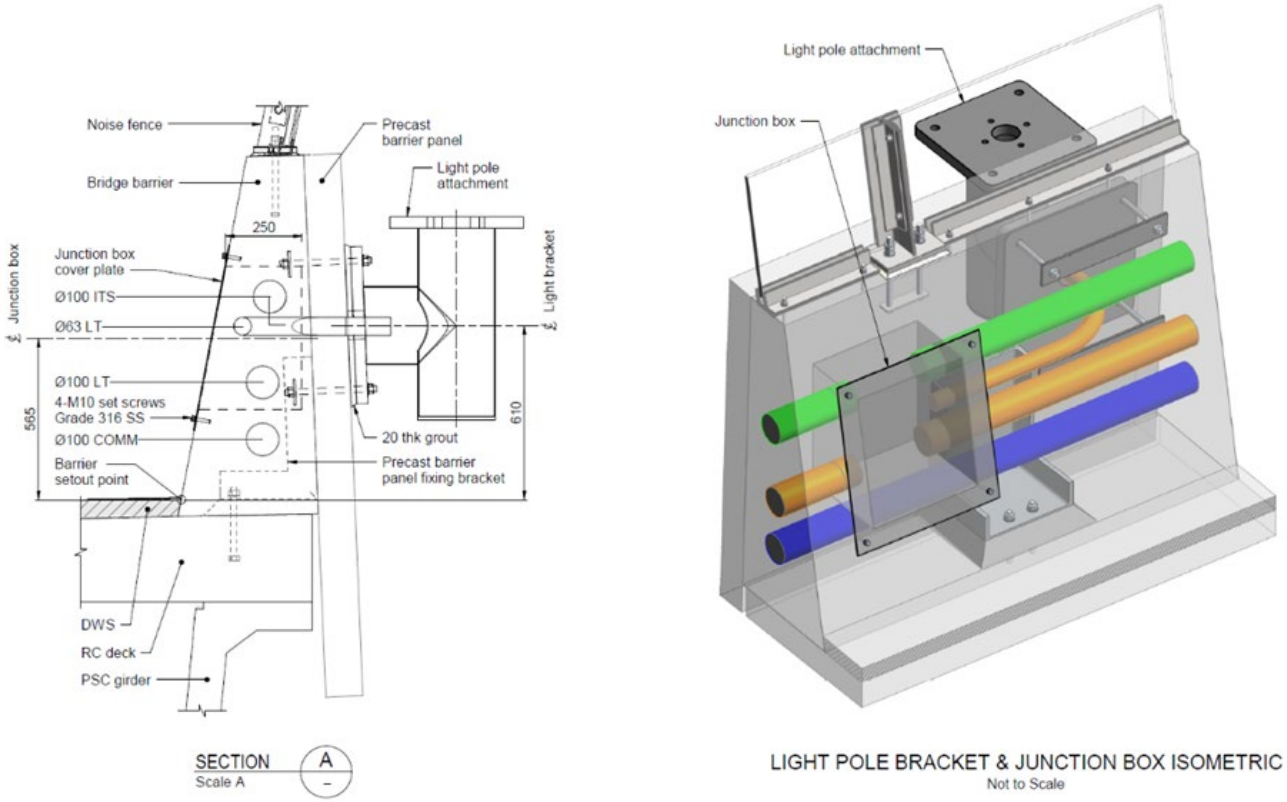


6.13.8 Light pole brackets and anchorages

All light pole installations on bridges and other structures shall be in accordance with MRTS94 *Road Lighting* and Section 4.12.10 of the DCBoS.

Light poles should be placed as close to the pier or abutment as practical, ideally a nominal distance of 1-3 m to reduce vibrations. Light pole bracket anchorages shall be level and clearly set out on the concrete deck layout plan. A diagram showing the typical set out dimensions should be included to provide clear guidance for correct positioning and orientation (refer to Figure 6.13.8 for example of a light pole bracket design).

Figure 6.13.8 – Example light pole bracket



6.13.9 Typical content required on the bridge deck drawings

Table 6.13.9 provides the minimum drawing content that should be presented on the set of project-specific drawings for the elements listed above, along with typical drawing elements, such as views, details, schedules and diagrams, and sub-set specific notes, and each is cross-referenced to figures extracted from example drawings.

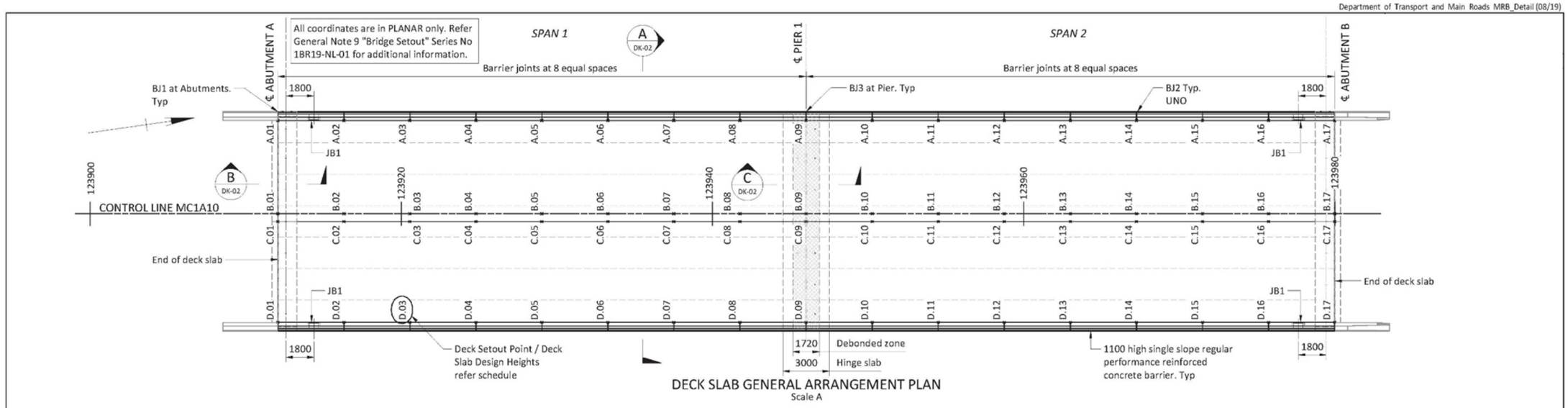
Table 6.13.9 – Bridge deck – Project-specific drawings content

Requirement	Drawing or element description	Figure reference
Deck plan	A plan that depicts the typical spans showing the following, but not limited to: • bridge control • north arrow • centrelines of abutments and piers • width between kerbs or barriers • crossfall value and direction arrow • outline of kerbs or barriers, construction joints, relieving slabs, and wing walls, as well as attachments to barriers, junction boxes within kerbs or barriers, where required • deck heights, as per Section 6.8, if not using a dedicated schedule • location and types of joints • durface treatments such as de-bonded zones, or infill pours, construction joints, as specified • set out and spacing of bridge traffic barrier anchorage groups, and • set out and spacing of deck drainage.	Figure 6.13.9(a)
Deck heights schedule	A dedicated table to show the deck heights at bridge control and at the kerbs.	Figure 6.13.9(a)
Deck sections	Typical sections that depict the deck features, as described above for deck plan, as well as labelling elements not visible in the deck plan view, such as: • Offset to crown if not coincidental with bridge control • Deck concrete and/or DWS thickness • DWS layers • Girder arrangement and gaps between girders • Barrier outlines showing any conduits within and panels to the outside faces, and • Section and detail labels for details to be taken off.	Figure 6.13.9(b)

Requirement	Drawing or element description	Figure reference
Pre-camber diagram	Diagram to explain formwork set out to accommodate downward deflection of the girders due to the mass of the concrete deck, and DWS if used.	Figure 6.13.9(a)
Deck-specific notes and legend	Deck-specific notes, including deck casting notes and legend specific to the deck.	Figure 6.13.9(a) Figure 6.13.9(d)
Concrete details as sections and details	Details required: • insitu barriers • deck sealant treatment for and dimensions of gaps between girders • cross-girder details, including debonding treatment for gaps between girders over piers • expansion joints if not detailed elsewhere in the package • cover plates at expansion joints for kerbs or barriers, if used, and if not detailed elsewhere in the package • small movement joints • typical section at barrier detailing precast and cast-insitu elements, including all connections between the elements and to the deck, dimensioned, and all materials described • dowelled connections at barrier joints • joint sealants at gaps in kerbs or barriers • conduit joints at gaps in kerbs or barriers • details of attachments to barriers such as lighting or Intelligent Transport System (ITS) upstands, and associated conduits, junction boxes, and cover plates.	Figure 6.13.9 (b) and Figure 6.13.9(d)
Deck and cross-girder reinforcement details	Plan view of and sections through deck and cross-girders to provide details of the following, but not limited to: • all bars and spacing within the deck, barriers, and kerbs, as required • construction joints, and • enlarged details of complex or congested bars.	Figure 6.13.9(g) to Figure 6.13.9(k)

Requirement	Drawing or element description	Figure reference
Restraint block details (girders only)	Connection details into the cross-girders, including construction sequence, dowel and dowel cap sizes, fabrication, and configuration.	Figure 6.13.9(d) and Figure 6.13.9(e)

Figure 6.13.9(a) – Prestressed concrete girders deck – concrete layout plan



DECK SLAB DESIGN HEIGHTS			
Deck Setout Point	Easting (m)	Northing (m)	Deck Slab Design Height (Ht) (m)
A.01	239932.980	7412786.662	13.710
A.02	239933.586	7412790.862	13.718
A.03	239934.193	7412795.063	13.727
A.04	239934.799	7412799.263	13.735
A.05	239935.405	7412803.464	13.744
A.06	239936.011	7412807.665	13.752
A.07	239936.617	7412811.865	13.761
A.08	239937.223	7412816.066	13.769
A.09	239937.831	7412820.279	13.778
A.10	239938.439	7412824.492	13.786
A.11	239939.045	7412828.692	13.795
A.12	239939.651	7412832.893	13.803
A.13	239940.257	7412837.093	13.812
A.14	239940.863	7412841.294	13.820
A.15	239941.469	7412845.494	13.829
A.16	239942.075	7412849.695	13.837
A.17	239942.681	7412853.895	13.846

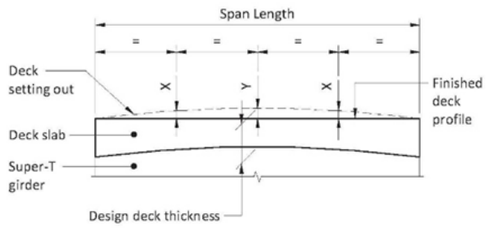
DECK SLAB DESIGN HEIGHTS			
Deck Setout Point	Easting (m)	Northing (m)	Deck Slab Design Height (Ht) (m)
B.01	239938.901	7412785.807	13.889
B.02	239939.507	7412790.008	13.898
B.03	239940.113	7412794.209	13.906
B.04	239940.719	7412798.409	13.915
B.05	239941.325	7412802.610	13.923
B.06	239941.931	7412806.810	13.932
B.07	239942.537	7412811.011	13.940
B.08	239943.144	7412815.211	13.949
B.09	239943.751	7412819.424	13.957
B.10	239944.359	7412823.637	13.966
B.11	239944.965	7412827.838	13.974
B.12	239945.571	7412832.038	13.983
B.13	239946.178	7412836.239	13.991
B.14	239946.784	7412840.440	14.000
B.15	239947.390	7412844.640	14.008
B.16	239947.996	7412848.841	14.016
B.17	239948.602	7412853.041	14.025

DECK SLAB DESIGN HEIGHTS			
Deck Setout Point	Easting (m)	Northing (m)	Deck Slab Design Height (Ht) (m)
C.01	239939.396	7412785.736	13.904
C.02	239940.002	7412789.937	13.913
C.03	239940.608	7412794.137	13.921
C.04	239941.214	7412798.338	13.930
C.05	239941.820	7412802.538	13.938
C.06	239942.426	7412806.739	13.947
C.07	239943.032	7412810.939	13.955
C.08	239943.638	7412815.140	13.964
C.09	239944.246	7412819.353	13.972
C.10	239944.854	7412823.566	13.981
C.11	239945.460	7412827.766	13.989
C.12	239946.066	7412831.967	13.998
C.13	239946.672	7412836.168	14.006
C.14	239947.278	7412840.368	14.015
C.15	239947.885	7412844.569	14.023
C.16	239948.491	7412848.769	14.031
C.17	239949.097	7412852.970	14.040

DECK SLAB DESIGN HEIGHTS			
Deck Setout Point	Easting (m)	Northing (m)	Deck Slab Design Height (Ht) (m)
D.01	239945.811	7412784.810	13.710
D.02	239946.418	7412789.011	13.718
D.03	239947.024	7412793.212	13.727
D.04	239947.630	7412797.412	13.735
D.05	239948.236	7412801.613	13.744
D.06	239948.842	7412805.813	13.752
D.07	239949.448	7412810.014	13.761
D.08	239950.054	7412814.214	13.769
D.09	239950.662	7412818.427	13.778
D.10	239951.270	7412822.640	13.786
D.11	239951.876	7412826.841	13.795
D.12	239952.482	7412831.041	13.803
D.13	239953.088	7412835.242	13.812
D.14	239953.694	7412839.442	13.820
D.15	239954.300	7412843.643	13.829
D.16	239954.906	7412847.844	13.837
D.17	239955.512	7412852.044	13.846

PRE-CAMBER SCHEDULE

SPAN	DIMENSION	
	X	Y
1	17	23
2	17	23



PRE-CAMBER DIAGRAM
NTS

LEGEND

A.01
- Setout point number
- Height row reference

BJ2
- Joint Type
- Barrier Joint

JB Junction Box. Refer Series No 1BR19-DK-06

NOTES

1. For General Notes, refer Series No 1BR19-NL-01 & 1BR19-NL-02.
2. Construction of the reinforced concrete deck shall be in accordance with MRTS77.
3. Coat finished deck surface with bituminous waterproofing membrane for the full length of the bridge, including relieving slabs.
4. Deck Pre-camber:
   Deck formwork heights to be set with an upward camber to the dimensions shown on the Pre-camber Diagram adjacent to compensate for the downward deflection of the Super-T girders due to the mass of the deck and DWS. Note that the hog in the Super-T girders precludes their use as a datum for setting out formwork heights. There is no allowance in the adjacent profile for Vertical curve in the road Control Line.
5. Deck Casting Notes:
   - Casting of deck shall not occur until all girders within span are installed.
   - Initial pours to be placed prior to infill pours.
   - Each length of initial pour shall be carried out as a continuous operation.
   - Infill pour cannot be placed until at least 7 days after adjacent pours have been completed.

BRIDGE DESIGN CRITERIA: AS(/NZS) 5100-2017 | DESIGN LOADING: SM1600 & HLP400 | DESIGN SPEED: 110km/h | EARTHQUAKE ZONE: BEDC-3 | BARRIER PERFORMANCE LEVEL: Regular | BRIDGE TYPE: RC Deck on Super-T Girders | BIS No.

Associated Job Nos | Auxiliary Drg Nos | Survey Data: Datum SOP A; Horiz. Grid PLANAR; Height Origin AHD (DERIVED); Survey Books MR102631 | Scales: Scale A 0 1.25 2.5 3.75 5 m | Dimensions shown in Millimetres except where shown otherwise

CTL CHGE

Reference Points: Proceeding RP | Dist. to start of job (km) | From start to end of job | From end to following RP | Following RP | Through Chainage from

Drawn | Checked | Designed No. | Verified No. | Design Reviews (RPEQ) No. Date.

DECK
CONCRETE LAYOUT PLAN

ENGINEERING CERTIFICATION (RPEQ): ENG. AREA | NAME | SIGNATURE | NO. | DATE — Structural

Queensland Government

Job No. | Contract No. | Drawing No. | Series Number | BR Drgs

05				
04				
03				
A	Issued for Construction			
	Revisions/Descriptions	Name or RPEQ No.	Signature	Date

CAD FILES

Figure 6.13.9(b) – Prestressed concrete girders deck – concrete sections and details – Sheet 1

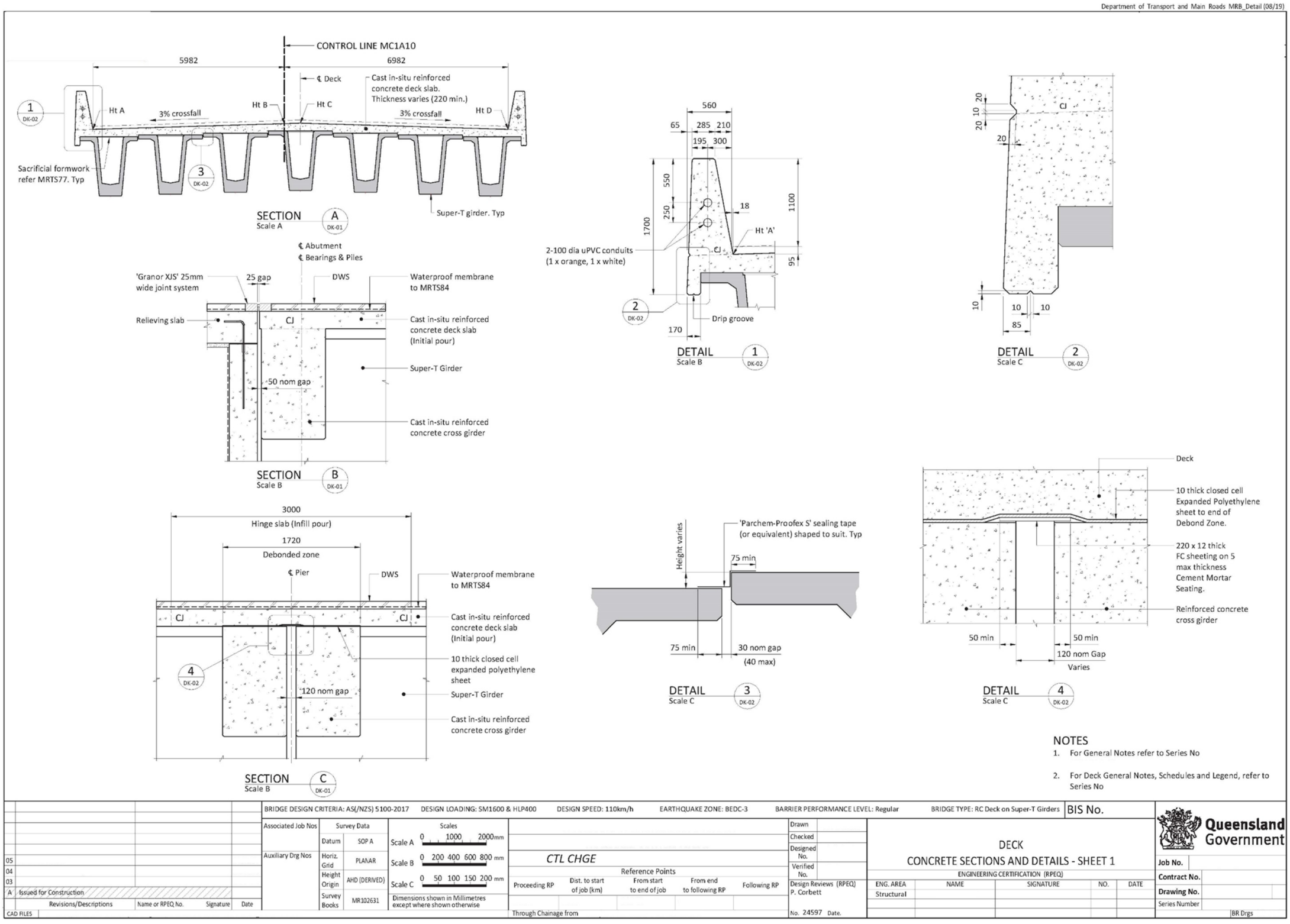


Figure 6.13.9(c) – Prestressed concrete girders deck – concrete sections and details – Sheet 2

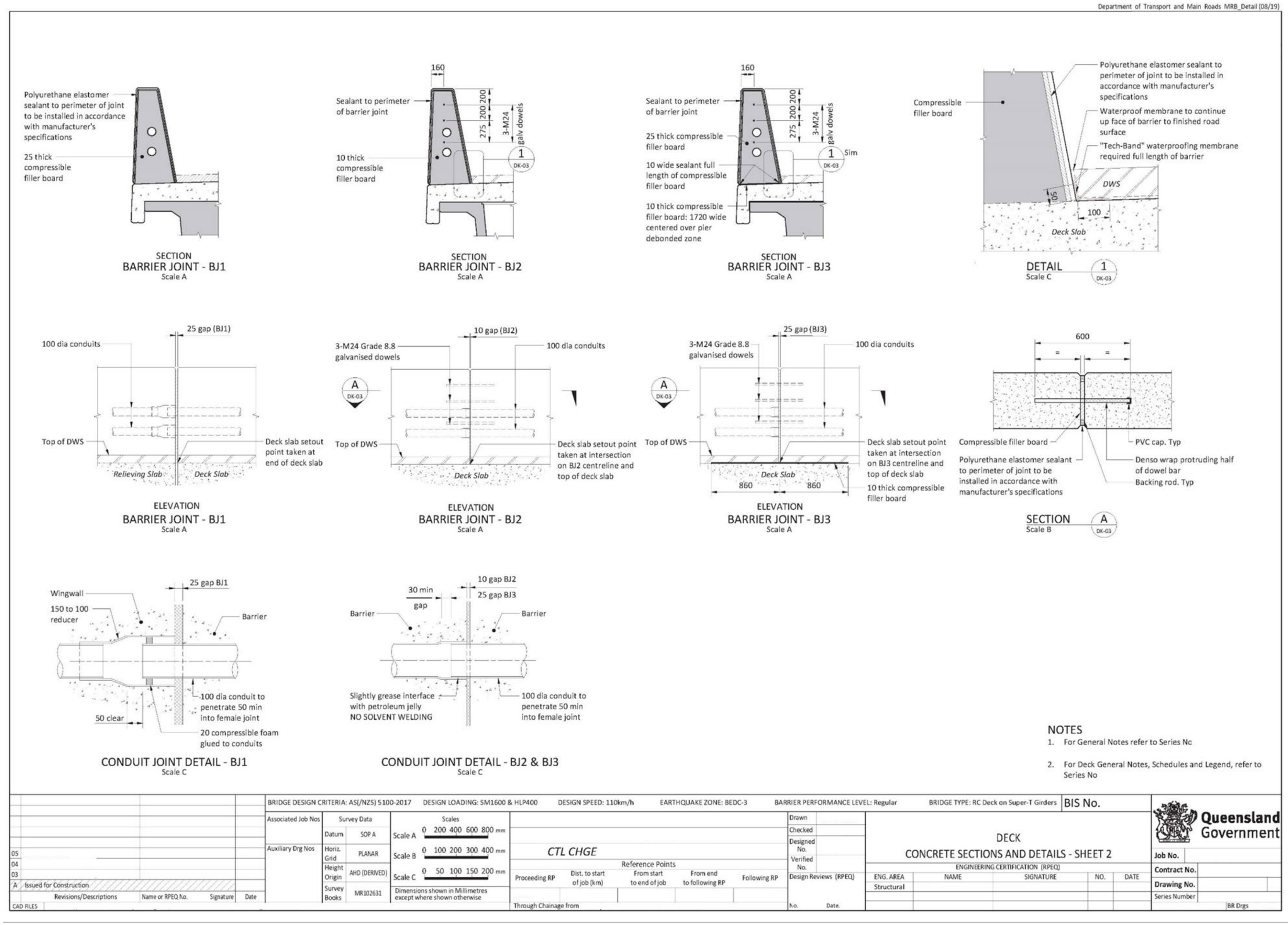
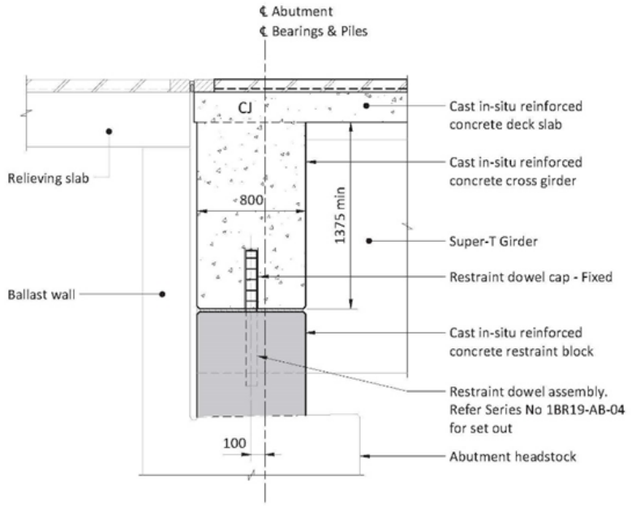
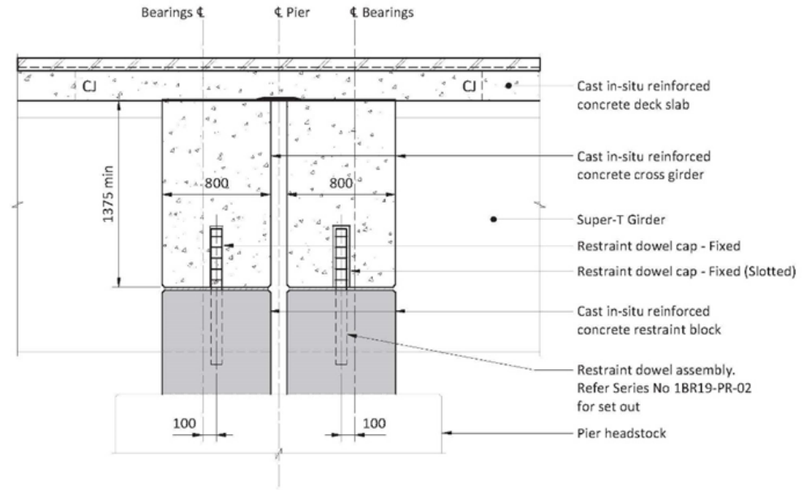


Figure 6.13.9(d) – Prestressed concrete girders deck – Sheet 3



RESTRAINT DETAIL AT ABUTMENT
Scale A



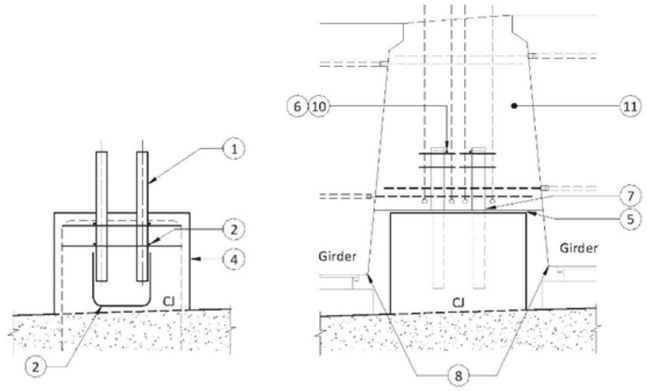
RESTRAINT DETAIL AT FIXED PIER
Scale A

INDICATIVE CONSTRUCTION SEQUENCE PRESUMED IN DESIGN

1. Set up dowels on site.
2. Dowels to be held rigidly over the headstock using a suitable temporary supporting system to be determined by the contractor.
3. Check set out horizontally and vertically to the specified tolerances below.
4. Pour restraint blocks.
5. Place cellular polystyrene board with cut outs for dowels on top of the restraint block. Seal gap between the cut out and the dowel.
6. Position cap assembly to the specified tolerances.
7. Fully seal interface between the cap and polystyrene board all round to prevent ingress of concrete during cross girder pour.
8. Place Super-T girders.
9. Place cross girder reinforcement.
10. Restrain caps in place against reinforcement cage prior to the pour.
11. Pour cross girder.

RESTRAINT DOWEL AND CAP INSTALLATION TOLERANCES

- Plan Position: ± 2mm
- Verticality: 1:200



NOTE: 2 dowels shown applies to Pier locations.
3 dowel assembly required at Abutments.

INDICATIVE CONSTRUCTION SEQUENCE PRESUMED IN THE DESIGN
Scale A

NOTES

1. For General Notes refer to Series No
2. For Deck General Notes, Schedules and Legend, refer to Series No

RESTRAINT DOWEL NOTES

1. Any interface, joints or cuts in the polystyrene board shall be fully sealed prior to the cross girder pour to prevent ingress of concrete during the pour.
2. Dowels to be Grade 2205 Stainless Steel with a minimum yield strength of 450MPa.
3. Contractor to develop construction methodology and provide dowel support arrangements to suit construction requirements.

BRIDGE DESIGN CRITERIA: AS(/NZS) 5100-2017 | DESIGN LOADING: SM1600 & HLP400 | DESIGN SPEED: 110km/h | EARTHQUAKE ZONE: BEDC-3 | BARRIER PERFORMANCE LEVEL: Regular | BRIDGE TYPE: RC Deck on Super-T Girders | BIS No.

Associated Job Nos | Auxiliary Drg Nos

Survey Data: Datum SOP A; Horiz. Grid PLANAR; Height Origin AHD (DERIVED); Survey Books MR102631

Scales: Scale A 0 200 400 600 800 mm
Dimensions shown in Millimetres except where shown otherwise

CTL CHGE

Reference Points: Proceeding RP | Dist. to start of job (km) | From start to end of job | From end to following RP | Following RP
Through Chainage from

Drawn | Checked | Designed No. | Verified No. | Design Reviews (RPEQ) No. Date.

DECK
CONCRETE SECTIONS AND DETAILS - SHEET 3

ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	NAME	SIGNATURE	NO.	DATE
Structural				

Queensland Government

Job No. | Contract No. | Drawing No. | Series Number | BR Drgs

	Revisions/Descriptions	Name or RPEQ No.	Signature	Date
05				
04				
03				
A	Issued for Construction			

CAD FILES

Figure 6.13.9(e) – Prestressed concrete girders deck – Sheet 4

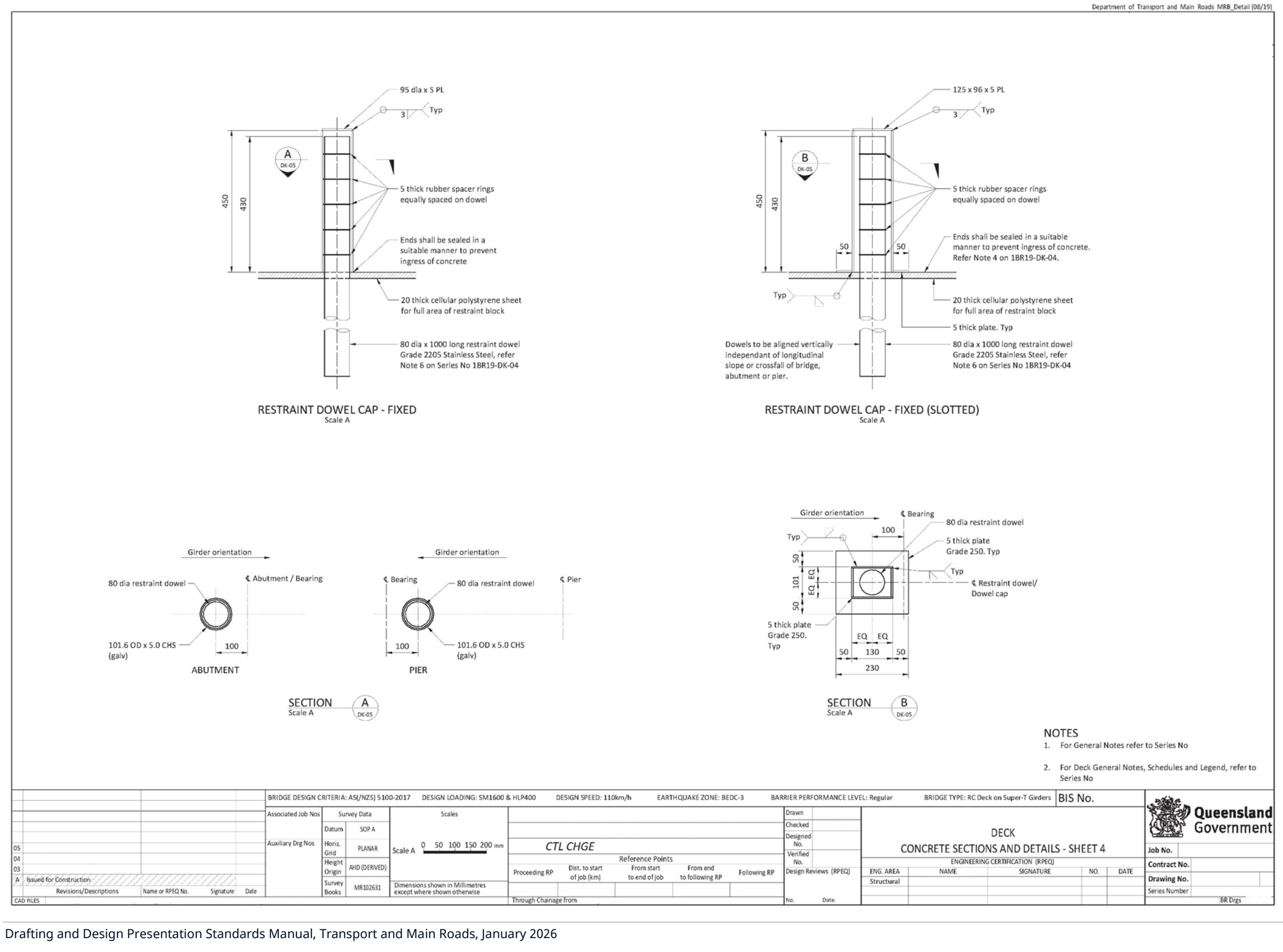


Figure 6.13.9(f) – Prestressed concrete girders deck – Sheet 5

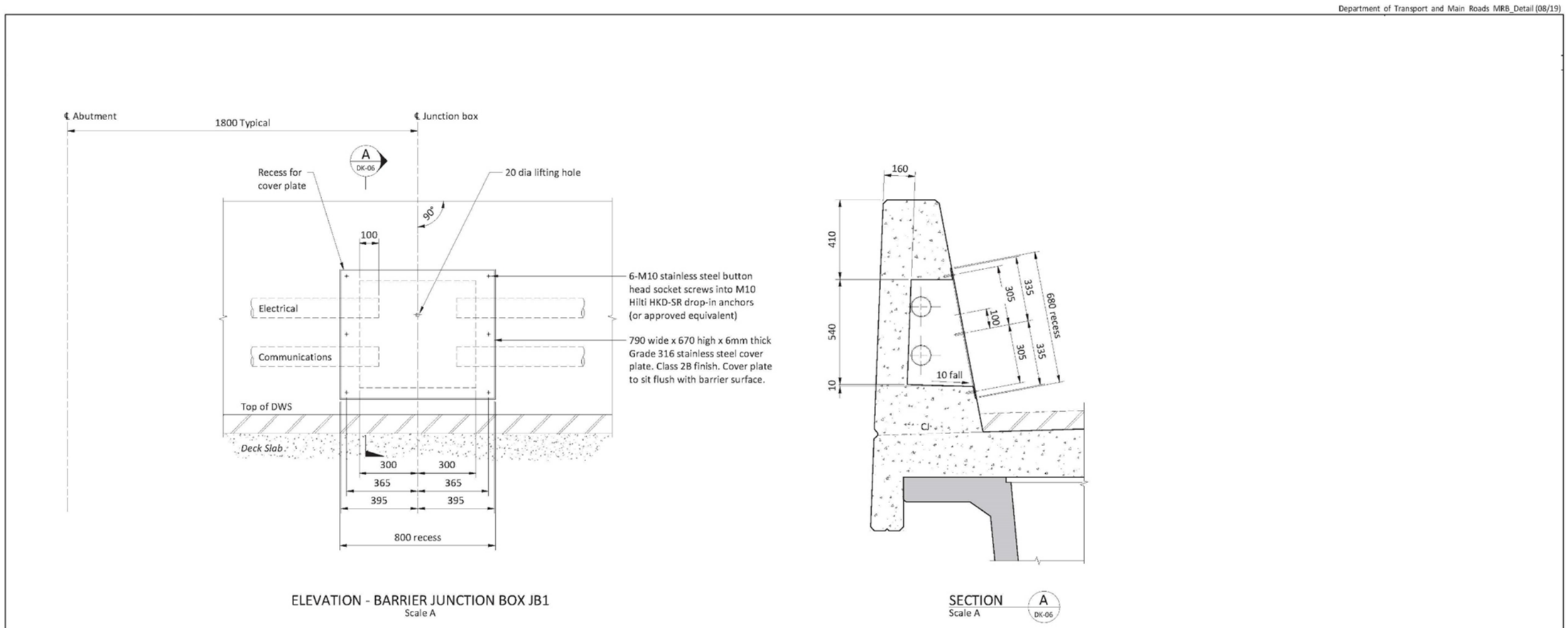
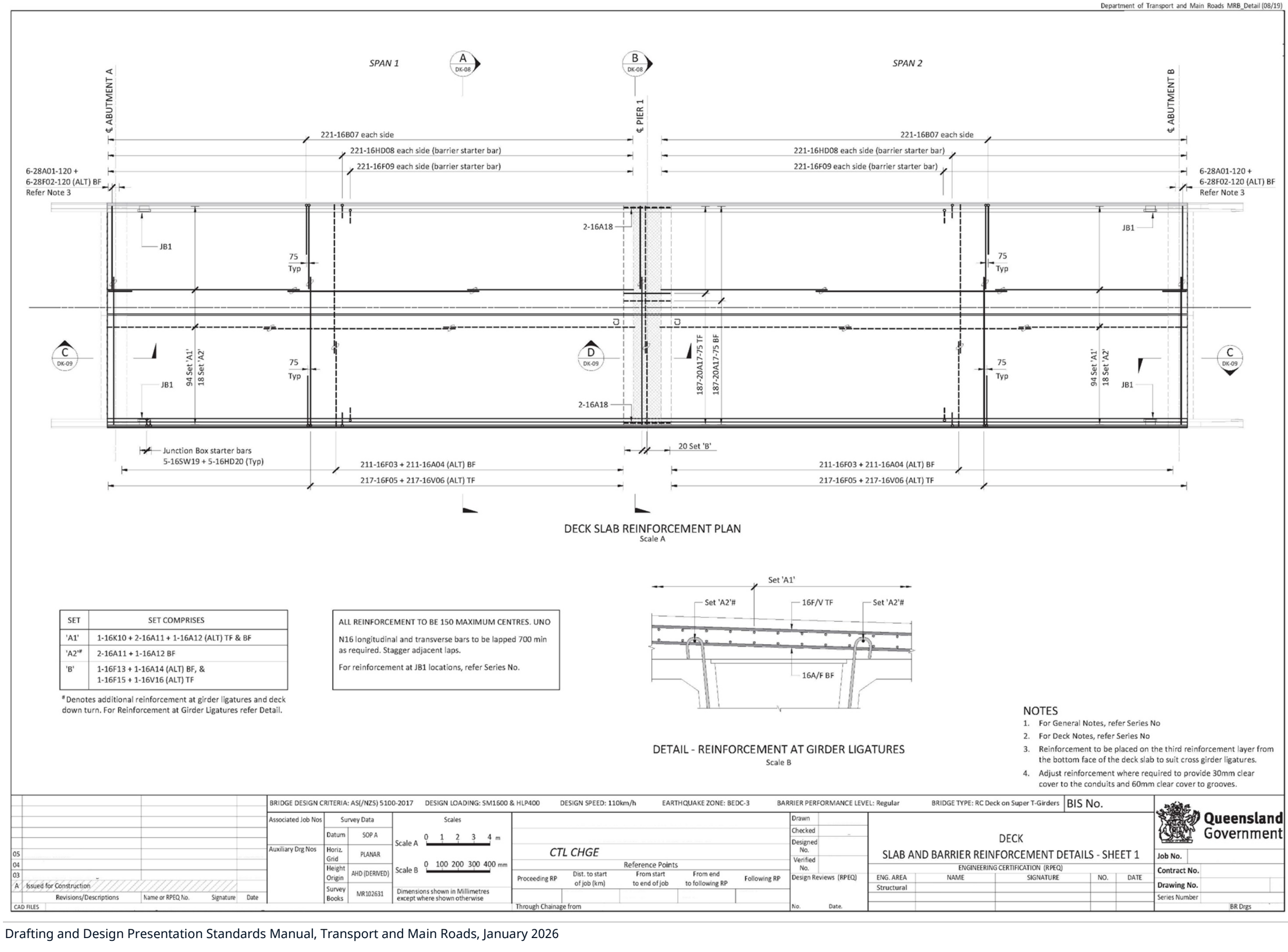


Figure 6.13.9(g) – Prestressed concrete girders deck – Sheet 6



DECK SLAB REINFORCEMENT PLAN
Scale A

SET	SET COMPRISES
'A1'	1-16K10 + 2-16A11 + 1-16A12 (ALT) TF & BF
'A2'#	2-16A11 + 1-16A12 BF
'B'	1-16F13 + 1-16A14 (ALT) BF, & 1-16F15 + 1-16V16 (ALT) TF

# Denotes additional reinforcement at girder ligatures and deck down turn. For Reinforcement at Girder Ligatures refer Detail.

ALL REINFORCEMENT TO BE 150 MAXIMUM CENTRES. UNO

N16 longitudinal and transverse bars to be lapped 700 min as required. Stagger adjacent laps.

For reinforcement at JB1 locations, refer Series No.

DETAIL - REINFORCEMENT AT GIRDER LIGATURES
Scale B

NOTES
1. For General Notes, refer Series No
2. For Deck Notes, refer Series No
3. Reinforcement to be placed on the third reinforcement layer from the bottom face of the deck slab to suit cross girder ligatures.
4. Adjust reinforcement where required to provide 30mm clear cover to the conduits and 60mm clear cover to grooves.

BRIDGE DESIGN CRITERIA: AS(/NZS) 5100-2017 DESIGN LOADING: SM1600 & HLP400 DESIGN SPEED: 110km/h EARTHQUAKE ZONE: BEDC-3 BARRIER PERFORMANCE LEVEL: Regular BRIDGE TYPE: RC Deck on Super T-Girders BIS No.

05
04
03
A Issued for Construction
Revisions/Descriptions Name or RPEQ No. Signature Date
CAD FILES

Associated Job Nos
Auxiliary Drg Nos
Survey Data: Datum SOP A; Horiz. Grid PLANAR; Height Origin AHD (DERIVED); Survey Books MR102631
Scales: Scale A 0 1 2 3 4 m; Scale B 0 100 200 300 400 mm
Dimensions shown in Millimetres except where shown otherwise

CTL CHGE
Reference Points
Proceeding RP | Dist. to start of job (km) | From start to end of job | From end to following RP | Following RP
Through Chainage from

Drawn
Checked
Designed No.
Verified No.
Design Reviews (RPEQ) No. Date.

DECK
SLAB AND BARRIER REINFORCEMENT DETAILS - SHEET 1
ENGINEERING CERTIFICATION (RPEQ)

ENG. AREA	NAME	SIGNATURE	NO.	DATE
Structural				

Queensland Government
Job No.
Contract No.
Drawing No.
Series Number
BR Drgs

Figure 6.13.9(h) – Prestressed concrete girders deck – Sheet 7

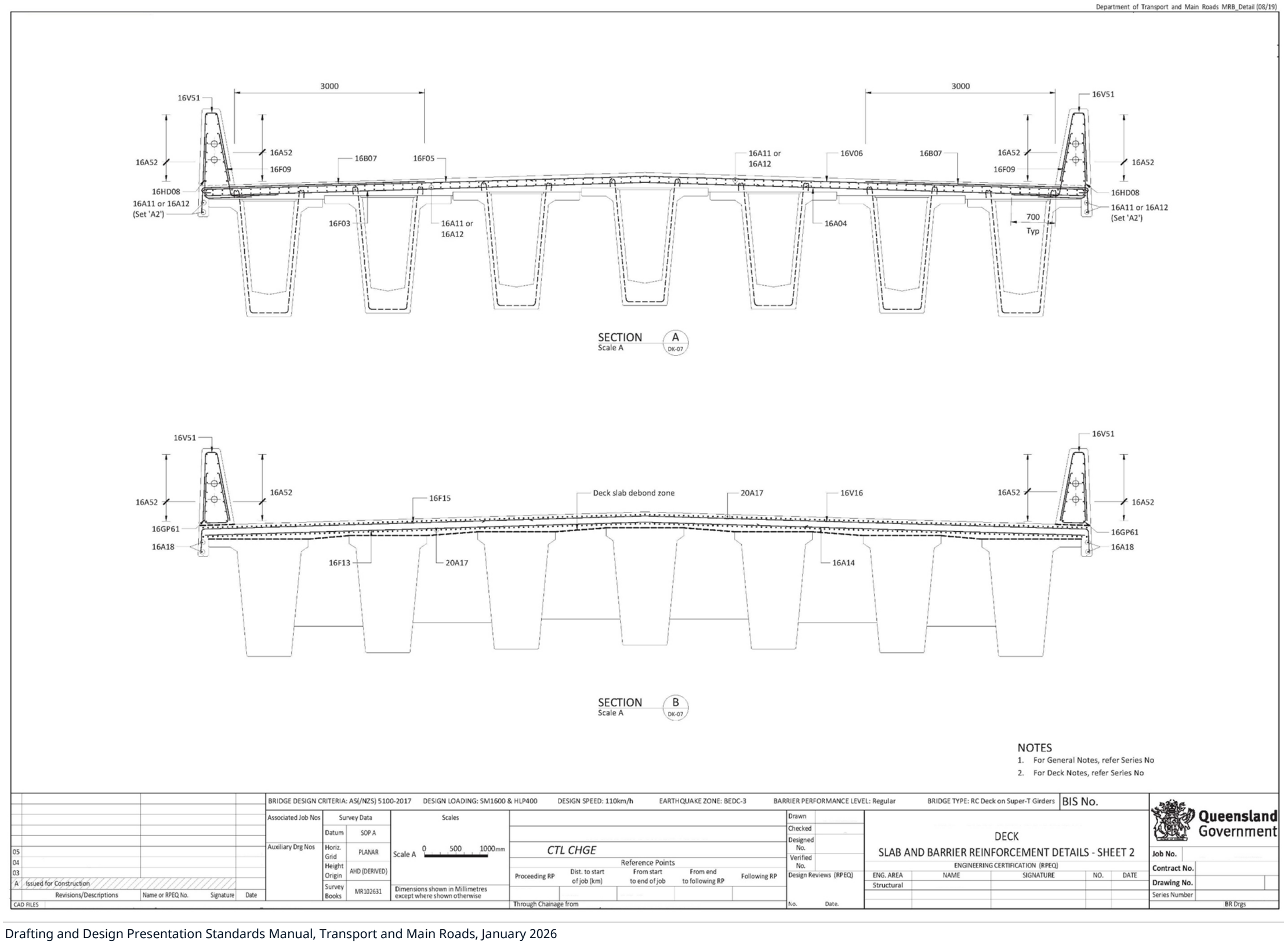


Figure 6.13.9(i) – Prestressed concrete girders deck – Sheet 8

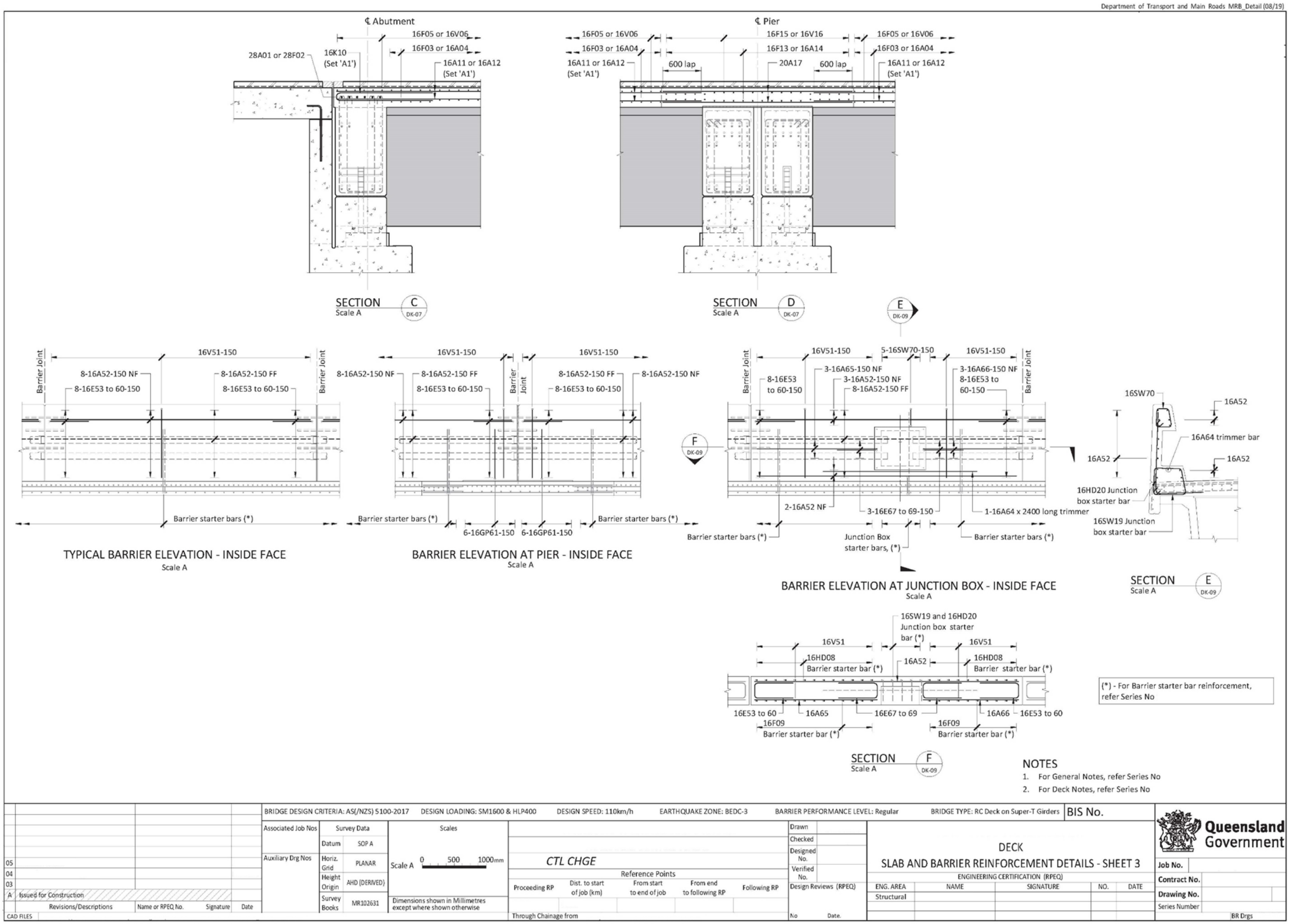


Figure 6.13.9(j) – Prestressed concrete girders deck – Sheet 9

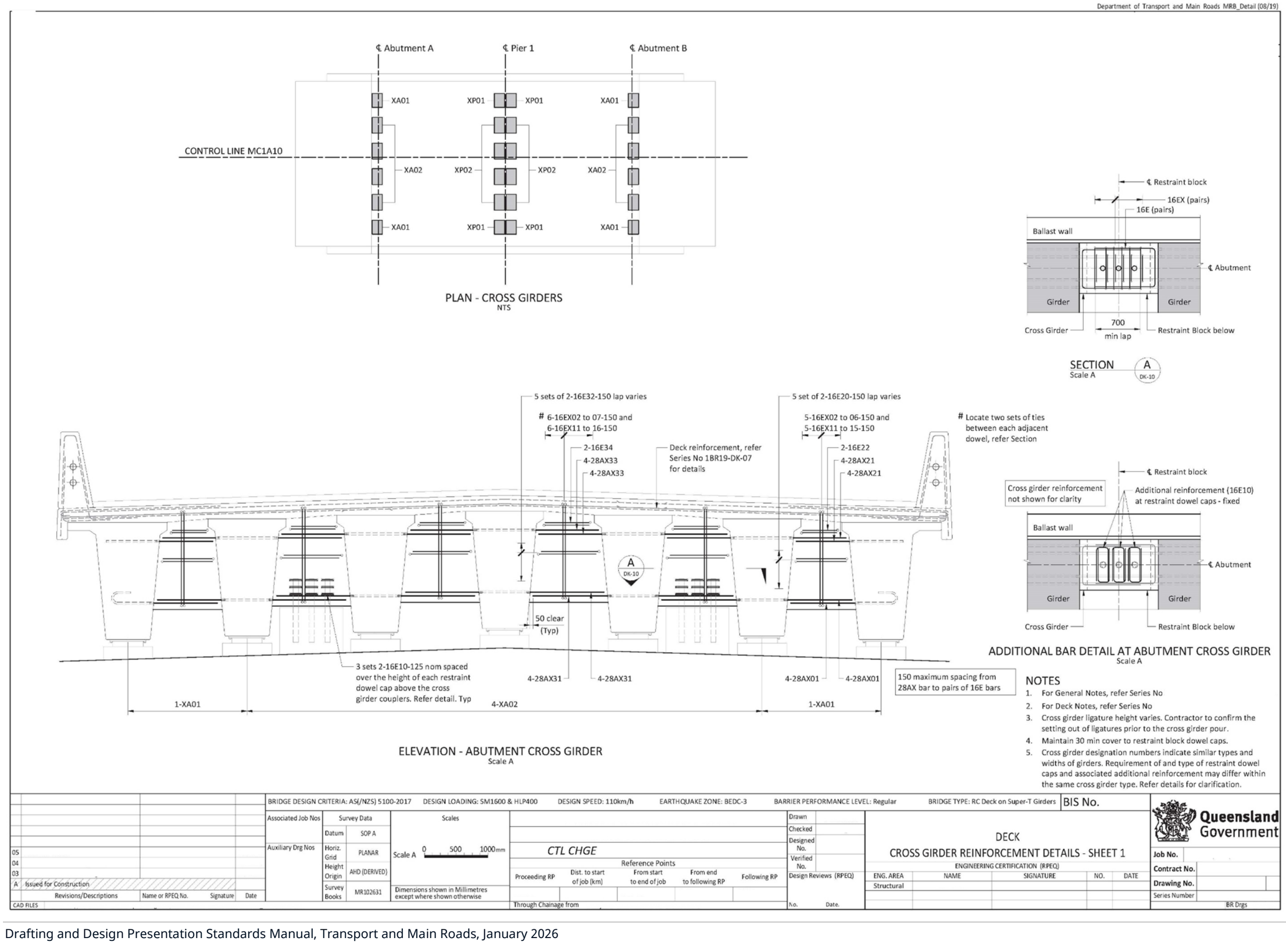
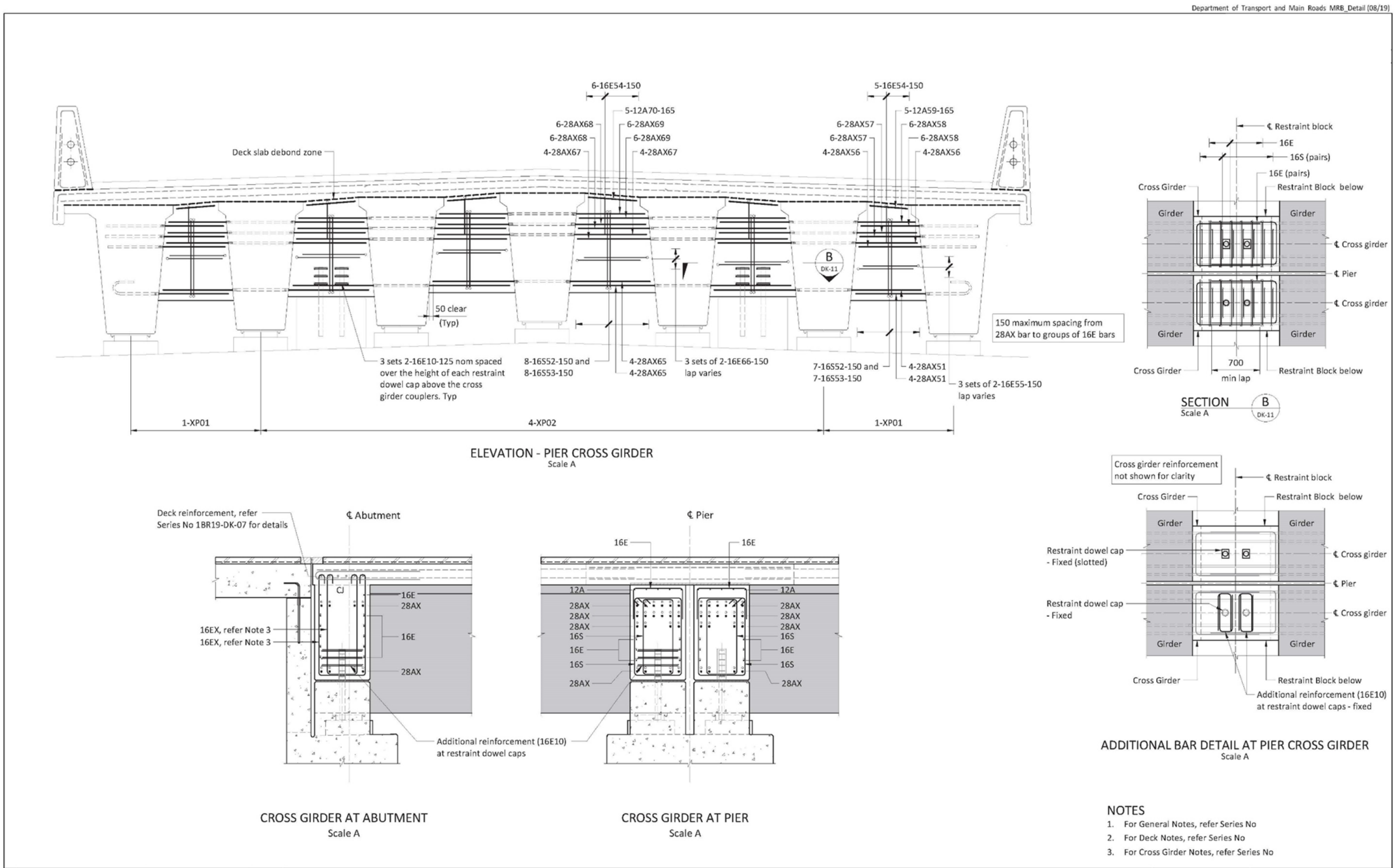


Figure 6.13.9(k) – Prestressed concrete girders deck – Sheet 10



6.14 Typical content required on the relieving slab drawings

Refer to SD2255 *Bridge approaches – Relieving Slab 3 metre span* and SD2256 *Bridge approaches – Relieving Slab 6 metre span* for standard details for relieving slabs, if these elements are to be provided within the bridge package.

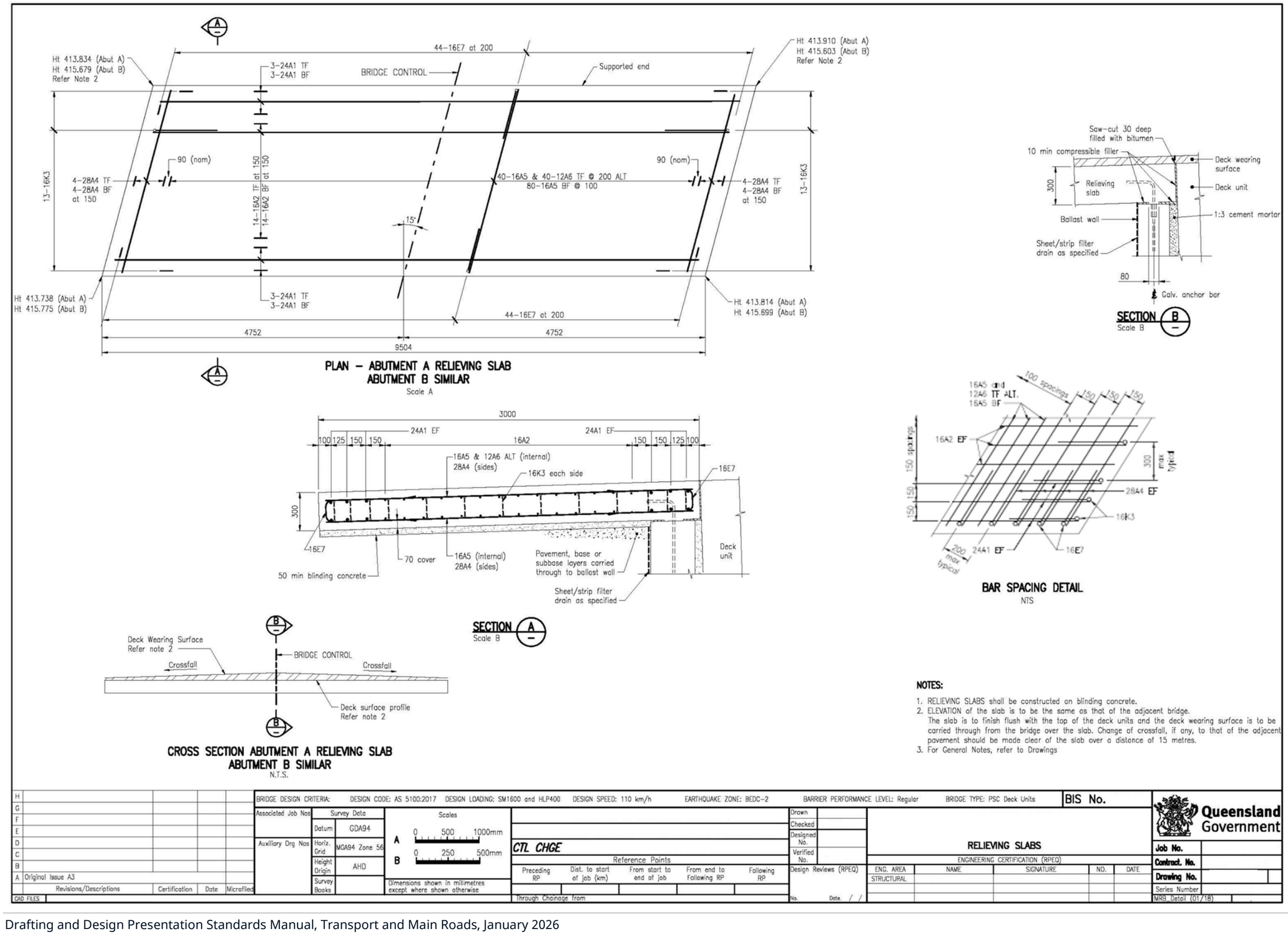
Table 6.14 provides the minimum drawing content that should be presented on the set of project-specific drawings for the elements listed above, along with typical drawing elements, such as views, details, and sub-set specific notes, and each is cross-referenced to figures extracted from example drawings.

Table 6.14 – Relieving slabs – Specific drawings content

Requirement	Drawing or element description	Figure reference
Concrete and reinforcement detailing	Plan, elevation and sections showing the following: • dimensions of the slab, and heights at each corner for Abutment A and Abutment B, and any additional height information such as crown levels and steps • reinforcement detailing, the starter bar connection from ballast wall detail, and bar spacing detail, and • notes specific to this drawing and not found elsewhere in the package.	Figure 6.14

Note: The design intent of a relieving slab is to provide an intermediate driving surface that rotates along the front face of the slab and in doing so accommodates any settlement or voids due to flooding or erosion within the road embankments. For this reason, any proposed internal fillets between the abutment headstock and the wing walls must allow sufficient tolerance to permit the slab to rotate. A minimum 50 mm clearance is suggested.

Figure 6.14 – Relieving slabs



6.15 Typical content required on the post and rail traffic barrier drawings

Table 6.15 provides the minimum drawing content that should be presented on the set of project-specific drawings for the elements listed above, along with typical drawing elements, such as layouts, assemblies, typical sections, fabrication details, and sub-set specific notes, and each is cross-referenced to figures extracted from example drawings. Refer to SD2200 *Bridge Traffic Barriers – Post and Rail Traffic Barriers Regular Performance Level (Drawing 1 of 5 to Drawing 5 of 5)* for standard details for regular performance bridge traffic barriers.

In the case of bridge traffic barriers, it is expected that all details on SD2200 *Bridge Traffic Barriers – Post and Rail Traffic Barriers Regular Performance Level (Drawing 1 of 5 to Drawing 5 of 5)* relevant to the design are to be reproduced and certified on the project-specific drawings so as to provide comprehensive details for fabrication, future repairs, and asset management reasons.

Thrie beam guardrail design is now withdrawn as a Standard Drawing. Dimensions may need to be varied to suit the guardrail system proposed for use on the specific design. This will potentially impact the post heights and transition lengths of the end post assembly and post heights of intermediate posts.

Note: Example bridge traffic barrier drawings provided do not include expansion joint details for the bridge shown (refer to SD2200 *Bridge Traffic Barriers – Post and Rail Traffic Barriers Regular Performance Level (Drawing 1 of 5 to Drawing 5 of 5)*) for details of expansion joint assemblies and connectors).

Table 6.15 – Post and rail traffic barrier – specific drawings content

Requirement	Drawing or element description	Figure reference
Barrier layout and assembly details	Elevation and sections showing the following: • detailed elevation showing post types and spacing, rail types, rail connector types, and guardrail connection at end post where required • typical sections at end posts and at intermediate posts with dimensions from DWS to guardrail and to top of rails, and anchorage set out in the kerb • post anchorage fabrication details and count • traffic rail joint assembly • rail connector fabrication details and count, and • notes specific to this drawing and not found elsewhere in the package.	Figure 6.15(a) Figure 6.15(b)

Requirement	Drawing or element description	Figure reference
Typical assembly	Typical assembly showing the following: • end, transition, and first intermediate post, with rails and rail connector, and guardrail connection details at end post where required • typical sections at end posts and at intermediate posts, and • notes specific to the post and rail fabrication sub-set of drawings if not found elsewhere in the package.	Figure 6.15(a)
Rail and rail connector fabrication	Fabrication details as follows: • rail details showing support plates, including welding, and count for each type, and • rail connectors and count for each type.	Figure 6.15(b)
Post fabrication details	Fabrication details for each post type, including all base and anchor plates, welding, guardrail connection, and count for each type.	Figure 6.15(c)

Figure 6.15(a) – Steel bridge traffic barriers – Sheet 1

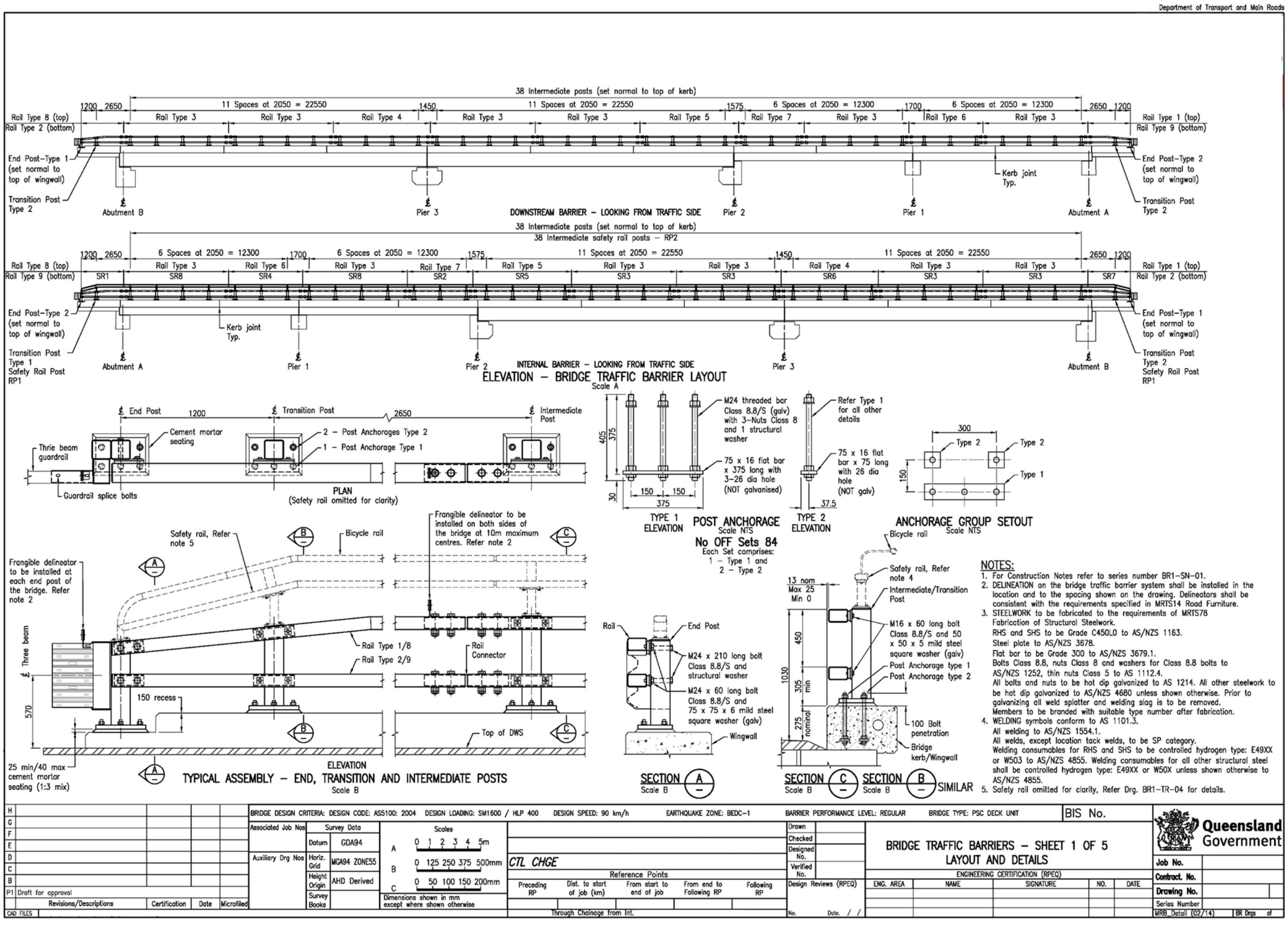


Figure 6.15(b) – Steel bridge traffic barriers – Sheet 2

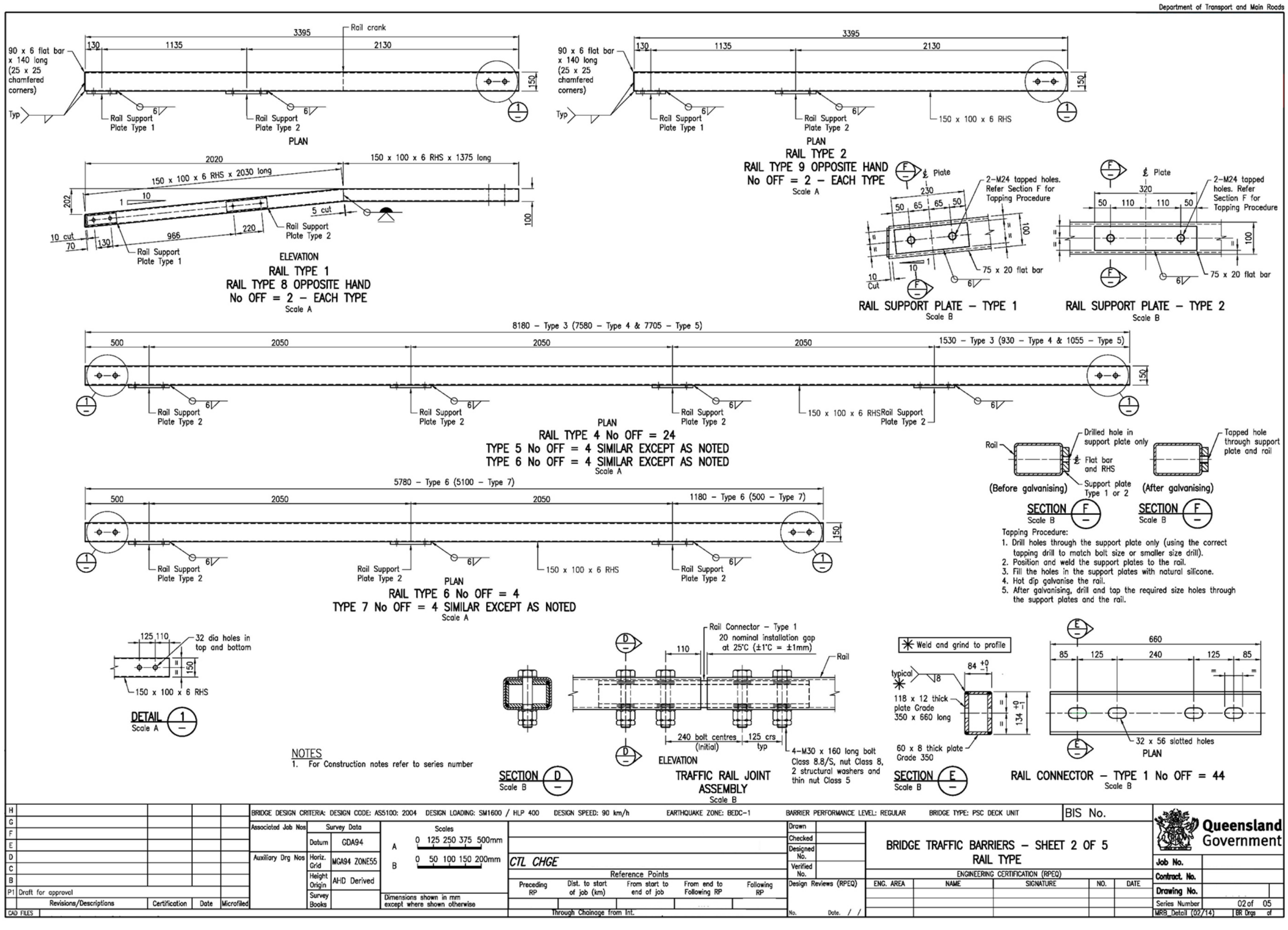
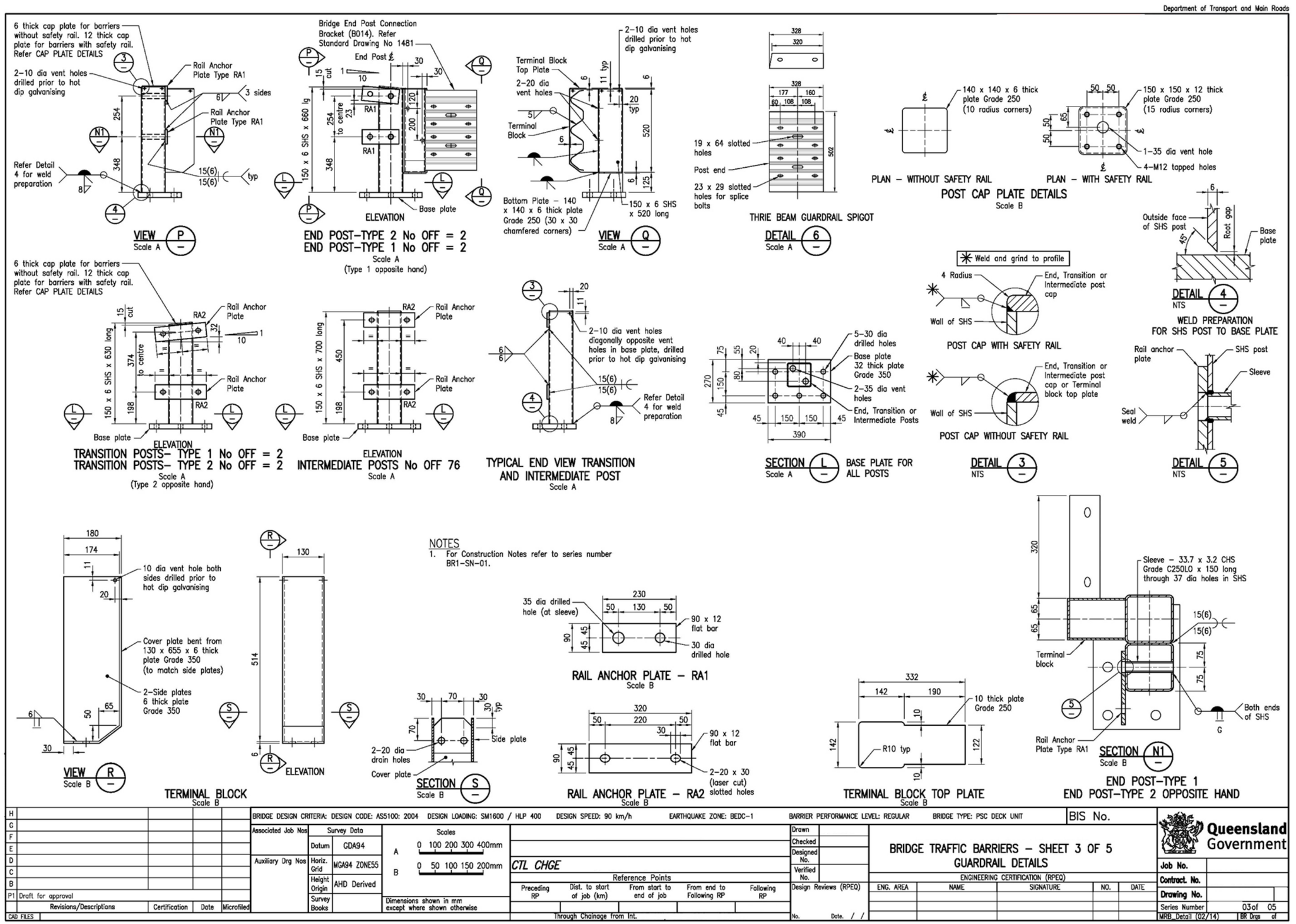


Figure 6.15(c) – Steel bridge traffic barriers – Sheet 3



7 Expansion Joints

7.1 General

Bridge expansion joints, also known as movement joints, are essential for ensuring uninterrupted traffic flow between 2 structures. They are specifically designed to accommodate structural movements caused by factors such as creep, shrinkage, temperature fluctuations, and live load deformations.

Bridge expansion joint systems come in a variety of types and shapes. The expansion component of the system may be a flexible filler material, a flexible neoprene gland, or a finger joint.

All expansion joints on new bridges are to conform to the requirements of AS 5100 *Bridge Design* and Section 4.13 of the DCBoS and their relevant specifications.

The common expansion joints used on departmental bridges and the relevant Technical Specifications for each are as follows:

- cast-in extruded aluminium strip seal expansion joints, to MRTS82 *Bridge Deck Expansion Joints*
- bolted-in extruded aluminium strip seal expansion joints, to MRTS82 *Finger Type Bridge Deck Expansion Joints*
- sealant joints with elastomeric concrete nosing, to MRTS82 *Bridge Deck Expansion Joints*
- strip seal expansion joints without deck anchors, to MRTS82 *Bridge Deck Expansion Joints*
- elastomeric compression seal expansion joints, to MRTS82 *Bridge Deck Expansion Joints*, and
- fingerplate or saw tooth expansion joints, to MRTS82A *Finger Type Bridge Deck Expansion Joints*.

7.2 Extruded aluminium expansion joints

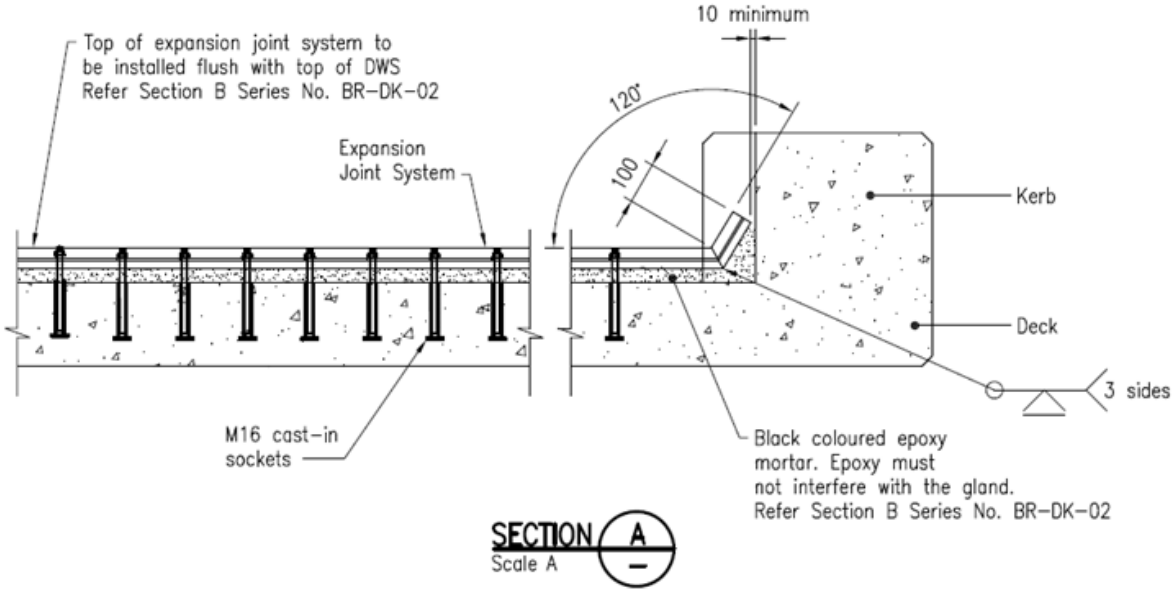
Extruded aluminium strip seal joints shall be fully detailed within the bridge deck sub-set of drawings.

Where the joints require additional fabrication and detailing due to complex geometry, these can be documented in a dedicated expansion joint sub-set of drawings (refer to Table 8 in Chapter 2 of this volume for series nomenclature).

Minimum details to be included on the drawings are listed in the table below.

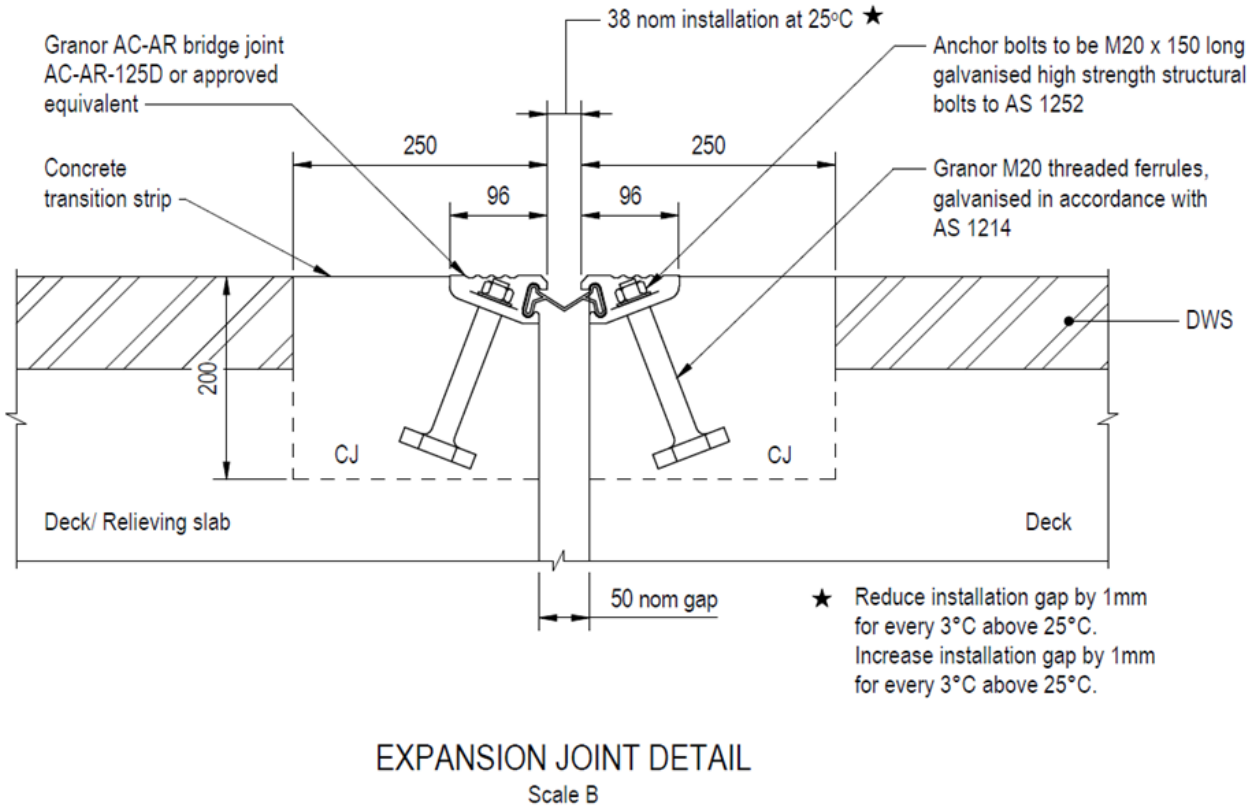
Depending on the size of the gland and thickness of the DWS, the gland will usually hang below the top face of the deck. Typically, the gap is designed to be 50 mm, however, this shall be confirmed by the design engineer to ensure sufficient contraction of the joint. Glands are typically terminated at 120° vertically, at 100 mm, as shown in Figure 7.2(a).

Figure 7.2(a) – Typical gland termination detail



The installation width should be shown nominally on the design drawings. Joint installations widths can be found on the supplier's websites and shall be confirmed by the design engineer. An example of a typical extruded aluminium expansion joint is shown in Figure 7.2(b).

Figure 7.2(b) – Extruded aluminium expansion joint example



EXPANSION JOINT DETAIL
Scale B

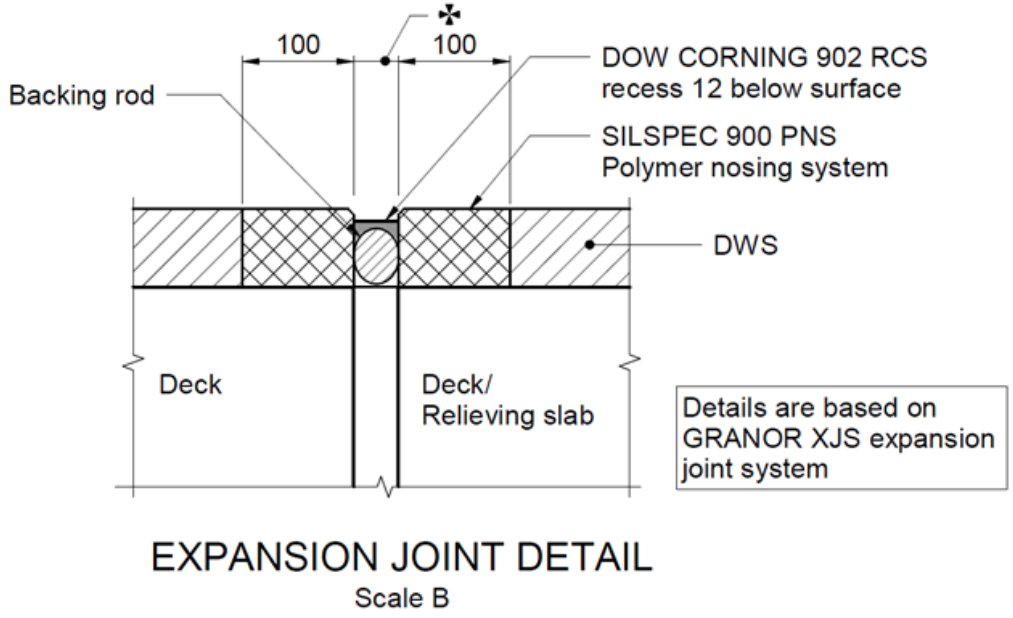
7.3 Sealant, strip seal and compression seal expansion joints

Sealant joints and strip seal joint types are simpler than extruded aluminium joint types mentioned above and typically require less detailing. All joints shall be detailed within the bridge deck drawings.

Minimum details to be included on the drawings are listed in the table below.

For an example of these joints, see Figure 7.3.

Figure 7.3 – Typical sealant, strip seal, and compression seal example



7.4 Fingerplate or saw tooth expansion joints

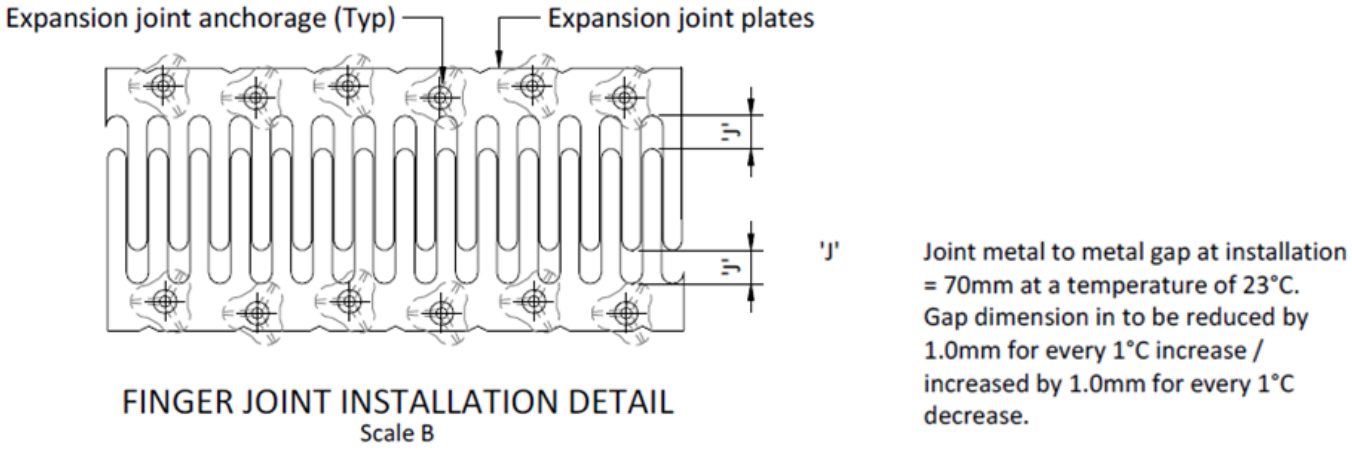
These joints are ideal for accommodating large structural gaps that exceed standard limits. They are versatile and can be adapted to various skew orientations. All finger or saw tooth expansion joints shall be fully detailed to check for clashes of the fingers or teeth against each other under possible deck movement in operation.

Structural drawings shall provide sufficient detail to enable the complete fabrication of each item or supply the sufficient information for fabricators to prepare detailed shop drawings. These details should be included in the bridge deck drawings or a dedicated expansion joint and cover plate sub-set of drawings (refer to Table 8 in Chapter 2 of this volume for series nomenclature).

The critical gap between the ends of respective assembled joint components shall be determined by the design engineer and shown on the drawings, see Figure 7.4.

Minimum details to be included on the drawings are listed in the table below.

Figure 7.4 – Finger joint installation detail example



7.5 Cover plates at joints

Cover plates are required for the concrete kerb or barrier at expansion joints but not limited to those locations. Minimum requirements are described in Section 4.13.8 of the DCBoS and shall be as shown in SD2045 *Bridge Kerbs – Standard Details of Cast Insitu Kerbs for Transversely Stressed PSC Deck Units* for cast-insitu kerbs.

Cover plates shall be fully detailed in the bridge deck or expansion joint drawings.

7.6 Typical content required on the expansion joint drawings

Table 7.6 provides the minimum drawing content that should be presented on the set of project-specific drawings for the elements listed above, along with typical drawing elements, such as views, details, and sub-set specific notes, and each is cross referenced to figures extracted from example drawings.

Table 7.6 – Expansion joint – specific drawings content

Requirement for joint types	Drawing or element description	Figure reference
Extruded aluminium expansion joints	Plan, elevation and sections showing the following: • plan of the bolted-in joint assembly • installation detail • block out dimensions in barrier and deck • labelling of joint components and other details • reinforcement integration with joint • termination of the gland into the barrier or kerb • installation gap • nominal gap between concrete • dimensional set out of anchor bolt assemblies, and • notes specific to the drawings and not found elsewhere in the package.	Figure 7.2(a) Figure 7.2(b)
Sealant, strip seal, and compression seal expansion joints	The design drawings shall clearly show: • minimum nosing dimensions and material specifications • nominal installation gap • nominal gap between concrete elements • dimensional layout of the joint, including chamfers to the edges exposed to traffic • labelling of joint components, including backing rod and sealant type, and • notes specific to this drawing.	Figure 7.3
Fingerplate or saw tooth expansion joints	Plan, elevation and sections showing the following: • plan of the finger / saw tooth joint assembly • installation detail, including gap between fingers on finger joints • block out dimensions in barrier and deck • reinforcement integration with joint • plan of the finger joint assembly • block out dimensions • labelling of joint components and other details • installation detail, including gap between fingers, and • notes specific to this drawing and not found elsewhere in the package.	Figure 7.4

Requirement for joint types	Drawing or element description	Figure reference
Cover plates	Fabrication details as per SD2045 *Bridge Kerbs – Standard Details of Cast Insitu Kerbs for Transversely Stressed PSC Deck Units* for standard details or to project-specific design.	SD2045 *Bridge Kerbs – Standard Details of Cast Insitu Kerbs for Transversely Stressed PSC Deck Units*

8 Bridge Furniture

8.1 General

As stated in Section 4.12.10 of the DCBoS, it is necessary to include ancillary road infrastructure on a bridge, including:

- noise barriers
- safety screens, namely anti-throw and/or anti-jump
- electrification barriers
- signage, and
- ITS equipment.

All attachments shall be in accordance with Section 4.12.10 of the DCBoS and to any relevant Technical Specification.

8.2 Protection, noise, and privacy screens

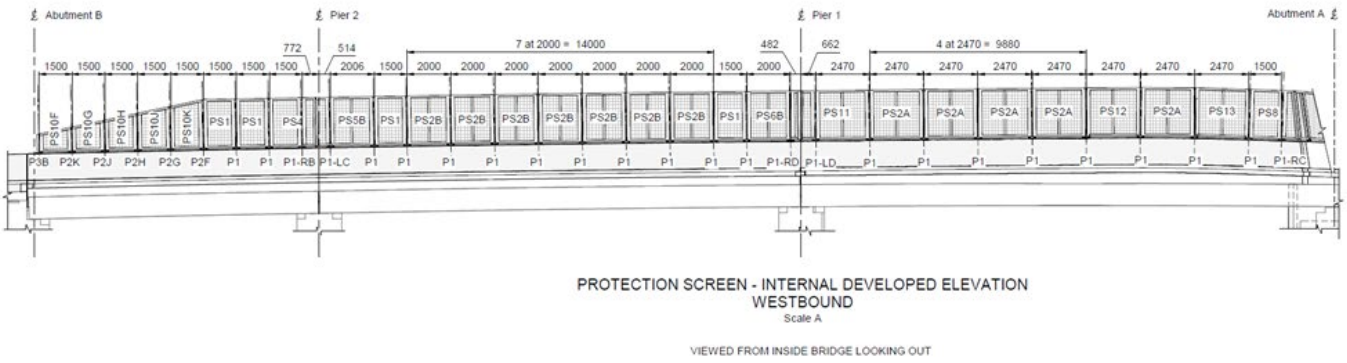
All screens require engineering drawings with sufficient detail for the fabrication of each item, sufficient to inform the fabricator to create detailed shop drawings, and for installation.

For items that are to be bolted or welded in the field, assembly details shall clearly depict all components in their final positions within the structure. Generally, the following views are required as a minimum:

- detailed long section view: looking from inside out, highlighting key features such as screen panels, anchorage locations using dimensions or eastings and northings, ensuring all elements are visible and clearly marked
- elevations of screen and post assembly types

- typical sections of screen and post assembly types, taking care that such issues as anchors have sufficient length and edge distances are checked, and
- enlarged details of complex elements.

Figure 8.2 – Protection screen elevation example



8.3 Signs

All sign installations on bridges and other structures shall be in accordance with MRTS14 *Road Furniture* and Section 4.12.10 of the DCBoS.

Sign anchorages shall be level and clearly set out on the concrete deck layout plan. A diagram showing the typical set out dimensions should be included to provide clear guidance for correct positioning and orientation.

Fabrication and assembly details shall clearly depict all components, taking care to check for such issues as sufficient anchor lengths and base plate edge distances.

8.4 Typical content required on protection screen drawings

Table 8.4 provides the minimum drawing content that should be presented on the set of project-specific drawings for the elements listed above, along with typical drawing elements, such as views, details, and sub-set specific notes, and each is cross-referenced to figures extracted from example drawings.

Table 8.4 – Bridge furniture – specific drawings content for protection screens

Requirement	Drawing or element description	Figure reference
Screen layout elevation and plan views	Elevation, plan, and sections showing the following: • Anchorage locations • Panel layout and type numbers, and • Notes specific to the drawings and not found elsewhere in the package.	Figure 8.4(a) Figure 8.4(b)
Typical assembly details	Typical sections of panels and post assembly types, layout, sizes, and dimensions of anchors, including protrusion lengths.	Figure 8.4(c)
Post and screen fabrication details	Fabrication details for each post type and panel type, including all base and anchor plates, welding, and count for each type.	Figure 8.4(c) Figure 8.4(d)

Figure 8.4(a) – Example screen drawings – Sheet 1

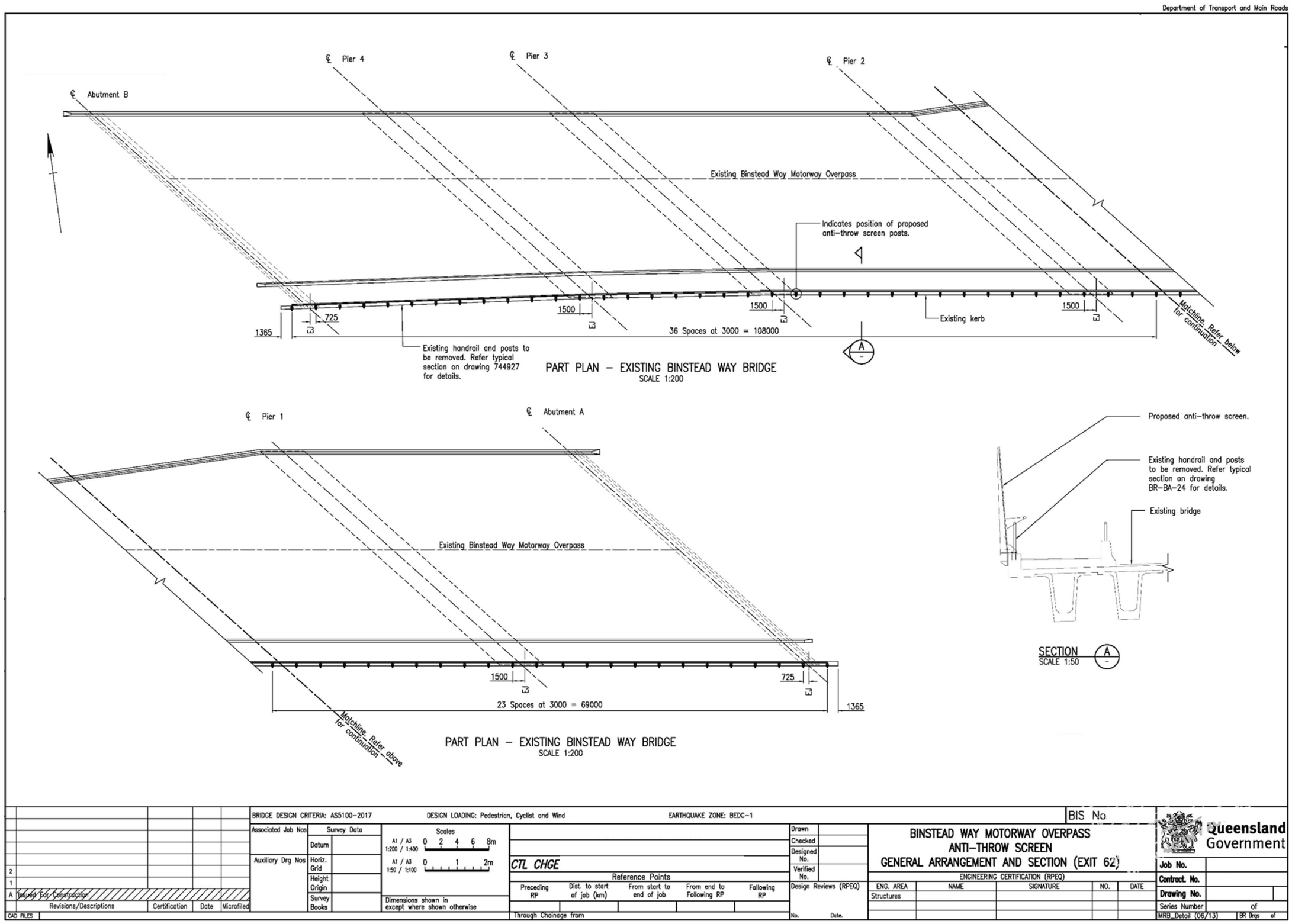


Figure 8.4(b) – Example screen drawings – Sheet 2

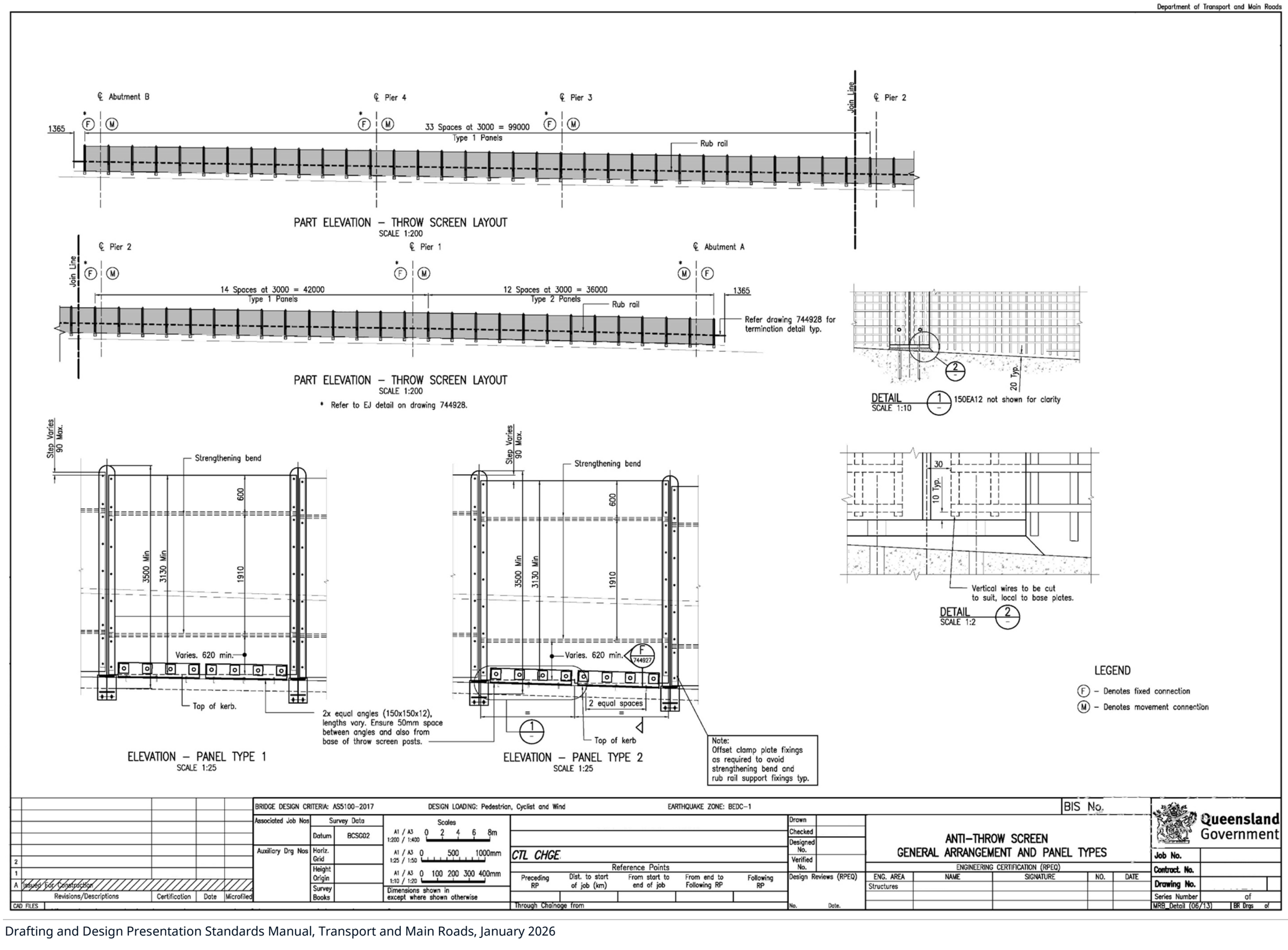


Figure 8.4(c) – Example screen drawings – Sheet 3

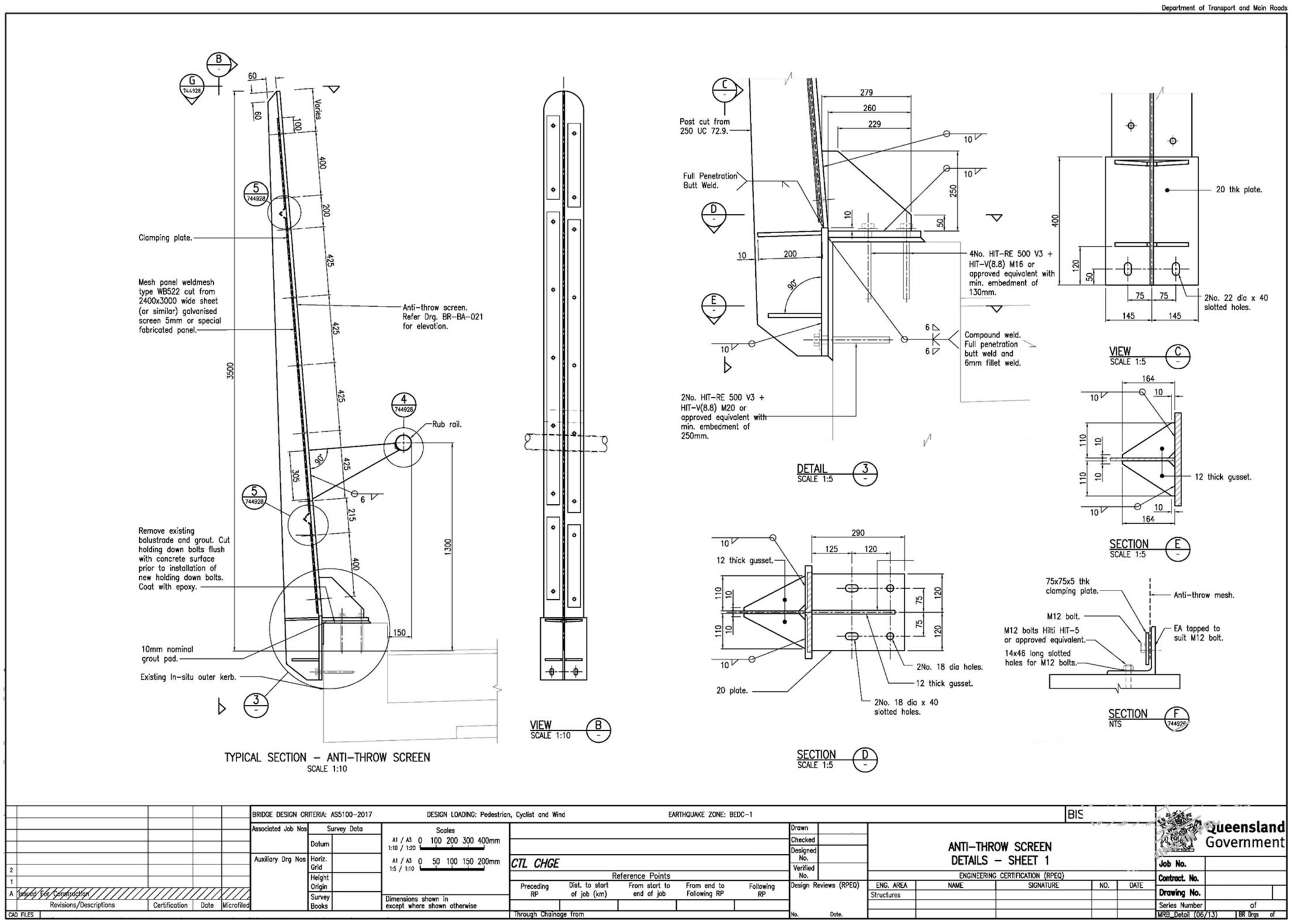
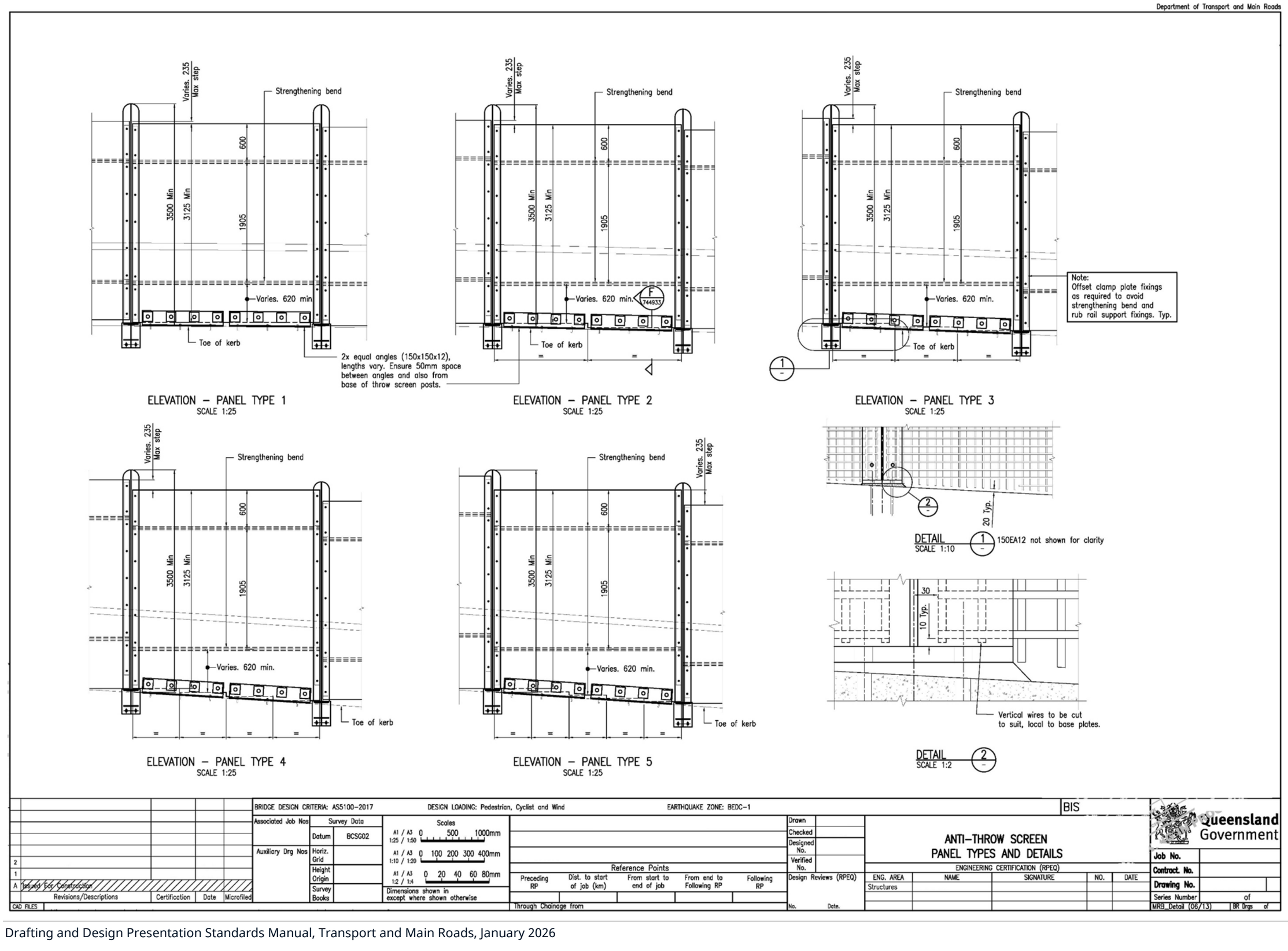


Figure 8.4(d) – Example screen drawings – Sheet 4



9 Bridge widening, strengthening and rehabilitation

9.1 General

Designs for the modification of bridges vary greatly, depending on the types of existing structure and the width of the widening required. Each project is evaluated individually, with appropriate drawings created to suit the specific conditions.

All engineering drawings for bridge widening, strengthening, or rehabilitation works shall comply with the standards outlined in this document, with Section 3.6 of the DCBoS, and MRTS86 *Preparation for Bridge Widening*.

Any issues found regarding adequacy of survey, worker safety, accessibility, and constructability, such as with drilling, bolting, site welding, and erection, while drafting the details, should be raised with the design engineer.

9.2 Bridge modification considerations

Project experience tells us that the most frequent issues encountered with widenings are:

- The correct position and alignment of transverse stressing bars.
- Location and proximity of existing foundations to the proposed new foundations especially where existing piles are raked.
- Condition state of existing transverse stressing bars. Occasionally transverse stressing bars may require coring to remove and replace.
- The existing deck may exhibit variations in hog, vertical alignment, and superelevation compared to the original design, which should be accommodated in the widening.
- DWS thickness may vary significantly from As Constructed drawings due to multiple resurfacing works over the life of the existing bridge.
- Where a bridge traffic barrier is to be replaced on the non-widened side, the abutment wing walls will require modification, or extra footings required, to accommodate impact loads and longer vertical transitions than the original structure.
- The location of existing reinforcement shall be accommodated in the widening design, and proposed dowel locations are to be designed accordingly to avoid clashes. Ground penetrating radar is to be stipulated on drawings to avoid clashes with existing reinforcement.

- Constructability of concrete pours are to be considered. Where the existing deck is under traffic and an infill pour is required, consideration of traffic speed, proximity of traffic, and type of concrete for the infill pour, is to be accommodated.
- Stage construction is to be documented appropriately on the drawings.
- Any proposed demolition works are to be detailed clearly. In some instances, hydro demolition may be an advantage, and
- It is not wise to rely solely on notes such as “All dimensions to be verified on site” without undertaking a site survey, as this will often lead to significant construction variations.

9.3 Bridge widening surveys

All surveys shall comply with TMR *Surveying Standards*. Bridge widening surveys are described in Section 1.6.5 of Part 2 of that document.

An accurate survey of the existing structure to identify, and locate in space, the “as is” details of the widened structure is critical when designing a widening for many reasons, including:

- safety in design – identifying any site conditions or modifications that need to be considered as part of the design modifications
- identifying that site details match the as built drawing records held by the department
- identify any discrepancies in bridge settlement, vertical alignment, and physical dimensions of the existing deck and substructure
- identifying the precise location, extension, and size of transverse stressing bars, if applicable, and
- identifying the exact final hog of the existing deck units / girders which is critical to accommodate during design of the adjacent units or girders.

Due to the small tolerances in bridge construction, the following survey accuracy is desirable:

- bridge survey, to within 5 mm, and
- ground survey, to within 100 mm.

9.3.1 Survey Data Checklist

When preparing bridge modification drawings, ensure sufficient information is available for the bridge features and geometric set out.

Key 3D features to be included in the survey are as follows:

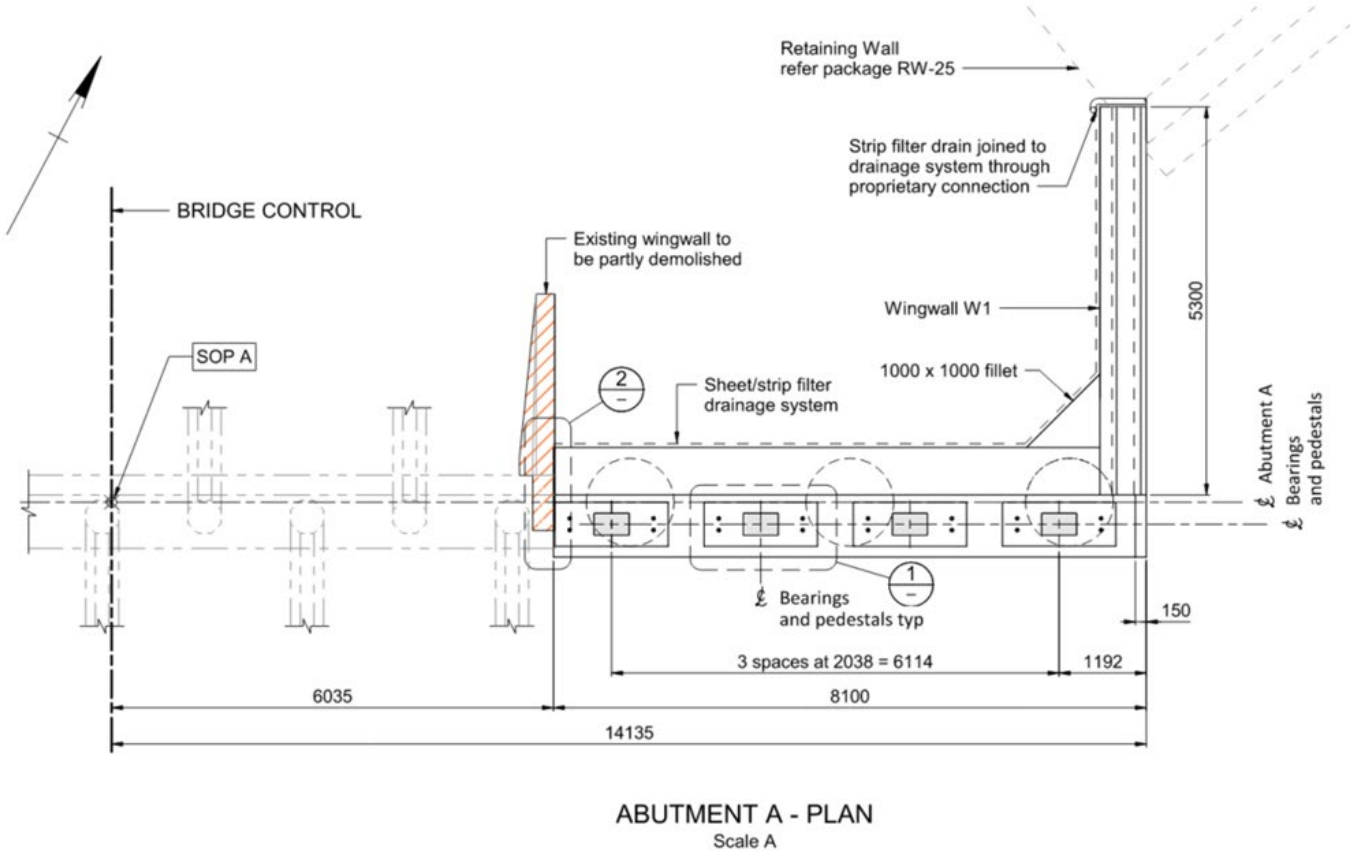
- Pier and abutments:
  - faces of pier and abutment headstocks
  - centreline of pier headstocks, and
  - soffit of outer units / girders at abutments and piers.
- Bridge barriers:
  - centres of bridge railing posts, and
  - interface survey strings for bridge barriers / kerbs and drainage systems (DWS).
- Deck unit bridges:
  - centres of transverse stressing bars at the outer kerb faces
  - protrusion of transverse stressing bars from nuts
  - transverse stressing bar ends, and
  - hog (camber) of deck units,
- Girder bridges:
  - centres of cross-girders
  - faces of diaphragms and pedestals
  - hog (camber) of girders, and
  - girder ends.
- Additional features:
  - deck and barrier edge lines such as kerb face, top face, end lines at piers and abutments
  - gaps at ends of deck units or girders, and
  - centre of piles, pile dimensions (diameter), rake angle, if applicable.

For more information on survey requirements for bridge widenings, refer to Section 1.6.5 of TMR *Surveying Standards – Part 2: Geomatic Survey Types*.

9.4 Presentation of bridge widening drawings

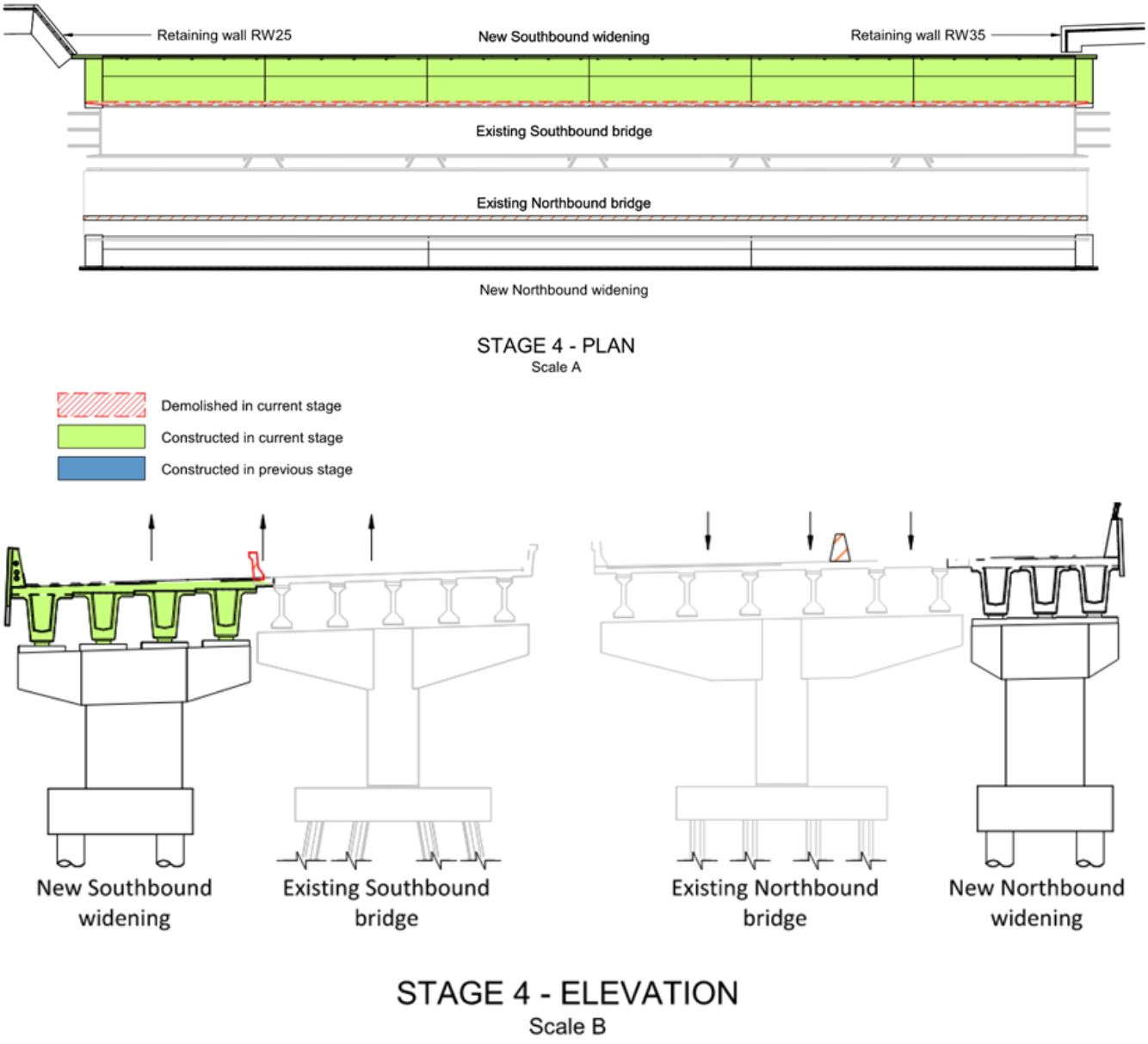
When presenting engineering drawings for bridge widening projects, it is essential to clearly distinguish between new, existing, and demolished elements to ensure accuracy and effective communication. The new bridge structure should be depicted prominently to stand out, while existing bridge components should be shown in a lighter style to provide context without overshadowing the new design. Demolished elements shall be distinctly represented, typically using a dashed or phantom line combined with a diagonal coloured hatch pattern, for example, and precise labelling such as “to be demolished”, to emphasise their removal. In this way, the part that is to remain should be shown in the same phantom line but without hatching, and be suitably labelled, such as “to remain”. An example of this can be seen in Figure 9.4(a).

Figure 9.4(a) – Demolished bridge elements example



Structural elements requiring demolition as part of the widening process shall be explicitly marked on the engineering drawings. Additionally, construction sequencing drawings shall be included to illustrate the stages of work, ensuring the constructability of the widened bridge is clearly understood. These practices are critical for maintaining clarity and supporting smooth project execution (refer to Figure 9.4(b) for an example).

Figure 9.4(b) – Widened bridge construction sequencing example



9.4.1 Clashes with existing structure

The existing structure and its foundations must be appropriately drafted to identify key features, sizes, locations, and rakes (if applicable). This provides a basis for the proposed foundation design to consider and avoid potential conflicts during the bridge widening process. For example, new foundations adjacent to raked piles must include appropriate allowances to provide sufficient tolerance during construction, considering any sub-surface out of position or rake deviations. Existing pile rake angles shall be clearly shown on the pile layout drawing by depicting the top and tip of the raked piles in plan, based on the as built driving lengths and rakes.

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