



AUS-SPEC

Infrastructure Specifications

0293 Crib retaining walls

0293 CRIB RETAINING WALLS

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the Cessnock City Council area by both Council and industry. NATSPEC regularly updates the base templates (currently in April and October each year), and Council may incorporate changes into its version of AUS-SPEC from time to time. To assist in highlighting any changes made by Council to the NATSPEC templates, the following conventions are used.

- See ANNEXURE M at the end of this document which contains (where practical) Cessnock City Council customisations (also known as 'office master' text). References to the Annexure are to also be inserted at relevant clauses in the main body of the document.
- Where content is added to the main body of the document, it is to be shown **in brown text like this**.
- Where content is deleted or excluded from the main body of the document, it is to be shown ~~struck through like this~~. Such clauses are to have no effect.

Where there is a conflict between main body text and Cessnock City Council specific clauses, Council's specific clauses shall prevail.

1 GENERAL**1.1 RESPONSIBILITIES****General**

Requirement: Provide proprietary timber and precast concrete crib retaining walls including footings, subsoil drains, masonry construction and backfilling, as documented.

1.2 CROSS REFERENCES**General**

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- 0136 *General requirements (Construction)*.
- 0152 *Schedule of rates (Construction)*.
- 0161 *Quality management (Construction)*.
- 0319 *Auxiliary concrete works*.
- 1101 *Traffic management*.
- 1102 *Control of erosion and sedimentation (Construction)*.
- 1111 *Clearing and grubbing*.
- 1112 *Earthworks (Road reserve)*.
- 1171 *Subsurface drainage*.
- 1172 *Subsoil and formation drains*.

1.3 STANDARDS**General**

Formwork for concrete: To AS 3610.1 (2018) and Austroads ATS 5305 (2023).

Concrete structures: To AS 3600 (2018).

Earth retaining structures: To AS 4678 (2002).

Geotechnical site investigations: AS 1726 (2017).

Timber structures: To AS 1720.1 (2010) and AS 1720.2 (2006).

1.4 INTERPRETATION**Definitions**

General: For the purposes of this worksection the following definitions apply:

- Foundation level: The level at the underside of the 50 mm thick mass concrete blinding layer, below the reinforced concrete footing.
- Header unit: Components which run perpendicular to the face of the wall, i.e. into the embankment.
- Stretcher unit: Components running horizontally and parallel to the face of the wall.

1.5 TOLERANCES

General

Construction tolerances: To AS 4678 (2002) Table 6.1.

Footings

Finished level: ± 10 mm.

Horizontal alignment: ± 25 mm.

Batter slope

Completed crib wall variation from design slope: ± 20 mm in 3 m.

Batter slope and alignment of excavation: Maximum 25 mm inside the line of design slope.

Course levels and jointing

Requirement: Make sure wall units of each course conforms to the following:

- Vertical alignment of stretcher units: ± 25 mm.
- Vertical alignment of header units up the face of wall: ± 20 mm.
- Deviation of a course of stretcher unit: ± 10 mm from a 3 m straightedge.
- Relative position of adjacent stretcher units in any one course: ± 5 mm of the true alignment in plan or elevation.

1.6 SUBMISSIONS

Products and materials

Bonding additive: If mortar bedding is required, submit details of bonding additive for approval.

Steel reinforcement: If galvanized coatings are documented, submit evidence of conformity for galvanized coating mass and thickness.

Tests

Results: Submit results of testing to **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Variations

Design changes: If changes are proposed to the location, length, height, design levels or strength, submit details for approval before start of excavation.

Alternative systems: If an alternative system is proposed, submit detail drawings, design calculations, Engineer's certification, and details of installation procedures.

Alternative backfill material: If proposed, submit details for approval.

Warranties

Requirement: Submit the following:

- -All necessary documentation to enable Council as the future asset owner to claim on warranties and guarantees for the performance and/or replacement of all components, with terms and durations in accordance with any DA consent conditions and approved plans, or if none are specified, in line with the standard warranties offered by industry or major competing suppliers. Alternatively submit analysis to demonstrate that the product with a lesser warranty duration represents a superior whole-of-life cost for Council.

1.7 INSPECTIONS

Notice

General: To **ANNEXURE – SUMMARY OF HOLD AND WITNESS POINTS**. Give notice so that inspection may be made of the following:

- Set-out: Including location of walls, and levels and dimensions of footings.
- Foundation: Foundation for footings on completion of excavation. If unsuitable foundation material is found, give notice for further inspection after backfilling and re-compacting with sound material.
- Subsoil drains: Drainage line in place.

- Reinforced concrete footing: Steel reinforcement in place before the commencement of concrete placement.
- Clean up before backfilling: Removal of bracing, after completion of clean up, before backfilling.

2 MATERIALS

2.1 PRECAST CONCRETE CRIB WALL COMPONENTS

Proprietary systems

Type: Precast concrete crib wall system of reinforced, segmental or prestressed concrete interlocking or pinned stretchers and headers.

Design, construction and installation of precast elements: To AS 3850.3 (2021).

Component dimensions: As documented.

2.2 TREATED TIMBER CRIB WALL COMPONENTS

Proprietary systems

Type: Interlocking or pinned stretchers and headers.

Timber treatment: To the AS/NZS 1604 series for insect and fungal resistance.

Minimum Hazard Class: H5 to AS/NZS 1604.1 (2021).

Timber design and properties: To AS 1720.1 (2010) and AS 1720.2 (2006).

2.3 CONCRETE

Properties

Standard: To AS 3600 (2018) and supply of special class concrete to Austroads ATS 5315 (2023).

Minimum compressive strength: 20 MPa.

Maximum nominal size of aggregate: 20 mm.

Maximum nominated slump at the point of placement: 80 mm.

2.4 STEEL REINFORCEMENT

Protective treatment

Galvanizing: If required, conform to the following:

- Average minimum coating thickness: 85 μm of minimum 98% by mass of zinc.

Separation of materials: Do not combine galvanized and uncoated components.

2.5 BACKFILL MATERIAL

Properties

Material within crib wall: Granular material conforming to the following:

- Free from clay.
- Maximum particle size: 50 mm.
- Plasticity Index tested to AS 1289.3.3.1 (2009): Between 2 and 12.

2.6 TESTING

Quality

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

3 EXECUTION

3.1 ESTABLISHMENT

Set-out

Requirement: Using recovery pegs, set out the crib wall structure as documented. Identify the line of the top of the cut batter and location, length and height of the wall.

Foundation

Site preparation: To 1111 *Clearing and grubbing*.

Excavation and foundation preparation: To 1112 *Earthworks (Road reserve)*.

Levels and dimensions: Before setting out, confirm levels and dimensions of the footings to provide satisfactory and stable foundation.

3.2 EXCAVATION**General**

Requirement: Excavate to the required width and batter angle behind the finished face of the crib walls, and to the depths and dimensions of footings, including the 50 mm mass concrete blinding layer.

Loose material: Remove.

Minor rock fissures: Clean out and fill with concrete, mortar or grout.

Surplus excavated material: Use in the construction of embankments or remove from site.

Compaction

Base of excavation: Conform to **COMPACTION** and trim so that all levels are 25 mm maximum above the design foundation level.

Base of excavation level: Confirm by survey.

Over-excavation

Over-excavation below foundation level: Conform to the following:

- In rock: Fill with concrete of the same quality as the footing.
- In soil: Backfill and recompact in conformance with **COMPACTION**.

Batter slope trimming

Trimming: Make sure no point of the batter slope and line of excavation is more than 25 mm inside the line of the documented batter slope, after allowing for the width of the crib wall and granular drainage layer behind the wall.

Batter slope and alignment: Confirm by survey.

Foundation

Foundation material: If deemed unsuitable to support the proposed structure, excavate and backfill with sound material, and recompact in conformance with **COMPACTION**.

Unsuitable foundation material: Remove from site.

Safety

Excavation safety control measures: Provide measures, including sheeting, bracing, formwork and falsework as recommended by the *Excavation work Code of Practice (2018)* and the *General guide for formwork and falsework (2014)* by Safe Work Australia.

Dewater: Keep the excavation free of water.

3.3 SUBSOIL DRAINS**General**

Requirement: Provide subsoil drainage conforming to 1171 *Subsurface drainage* and 1172 *Subsoil and formation drains* consisting of the following:

- 100 mm diameter slotted corrugated plastic pipe with seamless tubular filter fabric.
- Maximum 100 mm thick Type A filter material, contained within a layer of geotextile fabric, surrounding the plastic pipe.

Location: Provide drainage line at the base of the drainage layer, as documented.

Laying: To an even line and uniform grade of 2% minimum fall towards the outlet.

Outlets: Discharge into adjacent stormwater gully pits or headwalls, or alternatively, through adjacent fill batter.

- Markings: Make sure discharge point markings are clearly visible.

Drainage layer

Geotextile: Provide a layer of geotextile, conforming to 1171 *Subsurface drainage*, between the back of the crib wall units and the granular drainage layer.

Granular layer: Provide a continuous granular drainage layer behind the crib wall as follows:

- To the full height of the wall.
- In the required width, measured perpendicular to the face of the wall.
- Progressively placed in layers of 150 mm maximum, compacted in conformance with **COMPACTION**.

Granular layer material: Broken stone or river gravel of clean, hard, durable particles graded from 10 mm to 50 mm to AS 1141.11.1 (2020) as follows:

- Maximum particle dimension: 50 mm.
- Passing the 9.5 mm AS sieve: Not more than 5% by mass.

3.4 REINFORCED CONCRETE FOOTING

General

Requirement: Provide reinforced concrete footings as documented.

Concrete blinding slab

Requirement: Provide a 50 mm concrete blinding slab at the base of the excavation for footings.

Formwork

Requirement: Provide formwork to AS 3610 and Austroads ATS 5305 (2023).

Placement and compaction

Requirement: Conform to *0319 Auxiliary concrete works* for the following:

- Placement of steel reinforcement.
- Placement and compaction of concrete.
- Finishing.
- Curing.
- Joints.

Placement of special class concrete: To Austroads ATS 5320 (2023).

3.5 ERECTION OF CRIB WALL

Manufacturers' recommendations

Wall construction: Conform to the manufacturers' recommendations. Commencing at the lowest part of the wall, place alternating rows of interlocking stretchers and headers.

Placing

Header units: Place units so that perpends are maintained in a straight line.

Stretcher units: Place over header units, with ends butted together, to form a straight vertical line over the full height of the wall. Connect stretcher units into the notches if they are provided in header units.

Line and level checking: After each course is laid, make sure wall units conform to **TOLERANCES, Course levels and jointing**.

Jointing

Bearing: Provide connections to the manufacturer's recommendations, with each unit bearing evenly on the underlying unit.

Joints: Dry mortarless joints.

Mortar bedding: If required, provide joints between units properly bedded in cement mortar containing the following:

- Mix proportion (sand:cement): 3:1.
- An approved bonding additive.

Maintaining shape

Slope: Maintain the slope of the batter and a plane face or even curvature over the full area of the work.

Slope variation: 25 mm maximum between completed crib wall and batter slope.

3.6 BACKFILLING

Clean up before backfilling

Remove: All timbering, bracing and waste before placing backfill.

Placing

Requirement: Progressively backfill excavations for foundations and construction of the crib walls, to the level of the surrounding ground, with material from cuttings, or with other approved material.

Backfill within crib wall: Progressively place as each course of stretchers and headers are installed.

Compaction: Avoid damaging or distorting the wall.

Sealing tops and ends of walls

Sealing: Completely seal tops and ends of walls with compacted earth or other treatment, as documented.

Extent: Conform to the following:

- Top of wall: Over the full length of wall.
- Ends of walls: Full vertical edge.

Geotextile: Within the top 3 courses of header units, place compacted earth after placing geotextile over cribwall infill.

Erosion control

Requirement: Where erosion is likely to occur, backfill around the ends of walls using stone fill or lean mix concrete.

3.7 COMPACTION**General**

Layers: Compact materials in layers not exceeding 150 mm compacted thickness.

Moisture content: Within 2% of Optimum Moisture Content.

Relative compaction levels table

Foundations or backfill	Relative compaction
Foundations or base of excavation to a depth of 150 mm below foundation levels. Includes fill for over excavated foundations.	95%
Granular drainage layer, subsoil filter material, material replacing unsuitable material and backfill material	95%
Backfill within crib wall structure	98%
Note: Compaction for cohesionless soils may be acceptable: <ul style="list-style-type: none"> - Controlled fill – Class I: Material compacted to minimum 75% density index. - Controlled fill – Class II: Material compacted to minimum 65% density index. 	

3.8 TESTING**Quality**

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

4 ANNEXURE A**4.1 ANNEXURE - SUMMARY OF HOLD AND WITNESS POINTS**

For private developments, certain Hold and Witness Points where specifically noted below require representatives of both the Superintendent and the Principal Certifier (e.g. Council) to authorise release.

Clause and description	Type	Submission/Inspection details	Submission/Notice times	Process held
SUBMISSIONS, Variations Design changes	H Superintendent and Principal Certifier	Details of design changes.	2 weeks before commencement	Setting out
SUBMISSIONS, Variations	H Superintendent	Details and Engineer's certification of proposed	28 days before delivery of	Material ordering and

Clause and description	Type	Submission/Inspection details	Submission/Notice times	Process held
Alternative systems	and Principal Certifier	alternative system.	components to site	delivery
SUBMISSIONS, Variations Alternative backfill material	H Superintendent and Principal Certifier	Details of material proposed.	5 days before backfilling	Backfilling
INSPECTIONS, Notice Set-out	H	Set-out for walls and footings.	3 days before inspection	Foundation excavation
INSPECTIONS, Notice Foundation	H	Foundation for footings.	3 days before inspection	Subsoil drainage
INSPECTIONS, Notice Subsoil drains	H Superintendent and Principal Certifier	Drainage line in place.	3 days before inspection	Concrete placing
INSPECTIONS, Notice Reinforced concrete footing	H	Footing formwork and reinforcement.	1 day before inspection	Concrete placing
INSPECTIONS, Notice Clean up before backfilling	W Superintendent and Principal Certifier	Completed clean up.	1 day before inspection	-

Note: H = Hold Point, W = Witness Point

4.2 ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Alignment	Set-out	1 contract	25 m sections	Survey
Footing	Concrete slump	1 contract	1 per load	AS 1012.3.1 (2014)
	Concrete strength	1 contract	1 per contract or 100 m ³ (whichever is the lesser)	AS 1012.9 (2014)
Reinforcing	Steel reinforcement coating mass and thickness	1 contract	1 per contract	AS/NZS 4680 (2006) Appendix G
Backfilling	Quality and plasticity	1 contract	1 per contract	AS 1289.3.3.1 (2009)
	Drainage layer grading	1 contract	1 per contract	AS 1141.11.1 (2020)
Foundations and backfill	Compaction: Generally	1 contract or 200 linear metres (whichever is the lesser)	3 per 200 linear metres	AS 1289.5.4.1 (2007)
	Compaction: Non-cohesive material	1 contract or 200 linear metres (whichever is the lesser)	3 per 200 linear metres	AS 1289.5.6.1 (1998)

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
		lesser)		

4.3 ANNEXURE - PAY ITEMS

This Annexure applies to Council projects. For private development works use of this schedule is optional, at the Superintendent's discretion.

Pay items	Unit of measurement	Schedule rate inclusions
0293.1 Excavation	m ³ , measured in bank volume of excavation. Determine the volume by the End Area Method using design cross-sectional areas calculated at each change in height or width of the wall.	Include in the rate for excavation: - Excavation and backfilling of all types of materials, with no separate rates for earth and rock. - The disposal of surplus material - The control of stormwater runoff. Do not include: - Drying out wet excavated material or replacement of over-excavation beyond the design cross-sectional limits defined above.
0293.2 Unsuitable material below foundation	m ³ , measured as bank volume of excavation below foundation level requiring removal and replacement.	All costs associated with excavating and removing unsuitable material below foundation level of the concrete footing, backfilling with replacement material and compaction to the foundation level.
0293.3 Reinforced concrete footing (alternative)	m ³ of reinforced concrete.	All costs associated with the supply and placement of all formwork, embedments, reinforcement (including starter bars, if required), concrete (including 50 mm mass concrete blinding layer), stepping of footing, joints, curing and backfilling to the footing. Take the volume from the drawings, excluding the volume of the 50 mm mass concrete blinding layer.
0293.3 Compacted subbase foundation (alternative)	m ³ , measured as the compacted volume.	All costs associated with placing, compacting and subbase trimming.
0293.4 Constructed crib wall	m ² , measured as face area of crib wall from the top of the footing to the top of the wall.	All costs associated with the supply and placement of materials and workmanship required to complete the documented structure including crib units, granular drainage layer behind the wall, earth backfill and capping, and subsoil drain at the base of the drainage layer.
Traffic management	Lump sum.	To 1101 <i>Traffic management</i> .
Erosion and sedimentation control		To 1102 <i>Control of erosion and sedimentation (Construction)</i> .
Concrete footings		Construction of footings, including concrete, reinforcement and formwork to 0319 <i>Auxiliary concrete works</i> .
Subsoil drainage		Drainage, including granular drainage layer, subsoil drainage pipe and filter material to 1171

Pay items	Unit of measurement	Schedule rate inclusions
		<i>Subsurface drainage or 1172 Subsoil and formation drains, as appropriate.</i>

4.4 ANNEXURE D - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS 1012		Methods of testing concrete
AS 1012.3.1	2014	Determination of properties related to the consistency of concrete - Slump test
AS 1012.9	2014	Compressive strength tests - Concrete, mortar and grout specimens
AS 1141		Methods for sampling and testing aggregates
AS 1141.11.1	2020	Particle size distribution - Sieving method
AS 1289		Methods of testing soils for engineering purposes
AS 1289.3.3.1	2009	Soil classification tests - Calculation of the plasticity index of a soil
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.6.1	1998	Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material
AS 1604		Specification for preservative treatment
AS 1604.1	2021	Sawn and round timber
AS 1720		Timber structures
AS 1720.1	2010	Design methods
AS 1720.2	2006	Timber properties
AS 1726	2017	Geotechnical site investigations
AS 3600	2018	Concrete structures
AS 3610		Formwork for concrete
AS 3610.1	2018	Specifications
AS 3850		Prefabricated concrete elements
AS 3850.3	2021	Civil construction
AS 4678	2002	Earth-retaining structures
AS/NZS 4680	2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 5605	2007	Guide to the safe use of preservative-treated timber
Austrroads ATS		Austrroads technical specifications
Austrroads ATS 5305	2023	Formwork for concrete
Austrroads ATS 5315	2023	Supply of special class concrete
Austrroads ATS 5320	2023	Placement of concrete
SWA Formwork	2014	General guide for formwork and falsework
Safe Work Australia	2018	Excavation work
EN 15804	2012	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
ISO 14025	2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 21930	2017	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services
Cessnock City Council		Development Engineering Handbook

5 ANNEXURE M – CESSNOCK CITY COUNCIL SPECIFIC CLAUSES

M1.	Variations to or non-conformances with Council's AUS-SPEC are to be evaluated with reference to the procedure in Council's <i>Development Engineering Handbook</i> . Acceptance is to be obtained in writing from: <ul style="list-style-type: none"> a) an authorised representative of Council's Director of Infrastructure and Engineering Services. 	Variation procedure
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M2.	This specification applies in addition to any development consent (DA) conditions. If there is any inconsistency, the conditions of consent shall prevail.	DA Conditions
M3.	Refer to the Cessnock City Council Development Engineering Handbook for final inspection, works-as-executed and handover requirements.	Completion

6 AMENDMENT HISTORY

0	15/01/2024	First Published
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