

COFFS HARBOUR CITY COUNCIL



**DEVELOPMENT SPECIFICATION
DESIGN**

1353 Precast box culverts

Version 1 01 January 2009

1353 PRECAST BOX CULVERTS

1 SCOPE AND GENERAL

1.1 SCOPE

This worksection covers the installation of precast concrete box culverts and should be read in conjunction with 1351 *Stormwater drainage (Construction)*.

The work to be executed under this worksection consists of:

- preparation of foundations;
- provision of bedding;
- construction of base slabs;
- installation of precast culvert units;
- headwalls and wingwalls;
- backfilling against structures;
- provision and removal of coffer dams;
- excavation of inlet and outlet channels.

1.2 QUALITY

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are given in 0161 *Quality (Construction)*.

1.3 REFERENCED DOCUMENTS

The following documents referred to in this worksection shall be deemed as the latest edition of the Australian Standards, including amendments and supplements.

Worksections

- 0161 *Quality (Construction)*
- 0310 *Minor concrete works*
- 1112 *Earthworks (Roadways)*
- 1121 *Open drains, including kerb and channel (gutter)*
- 1141 *Flexible pavements*
- 1171 *Subsurface drainage*
- 1172 *Subsoil and foundation drains*
- 1351 *Stormwater drainage (Construction)*
- 1352 *Pipe drainage*
- 1354 *Drainage structures*

Standards

- AS 1597 Precast reinforced concrete box culverts
- AS 1597.1 Small culverts (not exceeding 1200 mm width and 900 mm depth) (Obsolescent)
- AS 1597.2 Large culverts (from 1500 mm span and up to and including 4200 mm span and 4200 mm height)
- AS/NZS ISO 9001 Quality management systems - Requirements

Other publications

- AUSTROADS
- AP – 3/90: Guide to Geotextiles

2 MATERIALS

2.1 CULVERT UNITS, LINK AND BASE SLABS

Supply

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 1200 mm width and 900 mm depth, and
- AS 1597.2 for large culverts from 1500 mm span and up to and including 4200 mm span and 4200 mm 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.

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.

Box culvert units

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.

Each unit shall be marked at time of manufacture with:

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

2.2 CONCRETE

The concrete and reinforcement for cast-in-situ base slabs shall comply with 0310 *Minor concrete works*.

2.3 SELECTED BACKFILL

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

2.4 ORDINARY BACKFILL

Ordinary backfill is material obtained from culvert excavations, cuttings and/or borrow areas which is in accordance with the requirements for the upper 1.5 m of embankment construction as detailed in 1112 *Earthworks (Roadways)*.

3 CONSTRUCTION

3.1 COFFER DAMS

Construction costs

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.

Construction

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.

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.

Specified clearances

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.

Timber or bracing Removal

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.

3.2 EXCAVATION

Excavation shall be carried out in accordance with 1351 *Stormwater drainage (Construction)*.

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

3.3 FOUNDATIONS**Rock Foundations**

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.

Additional excavation

Where rock is encountered over part of the foundation only, or lies within 300 mm below the underside of the mass concrete or selected fill, all rock shall be removed to a depth of 300 mm 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 Ordinary Backfill.

Uniform surface

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

Line and level

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.

Unsuitable material

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 1351 *Stormwater drainage (Construction)*.

3.4 BEDDING**Cast-in-situ base slabs**

Bedding shall be either mass concrete or lightly bound DGB20 in accordance with 1141 *Flexible pavements*, whichever is shown on the Drawings, as follows:

- Mass concrete bedding: Mass concrete bedding shall be of the same compressive strength as for the base slab and shall not be less than 50 mm 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 by screeding.

- DGB20 bedding: Lightly bound DGB20 bedding shall be compacted in accordance with 1351 Stormwater drainage (Construction) 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 ± 10 mm 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.

Precast base slabs

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 150 mm 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.

3.5 CAST-IN-SITU BASE SLABS

Construction

Cast-in-situ base slabs shall be constructed to the dimensions shown on the Drawings and in accordance with worksection and not with 0310 *Minor concrete works*.

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

Recesses for walls

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

3.6 INSTALLATION OF PRECAST UNITS

Minimum strength

Precast units shall not be installed until the base slab has attained a minimum compressive strength of 20 MPa.

Mortar bed in recess

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 on supports

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 5 mm after placement of precast unit.

Lifting hooks

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 12 mm below the surface of the unit and the recess sealed with epoxy mortar.

Gap between cells

In the case of multi-cell culverts, the gap as shown on the Drawings, typically 15 mm, shall be provided between adjacent cells.

This gap shall be filled with cement mortar or grout.

Curing of joints

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

Joint covering

All external surfaces of joints between precast crown units, both laterally and longitudinally, shall be covered full length, and minimum 250 mm width, with strips of non-woven geotextile of minimum mass 270 grams/m² in accordance with AUSTRROADS *Guide to Geotextiles*.

3.7 BACKFILL

Removal of formwork

All bracing and formwork shall be removed prior to backfilling.

Selected backfill

Selected backfill shall be placed in the side zones of the box culverts and wingwalls, and to a depth of 300 mm in the overlay zone of the culverts, in layers with a maximum compacted thickness of 150 mm 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 1112 *Earthworks (Roadways)*.

Wingwalls

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

Subsoil drain

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 1172 *Subsoil and foundation drains*.

The subsoil drain shall be enclosed in a seamless tubular filter fabric in accordance with 1171 *Subsurface drainage*.

Sequence

Backfill layers shall be placed simultaneously on both sides of the culvert with a maximum 600 mm level difference to avoid differential loading.

Backfilling and compaction shall commence at the wall and proceed away from it.

Horizontal terraces

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 1 m width before the backfill is placed.

3.8 EXCAVATION OF INLET AND OUTLET CHANNELS

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 1121 *Open drains, including kerb and channel (gutter)*.

3.9 CONSTRUCTION LOADING ON CULVERTS

Traffic over culvert

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 32 MPa.

Loading restrictions

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

4 LIMITS AND TOLERANCES

The limits and tolerances applicable to this worksection are summarised in

Table 4.1 Summary of limits and tolerances

Activity	Limits/Tolerances	Worksection Clause Reference
Mass Concrete Correction		
- Over highest points of rock	≥50 mm	Foundations
Mass Concrete Bedding		
- Level	± 10 mm	Bedding
- Line	± 5 mm	Bedding
Culvert Location		
- Invert Level	±10 mm	Cast-in-Situ Base Slabs
- Grade	5 mm in 2.5 m (1 in 500)	Cast-in-Situ Base Slabs
- Plan Position	±50 mm	Cast-in-Situ Base Slabs

5 MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

Payment shall be made for all the activities associated with completing the work detailed in this worksection on a schedule of rates basis in accordance with Pay Items 1353.1 and 1353.2.

A lump sum price for any of these items shall not be accepted.

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.

Excavation for box culverts is measured and paid in accordance with 1351 *Stormwater drainage (Construction)*.

Excavation for inlet and outlet channels is measured and paid in accordance with 1121 *Open drains, including kerb and channel (gutter)*.

Base slab bedding using lightly bound DGB20 is measured and paid in accordance with this worksection and not 1141 *Flexible pavements*.

Cast-in-situ base slabs are measured and paid in accordance with this worksection and not Specification and not with 0310 *Minor concrete works*.

Miscellaneous minor concrete work not included in the pay items in this worksection shall be in accordance with pay items described in 0310 *Minor concrete works*.

Ordinary embankment backfill is measured and paid in accordance with 1112 *Earthworks (Roadways)*.

Cast-in-situ headwalls and wingwalls are measured and paid in accordance with 1354 *Drainage structures*.

Subsoil drains are measured and paid in accordance with 1172 *Subsoil and foundation drains*.

5.2 DEDUCTIONS

Payment for in-situ concrete work shall be made at the scheduled rates provided the concrete meets the strength requirements specified in 0310 *Minor concrete works*.

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%.

If the deficiency in strength exceeds 10%, the concrete represented by the specimens may be rejected, in which case no payment will be made.

5.3 PAY ITEMS

1353.1 In-situ base slab

The unit of measurement shall be the cubic metre of reinforced concrete in place (excluding the mass concrete bedding layer).

The width, length and depth of the slab shall be as specified on the Drawings or as directed by the Superintendent.

The schedule rate shall include foundation preparation, bedding and all activities associated with the construction of the base slab.

The schedule rate does not include excavation.

1353.2 Precast concrete box culverts

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

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