**Drafting and Design Presentation Standards**
**Volume 3: Structural Drafting Standards**

# Chapter 17: Cast Insitu Kerbs and Decks

**May 2013**

Queensland Government

## Chapter 17 Amendments

### Revision register

| Issue/Rev No. | Reference Section | Description of Revision | Authorised by | Date |
|---|---|---|---|---|
| 1 | – | First Issue. | Manager (Structural Drafting) | April 2011 |
| 2 | – | Document name change. | Manager (Structural Drafting) | Nov 2011 |
| | 17.12 | Add reference to section 10.10. | | |
| | Appendix A | Update deck design sketches with latest typical details. | | |
| 3 | – | Page numbers for Appendix A updated throughout the whole chapter/ | Team Leader (Structural Drafting) | May 2013 |
| | 17.3 | Wording changed to steel bridge traffic barrier. | | |
| | 17.4 | Wording changed to steel bridge traffic barrier. | | |
| | 17.5 | Continuous Deck without DWS – Paragraph re-worded. | | |
| | 17.13 | Note on concrete inserts added. | | |
| | 17.14 | Paragraph 4 – 50 mm nominal gap was 100 mm. Re-worded XJS expansion joint details.<br>Figure 17.14-1 – deleted. | | |
| | Appendix A | Deck design sketches re-numbered and revised. | | |

**Contents**

# 17 Cast Insitu Kerbs and Decks

## *17.1 Glossary of terms*

For a complete glossary of terms refer Chapter 1 – *Introduction.*

## *17.2 Figures and examples shown in this volume*

The figures and examples shown in this volume are for presentation purposes only, and may contain some details that are now superseded. These details have been included for ease of reference, to illustrate typical solutions, and to show the required standard of drafting presentation. The details are not to be used without an engineering check and certification by a Structural RPEQ to confirm that the details are appropriate for the specific project.

## *17.3 General*

Bridges have either cast insitu kerbs or a reinforced concrete deck. The deck may have a kerb with a steel bridge traffic barrier or it will have a concrete traffic barrier. Refer Chapter 9 – *Bridge Deck Types*. Many of the details that are required to produce kerb and deck drawings have been standardised and are shown on standard deck design sheets which have been developed in Bridge and Marine Engineering and are used as the standard for design and presentation in the production of departmental bridge drawings. The design sheets also show additional details such as girder restraint angles and cast in socket details for deck units.

Engineers may use these standard details, modifying them to be project specific, and issue them as design sheets. Drafters use the standard sheets in their AutoCAD form to produce detailed deck drawings. Refer *Appendix A Deck Design Sketches*.

## *17.4 Cast Insitu Kerbs*

Standard cast insitu kerbs are 500 mm wide. This is wide enough to fit an 80 mm electrical/telecommunications conduit when required. The top of the kerb is 275 mm above the road running surface.

Deck unit bridges with cast insitu kerbs have starter bars protruding from the outer deck unit which are used to bond the kerb to the deck unit. The kerbs have additional ligatures where the steel bridge traffic barrier post anchorages are cast into it.

**Top Face of Kerbs**

The top face of the kerb is level on bridges with a crossfall or superelevation up to and including three per cent. For bridges with a superelevation greater than three per cent, the top face of the kerb follows the superelevation. *Appendix A Deck Design Sketches – Sketch 5* shows standard details for kerb reinforcement.

**Expansion Joints**

On bridges with an extruded aluminium expansion joint, recesses are cast into the kerbs. Refer *Appendix A Deck Design Sketches – Sketch 6*.

Due to the effects of crossfall and/or hog, the thickness of DWS at piers and abutments may be particularly thick if the bridge does not have a concrete deck. Because the top of an extruded aluminium expansion joints finishes flush with the top of the DWS, an expansion joint bolted directly onto deck units may need to be seated on a deep layer of epoxy mortar.

When the thickness of epoxy mortar beneath the expansion joint exceeds 70 mm, the epoxy mortar shall be reinforced. In *Appendix A Deck Design Sketches* this is referred to as deep DWS. Epoxy mortar that does not need to be reinforced is referred to as shallow DWS.

Reinforcing the epoxy mortar is done with stainless steel 12AT bars which are screwed into M10 sockets cast in the deck units and bent on site. Refer *Appendix A Deck Design Sketches – Sketches 6, 7 and 8*. On bridges with a crowned running surface, the thickness of the epoxy mortar may be such that the 12AT bars are not required on some of the outer deck units.

**Deck Wearing Surface Height Diagram**

Bridges on vertical curves are required to show finished DWS Heights at specific intervals along the bridge. 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 a span can be divided into equal length segments and Heights given at these spacings. Deck crossfall/superelevation details and deck cross section dimensions are also required.

Heights are to be given at right angles to the Bridge Control (or radially if the bridge is on a horizontal curve), and should start and finish at a chainage which wholly includes the relieving slabs. It must be clearly noted that the Heights are given at right angles to the bridge control and not along the skew line of the bridge. For an example of the required details refer Figure 17.4.1 *Example Deck Wearing Surface Heights*.

Bridges with a varying crossfall/superelevation also need a table of Heights following the same methodology as a bridge on a VC.

Where the bridge documentation is delivered as part of a set that includes civil and alignment drawings, the DWS Heights are usually defined within that set. The DWS Heights need not be shown on the bridge drawings. On Design and Construct projects, it is common practice that the Contractor’s Surveyors use the alignment model (from 12D) to determine the DWS Heights at any point they require.

***Figure 17.4.1 Example Deck Wearing Surface Heights***

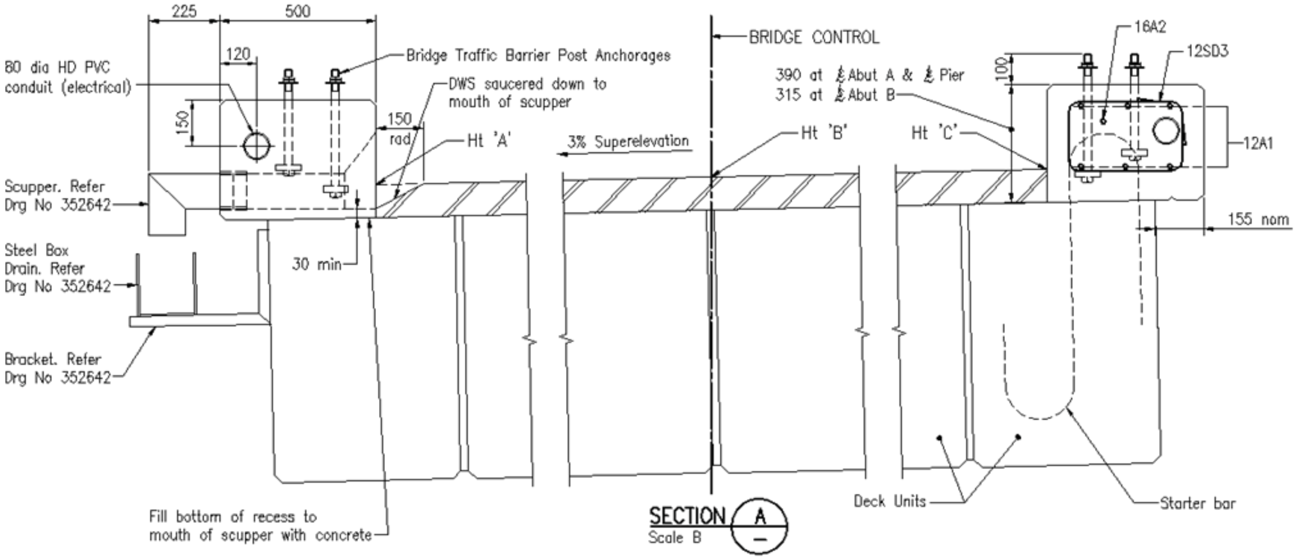
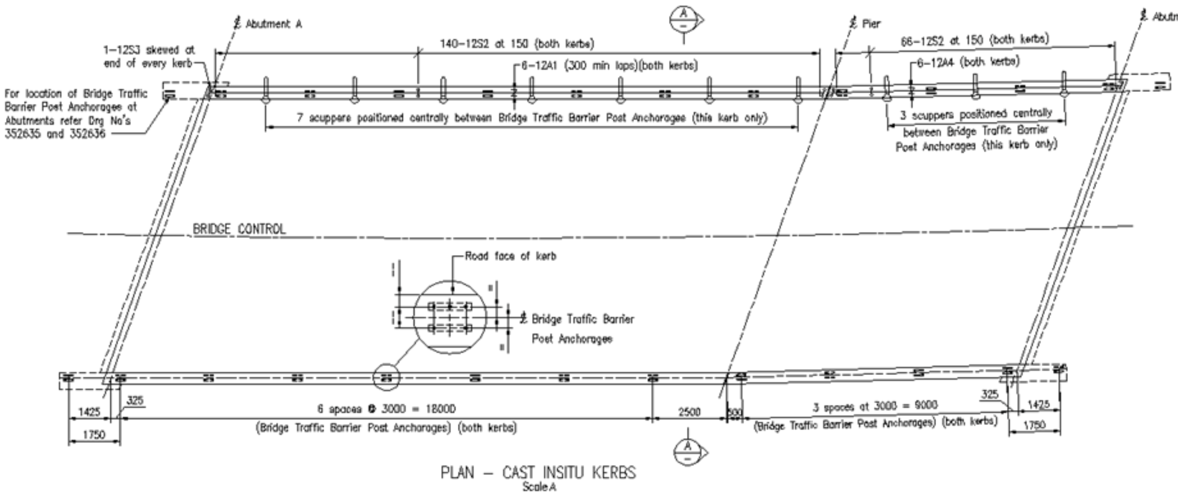



TABLE OF Ht's (All Ht's are radial to BRIDGE CONTROL)

| CHAINAGE | 3516 | 3518 | 3520 | 3522 | 3524 | 3526 | 3528 | 3530 | 3532 | 3534 | 3536 | 3538 | 3540 | 3542 | 3544 | 3546 | 3548 | 3550 | 3552 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ht 'A' | – | – | 41.317 | 41.328 | 41.341 | 41.354 | 41.370 | 41.386 | 41.404 | 41.423 | 41.444 | 41.466 | 41.488 | 41.513 | 41.537 | 41.563 | 41.590 | 41.619 | 41.649 |
| Ht 'B' | 41.436 | 41.446 | 41.457 | 41.469 | 41.482 | 41.496 | 41.512 | 41.528 | 41.546 | 41.565 | 41.585 | 41.606 | 41.628 | 41.652 | 41.676 | 41.702 | 41.729 | 41.757 | 41.786 |
| Ht 'C' | 41.577 | 41.586 | 41.596 | 41.607 | 41.620 | 41.633 | 41.649 | 41.665 | 41.683 | 41.702 | 41.723 | 41.744 | 41.766 | 41.790 | 41.814 | 41.840 | 41.867 | – | – |




### *17.5 Decks*

Decks are used on all girder bridges.

Decks are also used on deck unit bridges in special cases, typically:

- Multi span bridges on small radius horizontal curves and/or vertical curves
- Footwalks and bikeway bridges where deck units are widely spaced to act as girders
- Skews greater than 40°.

Decks are coated with bituminous waterproofing membrane to stop water permeating through the concrete deck and damaging the 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 Chapter 19 – *Bridge Barriers, 19.9 Single Sloped Concrete Traffic Barriers*.

Decks are designed to link simply supported deck spans at piers and abutments in one of three ways: fixed joint, expansion joint or continuous deck.

**Fixed Joint**

At abutments where the deck units/girders have fixed bearings (not cement mortar seating), an XJS expansion joint system (or approved equivalent) shall be installed. Refer *Appendix A Deck Design Sketches – Sketch 6*.

**Expansion Joint**

At piers or abutments where the decks units/girders have expansion bearings, (or expansion/fixed at piers), an expansion joint is required to join the deck sections of the adjacent spans. Refer Chapter 18 – *Expansion Joints and Miscellaneous Details* and *Appendix A Deck Design Sketches – Sketches 6 and 7*.

**Continuous Deck with DWS**

At piers where the deck units/girders have fixed bearings the concrete deck is cast over the gap between the adjacent spans. Concrete is used rather than a filler material because it is the better option for making the joint waterproof. The deck is not poured over two adjacent spans at once, rather it is done in a series of initial and infill pours. The infill pour is done over the pier and the deck is debonded from the decks units/girders with a sheet of closed cell expanded polyethylene. Refer *Appendix A Deck Design Sketches – Sketches 1, 3 and 4*.

**Continuous Deck without DWS**

When DWS is not used, the construction joint to one side of the pier centreline must be spread widely apart to ensure a smooth transition between pours. Refer *Appendix A Deck Design Sketches – Sketches 2, 3 and 4*.

## *17.6 Deck Overhang*

**Limits of Overhang**

The deck units/steel girders supporting the deck should be set out so that the maximum overhang on both sides of the bridge is equal. The maximum overhang for a deck unit bridge should be approximately 350 mm, refer *Appendix A Deck Design Sketches – Sketch 3 (Section C)*. If a greater overhang is required, the Drafter shall liaise with the Design Engineer to establish an acceptable outcome.

Bridge decks are often designed to follow horizontally curved alignments. This results in the RHS and LHS kerbs being cast on concentric circular curves which create a varying overhang of the deck outside the line of prestressed beams. The bridge 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 is cast to match the curved alignment. Refer Chapter 14 – *Prestressed Concrete Girders, 14.5 Girder Profiles*.

### *17.7 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 decks units/girders. At the extremities of the deck adjacent to the kerbs, the longitudinal steel shall be cut to avoid clashing with the curved longitudinal bars in the kerbs. Refer *Appendix A Deck Design Sketches – Sketch 1 (Deck Reinforcement in Bridges with Small Radius Horizontal Curves)*.

### *17.8 Pre-camber*

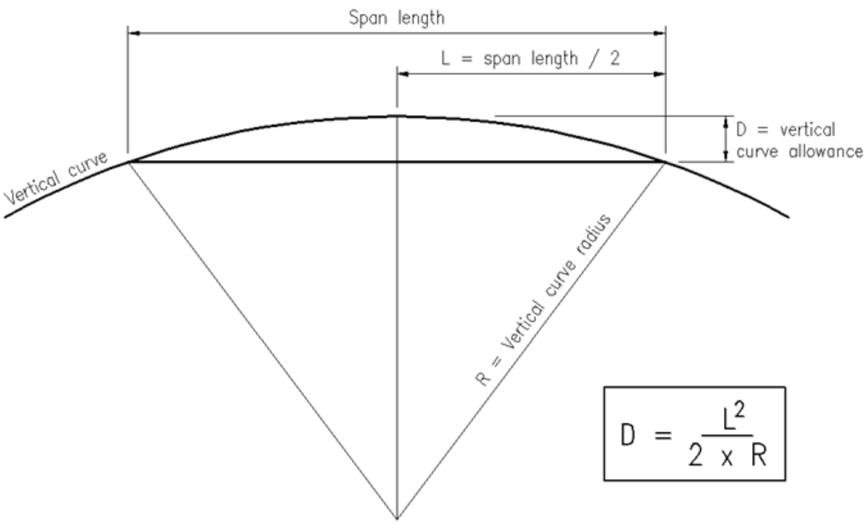
When a deck is poured onto deck units/girders the mass of the concrete deck will cause the hog in the beams to reduce. This is known as pre-camber and the distance that the hog will reduce is calculated by the design engineer and must be shown on the deck drawings in a pre-camber diagram. When the bridge is being constructed, the formwork will be set higher than the finished height by the pre-camber amount. Therefore, once the deck has been poured, the deck shall settle at the correct height. Formwork for the deck shall be supported by the girders/deck units. On no account is the formwork to be tommed from the ground. Refer *Appendix A Deck Design Sketches – Sketch 3 (Pre-camber Diagram)*.

### *17.9 Deck Thickness*

When calculating the deck thickness at the abutments and piers, the pre-camber and hog are taken into account. The deck thickness at the abutments and piers is the minimum deck thickness at midspan, plus the hog, minus the pre-camber.

A further complication is added on bridges with a VC. On a crest VC, an additional allowance is subtracted from the deck thickness. Therefore the deck thickness at the abutments and piers is the minimum deck thickness at midspan, plus the hog, minus the pre-camber, minus the VC allowance.

***Figure 17.9-1 Vertical Curve Allowance***




On a sag VC, an additional allowance is added to the deck thickness. Therefore the deck thickness at the abutments and piers is the minimum deck thickness at midspan, plus the hog, minus the pre-camber, plus the VC allowance. A check of the additional deck thickness shall be undertaken to ensure overloading of the abutments and piers does not occur. Refer Figure 17.9-1 *Vertical Curve Allowance*.

### *17.10 Deck Heights*

The drawings must provide enough deck Heights in order for the deck to be constructed. Level bridges require a control line Height, crossfall/superelevation details, and deck cross section dimensions.

Bridges on a grade require the control line Height at all abutments and piers, crossfall/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 Heights to be given every few meters 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 a span can be divided into equal length segments and Heights given at these spacings. Additional Heights shall be shown at the abutment and pier centrelines. Deck crossfall/superelevation details and deck cross section dimensions are also required. Refer *Appendix B Example Deck Drawings – Sheet 2*.

Heights are to be given at right angles to the Bridge Control (or radially if the bridge is on a horizontal curve), and should start and finish at a chainage which wholly includes the relieving slabs. If the bridge is skewed, it must be clearly noted that the Heights are given at right angles to the bridge control and not along the skew line of the bridge.

Bridges with a varying crossfall/superelevation also need a table of Heights following the same methodology as a bridge on a VC.

The top face of the kerb is level on bridges with a crossfall or superelevation up to and including three per cent. For bridges with a superelevation greater than three per cent, the top face of the kerb follows the superelevation.

Where the bridge documentation is delivered as part of a set that includes civil and alignment drawings, the DWS heights are usually defined within that set. The deck Heights need not be shown on the bridge drawings. The DWS thickness shall be shown on the drawings and the Contractor's Surveyors use the alignment model (from 12D) to determine the deck Heights at any point they require.

### *17.11 Cross Girders*

Bridges with super T-girders shall have cross girders. The cross girder reinforcement protrudes into the deck. The cross girders must be cast separately to the deck slab. Refer Chapter 14 – *14.10 Cross Girders*.

### *17.12 Deck Drainage and Scuppers*

Bridge decks are required to be drained so that no ponding of water (or spillage from vehicles), occurs on the roadway surface. Drainage is generally achieved by the use of scuppers, either through the kerbs or through the deck units, discharging directly to the stream bed below, or into a drainage system when required (refer Environmental Drainage on the following page).

Bridges over train lines, pedestrian walkways or roads, are not to discharge deck drainage in the manner described above. When these situations arise, drainage is to be achieved using an acceptable method suitable to the design of the structure involved. The solutions need to be considered on an individual basis which may include any of the following examples:

- build the bridge on a grade (in extenuating circumstances the bridge must be level). Refer Chapter 10 – *Bridge Geometry, 10.10 Road Design Considerations with Respect to Low-Level Frequently Flooded Bridges*
- Scuppers may not be necessary for a short bridge if the bridge is on a grade
- provide a collection drain or pipe on the outside of the deck to collect the water and run it to the end of the bridge.

Queensland Railways must always be consulted before a bridge is designed over their train lines to ensure it meets their current requirements, particularly in regards to deck drainage, future works, barrier requirements and minimum clearances.

**Scuppers through Cast Insitu Kerbs on Deck Units**

There are two methods commonly used in this situation:

- **Method 1**

PVC scuppers are provided in deck units, where applicable. The departmental standard deck units have scuppers 80 mm in diameter, and at 2.05 m centres. Non-standard scupper details may be required if determined by a hydraulic analysis. Kerbs are cast with a suitable blockout at each scupper location which is removed after casting, to form the completed scupper system. Refer *Appendix A – Deck Design Sketches – Sketch 5*.

- **Method 2**

Scuppers formed with 100 mm diameter PVC tube spaced at a maximum of 2.05 m centres passing through the kerb. The scuppers shall be placed centrally between the bridge traffic barrier post anchorages. The 2.05 m maximum spacing may be increased if a hydraulic analysis determines that it can be.

**Scuppers in Decks**

There are two methods commonly used in this situation:

- **Method 1**

Scuppers formed with 150 mm diameter PVC tube spaced at a maximum of 2.4 m centres passing through the kerb. The scuppers shall be placed centrally between the bridge traffic barrier post anchorages. The 2.4 m maximum spacing may be increased if a hydraulic analysis determines that it can be. Depending on the application, the scupper shown on TMR Standard Drawing 1145 *Details for Cast Insitu Deck* may be suitable

- **Method 2**

Scuppers formed with 100 mm diameter PVC tube spaced at a maximum of 2.4 m centres passing through the kerb. The scuppers shall be placed centrally between the bridge traffic barrier post anchorages. The 2.4 m maximum spacing may be reduced if a hydraulic analysis determines that it can be. Refer *Appendix A Deck Design Sketches – Sketch 4* for examples

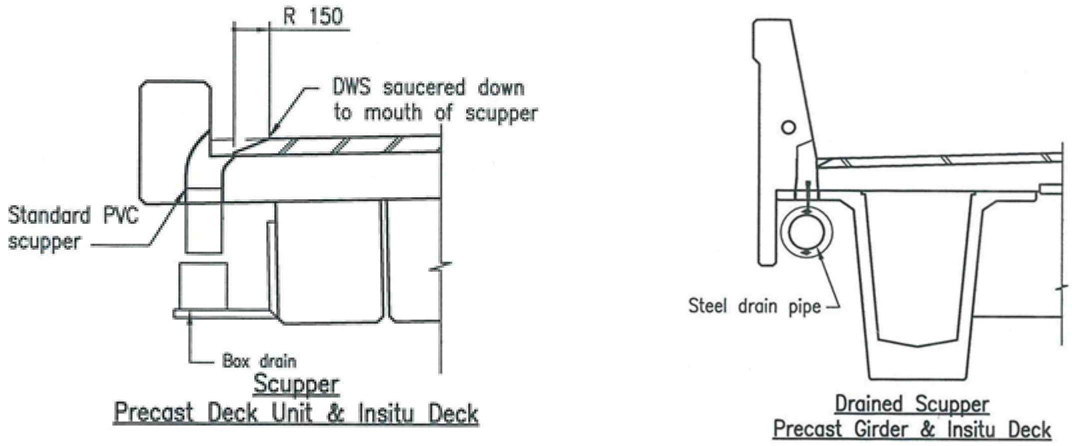
**Environmental Drainage**

In certain circumstances there are requirements to provide deck drainage systems to ensure that any spillages that may occur on bridges will be channelled off the bridge and dispersed, rather than run directly to the waterway.

Generally the systems provided to achieve these requirements are by way of scuppers and a drain fixed externally to the bridge structure.

Refer Figure 17.12-1 *Deck Drainage Systems*, for examples of typical scupper arrangements and *Appendix A Deck Design Sketches – Sketches 4 and 5* for standard scupper details.

***Figure 17.12-1 Deck Drainage Systems***




### *17.13 Junction Boxes*

Because of the difficulty in pulling wires through a long length of conduit, junction boxes shall be placed at a maximum of every:

- 80 m when the conduit has bends at the abutments where it dives below ground
- 150 m when the conduit has no bends.

The junction box shall be covered with a recessed 10 mm thick stainless steel plate when the plate presents a snagging point for traffic; that is, when attached to the traffic side of a concrete traffic barrier. Otherwise the plate shall be fabricated from 3 mm thick stainless steel.

Concrete inserts cast into bridge concrete traffic barriers/kerbs for attachment of junction box covers are to be placed on the traffic approach side of joint. Refer *Appendix A Deck Design Sketches – Sketch 6*.

### *17. 14 Conduits*

Most bridges in urban areas require conduits for electrical and/or telecommunication services. Even if the service is not required in the short term, an empty conduit may be installed for future services. The Client will advise what service requirements are required on the Bridge Design Information Request Form. Refer Chapter 1 – *Introduction, Appendix A Example Bridge Design Information Request Letter*.

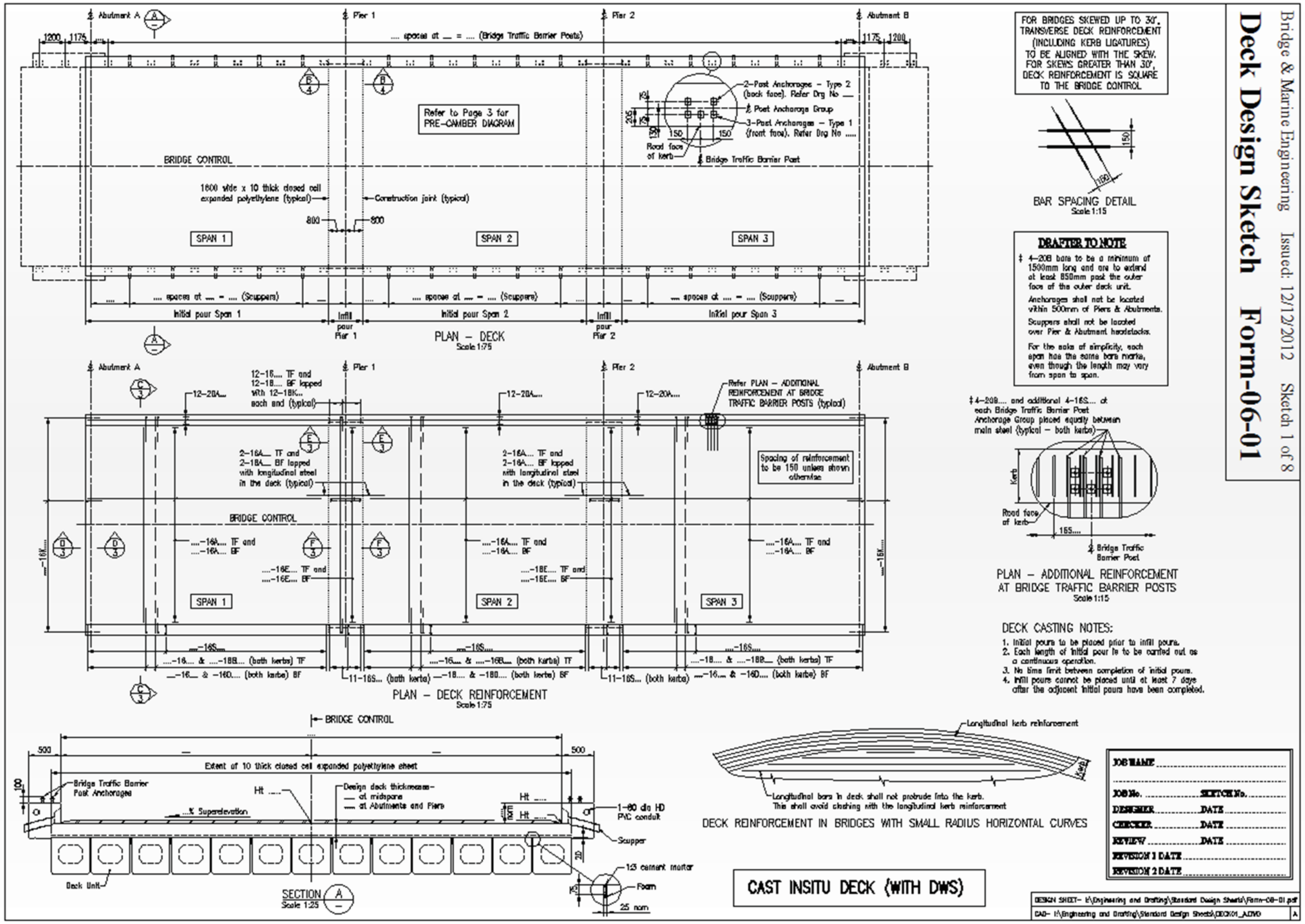
If services are required, the width of the bridge concrete traffic barriers/kerbs may need to increase to accommodate the conduits, therefore this issue must be resolved before detailed design begins. A standard kerb is 500 mm wide and can accommodate only one 80 mm diameter conduit.

Larger diameter conduits may make installation of the wiring easier. Therefore, in concrete traffic barriers, 100 mm diameter conduits shall be used whenever there is enough room, provided the deck units/girders are not supported by bearings. If this is the case, the conduits shall be 80 mm diameter to allow 100 mm diameter ‘Stormflex’ pipe to be wrapped around it. The ‘Stormflex’ pipe is used to allow for expansion due to concrete shrinkage, temperature differential, and jacking.

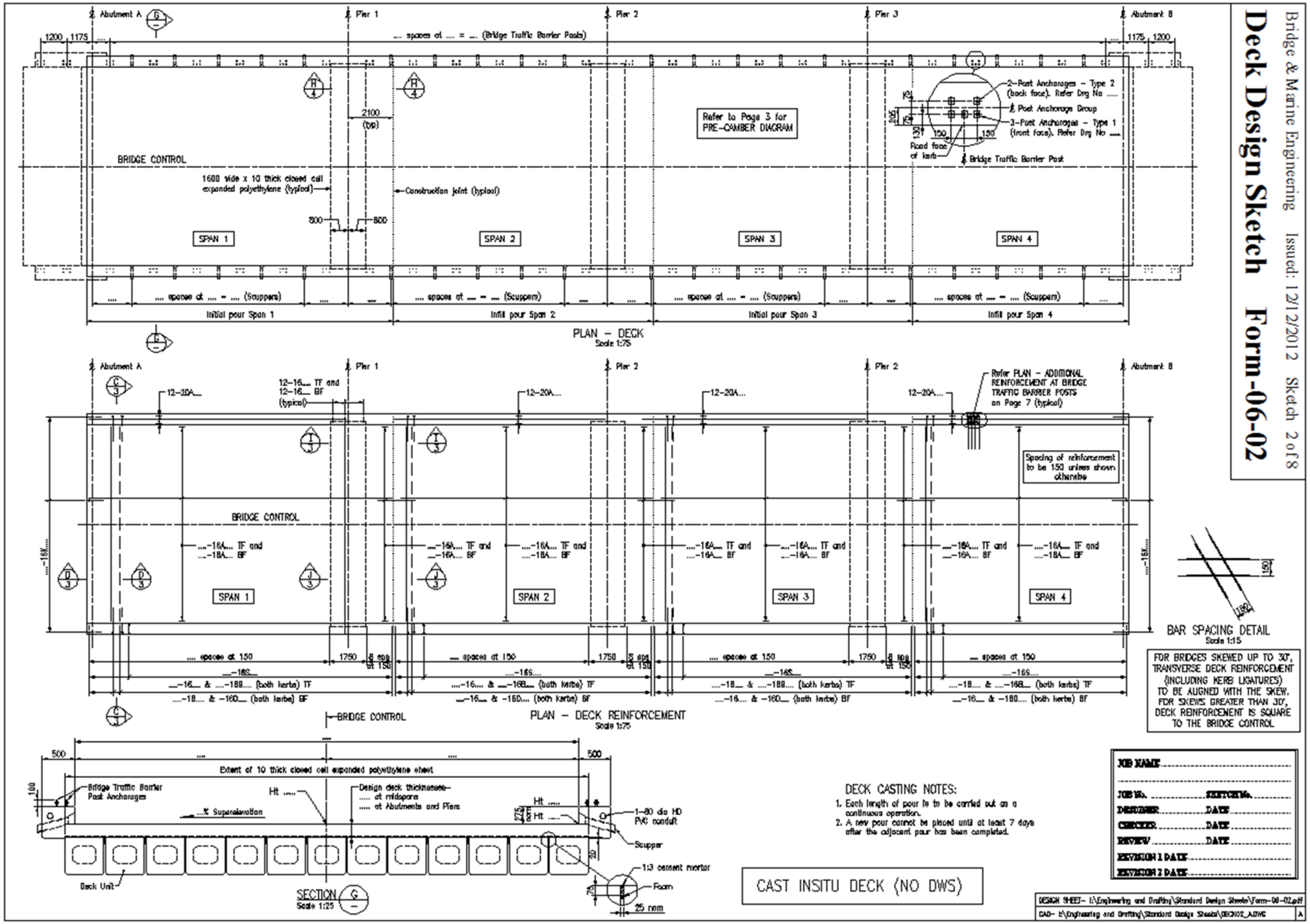
A 50 mm nominal gap between adjacent kerbs shall be provided to allow the ‘Stormflex’ pipe to accommodate the change of conduit alignment caused by bridge jacking. When an XJS expansion joint (or approved equivalent) is provided at the abutments, the gap between the deck and the relieving slab is 25 mm. The additional 25 mm required shall be taken up in the kerb. However a recess will need to be formed around the ‘Stormflex’ pipe. Refer *Appendix A Deck Design Sketches – Sketch 8*.

## Appendix A – Deck Design Sketches

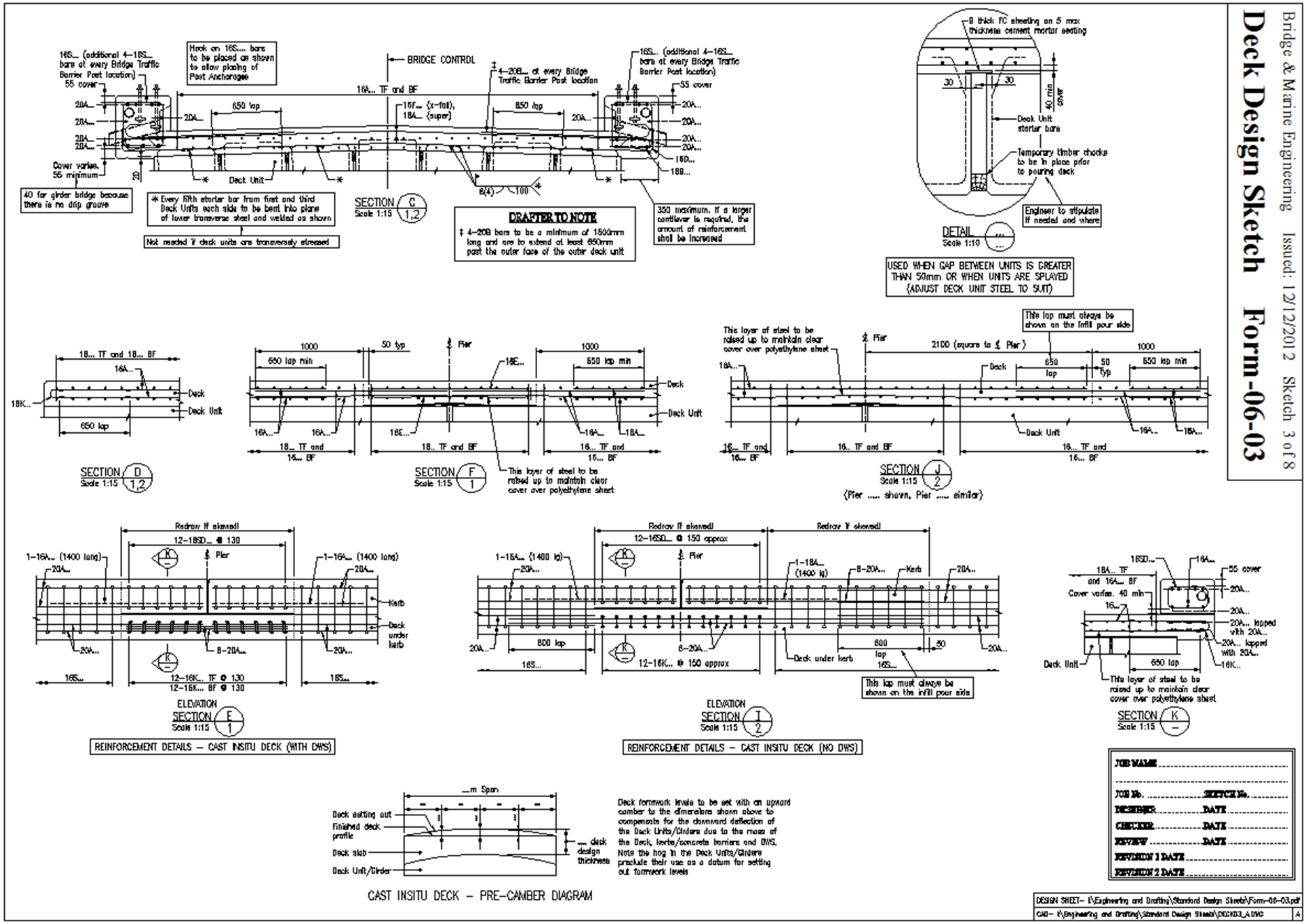
***Appendix A – Deck Design Sketches – Sketch 1***



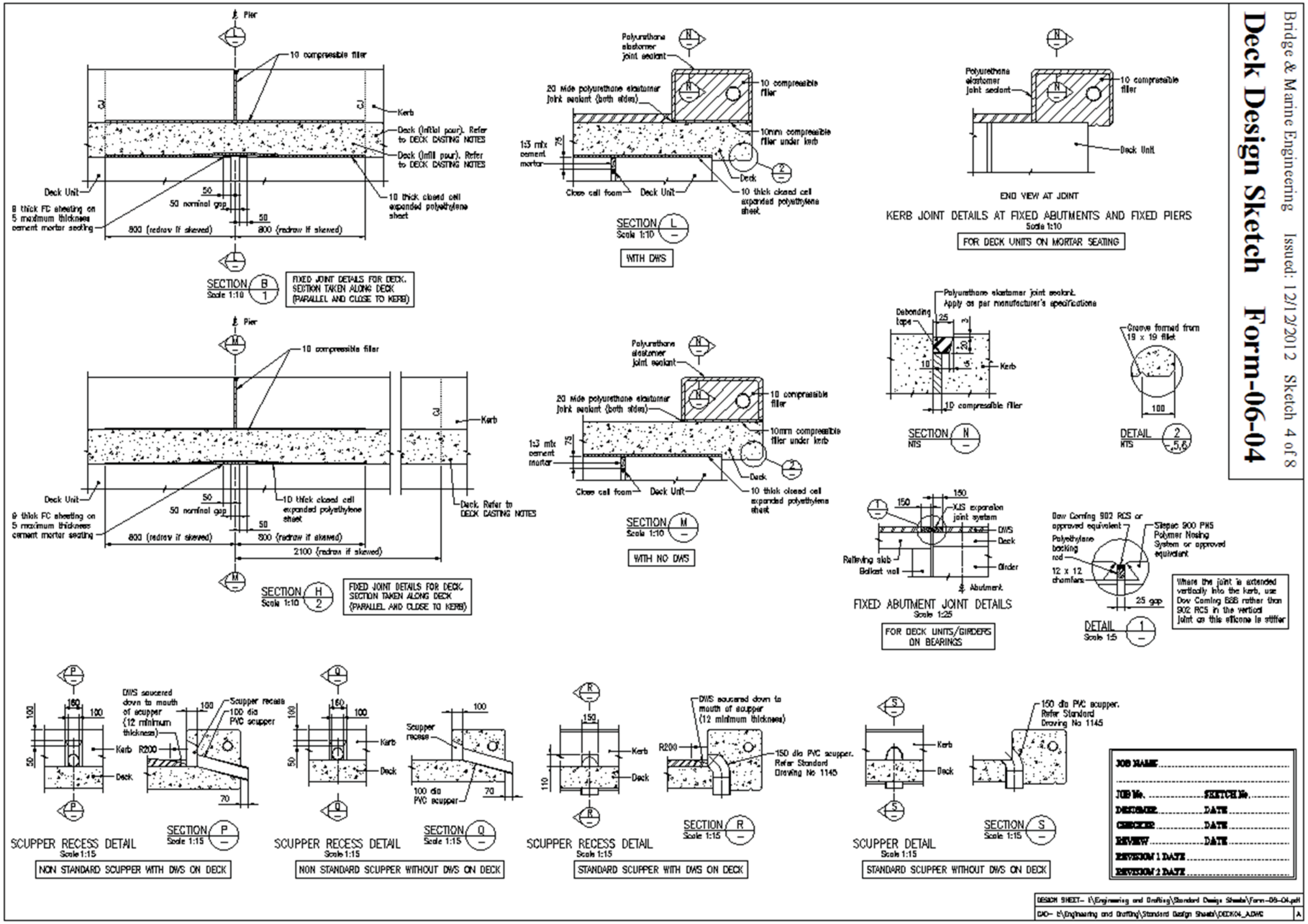
***Appendix A – Deck Design Sketches – Sketch 2***



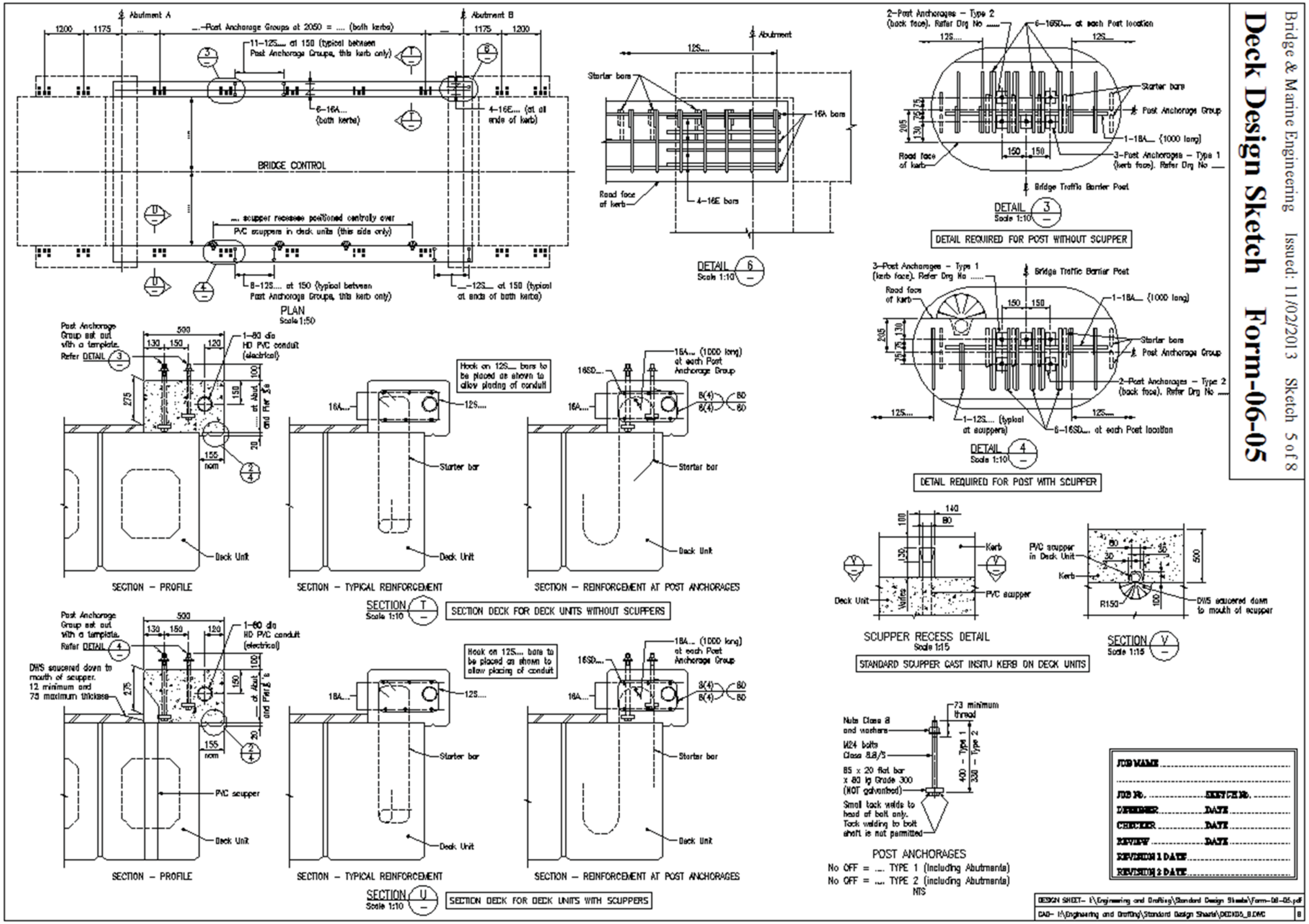
***Appendix A – Deck Design Sketches – Sketch 3***



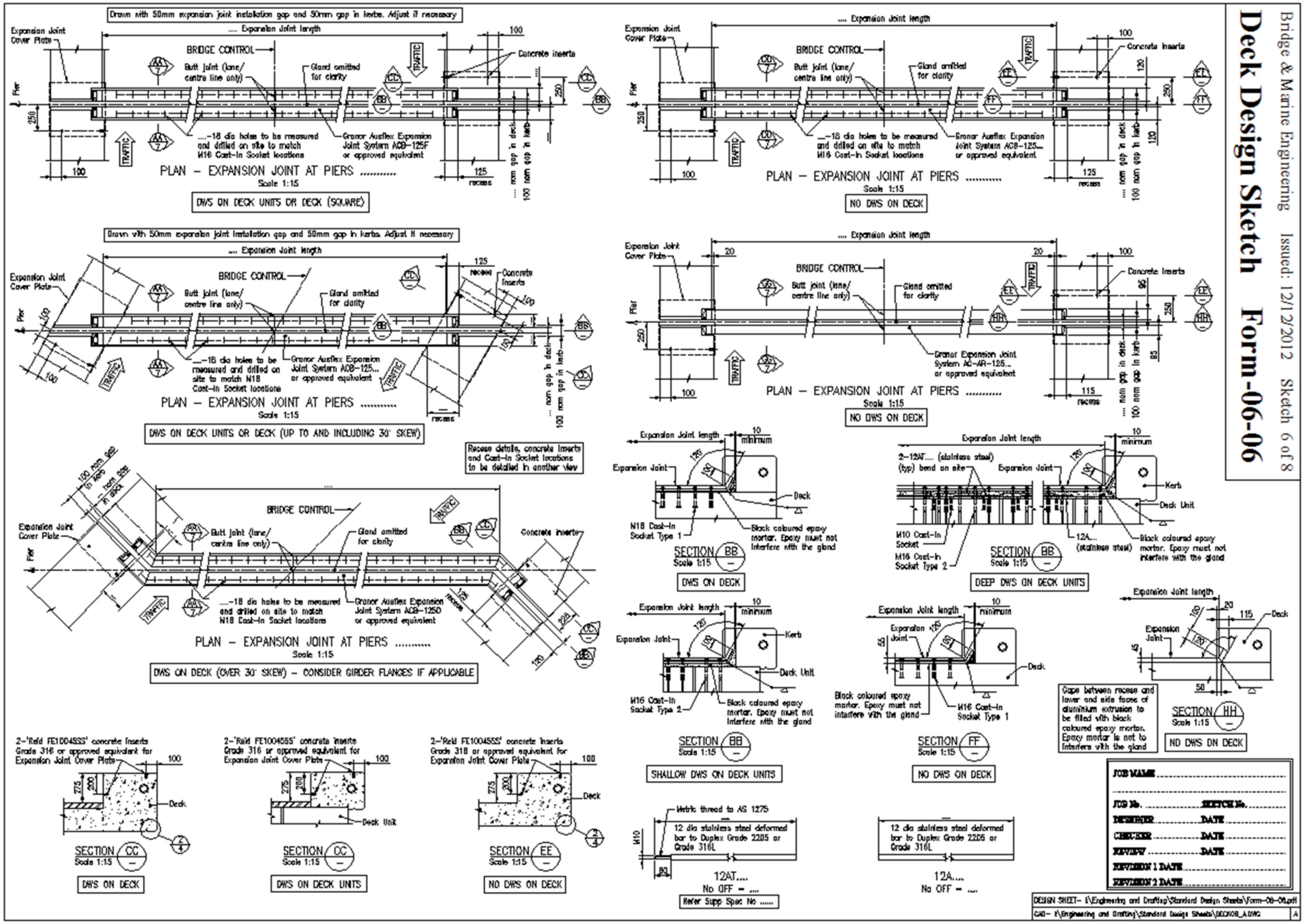
***Appendix A – Deck Design Sketches – Sketch 4***



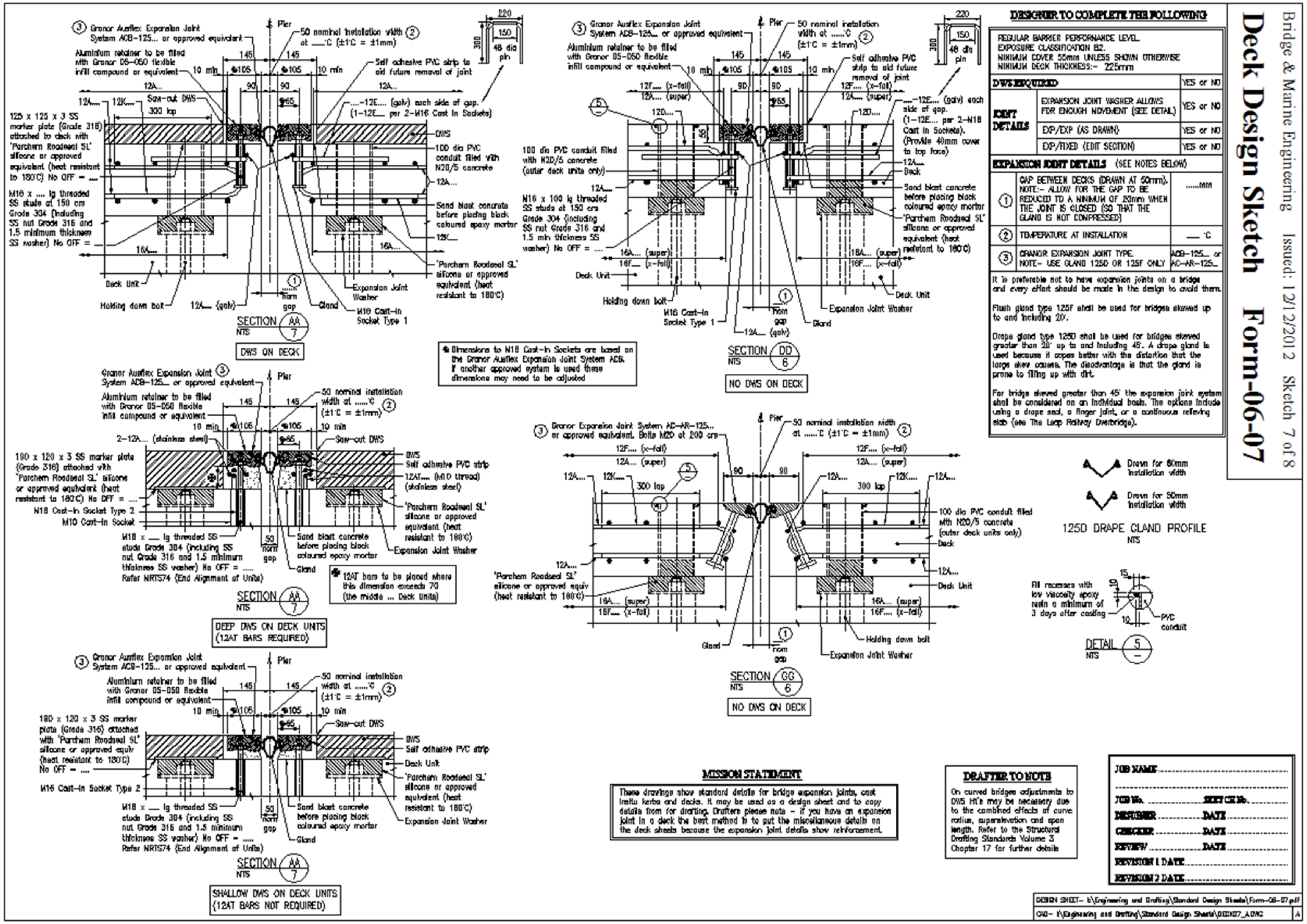
***Appendix A – Deck Design Sketches – Sketch 5***



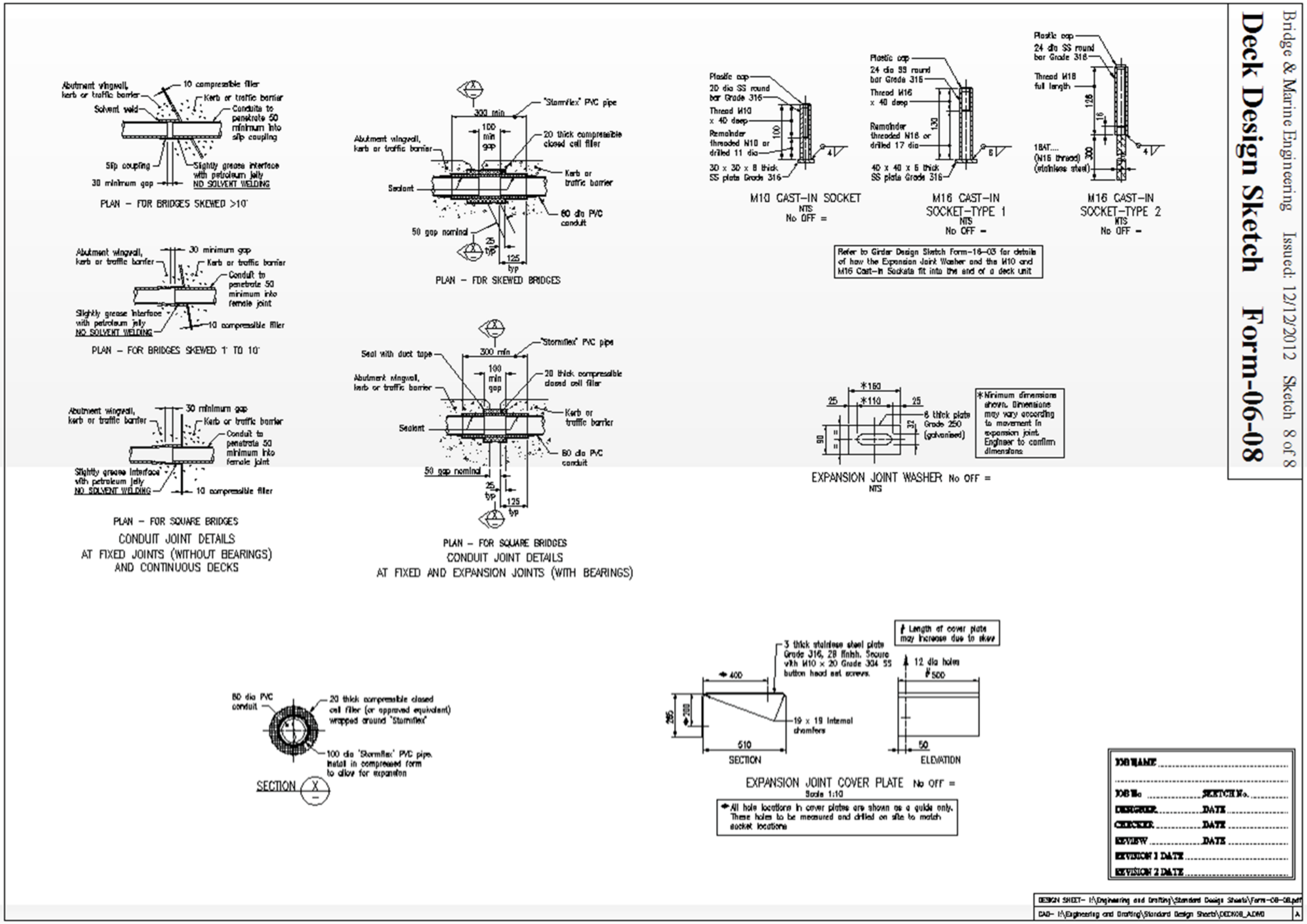
***Appendix A – Deck Design Sketches – Sketch 6***



***Appendix A – Deck Design Sketches – Sketch 7***

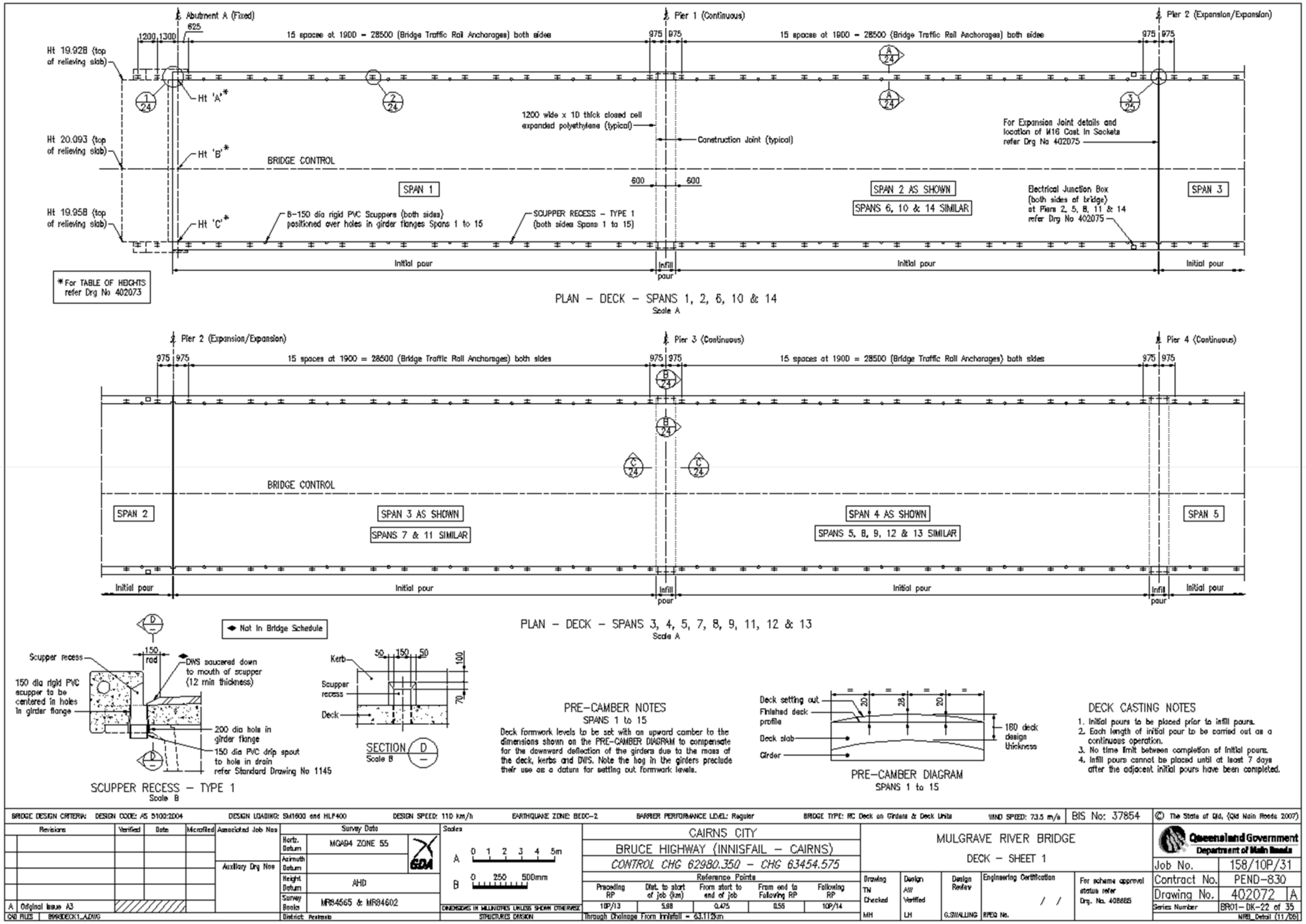


***Appendix A – Deck Design Sketches – Sketch 8***

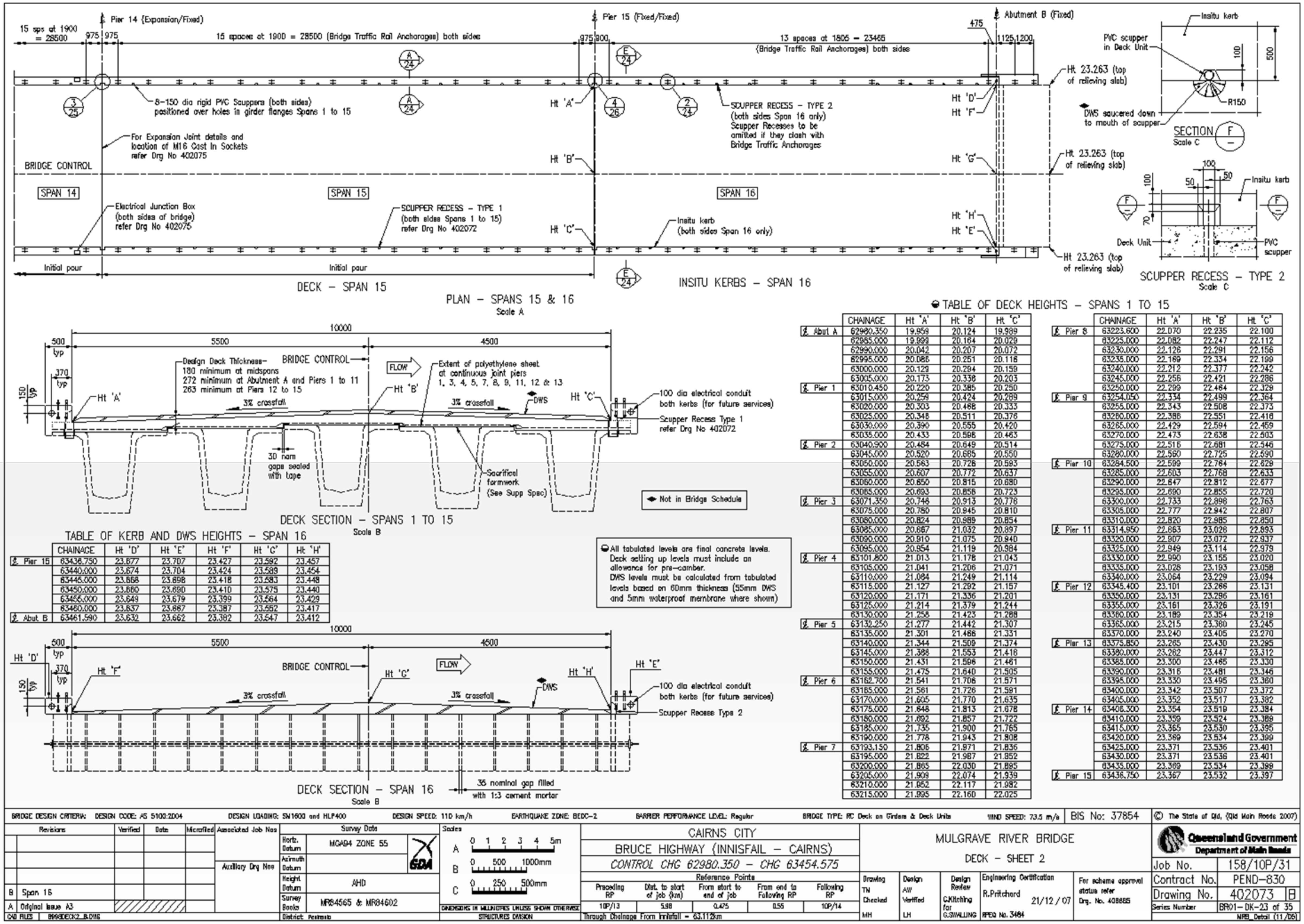


## Appendix B – Example Deck Drawings

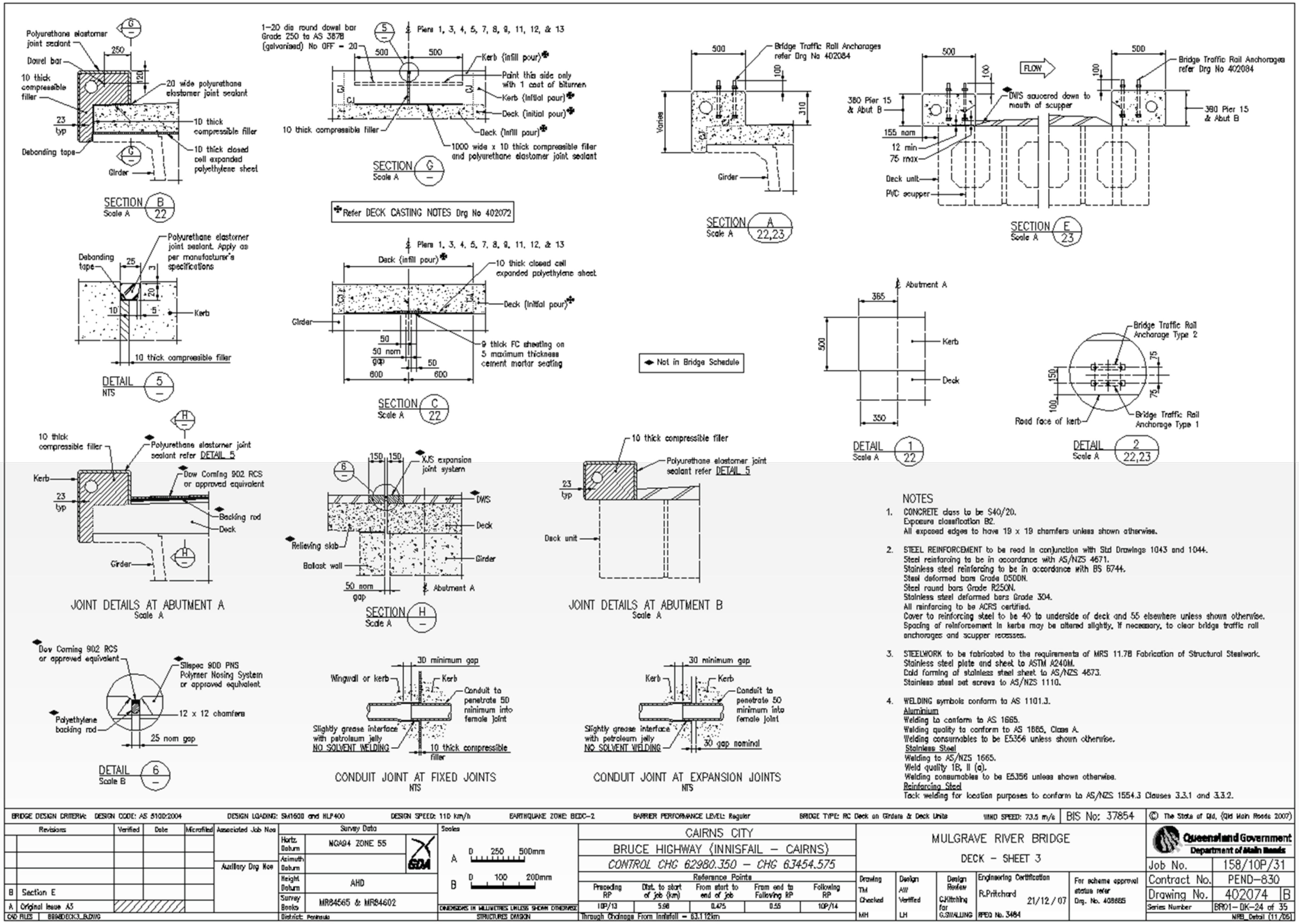
***Appendix B – Example Deck Drawings – Sheet 1***



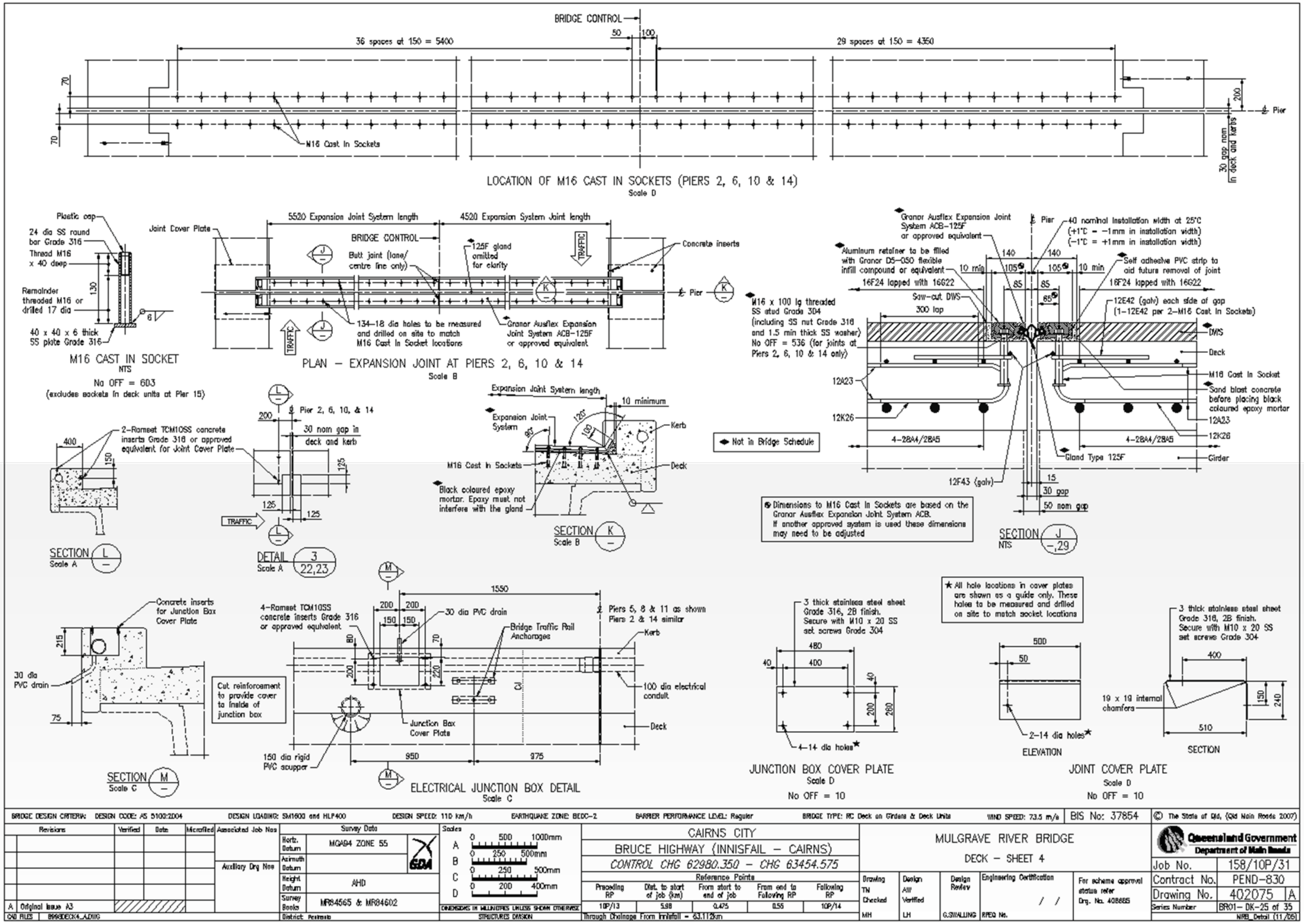
***Appendix B – Example Deck Drawings – Sheet 2***



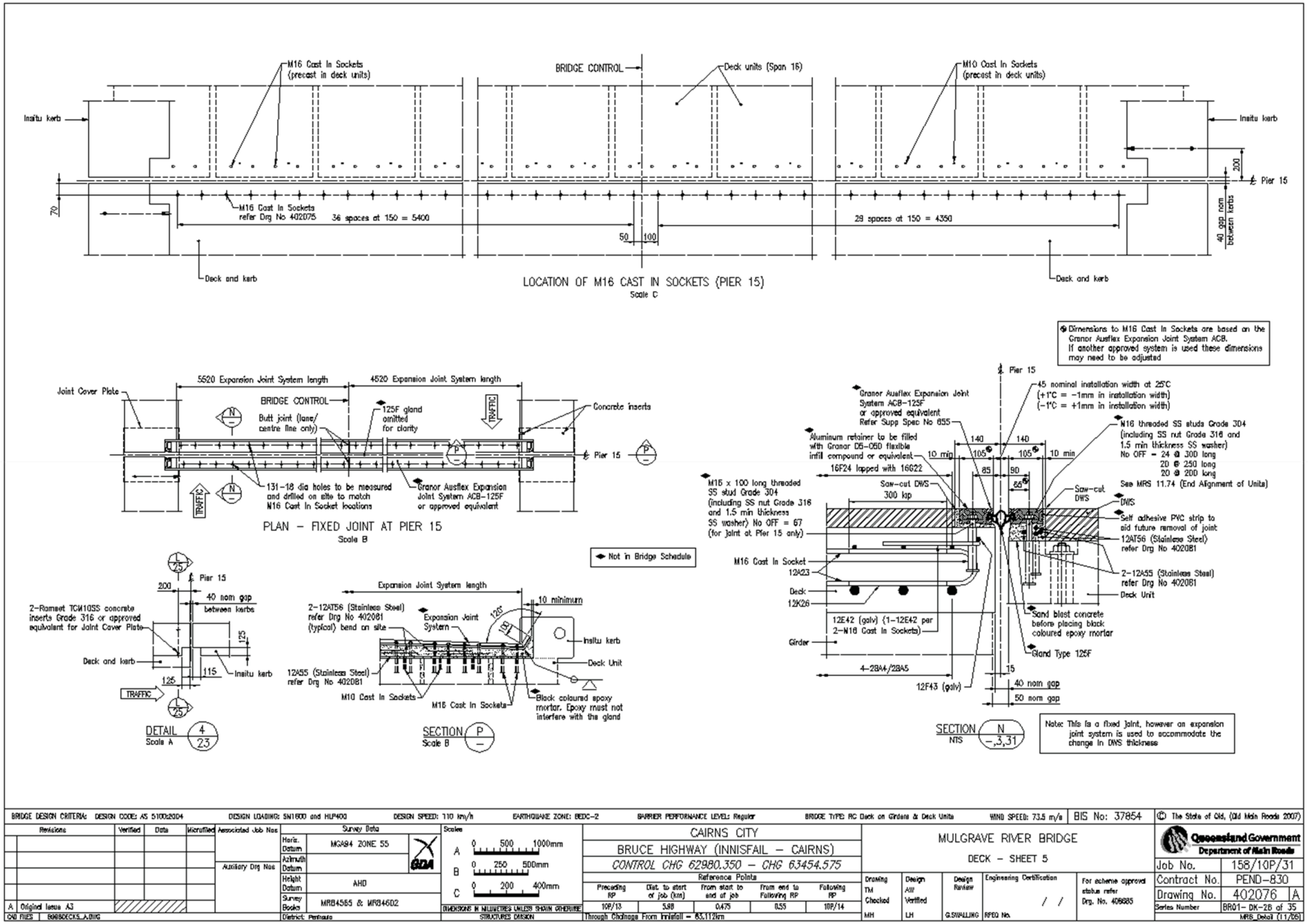
***Appendix B – Example Deck Drawings – Sheet 3***



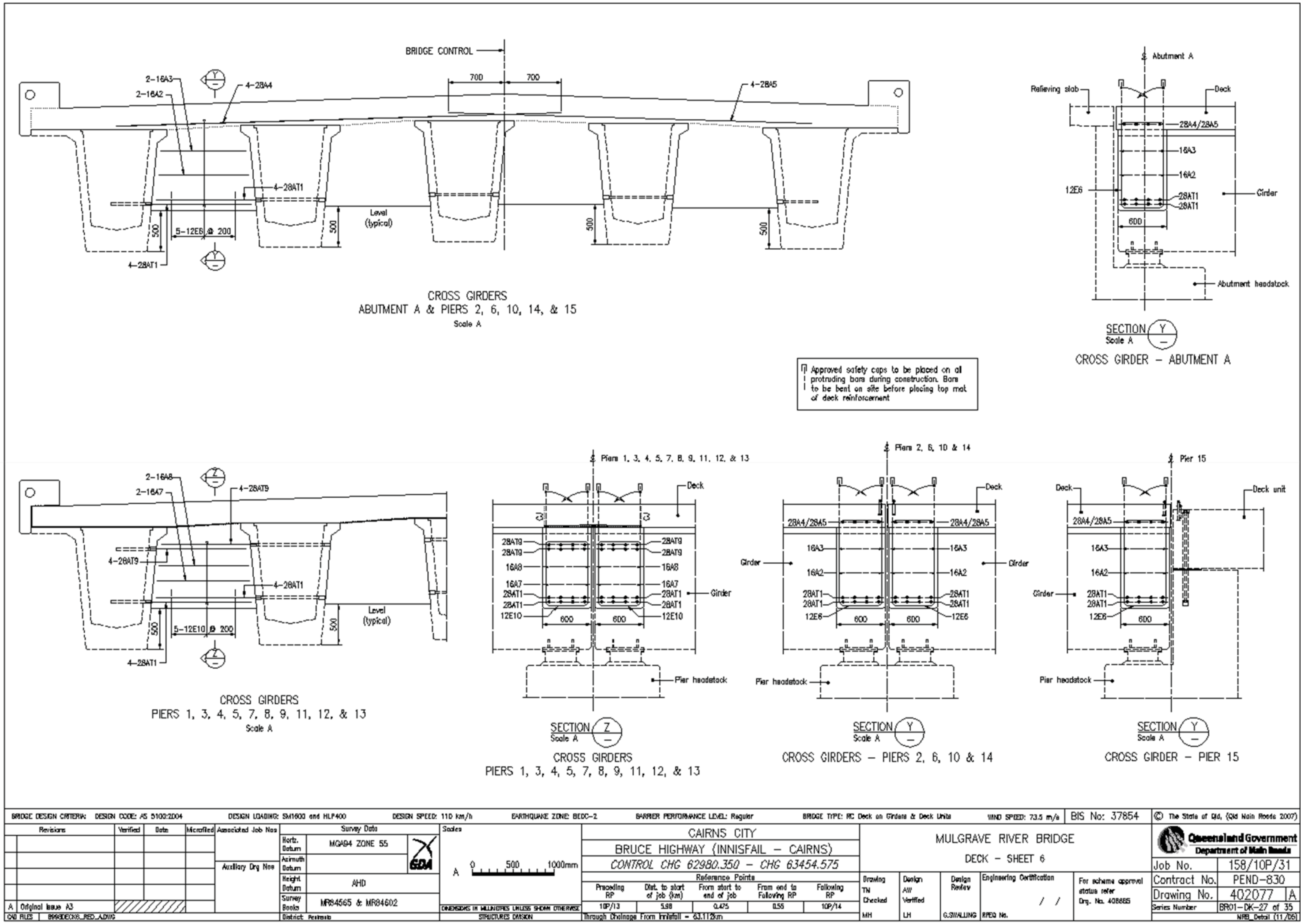
***Appendix B – Example Deck Drawings – Sheet 4***



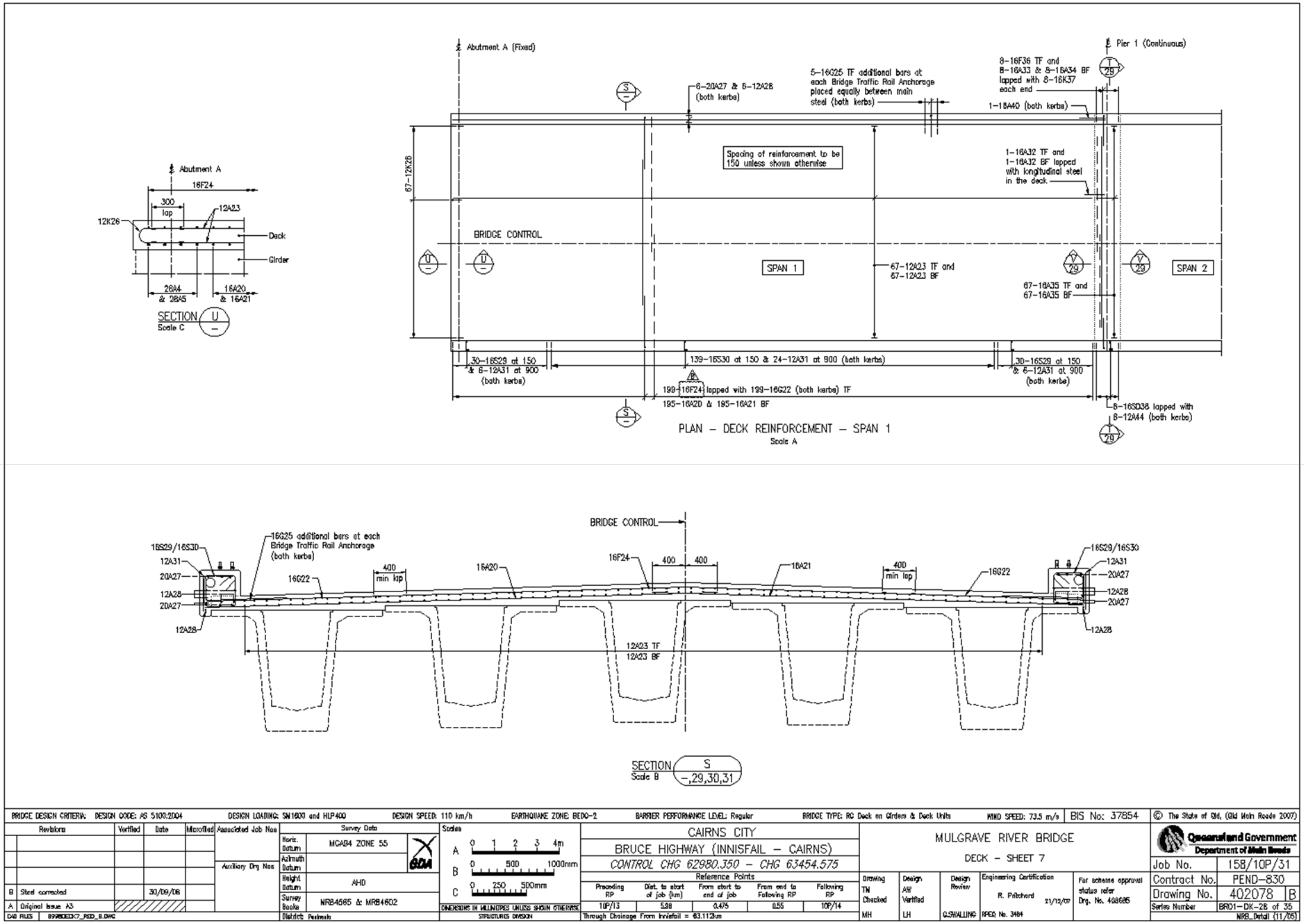
***Appendix B – Example Deck Drawings – Sheet 5***



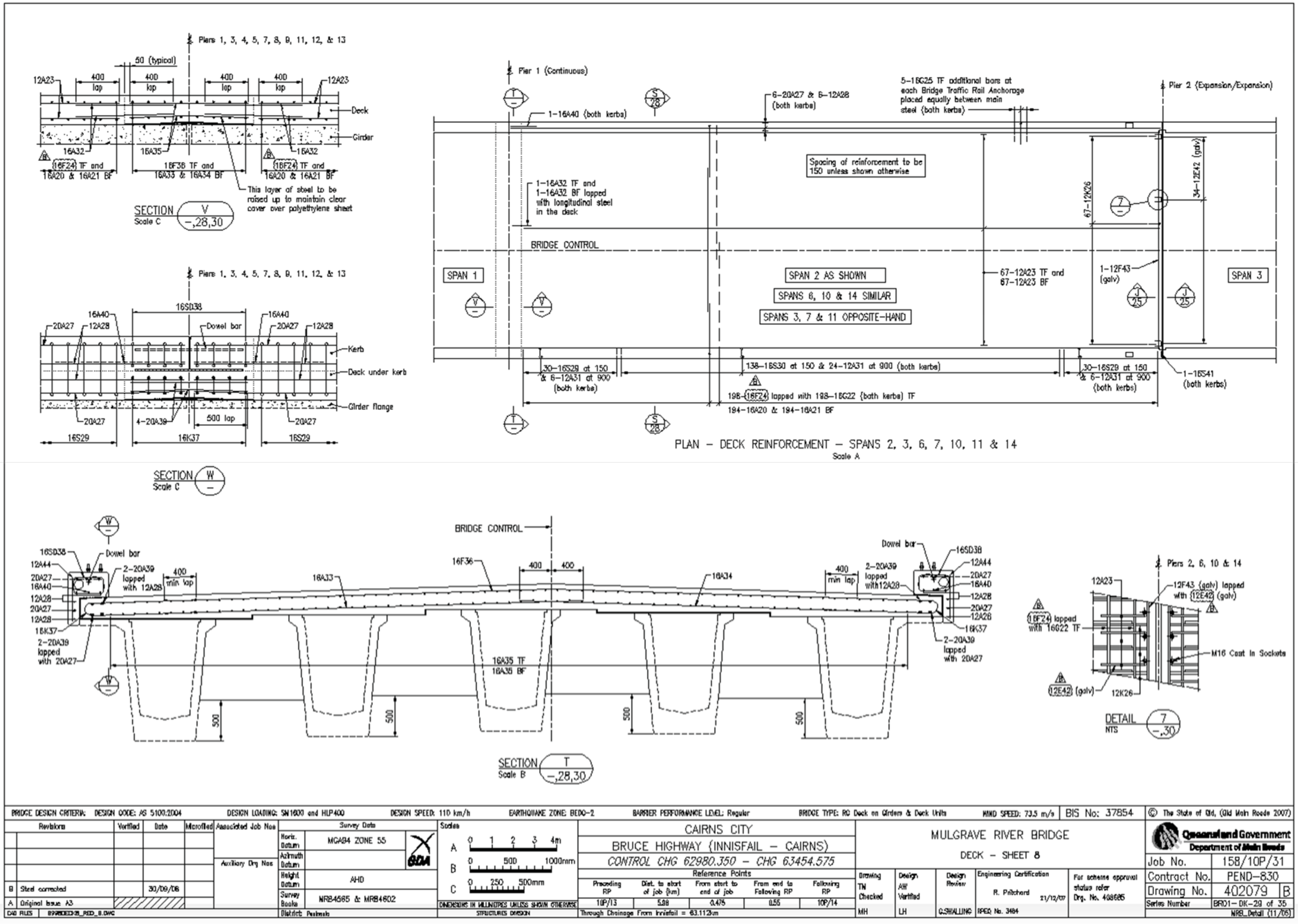
***Appendix B – Example Deck Drawings – Sheet 6***



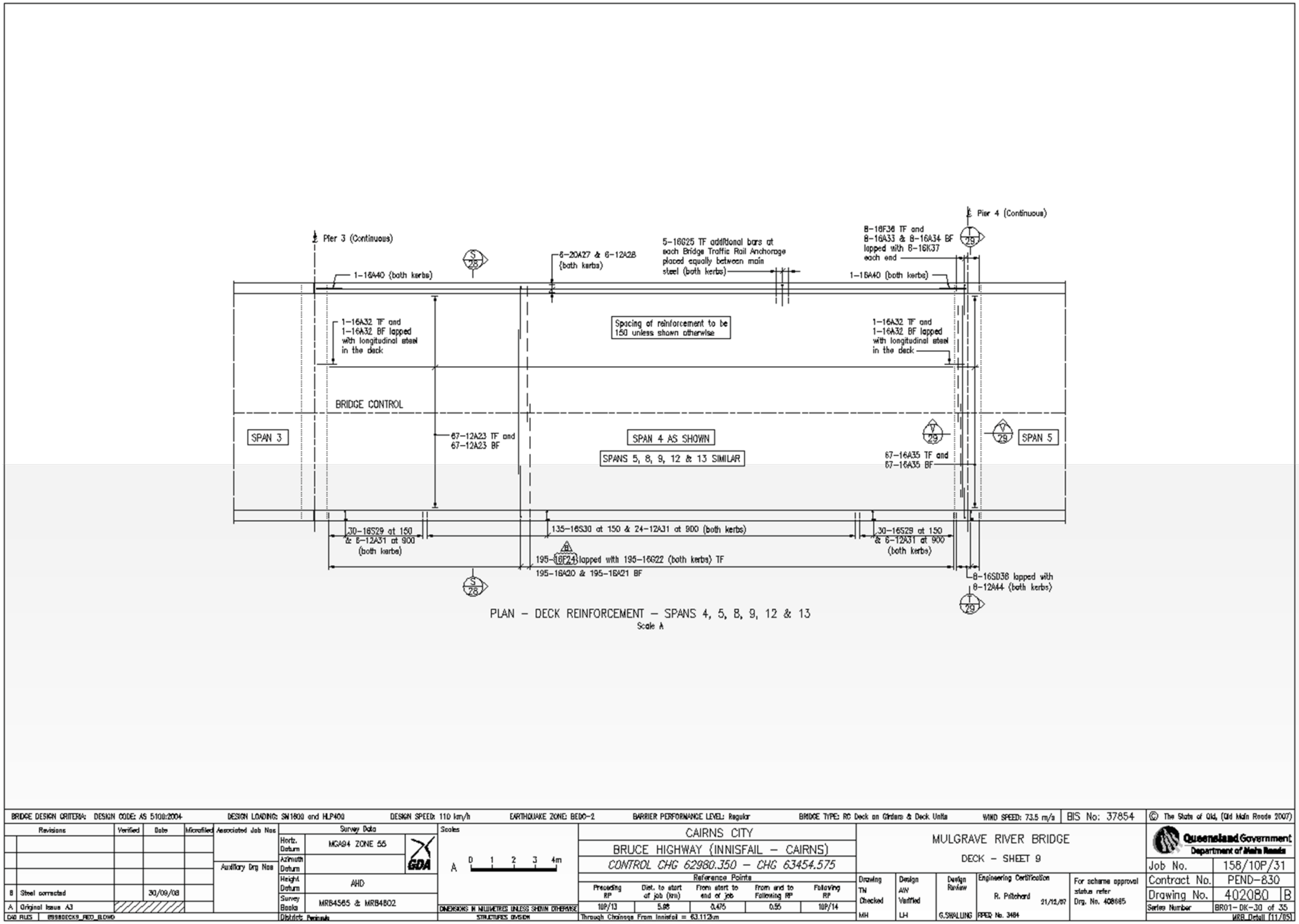
***Appendix B – Example Deck Drawings – Sheet 7***



***Appendix B – Example Deck Drawings – Sheet 8***



***Appendix B – Example Deck Drawings – Sheet 9***



***Appendix B – Example Deck Drawings – Sheet 10***