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

BRIDGEWORKS SPECIFICATION

B1 - EARTHWORKS AND FOUNDATIONS April 2003

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B1.1 SCOPE

This Specification sets out the requirements for earthworks, foundations and site preparation works associated with abutments, piers, retaining walls, culverts and other structures but excludes piles and pile driving.

B1.2 REFERENCES

The Following Australian Standards and Specifications are referred to in this Specification

A.S. 1289 Methods of testing soils for engineering purposes

A.S. 2439 Perforated plastics drainage and effluent pipe and fittings

G2 Contract Management Plan

G4 Compaction Methods

R21 Clearing and Grubbing

R24 Geotextiles

B10 Supply of Concrete.

B11 Reinforced, Prestressed and Mass Concrete.

B13 CLEARING AND GRUBBING

Clearing and grubbing shall conform to the requirements of Specification R21, Clearing and Grubbing.

B1.4 COFFER DAMS

B1.4.1 General

Cofferdams shall be constructed so as to be as watertight as practicable, and to prevent damage to the foundation by erosion or percolation and shall be well braced.

The interior dimensions shall be such as to give sufficient clearance for the construction of forms and the inspection of their exteriors, and to permit pumping outside the forms.

Cofferdams shall be designed for full hydrostatic head.

The cofferdam design shall be performed and drawings submitted in accordance with Specification B11.

Unless otherwise provided for in the Contract cofferdams, including temporary piles, shall be removed to the level of the river bed after completion of the substructure.

No timber or bracing shall be left in the concrete of the finished structure.

B1.4.2 Dewatering

Concrete shall not be placed under water. Should pumping be necessary from the interior of the cofferdam, it shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete.

If pumping is required during the placing of concrete and for a period of twenty-four hours thereafter, it shall be done using a suitable sump separated from the concrete work and placed in such a manner that water flows to the sump without passing through concrete.

B1.5 EXCAVATION

The work shall include the excavation of foundation pits, cofferdams, cylinders and other foundations. Excavation shall be from the existing surface level in all materials and shall include all

pumping, bailing, draining, sheeting, bracing, preparation of foundation pits and other necessary works and materials.

Where excavation of the stream channel is included in the Contract the excavation shall extend to join the existing stream bed in a regular manner to ensure a smooth flow of water past the structure.

For excavations in materials other than sound rock and which are deeper than 1.5 metres timbering shall be installed during or immediately after excavating except, when site conditions permit, untimbered sloping or benched sides for excavations may be used. The Contractor shall be responsible for the design of excavations.

On commencing excavation every effort shall be made by the Contractor to ensure that all work in connection with the work below ground level is carried out expeditiously.

If excavations are to be left open for any length of time, the Contractor shall arrange for periodic inspections of timbering and/or sheeting to be made and any remedial works to be carried out as necessary.

At all times during the course of excavation deeper then 1.5 metres a secured access ladder shall be provided in accordance with the scaffolding regulations.

Excavations in rock may be carried out with the assistance of explosives used in accordance with Specification G2, Blasting and Structurally Damaging Processes.

It is the Contractor's responsibility to ensure the safety and maintenance of all excavated areas until the works are completed. The Contractor shall erect all necessary warning signs, lights and barriers around all excavations.

Water encountered during excavation shall be sealed off or diverted. The Contractor shall provide adequate pumping plant, sumps and drains to control water.

Care shall be taken to prevent the bottom of the excavation from being softened and disturbed by the action of water or any construction activity.

In clayey soils the bottom layer of 150mm shall not be removed until immediately prior to placing of the blinding concrete. Water shall not be permitted to remain around the footing during construction.

The bottoms of excavations for the pier, abutment and wall footings, and subway and culvert base slabs shall be trimmed in horizontal beds or steps, and shall be taken down 50 mm deeper than the level shown on the Drawings. All loose material shall be removed and a layer of concrete of strength grade 15 MPa placed up to the level shown on the Drawings.

The sides of footings shall be formed in accordance with Specification B11. Where the depth of the footing is entirely within sound rock or other stable material the Contractor may be permitted to dispense with formwork for the sides of footings providing he elects to pay for any excess concrete used.

No blinding or foundation concrete shall be placed until the bottom of the excavation has been inspected and accepted by the Superintendent.

The reduced levels of the bottoms of footings or other foundations as shown on the Drawings represent the extent of the work included in the bulk sum of the tender. These levels shall be considered as approximate only, and the Superintendent may order, in writing, such changes in dimensions or levels of footings as may be necessary to ensure a satisfactory foundation.

Where such changes are ordered, additions or deductions will be made in accordance with the General Conditions of Contract.

B1.6 DISPOSAL OF EXCAVATED MATERIAL

All excavated material that is unsuitable for use under the Contract shall be removed from the site.

B1.7 SPECIAL FILL AT ABUTMENTS AND RETAINING WALLS

B1.7.1 Select Fill

Select fill shall consist of natural gravels free of organic material complying with the following grading limits:

A.S. SIEVE SIZE	% PASSING BY MASS
75	100
37.5	70 - 100
19	50 - 100
9.5	35 - 75
4.8	25 - 60
2.36	15 - 45
0.425	10 - 25
0.075	0 - 15

The maximum plasticity index shall be 15.

B1.7.2 Impervious Fill

Impervious fill shall have a particle density of 2.3 tonnes/m^3 or higher and absorption of not greater than 2 percent.

The grading for the fill shall fall within the following limits:

A.S. SIEVE SIZE	% PASSING BY MASS
37.5	100
26.5	85 - 100
19.0	75 - 100
9.5	64 - 100
4.75	45 - 90
2.36	30 - 73
0.425	16 - 39
0.075	9 - 22

The properties for the fine fraction of the fill shall comply with the following limits:

PROPERTY	VALUES NOT EXCEEDING
Liquid Limit	35
Plastic Index (PI)	4 - 15*
+ The Product of PI x Percent Passing 0.425 mm (of total material)	300

* The PI shall not be less than 4 + Not for crushed rock.

B1.7.3 Cement Stabilised Sand

Cement stabilised sand shall be placed at locations indicated on the Drawings. Cement stabilised sand shall consist of clean medium to fine grained sand mixed with 3% cement by mass.

B1.7.4 Testing

The minimum number of compliance tests carried out on special fill materials shall be 1 per 300 m^3 for select fill, and 1 per 100 m^3 for impervious fill. Reduction in frequency of testing may be permitted on evidence of consistent compliance.

B1.8 PLACEMENT OF SPECIAL FILL

B1.8.1 General

Special fill placement shall include the preparation and compaction of the areas upon which fill is to be placed and the placing and compaction of the fill.

Compaction assessment shall be in accordance with Specification G4.

The construction of any section of an embankment shall not be commenced until the preparation for that section has been inspected and accepted by the Superintendent.

After excavation has been completed, the embankment foundation to a minimum depth of 150 mm shall be compacted to a minimum characteristic dry density ratio of 95% of Standard Compaction.

Prior to the placement of cement stabilised sand the base of the foundation shall be cleaned of all loose and foreign material.

B1.8.2 Filling

No fill shall be placed against any abutment wall or wingwall until 21 days after the concrete in the wall has been placed or curing has been completed and the concrete strength has been demonstrated to be adequate.

Fill material shall be placed in horizontal layers of not greater than 450 mm thickness loose measurement extending across the full width of embankment. Each layer shall be compacted to a minimum characteristic dry density ratio of 95% of Standard Compaction.

Further to Specifications G4 for testing purposes one layer at one abutment shall normally constitute one lot.

During construction each layer shall be sufficiently shaped to ensure adequate run-off without pondage.

Material shall be compacted into the embankments only when its moisture content lies within the range of 80% to 110% of the optimum moisture content for the material using Standard Compaction determined in accordance with AS 1289.5.1.1.

Any additional water supplied shall be distributed in an even manner on loose material prior to compaction or on to material which has been adequately tyned or scarified to loosen the surface. Mechanical plant shall then be used to satisfactorily blend and distribute the additional water evenly through the fill material prior to the commencement of compaction.

Material which has a moisture content in excess of 110% of the optimum moisture content for the material shall not be compacted in the fill until its moisture content has been reduced. If the material already on the fill has had its moisture content raised outside the allowable range by rainfall or excessive application of water, no further work shall be carried out until the moisture content has been reduced to within the allowable moisture range, or the excessively wet material is removed from the embankment fill and replaced with suitable fill all at the Contractor's cost.

The line of embankment in front of abutments shall initially be constructed at least 500 mm measured horizontally in excess of the line shown on the Drawings. The embankment shall be cut back to the line shown on the Drawings immediately prior to the construction of the batter protection. The surplus material shall be removed from the site at the Contractor's expense.

Cement stabilised sand shall be placed in 450mm thick layers across the full width of the foundation.

B1.8.3 Tolerances

All filling shall be finished to reasonably smooth and uniform surfaces which shall conform within the following limits to lines, grades and cross-sections shown on the Drawings:-

(i) Approach slab formation level. The finished surface of filling under the slab shall be such as to allow the tolerances set out in Specification B11 to be achieved.

(ii) Other fill levels. The formation surface shall be within + 25 mm and -50 mm of the specified level. It shall be finished to a smooth uniform surface without undulation that is likely to pond water.

(iii) Batters. At all levels the average plane of the batters shall not be steeper than the slope specified, and no point on the completed batter shall vary from the average plane by more than 250 mm. The toe of the batter shall not be within and not be more than 600 mm outside the planned batter line.

B1.8.4 Abutment Drainage

Abutment drainage shall be provided by at least 18 mm thick prefabricated, fully filtered, vertical subsoil drainage material.

Such drainage shall be placed on the back of the abutment wall and wingwalls as shown on the Drawings.

Perforated drainage pipe at the base of the abutment drainage shall be Class 1000 conforming with the requirements of AS 2439 - Part 1 for Type 1 perforated drainage pipe. It shall be wrapped in Class B non-woven geotextile filter fabric as specified in Specification R24.

The compaction equipment shall be kept a minimum of 100 mm from the face of the abutment drainage to prevent any damage.

To minimise the risk of any physical damage during mechanical back-filling a plywood board may be progressively moved across the abutment drainage face. Should a cut occur in the geotextile then it shall be taped to ensure that no soil can enter the drains. If a large area of geotextile is damaged then a patch of geotextile shall be placed over the area allowing an overlap of at least 100 mm.

B1.9 MAINTENANCE

The Contractor shall maintain the formation and earthwork surfaces at all times and shall control the construction equipment and traffic using the formation. Any damage resulting from traffic or any other causes shall be made good

B1.10 BACKFILLING

All shoring, bracing, rubbish, silt or other unsatisfactory material shall be removed before back-fill is placed. No filling shall be carried out until at least seven days after casting the adjacent concrete or curing has been completed and the concrete strength has been demonstrated to be adequate.

Except where specified to the contrary, spaces excavated for foundations and not occupied by permanent work shall be backfilled to the level of the surrounding ground with material such as sound earth free from timber or rubbish, which shall be placed in horizontal layers not exceeding 300 mm in thickness (loose) and shall be compacted to a minimum characteristic dry density ratio of 95% of Standard Compaction.

Backfill on all sides of piers and walls shall be carried up at the same level until the ground surface is reached. Notwithstanding these provisions, the Contractor shall comply with any special instructions given in the Drawings or by the Superintendent relating to methods of placing, filling and compaction.

When filling is being placed against walls, compaction shall commence at the wall in order to avoid the development of excessive pressure due to wedge action between the wall and any filling which may have been compacted previously.

Where erosion is likely to occur, the Superintendent may direct that backfilling around piers and in front of abutments and wingwalls be of stone fill or lean concrete.

B1.11 ROCK PITCHED BATTER PROTECTION

B1.11.1 Batter Trimming

After the earthworks of the approach embankments have been placed and compaction has been completed, the batters shall be trimmed back to the slopes shown on the Drawings. Immediately prior to the start of rock placement, the necessary additional excavation adjacent to the toe of the fill shall be carried out.

B1.11.2 Materials

(i) Geotextile Filter Fabric shall be Class A non-woven geotextile filter fabric as specified in Specification R24.

(ii) Insitu Concrete for the coping and foundation shall conform with Specification B10.

(iii) Rock shall be sound igneous rock with a minimum specific gravity of 2.7. The rock shall be dense, durable and resistant to weathering.

(iv) Bedding Material shall comprise crushed rock or gravel whose particle size lies between 19 and 37.5 mm with at least 40 percent of the material greater than 26.5 mm in size.

(v) Mortar shall consist of one part of Portland Cement to five parts of fat sand, thoroughly mixed with water to produce mortar having a thick creamy consistency.

(vi) Impervious Material shall conform with the requirements of this Specification.

B1.11.3 Mortar Set Rock Pitching

Pitching shall consist of irregular stones selected to roughly fit together and placed on bedding material having a mean thickness of 100 mm. The stone facing shall have a mean thickness of 300 mm with at least 90 percent of the individual stones having a mass not less than 40 kg. No stones shall have a mass less than 10 kg.

The stones shall be firmly bedded without any tendency to rock and, where necessary, shall be securely wedged in position by stone spalls. Any stones which break or crumble during placement may be rejected.

As the stones are carefully placed to the slopes specified on the Drawings, the spaces between them shall be completely filled with hand-placed mortar from bottom to top, and the surface shall be cleaned to expose the individual stone faces. All mortared joints shall be raked 5 mm below the adjacent surface of the rock pitching.

The pitching shall be laid in horizontal courses with headers at intervals or in random fashion depending on the stone available. Pitching shall be finished with a horizontal course at the R.L. shown on the Drawing.

B1.11.4 Dry Pack Rock Pitching

Dry pack rock pitching shall comprise rock fragments of size range 200 mm to 400 mm with at least 80 percent of the material greater than 300 mm in size. The rocks shall be placed on the geotextile filter fabric to a mean thickness of 500 mm. They shall be placed dry jointed, but shall be chinked and well interlocked.

The area adjacent to the toe of the rock pack shall be backfilled to existing natural surface level in accordance with this Specification .

B1.12 PAYMENT

B1.12.1 Earthworks

The quantities of excavations, except where otherwise mentioned hereunder shall be based on the horizontal area of the bottom of each footing, multiplied by the mean depth from the surface of the ground to the bottom of the footing shown on the Drawings.

The Items shall include the maintaining of the sides of the excavation with timbering where necessary and the backfilling and compaction of excavated earth. The rate for excavationl shall include provision for clearing and grubbing. Allowance shall be made for any over excavation involved and for any necessary dewatering prior to completion of the backfilling.

Hard, rigid or strongly cemented deposits, in solid beds or masses, which cannot be removed by ripping with a Class 150C bulldozer in good condition and with matching hydraulic ripper, at a production rate of 15 m^3 solid or more per hour, shall be classified as "rock". Alternatively, masses which cannot be removed by a 40 tonne excavator fitted with a rock bucket in good condition, at a production rate of 15 m^3 solid or more per hour, shall be classified as "rock". Boulders and detached pieces of solid rock, measuring 2 m^3 or more, shall also be classified as "rock". It shall be the responsibility of the Contractor to provide the excavator or bulldozer and matching ripper at the Contractor's expense but the Superintendent shall have the right to nominate an operator for the machine.

Payment for rock shall be by measurement of the volume as described.

B1.12.2 Special Fill

Payment for special fill shall be based on the measured compacted, in place volume as determined from design cross sections extending from the foundation level.

B1.12.3 Rock Pitching

The rates in the Bill of Quantities for Items 1.08, 1.09 and 1.13 shall allow for winning the rock, cartage, stockpiling and re-handling as necessary, and placing of bedding material and rock in accordance with the Drawings and Specification. The rate for Item 1.08 shall include providing mortar joints as specified. The area measured for payment shall be the face area of the rock protection.

B1.13 HOLDPOINTS

The following hold points have been identified in this Specification:

- Inspection prior to placement of blinding concrete (B1.5)
- Inspection of embankment base (B1.8)

B1.14 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:

- Excavation support, management and maintenance (B1.5)
- Disposal of surplus excavated material (B1.6)
- Source of special fill material (B1.7)
- Verification procedure for cure and strength of concrete prior to placing fill (B1.8.2)
- Drainage materials (B1.8.4)