Drafting and Design Presentation Standards
Volume 3: Structural Drafting Standards

Chapter 16: Piles and Footings

May 2013

Queensland Government

Chapter 16 Amendments

Revision register

Issue/Rev No.	Reference Section	Description of Revision	Authorised by	Date
1	–	First Issue.	Manager (Structural Drafting)	March 2011
2	–	Document name change.	Manager (Structural Drafting)	Nov 2011
	16.4	450 and 500 mm piles shall not be used.		
3	16.10	Cast in Place pile wording details revised. Figure 16.10-1 amended.	Team Leader (Structural Drafting)	May 2013
	–	Appendix G – new drawing added.		

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16 Piles and Footings

16.1 Glossary of terms

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

16.2 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figures and examples shown in this volume are for presentation purposes only, and may contain some details that are now superseded.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.

16.3 General

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

- Driven Piles
- Cast in place piles
- Spread footings.

Driven piles most commonly used in bridge design are as follows:

- Precast Prestressed Concrete (PSC) Piles
- Precast Prestressed Concrete (PSC) Spliced Piles.

Other types of driven piles may be used, if approved on a project specific basis, by the Department of Transport and Main Roads:

- Reinforced Concrete (RC) Piles
- Composite Piles (a combination of PSC and RC piles)
- Steel Piles.

Piles and footings shall be set out on the Abutment and Pier drawings and also on the Pile Identification and Setting Out Diagram which is shown on the General Arrangement drawings. Refer Chapter 11 – *General Arrangements, Figure 11.7.3 – Pile Identification and Setting Out Diagram*.

16.4 Precast Prestressed Concrete Piles

PSC piles are the most commonly used pile type. They are octagonal in cross section, measure 550 mm across opposite faces, and can be manufactured up to 28 m in length.

450 mm and 500 mm PSC piles were once commonplace, however, they shall no longer be used because most casting yards are not set up to produce them.

Pile drawings require a Schedule. Details to be supplied in the Schedule may include, but are not limited to:

- Pile location
- Pile length
- Numbers of each pile type

- Headbar diameter, length and number per pile
- Total mass of piles

Refer *Appendix A Example PSC Pile Drawing*.

16.5 Precast Prestressed Concrete Spliced Piles

Typically, casting yards are only set up to make piles up to 28 m in length. When piles longer than 28 m are required, two segments of the same profile are joined together with a mechanical splice. The splice shall be placed in the lower half of the pile where the bending moment is reduced. The department intends to produce a new standard drawing for spliced piles.

Refer *Appendix B Example PSC Spliced Pile Drawings*.

16.6 Reinforced Concrete Piles

RC piles are square in cross section and are not prestressed. Their use is not permitted for bridge foundations. Any Designer who believes the use of such piles is cost effective and will achieve the strength and durability required, may prepare a written submission for consideration by the Deputy Chief Engineer (Structures). Delays in assessing such submissions, and any consequent costs are entirely the responsibility of the Designer.

16.7 Composite Piles

The most common form of composite pile used in bridge design is a PSC pile and a RC pile joined by a mechanical splice. However, their use is not permitted for bridge foundations. Any Designer who believes the use of such piles is cost effective and will achieve the strength and durability required, may prepare a written submission for consideration by the Deputy Chief Engineer (Structures). Delays in assessing such submissions, and any consequent costs are entirely the responsibility of the Designer. Refer *Appendix C Example Composite Pile Drawing*.

16.8 PSC Pile Rock Shoe

When the ground is too hard to drive PSC piles fitted with a standard cast iron pile shoe, the shoe may be substituted with a steel rock shoe. The hardened steel pin on the shoe is designed to break through rock. Refer *Appendix D Example PSC Pile Rock Shoe Drawing*.

16.9 Steel Piles

Steel Universal Columns (UC) may sometimes be used for the following reasons:

- to save on transport costs when the bridge is in a dry, remote area
- they may be permitted in overflow bridges (not the main channel) where there is no permanent water in the stream
- the ground is too hard for PSC piles.

The use of steel piles must be approved by the Director (Bridge and Marine Engineering).

Fabrication details shall be shown on the drawings as necessary. Details may include, but are not limited to:

- Layout of piles about the Bridge Control

- Type and size of pile
- Orientation of pile
- Height of pile tip
- Height of soffit of pilecap or headstock
- Rake of pile if not vertical
- Ultimate Pile Capacity
- Pile tip details.

Steel piles may be used in conjunction with precast abutment and pier headstocks that are precast off site. These are typically used in remote areas where the procurement of large quantities of fresh concrete is impractical, or when a quick construction period is required. Refer *Appendix F Example Steel Pile and Precast Headstock Drawing*.

16.10 Cast in Place Piles

Cast in place piles in bridge structures consist of a reinforced concrete column contained in either a concrete pipe liner or a steel liner. The liner is founded on suitable hard strata using a socketed base. Belled bases are not permitted. Bored piles (constructed on site without a liner) are not permitted for bridge foundations.

Details of cast in place piles to be shown on the abutment and pier drawings may include, but are not limited to:

- Layout of piles about the Bridge Control
- Size, grade and type of liner
- Height of soffit of pilecap/headstock
- Height of toe of liner
- Provisional Height of bottom of socket/bell
- A note clarifying the fixity requirements of the socket/bell into rock
- Details of the size and shape of the socket/bell
- Design Foundation Bearing Pressure
- Rock anchors
- Cover to steel reinforcing details. The size of the stainless steel nib depends on the reinforcement cover requirements. Refer Figure 16.10-1 *Example Stainless Steel Nib*
- Cathodic protection details. Note that stainless steel nibs cannot be used with cathodic protection. An alternate such as ceramic spacers will be required.
- Stiffening band details at the toe of the steel liner, including transition liner details if required. Refer Figure 16.10-2 *Example Stiffening Band*. The thickness of the stiffening band, transition liner and the main pile liner may vary depending on the ground conditions and the diameter and length of the liner.

Refer *Appendix G Example CIP Pile Drawing.*

Figure 16.10-1 Example Stainless Steel Nib

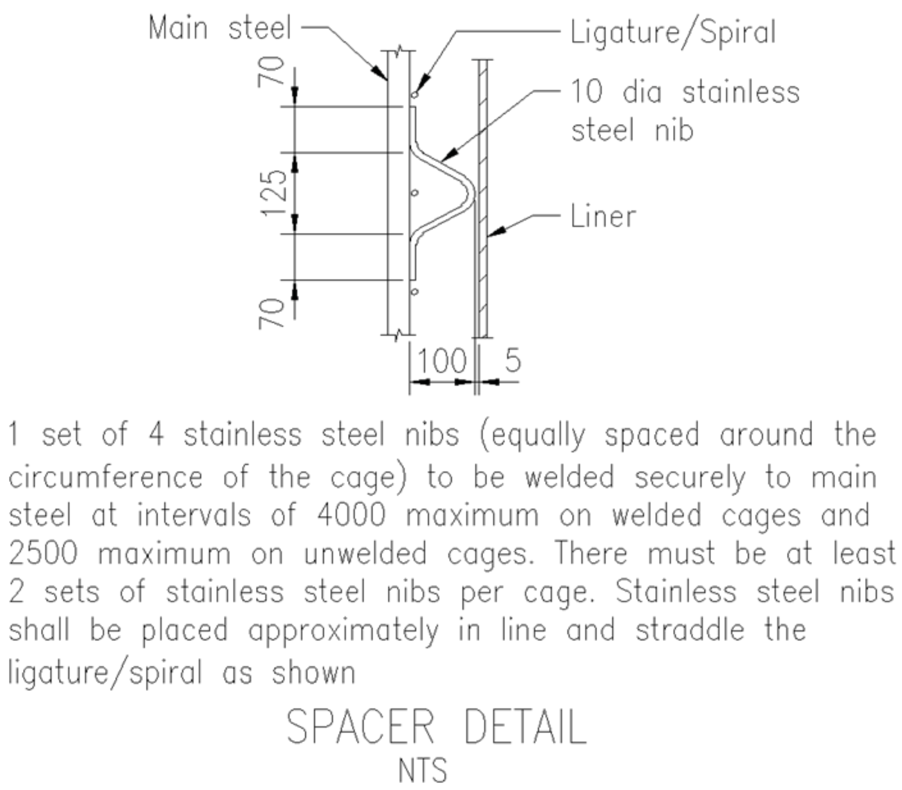
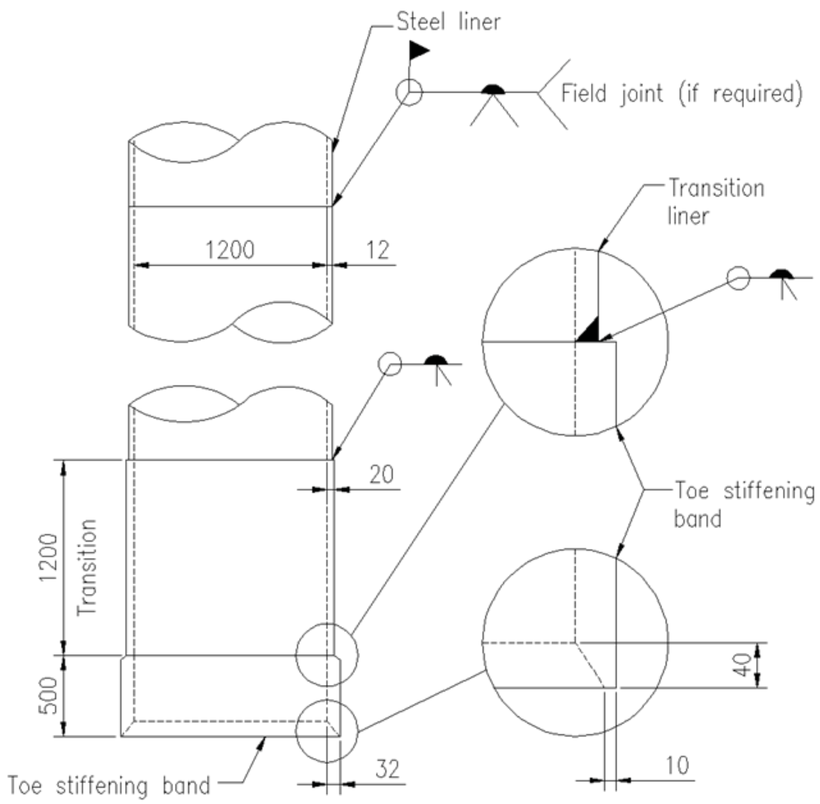


Figure 16.10-2 Example Stiffening Band



16.11 Spread Footings

Spread footings are used when strata capable of carrying the design loads is found close to the ground surface.

Details of spread footings to be shown on the abutment and pier drawings may include, but are not limited to:

- Layout of footings about the Bridge Control
- Dimensions of footing
- Reinforcement details
- Height of soffit of footing
- Rock anchors
- Blinding concrete
- Design Foundation Bearing Pressures.

Refer *Appendix H Example Spread Footing Drawings*.

Appendix A – Example PSC Pile Drawing

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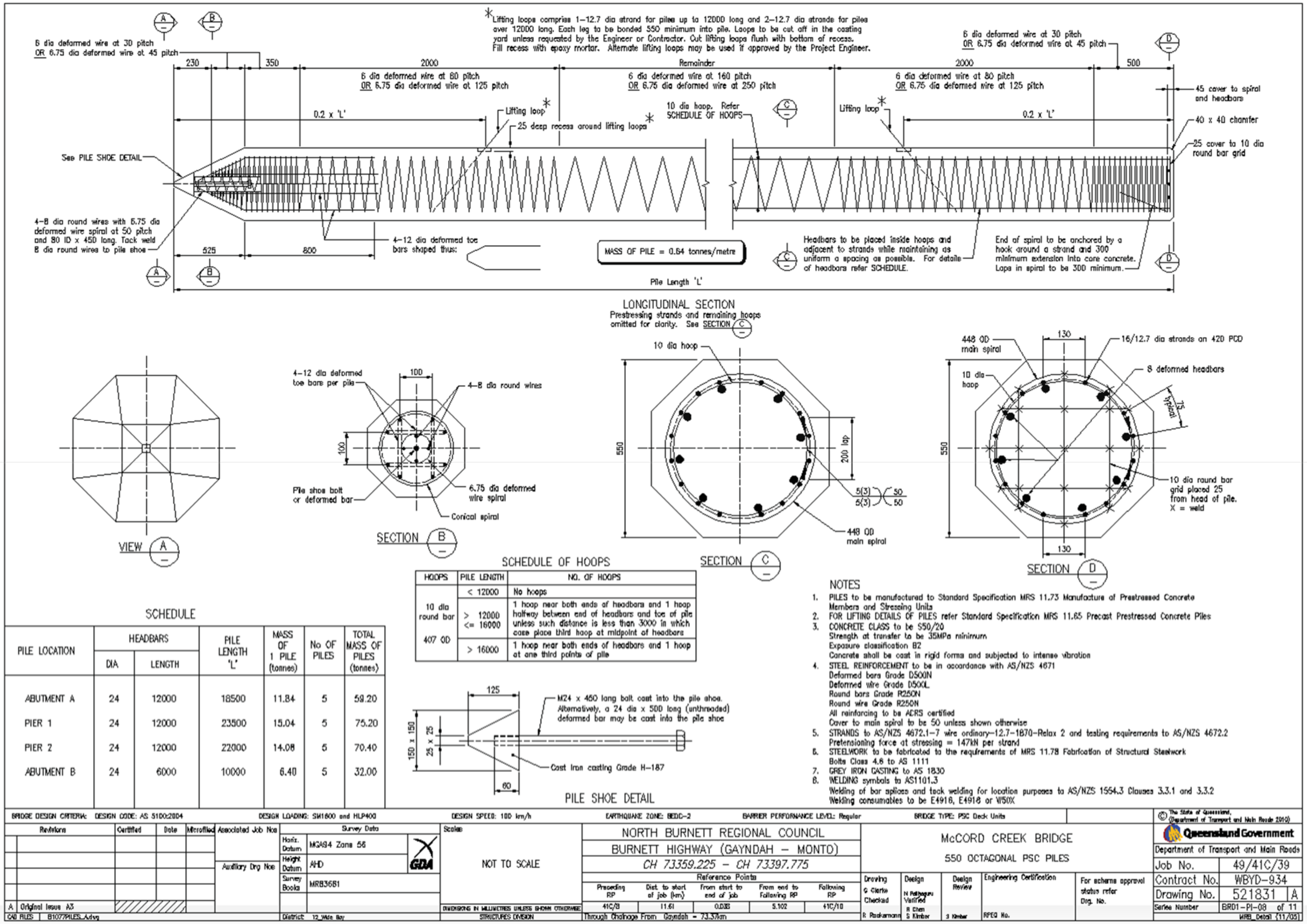
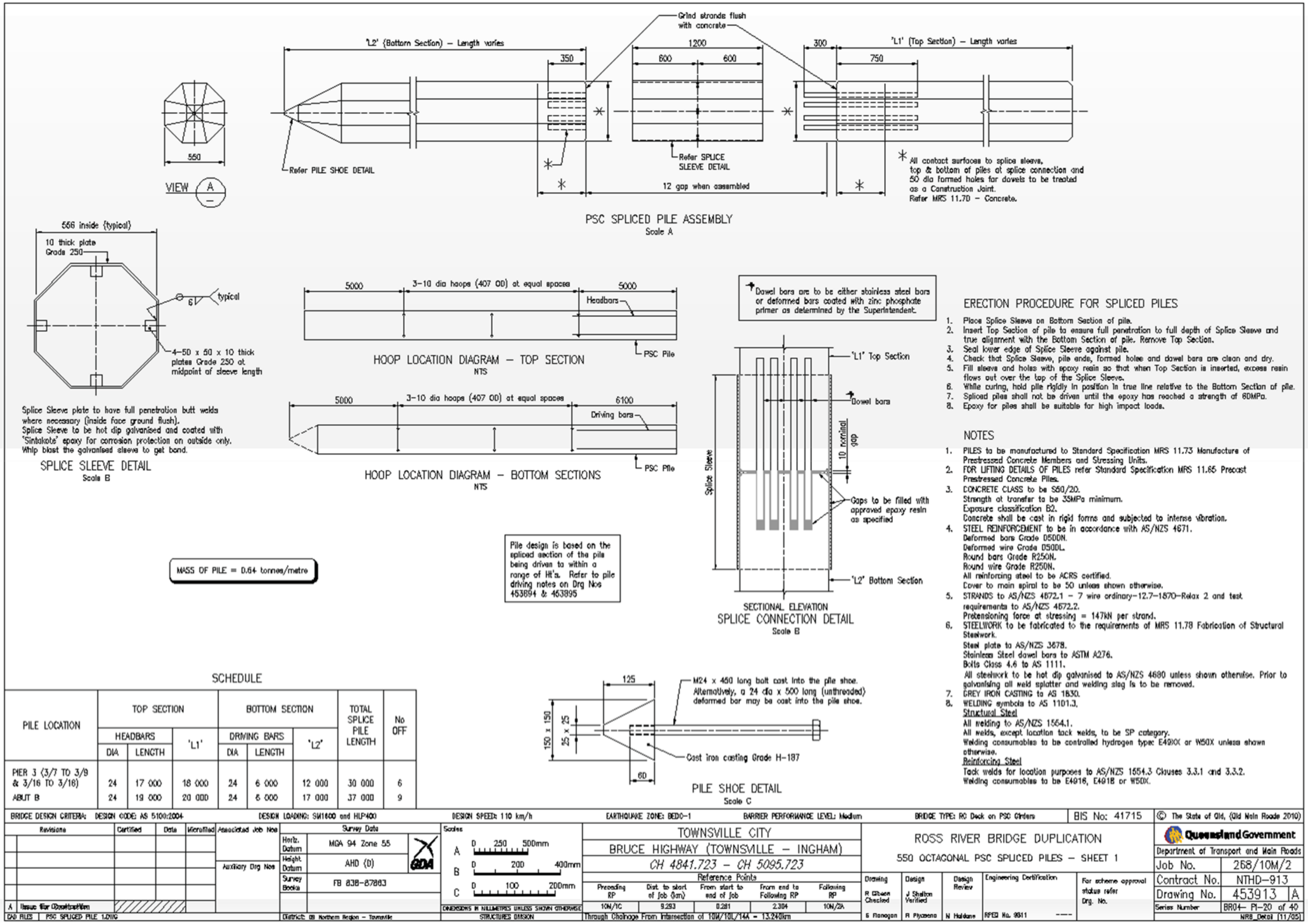
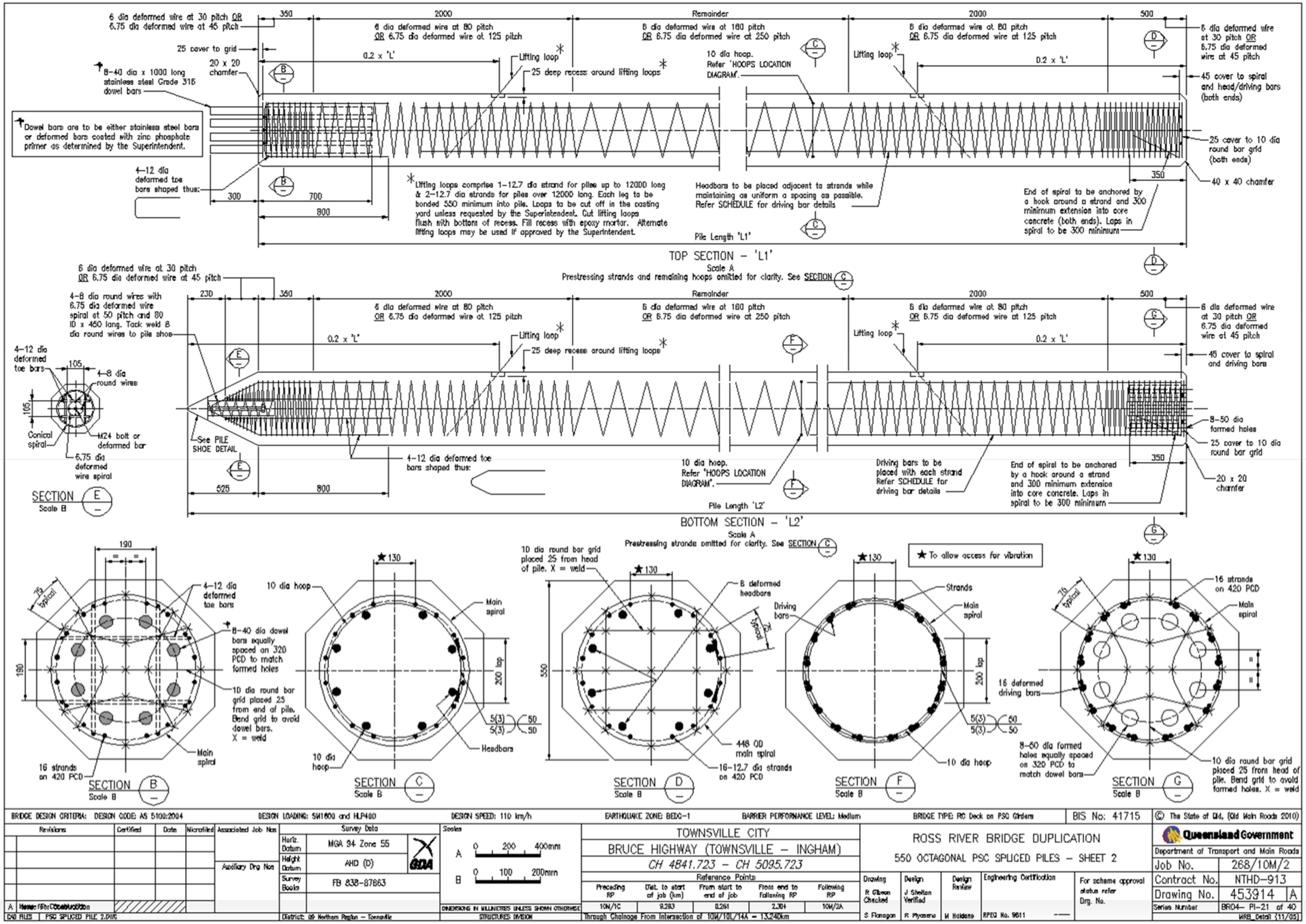


Appendix B – Example PSC Spliced Pile Drawings

Appendix B – Example PSC Spliced Pile Drawings – Sheet 1



Appendix B – Example PSC Spliced Pile Drawings – Sheet 2



Appendix C – Example Composite Pile Drawing

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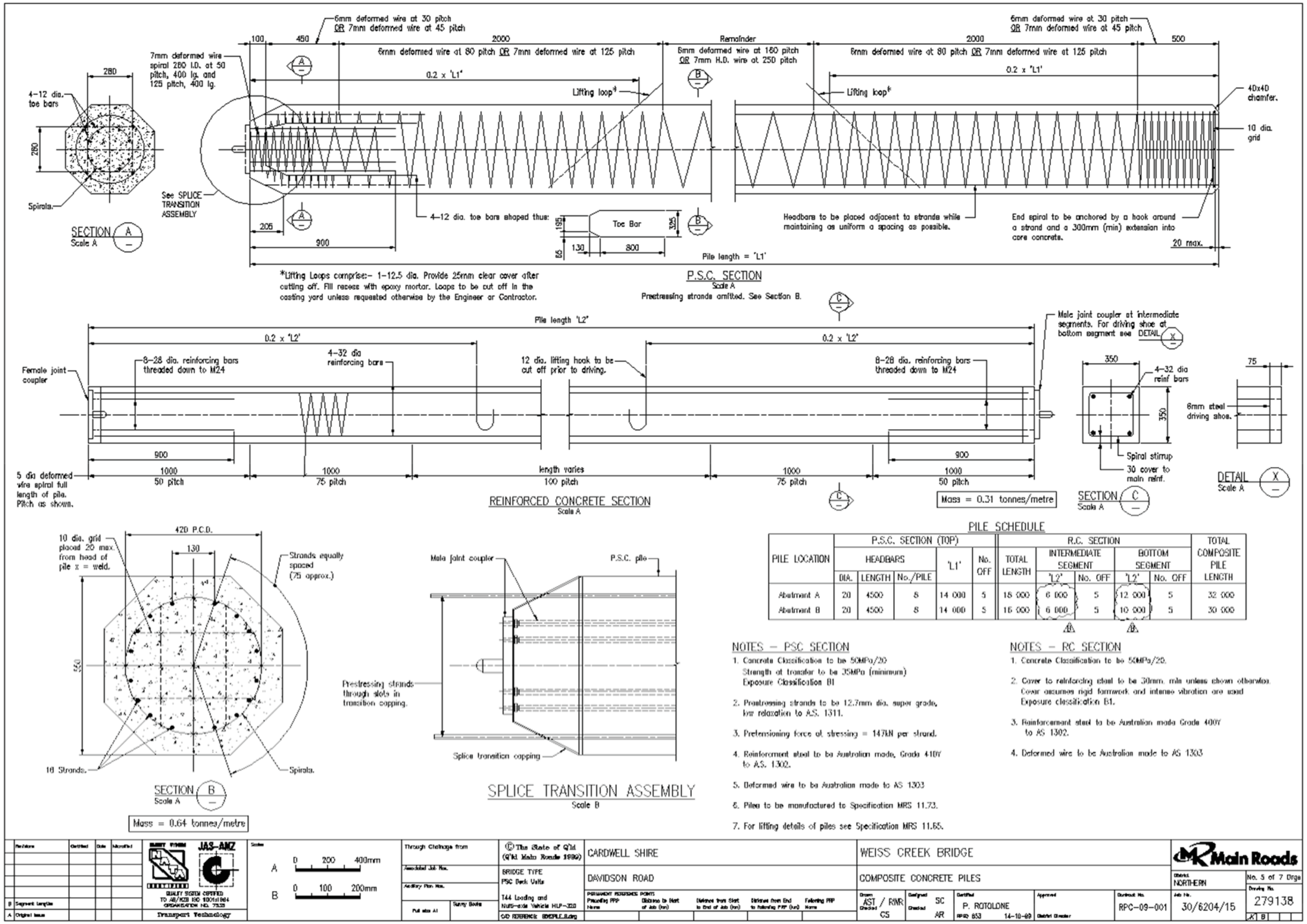

Appendix D – Example PSC Pile Rock Shoe Drawing

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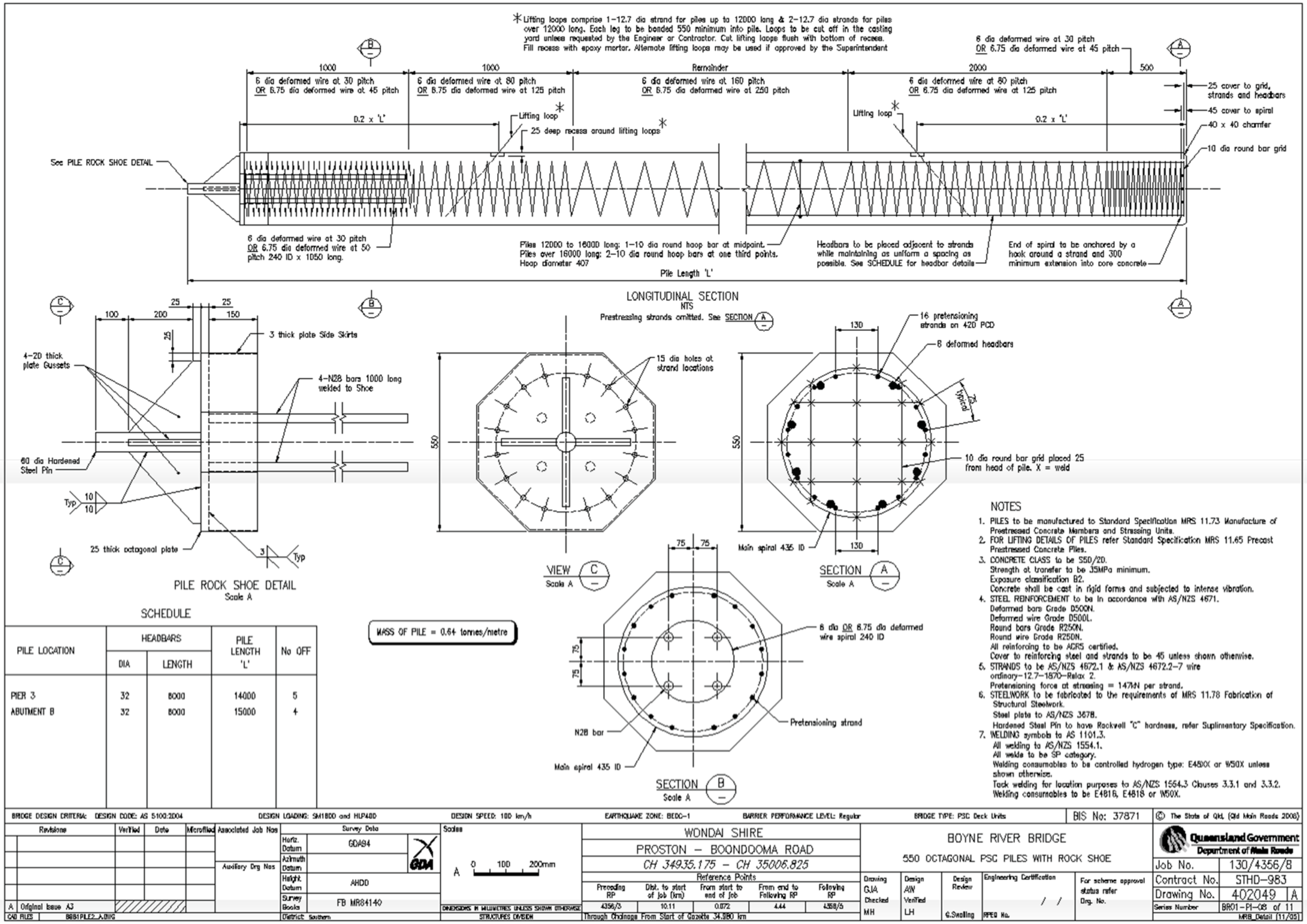

PILE LOCATION	HEADBARS DIA	HEADBARS LENGTH	PILE LENGTH 'L'	No OFF
PIER 3	32	8000	14000	5
ABUTMENT B	32	8000	15000	4

Appendix E – Example Steel Pile and Cast Insitu Headstock Drawing

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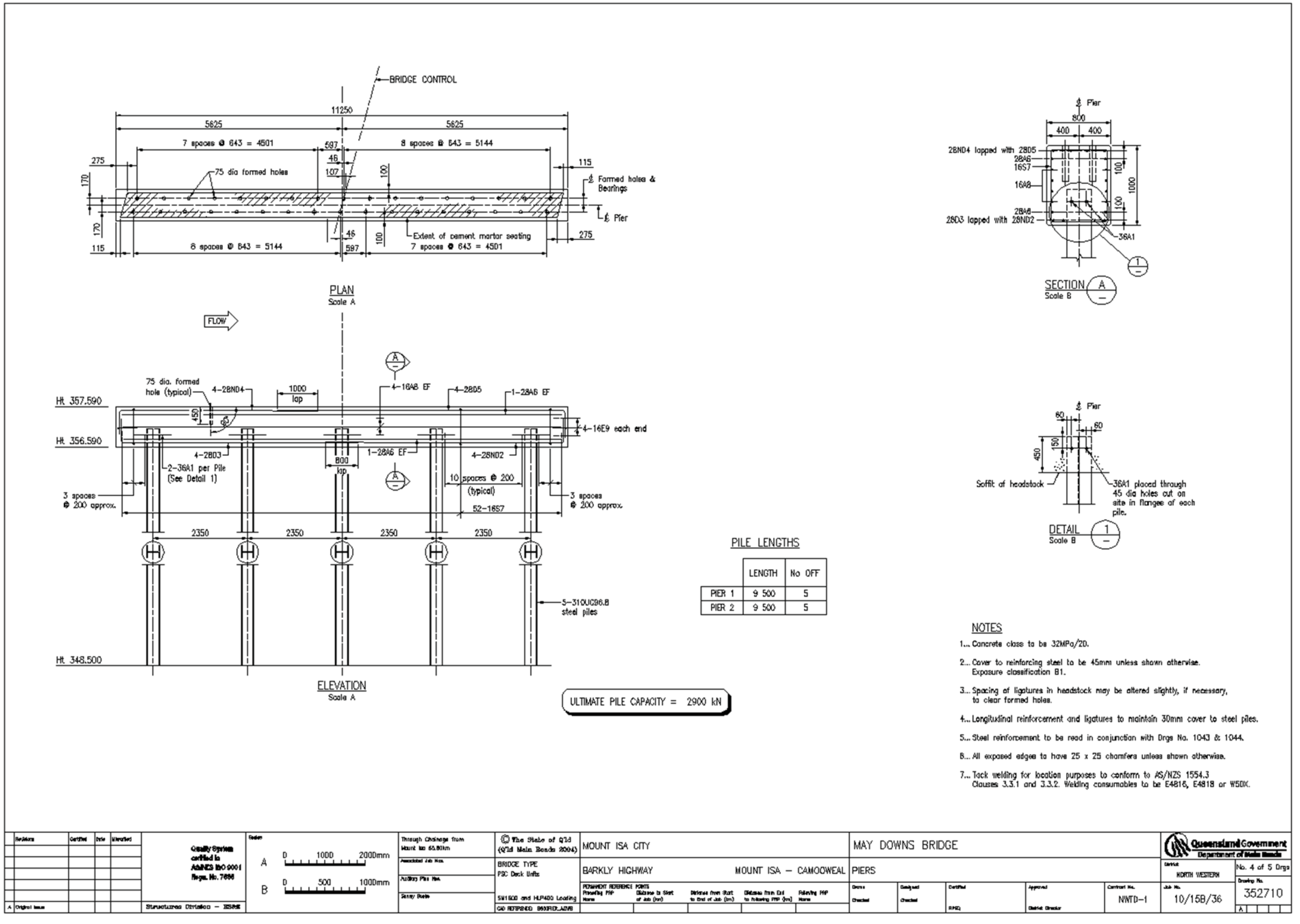

Appendix F – Example Steel Pile and Precast Headstock Drawing

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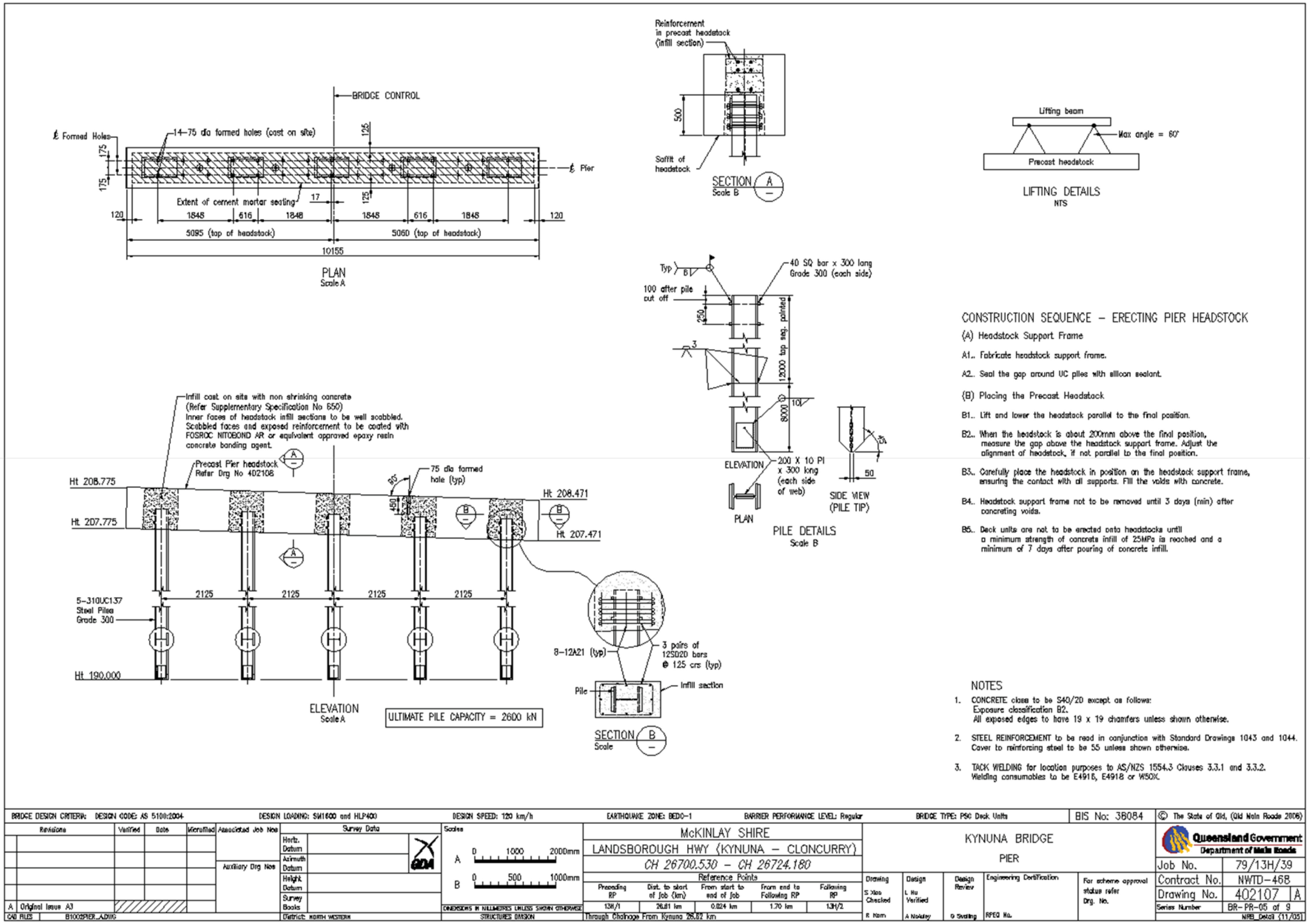

Appendix G – Example CIP Pile Drawing

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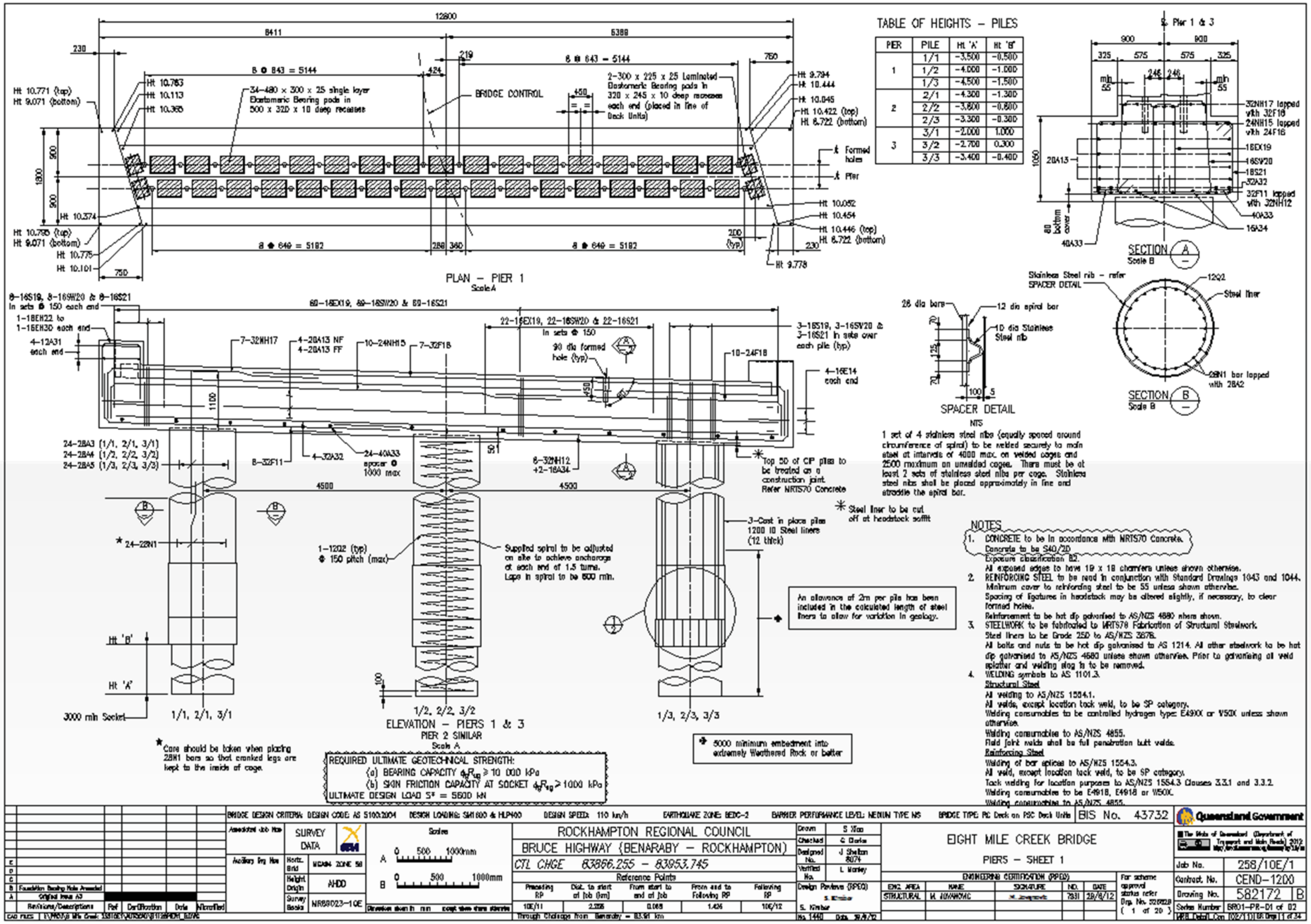
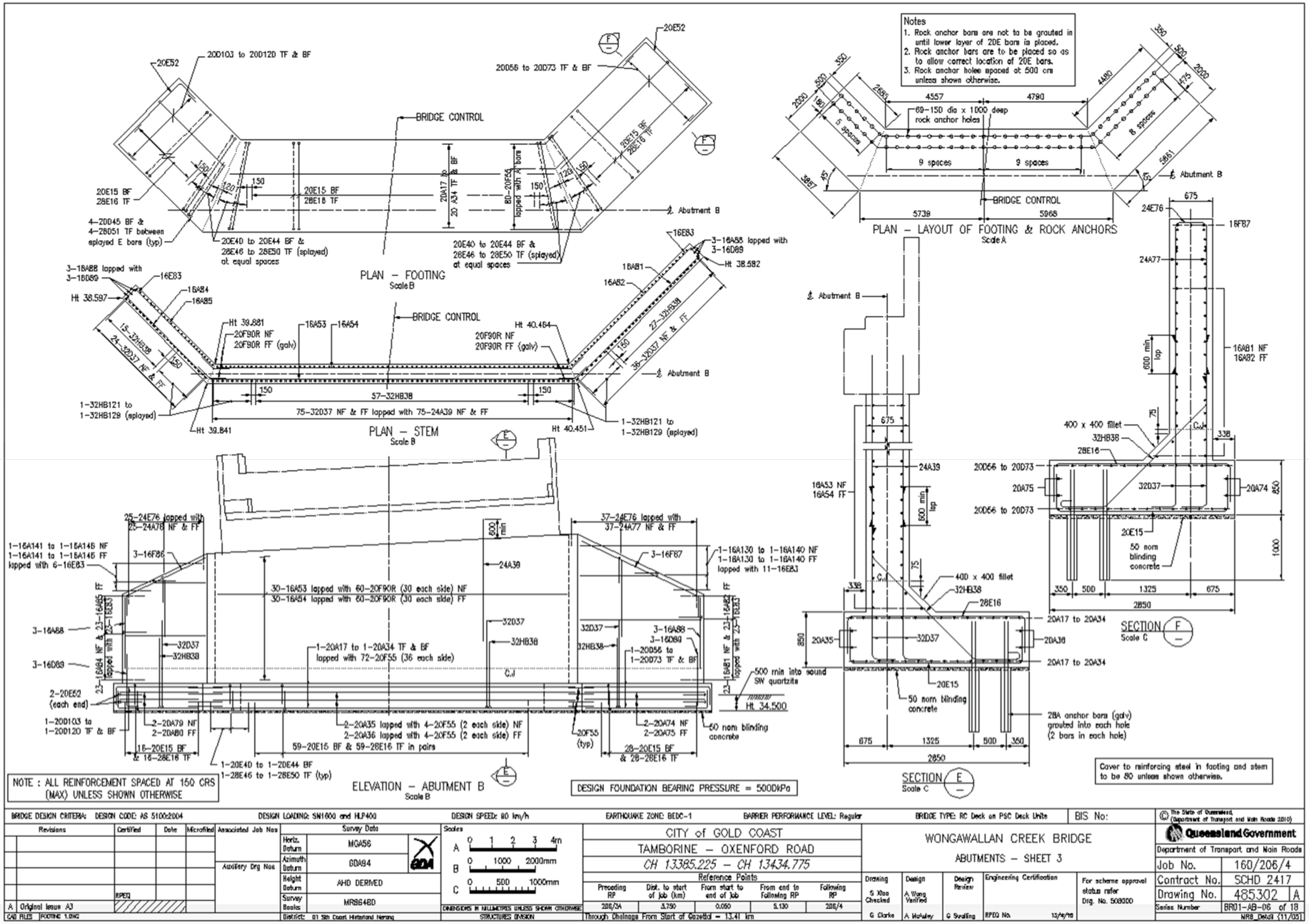


Appendix H – Example Spread Footing Drawings

Appendix H – Example Spread Footing Drawings – Sheet 1



Appendix H – Example Spread Footing Drawings – Sheet 2