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DEVELOPMENT DESIGN SPECIFICATION

D4

SUBSURFACE DRAINAGE DESIGN

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
1	IPWEA Mid North Coast Working Party Review	D4	A,O,P	HC	Jan 2001
1	Drawing of sub-soil drain P D4-3	Figure D4.1	M	GS	June 2003
2	Bidim changed from A24 to A12	Figure 4.1	M	AS	Jan 2005

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DEVELOPMENT DESIGN SPECIFICATION D4 SUBSURFACE DRAINAGE DESIGN

GENERAL

D4.01 SCOPE

1. The work to be executed under this Specification consists of the design of the subsurface drainage system for the road pavement and/or subgrade.
2. This Specification contains procedures for the design of subsurface drainage, including:
 - (a) Subsoil and Foundation Drains
 - (b) Sub-Pavement Drains
 - (c) Drainage Mats, including Type A and Type B Mats.
3. Reference guidelines for the application and design of subsurface drainage include ARRB Special Report 35, *APRG Report 21*, and the AUSTROADS publication – Guide to the Control of Moisture in Roads (refer to references below for the full titles of these guidelines).

D4.02 OBJECTIVES

1. The objective in the design of the subsurface drainage system is to control moisture content fluctuations in the pavement and/or subgrade to within the limits assumed in the pavement design. ***Control Moisture Content***

D4.03 TERMINOLOGY - RESERVED

1. Subsoil drains are intended for the drainage of ground water or seepage from the subgrade and/or the subbase in cuttings and fill areas. ***Subsoil Drains***
2. Foundation drains are intended for the drainage of seepage, springs and wet areas within and adjacent to the foundations of the road formation. ***Foundation Drains***
3. Sub-pavement drains are intended for the drainage of the base and subbase pavement layers in flexible pavements. They may also function to drain seepage or groundwater from the subgrade. ***Sub-pavement Drains***
4. Type A drainage mats are intended to ensure continuity of a sheet flow of water under fills, to collect seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water. ***Type A Drainage Mats***
5. Type B drainage mats are constructed to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings. ***Type B Drainage Mats***

D4.04 REFERENCE AND SOURCE DOCUMENTS**(a) Council Specification**

- C230 - Subsurface Drainage – General
- C231 - Subsoil and Foundation Drains
- C232 - Pavement Drains
- C233 - Drainage Mats

(b) Australian Standards

- AS2439.1 - Perforated drainage pipe and associated fittings.
- AS/NZS 1477 - Unplasticised PVC (UPVC) pipes and fittings for pressure applications.

(c) Reserved**(d) Other**

- AUSTROADS - Guide to the Control of Moisture in Roads, 1983
- ARRB-SR35 - Australian Road Research Board, Special Report No. 35 - Subsurface Drainage of Road Structures, Gerke R.J., 1987.
- APRG Report 21 - AUSTROADS – A Guide to the Design of New Pavements for Light Traffic.

SUBSOIL AND SUB-PAVEMENT DRAINS**D4.05 WARRANTS FOR USE**

- | | | |
|----|--|----------------------------|
| 1. | Subsoil drains are designed to drain groundwater or seepage. | Subsoil Drains |
| 2. | Sub-pavement drains are primarily designed to drain water from base and subbase pavement layers in flexible pavements, and also to drain seepage or groundwater from the subgrade. | Sub-pavement Drains |
| 3. | Subsoil or sub-pavement drains shall generally be provided on both sides of the formation. Exceptions to the above will be: | Geotechnical Survey |
| a) | <i>When the geotechnical report indicates the absence of subsurface moisture at the time of investigation,</i> | |
| b) | <i>When the likelihood that changes in the subsurface moisture environment will not occur within the design life of the pavement,</i> | |
| c) | <i>When the pavement has been specifically designed to allow for likely variations in subgrade and pavement moisture contents,</i> | |
| d) | <i>When the table drains are constructed with an invert level lower than the subgrade level, and/or</i> | |
| e) | <i>When the water tables do not rise to within 300mm of the subgrade level after prolonged rainfall.</i> | |

Where only one side of the formation is in cut, and the other side in fill, it may be sufficient to provide subsoil or sub-pavement drains only along the edge of the formation in cut.

4. The need for additional subsoil and sub-pavement drains may become apparent during the construction process due to changes in site moisture conditions or to areas of poorer subgrade being uncovered that were not identified in the geotechnical investigation.

During Construction

D4.06 LAYOUT, ALIGNMENT AND GRADE

1. A cross section of typical subsurface drain is shown below in Figure D4.1.

Typical Cross Sections

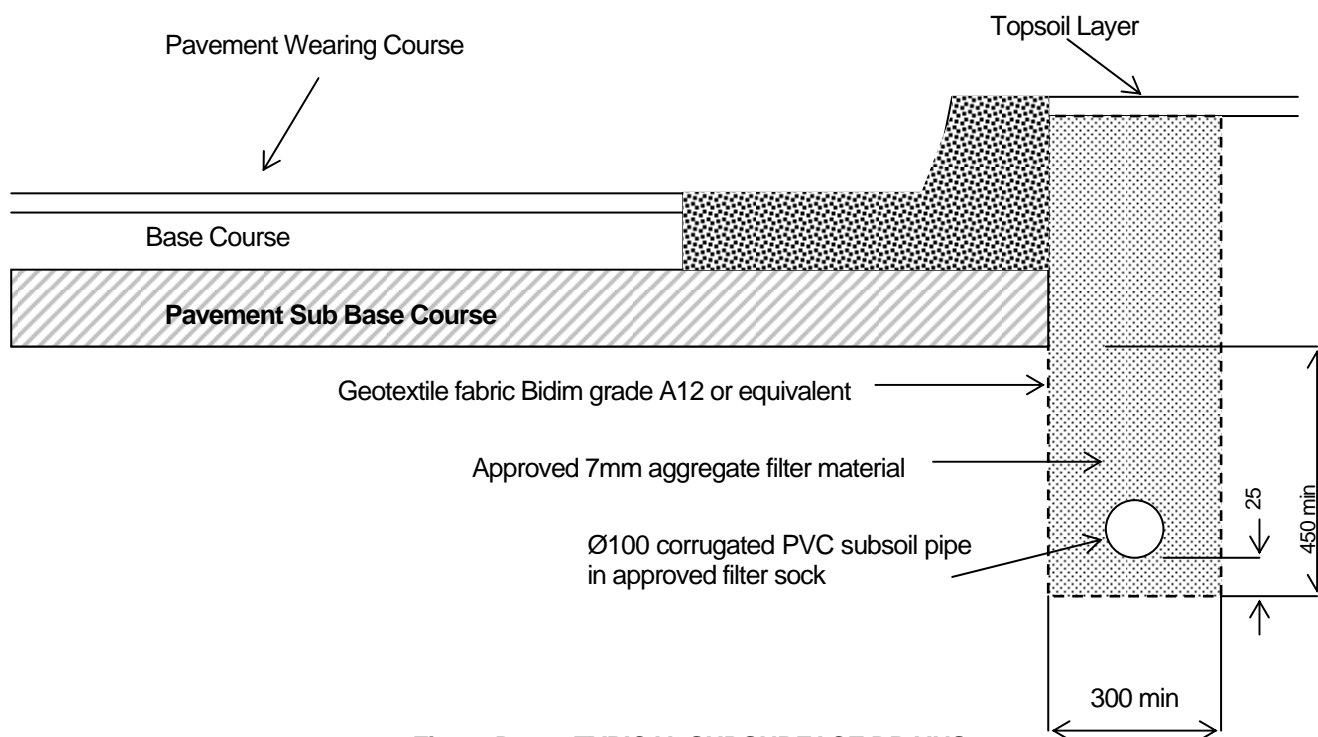


Figure D4.1 – TYPICAL SUBSURFACE DRAINS

2. In kerbed roads, the two locations for the subsoil and sub-pavement drains are shown in Figure D4.1.

Kerbed Roads

3. In unkerbed roads, subsoil and sub-pavement drains shall be located within the shoulder, preferably at the edge of the pavement layers.

Unkerbed Roads

4. The minimum longitudinal design grade for subsurface drains shall be 1.0%.

Grade

5. Trench widths shall be a minimum of 300mm, with a minimum depth below finished subgrade level of 600mm in earth and 450mm in rock, and below the invert level of any service crossings existing close to these depths.

Trench Dimensions

6. Outlets shall be spaced at maximum intervals of 100 metres. Where possible, subsoil and sub-pavement drainage pipes shall discharge into gully pits or other stormwater drainage structures. Where not possible, outlets shall be provided through fill batters.

Outlets

7. Cleanouts are to be provided at the commencement of each run of drain, and at intervals not exceeding 50 metres. Cleanouts shall generally be located directly at the rear of kerb or at the edge of shoulder, as applicable.

Cleanouts**FOUNDATION DRAINS****D4.07 WARRANTS FOR USE**

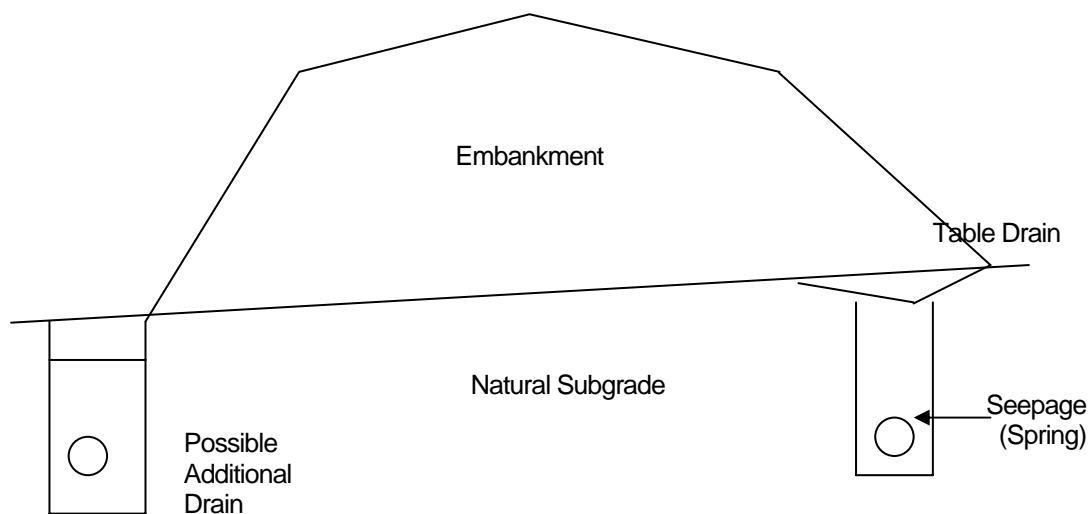
1. Foundation drains are designed to drain excessive ground water areas within the foundation of an embankment or the base of cutting, or to intercept water from entering these areas.

Foundation Drains

2. Foundation drains shall be designed and detailed on the drawings where geotechnical investigation indicates the presence or potential presence of excess groundwater.

Geotechnical Survey During Construction**D4.08 LAYOUT, ALIGNMENT AND GRADE**

1. Typical cross-sections of foundation drains are shown below in Figure D4.2.

Typical Cross Section**Figure D4.2 - Foundation Drains**

2. The minimum design grade shall be 1.0%.

Grade

3. Foundation drains shall be a minimum trench width of 300mm, with a variable trench depth to suit the application and ground conditions on site.

Trench Dimensions

4. Outlets shall be spaced at maximum intervals of 100 metres.

Outlets

5. Where practicable, cleanouts are to be provided at the commencement of each run of foundation drain and at intervals not exceeding 50 metres. Where not practicable to provide intermediate cleanouts, outlets shall be spaced at maximum intervals of 80 metres.

Cleanouts

DRAINAGE MATS (BLANKETS)

D4.09 WARRANTS FOR USE

1. Type A drainage mats are designed where there is a need to ensure continuity of a sheet flow of water under fills, to collect surface seepage from a wet seepage area, or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water. Type A drainage mats are constructed after the site has been cleared and grubbed and before commencement of embankment construction. **Type A Mats**
2. Type B drainage mats are designed where there is a need to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings. Type B drainage mats shall be constructed after completion of the subgrade construction and before construction of the pavement. **Type B Mats**
3. The geotechnical survey should address the need for the provision of the drainage mats along the proposed road alignment. **Geotechnical Survey**
4. Information on drainage mats is contained in the construction specification, DRAINAGE MATS CONSTRUCTION – C233N.

MATERIALS

D4.10 SUBSOIL AND SUB-PAVEMENT DRAIN PIPE

1. Pipes designated for subsoil, foundation and sub-pavement drains shall be *minimum* 100mm dia. slotted pipe or equivalent.
2. Corrugated plastic pipe shall conform with the requirements of AS2439.1. The appropriate class of pipe shall be selected on the basis of expected live loading at the surface. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1.
3. Slotted rigid UPVC pipe shall comply with AS 1254.
4. All pipe shall be slotted, and fitted with a suitable geotextile filter tube, except for cleanouts and outlets through fill batters which shall be unslotted pipe.
5. Other types of subsoil drainage systems may be permitted in consultation with Council.

D4.11 INTRA PAVEMENT DRAIN PIPE

1. Pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses neither less than 150mm nor more than 200mm shall be slotted thick walled UPVC pressure pipe complying with AS/NZS 1477.
2. Pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses exceeding 200mm shall be slotted pipe of a type and class approved by Council.
3. Pipes for use in Type B drainage mats shall be slotted thick walled UPVC pressure pipe complying with AS/NZS 1477.

D4.12 FILTER MATERIAL

1. The types of filter material covered by this Specification shall include:
 - (a) Type A filter material for use in subsoil, foundation, and sub-pavement (trench) drains and for Type B drainage mats.
 - (b) Type B filter material for use in subsoil, foundation and sub-pavement (trench) drains.
 - (c) Type C filter material comprising crushed rock for use in Type A drainage mats.
 - (d) Type D filter material comprising uncrushed river gravel for use in Type A drainage mats.
2. Material requirements and gradings for each type of filter material are included in the Construction Specification, SUBSURFACE DRAINAGE GENERAL – C221, and shall be noted on the design drawings.
3. The type of filter material specified to backfill the sub-surface drainage trenches (subsoil, foundation and sub-pavement drains) shall depend on the permeability of the pavement layers and/or subgrade and the expected flow rate. Generally, Type A filter material is used for the drainage of highly permeable subgrade or pavement layers such as crushed rock or coarse sands, while Type B filter material is used for the drainage of subgrade and pavement layers of lower permeability such as clays, silts or dense graded gravels. Further guidance to the selection of appropriate filter material is contained in ARRB Special Report 35.

D4.13 GEOTEXTILE

1. Geotextile shall be provided, and detailed on the drawings, to provide separation (ie. prevent infiltration of fines) between the filter material in the trench and the subgrade or pavement material. Geotextile shall be designated to encapsulate the filter material. The geotextile shall comply with the requirements included in the Construction Specification, SUBSURFACE DRAINAGE GENERAL – C221.
2. All subsoil drainage systems, both Type A and Type B Drainage Mats, shall be encapsulated in geotextile.

DOCUMENTATION**D4.14 DESIGN DRAWINGS AND CALCULATIONS**

1. The proposed location of all subsurface drains shall be clearly indicated on the Design Drawings, including the nominal depth and width of the trench, and the location with respect to the line of the kerb/gutter or edge of pavement. Details shall be shown on a typical cross sectional drawing. The location of outlets and cleanouts shall also be indicated on the Drawings.
2. Geotechnical reports, assumptions and/or calculations used in the design of subsurface drainage shall be supplied to Council for approval with the Design Drawings.

**Submission
Details**

SPECIAL REQUIREMENTS

D4.15 RESERVED

D4.16 RESERVED

D4.17 RESERVED

D4.18 RESERVED

