

BRIDGE TECHNICAL DIRECTION BTD2013/01

DESIGN OF PRECAST REINFORCED CONCRETE BOX CULVERTS

Background

This Bridge Technical Direction stipulates Roads and Maritime Services (RMS) required design and construction practice for precast reinforced concrete box culverts (RCBC).

Information

Major problems with differential settlement and damage by floods have been experienced with culverts without cast-in-situ base slabs and precast wingwalls for high crown units.

This Bridge Technical Direction supersedes BTD/2008/04_Rev1, which is now withdrawn.

Bridge Technical Direction

As specified in RMS R16, RCBC for RMS shall be designed in accordance with AS 1597.2 and AS 5100 for a design life of 100 years.

For all RCBC designed and constructed for RMS or those that will become property of RMS, the following conditions shall apply:

- a. Base slabs shall be cast-in-situ reinforced concrete;
- b. Base slab of single cell culverts, shall extend a minimum of 300 mm beyond the outer faces of the inverted U-shaped precast crown units. For multi-cell culverts, the base slabs shall extend a minimum of 300 mm beyond the outer faces of the outer units;
- c. Dowels in base slab expansion or contraction joints or dowels connecting precast link slabs with precast crown units shall be stainless steel Grade 304 to ASTM A276. The dowels shall be designed for the shear forces across the joint and shall have a minimum diameter of 20 mm;
- d. Dowels in base slabs shall be at least 600 mm long, at a maximum spacing of 600 mm and debonded on one side of the joint;
- e. Contraction joints in base slabs shall coincide with butt joints between crown units;
- f. At least two dowels shall be provided at each end of the slab, in link slab to crown unit connections,
- g. Wingwalls and headwalls shall be cast-in-situ, where the nominal height of the end crown unit is 1800 mm or greater;

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- h. Cast-in-situ reinforced concrete slabs shall be provided over crown units, where the minimum pavement depth over the top of the crown units cannot be achieved;
- i. Cut-off walls shall be provided at the ends of the base slab and on the front faces of adjacent wingwalls;
- j. The assumed dimensions, or the actual dimensions where available, of the precast crown units shall be shown on the design drawings;
- k. Crown units shall be placed on mortar in recesses in base slabs to ensure even bearing and restraint of the base of the legs. The reduced cover in the base slab under the recess is deemed to comply with Clause 4.10 of the AS 5100.5 where the following requirements are met:
 - The nominal cover under the recess is 30 mm; and
 - A non-shrink cementitious mortar with minimum 28 day strength of 40 MPa is specified to fill the recess.

The depth of the recess shall not be less than:

- 25 mm; and
- the nominal cover for the relevant exposure classification specified in Clause 4.10 of AS 5100.5 minus 30 mm.

Example: For exposure classification C and for 50 MPa concrete the appropriate nominal cover is 70 mm. The depth of the recess must be not less than $70 \text{ mm} - 30 \text{ mm} = 40 \text{ mm}$.

References: BTD2008/04_Rev1

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