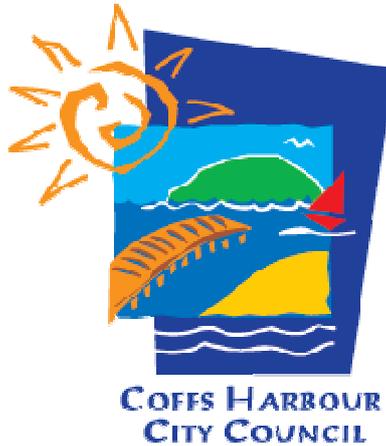


COFFS HARBOUR CITY COUNCIL



**DEVELOPMENT SPECIFICATION
DESIGN**

0293 Crib retaining walls

Version 1 01 January 2009

0293 CRIB RETAINING WALLS

1 SCOPE AND GENERAL

1.1 SCOPE

This worksection covers the construction of proprietary timber crib and precast concrete crib retaining walls.

The use of segmental concrete reinforced soil or reinforced concrete masonry cantilever retaining walls are not specifically covered; however, their design and construction shall be carried out in accordance with this worksections.

The work to be executed under this worksection consists of excavation for foundations, construction of reinforced concrete footing, precast concrete or treated timber crib wall, selected backfill in and behind crib wall, and subsurface drainage to the wall as shown on the Drawings.

Where the work involves the design and construction of structures required to retain and reinforce soil, rock and other materials such as segmental concrete reinforced soil retaining walls or reinforced concrete masonry cantilever retaining walls, then it shall be carried out in accordance with this specification and AS 4678.

1.2 QUALITY

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are given in 0161 *Quality (Construction)*.

1.3 REFERENCED DOCUMENTS

The following documents referred to in this Specification shall be deemed as the latest edition of the Australian Standards, including amendments and supplements.

Worksections

0161 *Quality (Construction)*

0310 *Minor concrete works*

1102 *Control of erosion and sedimentation*

1171 *Subsurface drainage*

1172 *Subsoil and foundation drains*

Standards

AS 1012 Methods of testing concrete

AS 1012.3.1 Determination of properties related to the consistency of concrete—Slump test

AS 1012.9 Determination of the compressive strength of concrete specimens

AS 1141 Methods for sampling and testing aggregates

AS 1141.11 Particle size distribution by dry sieving

AS 1289 Methods for testing soils for engineering purposes

AS 1289.3.3.1 Soil classification tests—Calculation of the plasticity index of a soil

AS 1289.5.4.1 Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio

AS 1604 Specification for preservative treatment

AS 1604.1 Sawn and round timber

AS 4678 Earth-retaining structures

AS/NZS 4680 Hot-dip galvanised (zinc) coatings on fabricated ferrous articles

1.4 CONTROL OF EROSION AND SEDIMENTATION

The Contractor shall install and maintain effective erosion and sedimentation control measures during the construction of the crib wall in accordance with 1102 *Control of erosion and sedimentation*.

2 MATERIALS

2.1 PRECAST CONCRETE CRIB WALL COMPONENTS

Proprietary systems

Crib wall components shall consist of proprietary precast concrete crib wall systems of reinforced, segmental or prestressed concrete interlocking or pinned stretchers and headers of the dimensions as shown on the Drawings.

Alternative system

Where the Contractor proposes using an alternative concrete crib wall system to the one detailed on the Drawings, detailed drawings, design calculations and Engineer's certification, and full details of installation procedures shall be submitted for approval to the Superintendent a minimum of 28 days prior to delivery of components to site for incorporation into the Works.

This action constitutes a HOLD POINT.

The Superintendent's approval of the submitted details is required prior to the release of the hold point.

2.2 TREATED TIMBER CRIB WALL COMPONENTS

Proprietary systems

Crib wall components shall consist of proprietary timber crib wall systems of insect and fungi resistant treated timber, of minimum Hazard Class H4 in accordance with AS 1604.1, interlocking or pinned stretchers and headers of the dimensions as shown on the Drawings.

Alternative system

Where the Contractor proposes using an alternative timber crib wall system to the one detailed in the Drawings, detailed drawings, design calculations and Engineer's certification, and full details of installation procedures shall be submitted for approval to the Superintendent a minimum of 28 days prior to delivery of components to site for incorporation into the Works.

This action constitutes a HOLD POINT.

The Superintendent's approval of the submitted details is required prior to the release of the hold point.

2.3 CONCRETE

Concrete supplied and placed for the reinforced concrete footing and 50 mm mass concrete blinding layer shall comply with 0310 *Minor concrete works*.

Unless otherwise indicated on the Drawings, the concrete shall have a compressive strength not less than 20 MPa when tested in accordance with AS 1012.9, with a maximum nominal size of aggregate of 20 mm and a nominated slump at the point of placement not exceeding 80 mm as determined by AS 1012.3.1.

2.4 STEEL REINFORCEMENT

Steel reinforcement provided for concrete shall comply with 0310 *Minor concrete works*.

In addition, where galvanising of reinforcing steel is indicated on the Drawings or otherwise specified, such galvanising shall be an average minimum coating thickness of 85 µm of not less than 98 per cent by mass of zinc when tested in accordance with AS/NZS 4680.

3 SITING AND EXCAVATION

3.1 SET OUT

The Contractor shall set out the crib wall structure as shown on the Drawings in sufficient detail to identify the location, length and height of the wall, together with the line of the top of cut batter.

3.2 DESIGN CHANGES

Should the Contractor propose changes to location, length, height, design levels or strength, to suit the Contractor's purposes or construction techniques, the Contractor's proposals shall be presented for the Superintendent's approval.

Changes to suit the Contractor's construction procedures shall be at the Contractor's cost.

The Contractor shall present the crib wall structure set out, including any changes proposed by the Contractor, for the Superintendent's approval prior to commencing excavation.

This action constitutes a HOLD POINT.

The Superintendent's approval of the set out is required prior to the release of the hold point.

3.3 FOUNDATION LEVEL

The foundation level shall be defined as the level at the underside of the 50 mm mass concrete blinding layer below the reinforced concrete footing.

The levels and dimensions of foundations shall be recognised as subject to confirmation or alteration before construction, and the Superintendent may direct such changes of the levels and of dimensions of footings as may be necessary to ensure a satisfactory foundation.

3.4 EXCAVATION

General

Excavation shall be undertaken to the required width and batter angle behind the finished face of the crib wall and to the depths and dimensions of footings shown on the Drawings, including the 50 mm mass concrete blinding layer.

All loose material shall be removed.

Minor fissures in rock shall be thoroughly cleaned out and filled with concrete, mortar or grout.

Compaction

The base of the excavation shall be compacted in accordance with the requirements of Clause 4.4 and trimmed to ensure that at no point the level is more than 25 mm above the design Foundation Level.

The levels of the base of the excavation shall be confirmed by survey.

Over-excavation

Any over-excavation in rock below foundation level shall be filled with concrete of the same quality as that of the footing, while over-excavation in earth below foundation level shall be backfilled and recompacted to the requirements of **Compaction**.

Batter slope trimming

The batter slope and alignment of the excavation shall be trimmed to ensure that at no point the line of the batter is more than 25 mm inside the line of the specified batter slope, after allowing for the width of the crib wall and the granular drainage layer behind the wall.

The batter slope and alignment of the excavation for the crib wall shall be confirmed by survey.

Surplus excavated material shall be used in the construction of embankments, or spoiled as directed by the Superintendent.

Safety

The Contractor shall supply and erect any necessary sheeting and bracing to support the excavation in a safe manner and in accordance with statutory requirements.

The excavation shall be kept free of water.

Unsuitable foundation

Following excavation to Foundation Level, the Contractor shall present the foundation on which the footing for the wall is to be placed for inspection and approval by the Superintendent.

If the foundation is composed of material which the Superintendent deems to be unsuitable to support the proposed structure, such material shall be excavated to the extent directed by the Superintendent, backfilled with sound material, and recompacted to the requirements of **Compaction**.

The foundation shall then be presented again for the approval of the Superintendent. The unsuitable material from the excavation below Foundation Level shall be spoiled as directed by the Superintendent.

This action constitutes a HOLD POINT.

The Superintendent's approval of the foundation is required prior to the release of the hold point.

4 CONSTRUCTION

4.1 REINFORCED CONCRETE FOOTING

In accordance with drawings.

The reinforced concrete footing shall be constructed to the details as shown on the Drawings.

Formwork

Unless otherwise indicated on the Drawings, forms shall be used for all vertical concrete surfaces.

All formwork shall comply with 0310 *Minor concrete works*.

Placement and compaction

For the reinforced concrete footing and 50 mm mass concrete blinding layer, the placement and compaction of concrete, including joints, finishing, curing and protection of concrete, and the placement of the reinforcing steel shall comply with 0310 *Minor concrete works*.

Tolerance

The finished concrete footing shall not vary by more than 10 mm from the specified levels and by more than 25 mm from the specified horizontal alignment.

4.2 ERECTION OF CRIB WALL

Manufacturer's recommendations

All works in crib wall construction shall be in accordance with manufacturers' recommendations, commencing at the lowest part of the wall, with alternating rows of accurately positioned interlocking stretchers and headers.

Course levels and jointing

Wall units are to be placed so as to form closely butted joints, and shall be checked for line and level after each course is laid.

The level of each course of stretcher units shall not vary from the planned level by more than 25 mm at any point.

The maximum deviation of a course of stretcher units from a 3 m straight-edge placed longitudinally along the wall shall not exceed 10 mm.

Header unit ends vertical

Header units shall be placed so as to maintain the ends of header units vertical for the full height of the wall and the ends of stretcher units shall be close abutting and maintain a vertical line throughout the height.

Joints

Each unit shall bear evenly on the underlying unit and connect to it as shown on the manufacturer's detail drawings.

Dry mortarless joints shall be used for concrete crib units except where otherwise shown on the Drawings.

Where shown as mortar bedded, the joints between units shall be properly bedded in a cement mortar containing a sand/cement ratio of 3:1 and an approved bonding additive.

Maintain shape

The slope of the batter shall be maintained throughout the work and the plane face or even curvature maintained over the full area of the work.

The completed crib wall shall not vary from the specified batter slope by more than 25 mm.

4.3 BACKFILLING

Cleanup before backfill

All timbering, bracing and rubbish of all descriptions shall be removed before backfill is placed.

Progressively placed

Selected backfill shall be progressively placed within the crib wall as each course of stretchers and headers is installed.

It shall consist of granular material, free from clay, having a maximum dimension not exceeding 50 mm and a Plasticity Index of not less than 2 nor more than 12 when tested in accordance with AS 1289.3.3.1.

The material shall be placed in layers not exceeding 150 mm and compacted in accordance with **Compaction**. Care shall be taken during compaction to avoid damaging or distorting the wall.

Alternative material

The Contractor may submit alternative backfill materials for approval by the Superintendent.

Drainage layer

Behind the line of the crib wall units, and for the full height of the wall, a continuous granular drainage layer of width as shown on the Drawings (measured perpendicular to the face of the crib wall) shall be progressively placed in layers not exceeding 150 mm and compacted in accordance with Clause 4.4.

It shall consist of broken stone or river gravel, consisting of clean, hard, durable particles graded from 50 mm to 10 mm to AS 1141.11 such that:

- The maximum particle dimension shall not exceed 50 mm;
- No more than 5 per cent by mass shall pass the 9.5 mm AS sieve.

Geotextile

A layer of geotextile complying with 1171 *Subsurface drainage* shall be placed between the back of the crib wall units and the granular drainage layer.

Subsoil pipe

A subsoil drainage line shall be constructed at the base of the drainage layer as shown on the Drawings. It shall outlet either into adjacent stormwater gully pits or headwalls, or alternatively through adjacent fill batter, and be suitably marked.

The subsoil drain shall comply with 1171 *Subsurface drainage* 1172 *Subsoil and foundation drains* and shall consist of 100 mm diameter slotted corrugated plastic pipe and seamless tubular filter fabric, surrounded by a maximum of 100 mm of Type A Filter Material contained within a layer of geotextile.

Unless shown otherwise on the Drawings, the subsoil pipe shall be laid to an even line and uniform grade of not less than two per cent fall towards the outlet.

Backfill progressively placed and compacted

Except as specified above, excavations for foundations and for the construction of the crib walls shall be backfilled, progressively with crib wall construction, to the level of the surrounding ground with material from cuttings, or with other material acceptable to the Superintendent, and compacted in accordance with **Compaction**.

Sealing tops and ends of walls

Complete sealing utilising compacted earth shall be provided at the top of crib walls over the full length and at the vertical edge at both ends of all crib walls in accordance with the manufacturer's instructions and to the satisfaction of the Superintendent.

Other forms of sealing

Where erosion is likely to occur the Superintendent may direct that backfilling around the ends of walls be of stone fill or lean mix concrete, in which case the extra work will be paid for as a Variation to the Works.

4.4 COMPACTION

Foundations and backfill shall be compacted to the following requirements when tested in accordance with AS 1289.5.4.1 for standard compactive effort:

	Relative compaction
Foundations or base of excavation to a depth of 150 mm below foundation levels	95%
Selected backfill within crib wall structure	98%
All other fill material for crib wall construction including granular drainage layer, subsoil filter material, material replacing unsuitable material and backfill material	95%

Unless otherwise directed by the Superintendent, all material shall be compacted in layers not exceeding 150 mm compacted thickness.

5 LIMITS AND TOLERANCES

The limits and tolerances applicable to the various clauses in this worksection are summarised in Table 5.1.

Table 5.1 Summary of limits and tolerances

Activity	Limits/tolerances	Worksection clause reference
Excavation		
-Foundation level	Level of foundation for footing at any point shall not be more than 25 mm.	Excavation
-Batter slope	Batter slope and alignment of excavation shall not be more than 25 mm inside the line of the specified batter slope behind the line of the wall and granular drainage layer.	Excavation
Reinforced concrete footing		
-Finished level	Finished level of footing shall not vary more than 10 mm from the specified levels.	Reinforced concrete footing
-Horizontal alignment	Horizontal alignment of footing shall not vary more than 25 mm from the specified alignment.	Reinforced concrete footing
Crib wall		
-Level of stretcher units	The level of each course shall not vary more than 25 mm from the specified level.	Erection of crib wall
-Deviation of stretcher units	The departure from the line of each course of stretcher units shall not exceed 10 mm in any 3 metre length.	Erection of crib wall
-Batter slope of wall	The completed crib wall shall not vary more than 25 mm from the specified batter slope.	Erection of crib wall

6 MEASUREMENT AND PAYMENT

6.1 MEASUREMENT

Payment shall be made for all the activities associated with completing the work detailed in this Specification on a schedule of rates basis in accordance with Pay Items 0293.1 to 0293.4 inclusive.

A lump sum price for any of these items shall not be accepted.

If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

Erosion and sedimentation control measures are measured and paid in accordance with 1102 *Control of erosion and sedimentation*.

Construction of footings, including concrete, reinforcement, formwork, etc, is measured and paid in this worksection and not 0310 *Minor concrete works*.

The granular drainage layer, subsoil drainage pipe and filter material is measured and paid in accordance with this worksection and not 1171 *Surface drainage* or 1172 *Subsoil and foundation drains*.

6.2 PAY ITEMS

0293.1 Excavation

The unit of measurement shall be the cubic metre measured in bank volume of excavation.

The volume shall be determined by the End Area Method using design cross-sectional areas calculated at each change in height or width of the wall.

The design cross-sectional areas shall be bounded by the underside of the 50 mm mass concrete layer, the width of the footing shown on the Drawings plus the width of the granular drainage layer at a batter slope parallel to the front face of the crib wall, and the reduced level at the top of the crib wall.

The disposal of surplus material shall be included in the excavation rates.

No additional payment shall be made for drying out wet excavated material or replacement of over excavation beyond the design cross-sectional limits defined above.

The schedule rate for excavation shall allow for excavation and backfilling of all types of materials. Separate rates shall not be included for earth and rock.

The control of stormwater runoff shall be included in the rate for excavation.

0293.2 Unsuitable material below foundation

The unit of measurement shall be the cubic metre measured as bank volume of excavation below foundation level which is directed to be removed and replaced.

The schedule rate under this Pay Item shall include all operations involved in the excavation and removal to spoil of unsuitable material below foundation level of the concrete footing and the backfilling and compaction to foundation level with replacement material.

0293.3 Reinforced concrete footing

The unit of measurement shall be the cubic metre of reinforced concrete.

The volume shall be taken from the Drawings, excluding the volume of the 50 mm mass concrete blinding layer.

The schedule rate under this Pay Item shall include all operations involved in the supply and placement of all formwork, embedments, reinforcement, concrete (including 50 mm mass concrete blinding layer), stepping of footing, joints, curing and backfilling to the footing.

0293.4 Construct crib wall

The unit of measurement shall be the square metre, measured as face area of crib wall from the top of the footing to the top of the wall.

The schedule rate under this Pay Item shall include all operations involved in the supply and placement of all materials and workmanship required to provide the completed structure as shown on the Drawings including supply and erection of crib wall units, selected backfill within the wall, granular drainage layer behind the wall, earth backfill and capping, and subsoil drain at the base of the drainage layer.