DEPARTMENT *of* INFRASTRUCTURE, ENERGY *and* RESOURCES, TASMANIA

BRIDGEWORKS SPECIFICATION

B6 - STEEL CASED CAST-IN-PLACE R.C. PILES April 2003

Includes previous B6 and B8

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B6.1 SCOPE

This Specification sets out the requirements for:

- the construction of steel cased reinforced concrete piles formed by driving or sinking steel casings, excavating all materials from inside the casings and subsequently filling the casings with concrete.
- the construction of bored reinforced concrete piles with rock sockets.

B6.2 REFERENCES

The following Australian Standards apply:

A.S. 1450 Steel tubes for mechanical purposes

A.S. 1554 Structural steel welding

A.S. 1548 Steel plates for pressure equipment

A.S. 1726 Geotechnical site investigations

A.S. 2159 Piling design and installation

A.S. 3678 Structural steel - hot rolled plates, floor plates and slabs

A.S. 3679 Structural steel

A.S. 4671 Steel reinforcing materials

A.S. 4680 Hot dip galvanised (zinc) coatings

B6.3 MATERIALS

B6.3.1 Steel for Pile Casing

The following steel may be used for manufacture of pile casing sections:

AS 3678 Grades 250 and 350

AS 1450 All Grades

AS 1548 All Grades

B6.3.2 Reinforcing Steel

Reinforcing steel for reinforced concrete shall comply with Specification B11, Reinforced Pretensioned or Mass Concrete.

B6.3.3 Concrete

Concrete shall comply with the following parts of this Specification.

(1) Specification B10 - Supply of Ready-Mixed Concrete

(2) Specification B11 - Reinforced, Pretensioned or Mass Concrete

B6.4 PERMANENT CASING

B6.4.1 Fabrication of Pile Casing See clause in B5

The steel casings shall have an outside diameter and wall thickness not less than that shown on the Drawings, and shall be left permanently in place. The piles shall be reinforced as shown on the Drawings.

Fabrication shall conform to Specifications B5 and B25 and to the dimensions shown on the Drawings. The inside diameter of the casing shall not be less than the nominal diameter shown on the Drawings with a maximum out of round tolerance of $\pm$ 2 mm.

All longitudinal and transverse welds shall be made with full penetration butt welds and adjacent segments shall be rotated 90^{o} relative to each other so that longitudinal welds on the fabricated casing are staggered.

The toe of the casing for each pile shall be reinforced with a welded driving ring, as shown on the Drawings.

If field splicing is necessary, at each field splice the upper section of casing shall be fitted with a bevelled backing plate welded into the casing. At the backing plate, the casing itself shall also be bevelled in preparation for field splicing by butt welding, as detailed on the Drawings.

B6.4.2 Defective Materials

Defects arising from the manufacture of steel which become evident at any stage of fabrication shall be the subject of a non-conformance report.

The cost of repairs or replacement shall be the Contractor's responsibility.

B6.4.3 Cutting

Steelwork may be cut by flame cutting, sawing or shearing unless specified otherwise. Surfaces produced by such cutting shall be finished square (unless a bevelled edge is called for) true and smooth to the required dimensions.

Where the finish of cut edges is not satisfactory, they shall be ground or machined.

B6.5 PLACING CASING AND EXCAVATION

The Contractor shall include his detailed proposals for the driving or sinking of the casings in the Contract Management Plan.

During placing, the toe of the casing should be kept far enough ahead of the excavation to prevent material from outside the casing entering and causing cavities and settlements in the adjoining ground.

The excavation shall be carried out to the Contract Levels shown on the Drawings or to such other levels as approved by the Superintendent. Excavation in rock may be uncased subject to the approval of the Superintendent.

Excavated material shall become the property of the Contractor and be disposed of off site.

All material in hard, rigid or strongly cemented deposits in solid beds or masses, which cannot be removed without the use of pneumatic picks or wedges and hammers will be classified as "rock" for the purposes of payment.

Bases shall be trimmed in neat horizontal planes and all loose material including rock fragments and other debris shall be removed.

B6.6 CONTRACT LEVELS

All reduced levels (R.L.) of the bottom of the piles marked as "Contract Level" on the Drawings, represent the extent of the work to be included in the lump sum tendered.

The placement of concrete shall not be commenced before evidence of cleanliness of the bottom of the excavation has been provided to the Superintendent in accordance with Specification G2. The Superintendent may order in writing such changes of the levels as may be necessary to ensure a satisfactory foundation.

B6.7 TOLERANCES

The pile shafts shall be constructed or the steel casings shall be driven or sunk with a variation of not more than 10 mm per metre of pile from the vertical, or from the batter shown on the Drawings, with a maximum variation at the head of the casing of not more than 75 mm from the position on the Drawings.

B6.8 DOWEL ANCHORS

Holes for dowell anchors shall be drilled to the diameter and alignment as shown on the Drawings and to the following tolerances:

(i) The maximum permitted deviation of the hole centre as shown on the Drawings shall be 50mm.

(ii) The maximum permitted deviation of the hole from the specified rake shall be 1 in 25.

(iii) Permitted variations in hole diameter be 0 to 10 mm.

(iv) Permitted variations in length of hole shall be 0 to 100 mm. Extra drilling length shall be added to the depth when detritus cannot be removed from the bottom of the hole at no extra cost to the Principal.

Drilling shall be carried out in the presence of the Superintendent.

Anchor bars shall be either stainless steel reinforcing bars or bars hot dipped galvanised in accordance with AS 4680 and passivated in a 0.2 percent sodium dichromate solution or its equivalent.

After the Superintendent has approved the drilled holes and the method of ensuring minimum cover of the bars, the Contractor shall carefully lower the anchor bars into the holes ensuring that no fall-in of earth occurs.

Once the anchor bars have been fixed to the approval of the Superintendent, the Contractor shall proceed with the grouting of the annulus in accordance with AS 1481, note 5.9, where applicable.

Grout for filling the annulus shall consist of normal cement, water and an approved additive to reduce shrinkage.

The maximum water-cement ratio shall be 0.40 by mass.

The minimum compressive strength of 75 mm capped test cubes made of grout shall be 30 MPa at 28 days - 2 cubes to be taken for each day's grouting.

After grouting, the bars shall remain undisturbed for a minimum of three days.

B6.9 SINKING AND EXCAVATION OF CAST-IN-PLACE PILES

The pile shall be cast in contact with the surrounding foundation material over the specified socket length in order to provide the maximum amount of friction between the circumference of the pile and the surrounding material. Any temporary casing shall be slowly withdrawn during concreting. Where the pile is above river bed level or the surrounding material is not capable of supporting the pile concrete over any part of the pile, permanent casing shall be used over that part. The internal diameter of any casing shall not be less than 900 mm. The cost of any temporary or permanent casing required in the pile construction shall be included in the tendered rate for the pile.

Rock sockets shall be provided to the alignment, minimum diameter and depth into bedrock as shown on the Drawings and to the tolerances specified above.

The Contractor shall prove the soundness of the foundation rock below Contract Level, after each pile shaft has been excavated, by taking 45 mm diameter or greater cores by diamond drilling to a depth of 5 m below Contract Level. Drilling shall be conducted in accordance with AS 1726.The drilling shall be continuously supervised by an experienced drilling technician and logged on detailed written graphic logs. An experienced drilling contractor shall be employed with core runs not to exceed 800 mm before retrieval and the drilling carefully controlled to ensure maximum core recovery.

The core shall be boxed in accordance with Section 6 of AS 1726 and submitted together with the logs to the Superintendent not later than noon of the next day after the core has been drilled. A hold point shall be observed at this stage to enable the Superintendent to inspect the cores and subsequently determine the final pile foundation level.

The base of the rock socket shall be trimmed in neat horizontal planes and all loose material including rock fragments and other debris shall be removed.

Silt leakage shall be positively prevented by seal to a pile casing, use of bentonite, maintenance of a positive hydrostatic pressure in the pile or other method specifically stated in the Contract Management Plan.

The Contractor shall keep records of the installation of each pile..

The Contractor shall submit two signed copies of these records to the Superintendent not later than noon of the next working day after the pile has been excavated to Contract Level. Any unexpected ground conditions reported in accordance with B6.11 shall be noted in the records.

The method of ensuring minimum cover of the bars, shall be detailed in the Contract Management Plan. No reinforcement shall be installed until the Superintendent's hold point for pile cleanliness (see Annexure G2.1) is cleared. The Contractor shall carefully lower the reinforcement cage into the holes ensuring that no fall-in of foundation material occurs.

The placement of concrete in the pile shafts shall be in accordance with this Specification.

B6.10 REINFORCEMENT

The shaft or steel casing walls shall be thoroughly cleaned of all loose material, including any material adhering to the inside of the casing, before the reinforcement is placed. The reinforcement shall be welded or tied to form a rigid cage. Adequate spacers shall be securely attached to the cage to ensure that no displacement will take place during concreting and that the correct cover is maintained.

B6.11 CONCRETING

The placing of the concrete shall be a continuous process from the socket bottom or toe level to the top of the casings.

Where practicable, the casing shall be dewatered and the concrete placed in the dry.

Where the rate of influx of water into the casing is, such as to preclude dewatering, the pile concrete shall be placed by tremie or other method as approved by the Superintendent.

During concreting, the tremie outlet shall be kept a minimum of two metres below the top surface of the concrete at all times. Concreting shall be placed to a level 30mm above the soffit of the pile cap.

Concrete placed under water shall not be internally vibrated.

The top of any tremie concreted surface shall be cut back to sound, uniform, void free concrete before casting other concrete on top.

B6.12 UNEXPECTED GROUND CONDITIONS

The Contractor shall report immediately to the Superintendent any circumstances which indicate that in the Contractor's opinion the ground conditions differ from those expected by him from his interpretation of the site investigation information.

B6.13 WELDING

All welding shall be performed to level SP of AS 1554, Part 1.

B6.14 NOISE CONTROL

The Contractor shall carry out the work in such a manner and at such a time as to minimise noise and disturbance.

B6.15 PAYMENT

B6.15.1 Fabrication of steel pile casings

The rate in the Bill of Quantities for fabrication of steel pile casings shall include fabrication into cylindrical sections of suitable lengths for handling, transporting and installation, transporting from the fabrication shop to site, and unloading at site.

B6.15.2 Sinking and Excavation of Pile Shafts to Contract Level

The rate in the Bill of Quantities for sinking and excavation of pile shafts from cut-off level to the Contract Levels shown on the Drawings shall include the provision of any temporary or permanent steel casing, the driving or sinking of the casings, excavation of all materials including solid rock to form rock sockets, removal of the excavated material off site and any necessary dewatering. The rate shall also include withdrawing temporary casings and cutting off the top of permanent casings to suit pile cap construction.

B6.15.3 Core Drilling

The rate in the Bill of Quantities for core drilling shall include full payment for providing all labour, materials, tools, equipment and any other work incidental to completing the drilling. Payment for this Item shall include logging, handling and boxing the core and delivery to the Superintendent's site office. The quantity shall be measured as the actual length of core recovered. No payment shall be made beyond the target level for core recovery.

B6.15.4 Installing steel pile casings

The rate in the Bill of Quantities for installing steel pile casings shall include taking the casing sections from storage area, the driving or sinking of steel casings and excavation of all materials to the Contract Levels shown on the Drawings, all necessary welded field splices, removal of the excavated material off site and any necessary dewatering.

B6.15.5 Cutting off

The rate in the Bill of Quantities for cutting off shall include cutting off the tops of the piles at the levels shown on the Drawings and removal of cut-offs from the site. No extra payment will be made for increased cut off lengths, where casings are not installed to the estimated contract levels. Measurement of this item has been based on the total finished length of the casings, viz: the sum of the casing lengths between cut off level and contract level.

B6.15.6 Insitu Concrete

The rate in the Bill of Quantities for the supply and placing of insitu concrete shall include full payment for providing all labour, materials, tools, equipment and any other work incidental to completing this reinforced concrete item including the supply, cutting to lengths, bending, handling and placing of reinforcement and any necessary dewatering. No increase in rate will be allowed for placing insitu concrete below the Contract Level shown on the Drawings.

The quantity in the Bill of Quantities is the product of the length of pile from Contract Level to cut-off level and the cross sectional area of the minimum pile section stated on the Drawings.

B6.15.7 Installation of Dowel Anchors

The rate in the Bill of Quantities for installation of dowel anchors shall include the drilling of three initial holes at each pile bottom to prove rock, a maximum 24 hour delay awaiting a decision to accept the depth of excavation or otherwise, the further drilling of holes as shown on the Drawings, installation of the dowels and their subsequent grouting.

B6.15.8 Rock

Extra over items in the Bill of Quantities for rock excavation shall include for any over excavation involved, for any necessary additional backfilling or mass concrete, trimming of the bottoms and removal of the rock material off site.

B6.15.9 Additional Excavation

The rate in the Bill of Quantities for additional excavation of sockets (provisional sum) applies if the Superintendent considers it necessary to excavate below the Contract Levels of the casings to a level where rock has been proved following initial drilling of the holes for the dowel anchors. Payment for this item shall include excavation of the socket(s), approved necessary temporary supports, disposal of the excavated material off site, the supply and placing of insitu concrete, any necessary dewatering, the cost of abortive initial drilling to prove sound rock and the cost of delays as a consequence of this additional work(s). The cost of subsequent drilling for and installation of the dowel anchors upon completion of the socket excavation shall be taken as covered in the rate for installation of dowel anchors. Any additional reinforcement required by virtue of the lengthening of the reinforced concrete piles will be paid for as a variation to the Contract. Measurement of this item shall be the volume of excavation calculated on the pile diameter multiplied by the mean depth from the bottom of the pile casing to the base of the socket.

B6.14.10 Sinking and Excavation of Pile Shafts Below Contract Level (Provisional Item)

The rate in the Bill of Quantities for sinking and excavation of pile shafts below the Contract Levels shown on the Drawings shall include the provision of any temporary or permanent steel casing required, the driving or sinking of the casings, excavation of all materials, removal of the excavated material off site, any necessary dewatering, and shall also include withdrawing temporary casings.

B6.16 HOLDPOINTS

The following hold points have been identified in this Specification:

- Submission of cores and logs (B6.9)
- Cleanliness of pile excavation prior to concreting (B6.9)

B6.17 INFORMATION TO BE INCLUDED IN CONTRACT MANAGEMENT PLAN

The following information to be included in the Contract Management Plan has been identified in this Specification:

- Equipment and procedures for the driving or sinking of casings (B6.5)
- Procedures to prevent silt ingress into casing (B6.9)
- Procedure to ensure correct cover to reinforcing (B6.9)