Drafting and Design Presentation Standards
Volume 3: Structural Drafting Standards

Chapter 8: Bridge Widening

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Queensland Government

Feedback

Please send your feedback regarding this document to: tmr.techdocs@tmr.qld.gov.au

Chapter 8 Amendments

Revision register

Issue/Rev No.	Reference Section	Description of Revision	Authorised by	Date
1	-	First Issue	Manager (Structural Drafting)	Apr 2011
2	-	Document name change	Manager (Structural Drafting)	Nov 2011
3	All	General review and updates	Senior Designer	Aug 2019
	8.4	Additional information supplied for reasons bridge surveys are required. List of known bridge widening project issues.		
	8.10	New section - Historic Bridges		
	8.11	New section - Foundations		

Contents

Figures

8 Bridge Widening

8.1 Glossary of terms

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

8.2 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figures and examples shown in this volume are for presentation purposes only and may contain some details that are now superseded.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 Registered Professional Engineer Queensland (RPEQ) to confirm that the details are appropriate for the specific project in accordance with AS 5100 and the department's *Design Criteria for Bridges and Other Structures*.

8.3 Standard design details

Designs for the widening of bridges vary greatly depending on the types of existing structures and the width of the widening required.

The purpose of this chapter is to give some examples and procedures to follow as a guide only. Each case should be assessed on its own merits and appropriate drawings produced accordingly. For example, drawings for a bridge widening refer Appendix A - *Example Drawings*.

8.4 Bridge surveys

For bridges requiring widening, an accurate bridge survey is required so that "as constructed" details can be identified. Detailed design for the widened structure can then be prepared taking into account the layout of the existing structure. Typical requirements for bridge surveys are detailed in Section 8.7 *Survey Information for Bridge Widening*.

Bridge surveys are critical when designing a widening for many reasons including:

- identifying site details match drawings held by Transport and Main Roads (as constructed drawings are often not available for older projects)
- identifying the precise location, extension and size of transverse stressing bars, if applicable
- identifying the exact final hog of the existing deck units which is critical to accommodate during design of the adjacent units or girders, and
- identify any discrepancies in bridge settlement, vertical alignment and physical dimensions of the existing deck and substructure.

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 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 wingwalls will require modification or extra footings required to accommodate impact loads and longer vertical transitions than the original structure.
- The location of existing reinforcement must 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.
- 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.

8.5 Set out

Offset control lines

In addition to the procedure described below, it should be noted that occasionally the assumed Bridge Control Line for the project may not be the centre of the proposed structure or roadway. When this is the case, the set out shall be from that agreed Bridge Control.

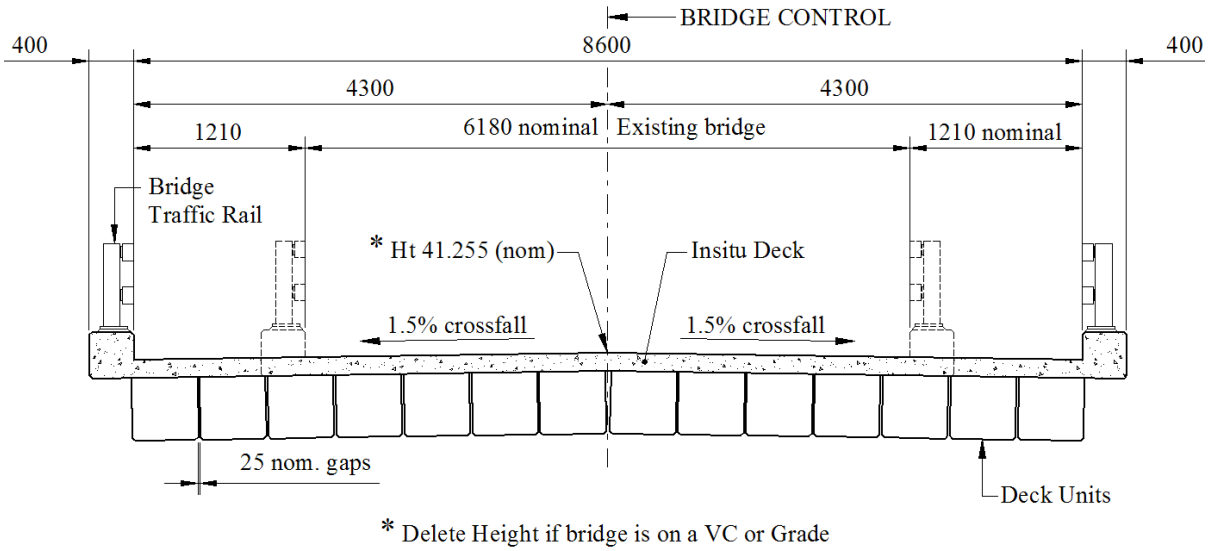
Bridges widened on both sides

Bridges widened on both sides should be set out from the centre of the widened bridge as follows:

- locate the centre of the bridge to be widened by reference to the existing bridge survey
- locate the centre of the widened bridge by reference to the additional widths required
- nominate this line on the Plan view of the General Arrangement as the Bridge Control Line
- in conjunction with the road alignment survey, if possible, give the co-ordinates of the Bridge Control Line on the Setting Out Diagram, and
- show all setting out dimensions from the Bridge Control Line on all drawings.

Refer Figure 8.5(a) - *Bridges widened on both sides*.

Figure 8.5(a) - Bridges widened on both sides



Note: It is particularly rare to widen a structure on both sides due to the increased cost of the works.

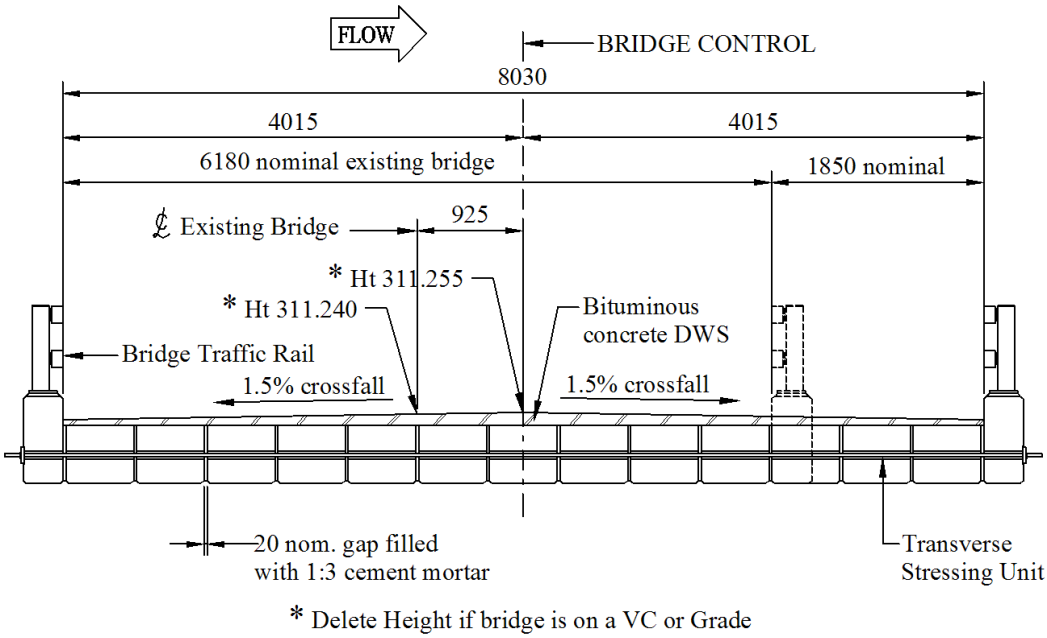
Bridges widened on one side

Bridges widened on one side only should be set out from the centre line of the widened bridge as follows:

- locate the centre of the bridge to be widened by reference to the existing bridge survey
- locate the centre of the widened bridge by adding a dimension of half the required widening to the location of the existing bridge centreline
- nominate this line on the Plan view of the General Arrangement as the Bridge Control Line
- in conjunction with the road alignment survey, if possible, give co-ordinates of the Bridge Control Line on the Setting Out Diagram, and
- show all setting out dimensions from the Bridge Control Line on all drawings.

Refer Figure 8.5(b) - *Bridges widened on one side*.

Figure 8.5(b) - Bridges widened on one side



8.6 PSC deck unit issues

Stressing bar couplers

Stressing bar couplers are used to join transverse stressing bars in the existing structure to those in the widening.

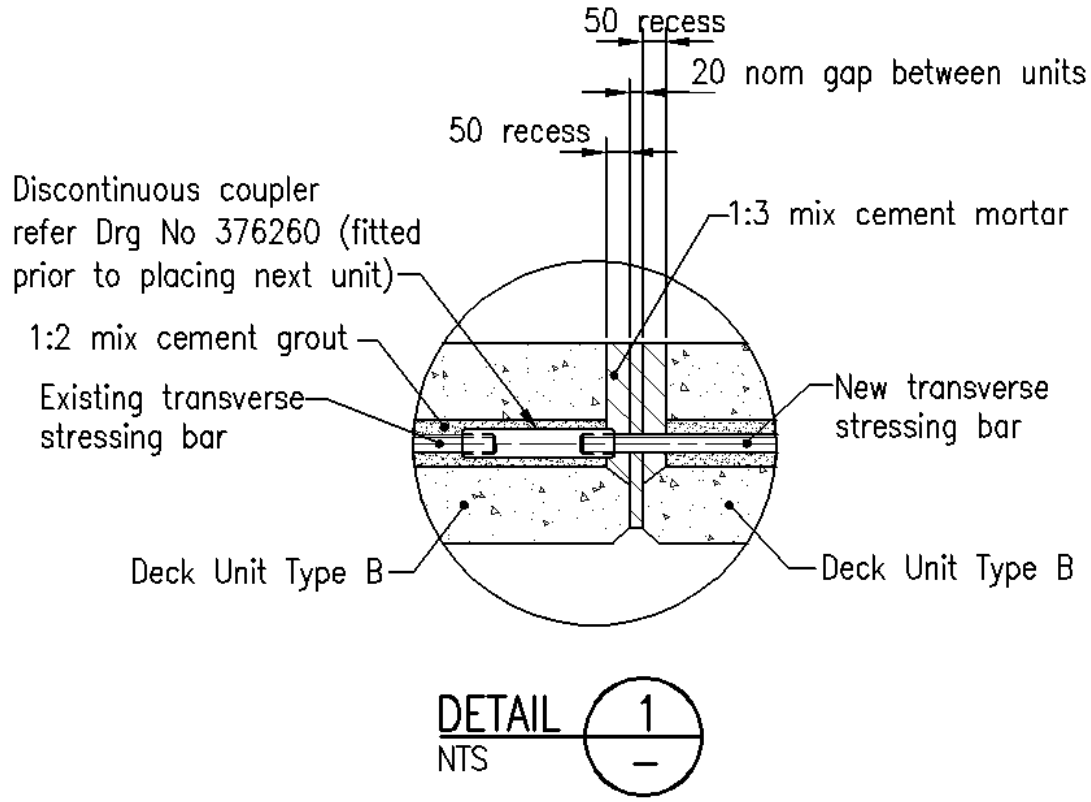
Most stressing bars to be extended will be “DSI” bar (32 mm diameter thread), “Macalloy” bars (imperial thread 11/8” diameter), and “VSL” bars (29 mm diameter coarse thread).

The type of stressing bar used in the existing structure is to be identified in the survey of the existing bridge so that a suitable coupler can be detailed on the drawings. Information sourced from existing bridge drawings is to be verified on site as substitute products may have been used.

The internal thread in all couplers is to be a minimum of 50 mm long in each end, with an unthreaded section in the centre of the coupler at least 10 mm, though it may need to be longer to suit the geometry. The discontinuous thread ensures that each stressing bar is screwed equal lengths into the coupler. For an example refer Appendix A - Example Drawings, Sheet 5.

Details of how the coupler is assembled shall be shown on the General Arrangement drawings. Typically the detail is a blow up from the Section Deck view. Refer Figure 8.6(a) - *Coupling detail*.

Figure 8.6(a) - Coupling detail



Note: threads are to suit both new and existing bars. Existing thread to be verified on site prior to design development for widening works).

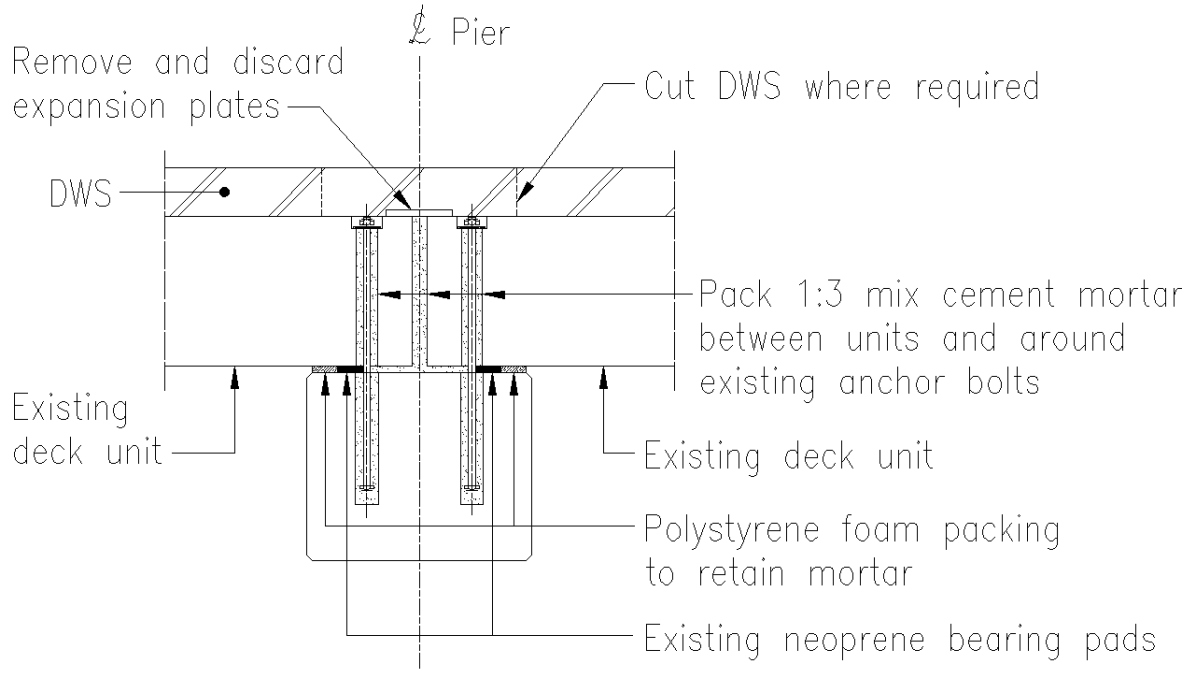
Recesses in new deck units

Recesses are provided in the new deck units over discontinuous couplers to provide access to enable the coupling of the transverse stressing bars. The recesses shall be large enough to fit a clenched fist through.

Articulation change

During the design of bridge widening the articulation may be changed. A typical detail of a conversion procedure from a deck expansion plate joint to a fixed joint is shown in Figure 8.6(b) - *Joint conversion at piers*. A similar detail would also apply to abutments.

Figure 8.6(b) - Joint conversion at piers



Conversion procedure at piers

When converting from an expansion joint to a fixed joint the following procedure may be adopted:

1. Remove all existing DWS.
2. Remove the deck expansion plates.
3. Remove the nuts and washers from all anchor bolts in the deck units on both sides of the piers. Up to 25% of the nuts may be left if they cannot be removed.
4. Pack polystyrene foam under the deck units to prevent cement mortar from escaping.
5. Pour 1:3 cement mortar into the 50 mm gap between the deck units (along the pier centreline) and around the holding down bolts. Pack mortar down to ensure that gap under the deck units is filled and the holding down bolt holes are completely filled.
6. Replace the washers and nuts on the holding down bolts.
7. Re-pave with DWS.
8. Rubberised bituminous filler and canite between the ends of the kerb units at the piers is to be removed and replaced with 1:3 cement mortar.

A similar procedure would apply to abutment conversions.

8.7 Survey information for bridge widening

Introduction

The following information is required to produce new bridge drawings of a widened structure:

- Figure 8.7(a) - *Survey information required for bridge widenings*
- Figure 8.7(b) - *Survey information required for widening of deck unit bridges*

- Figure 8.7(c) - *Survey information required for widening of girder bridges with a reinforced concrete deck*.

Requirements

1. The line of the bridge:
   a) the direction of Gazettal
   b) the distance of each kerb from the control line, defined in the survey data and linked to the proposed new alignments, see Figure 8.7(a) - *Survey information required for bridge widenings*.
2. The following features are to be located along the outside face of the kerbs:
   a) faces of the pier and abutment headstocks
   b) centreline of the pier headstocks, and
   c) centres of the bridge railing posts.
3. Dimensions shall be taken from a datum or reference points which should be clearly related to the concrete structure and running dimensions and bearings shall be given to features required. Preferably datum or reference points should be given in co-ordinates and related to a chainage where possible. In multi span bridges, details shall be supplied for each span.
4. Heights are required on the DWS or concrete deck at each kerb and along the centre of the roadway (if crowned). Heights should be provided at the abutments and piers with additional intermediate Heights being required along the bridge at approximately three metre centres.
5. The flow direction is to be indicated as shown in Figure 8.7(a) - *Survey information required for bridge widenings*.
6. Heights are also required where possible on the top of the pier and abutment headstocks. Location of Heights should be clearly defined, see Figure 8.7(b) - *Survey information required for widening of deck unit bridges* and Figure 8.7(c) - *Survey information required for widening of girder bridges with a reinforced concrete deck*.
7. Information on kerbs is required as follows:
   a) depth of the outside kerb units or cast insitu kerbs
   b) hog of the outer kerb units
   c) height of the transverse stressing bar above the soffit of the outside kerb units
   d) protrusion of the transverse stressing bar from its nut
   e) type of transverse stressing bar i.e. “Macalloy” bar (imperial 11/8” diameter thread), “DSI” bar (32 mm diameter thread), or “VSL” bar (29 mm diameter coarse thread)
   f) note if the thread is badly corroded or damaged
   g) height of kerb above the DWS or concrete deck
   h) depth of DWS at the kerbs at every mid span, abutment and pier, and
   i) location of cross girders on girder bridges.

8. Other dimensions as indicated on Figure 8.7(b) - *Survey information required for widening of deck unit bridges* and Figure 8.7(c) - *Survey information required for widening of girder bridges with a reinforced concrete deck*, to be supplied where possible.
9. Details of existing services and infrastructure. For example:
    a) overhead power and telephone lines
    b) fences
    c) road furniture, and
    d) services attached to the bridge.
10. Areas of the structure and abutment protection showing signs of deterioration or erosion should be defined and photographs supplied.
11. Condition of the DWS and expansion joints should be reported on and photographs supplied.
12. Other photographs of noteworthy features.
13. Note the existence of relieving slabs on the bridge (this is often unclear on the original bridge drawings).

Bridge widened on one side

Detailed information is required only on the widened side, although some dimensions will be necessary on the non-widened side to define the bearing of pier centre lines, abutments faces and transverse stressing bars.

If new rails are to be provided on the non-widened side, dimensions will be required to the abutment wingwalls and the centre of bridge railing posts.

Heights on ground at abutments and piers

Supply sufficient Heights so that the profile of the ground surface at the top and the toe of the existing abutment protection can be established. Provide Heights in the vicinity of the proposed abutment and pier extensions.

Provide water Heights of creeks and rivers and the date of the surveyed levels. If in tidal zone, high and low water should be registered together with the time and date of the surveyed Heights.

For railway overbridges

Bearing of the centre lines of all tracks and the chainage of the intersection of track centre lines.

Heights on both rails of all tracks are required at 5 m intervals for a distance of 50 m either side of the bridge.

Heights are required at the soffit of the girders or deck units, directly over the rails, and on both sides of bridge.

Existing horizontal clearances from the centreline of tracks to the faces of the piers and abutments should be shown on a detailed sketch.

For road overbridges

Heights at 5 m centres are required on the existing underpass roadway for a distance of 50 m either side of bridge. Levels are required on both sides of the pavement and at the centreline if the roadway is crowned.

Heights are required at the soffit of the girders or deck units over the roadway, on both sides of the bridge.

Existing horizontal clearances from the roadway to faces of the piers and abutments should be shown on a detailed sketch.

Figure 8.7(a) - Survey Information required for bridge widenings

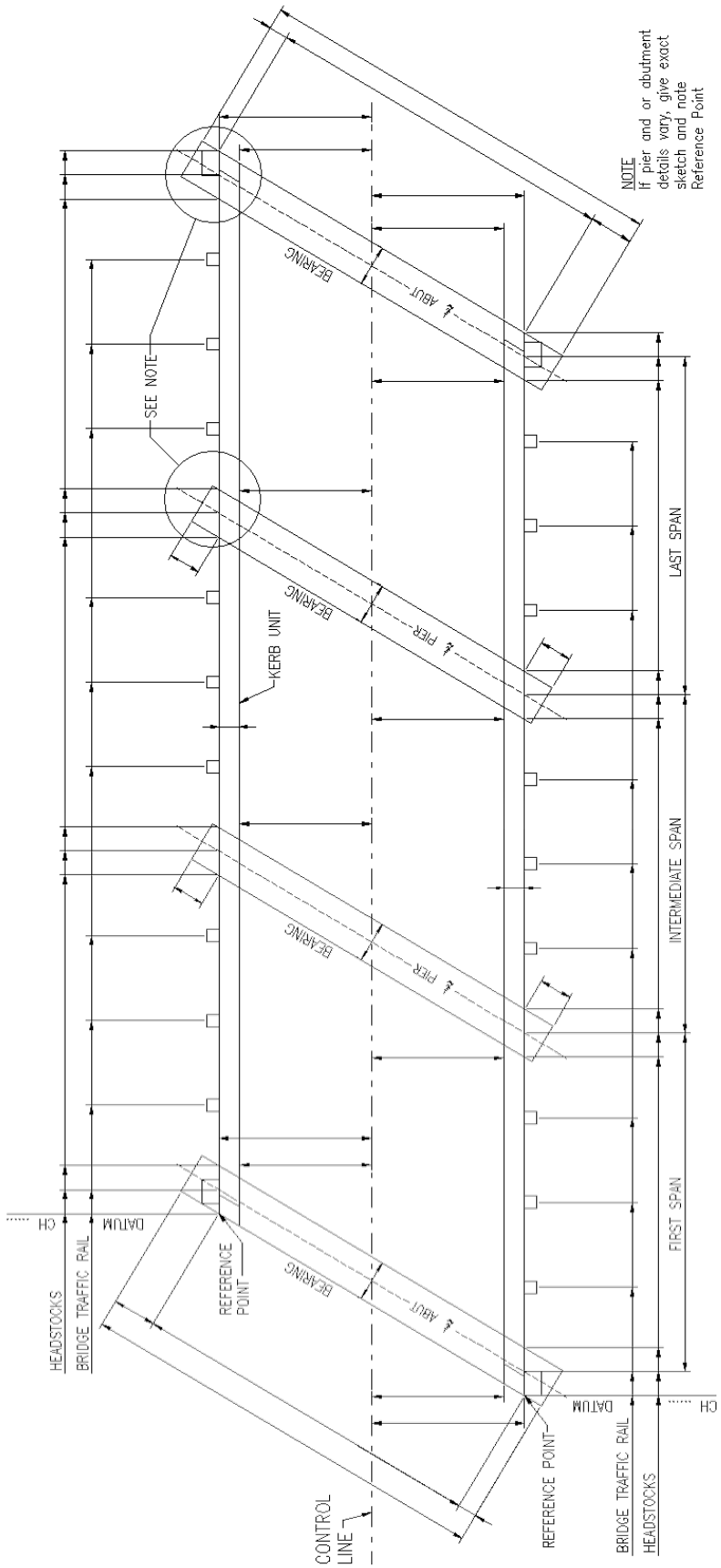


Figure 8.7(b) - Survey Information required for widening of deck unit bridges without a concrete deck

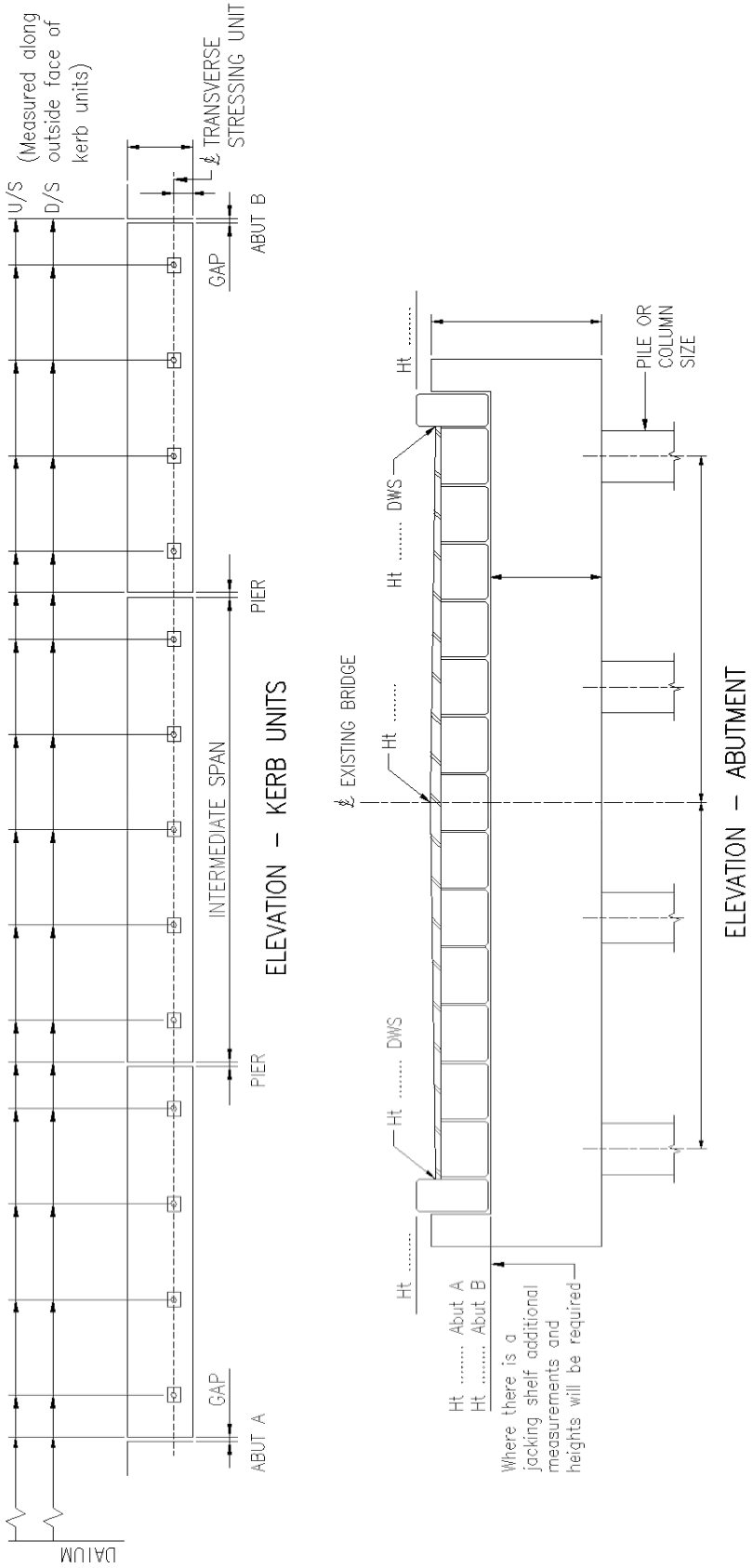
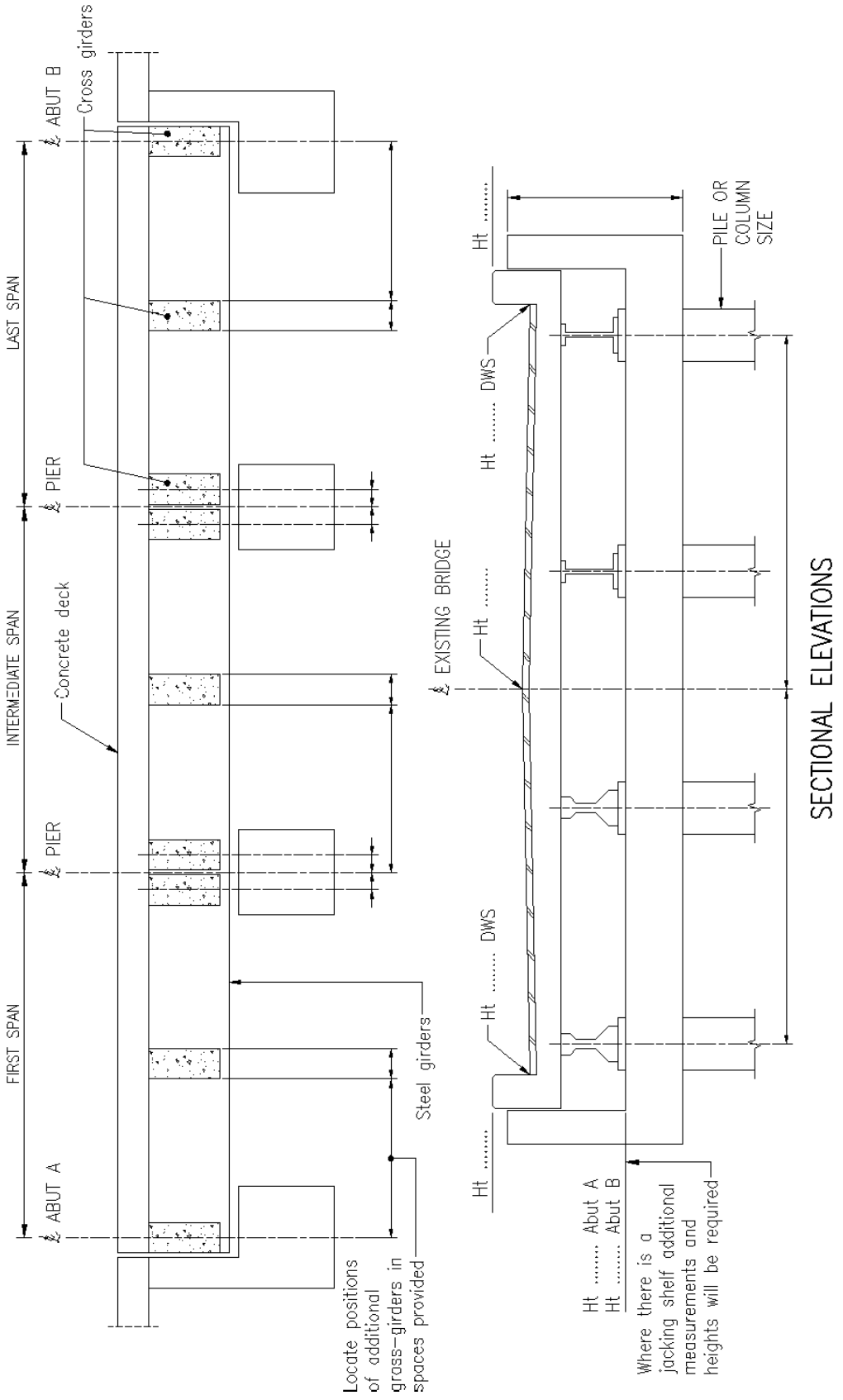


Figure 8.7(c) - Survey Information required for widening of girder bridges with a reinforced concrete deck



8.8 Survey format

Survey details are to be supplied in 12D format.

8.9 Survey accuracy

Because of the small tolerances involved in bridge construction, the bridge survey must be accurate to within 5 mm. The survey of the ground must be accurate to within 100 mm.

8.10 Demolished bridge artefacts

It is worth noting that in some cases existing bridges may be the second or third generation of existing structures for the particular site.

Details of the original bridge will often appear drafted on the General Arrangement plan and or elevation of the structure to be widened. Existing piles may be cut off below ground.

Further information, if required, may be available from Transport and Main Roads Plan Room or Structures Branch.

8.11 Foundations

Existing bridge foundations must be considered in the designed widening so that the new foundations do not clash with or impede the existing bridge foundations.

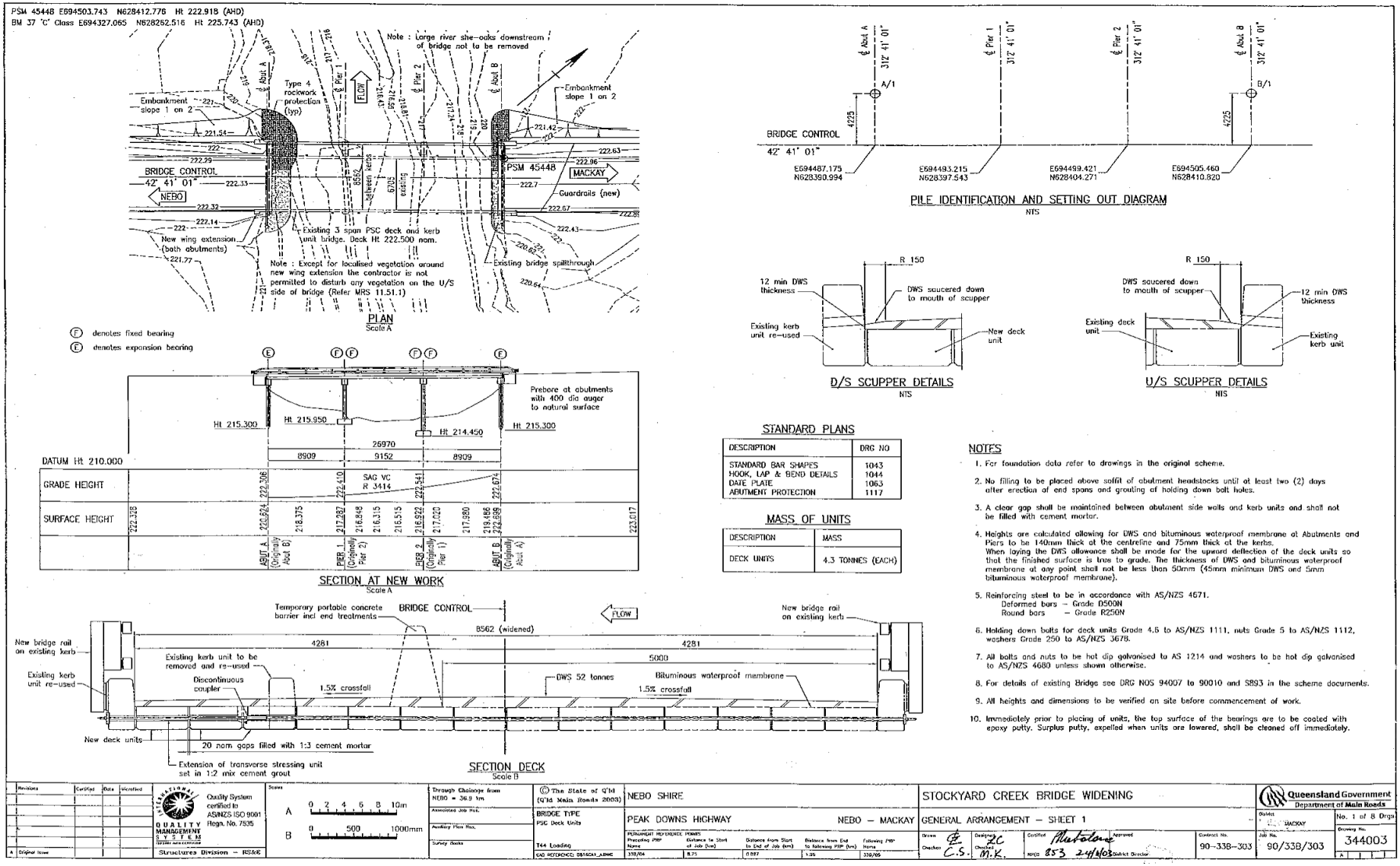
Existing timber piles also present a problem with new piles when they are in direct clash.

New foundations in close proximity to existing foundations may not only reduce the existing foundation capacities but in extreme cases have caused uplift of existing foundations and structures during driving.

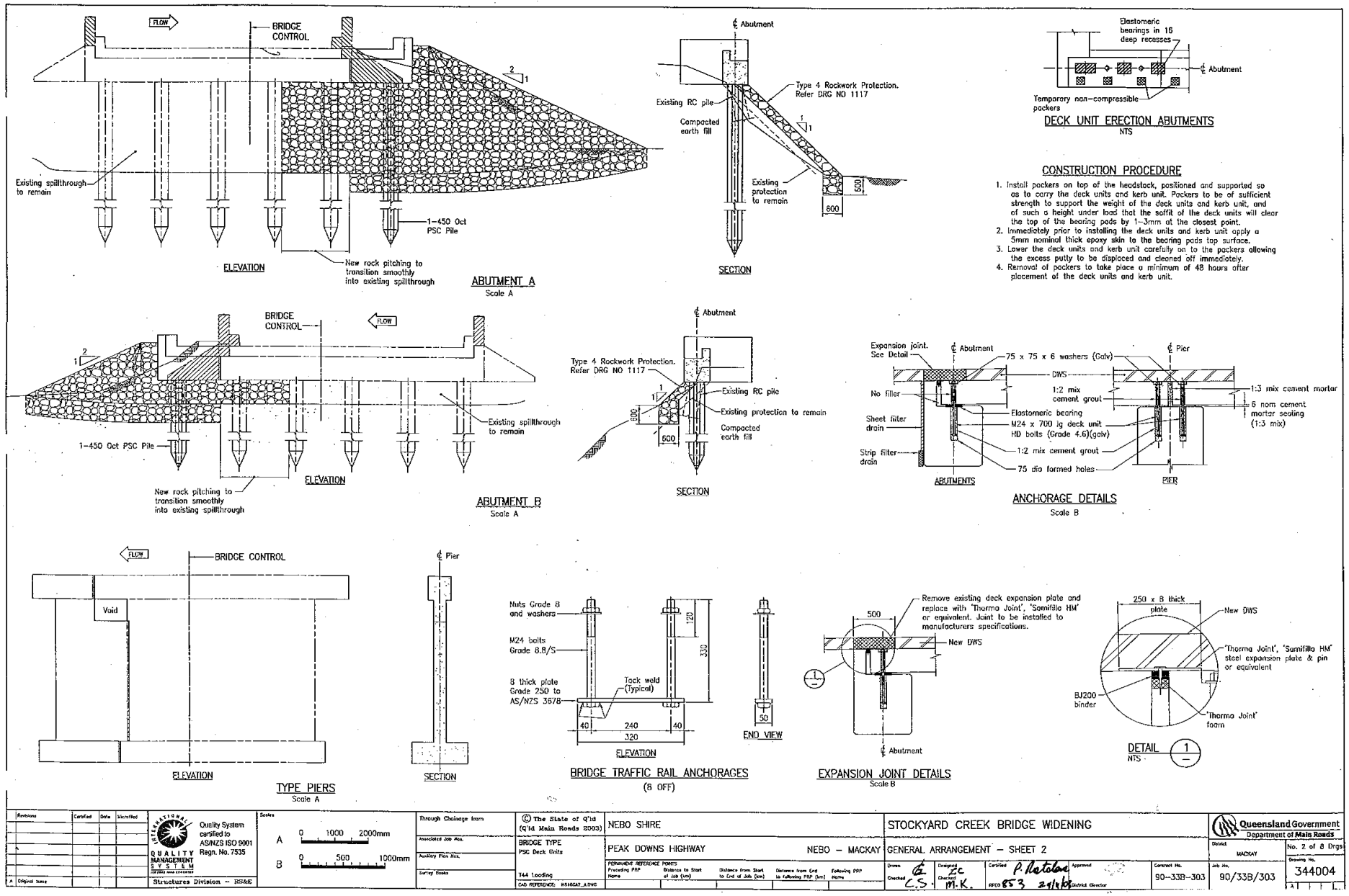
External piles may be raked on the existing structure. Raked piles should be identified during the detailing of the widening and appropriate allowance made to avoid them. This will often result in multiple rows of piles on the extension to avoid the existing raked piles.

Appendix A – Example drawings

Example drawings – Sheet 1

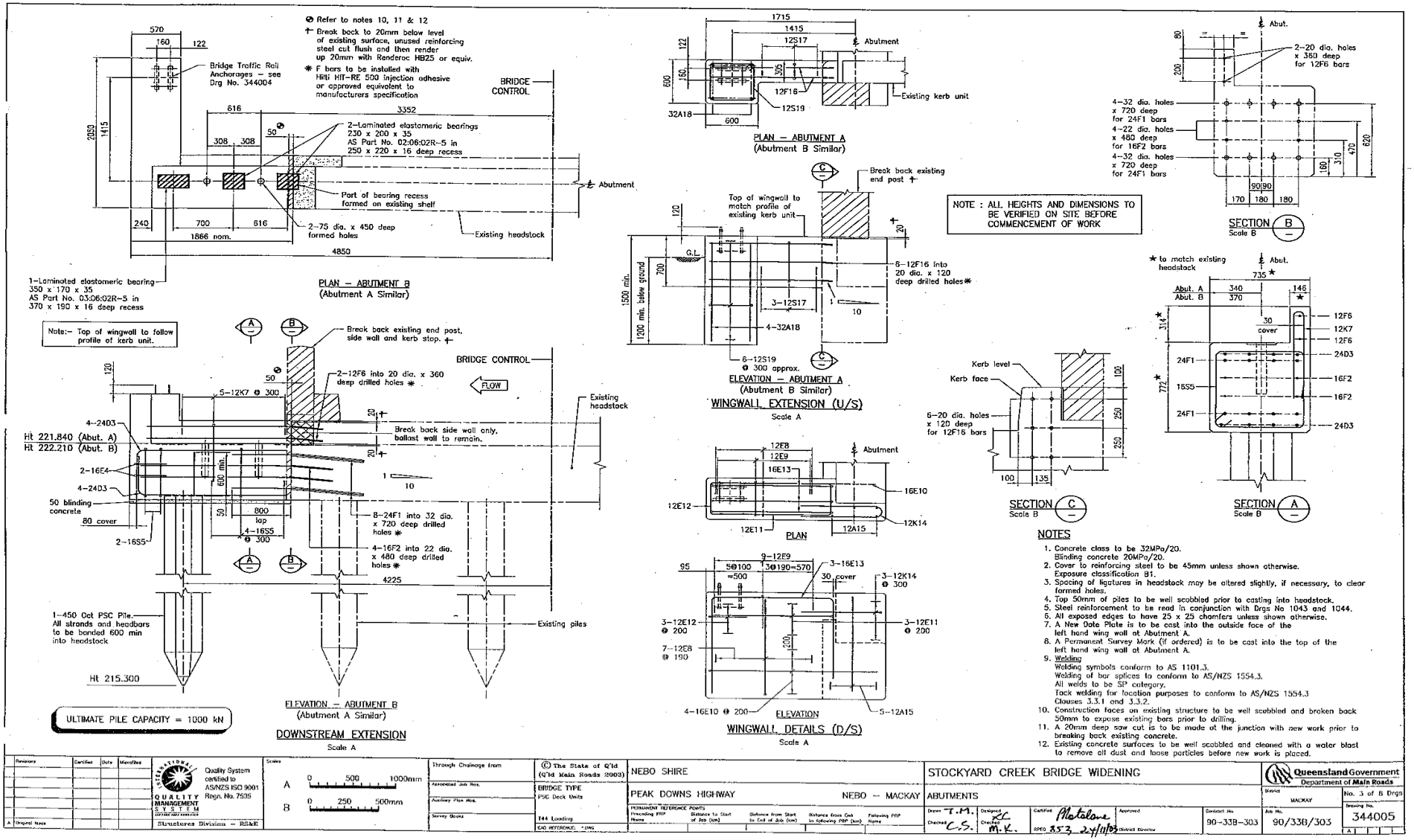


Example drawings – Sheet 2

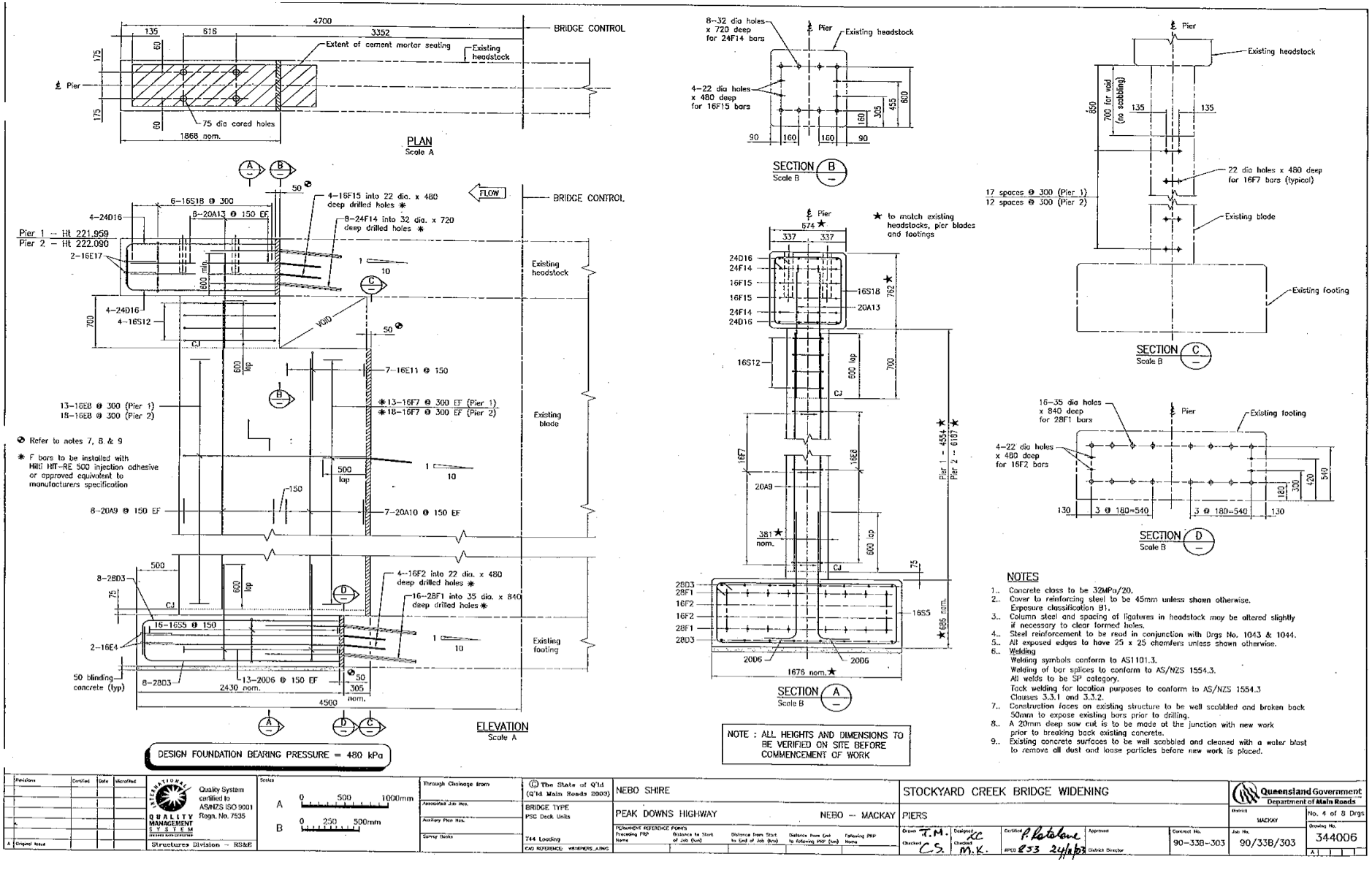


Example drawings – Sheet 3

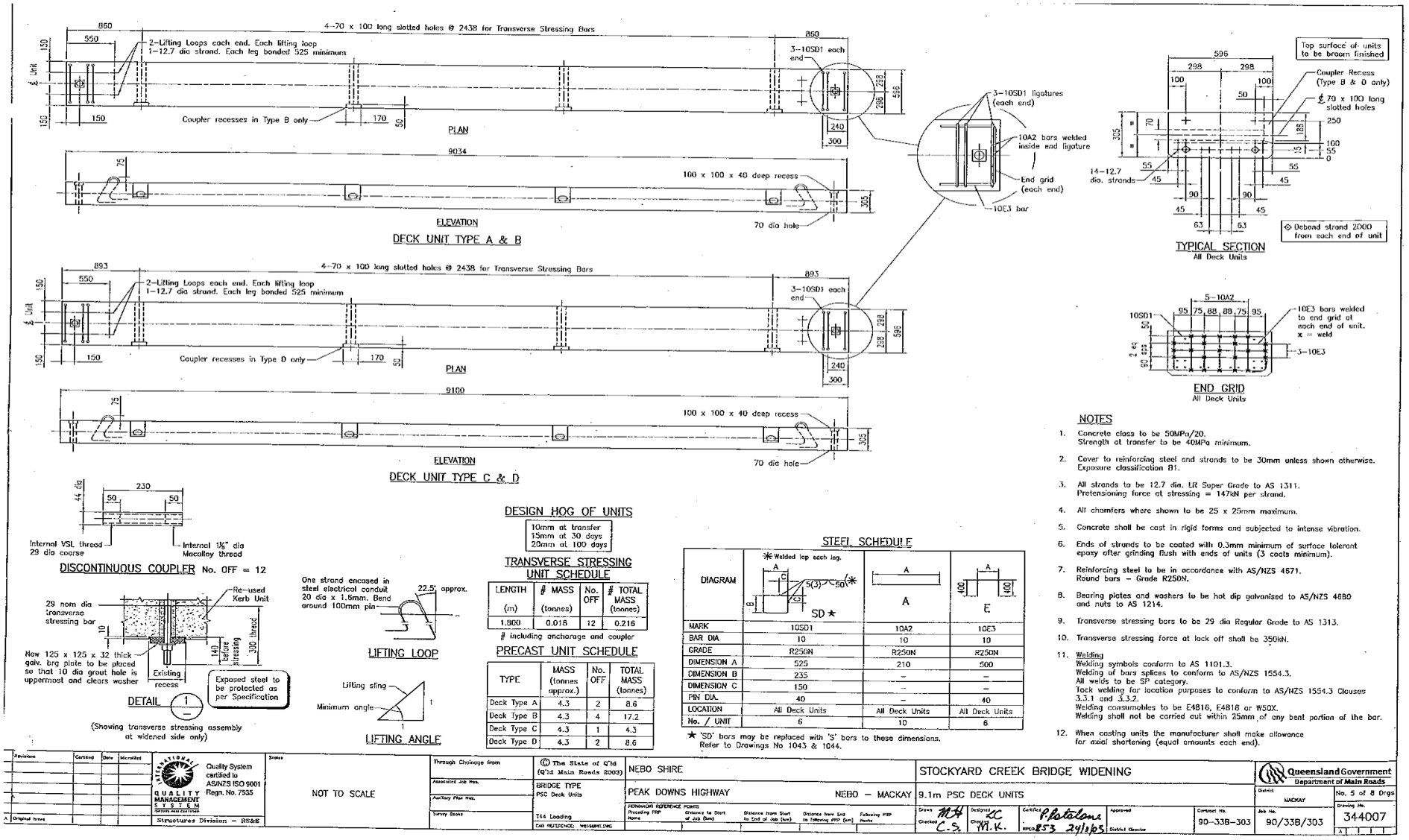
(Note: The example shown is for 1:2 sloped Bridge Traffic Barriers – extra posts are required for 1:10 slope Bridge Traffic Barriers).



Example drawings – Sheet 4



Example drawings – Sheet 5



LENGTH (m)	# MASS (tonnes)	No. OFF	# TOTAL MASS (tonnes)
1.800	0.018	12	0.216

TYPE	MASS (tonnes approx.)	No. OFF	TOTAL MASS (tonnes)
Deck Type A	4.3	2	8.6
Deck Type B	4.3	4	17.2
Deck Type C	4.3	1	4.3
Deck Type D	4.3	2	8.6

DIAGRAM	✱Welded lap each leg. SD ★	A	E
MARK	10SD1	10A2	10E3
BAR DIA	10	10	10
GRADE	R250N	R250N	R250N
DIMENSION A	525	210	500
DIMENSION B	235	–	–
DIMENSION C	150	–	–
PIN DIA.	40	–	40
LOCATION	All Deck Units	All Deck Units	All Deck Units
No. / UNIT	6	10	6

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