



ACT
Government

PRECAST BOX CULVERTS 03C

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INFRASTRUCTURE
TECHNICAL
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03 - UNDERGROUND SERVICES

Transport Canberra and
City Services

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CONTENTS

- 1 PRECAST BOX CULVERTS..... 4**
- 1.1 General 4
 - 1.1.1 Responsibilities..... 4
 - 1.1.2 Cross references..... 4
 - 1.1.3 Referenced documents 4
 - 1.1.4 Standards 5
 - 1.1.5 Interpretation..... 5
 - 1.1.6 Hold points and witness points 6
- 1.2 Materials 7
 - 1.2.1 General..... 7
 - 1.2.2 Precast concrete..... 7
- 1.3 Execution 8
 - 1.3.1 Provision for traffic..... 8
 - 1.3.2 Site establishment..... 8
 - 1.3.3 Handling, delivery and storage..... 8
 - 1.3.4 Excavation 8
 - 1.3.5 Foundations..... 9
 - 1.3.6 Installation..... 9
 - 1.3.7 Backfill 11
 - 1.3.8 Finishing 11
- 1.4 Completion 12
- 2 MEASUREMENT AND PAYMENT13**
- 2.1 Measurement 13
- 2.2 Pay items 14

LIST OF TABLES

- Table 3C-1 Hold point table..... 6
- Table 3C-2 Witness point table 6
- Table 3C-3 Pay items table 14

1 PRECAST BOX CULVERTS

1.1 General

1.1.1 Responsibilities

1.1.1.1 General

Requirement: Provide precast box culvert units including construction of base slabs as documented.

1.1.2 Cross references

General: The following documents are related to this Specification.

1.1.2.1 ACT Legislation

Road Transport (General) Act

Public Roads Act

Scaffolding and Lifts Act

Scaffolding and Lifts Regulation

Work Health and Safety Act

1.1.2.2 Specifications

Requirement: Conform to the following:

MITS 00	Preliminaries
MITS 01	Traffic Management
MITS 02	Earthworks
MITS 03A	Trenching for underground services
MITS 03B	Pipe drainage
MITS 04	Flexible pavement construction
MITS 06	Concrete kerbs, footpaths and minor works
MITS 08	Incidental works
MITS 09	Landscape
MITS 10	Concrete works

1.1.3 Referenced documents

1.1.3.1 Standards

General: The following documents are incorporated into this Specification by reference:

Australian standards

AS 1379	Specification and supply of concrete
AS 1478	Chemical admixtures for concrete, mortar and grout
AS 1478.1	Admixtures for concrete
AS/NZS 1554	Structural steel welding

AS/NZS 1554.3	Welding of reinforcing steel
AS 1597	Precast reinforced concrete box culverts
AS 1597.1	Small culverts (not exceeding 1200mm span and 1200mm height)
AS 1597.2	Large culverts (exceeding 1200mm span or 1200mm height and up to and including 4200m span and 4200mm height)
AS 2758	Aggregates and rock for engineering purposes
AS 2758.1	Concrete aggregates
AS 3600	Concrete structures
AS 3610	Formwork for concrete
AS 3610.1	Documentation and surface finish
AS 3972	General purpose and blended cements
AS/NZS 4671	Steel reinforcing materials
AS/NZS ISO 9001	Quality management systems – Requirements

1.1.3.2 Other publications

Austrroads

AGPT	Austrroads Guide to Pavement Technology
AGPT04G	Part 4G: Geotextiles and Geogrids

National Precast Concrete Association Australia

NP:PCH	Precast Concrete Handbook
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1.1.4 Standards

1.1.4.1 General

Small culverts including all link slabs: To AS 1597.1.

Large culverts including all link slabs: To AS 1597.2.

Precast culverts: To the recommendations in *NP: PCH Precast Concrete Handbook*.

Proprietary products: To *TCCS Products previously considered for use list*

1.1.5 Interpretation

1.1.5.1 Abbreviations

General: For the purposes of this Specification the abbreviations given below apply.

RCBC: Reinforced Concrete Box Culvert

TCCS: Transport Canberra and City, ACT Government, and its successors.

1.1.5.2 Definitions

General: For the purposes of this Specification the definitions given in AS 1597.1, AS 1597.2, as appropriate and below apply:

Large culvert unit: Culvert unit with a span exceeding 1200mm up to 4200mm and a height from 1200mm up to 4200mm.

Precast box culvert: Includes link slabs and precast reinforced concrete crown sections.

Small culvert unit: Culvert unit with a span up to 1200mm and a height up to 1200mm.

1.1.6 Hold points and witness points

1.1.6.1 Notice

General: Give written notice to the Authorised Person so that the documented inspection and submissions may be made to the **Hold point table** and the **Witness point table**.

Table 3C-1 Hold point table

Item	Clause title	Requirement	Notice for inspection	Release by
Materials				
3C.1	Precast Concrete - General	Submit certificate of conformance	3 working days prior to dispatch	Authorised Person
Execution				
3C.2	Handling, delivery and storage - General	Inspect box culvert units for dimensional accuracy and defects	3 working days prior to installation	Authorised Person
3C.3	Installation – Cast insitu base and link slabs	Submit certification that installation of reinforcement and compliance of formwork conforms with MITS 10 Concrete works and the Drawings and give notice for inspection.	1 working day before pouring concrete	Authorised Person
3C.4	Installation - Placement of units	Present joints and seals for before backfilling	1 working day	Authorised Person
3C.5	Completion - Construction loading on culvert	Provide certification base slab concrete has achieved minimum compressive strength of 32MPa.	28 days	Authorised Person

Table 3C-2 Witness point table

Item	Clause title	Requirement	Notice for inspection
Execution			
3C.1	Installation - Cast insitu base slabs	Supply certification that concrete has achieved minimum compressive strength of 20MPa	1 working day
3C.2	Backfill - General – Balancing backfill	Backfill layers simultaneously on both sides to avoid differential loading	1 working day

1.2 Materials

1.2.1 General

1.2.1.1 Materials and Components

Pipes: To *MITS 03B Pipe drainage*.

Structures: To *MITS 03D Drainage structures*.

Concrete, reinforcement and formwork: To *MITS 10 Concrete works*.

Cast in inserts: Provide structural steel cast in lifting items as shown on the Drawings.

1.2.2 Precast concrete

1.2.2.1 General

Concrete: To *AS 1379*.

Type of joint: Butt joint.

Certification: Provide precast box culvert unit certificate of conformance with the following:

- > Small culvert units: To *AS 1597.1*.
- > Large culvert units: To *AS 1597.2*.

This is a **HOLD POINT**.

Marking: Mark each unit at time of manufacture with the following, using 75mm high letters in an easily visible location which is hidden once the unit is installed:

- > Type and size.
- > Casting date.
- > Manufacturer's name.
- > Inspection pass date.
- > Batch number.

1.3 Execution

1.3.1 Provision for traffic

1.3.1.1 General

Requirement: Conform to *MITIS 01 Traffic Management*.

1.3.2 Site establishment

1.3.2.1 Survey

Requirement: Conform to *MITIS 00A General Requirements*.

1.3.3 Handling, delivery and storage

1.3.3.1 General

Lifting: Provide lifting holes, galvanized lifting points or steel lifting eyes in the culvert units, link and base slabs for all culverts larger than 600 x 450. Handle and load precast box culvert units to prevent any damage to the units.

Delivery and storage: Do not transfer completed precast box culvert units from the place of manufacture until the following is achieved:

- > 70% of the minimum concrete strength.
- > Small culvert units: Cured to *AS 1597.1 clause 2.6.3*.
- > Large culvert units: Cured to *AS 1597.2 clause 2.6.3*.

Inspection: Inspect batches of precast box culvert units for dimensional accuracy and defects following delivery to installation location. Conform to the following:

- > Small culvert unit: To *AS 1597.1*.
- > Large culvert unit: To *AS 1597.2*.

This is a **HOLD POINT**.

1.3.4 Excavation

1.3.4.1 General

Excavation: Conform to *MITIS 03A Trenching for underground services* and *MITIS 02B Bulk Earthworks*.

Batter slopes: Evenly transitioned over 10m length from the edge of the wingwall to match culvert wingwall slopes.

1.3.5 Foundations

1.3.5.1 Rock foundations

Level: Excavate foundations in rock neatly to the underside of the bedding as shown on the drawings.

Prepare: Thoroughly clean out all minor fissures and refill with concrete, mortar or grout. Remove all loose material.

Rock: If rock is encountered over part of the foundation, excavate the whole of the foundation to a depth of 300mm below the level of the bottom of the base concrete slab.

Backfill: Replace and compact this additional excavation with backfill material to provide uniform bearing conditions. Conform to *MITIS 03A Trenching for underground services*, Grading limits for bed and haunch zones (stormwater) table.

1.3.5.2 Bedding

Bedding: Unless note otherwise, provide DGB20 bedding for cast insitu base slabs:

- > DGB20 material: To *MITIS 04 Flexible pavement construction*.
- > Lightly bound and compacted: To *MITIS 03A Trenching for underground services*.
- > Dimensions: As shown on the drawings.
- > Place to the line and level of the underside of the base slab: $\pm 10\text{mm}$ in level and $\pm 5\text{mm}$ in line.
- > Finish: Smooth surface finish by screeding.

1.3.6 Installation

1.3.6.1 General

Inlet and outlet invert levels: As shown on the drawings $\pm 10\text{mm}$ and smooth, uniform gradient throughout each culvert length.

Installation: Conform to the following:

- > Small culvert units: To *AS 1597.1 Section 4*, the Drawings, *MITIS 10 Concrete works* and this Specification.
- > Large culvert units: To *AS 1597.2 Section 5*, the Drawings, *MITIS 10 Concrete works* and this Specification.

This is a **HOLD POINT**.

1.3.6.2 Cast insitu base and link slabs

Requirement: Construct cast insitu base slabs to the dimensions shown on the Drawings and in conformance with this Specification.

Formwork and reinforcement: Certify that the installation of reinforcement and compliance of formwork conforms with *MITIS 10 Concrete works* and the Drawings. The placed reinforcement shall be inspected by the Authorised Person prior to the concrete being poured.

This is a **HOLD POINT**.

Traffic: Prevent construction or public traffic over the base slab within 7 days of placement.

Tolerance: Conform to the following:

- > Invert levels: - 10mm, + 10mm.
- > Grade: 5mm in 2.5m (1 in 500).
- > Plan position: ± 50mm.
- > Surface irregularities: < 5mm abrupt and 8mm over a 3m straightedge.

Recesses: Form recesses to accommodate the walls of the precast crown units in the base slab to the dimensions shown on the drawings.

Minimum strength requirement: Provide NATA test certificate to confirm the base slab has attained the required compressive strength specified on the Drawings. Do not install precast units until after the base slab has attained the minimum compressive strength.

This is a **WITNESS POINT**.

1.3.6.3 Placement of units

Pre-cast or cast in situ base slabs: When two or more rows of parallel box sections are to be constructed together, they shall be laid on a single base slab.

Temporary plug: If required, seal the ends of the culvert with a temporary plug to exclude water, sand or other deleterious materials.

Cement mortar: 0.4 : 1 : 3, Water : Cement : Sand ratio by mass.

Mortar bed in recess: Install precast crown units on a bed of cement mortar in the recesses in the base slab. Pack any gaps between the side walls and the sides of the recesses with cement mortar.

Voids: Seal lifting holes and butt joints between the ends of units with cement mortar or grout of a consistency that ensures the void is filled.

Mortar bed on supports: Thoroughly clean the bearing areas of the supports before placement of top slabs on U-shaped units or link slabs on adjacent crown units and cover with a bed of mortar.

Thickness of mortar bed: > 5mm after placement of precast units.

Lifting hooks: Cut lifting hooks and seal the exposed steel with an anti corrosion coating approved by the Authorised Person.

Multi-cell: In the case of multi-cell culverts, provide a gap between adjacent cells as shown on the drawings or typically 15mm. Fill this gap with cement mortar or grout.

Curing of joints: Protect all mortar joints from the sun and cure in an approved manner > 48 hours prior to placing backfill.

Joint covering: Cover all external surfaces of joints between precast crown units, both laterally and longitudinally for the full length, and minimum 250mm width, with strips of non-woven geotextile of minimum mass 270 grams/m² in conformance with *AGPT04G/09*.

Check inspection: Prior to backfill placing inspect and make good all seals, joints and levels.

This is a **HOLD POINT**.

1.3.7 Backfill

1.3.7.1 General

Removal of formwork: Remove all bracing and formwork prior to backfilling.

Embankments: Unless otherwise specified, construct culverts in conjunction with or prior to filling embankments.

Zones: Place selected backfill in the side zones of the box culverts and wingwalls, and to a depth of 300mm in the overlay zone of the culverts.

Backfill: Conform to *MITS 03A Trenching for underground services, Grading limits for side and overlay zones (stormwater) table*. Alternatively, cementitious flowable fill with a compressive strength in the range 0.6Mpa to 3 Mpa may be used. Backfilling shall not take place until the cast-in place reinforced concrete base slab, if any, has reached its specified 28-day strength.

Compaction: Compact in layers > 150mm compacted thickness.

Ordinary backfill: Backfill the remainder of the excavation with General Fill in conformance with *MITS 02B Bulk earthworks*.

Wingwalls: Do not place backfill against wingwalls until concrete has gained sufficient strength as directed in the Drawings.

Subsoil drain: Provide a subsoil drain enclosed in a seamless tubular filter fabric at the outer walls of the precast crown sections and at wingwalls as shown on the drawings and in conformance with *MITS 03J Subsoil and foundation drains*.

Balancing backfill: Place backfill layers simultaneously on both sides of the culvert with a maximum 600mm level difference to avoid differential loading. Commence backfilling and compaction at the wall and proceed away from it.

This is a **WITNESS POINT**.

Horizontal terraces: If the slopes bounding the excavation are steeper than 4H:1V, cut benches in the form of successive horizontal terraces at least 1m in width before the backfill is placed.

1.3.8 Finishing

1.3.8.1 General

Requirement: Remove and replace a precast box culvert if required for any of the following reasons:

- > Any culvert is not within tolerances true to line.
- > The level or grade shows settlement of the culvert after installation.
- > Damage occurs during backfilling, compaction or subsequent operations.

Flushing: Flush clean all culverts from end to end and maintain in proper working order until the completion of works.

1.3.8.2 Construction loading on culverts

Constraint: Prevent the passage of construction vehicles and plant over the culvert until 28 days after the casting of the base slab or until the compressive strength of the base slab concrete has reached 32MPa.

This is a **HOLD POINT**.

Construction vehicles or plant: Where construction vehicles or plant with axle loads > 50t submit proposed procedure for prevention of early loading and method for approval.

Loading restrictions: Provide construction vehicle loads on culverts for various design fill heights to conform to manufacturers specifications.

1.4 Completion

1.4.1.1 Submissions

Work as Executed Records: To *MITS 00B Quality Requirements*.

2 MEASUREMENT AND PAYMENT

2.1 Measurement

2.1.1.1 General

Payments made to the Bill of Quantities: To *MIT 00A General requirements*, this Specification, the drawings and **Pay items**.

2.1.1.2 Methodology

The following methodology will be applied for measurement and payment:

- > Allow for all work, materials, testing and quality assurance requirements in each Pay Item.
- > Embankment backfill: To *MIT 02B Bulk earthworks*.
- > Excavation, bedding, support and backfill material for precast reinforced box culverts: Conform to *MIT 03A Trenching for underground services*, paid under this Specification.
- > Backfill under roads, paths and driveways: Extra over to *MIT 03H Road openings and restorations*.
- > Cast-insitu headwalls and wingwalls: To *MIT 03D Drainage structures*.
- > Subsoil drains: To *MIT 03J Subsoil and foundation drains*.
- > Excavation for inlet and outlet channels: To *MIT 02B Bulk earthworks*.
- > Miscellaneous minor concrete work not included in the pay items in this Specification: Conform to *MIT 10 Concrete works*.
- > All costs associated with removal of water from excavations shall be included within respective excavation rates for stormwater pipes and drainage structures.
- > No Additional payment will be made for excavation in rock, overbreak of trench due to ground conditions or over excavation of trenches.

2.1.1.3 Deductions

Insitu concrete strength: Deductions made as follows:

- > Scheduled rate of payment is 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%.
- > If the deficiency in strength exceeds 10%, the concrete represented by the specimens may be rejected, in which case no payment will be made.

2.2 Pay items

Table 3C-3 Pay items table

Item No	Pay items	Unit of measurement	Schedule of rates scope
3C.1	Cast insitu base slab	Number	<p>All activities associated with the construction of cast insitu base slabs including excavation for the slab in all types of material encountered including rock, over excavation for bedding, shoring, foundation preparation, bedding, supply and installation of concrete, reinforcement and formwork.</p> <p>A separate pay item shall be included in the Contract for each culvert including a description of the slab dimensions. For example;</p> <p>3C.1.1 Culvert 1: 1200x3000x200 base slab 3C.1.2 Culvert 2: 2x5000x4500x250 base slab Etc...</p>
3C.2	Precast RCBC	Number	<p>All activities associated with the construction of Precast RCBC's including supply and installation of the units.</p> <p>This pay item shall include excavation for the units in all types of material encountered including rock, shoring, jointing including "sand bands", sealing, backfilling and compaction.</p> <p>A separate pay item shall be included in the Contract for each culvert dimension. For example;</p> <p>3C.2.1 900Wx450H 3C.2.2 3000Wx1200H Etc...</p>
3C.3	Cast insitu link slab	Number	<p>All activities associated with the construction of cast insitu link slabs including excavation for the slab in all types of material encountered including rock, over excavation for bedding, foundation preparation, bedding, supply and installation of concrete, pinning, reinforcement and formwork.</p> <p>A separate pay item shall be included in the Contract for each culvert including a description of the slab dimensions. For example;</p> <p>3C.3.1 Culvert 1: 5000x4500x200 link slab Etc...</p>
3C.4	Modify precast RCBC	Number of precast units modified	<p>All activities extra over Precast RCBC associated with the adjustment of precast units to suit splays or skewed headwalls as specified.</p> <p>This pay item shall include cutting, sealing, finishing and legal disposal of off-cuts.</p>



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