

QUEENSLAND

CONSTRUCTION
SPECIFICATION

C276

CRIB RETAINING WALLS

**DEVELOPMENT CONSTRUCTION SPECIFICATION
C276 - CRIB RETAINING WALL**

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DEVELOPMENT CONSTRUCTION SPECIFICATION

C276 - CRIB RETAINING WALL

GENERAL

C276.01 SCOPE

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

The work to be executed under this Specification 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.

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

C276.02 REFERENCE DOCUMENTS

Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specifications

C211	-	Control of Erosion and Sedimentation
C230	-	Subsurface Drainage - General
C231	-	Subsoil and Foundation Drains
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1012.3.1	-	Determination of properties related to the consistence of concrete - Slump test.
AS 1012.9	-	Determination of the compressive strength of concrete specimens
AS 1141.11	-	Particle size distribution by dry sieving
AS 1289.3.3.1	-	Calculation of the plasticity index of a soil
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1604.1	-	Specification for preservative-treatment-Part 1:Sawn and round timber
AS/NZS4680	-	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles.

C276.03 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 the Specification for - CONTROL OF EROSION AND SEDIMENTATION.

MATERIALS

C276.04 PRECAST CONCRETE CRIB WALL COMPONENTS

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

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.

C276.05 TREATED TIMBER CRIB WALL COMPONENTS

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 (minimum Hazard Class H4 remains the same), interlocking or pinned stretchers and headers of the dimensions as shown on the Drawings.

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.

C276.06 CONCRETE

Concrete supplied and placed for the reinforced concrete footing and 50mm Specification mass concrete blinding layer shall comply with the Specification for MINOR CONCRETE WORKS.

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

C276.07 STEEL REINFORCEMENT

Steel reinforcement provided for concrete shall comply with the Specification for Specification 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 85µm of not less than 98 per cent by mass of zinc when tested in accordance with AS/NZS4680.

SITING AND EXCAVATION

C276.08 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.

Should the Contractor propose changes to location, length, height, design levels for 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.

C276.09 FOUNDATION LEVEL

The foundation level shall be defined as the level at the underside of the 50mm 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.

C276.10 EXCAVATION

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 50mm 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.

The base of the excavation shall be compacted in accordance with the requirements of Clause

276.14 and trimmed to ensure that at no point the level is more than 25mm above the design Foundation Level. The levels of the base of the excavation shall be confirmed by survey.

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 Clause 276.14.

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 25mm 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.

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.

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 Clause 276.14. 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.

CONSTRUCTION

C276.11 REINFORCED CONCRETE FOOTING

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

Unless otherwise indicated on the Drawings, forms shall be used for all vertical concrete surfaces. All formwork shall comply with the Specification for MINOR CONCRETE WORKS.

For the reinforced concrete footing and 50mm 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 the Specification for MINOR CONCRETE WORKS.

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

C276.12 ERECTION OF CRIB WALL

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

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 25mm at any point. The maximum deviation of a course of stretcher units from a 3m straight-edge placed longitudinally along the wall shall not exceed 10mm.

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.

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.

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 25mm.

C276.13 BACKFILLING

All timbering, bracing and rubbish of all descriptions shall be removed before backfill is 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 50mm 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 150mm and compacted in accordance with Clause 276.14. Care shall be taken during compaction to avoid damaging or distorting the wall.

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

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 150mm and compacted in accordance with Clause 276.14. It shall consist of broken stone or river gravel, consisting of clean, hard, durable particles graded from 50mm to 10mm to AS 1141.11 such that:

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

A layer of geotextile complying with the Specification for SUBSURFACE DRAINAGE - GENERAL shall be placed between the back of the crib wall units and the granular drainage layer

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 the requirements of the Specifications for SUBSURFACE DRAINAGE - GENERAL and SUBSOIL AND FOUNDATION DRAINS and shall consist of 100mm diameter slotted corrugated plastic pipe and seamless tubular filter fabric, surrounded by a maximum of 100mm 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.

Except as specified above, excavations for foundations and for the construction of the crib walls shall be backfilled to the level of the surrounding ground with material from cuttings, or with other material acceptable to the Superintendent, and compacted in accordance with Clause 276.14.

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.

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.

C276.14 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:

- | | | |
|-----|---|-----|
| (a) | Foundations or base of excavation to a depth of 150 mm below foundation levels | 95% |
| (b) | Selected backfill within crib wall structure | 98% |
| (c) | 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 150mm compacted thickness.

SPECIAL REQUIREMENTS

- C276.15** RESERVED
C276.16 RESERVED
C276.17 RESERVED
C276.18 RESERVED

LIMITS AND TOLERANCES

C276.19 SUMMARY OF LIMITS AND TOLERANCES

The limits and tolerances applicable to the various clauses in this Specification are summarised in Table 276.1 below.

	Activity	Limits/Tolerances	Spec Clause
1.	Excavation		
	(a) Foundation Level	Level of foundation for footing at any point shall not be more than 25mm.	C276.10
	(b) Batter Slope	Batter slope and alignment of excavation shall not be more than 25mm inside the line of the specified batter slope behind the line of the wall and granular drainage layer.	C276.10
2.	Reinforced Concrete Footing		
	(a) Finished Level	Finished level of footing shall not vary more than 10mm from the specified levels.	C276.11
	(b) Horizontal Alignment	Horizontal alignment of footing shall not vary more than 25mm from the specified alignment.	C276.11
3.	Crib Wall		
	(a) Level of Stretcher Units	The level of each course shall not vary more than 25mm from the specified level.	C276.12
	(b) Deviation of Stretcher Units	The departure from the line of each course of stretcher units shall not exceed 10mm in any 3 metre length.	
	(c) Batter Slope of Wall	The completed crib wall shall not vary more than 25mm from the specified batter slope.	C276.12

Table 276.1 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT**C276.20 PAY ITEMS**

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 276(a) to 276(d) 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 the Specification for CONTROL OF EROSION AND SEDIMENTATION.

Construction of footings, including concrete, reinforcement, formwork, etc, is measured and paid in this Specification and not in the Specification for MINOR CONCRETE WORKS.

The granular drainage layer, subsoil drainage pipe and filter material is measured and paid in accordance with this Specification and not in the Specification for SUBSURFACE DRAINAGE - GENERAL or SUBSOIL AND FOUNDATION DRAINS.

Pay Item 276(a) 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 50mm 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.

Pay Item 276(b) 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.

Pay Item 276(c) 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 50mm 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 50mm mass concrete blinding layer), stepping of footing, joints, curing and backfilling to the footing.

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Pay Item 267(d) 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.