

QPRC



**QUEANBEYAN PALERANG
REGIONAL COUNCIL**

**DEVELOPMENT CONSTRUCTION
SPECIFICATION**

C222

PRECAST BOX CULVERTS

**VERSION 2 – APRIL 2018
TRIM REF: SF140543
C1850403**

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
VERSION 1	Specification Version 1 reference, notice of inspections added	C222.01	A	KD	12/03/10
	Specification Version 1 reference, standards updated	C222.02.1	A		
	Hold Point added	C222.03.3	A		
	Specification Version 1 reference	C222.04.1	A		
	Witness Point added	C222.06.1	A		
	Specification Version 1 reference	C222.07.3	A		
	Backfill to Clause C222.06 reference, Specification Version 1 reference, Witness Point added	C222.08.1	A		
	Specification Version 1 reference	C222.09	A		
	Specification Version 1 reference, Witness Point added	C222.10.2	A		
	Specification Version 1 reference, Specification Version 1 reference,	C222.11.1	A		
	Specification Version 1 reference, Annexure added	C222.13	A		
		C222.14.1			
		C222.20			

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		C222.21 C222-A			
VERSION 2	References to QPRC updated PCA Concurrence added	Various C222-A	M A	CS	16/03/2018

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GENERAL

C222.01 SCOPE

1. This Specification covers the installation of precast concrete box culverts and should be read in conjunction with the Specification for STORMWATER DRAINAGE - GENERAL. - VERSION 2

2. The work to be executed under this Specification consists of:

Extent of Work

- (a) preparation of foundations;
- (b) provision of bedding;
- (c) construction of base slabs;
- (d) installation of precast culvert units;
- (e) headwalls and wingwalls;
- (f) backfilling against structures;
- (g) provision and removal of coffer dams;
- (h) excavation of inlet and outlet channels.

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

Quality

4. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C222-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C222-A.

Inspections

C222.02 REFERENCE DOCUMENTS

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

*Documents
Standards
Test Methods*

(a) Council Specifications

- C213 - Earthworks - Version 2
- C220 - Stormwater Drainage – General - Version 2
- C224 - Open Drains, including Kerb and Gutter - Version 2
- C242 - Flexible Pavements - Version 2
- C271 - Minor Concrete Works - Version 2

(b) Australian Standards

- AS 1012 Methods of testing concrete
- AS 1012.9-1999 Determination of the compressive strength of concrete specimens
- AS 1379-2007 Specification and supply of concrete
- AS 1478 Chemical admixtures for concrete, mortar and grout

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AS 1478.1-2000	Admixtures for concrete
AS/NZS 1554	Structural steel welding
AS/NZS 1554.3:2008	Welding of reinforcing steel
AS 1597	Precast reinforced concrete box culverts -
AS1597.1:2010	Small culverts(not exceeding 1200 mm width and 900 mm depth)
AS1597.2:1996	Large culverts (from 1500 mm span and up to and including 4200 mm span and 4200 mm height)
AS 2758	Aggregates and rock for engineering purposes
AS 2758.1-1998	Concrete aggregates
AS 3600-2009	Concrete structures
AS 3610	Formwork for concrete
AS 3972-1997	Portland and blended cements
AS/NZS 4671:2001	Steel reinforcing materials
AS/NZS ISO 9001:2008	Quality Management Systems - Requirements.

(c) Other

AUSTROADS

AGPT04G/09- Guide to Pavement Technology, Part G4 – Geotextiles and Geogrids

National Precast Concrete Association Australia
NP:PCH 2009 Precast Concrete Handbook

MATERIALS

C222.03 CULVERT UNITS, LINK AND BASE SLABS

1. The supply and testing of precast reinforced concrete box culvert units, link and base slabs shall be in accordance with AS 1597.1 for small culverts not exceeding 1200mm width and 900mm depth and AS 1597.2 for large culverts from 1500mm span and up to and including 4200mm span and 4200mm height with the following alterations or additional requirements:

- Proof load testing shall be arranged by the Contractor in batches as specified in either AS 1597.1 or AS1597.2 as appropriate.
- Lifting holes, galvanised lifting points or steel lifting eyes shall be provided in the culvert units, link and base slabs.
- The end units shall have factory installed starter bars for headwall and wingwall construction.
- Delivery and unloading shall be the Contractor's responsibility.

2. The Supplier shall implement and maintain a Quality System in accordance with ISO 9002 to ensure materials, manufacture and proof load testing conform to the appropriate Standards.

3. A conformance certificate, to AS 1597.1 or AS 1597.2, for the box culvert units shall be submitted at least 3 working days prior to despatch. This action constitutes a **HOLD POINT**.

**Box Culvert
Units
(HP)**

4. Each unit shall be marked at time of manufacture with:

- Type and size
- Casting date
- Manufacturer's name

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(d) Inspection pass and date.

C222.04 CONCRETE

1. The concrete and reinforcement for cast-in-situ base slabs shall comply with the Specification for MINOR CONCRETE WORKS - VERSION 2. **Quality**

C222.05 SELECTED BACKFILL

1. The quality of selected backfill shall comply with the requirements in AS 1597.2. **Quality**

C222.06 ORDINARY BACKFILL

1. Ordinary backfill is material obtained from culvert excavations, cuttings and/or borrow areas which is in accordance with the requirements for the upper 1.0m of embankment construction as detailed in the Specification for EARTHWORKS - VERSION 2. **Quality**

CONSTRUCTION

C222.07 COFFER DAMS

1. At some sites it may be expedient for the Contractor to construct a coffer dam. All costs associated with the construction of coffer dams shall be borne by the Contractor. **Contractor's Costs**

2. Coffers shall be sufficiently watertight to prevent damage of the concrete by percolation or seepage through the sides, and shall be taken sufficiently below the level of the foundations to prevent loosening of the foundation materials by water rising through the bottom of the excavation. Coffers shall be adequately braced and shall be so constructed that removal will not weaken or damage the structure. **Construction**

3. A coffer dam may be constructed to the actual size of the reinforced concrete invert slab and used as side forms for the concrete. The details of the coffer dam and formwork, and the clearances proposed shall be subject to the approval of the Superintendent. This action constitutes a **WITNESS POINT**. The Contractor shall be responsible for the successful construction of the work. **Contractor's Responsibility (WP)**

4. Coffers which have tilted or have moved laterally during sinking, shall be righted or enlarged to provide the clearances specified. This work will be at the Contractor's expense. **Specified Clearances**

5. No timber or bracing shall be left in the concrete or in the backfill of the finished structure. Coffers, including temporary piles, shall be removed at least to the level of the invert after completion of the structure. **Removal**

C222.08 EXCAVATION

1. Excavation shall be carried out in accordance with the provisions in the Specification for STORMWATER DRAINAGE - GENERAL. – VERSION 2. **Specification**

2. The trench width shall be the width of the base slab plus 150mm minimum each side. **Trench Width**

C222.09 FOUNDATIONS

1. Rock foundations shall be neatly excavated to the underside of the mass concrete or selected fill bedding shown on the Drawings. All minor fissures shall be thoroughly cleaned out and refilled with concrete, mortar or grout. All loose material shall be removed.

Rock Foundations

2. Where rock is encountered over part of the foundation only, or lies within 300mm below the underside of the mass concrete or selected fill, all material shall be removed to a depth of 300mm below the mass concrete or selected fill for the full width of the foundation over the length where the rock is encountered. This additional excavation shall be backfilled with ordinary backfill material in accordance with Clause C222.06.

Additional Excavation

3. Over-excavation or uneven surfaces shall be corrected with mass concrete so as to provide a uniform surface at least 50mm above the highest points of rock.

Uniform Surface

4. Earth foundations shall be finished to line and level to the underside of bedding shown on the Drawings. Care shall be taken to avoid disturbing material below this level.

Line and Level

5. All soft, yielding or unsuitable material shall be removed and replaced with ordinary backfill material as directed by the Superintendent and backfilled in accordance with the Specification for STORMWATER DRAINAGE - GENERAL - VERSION 2. This action constitutes a **WITNESS POINT**.

Unsuitable Material (WP)

C222.10 BEDDING

(a) Cast-In-Situ Base Slabs

1. No bedding material shall be placed until the foundations have been inspected and approved by the Superintendent.

Inspection

2. Bedding shall be either mass concrete or lightly bound DGB20 in accordance with the Specification for FLEXIBLE PAVEMENTS - VERSION 2, whichever is shown on the Drawings.

Type

3. Mass concrete bedding shall be of the same compressive strength as for the base slab and shall not be less than 50mm thick over any point in the foundation. It shall be laid to the line and level of the underside of the base slab to a tolerance of ± 10 mm in level and ± 5 mm in line. The bedding shall be finished to a smooth surface.

Mass Concrete

(b) Precast Base Slabs

1. Precast base slabs, U-shaped culvert units and one piece culvert units shall be supported on a bed zone of selected backfill of minimum compacted depth 150mm in accordance with AS 1597.2.

Selected Fill

C222.11 CAST-IN-SITU BASE SLABS

1. Cast-in-situ base slabs shall be constructed to the dimensions shown on the Drawings and in accordance with the requirements of the Specification for MINOR CONCRETE WORKS - VERSION 2. The invert levels shall be within -10mm to +10mm of the design level, grade 5mm in 2.5m (1 in 500) and plan position ± 50 mm.

Construction

2. Recesses to accommodate the walls of the precast crown units shall be formed in the base slab to the dimensions shown on the Drawings.

Recesses for Walls

C222.12 INSTALLATION OF PRECAST UNITS

1. Precast units shall not be installed until the base slab has attained a minimum compressive strength of 20MPa. *Minimum Strength*
2. Precast crown units shall be placed on a bed of mortar in the recesses in the base slab. Any gaps between the side walls and the sides of the recesses shall be packed with cement mortar. Lifting holes and butt joints between units shall be packed or sealed with cement mortar or grout. *Mortar Bed in Recess*
3. Before placement of top slabs on U-shaped units or link slabs on adjacent crown units, the bearing areas of the supports shall be thoroughly cleaned and covered with a bed of mortar of minimum thickness 5mm after placement of precast unit. *Mortar Bed on Supports*
4. Steel lifting hooks shall be cut flush with the surface of the concrete, cleaned to bright metal and coated with two coats of coal tar epoxy. Alternatively, they shall be cut off 12mm below the surface of the unit and the recess sealed with epoxy mortar. *Lifting Hooks*
5. In the case of multi-cell culverts, a nominal 15mm gap shall be provided between adjacent cells. This gap shall be filled with cement mortar or grout. *Gap Between Cells*
6. All mortar joints shall be protected from the sun and cured in an approved manner for not less than 48 hours. *Curing of Joints*
7. All external surfaces of joints between precast crown units, both laterally and longitudinally, shall be covered full length, and minimum 250mm width, with strips of non-woven geotextile of minimum mass 270 g/m² in accordance with AUSTROADS *Guide to Geotextiles*. *Joint Covering*
8. The Contractor shall present the laid and jointed units for inspection by the Superintendent prior to commencement of trench backfilling. This is a **HOLD POINT**. *Inspection by Superintendent (HP)*

C222.13 BACKFILL

1. All bracing and formwork shall be removed prior to backfilling. *Removal of Formwork*
2. Selected backfill, in accordance with the Specification for EARTHWORKS - VERSION 2, shall be placed in the side zones of the box culverts and wingwalls, and to a depth of 300mm in the overlay zone of the culverts, in layers with a maximum compacted thickness of 150mm in accordance with the backfilling and compaction requirements of AS 1597.2. The remainder of the excavation shall be backfilled with ordinary embankment fill in accordance with the Specification for EARTHWORKS - VERSION 1. *Selected Backfill*
3. No backfill shall be placed against wingwalls until 21 days after casting. This action constitutes a **WITNESS POINT**. *Wingwalls (WP)*
4. Backfill layers shall be placed simultaneously on both sides of the culvert with a maximum 600mm level difference to avoid differential loading. Backfilling and compaction shall commence at the wall and proceed away from it. *Sequence*
5. Where the slopes bounding the excavation are steeper than 4:1, they shall be cut in the form of successive horizontal terraces of at least 1m width before the backfill is placed. *Horizontal Terraces*

C222.14 EXCAVATION OF INLET AND OUTLET CHANNELS

1. Excavation of inlet and outlet channels shall be carried out as shown on the Drawings and shall extend to join the existing stream bed in a regular manner as detailed in the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER - VERSION 2.

Extent

C222.15 CONSTRUCTION LOADING ON CULVERTS

1. Construction vehicles and plant shall not pass over the culvert until 28 days after the casting of the base slab or until the cylinder compressive strength of the base slab concrete has reached 32MPa.

Traffic Over Culvert

2. Construction vehicle loads on culverts for various design fill heights shall be in accordance with AS 1597.2.

Loading Restrictions.

LIMITS AND TOLERANCES

C222.16 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C222.1 below:

Item	Activity	Limits/Tolerances	Spec Clauses
1.	Mass Concrete Correction		
	a) Over highest points of rock	50mm	C222.09
2.	Mass Concrete Bedding		
	a) Level	± 10mm	C222.10
	b) Line	± 5mm	C222.10
3.	Culvert Location		
	a) Invert Level	±10mm	C222.11
	b) Grade	5mm in 2.5m (1 in 500)	C222.11
	c) Plan Position	±50mm	C222.11

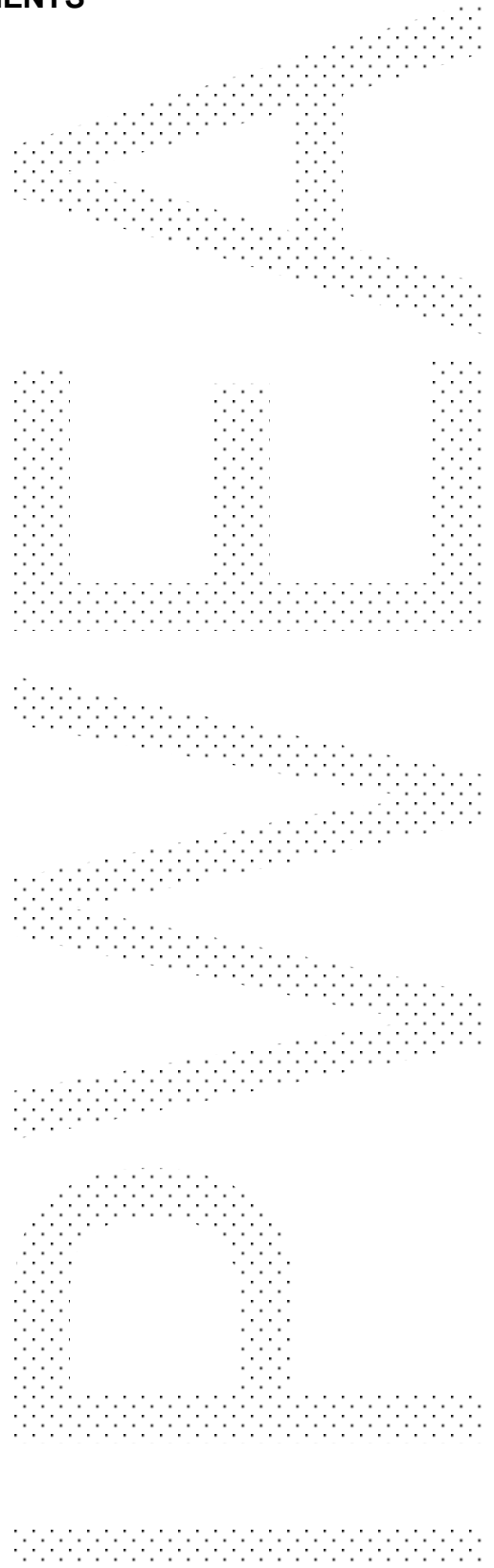
Table C222.1 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C222.17 RESERVED

C222.18 RESERVED

C222.19 RESERVED



MEASUREMENT AND PAYMENT

C222.20 DEDUCTIONS

1. Payment for in-situ concrete work shall be made at the scheduled rates provided the concrete meets the strength requirements specified in the Specification for MINOR CONCRETE WORKS - VERSION 2.
2. Where any concrete does not reach the strength specified, the scheduled rate of payment shall be reduced by 2% for each 1%, or fraction thereof, by which the strength of the specimen fails to reach the specified strength, up to a maximum deficiency of 10%.
3. If the deficiency in strength exceeds 10%, the concrete represented by the specimens may be rejected, in which case no payment will be made.

C222.21 PAY ITEMS

1. Payment shall be made for the activities associated with completing the work detailed in this Specification in accordance with Pay Items C222(a) and C222(b).
2. A lump sum price shall not be accepted.
3. 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.
4. Excavation for box culverts is measured and paid in accordance with the Specification for STORMWATER DRAINAGE – GENERAL - VERSION 2.
5. Excavation for inlet and outlet channels is measured and paid in accordance with the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER - VERSION 2.
6. Base slab bedding using lightly bound DGB20 is measured and paid in accordance with this Specification and not in the Specification for FLEXIBLE PAVEMENTS - VERSION 2.
7. Cast-in-situ base slabs are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS - VERSION 2.
8. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS - VERSION 2.
9. Ordinary embankment backfill is measured and paid in accordance with the Specification for EARTHWORKS - VERSION 2.
10. Cast-in-situ headwalls and wingwalls are measured and paid in accordance with the Specification for DRAINAGE STRUCTURES - VERSION 2.

Pay Item C222(a) IN-SITU BASE SLAB

1. The unit of measurement shall be the cubic metre of reinforced concrete in place (excluding the mass concrete bedding layer).
2. The width, length and depth of the slab shall be as specified on the Drawings or as directed by the Superintendent.
3. The schedule rate shall include foundation preparation, bedding and all activities associated with the construction of the base slab.
4. The schedule rate does not include excavation.

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Pay Item C222(b) PRECAST CONCRETE BOX CULVERTS

1. The unit of measurement shall be linear metre of the actual length installed.
2. The Schedule Rate shall include supply, installation and jointing of the precast units, selected backfilling and testing of the units.

ANNEXURE C222- A

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
MATERIALS			
Culvert Units, Link and Base Slabs			
C222.03.3 - Box Culvert Units	Provide conformance certificate	3 working days prior to dispatch	Superintendent – PCA concurrence required
BEDDING			
Bedding			
C222.10.b – Cast- in-situ Base Slabs	Finish to a smooth surface	1 working day	Superintendent
C222.10.c - Precast Base Slabs	Inspection	1 working day	Superintendent
C222.12.8 – Inspection by Superintendent	Call for inspection	1 working day	Superintendent – PCA concurrence required

Summary of WITNESS POINTS

Clause title/Item	Requirement	Notice for inspection
CONSTRUCTION		
Coffer Dams		
C222.07.3 - Contractor's Responsibility	Provide details of coffer dam and formwork	5 working days prior to construction
Foundations		
C222.09.5 - Unsuitable Material	Replace with ordinary backfill	Progressive
Backfill		
C222.13,3 - Wingwalls	21 day curing prior to backfill	Progressive