

**CONSTRUCTION
SPECIFICATION**

C222

PRECAST BOX CULVERTS

SPECIFICATION C222 - PRECAST BOX CULVERTS

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CITATION

This document is named “Kempsey Shire Council, Construction Specification C222 – Precast Box Culverts”.

ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on PMHC AUS-SPEC. Parts of the AUS-SPEC document that remain are still subject to the original copyright.

VERSIONS, C222 Precast Box Culverts

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Infrastructure
1.0	Version 1 – First Draft Version		March 2025	

SPECIFICATION C222: PRECAST BOX CULVERTS

GENERAL

C222.01 SCOPE

1. This Specification covers the installation of precast concrete box culverts and should be read in conjunction with Specification C220 STORMWATER DRAINAGE - GENERAL.

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 Development Construction Specification – Quality Control Requirements (CQC).

Quality

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
- C220 - Stormwater Drainage - General
- C224 - Open Drains including Kerb and Gutter
- C242 - Flexible Pavements
- C271 - Minor Concrete Works

(b) Australian Standards

- AS 1597.1 - Precast reinforced concrete box culverts - Small culverts (not exceeding 1200 mm span and 1200 mm height)
- AS 1597.2 - Precast reinforced concrete box culverts - Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
- AS/NZS ISO 9001 Quality Management Systems

(c) Other Standards

AUSTROADS

AGPT04G-09 - Guide to Pavement Technology – Part 4G: Geotextiles and Geogrids

(e) Standard Drawings

Kempsey Shire Council Standard Drawings ASD 300 to ASD328 – Drainage Series.

C222.03 ABBREVIATIONS

C222.04 DEFINITIONS

MATERIALS

C222.05 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 span and 1200mm height and AS 1597.2 for large culverts exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height with the following alterations or additional requirements:

- (a) Proving load testing shall be arranged by the Principal Contractor in batches as specified in either AS 1597.1 or AS1597.2 as appropriate.
- (b) Lifting holes, galvanised lifting points or steel lifting eyes shall be provided in the culvert units, link and base slabs.
- (c) The end units shall have factory installed starter bars for headwall and wingwall construction.

Supply

2. The Supplier shall implement and maintain a Quality System in accordance with ISO 9001 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 to the Principal Certifier at least 5 working days prior to despatch. This is a **HOLD POINT**.

HOLD POINT

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

- (a) Type and size
- (b) Casting date

- (c) Manufacturer's name
- (d) Inspection pass and date.

C222.06 CONCRETE

- | | |
|--|----------------|
| 1. The concrete and reinforcement for cast-in-situ base slabs shall comply with Specification C271 MINOR CONCRETE WORKS. | <i>Quality</i> |
|--|----------------|

C222.07 SELECTED BACKFILL

- | | |
|--|----------------|
| 1. The quality of selected backfill shall comply with the requirements in AS 1597.2 and Specification C213 EARTHWORKS. | <i>Quality</i> |
|--|----------------|

C222.08 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 Specification C213 EARTHWORKS. | <i>Quality</i> |
|---|----------------|

CONSTRUCTION

C222.09 COFFER DAMS

- | | |
|---|--|
| 1. At some sites it may be expedient for the Principal Contractor to construct a coffer dam. All costs and environmental approvals associated with the construction of coffer dams shall be borne by the Principal Contractor. | <i>Work Method</i> |
| 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. | <i>Construction</i> |
| 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 Certifying Consultant, but the Principal Contractor shall be responsible for the successful construction of the work. | <i>Principal Contractor's Responsibility</i> |
| 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 Principal Contractor's expense. | <i>Specified Clearances</i> |
| 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. | <i>Removal</i> |

C222.10 EXCAVATION

- | | | |
|----|---|---|
| 1. | Excavation shall be carried out in accordance with the provisions in Specification C220 STORMWATER DRAINAGE – GENERAL including adherence to Hold and Witness Points. | HOLD POINT /
WITNESS
POINT |
| 2. | The trench width shall be the width of the base slab plus 300mm minimum each side. | Trench Width |

C222.11 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. | 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 foundation material shall be removed and replaced with ordinary backfill material as directed by the Principal Certifier, in conjunction with a qualified Geotechnical Engineer, and backfilled in accordance with Specification C220 STORMWATER DRAINAGE - GENERAL. | Unsuitable
Foundation
Material |
| 6. | The Principal Contractor will adhere to all Hold Points and Witness Points relating to foundation inspection and unsuitable foundation material as specified in C220 Stormwater Drainage – General. | HOLD POINT /
WITNESS
POINT |

C222.12 BEDDING

(a) Cast-In-Situ Base Slabs

- | | | |
|----|---|-------------------|
| 1. | No bedding material shall be placed until the foundations have been inspected and approved by the Principal Consultant in conjunction with a qualified Geotechnical Engineer. | Inspection |
| 2. | Bedding shall be either mass concrete or lightly bound DGB20 in accordance with Specification C242 FLEXIBLE PAVEMENTS, 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*

C222.13 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 Specification C271 MINOR CONCRETE WORKS. 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*

C222.14 INSTALLATION OF PRECAST UNITS

1. Precast units shall not be installed until the base slab has attained a minimum compressive strength of 20 MPa. *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. After installation of the precast units, all external surfaces of joints between precast units, shall be sealed with a 250mm wide membrane or rubberised asphalt integrally bonded to polypropylene mesh (eg. Bituthene or approved equivalent), of minimum 1.6mm thickness unless shown otherwise on the drawings. *Joints between precast units*
- Seal lifting holes to prevent ingress of materials.
4. 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*
5. Steel lifting hooks shall be cut flush with the surface of the concrete, cleaned to bright metal and coated with two coats of epoxy to prevent corrosion of the steel. Alternatively, they shall be cut off 12mm below the surface of the unit and the recess sealed with epoxy mortar. *Lifting Hooks*
6. 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*

7. All mortar joints shall be protected from the sun and cured in an approved manner for not less than 48 hours. *Curing of Joints*

8. The Principal Contractor shall present the laid and jointed precast units for inspection by the Principal Certifier prior to commencement of trench backfilling. This is a **WITNESS POINT**. *Inspection by Principal Certifier*

**WITNESS
POINT**

C222.15 BACKFILL

1. All bracing and formwork shall be removed prior to backfilling. *Removal of Formwork*

2. Selected backfill 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 Specification C213 EARTHWORKS. *Selected Backfill*

3. No backfill shall be placed against wingwalls until 21 days after casting, or until the concrete has achieved at least 75% of the 28 day concrete strength. *Wingwalls*

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*

C222.16 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 Specification C224 OPEN DRAINS INCLUDING KERB AND GUTTER. *Extent*

C222.17 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 the specified concrete design strength. *Traffic Over Culvert*

2. Construction vehicle loads on culverts for various design fill heights shall be in accordance with AS 1597.2. The Principal Contractor shall design and provide adequate protective measures for the crossings over box culverts and shall submit these details to the Principal Certifier for prior approval. This is a **HOLD POINT**. *Loading Restrictions*
Hold Point

LIMITS AND TOLERANCES

C222.18 SUMMARY OF TOLERANCES

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

Item	Activity	Tolerance	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