TWEED SHIRE COUNCIL

DEVELOPMENT DESIGN SPECIFICATION

D4

SUBSURFACE DRAINAGE SYSTEM

VERSION 1.3

SPECIFICATION D4 – SUBSURFACE DRAINAGE SYSTEM

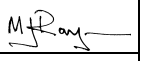
CITATION

This document is named "Tweed Shire Council, Development Design Specification D4 - Subsurface Drainage System".

ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on AUS-SPEC Development Design Specification D4 - Subsurface Drainage System, January 2002 (Copyright SWR-TM). Substantial parts of the original AUS-SPEC document have been deleted and replaced in the production of this Tweed Shire Council Development Specification. The parts of the AUS-SPEC document that remain are still subject to the original copyright.

VERSIONS, D4 SUBSURFACE DRAINAGE SYSTEM

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Engineering Services
1.1	Original Version		1 July 2003	
1.2	Amendments to referenced standard drawings	D4.04	1 June 2004	
1.3	Amend specified class of corrugated plastic pipe	D4.10	9 July 2012	

DEVELOPMENT DESIGN SPECIFICATION D4

SUBSURFACE DRAINAGE SYSTEM

GENERAL

D4.01 SCOPE

1. This specification is for 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 Reports 35 and 41, and the AUSTROADS publication - Guide to the Control of Moisture in Roads. The full titles of these guidelines are given below.

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

1. Subsoil drains are intended for the drainage of ground water or seepage from the subgrade and/or the subbase in cuttings. ***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

In cases of conflict or contradiction, unless otherwise specified, the provisions of this Specification will prevail over all reference documents and prevail over all Tweed Shire Council Standard Drawings.

(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
ASTM - D3787		

(c) RTA Specifications

MR Form 1160	-	Supply and Delivery of Seamless Tubular Filter Fabric.
3555	-	Slotted Fibre Reinforced Concrete Pipe for Subsurface Drainage

(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.
ARRB-SR41	-	Australian Road Research Board, Special Report No. 41 - A structural Design Guide for Flexible Residential Street Pavements, Mulholland P.J., 1989.

(e) Tweed Shire Council Standard Drawings that apply to this section:

S.D. 012	Subsoil Drainage Details

SUBSOIL AND SUB-PAVEMENT DRAINS

D4.05 WARRANTS FOR USE

1. Subsoil drains are designed to drain groundwater or seepage from the subgrade and/or subbase in cuttings. ***Subsoil Drains***

2. Sub-pavement drains are designed to drain water from base and subbase pavement layers in flexible pavements, and to drain seepage or groundwater from the subgrade. ***Sub-pavement Drains***

3. Subsoil or sub-pavement drains are to be provided on both sides of the road formation in the following locations, except where their use may cause environmental damage such as draining significant wetlands or potential acid sulphate soils. In these cases, an approved alternate method of preventing water infiltration into the pavement is to be provided. ***Subsoil drainage***

   (a) Cuttings

(b) Locations of known hillside seepage, high water table or isolated springs

(c) Flood prone or poorly drained areas

(d) Filled subdivisions – For sandy subgrade sites, subsoil drains shall be installed;

(i) 10m either side of Sag Gully pits

(ii) 10m on the upstream side of On-Grade Gully pits

(e) Highly moisture susceptible subgrades. I.e. Commonly displaying high plasticity or low soaked CBRs

(f) Where moisture susceptible pavements are used

(g) Existing pavements displaying distress due to excessive subsurface moisture

(h) Cut/fill transitions

4. The need for subsoil and sub-pavement drains may otherwise 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. Typical cross sections of subsoil and sub-pavement drains are shown below in Figures D4.1 and D4.2. As indicated in these figures, subsoil drain trenches are excavated to below subgrade level, while sub-pavement drains extend into or adjacent to the pavement layers to facilitate drainage of the pavement layers in addition to the subgrade.

Typical Cross Sections

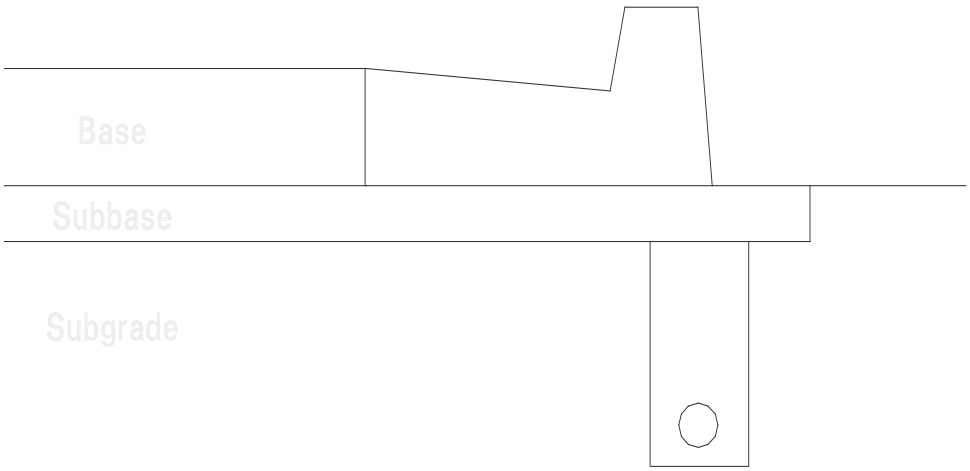


Figure D4.1 - Typical Subsoil Drain

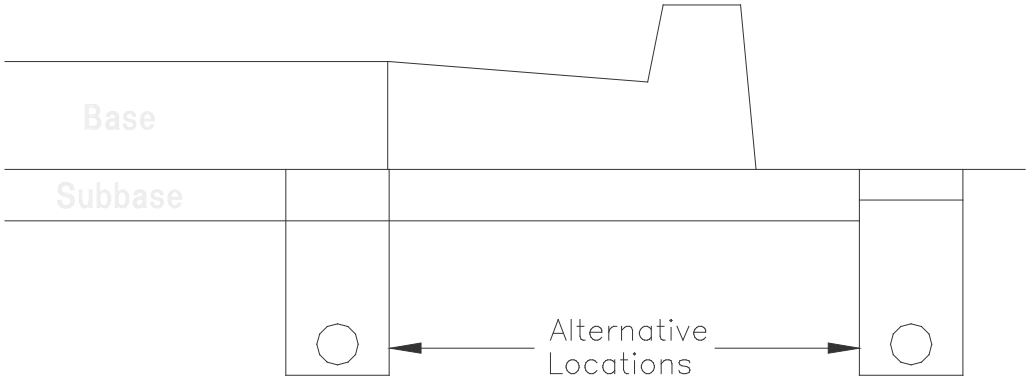


Figure D4.2 - Typical Sub-pavement Drain

2. In kerbed roads, the two acceptable alternative locations for the line of the trench are directly behind the kerb line. Pavement layers must extend to at least the line of the rear of the trench. ***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 as shown in Figure D4.2 or alternatively a table drain may be constructed with a minimum depth 0.2m below the bottom of box. ***Unkerbed Roads***

4. The minimum desirable longitudinal design grade shall be 1.0-1.5%. For non-corrugated pipes, an absolute minimum grade of 0.5% is acceptable. ***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. ***Trench Dimensions***

6. Outlets shall be spaced at maximum intervals of 120 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 60 metres. Cleanouts shall generally be located directly at the rear of kerb or within a gully pit with a screw on cap. To identify locations of cleanouts, markers are to be placed in the kerb except at gully pits. In unkerbed roads cleanouts shall be generally located at the edge of shoulder and are to be identified with a timber post bearing the appropriate 'SD' markings. ***Cleanouts***

FOUNDATION DRAINS

D4.07 WARRANTS FOR USE

1. Foundation drains are to be provided (except at locations where a Geotechnical Report states they are not to be installed) 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. The plans shall show the location of the foundation drains. ***Foundation Drains***

2. During construction excess water may demand an increase in the capacity of the foundation drains. The geotechnical survey during construction may advise of appropriate additional/amended drainage to the Design Plans. ***Geotechnical Survey During Construction***

3. Where the road formation traverses known swampy, flood-prone, or water charged

strata, the Design Plans shall show the location of the foundation drains. Annotate the foundation drains that are potentially not required.

4. Foundation drains are mandatory in road cuttings except where the designer can demonstrate redundancy.

D4.08 LAYOUT, ALIGNMENT AND GRADE

1. Typical cross-sections of foundation drains are shown below in Figure D4.3. ***Typical Cross Section***

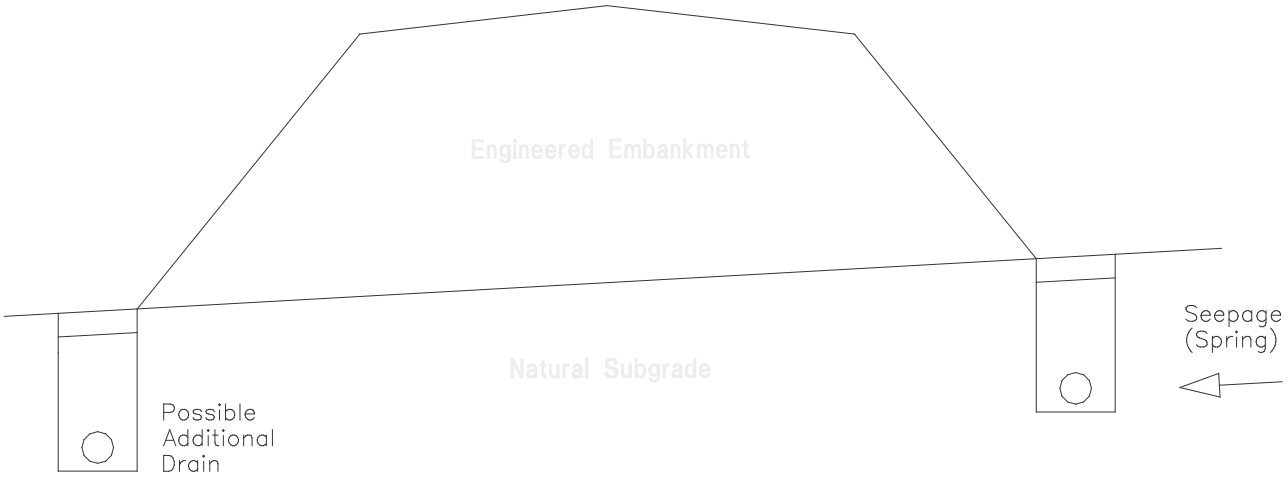


Figure D4.3 - Foundation Drains

2. The minimum design grade shall be 1.0%. For non-corrugated pipes an absolute minimum grade of 0.5% is acceptable. ***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 150 metres. ***Outlets***

5. Where practicable, cleanouts are to be provided at the commencement of each run of foundation drain and at intervals not exceeding 60 metres. Where not practicable to provide intermediate cleanouts, outlets shall be spaced at maximum intervals of 100 metres. The locations of cleanout points are to be identified with a white timber post bearing the appropriate 'SD' markings. ***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 ***Type B Mats***

drainage mats shall be constructed after completion of the subgrade construction and before construction of the pavement.

3. The need to design for the provision of drainage mats should be apparent from the result of the geotechnical survey along the proposed road formation alignment. Details of proposed works to be provided on Part 12 - Engineering Plans.

Geotechnical Survey

MATERIALS

D4.10 SUBSOIL AND SUB-PAVEMENT DRAIN PIPE

1. Pipes designated for subsoil, foundation and sub-pavement drains shall be 100mm dia. slotted pipe.

2. Corrugated plastic pipe shall be Class 400 conforming with the requirements of AS2439.1. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1.

3. Slotted fibre reinforced cement pipe shall be designated type “100 DMR” meeting the requirements of RTA Specification No. 3555 or an approved equivalent.

4. Slotted rigid UPVC pipe shall be of a type and class approved by Council.

5. All pipe shall be slotted, and fitted with seamless tubular filter fabric, with a sieve size < 425µm and Ball Burst of 45kg in accordance with ASTM D3787, except for cleanouts and outlets through fill batters which shall be unslotted pipe.

D4.11 INTRA PAVEMENT DRAIN PIPE

1. Pipes for use in Type B Drainage Mats shall be designated 100mm diameter slotted fibre reinforced cement pipe, designated type 100 DMR pipe or an approved equivalent, meeting the requirements of RTA Specification 3555, shall be designated for intra pavement drains where crushed rock subbase layer thicknesses are greater than 200mm, for edge drains where any part of the shoulder consists of material other than concrete, and for use in Type B Drainage Mats.

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.

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. Where necessary to provide separation (i.e. 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.

2. Geotextile shall also be designated for both Type A and Type B Drainage Mats.

DOCUMENTATION

D4.14 DESIGN PLANS AND CALCULATIONS

1. The proposed location of all subsurface drains shall be clearly indicated on the Design Plans, 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. Where practicable, the location of outlets and cleanouts shall also be indicated on the Design Plans.

2. Assumptions and/or calculations made in the determination of the need or otherwise for subsurface drainage in special circumstances or as a variation to the requirements of this specification shall be submitted to Council for approval with the Design Plans.

SPECIAL REQUIREMENTS

D4.15 RESERVED

D4.16 RESERVED

D4.17 RESERVED

D4.18 RESERVED