

SECTION 705 - DRAINAGE PITS

##This section cross-references Sections 175, 610, 611, 689, 701 and 703.

If any of the above sections are relevant, they should be included in the specification.

If any of the above sections are not included in the specification, all references to those sections should be struck out, ensuring that the remaining text is still coherent:

705.01 GENERAL

This section specifies the requirements for the supply of materials and construction of drainage pits including the associated excavation, backfilling, culvert connections and supply and fitting of covers and associated components.

The supply of concrete and construction of items covered by this section shall comply with the requirements of Section 610.

705.02 STANDARDS

Standards are referenced in an abbreviated form (e.g. AS/NZS 4680).

(a) Australian Standards

AS/NZS 3679.1	Structural steel – Hot rolled bars and sections
AS/NZS 4671	Steel reinforcing materials
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 5100	Bridge Design Set

(b) Other Standards and Referenced Specifications

ASTM C1116	Standard Specification for Fiber-Reinforced Concrete
ASTM C1609	Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading)
ASTM C1399	Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete
ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D3822	Standard Test Method for Tensile Properties of Single Textile Fibers
ASTM A820	Standard Specification for Steel Fibres for Fibre-Reinforced Concrete

Section 175 details the relevant references to these documents.

705.03 DEFINITIONS

Drainage pit: A reinforced concrete chamber constructed or installed below ground, which is designed to receive water from the surface and from connected upstream underground stormwater drain(s) and facilitate its discharge into a connected downstream stormwater drain.

Fibre reinforced concrete (FRC): A concrete mixture containing uniformly dispersed and randomly oriented fibres.

Prototype testing: Load testing of the first type of unit(s) from a specific design and production.

705.04 MATERIALS

(a) Concrete

(i) Conventional Portland Cement-based Concrete

All concrete shall be manufactured to the concrete mix design registered by State Growth and comply with the requirements of Section 610. Concrete grades shall comply with Table 705.041

Table 705.041

Minimum Concrete Grade	Used for :
VR330/32	Drainage pits reinforced with steel reinforcement
VR450/50	Precast drainage pits using fibre reinforcement

(ii) Geopolymer Concrete

Geopolymer binder-based concrete as defined in Section 703 may be used for the construction of drainage pits provided the supply of geopolymer concrete and construction comply with the requirements of Section 610 and satisfy the concrete grade requirements of Table 705.041.

(b) Registration of Concrete Mix Designs

Concrete mix designs shall be registered in accordance with the requirements of Section 610, and re-registered on an annual basis, unless mix components change prior to the expiry of registration.

(c) Covers, Grates, Lids and Lintels

Covers, grates, lids and lintels shall be as shown on the drawings.

(d) Step Irons

Step irons shall be manufactured from steel to AS/NZS 3679.1 Grade 250, or AS/NZS 4671 Grade N500 and after fabrication shall be prepared, pre-treated and hot dip galvanized in accordance with the requirements of AS/NZS 4680 with a minimum average coating thickness equivalent to 600 g/m², **or manufactured from 13 mm steel bar covered with polypropylene plastic to a design and sample approved by the Superintendent.**

(e) Reinforcement

All steel reinforcement shall comply with the requirements of Section 611.

(f) Fibres

When relevant to the registered concrete mix, fibres shall comply with the requirements of ASTM C1116 and shall be supported with documentary evidence confirming their long term resistance to deterioration when in contact with the moisture and alkalis present in cementitious paste or the substances present in chemical admixtures.

Fibres shall be tested to the requirements of ASTM C1609 (flexural toughness) and ASTM C1399 (average residual strength of fibre reinforced concrete) to ensure compliance of the fibre reinforced concrete with the requirements of AS 5100.

Fibres shall be added to the concrete in such a manner to ensure that they are uniformly distributed, balling does not occur, and the concrete mix remains workable and cohesive without any segregation.

(i) Synthetic Fibres

Synthetic fibres shall be in the form of fine micro and macro virgin copolymer or polypropylene, consisting of twisted bundle non-fibrillated monofilament and fibrillated network fibre.

The synthetic fibre shall be capable of absorbing maximum energy without breakage and shall be designed to retain its cross sectional shape and avoid brittle failure.

(1) Properties of synthetic fibre

The synthetic fibres shall possess the following properties:

- Tensile strength (ASTM D3822) > 550 MPa
- Modulus of elasticity (ASTM D3822) > 5.0 GPa
- Specific gravity (fibre density) (ASTM D792) > 0.91 g/cm³
- Aspect ratio (length divided by the equivalent diameter of the fibre) between 70 and 170)

(2) Properties of synthetic fibre reinforced concrete

Synthetic fibre reinforced concrete shall possess the following properties:

- Average residual strength (ASTM C1399) > 1.0 MPa
 - Flexural toughness (ASTM C1609) > 4.5 MPa
 - Re3(Flexural toughness factor) (ASTM C1609) > 40%
- Note: Re3 - % of flexural strength at 3 mm deflection of standard beam test.

(ii) Steel Fibres

Steel fibres shall comply with the requirements of ASTM A820 for Type I, cold drawn wire, or Type II, cut sheet.

All fibres shall be deformed and have a minimum tensile strength of 800 MPa and an aspect ratio between 40 and 70.

705.05 EXCAVATION

(a) General

Excavation shall be to the depth indicated on the drawings or as necessary to secure a satisfactory foundation. Backfill material conforming to the requirements of Section 701 shall be supplied, placed and compacted in accordance with Clause 705.17.

(b) Precast Pits

For precast pits the excavation shall provide a clearance from all external faces of the pit to each face of the excavation of not less than 400 mm. Bedding conforming to the requirements of Section 701 shall be supplied, placed and compacted to a thickness not less than 80 mm on a clay foundation or 150 mm on a rock foundation.

705.06 CAST IN PLACE PITS

Cast in place pits shall be constructed at the locations and to the dimensions shown on the drawings.

Cast in place pits shall be constructed in accordance with the requirements of Section 610.

705.07 PRECAST STEEL REINFORCED CONCRETE DRAINAGE PITS

Precast steel reinforced concrete drainage pits shall be manufactured, supplied and installed in accordance with the requirements of Section 610.

Where precast steel reinforced concrete drainage pits do not conform to the drawings, the Contractor shall submit to the Superintendent detailed drawings and design computations carried out by a pre-qualified consultant and proof engineered by a Proof Engineer who is pre-qualified in accordance with the VicRoads scheme for pre-qualification, or approved by the Superintendent.

705.08 PRECAST FIBRE REINFORCED CONCRETE DRAINAGE PITS

(a) General

Precast fibre reinforced concrete (FRC) drainage pits shall be manufactured, supplied and installed in accordance with the requirements of Section 610.

Precast FRC drainage pits shall be subject to the following conditions:

- (i) The design of FRC drainage pits shall comply with the requirements of AS 5100 and the following additional loading requirements:
 - (1) the combined factored lateral pressure from axle loadings at any point at the ultimate limit state shall be not less than 25 kPa
 - (2) adequate drainage to be provided to pit walls to avoid hydrostatic pressure
 - (3) vertical load 210 kN applied anywhere on the pit
 - (4) equivalent minimum reinforcement area to be 150 mm²/m.

The design shall as a minimum provide equivalent performance to drainage pits constructed with steel reinforcement.

- (ii) The design of the FRC drainage pits shall be supported by detailed drawings and design computations carried out by a pre-qualified consultant and proof engineered by a Proof Engineer who is pre-qualified in accordance with the VicRoads scheme for pre-qualification.
- (iii) FRC drainage pits shall not be located under roads.
- (iv) Concrete used for the construction of FRC drainage pits shall comply with the requirements of Clause 705.04 and Section 610.

(b) Prototype Testing

A sample of two prototype FRC drainage pits shall be load tested in accordance with the requirements of AS 5100 to demonstrate that FRC drainage pits manufactured under the same conditions, and to the same design, satisfy the requirements of this section.

Where a new design or a significant departure from a proven design is proposed, prototype testing, appropriate to the design or design change, shall be carried out in accordance with the requirements of this section.

A significant change to an existing design shall be a change in the concrete mix design, decrease in the quantity of reinforcing fibre, change in the agreed brand, type and source of reinforcing fibre or decrease in the design wall thickness.

(c) Fibres

Fibres used in the manufacture of precast FRC drainage pits shall comply with the requirements of Clause 705.04(f).

705.09 ADDITIONAL REQUIREMENTS FOR PRECAST CONCRETE DRAINAGE PITS

(a) General

Precast pits shall be installed at the locations and to the dimensions shown on the drawings.

(b) Provision for Stormwater Drainage Connections

Provision shall be made for the connection of all stormwater drainage, culverts and subsurface drains as shown on the drawings.

Holes for subsurface drains shall be 150 mm diameter.

Weepholes of 50 mm diameter shall be provided in all precast pits and shall be placed between the midpoint and top of the stormwater drain in those walls which have openings for drains.

(c) Segments

If a precast pit is cast in segments, each section of the pit shall be rebated to ensure correct alignment and to prevent horizontal movement. A minimum rebate of 15 mm shall be used.

(d) Completion on Site

Where precast pits are to be completed on site, the provision of cut outs and protruding reinforcement shall be as specified or in accordance with the drawings.

705.10 STORMWATER DRAINAGE CONNECTIONS

All stormwater drainage connections to pits shall be neatly made, and where necessary the ends of all drains shall be trimmed off and finished with cementitious mortar as stated in Clause 705.14.

Openings into drainage pit walls to facilitate stormwater drainage connections shall be neatly saw cut to the required size.

Weepholes or holes installed on site shall be cut. Breaking out of holes is not permitted. Pits shall be replaced if circumferential or longitudinal cracking occurs as a result of installing holes or if the hole exceeds the pipe diameter by more than 50 mm.

Reinforcement exposed by the cutting of holes shall be coated with an approved epoxy treatment to prevent corrosion prior to rendering around the pipes.

705.11 STEP IRONS

Pits greater than 1.0 m deep shall be fitted with step irons as shown on the drawings. Steps shall be located so that they do not obstruct openings and that water does not discharge onto them. Steps shall be set into a wall which has no openings, or beside an opening, or across a corner of the pit.

Step irons shall be installed horizontal, vertically in line and shall project uniformly from drainage pit walls.

Where drainage pits are extended in height from the lowest pit, step irons shall be located such that an equidistant spacing between step irons is still maintained.

Step irons of an approved proprietary type shall be installed in accordance with the manufacturer's instructions.

Where step irons are cast in place, they shall be epoxy mortared into drilled holes using an epoxy material and method approved by the Superintendent. The joints between the step irons and the shafts shall be completely filled and neatly pointed so that the step irons are held rigid and the joints are watertight.

705.12 SHAPING OF FLOOR

Pit floors shall be smoothly shaped from the inlets to the outlet for a height of one-third of the diameter of the outlet pipe with cementitious mortar, to provide a profile that will ensure smooth flow conditions between inlet and outlet pipes and prevent any snagging of debris. The cementitious mortar shall comply with the requirements of Clause 610.32.

705.13 SURFACE FINISH

The method of construction and the materials used in the concrete and formwork shall remain consistent and shall comply with the requirements of this specification for surface finish.

Surfaces shall be finished uniform in appearance with a Class 2 surface finish in accordance with the requirements of Section 610.

705.14 JOINTING

The ends of components shall be free of any foreign matter at the time of jointing and shall be arranged to give best fit.

The joints between various components such as drainage pits, access chambers and pipes shall be made watertight using a cementitious mortar in accordance with the requirements of Clause 610.32. The joint areas shall be thoroughly cleaned and wetted just prior to filling. The cementitious mortar shall be used within its allowable application time and shall not be retempered.

The joints shall be finished to provide smooth surfaces, uniform with the inner surfaces of pits and access chambers.

Mortared joints and recesses shall be cured for a period of not less than 48 hours. Backfilling operations against end structures shall not be carried out during the curing period.

705.15 CONCRETE REPAIRS

The method of repair of minor surface imperfections including porous spots, shallow honeycombing, rough areas and blow holes not conforming to the class of surface finish as specified in Clause 705.13, and the method of cementitious patch repair of other concrete defects shall be in accordance with Section 689.

Epoxy materials shall not be used for the patch repair of concrete.

The exposed surface of the repaired area shall be similar in texture and colour to the surrounding concrete.

705.16 FITTING OF COVERS

Frames for pit covers shall be cast into the top of the pit or bedded on fresh mortar, 5 mm thick, consisting of two parts of sand, one part of cement and sufficient water to produce a mix of suitable consistency.

The level at every point of the perimeter shall be within 10 mm of the design level for that point, and the line of the cover shall be within 10 mm of the design kerb line.

705.17 BACKFILLING AROUND PITS

Backfilling around pits shall be placed in layers not exceeding 300 mm loose thickness and compacted to refusal using hand held mechanical equipment.

705.18 TOLERANCES

The tolerances listed in Clause 610.36 are the allowable deviations of the finished product from the dimensions shown on the drawings. These tolerances will be a basis for acceptance of the work.

SUPERSEDED