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SPECIFICATION

222

PRECAST BOX CULVERTS

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
1	Bedding	222.10 (a) 3	A	SR	30/3/01

SPECIFICATION 222 - PRECAST BOX CULVERTS

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GENERAL

222.01 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.

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***

222.02 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

213	-	Earthworks
220	-	Stormwater Drainage - General
224	-	Open Drains
230	-	Subsurface Drainage - General
231	-	Subsoil and Foundation Drains
242	-	Flexible Pavements
271	-	Minor Concrete Works

(b) Australian Standards

AS1597.1	-	Precast reinforced concrete box culverts - Small culverts
AS1597.2	-	Precast reinforced concrete box culverts - Large culverts
AS/NZS ISO 9002		Quality Systems - Model for Quality Assurance in Production, Installation and Servicing.

(c) Other

AUSTROADS	-	Guide to Geotextiles

MATERIALS

222.03 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: ***Supply***

(a) Proof load testing shall be arranged by the 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. Where starter bars in end units are not available, then starter bars shall be provided, in accordance with the Drawings, by drilling and epoxy grouting

(d) 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 requirements of AS 1597.1 or AS 1597.2 as appropriate.

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**. The Superintendent's approval of the conformance certificate is required prior to the release of the hold point. ***HP***

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.

222.04 CONCRETE

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

222.05 SELECTED BACKFILL

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

222.06 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 1.5m of embankment construction as detailed in the Specification for EARTHWORKS. ***Quality***

CONSTRUCTION

222.07 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. Coffer dams 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. Coffer dams 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, but the Contractor shall be responsible for the successful construction of the work. ***Contractor's Responsibility***

4. Coffer dams which have tilted or have moved laterally during sinking, shall be righted or enlarged to provide 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. Coffer dams, including temporary piles, shall be removed at least to the level of the invert after completion of the structure. ***Removal***

222.08 EXCAVATION

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

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

222.09 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 rock 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 as specified in Clause 222.06. ***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.

Unsuitable Material

222.10 BEDDING

(a) Cast-In-Situ Base Slabs

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

Type

2. 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 ± 10mm in level and ± 5mm in line. The bedding shall be finished to a smooth surface by screeding.

Mass Concrete

3. Lightly bound DGB20 (20mm nominal sized densely graded bare) bedding shall be compacted in accordance with the Specification for STORMWATER DRAINAGE - GENERAL to the dimensions shown on the Drawings. It shall be laid to the line and level of the underside of the base slab to a tolerance of ± 10mm in level and ± 5 mm in line. The bedding shall be finished to a smooth surface by screeding. This action constitutes a **HOLD POINT**. The Superintendent's approval to the bedding is required prior to the release of the hold point.

DGB20

HP

(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. This action constitutes a **HOLD POINT**. The Superintendent's approval to the bedding is required prior to the release of the hold point.

Selected Backfill

HP

222.11 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. The invert levels shall be within -10mm to +10mm, grade 5mm in 2.5m (1 in 500) and plan position ±50mm of the design level and position.

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

222.12 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 the ends of units shall be packed or sealed with cement mortar or grout of a consistency that ensures filling of the void.

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 or equivalent approved by the Superintendent. 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, the gap as shown on the Drawings, typically 15mm, 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 grams per square metre in accordance with AUSTROADS Guide to Geotextiles. ***Joint Covering***

222.13 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 the Specification for EARTHWORKS. ***Selected Backfill***

3. No backfill shall be placed against wingwalls until 21 days after casting. ***Wingwalls***

4. A subsoil drain shall be installed at the outer walls of the precast crown sections and at wingwalls as shown on the Drawings and in accordance with the Specification for SUBSOIL AND FOUNDATION DRAINS. The subsoil drain shall be enclosed in a seamless tubular filter fabric in accordance with the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Subsoil Drain***

5. 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***

6. 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***

222.14 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. ***Extent***

222.15 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

SPECIAL REQUIREMENTS

222.16 RESERVED

222.17 RESERVED

222.18 RESERVED

LIMITS AND TOLERANCES

222.19 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table 222.1 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Mass Concrete Correction**		
	a) Over highest points of rock	≥50mm	222.09
2.	**Mass Concrete Bedding**		
	a) Level	± 10mm	222.10
	b) Line	± 5mm	222.10
3.	**Culvert Location**		
	a) Invert Level	±10mm	222.11
	b) Grade	5mm in 2.5m (1 in 500)	222.11
	c) Plan Position	±50mm	222.11

Table 222.1 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT

222.20 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.

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.

222.21 PAY ITEMS

1. 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 222(a) and 222(b).

2. A lump sum price for any of these items 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.

5. Excavation for inlet and outlet channels is measured and paid in accordance with the Specification for OPEN DRAINS.

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.

7. Cast-in-situ base slabs are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

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.

9. Ordinary embankment backfill is measured and paid in accordance with the Specification for EARTHWORKS.

10. Cast-in-situ headwalls and wingwalls are measured and paid in accordance with the Specification for DRAINAGE STRUCTURES.

11. Subsoil drains are measured and paid in accordance with the Specification for SUBSOIL AND FOUNDATION DRAINS

Pay Item 222(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.

Pay Item 222(b) PRECAST CONCRETE BOX CULVERTS

1. The unit of measurement shall be linear metre of the actual length installed for each size of box culvert as shown on the Drawings..

2. The Schedule Rate shall include supply, installation and jointing of the precast units, selected backfilling and testing of the units.