



AUS-SPEC

Infrastructure Specifications

1171 Subsurface drainage

1171 SUBSURFACE DRAINAGE

IMPORTANT: This document has been adapted from the NATSPEC suite of specification templates for use in the Cessnock City Council area by both Council and industry. NATSPEC regularly updates the base templates (currently in April and October each year), and Council may incorporate changes into its version of AUS-SPEC from time to time. To assist in highlighting any changes made by Council to the NATSPEC templates, the following conventions are used.

- See ANNEXURE M at the end of this document which contains (where practical) Cessnock City Council customisations (also known as 'office master' text). References to the Annexure are to also be inserted at relevant clauses in the main body of the document.
- Where content is added to the main body of the document, it is to be shown **in brown text like this**.
- Where content is deleted or excluded from the main body of the document, it is to be shown ~~struck through like this~~. Such clauses are to have no effect.

Where there is a conflict between main body text and Cessnock City Council specific clauses, Council's specific clauses shall prevail.

1 GENERAL**1.1 RESPONSIBILITIES****General**

Requirement: Provide subsurface drainage, as documented.

1.2 CROSS REFERENCES**General**

Requirement: This worksection is not a self-contained specification. In addition to the requirements of this worksection, conform to the following:

- 0136 *General requirements (Construction)*.
- 0152 *Schedule of rates (Construction)*.
- 0161 *Quality management (Construction)*.
- 0319 *Auxiliary concrete works*.
- 1101 *Traffic management*.
- 1102 *Control of erosion and sedimentation (Construction)*.
- 1111 *Clearing and grubbing*.
- 1112 *Earthworks (Road reserve)*.
- 1174 *Drainage blankets*.

1.3 STANDARDS**General**

Subsurface drainage: To Austroads AGPT10 (2009).

Environmental and planning requirements: In accordance with any DA consent or REF recommendations.

1.4 INTERPRETATION**Abbreviations**

General: For the purposes of this worksection the following abbreviations apply:

- AAR: Alkali aggregate reactivity.
- CI: Cast iron.

Definitions

General: For the purposes of this worksection the following definitions apply:

- Cleanout: A subsurface drainage inlet at the surface of the pavement, shoulder or surrounding ground surface. Also known as flushout riser and inspection point.

- Mandrel: A short length of smooth pipe of internal diameter 20 mm - 30 mm greater than the external diameter of the slotted pipe being enclosed by filter fabric.
- No fines concrete: Material consisting graded coarse aggregate, typically to a single AS sieve size, bound together by a mixture of cement and water to supply sufficient strength. The result is an open textured cellular concrete with many voids and increased permeability. No fines concrete is only used under trafficked areas.
- Retempering of concrete: Use of water or admixtures in the mixer to delay the setting of concrete.
- Nominated mix: The designed mix submitted for approval.
- Prefabricated geocomposite drain: A proprietary product typically consisting of a plastic core wrapped in geotextile material, functioning as a single or second stage filter. Also termed as geocomposite edge drain and strip filter drain. These drains can be installed in narrower trenches than traditional pipe drains.
- Geotextile filter: A fabric manufactured from synthetic fibres of long chained polymer such as polypropylene, polyester or similar material and stabilised against deterioration by ultraviolet light. A geotextile filter can be either non-woven or knitted fabric.
- Production filter mix: A mix produced by a supplier using a stationary screening plant to meet the documented filter requirements.
- Trial mix: Trialling of the nominated mix to demonstrate that the mix design conforms to the documented requirements.
- Pervious pipe system: Comprises drainage pipes perforated, slotted, porous pipes, or impervious pipes laid with open joints.
- Staged granular filters: Single stage filter: A granular filter material placed in contact with the trench sides and surrounding the pervious pipe system.
 - . First stage filter: A granular filter material or geotextile placed in contact with the trench sides and surrounding a second stage filter surrounding the pervious pipe system.
 - . Second stage filter: A granular filter material or geotextile placed in contact with the pervious pipe system and surrounding a first stage filter.

1.5 TOLERANCES

General

The invert of pipe or drain: No more than 25 mm from the documented level and no more than 50 mm from the documented line.

No fines concrete production mix tolerance table

Attribute	Tolerance (% by mass)
Particle size distribution (AS sieve)	
19.0 mm	±2
9.5 mm	±5
Binder content	+3.0/-0

Prefabricated geocomposite drains

Tolerance: ±40 mm from the documented line and grade.

1.6 SUBMISSIONS

Authorities consultation

Requirement: Submit details of all utility authority notifications before commencing the works including the following:

- Service utility authorities: Submit evidence of notifications including responses received from all utility authorities for excavation in the vicinity using BEFORE YOU DIG AUSTRALIA notified utility services, a minimum of 14 days before execution of the contract commencement.

Location of subsurface utilities: Submit the accuracy of information of subsurface utilities and quality level: To AS 5488.1 (2022) and AS 5488.2 (2022).

Execution details

Siting of work: Submit any changes proposed to the location, length, designed levels, condition of installation or cover required to accommodate the requests from all the service authorities.

No fines concrete: Submit details of the following:

- Handling, storing and batching of materials: Proposed method:
 - . Method of charging the mixer, including proposed sequence of adding ingredients.
 - . Proposed method of how admixtures will be incorporated.
- Identification certificate (delivery docket) for each batch or load. Include the following:
 - . Pre-numbered.
 - . Issued sequentially in accordance with order of batching.
 - . Time of completion of batching.
- Retempering: Submit details of monitoring for compliance.
- Non-conformance: Submit details of any non-conformance.

Products and materials

General: Submit compliance certificates and test results from a registered testing authority for the following materials:

- Corrugated circular plastic pipe and fittings.
- Plain wall plastic pipe and fittings.
- Corrugated flat plastic pipe and fittings.
- Slotted thick walled PVC-U pressure pipe.
- Prefabricated geocomposite drains.
- Filter material type: Check test certificates for granular filter materials to **Type A** and **Type B filter grading tables**.
- No fines concrete: Nominated mix, submit the following including evidence of conformance:
 - . Cement: Brand and source.
 - . Water: Source.
 - . Admixtures: Proprietary source, type, name, dosage recommended by the manufacturer and evidence of conformance.
 - . Aggregates: Source, geological type, moisture condition, blend proportions and grading for each type of aggregate.
 - . Soluble salt content.
 - . Mix design: Constituent quantities per m³ of no fines concrete, water to cement ratio and nominated particle size distribution of aggregates.
 - . Permeability.
- Geotextile: Check maximum stored exposure to sunlight no greater than 14 days.

Records

Work-as-executed drawings: Submit plans of the completed subsurface drainage systems showing clearance and relative levels to the finished road construction. [See also clause M3 for handover requirements](#).

Information Sheets: Submit details of completed drain or drainage system, 5 days after completion of each drain or drainage system or as agreed with the superintendent.

No fines concrete: Submit at the end of each day, the total of individual masses of cement and aggregate used in the day's production.

Tests

Results: Submit results of testing to **ANNEXURE – MAXIMUM LOT SIZE AND MINIMUM TEST FREQUENCIES**.

Variations

Other types of subsurface drainage pipes: If proposed submit details of the type of pipe, and evidence of conformance.

1.7 INSPECTIONS

Notice

[Minimum 48 hours to be provided](#).

Give notice so that inspection may be made of the following:

- No fines concrete: Retempering.

- Siting of works: Set-out location and levels.
- Trenches: Excavation to the documented line, grade, width and depth.
- Laying of pipes: Compacted bedding, and placement of pipes to documented line and level.
- Backfilling: Documented level and relative compaction.
- Geotextile: Placement of fabric and not exposed to sunlight for more than 14 days in both trench and preconstruction storage.
- Flush test: Clean-outs of subsoil drainage lines.
- Inspection points for flushing: Check locations of inspection points, flush out risers and outlets at low points.

2 MATERIALS

2.1 SELECTION OF SUBSURFACE DRAIN AND FILTER TYPE

Subsurface pavement drains type

Pavement drains: Select from the **Subsurface drain and filter type table**.

Subsurface drain and filter type table

Parent Soil	Permeability range(m/sec)	Type of pavement drain ^a	Filter material ^b
Homogenous clay with very low permeability	<10 ⁻⁹	Type 3 or Type 4	Sand (Grade A1 to A3)
Silty or sandy clays and stratified clays with moderate low permeability	10 ⁻⁹ to 10 ⁻⁵	Type 2, Type 3 or Type 4	Sand (Grade A4 to A6)
Clean sand or gravel with high permeability	>10 ⁻⁵	Type 1 or Type 2	Aggregate (Grade B1 or B2)
Solid rock or clean broken rock with high permeability to permeable fissures	Not applicable	Type 1	Aggregate (Grade B3 or B4)

a. Pavement drains Type1, Type 2, Type 3 and Type 4 to Austroads AGPT10 (2009) Figure 3.1.
b. Filter material properties to **Type A filter gradings table** and **Type B filter gradings table**.
Source: Austroads AGPT10 (2009)

2.2 SUBSURFACE DRAINAGE PIPES

General

Fittings: Joints, couplings, elbows, tees and caps to the manufacturer's recommendations.

Corrugated circular plastic pipe and fittings

Standard: To AS 2439.1 (2007).

Pipe: Conform to the following:

- Size: 65 or 100 mm diameter.
- Clean-outs and outlets: 100 mm diameter unslotted pipe set into a suitable concrete surface access surrounded with access cap and associated location marker posts.
- Type: Type 1.
- Class: SN20.
- 65 mm diameter pipes in edge drains under kerbs and in no fines concrete: Class SN8 pipe or higher.

Plain wall plastic pipe and fittings

Standard: To AS 2439.1 (2007):

- Type: Type 2.
- Size: As documented.

Corrugated flat plastic pipe and fittings

Standard: To ASTM D2122 (2022).

Size: 170 or 300 mm high.

Clean-outs and outlets: 100 mm diameter unslotted pipe.

Slotted thick walled PVC-U pressure pipe and fittings

Standard: To AS/NZS 1477 (2017).

Pipe: Conform to the following:

- Size: If not documented, conform to the following:
 - . Nominal diameter: 58 mm.
 - . Minimum wall thickness: 6.5 mm.
- Type: Slotted except where documented otherwise.
- Slot sizes and spacings: To **ANNEXURE - SLOTTING DETAILS FOR THICK WALLED PVC-U PRESSURE PIPE.**

Joints: Square ends and butt jointed.

Prefabricated geocomposite drains and fittings

General: Conform to the following:

- Joints and fittings: Use manufactured joints and fittings.
- Damage: Show no signs of cracks, splits or indents:
 - . Supply of coils or bundles: Make sure that if ties are used, they do not cause any damage to drain.

Rigid geocomposite drain: Conform to the following:

- Standard: To ASTM D7001 (2020).
- Type: Class B.
- Requirement: To the **Rigid geocomposite drains - stiffness properties table.**
- Properties:
 - . Elongated high density polyethylene.
 - . Corrugated.
 - . Perforated or non-perforated.
 - . Location of perforations: Minimum 20 mm from the bottom of geocomposite drain.
 - . Clear water opening (150 and 300 mm drain): 3.5%..

Rigid geocomposite drains - stiffness properties table

Property	Test method	Requirement (150 and 300 mm drains)
Horizontal compressive strength at 20% deflection	ASTM D2412 (2021)	Minimum 200 kPa
Change in core area	ASTM D6244 (2006)	< 5% loss in internal core area

Flexible geocomposite drain: Conform to the following:

- Requirement: To the **Flexible geocomposite drains - stiffness properties table.**
- Do not use flexible strip filter drains in pavement subsurface with traffic loading.
- Properties:
 - . High density polyethylene with a geotextile wrapping.
 - . Geotextile: Non-woven and strength class A. To the **Robustness classification of geotextiles (G strength rating) table.**

Flexible geocomposite drains - stiffness properties table

Horizontal loading	Geocomposite drain height		
	Up to 200 mm	200 to 400 mm	400 mm and above
Min force (kN) at 4 mm deflection	5.5	11	16.5

2.3 FILTER MATERIAL**Standard**

General: AS 1141.11.1 (2020)

General

Properties: Clean, hard, and durable particles.

Subsoil drains laid in or adjacent to planted areas: pH range of filter material 6 to 7.

Compatibility of Filters with soils and Pipes: To Austroads AGPT10 (2009) Section 5.6:

- Standard filter gradings: To **Type A Filter gradings table** and **Type B Filter gradings table**.

. Type A filter: Use with natural soil, geotextile filters and pavement materials (A1 to A6)

. Type B filter: Use as second stage filters to Type A, or with geotextiles. (B1 to B4)

Parent soil: Select filter(s) based on the parent soil to be drained.

Type A Filter gradings table

Single and first stage filters (including sands, uniformly graded fine aggregates and gravel)

Type A	Percentage (%) passing sieve					
	A1	A2	A3	A4	A5	A6
Description of filter	Dune sand	Coarse washed sand		5 mm one size	6 – 8 mm one size	Sandy gravel
37.5 mm						100
26.5 mm						
19.0 mm					100	85 - 100
13.2 mm					90 - 100	
9.50 mm		100	100	100	70 - 100	65 - 100
4.75 mm		90 - 100	90 - 100	70 - 100	28 - 100	45 - 82
2.36 mm	100	75 - 100	70 - 100	0 - 50	0 - 28	30 - 60
1.18 mm	95 - 100	50 - 98	40 - 65	0 - 10	0 - 8	15 - 40
600 micron	70 - 98	30 - 80	12 - 40			5 - 25
300 micron	30 - 60	10 - 40	0 - 16	0 - 5	0 - 5	0 - 10
150 micron	0 - 12	0 - 7	0 - 4			0 - 5
75 micron	0	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3
Parent soil	Silt and friable clays		Sand silts	Fine to medium sands	Coarse sand	Sandy silts
Maximum pipe slot width	0.4 mm	0.6 mm	1.5 mm	3.0 mm	3.3 mm	5.0 mm
Suitable second stage filter	B1	B2	B3	B4		B3 or B4

Type B filter gradings table

Second stage filters (uniformly graded aggregates)

Type B	Percentage (%) passing sieve			
Direction of Filter	B1	B2	B3	B4
	5 mm one size	6 – 8 mm one size	10 mm one size	19 mm one size
37.5 mm				
26.5 mm				100
19.0 mm		100	100	70 - 100
13.2 mm		90 - 100	90 - 100	0 - 30
9.50 mm	100	70 - 100	40 - 70	0 - 10
4.75 mm	70 - 100	28 - 100	0 - 15	
2.36 mm	0 - 50	0 - 28	0 - 5	0 - 5
1.18 mm	0 - 10	0 - 8		
600 micron				
300 micron	0 - 5	0 - 3		
150 micron				Oct 2

Type B	Percentage (%) passing sieve			
	B1	B2	B3	B4
Direction of Filter				
75 micron	0 - 3	0 - 3	0 - 3	0 - 3
Proposed use	With type A1	With type A2	With types A3, A6	With types A4, A6
Maximum pipe slot size	3.0 mm	3.3 mm	9.0 mm	15.0 mm

Robustness classification of geotextiles (G strength rating) table

Geotextile strength class	Elongation ^a	Grab strength ^b (N)	Tearing strength(N) ^c	G rating ^d
A	≥30	500	180	900
	<30	800	300	1350
B	≥30	700	250	1350
	<30	1100	400	2000
C	≥30	900	350	2000
	<30	1400	500	3000
D	≥30	1200	450	3000
	<30	1900	700	4500
E	≥30	1600	650	4500

a. % elongation corresponding to max CBR burst strength determined in accordance with AS 3706.4 (2012).

b. Grab strength is the 80th percentile characteristic value of the lot when tested in accordance with AS 3706.2 (2012).

c. Tearing strength is the 80th percentile characteristic value of the lot when tested in accordance with AS 3706.3 (2012).

d. G rating calculated on the 80th percentile values of CBR burst strength when tested in accordance with AS 3706.4 (2012) and drop height determined in accordance with AS 3706.5 (2014). Where the strain at failure during the CBR burst strength exceeds 80%, the CBR burst strength at 80% strain shall be used.

Note: The number of tests shall be in accordance with AS 3706.1 (2012), but grab strength shall be determined on a 10 lot test.

Source: Austroads AGPT04G (2009).

Geotextile filter properties table

Geotextile filter type ^a	Minimum robustness G ^b	EOS ^c (microns)	Minimum elongation ^d (%)
First stage filter	900 (moderately robust)	85 - 230	45
Second stage filter	600 - 900	125 – 350	20

a. Geotextile filter type may vary in different states.

b. G = Geotextile strength rating.

c. EOS = Equivalent opening size using AS 3706.7 (2014). Determination of pore size distribution- dry sieving method.

d. Elongation at break as determined by AS 3706.2 (2012). Determination of tensile properties – wide strip method.

Note: Storage of geotextiles: Store geotextiles away from sunlight and not be exposed unnecessarily to sunlight during delivery and placement.

Source: Austroads AGPT10 (2009).

2.4 NO FINES CONCRETE

Coarse aggregate

Properties: Clean and durable.

Standard: To AS 2758.1 (2014).

Coarse aggregate properties table

Test method	Property	Requirement
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Test method	Property	Requirement
AS 1141.4 (2000)	Bulk density	Minimum 1200 kg/m ³
AS 1141.6.1 (2000)	Particle density	Minimum 2100 kg/ m ³
AS 1141.6.1 (2000)	Water absorption	Maximum 2.5%
AS 1141.11.1 (2020)	Particle size distribution	To the Particle size distribution table
AS 1141.14 (2007)	Particle shape:	
	- 2.1 ratio	Maximum 35%
	- 3.1 ratio	Maximum 10%
AS 1141.22 (2019)	Wet strength	Minimum 150 kN
RMS T239 (2022)	Fracture faces: Two or more	Minimum 80%
AS 1141.22 (2019)	Wet/dry variation	Minimum 35%
Note: Bulk density is the same as unit mass.		

Particle size distribution table

AS sieve size (mm)	Percent (%) passing by mass
26.5	100
19.0	95-100
9.5	0-5

Cement

Standard: General purpose cement to AS 3972 (2010).

Admixtures

Standard: To AS 1478.1 (2000).

Properties: Free from calcium chloride, calcium formate, triethanolamine or any other accelerator.

Combining admixtures: Do not combine without verification from the admixtures manufacturers that they are compatible.

Warm season retarder: Use a lignin or lignin-based (ligpol) set-retarding admixture, Type Re or Type WRRe.

Cool season retarder: Use a lignin or lignin-based set-retarding admixture containing maximum 6% reducing sugars, Type WRRe.

Alkali contribution: The total alkali contribution (measured as Na₂O) from all admixtures used in any mix must not exceed 0.20 kg/m³.

Other admixtures which may be used: Superplasticisers and high range sodium oxide water reducers, Type HR, WR, Re.

Water

Mixing water: To AS 1379 (2007) clause 2.4.

Water properties: Clean potable water, free from any material which may be harmful to the concrete or reinforcement including oil, acid, alkali, organic or vegetable matter.

Limits of impurities in mixing water: To AS 1379 (2007) Table 2.2 and the following:

- Chloride ion: Maximum 300 parts per million to AS 1478.1 (2000) Appendix C.
- Sulfate ion: Maximum 400 parts per million to AS 1289.4.2.1 (2020).

Nominated mix

Variations to the nominated mix: Any change without approval is subject to removal may be required by the Superintendent to be removed from the Works.

Aggregate to cement and water to cement ratios table

Grade	Aggregate to cement ratio (by mass)	Water to cement ratio
NFC SD	6:1	0.35-0.45

2.5 GEOTEXTILE

Standard

General: To AS 3706.

Properties

Requirement: Conform to the following:

- Material: A woven, non-woven or knitted type manufactured from synthetic materials other than polyamide, except seamless tubular filter fabric.
- Type: Needle punched, chemically bonded or heat melded.
- Curtain drains material: Polyester, polypropylene or polyethylene.
- Bio-stable and resistant to attack by alkalis, acids, dry heat, steam, moisture, brine, mineral oil, petrol, diesel and detergents.
- Open air exposure: Remove to spoil any geotextile exposed to sunlight for more than 14 days.
- Selection of material for robustness and strength: To suit subgrade conditions for the relevant location/ or function.
- Minimum mass requirements: As documented.
- Rate of water flow: To Austroads AGPT04G (2009) Table 4.1, under 100 mm constant head.
- Needle punched, non-woven geotextile representative equivalent opening size: Between 75 and 150 μm .
- Free of imperfections in weave or yarn, abrasion resistant and weave stability qualities such that it does not form holes, ladder, de-weave, tear or unravel more than 5 mm from a cut end.

Identification, marking and storage

Standard: To AS 3705 (2012).

Protection: Cover each roll to protect the fabric against moisture and ultraviolet radiation.

Storage: Store under a protective cover and support off the ground. Protect from damage and conform to the manufacturer's recommendations.

Seamless tubular filter fabric

Material: Polypropylene or polyester seamless knitted tubular filter fabric.

Arrangement: Enclose slotted pipe of 65 mm or 100 mm diameter.

Representative large opening size: Between 200 and 500 μm .

Fitting: Conform to the requirements of **ANNEXURE - PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE**.

Damaged filter fabric: Remove and replace filter fabric that is torn, excessively stretched or otherwise damaged during transportation, storage, fitting of the fabric or pipe laying. Replace filter fabric exposed for more than 14 days to sunlight.

2.6 TESTING.

Quality

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Quality verification: If material/product quality verification can be obtained from the supplier, documented tests need not be repeated.

Test authority: A registered laboratory.

Nominated mix aggregates testing: Date of testing less than 18 months from the time the nominated mix is proposed to be used.

No fines concrete: Coarse aggregate properties, conform to the following:

- Fractured faces: Each fractured face to be a ~~signification~~ **significant** proportion of the total surface area of the particle.
 - . Aggregates derived from igneous rock: Test not required.
- RMS T239 (2022).
- AAR: For petrographic examination, eliminate without further testing aggregates containing reactive components, including the following:
 - . Opaline material.

- . Unstable silica minerals including tridymite and cristobalite.
- . Sheared rock with stained quartz and microcrystalline quartz.
- Soluble salts content: Conform to the following:
 - . Chloride ion: < 0.8 kg/m³ of concrete.
 - . Sulfate ion: 5% of the cement content.

3 EXECUTION

3.1 GENERAL

Clearing and grubbing

Requirement: To 1111 *Clearing and grubbing*.

Subsoil and formation drains

Requirement: To 1172 *Subsoil and formation drains*.

Pavement drains

Requirement: To 1173 *Pavement drains*.

Drainage blankets

Requirement: To 1174 *Drainage blankets*.

Timing: Construct formation drain after completion of clearing and grubbing operations, and before commencement of embankment construction.

3.2 NO FINES CONCRETE

Trial mix

Requirement: Before starting production of each mix, prepare a trial batch of each nominated mix for testing.

Mixing and consistency

Contaminated material: Do not use aggregates that have become intermixed or contaminated with foreign matter.

Cement: Weigh cement separately.

Measuring equipment: Conform to the following:

- Water: Use a calibrated device with one litre increments.
 - . Accuracy: $\pm 2\%$.
- Admixtures accuracy: $\pm 5\%$.

Handling storage and batching

Standard: To AS 1379 (2007) Section 4 and Appendix A.

Mixing time: Conform to the following:

- For stationary batch mixers: Not less than 54 seconds plus 6 seconds for each m³.
- For mobile batch mixers: Full period of mixing required at either the testing station or the point of placement.
- Split drum mixers: Maximum 5 minutes.
- Measured from the time all ingredients are in the mixing drum.

Adding mixture

Admixtures: Separate and thoroughly pre-dilute in the mixing water before mixing with other materials. Mix to the manufacturer's recommendations.

Retempering

Requirement: Conform to the following:

- Designated mixing speed: Not less than 30 revolutions.
- If there is no evidence of original mixing conditions: Re-mix for 55 revolutions.
- Water: Record quantity on the identification certificate for each batch. Make sure it does not exceed the water to cement ratio of the mix.
 - . Addition of water after the commencement of discharge: Record the estimated remaining quantity of no fines concrete.
- Time: Retemper only within 40 minutes of completion of batching.

- Location: Either batch plant, testing stations or point of placement.

Production and transport

Transport and production equipment: Use equipment which:

- Prevent segregation or loss of materials.
- Supply a homogenous product.

Sampling

Requirement: Sample at the point of delivery within 45 minutes of completion of batching.

Material non-conformance

Requirement: Remove from the site and replace with conforming material.

3.3 TEMPORARY DRAINAGE DURING CONSTRUCTION**Temporary drainage during construction**

Runoff overflows during construction: Allow for runoff to avoid damage or nuisance due to scour, sedimentation, soil erosion, flooding, diversion of flow, damming, undermining, seepage, slumping or other adverse effects to the Works or surrounding areas and structures.

Equipment and material: Locate clear of watercourses and secure in the event of large runoff flows.

3.4 ESTABLISHMENT**Siting of work**

Set-out: To the type of subsurface drains, location and levels, as documented.

3.5 EXCAVATION**Safety**

Stabilisation: If required, undertake shoring, sheet piling or other stabilisation of the sides of trench excavation.

Trenches

Method: Excavate trenches as follows:

- To the line, grade, width and depth as documented or as required.
- Minimum grade: 0.5%.
- Construct the bottom of the trench to avoid localised ponding.
- Remove all loose material.

Unsuitable material

Requirement: Rectify unsuitable material to **UNSUITABLE MATERIAL** in the *1112 Earthworks (Road reserve)* worksection and as follows:

- Remove and dispose of unsuitable material at the bottom of the trench or at foundation level.
- Replace with backfill material to conform to the requirements of this worksection.
- Trim the bottom of the excavated trench or foundation parallel with the documented level and slope of the work.

Laying of pipes

Joints: Minimise joints in the pipeline.

Joints in slotted pipe: To the manufacturer's recommendations.

Flushout points construction: Construct flushout points at the locations shown on the Drawings, complete with concrete covers and cover caps.

Bedding for pipes in the geotextile wrapped zone

- General: Place filter aggregate bedding for the pipework as documented.
- Minimum depth of the bedding: 50 mm.

Prefabricated geocomposite drains

Flow rate: Space out outlets more frequently than for standard drain pipes to achieve the same flow capacity or increase drainage grade.

Laying of drain: Conform to the following:

- Trenches: Minimum 500 mm depth and 150 mm width.
- Location: Position centrally within the trench and place vertically.
 - . Other drainage pipes: If required, place alongside other drainage pipes in the same trench.

- Bedding: Not required and drain can be directly laid on the floor of the trench.

Joints: If geotextile is used to wrap sections of drain, use a minimum width of 450 mm.

Rigid geocomposite drains: Wrap pipe with non-woven geotextile strength class A encapsulating the drain and join the geotextile by heat or electrical weld to the **Robustness classification of geotextiles (G strength rating) table**.

3.6 BACKFILLING

General

Prevent damage to pipes: Place, spread, compact the subbase by tamping around and over the pipe to avoid damage to the drain pipes.

No fines concrete: Do not mechanically tamp.

Compaction: Compact cohesionless material to a Density Index of 70%.

Staged construction

Stage 1: After constructing the underlying trench, protect the filter material placed from scour and/or contamination by overlapping the geotextile above the underlying trench and placing a sacrificial geotextile or plastic. Cover with a 50 mm thick plug/cap of select fill material with a maximum particle size of 25 mm.

Stage 2: Place and compact above the plug the selected fill material to a relative compaction of 95%.

Stage 3: Excavate, remove plug/cap, and any contaminated filter material and any selected material covering. Conform to the following:

- Do not disturb previously laid pipes, filter sock or geotextile.
- Extend height of the underlying trench to the underside of the pavement.
- Alignment and width of trench: Same as the underlying trench.

Stage 4: Replace with filter material and compact to 95% relative compaction and place any overlying pavement layers.

3.7 GEOTEXTILE

Location

Extent: As documented.

Requirement: Install at the interface between the filter material and adjoining materials.

Installation

Placement: Cover the bottom and sides of the trench with sufficient fabric to wrap around the completed drain. Conform to the shape of the trench with minimal wrinkles, folds or air voids between fabric and trench, but not stretched over the soil. Do not allow loose material from outside of the trench to enter the excavation.

Intersections: Minimum 200 mm laps.

Program: Less than 14 days between initial laying out and final cover of the geotextile with drainage backfill layer. Where possible, place geotextiles just ahead of construction works, and cover with materials within 48 hours.

Protection: Secure the geotextile to prevent movement by wind or by construction. Protect and avoid damage during installation and backfilling operations.

Removal and replacement: Remove damaged geotextile. Remove and replace if geotextile is exposed to sunlight for longer than 14 days.

3.8 OUTLET STRUCTURES

Discharge and salinity prevention

Subsurface drainage pipes: Connect discharge into gully pits or to outlet structures, as documented.

Salinity prevention: Discharge on the downhill side of the embankment or in the cut area, to avoid recharging the subsurface water table.

Outlets

Location intervals: 120 m maximum at certain grades, for flat grades decrease spacing to 50 m.

Rodent proofing method: Secure outlets, including those discharging into gully pits, with stainless steel or UPVC filter fitting to prevent access by rodents.

Erosion control

Method: Locate the outlet so that erosion of the adjacent areas does not occur and/or protect the outlet by the placement of selected stone.

Locations: Provide marker posts to indicate the location of pipe outlets and assist maintenance. **To Marking of drains and outlets.**

Outlet pipe

Type: Install unslotted outlet pipes from curtain drains.

Levels: Make sure no point in an outlet pipe is higher than the pipe at the end of the curtain drain.

Concrete

Requirement: To 0319 Auxiliary concrete works.

Batters

Requirement: If connection to a trench drain or stormwater pit is not possible, install an outlet at the batter to discharge water beyond the edge of the road.

Pipe: Conform to the following:

- Type and size: Same as documented within the subsoil, formation or pavement drains.
- Length extending beyond the edge of the pavement: Non-perforated laid at the base of the trench.

Height: Taper height of the base of the trench of the connecting section of perforated pipe, from 0 to 100 mm, over a 2 m length.

Backfill: Backfill the section of pipe with selected material and conform to the following:

- Maximum particle size: 50 mm.
- Relative compaction: 95%.

3.9 CLEAN-OUTS**General**

Requirement: Provide clean-outs and cast iron caps, as documented.

Cleanout pit location: At the commencement start of each run of subsoil drain line.

Intervals: Approximately 100 – 140 m to cleanout risers and pits.

Flush out point: Provide the subsoil drain flush out point with a concrete cover of Class N32 concrete fitted with a removable cap to Austroads AGRD05A (2023) Figure 8.4.

3.10 MARKING OF DRAINS AND OUTLETS**General**

Marker Posts: Provide white powder coated galvanised steel post box sections with the following properties:

- Dimensions: 80 mm x 40 mm x 1200 mm high with welded steel cap on top of the posts.
- Drive posts:
 - . Underground: 500 mm.
 - . Above ground: 700 mm.
- Stencil with black letters: SS DRAIN on the 80 mm face of the post facing the road.
 - . Letters dimensions with height 60 mm and width 30 mm.

3.11 RECORDING**General**

Work-as-executed plans: Record details of all subsurface drainage pipes and the completed subsurface drainage systems.

Information sheets: Include the following:

- Date of completion of drain construction.
- Drain number.
- Type of drain.
- Pipe size.
- Pipe type:
 - . Seamless tubular filter fabric enclosure: If proposed.

- Filter type.
- Grade of drain and levels of the drain relevant to the finished edge of the road pavement or top of kerb.
- Locations of clean-outs.
- Locations of outlets: Include GPS coordinates.
- Geotextile type:
 - . Seamless tubular filter fabric enclosure: If proposed.
- Response time: The time taken for water to travel from the inlet end of a drain or from a clean-out leading to a drain, to the outlet end of the drain.

3.12 TESTING

Quality

Requirement: Test for all characteristics in conformance with **ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES**.

Site tests

No fines concrete: Permeability greater than 20 mm/s.

Geotextile exposed to sunlight in excess of 21 days: 60% retained strength.

Flush test: After completion of backfilling, pump clean water into the clean-out at the commencement start of each run, until only clean water discharges at the outlet.

- Minimum rate of flow of flushing water at the inlet: 100 l/min at the inlet.

4.2 ANNEXURE - SLOTTING DETAILS FOR THICK WALLED PVC-U PRESSURE PIPE

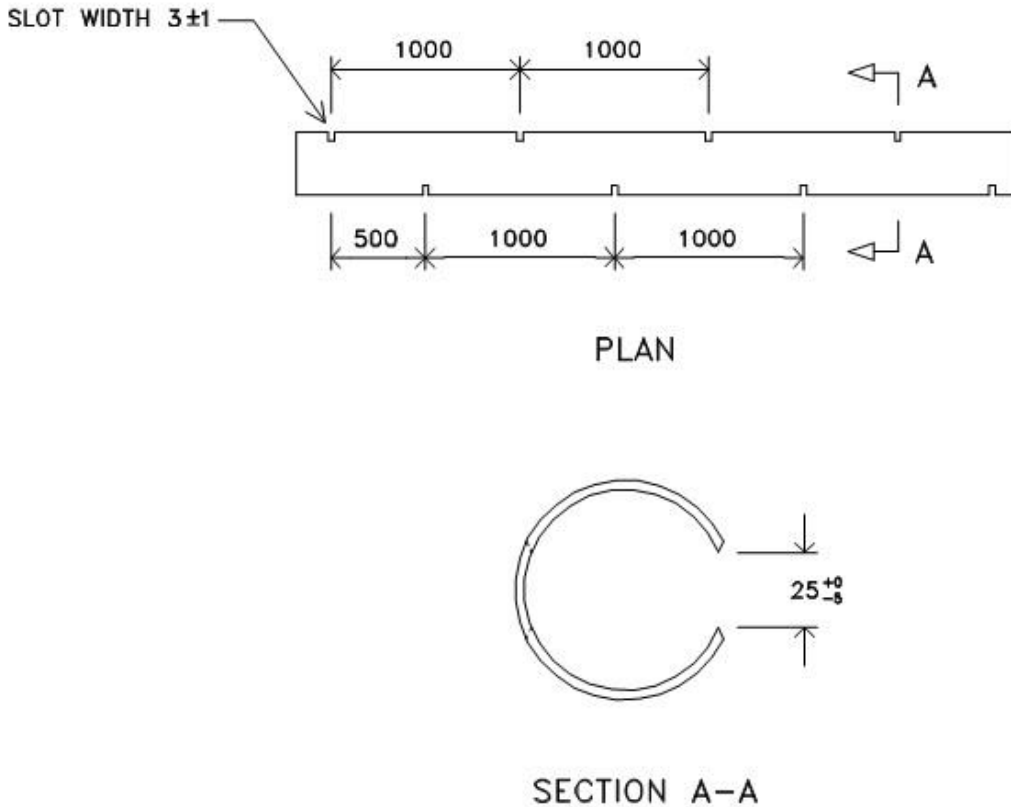


Diagram not to scale
Dimensions are in millimetres

4.3 ANNEXURE - PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE

General

Installation: Fit filter fabric to the slotted pipe on site immediately before it is laid in its final position in the works.

Requirement: Conform to the following procedure:

- Pull the filter fabric over and onto the mandrel. Pass the slotted pipe through the mandrel.
- Clamp the filter fabric to the forward end of the slotted pipe, when the end of the slotted pipe emerges from the mandrel, so that it cannot slip back along the pipe.
- Pull the remaining slotted pipe through the mandrel, allowing the filter fabric to progressively slip and stretch fit over the slotted pipe as it emerges.
- Neatly cut the filter fabric, leaving an overhang off the end of the pipe, after the slotted pipe has passed through the mandrel. This allows for a fully covered joint with an adjacent pipe when the pipes are installed in the drain.
- Clamp the filter fabric to the end of the slotted pipe, so that the filter fabric remains stretch-fitted onto the pipe when the pipe is positioned in the drain.

Precautions

Protection from damage: Do not drag the slotted pipe fitted with seamless tubular filter fabric over the ground. If carrying, lift off the ground, and protect from damage.

Damaged fabric: If the filter fabric is damaged and its filtering properties affected, remove it from the pipe and replace it with undamaged filter fabric.

Loose fabric: If the filter fabric becomes loose on the slotted pipe during installation, re-stretch it to the correct position. If re-stretching causes damage to the filter fabric, remove it and replace with undamaged filter fabric.

4.4 ANNEXURE - SUMMARY OF HOLD AND WITNESS POINTS

For private developments, certain Hold and Witness Points where specifically noted below require representatives of both the Superintendent and the Principal Certifier (e.g. Council) to authorise release.

Clause and description	Type	Submission/Inspection details	Submission/Notice times	Process held
SUBMISSIONS Service utility authorities consultation	H	Results of consultation with service authorities and locations of subsurface utilities.	14 days minimum before contract commencement	Commencement of work
SUBMISSIONS Products and materials Circular plastic pipe and fittings	H	Compliance certificates and test results.	7 days before supply of pipes	Pipe and fittings supply (round plain wall pipes)
SUBMISSIONS Products and materials Corrugated flat plastic pipe and fittings	H	Compliance certificates and test results.	7 days before supply of pipes	Pipe and fittings supply (corrugated pipes)
SUBMISSIONS Products and materials Slotted thick walled PVC-U pressure pipe	H	Compliance certificates and test results.	7 days before supply of pipes	Pipe and fittings supply (slotted thick walled PVC-U pressure pipe)
SUBMISSIONS Products and materials Filter granular material	H	Type of filter material and grading. Type A and B gradings.	7 days before	Delivery of granular filter material
SUBMISSIONS Products and materials No fines concrete	H	Nominated mix: Submit the following including evidence of conformance: Cement: Brand and source. Water: Source. Admixtures: Proprietary source, type, name, dosage recommended by the manufacturer and evidence of conformance. Aggregates: Source, geological type, moisture condition, blend proportions and grading for each type of aggregate. Soluble salt content.	5 days before date of delivery	Delivery of no fines concrete

Clause and description	Type	Submission/Inspection details	Submission/Notice times	Process held
		Permeability.		
SUBMISSIONS Records of no fines concrete placed each day	H	Daily record of mass of no fines concrete placed.	End of each day	Records
SUBMISSIONS Work- as – executed information sheets for completed subsoil drains	W	Show levels and clearance of the subsoil pipes to the finished road construction.	5 days after subsoil pipe completion.	Information sheets for completed subsoil drains
SUBMISSIONS Products and materials Geotextile	H	Data sheets, compliance certificates and test results.	14 days before supply of pipes	Geotextile supply
SUBMISSIONS Execution details Siting of work	H – Superintendent and Principal Certifier	Changes proposed to the length, location, designed levels, condition of installation or cover.	7 days before commencement	Commencement
INSPECTIONS Notice No fines concrete	H	Retempering if required.	3 days before after rettempering	Placement of no fines concrete
INSPECTIONS, Notice Siting of works	H	Set-out of location and levels.	7 days before pipe installation	Pipe installation
INSPECTIONS, Notice Trenches	H	Excavation to the documented line, grade, width and depth.	1 days before pipe installation	Pipe installation
INSPECTIONS, Notice Laying of pipes	H – Superintendent and Principal Certifier	Compacted bedding, and Placement of pipes or geocomposite drains to documented line and level.	1 day before backfilling	Backfilling
INSPECTIONS, Notice Backfilling	H	Documented level and relative compaction.	1 day before covering with geotextile	Placement of geotextile
INSPECTIONS, Notice Geotextile	H	Placement of fabric.	1 day before backfilling	Backfilling
INSPECTIONS, Notice Flush test	H	Clean-outs of subsoil drainage lines.	3 days before completion	Completion
Note: H = Hold Point, W = Witness Point				

4.5 ANNEXURE - MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
Material supply	Material quality — Supplier's documentary evidence and certification of:			
	Circular plastic pipe	1	1 per	AS 2439.1 (2007)

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
	and fittings	contract/size	type/size	
	Plain wall plastic pipe and fittings	1 contract/size	1 per type/size	AS 2439.1 (2007) and RMS T1507 (2012)
	Corrugated flat plastic pipe and fittings	1 contract/size	1 per type/size	ASTM D2122 (2022)
	Thick walled PVC-U pressure pipe:	1 contract/size	1 per type/size	AS/NZS 1477 (2017)
	- Transmissivity property of geotextile around pipe	1 contract/size	1 per type/size	ASTM D6574/D6574M (2013)
	- Crush strength test	1 contract/size	1 per type/size	AS 2439
	Prefabricated geocomposite drains: Damage	1 contract/size	1 per type/size	RMS T1508 (2012), RMS T1509 (2012) and RMS T1510 (2012)
	Rigid geocomposite drains:			
	- Horizontal compressive strength	1 contract/size	1 per type/size	ASTM D2412 (2021)
	- Change in core area	1 contract/size	1 per type/size	ASTM D6244 (2006)
	Flexible geocomposite drains:			
	- Stiffness	1 contract/size	1 per type/size	RMS T1507 (2012)
	Filter material:			
	- Grading Type A filter gradings table	1 contract/size	1 per type	AS 1141.11.1 (2020)
	- Grading for Type B filter gradings table	1 contract/size	1 per type	AS 1141.11.1 (2020) and AS 1141.22 (2019)
	Compaction	1 contract/size	1 per type	AS 1289.5.6.1 (1998)
	No fines concrete:			
	- Bulk density	1 contract	1 per type	AS 1141.4 (2000)
	- Particle density	1 contract	1 per type	AS 1141.6.1 (2000)
	- Water absorption	1 contract	1 per type	AS 1141.6.1 (2000)
	- Particle size distribution	1 contract	1 per type	AS 1141.11.1 (2020)
	- Particle shape: 2:1 ratio	1 contract	1 per type	AS 1141.14 (2007)
	- Particle shape: 3:1 ratio	1 contract	1 per type	AS 1141.14 (2007)
	- Petrographic examination	1 contract	1 per type	ASTM C295/C295M (2019)
	- Assessment and	1 contract	1 per type	Austrroads AGBT/T701 (2020)

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
	classification: Mortar bar test			
	- Assessment and classification: Concrete prism test	1 contract	1 per type	RMS T364 (2012)
	- Wet strength: Particle distribution interval	1 contract	1 per type	AS 1141.22 (2019)
	- Fractured faces	1 contract	1 per type	RMS T239 (2022)
	- Wet/dry variation	1 contract	1 per type	AS 1141.22 (2019)
	- Chloride testing: Aggregates	1 contract	1 per type	AS 1012.20.1 (2016)
	- Chloride testing: Water and admixtures dissolved in water	1 contract	1 per type	AS 1478.1 (2000)
	- Sulfate testing: Aggregates	1 contract	1 per type	AS 1012.20.1 (2016)
	- Sulfate testing: Water and admixtures	1 contract	1 per type	AS 1289.4.2.1 (2020)
	- Sulfate testing: Cementitious material	1 contract	1 per type	AS 2350.2 (2006)
	- Soluble salts: Hardened concrete	1 contract	1 per type	AS 1012.20.1 (2016)
	- Permeability: Moulding and curing specimens	1 contract	1 per type	RMS T376 (2016)
	- Permeability test	1 contract	1 per type	RMS T377 (2016)
	Geotextile:			
	- Identification and marking	1 contract	1 per type	AS 3705 (2012)
	- General	1 contract	1 per type	AS 3706 (Various)
	- Rate of water flow: Perpendicular flow test	1 contract	1 per type	AS 3706.9 (2012)
	- Exposure to sunlight in excess of 21 days	1 contract	1 per type	AS 3706.11 (2012)
	- Seamless tubular filter fabric: Opening size	1 contract	1 per type	RMS T1524 (2012)
	- Seamless tubular filter fabric: Laddering, unravelling or deweaving from a	1 contract	1 per type	RMS T1521 (2012)

Activity	Key quality verification requirements	Maximum lot size	Minimum test frequency	Test method
	cut end			
	- Seamless tubular filter fabric: Abrasion resistance	1 contract	1 per type	RMS T1522 (2012)
	- Seamless tubular filter fabric: Weave stability	1 contract	1 per type	RMS T1523 (2012)
Excavation – Trench base	Line and grade	1 drainage line	1 per 200 lin. m	Survey
	Compaction	1 drainage line	1 per 200 lin. m ^a	AS 1289.5.4.1 (2007)
Bedding and backfill: - Filter material	Compaction	1 drainage line	1 per drainage line	AS 1289.5.4.1 (2007)
- Selected backfill	Compaction	1 drainage line	1 per 200lin m ^a	AS 1289.5.4.1 (2007)
- Earth backfill	Compaction	1 drainage line	1 per 200 lin. m ^a	AS 1289.5.4.1 (2007)
- Cohesionless backfill	Compaction	1 drainage line	1 per 200 lin. m ^a	AS 1289.5.6.1 (1998)
Staged construction	Temporary plug over filter material: Plasticity Index of fill material	1 contract	1 per type	AS 1289.3.3.1 (2009)
a. or part thereof, per lot				

4.6 ANNEXURE - PAY ITEMS

This Annexure applies to Council projects. For private development works use of this schedule is optional, at the Superintendent's discretion. Include only the Pay items based on the Filter material Type A, or B: Select fill type as appropriate.

Pay items	Unit of measurement	Schedule rate inclusions
1171.1 Subsoil drain pipe - Corrugated circular plastic pipe and fittings, plain wall plastic pipe, thick walled PVC-U pressure pipe or prefabricated geocomposite drain	Linear Metres (Lin. M) - Measured along the length of the pipe.	All costs associated with: - Supply and laying of the subsoil pipe including connections, markers, fittings and seamless tubular filter fabric where documented. - The schedule quantity is a provisional quantity.
1171.2 Filter material Type A, backfill for single and first stage filters	- Compacted m ³ - Calculate the volume from the actual length and depth of the trench or blanket up to the level of the filter material multiplied by the design width of the trench.	- All costs associated with supply, placement and compaction of filter material and the capping of the trench where documented. - The schedule quantity is a provisional quantity.
1171.3 Filter material Type B backfill for second stage filters	- Compacted m ³ - Calculate the volume from the actual length and depth of the trench or blanket up to the level of the filter material	- All costs associated with supply, placement and compaction of filter material and the capping of the trench where documented.

Pay items	Unit of measurement	Schedule rate inclusions
	multiplied by the design width of the trench or blanket.	- The schedule quantity is a provisional quantity.
1171.4 No fines concrete	Compacted m ³	- All costs associated with supply, placement and compaction of no fines concrete.
1171.5 Outlet structures for subsurface drainage pipes	Each outlet structure.	- Outlet structures in conformance with this worksection excluding outlets into pits. - All costs associated with the construction of the outlet including forming of the structure, supply of concrete and, the provision of erosion control measures. - The schedule quantity is a provisional quantity.
1171.6 Supply of geotextile	m ² Area covered by geotextile as measured on site.	- All costs associated with: - Supply, placement and securing of the geotextile material. - No additional payment for additional geotextile used at intersections. - The schedule quantity is a provisional quantity.
1171.7 Establishment – Setting out	Lump Sum	All costs associated with setting out and associated survey work.
1171.8 Clean-out structures	Each Clean-out structure constructed as documented.	All costs associated with the following: Provision of clean-out structures Supply and installation of lids Recording of clean-out locations. Conform to <i>1171 Subsurface drainage</i> . The schedule quantity is a provisional quantity.
Minor concrete		To <i>0319 Auxiliary concrete works</i> .
Control of erosion and sedimentation		To <i>1102 Control of erosion and sedimentation (Construction)</i> .
Earthworks		To <i>1112 Earthworks (Road reserve)</i> .
Traffic management	Lump sum	To <i>1101 Traffic management</i> .

4.7 ANNEXURE - REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS 1012		Methods of testing concrete
AS 1012.20.1	2016	Determination of chloride and sulfate in hardened concrete and concrete aggregates - Nitric acid extraction method
AS 1141		Methods for sampling and testing aggregates

AS 1141.4	2000	Bulk density of aggregate
AS 1141.6.1	2000	Particle density and water absorption of coarse aggregate - Weighing-in-water method
AS 1141.11.1	2020	Particle size distribution - Sieving method
AS 1141.14	2007	Particle shape, by proportional caliper
AS 1141.22	2019	Wet/dry strength variation
AS 1289		Methods of testing soils for engineering purposes
AS 1289.3.3.1	2009	Soil classification tests - Calculation of the plasticity index of a soil
AS 1289.4.2.1	2020	Soil chemical tests - Determination of the sulfate content of a natural soil and the sulfate content of the groundwater - Normal method
AS 1289.5.4.1	2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.6.1	1998	Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material
AS 1379	2007	Specification and supply of concrete
AS/NZS 1477	2017	PVC pipes and fittings for pressure applications
AS 1478		Chemical admixtures for concrete, mortar and grout
AS 1478.1	2000	Admixtures for concrete
AS 2350		Methods of testing portland, blended and masonry cements
AS 2350.2	2006	Chemical composition
AS 2439		Perforated plastics drainage and effluent pipe and fittings
AS 2439.1	2007	Perforated drainage pipe and associated fittings
AS 2758		Aggregates and rock for engineering purposes
AS 2758.1	2014	Concrete aggregates
AS 3705	2012	Geotextiles - Identification, marking, and general data
AS 3706		Geotextiles - Methods of test
AS 3706.1	2012	General requirements, sampling, conditioning, basic physical properties and statistical analysis
AS 3706.2	2012	Determination of tensile properties - Wide strip and grab method
AS 3706.3	2012	Determination of tearing strength - Trapezoidal method
AS 3706.4	2012	Determination of burst strength - California bearing ratio (CBR) - Plunger method
AS 3706.5	2014	Determination of puncture resistance - Drop cone method
AS 3706.7	2014	Determination of pore-size distribution - Dry sieving method
AS 3706.9	2012	Determination of permittivity, permeability and flow rate
AS 3706.11	2012	Determination of durability - Resistance to degradation by light, heat and moisture
AS 3972	2010	General purpose and blended cements
AS 5488		Classification of subsurface utility information (SUI)
AS 5488.1	2022	Subsurface utility information
AS 5488.2	2022	Subsurface utility engineering (SUE)
Austrroads AGBT/T701	2020	Test method - Alkali-silica reactivity of aggregate – Accelerated mortar bar test.
Austrroads AGPT		Guide to pavement technology
Austrroads AGPT04G	2009	Geotextiles and geogrids
Austrroads AGPT10	2009	Subsurface drainage
Austrroads AGRD		Guide to road design
Austrroads AGRD05A	2023	Drainage – Road surface, network, basins and subsurface
RMS T239	2022	Fractured faces of coarse aggregate
RMS T364	2012	Concrete prism test for AAR assessment
RMS T376	2016	Moulding of no fines concrete specimens
RMS T377	2016	Water permeability of no fines concrete (Falling head laboratory permeameter)
RMS T1507	2012	Determination of the compressive stiffness of strip filters
RMS T1508	2012	Determination of the low temperature resistance of strip filters during straightening
RMS T1509	2012	Determination of the high temperature impact resistance of strip filters

RMS T1510	2012	Determination of the low temperature impact resistance of strip filters
RMS T1521	2012	Laddering, unravelling of deweaving of a seamless knitted tubular filter fabric from a cut end
RMS T1522	2012	Abrasion resistance of seamless knitted tubular filter fabric
RMS T1523	2012	Weave stability of seamless knitted tubular filter fabric
RMS T1524	2012	Determination of opening size of seamless knitted tubular filter fabric
ASTM C295/C295M	2019	Standard guide petrographic examination of aggregates for concrete
ASTM D2122	2022	Standard test method for determining dimensions of thermoplastic pipe and fittings
ASTM D2412	2021	Standard test method for determination of external loading characteristics of plastic pipe by parallel-plate loading
ASTM D6244	2006	Standard test method for vertical compression of geocomposite pavement panel drains
ASTM D6574/D6574M	2013	Test method determining the (in-plane) hydraulic transmissivity of geosynthetic by radial flow
ASTM D7001	2020	Standard specification for geocomposite for pavement edge drains and other high-flow applications
EN 15804	2012	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
ISO 14025	2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 21930	2017	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services

5 ANNEXURE M – CESSNOCK CITY COUNCIL SPECIFIC CLAUSES

M1.	Variations to or non-conformances with Council's AUS-SPEC are to be evaluated with reference to the procedure in Council's <i>Development Engineering Handbook</i> . Acceptance is to be obtained in writing from: an authorised representative of Council's Director of Infrastructure and Engineering Services.	Variation procedure
M2.	This specification applies in addition to any development consent (DA) conditions. If there is any inconsistency, the conditions of consent shall prevail.	DA Conditions
M3.	Refer to the Cessnock City Council <i>Development Engineering Handbook</i> for final inspection, works-as-executed and handover requirements.	Completion

6 AMENDMENT HISTORY

0	15/01/2024	First Published
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