AUSTROADS TECHNICAL SPECIFICATION ATS 2235

Supply of Box Culverts

Austroads

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1. Scope

1.1 Austroads Technical Specification ATS 2235 sets out the requirements for the supply of precast reinforced concrete rectangular box culverts and associated components ('Culverts'). It excludes Culverts which:

a) have a height or span exceeding 4.2 m;

b) are subject to internal hydraulic pressure; and

c) are designated railway load class.

1.2 ATS 2235 applies to both Small Culverts and Large Culverts. Culverts must comply with the requirements of AS 1597[1], as amended by this Specification.

[1] Note: A reference to AS 1597 without a part number is a refence the part of AS 1597 which is applicable to the culvert being supplied under this Specification.

1.3 Further to the provisions of Appendix A of AS 1597, the required size, load classes, exposure classification, Culvert types and other information are as shown on the drawings and/or other Contract documents.

1.4 The determination of the Exposure Classification applicable to the site where the Culverts will be installed is not covered by this Specification.

1.5 The Contractor must ensure that the Manufacturer of the Culverts complies with this Specification. The Contractor may be the same entity as the Manufacturer.

2. Referenced Documents

2.1 The following documents are referenced in this Specification:

Australian/New Zealand Standards	
AS 1597	Precast reinforced concrete box culverts
Part 1:	Small culverts (not exceeding 1200 mm span and 1200 mm height)
Part 2:	Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
AS 2193	Calibration and classification of force-measuring systems
AS 3850.3	Prefabricated concrete elements, Part 3: Civil construction
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 5100.5	Bridge Design, Part 5: Concrete
Austroads	
ATS 5310	Supply and Placement of Steel for the Reinforcement of Concrete
ATS 5315	Supply of Special Class Concrete
ATS 5340	Cementitious Patch Repair of Concrete
ATS 5341	Repair of Concrete Cracks
ATS 5850	Handling, Storage, Transportation and Erection of Structural Members

3. Definitions

3.1 In addition to the definitions in AS 1597, the following definitions and abbreviations apply to this Specification:

Large Culvert	A Culvert with a span or height exceeding 1200 mm, up to and including 4200 mm span and 4200 mm height.
IANZ	International Accreditation New Zealand
Manufacturer	The entity responsible for the manufacture of the Culvert in accordance with this Specification.
NATA	National Association of Testing Authorities
Principal's Registration Scheme	A scheme for the prequalification, registration or approval of products, manufacturers, suppliers and/or Professional Engineers in operation in the jurisdiction where the Culvert is to be installed.

Professional Engineer	A person who: a) has at least 5 years of experience which is relevant to the structural design/manufacture of Culverts; b) is registered on any scheme of registration of engineers prescribed by legislation in the applicable jurisdiction; c) is appropriately registered or prequalified if the Principal has implemented an applicable registration or prequalification scheme; and d) satisfies at least one of the following requirements: i) is a Chartered Professional Engineer; or ii) holds a 4-year civil engineering degree from a university that is accredited under the Washington Accord and is registered in a relevant area of practice on the National Engineering Register (in Australia) or the Register of Chartered Professional Engineers (in New Zealand).
Small Culvert	A Culvert with a span or height not exceeding 1200 mm.

4. Quality System Requirements

4.1 The Culverts must be manufactured under a quality management system which is independently certified by a JASANZ (Joint Accreditation System of Australia and New Zealand) accredited organisation as complying with AS/NZS ISO 9001. Evidence of the certification must be provided to the Principal prior to, or with, the delivery of Culverts to the Site (refer Clause 10.1).

4.2 Where a Principal's Registration Scheme is in place for the manufacture of Culverts in the jurisdiction where the Culverts are to be installed, the Manufacturer must be registered under that scheme. For Culverts installed in Queensland, refer to: https://www.tmr.qld.gov.au/business-industry/business-with-us/approved-products-and-suppliers/bridges-and-other-structures-approved-products-and-suppliers.

5. Materials

5.1 In addition to the requirements of AS 1597, concrete must be supplied in accordance with ATS 5315.

5.2 The concrete mix design(s) used for the manufacture of the Culverts must:

a) be a mix design which is approved/registered by the Principal, or

b) have been submitted to the Principal in accordance with ATS 5315 and accepted by the Principal in the preceding 12 months.

5.3 Reinforcing Steel used in Large Box Culverts must comply with ATS 5310.

6. Design

6.1 The design of the Culvert must be undertaken in accordance with AS 1597.2 and AS 5100.5, unless the structural capacity of the Culvert is determined in accordance with proving test loading and ultimate test loading in accordance with AS 1597.1. In the event of an inconsistency between AS 1597.2 and AS 5100.5, the latter will take precedence.

6.2 The design of the Culvert must include a reinforced haunch or curved surface at the internal corner.

6.3 For Small Culverts with a nominal length of 2.4 m, the design must have the same concrete thickness and distribution of reinforcement as a 1.2 m long unit.

6.4 Erection design (which provides for the element to resist all construction loads, temporary surcharge loads as applicable, handling forces, including impact, arising from stripping, storage, transport, lifting, temporary bracing and propping) must comply with AS 3850.3.

6.5 For Culverts with a mass less than 500 kg, a minimum of 2 lifting points must be provided. For Culverts with a mass of 500 kg or greater, a minimum of 4 lifting points must be provided.

6.6 Lifting anchors, where used, must be made of:

a) Exposure Classification C2: Stainless steel;

b) Less severe Exposure Classifications: Hot dip galvanised to AS 4680 or stainless steel.

6.7 The Contractor must ensure that the Professional Engineer who designed the lifting mechanism certifies that the lifting points and/or rigging diagram comply with AS 3850.3. The certification must be included in the Conformance Report (refer Clause 10.1).

7. Manufacture

Production and Placement of Concrete
(Refer AS 1597 Clause 2.6)

7.1 Formwork must be rigid and constructed from metal. Timber formwork is not permitted.

7.2 Culverts must be cast legs down or on end. Where a hole or void in the concrete is shown on the Drawings, the formwork or void former must be removed after casting.

7.3 The Manufacturer must maintain a batch recording system that records the weight and volume of each component used in the concrete mix. These records must be made available to the Principal upon request.

7.4 Concrete must be deposited in horizontal layers in a manner to avoid segregation and displacement of the steel reinforcement or other embedded items or formwork. The reinforcement may be displaced locally to obtain the specified cover to lifting holes, lifting anchors, dowel bars or any other cast in items.

7.5 Vibration must be by external form vibrators supplemented by internal vibration if required. External form vibrators are not required if self-compacting concrete is used.

7.6 Test cylinders for concrete compressive strength testing and for checking the adequacy of curing must be cured in the same manner as the Culvert.

Curing

7.7 For all Culverts, Clause 2.6.3 of AS 1597 is deleted and the requirements for curing specified in AS 5100.5 apply.

7.8 Where a curing compound is used, two coats must be applied at the full rate.

7.9 Culvert units must not be stripped of forms or handled off the base forms until the compressive strength exceeds 15 MPa.

Dimensions
(Refer AS 1597 Clause 2.8.1)

7.10 Culverts must not be cut to achieve the specified dimensions.

Tolerances
(Refer AS 1597 Clause 2.10)

7.11 End squareness must be measured on each end face across the unit section thickness. Verticality must be measured on each end and side face. The tolerances in Table 7.11 apply in addition to those listed in AS 1597 Table 2.7.

Table 7.11: Additional tolerances

Measurement	Permitted tolerance from design
End squareness	± 4 mm
Verticality	± 20 mm

Provision for Lifting Culverts
(Refer AS 1597 Clause 2.11)

7.12 Culverts must be lifted using the lifting points provided and in accordance with any requirements specified on the Drawings and/or rigging diagram.

7.13 If holes are provided instead of cast in lifting anchors, the Manufacturer must supply tight fitting concrete or plastic plugs with each consignment to seal the holes. Alternatively, the holes can be filled with a cementitious repair grout that complies with the requirements of ATS 5340.

7.14 All lifting anchors must be permanently marked or tagged by the Manufacturer with the working load limit, which must be clearly visible.

7.15 Any lifting anchor which is damaged must not be used, unless it has been inspected by a Professional Engineer and certified that it is suitable to use for lifting.

Storage and Handling
(Refer AS 1597 Clause 2.11)

7.16 The Manufacturer must a undertake a final visual inspection of the units prior to transport from the cast yard and include evidence of the inspection in the Conformance Report (refer Clause 10.1).

7.17 Culverts must not be transported from the precast yard within 7 days of casting and curing has been completed.

7.18 During transportation, Culverts must be supported on bearers made of timber or other suitable material. Rubber strips must be placed between units, both laterally and longitudinally. All tie down straps and chains must have rubber protection strips over the Culvert edges. The legs of all box culverts must be adequately braced to prevent whipping and bending.

7.19 Precast base slabs and link slabs must be transported in the as laid position.

7.20 Culverts to be stored must be placed on an even surface, stacked and supported in a manner that will avoid damage. Culverts may be stored in more than one layer. Timber or other suitable material which does not damage, mark or stain the Culverts must be used as supports between the ground and the Culverts and separating each layer. Unless a higher stack has been approved and certified by a Professional Engineer in accordance with ATS 5850, the stack height must not be greater than either 2.4 m or two Culverts.

7.21 Lids or base slabs must be stored in separate stacks of identical units up to a maximum height of six units separated by suitable packers which do not stain, damage or mark the Culverts in any way. The packers must be placed near the ends of the slab and directly above the supports of any lower layer.

Defects
(Refer AS 1597 Clause 2.13)

7.22 Further to the definitions in AS 1597 Clause 2.13.2, where the length of a crack(s) exceeds the length described below, it is deemed to be a Type 3 defect, even if the width is ≤ 0.3 mm:

a) an individual crack > 300 mm.

b) the cumulative length of cracks within 75 mm of one another > 500 mm.

7.23 The definition of a Type 1 defect in AS 1597 Clause 2.13.2 is amended to the following:

Clearly visible cracks not extending through the precast unit thickness and whose width, as determined in accordance with Appendix E, is not greater than 0.15 mm for all exposure classifications.

7.24 Dents, bulges, chips and spalls of a depth or height not more than 3 mm in any direction are permitted, provided they do not extend over the surface for a distance greater than twice the wall thickness of the unit and provided that the required cover is maintained.

7.25 The repair of Type 2 and Type 4 defects must be carried out in accordance with ATS 5340 and ATS 5341 respectively.

7.26 A Type 3 defect may only be repaired with the prior approval of the Principal. If approved, the repair must comply with ATS 5341.

Finishing and Repairs
(Refer AS 1597 Clause 2.14)

7.27 Any products used for the repair of Type 4 or Type 5 defects must be approved by the Principal.

8. Concrete Cover Testing

(Refer AS 1597 Appendix D)

8.1 The concrete cover to the steel reinforcement must be measured with a calibrated cover meter. One unit for concrete cover measurements from each 100 units of a batch or a maximum period of 3 months production must be selected for testing. The cover meter device must be capable of detecting the presence of reinforcement and indicating the depth from the concrete surface to the nearest point on the surface of the reinforcement with an accuracy of ± 2 mm at a depth of 25 mm.

9. Load Testing of Small Culverts

General

9.1 This Clause 9:

a) only applies where acceptance of Small Culverts is determined by load testing in accordance with AS 1597.1; and

b) specifies requirements for testing which are in addition to those specified in AS 1597.1.

9.2 Further to Clause 3.2.2 (a) of AS 1597.1, a significant change to an existing design includes:

a) changes to the maximum nominal aggregate size; and

b) changes to cover to reinforcement.

9.3 The testing machine used for load testing must meet the requirements of AS 2193 Class B and must be calibrated by a laboratory accredited by NATA or IANZ. A jack and pressure gauge system may be used provided that calibration is carried out at not more than 12 monthly intervals.

Type Testing
(Refer AS 1597.1 Clause 3.3)

9.4 When type tested in accordance with Clause 3.3 of AS 1597.1, the Culverts must satisfy the following additional requirements:

a) for Culverts with a specified cover to reinforcement of greater than 50 mm, the crack widths must be the same as for Culverts with 50 mm cover;

b) testing of Culverts must occur at 28 ± 5 days from the date of manufacture; and

c) for testing of 2.4m long units, the test load only needs to be applied to one end of the unit.

9.5 Type testing must be either:

a) witnessed by a Professional Engineer; or

b) performed by a laboratory that is accredited for the test method to meet the requirements of AS ISO/IEC 17025 by NATA or IANZ.

9.6 The results of the type testing must be certified and reported in accordance with Clause G9.2 of AS 1597.1. If requested, the test certificate and report must be made available to the Principal.

Routine Sampling and Testing
(Refer AS 1597.1 Clause 3.4)

9.7 If routine ultimate load testing is specified in the Contract documents, the frequency of testing and the basis of acceptance of the testing for ultimate load must be in accordance with Clause F6.2 of AS 1597.1.

9.8 For testing of 1.2 m and 2.4 m long units, the test load only needs to be applied to one end of the unit.

9.9 If any Culvert fails a test, that element will be rejected and the Principal may direct that an increased sampling frequency will apply for period of up to 6 months to Culverts of the same design. If no further failures have occurred during this specified period, the normal sampling frequency may be resumed.

10. Information to be Supplied by the Manufacturer

(Refer AS 1597.1 Appendix A3 or AS 1597.2 Appendix A2)

10.1 The information listed in AS 1597.1 Appendix A3 or AS 1597.2 Appendix A2 must be submitted to the Principal on, or prior to, delivery. This must be included in a Conformance Report, which also includes:

a) Evidence that:

i) the Culverts have been manufactured under a quality system certified to AS/NZS/ISO 9001 by a JASANZ accredited organisation;

ii) the concrete mix design(s) has been approved/registered by the Principal in accordance with Clause 5.2;

iii) if applicable, certification of the lifting mechanism from the Professional Engineer (Clause 7.15).

b) A Batch report, which includes:

i) nominated Design Designation (size, exposure classification, product code/drawing number);

ii) date range of manufacture;

iii) individual unit identifiers; and

iv) batch size.

c) A Visual Inspection report issued prior to transportation from the casting yard.

d) If Clause 8 applies, report(s) of testing in accordance with Clause 3.2.3 of AS 1597.1, including:

i) proving test load results;

ii) ultimate load test results;

iii) concrete compressive strength;

iv) cover to reinforcement; and

v) dimension accuracy checks.

e) If Clause 8 does not apply, reports(s) of testing carried out in accordance with AS 1597.2 Clause 4.4.

f) A statement that the Culverts conform to the requirements of this Specification.

g) A statement of whether the Culvert is defect free, has an acceptable defect or has been repaired/tested in accordance with Table 2.8 ‘Acceptability of Defects’ of AS/NZS 1597.

10.2 With each batch of Culverts delivered to the site, a delivery docket must be supplied that provides traceability to the Conformance Report for the batch.

HOLD POINT 1	
Process Held	Incorporation of Culverts into the Works.
Submission Details	The Conformance Report and Delivery Docket must be provided at least 2 working days prior to the incorporation of the Culverts into the Works.

Annexure A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points/Hold Points that apply to this Specification and the Records that the Contractor must submit to the Principal to demonstrate compliance with this Specification.

CLAUSE	HOLD POINT	WITNESS POINT	RECORD
10.2	1. Incorporation of Culverts into the Works		Conformance Report and Delivery Docket

Amendment Record

Amendment no.	Clauses amended	Action	Date
-	New specification	New	March 2025

Key

Format	Change in format
Substitution	Old clause removed and replaced with new clause
New	Insertion of new clause
Removed	Old clauses removed