



Muswellbrook Shire Council

DEVELOPMENT DESIGN SPECIFICATION

AUS-SPEC (Cot 09)

0043 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 AUS-SPEC 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
0	Customisation for Muswellbrook Council Local Government Area	all	AMOP		24/10/2011

Table of Contents

0043 Subsurface drainage	1
1 General	1
1.1 Responsibilities	1
1.2 Cross references	1
1.3 Referenced documents	1
1.4 Standards	1
1.5 Interpretations	1
2 Design	3
2.1 Planning	3
2.2 Design criteria	3
2.3 Materials	9
3 Documentation	11
3.1 General	11

0043 SUBSURFACE DRAINAGE

1 GENERAL

1.1 RESPONSIBILITIES

Objectives

Control moisture fluctuations: 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.

Salinity prevention: In the areas with a history of salinity problems, subsurface drainage may be prescribed to keep the groundwater table lower in the strata so as to avoid progressive deterioration of the health of topsoil and upper layers due to salinity levels increased by rising and/or fluctuating groundwater tables.

1.2 CROSS REFERENCES

Worksections

General: 0160 *Quality (Design)*.

- 1171 *Subsurface drainage*.
- 1172 *Subsoil and foundation drains*.
- 1173 *Pavement drains*.
- 1174 *Drainage mats*.

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

Standards

- | | |
|-------------------|--|
| AS/NZS 1477: 2006 | PVC pipes and fittings for pressure applications. |
| AS 2439 | Perforated plastics drainage and effluent pipe and fittings. |
| AS 2439.1-2007 | Perforated drainage pipe and associated fittings. |

Other publications

ARRB *Australian Road Research Board*.

ARR368: 2006 The collection and discharge of stormwater from road infrastructure.
Department of environment and climate change, NSW.

Resource NSW - Specification for supply of recycled materials for pavements, earthworks and drainage, 2003.

Other publications.

AUSTROADS

Guide to the control of moisture in roads, 1983.

AGPT10: 2009 Guide to Pavement Technology – Part 10: Subsurface drainage.

Victoria Road: Standard Drawing for subsurface drain types SD 1601

1.4 STANDARDS

General

Subsurface drainage design: To AGPT10.

Drainage design: To AGRD05.

1.5 INTERPRETATIONS

Definitions

General: For the purposes of this worksection the following definitions based on functions apply:

Drainage types:

- Subsoil drains: are intended for the drainage of ground water or seepage from the subgrade and/or the subbase in cuttings and fill areas.

- Foundation drains: Foundation drains are intended for the drainage of seepage, springs and wet areas within and adjacent to the foundations of the road formation. Can also be termed 'formation drains'.
- 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.

Drainage mats:

- 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. Can also be termed 'drainage blankets'.
- 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. Can also be termed 'drainage blankets'.

2 DESIGN

2.1 PLANNING

Geotechnical investigations

Investigations: Obtain an appropriate geotechnical investigation comprising sub-grade soil characteristics and ground water effects to enable selection of drainage units. Refer to Austroads Publication AGPT10.

Detail design report and appropriate Geotechnical investigation reports shall be submitted to council for approval. Designer shall provide supporting details for a selection of subsurface pavement drain and type.

2.2 DESIGN CRITERIA

Subsoil and sub-pavement drains

Locations: Provide subsoil or sub-pavement drains on both sides of the formation in the following locations:

- Cut formations where the depth to finished subgrade level is equal to or greater than 400 mm below the natural surface level.
- Locations of known hillside seepage, high water table, isolated springs or salt affected areas.
- Irrigated, flood-prone or other poorly drained areas.
- Highly moisture susceptible subgrades, i.e., commonly displaying high plasticity or low soaked CBRs.
- Use of moisture susceptible pavement materials.
- Existing pavements with similar subgrade conditions displaying distress due to excess subsurface moisture.
- At cut to fill transitions.

Exceptions:

- Omit drains if the geotechnical report indicates the absence of subsurface moisture at the time of investigation and the likelihood that changes in the subsurface moisture environment will not occur within the design life of the pavement and/or the pavement has been specifically designed to allow for likely variations in subgrade and pavement moisture contents.
- If 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.

Additional locations: 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.

Drawings: Indicate the potential need for subsoil or sub-pavement drains in addition to those shown on the Drawings.

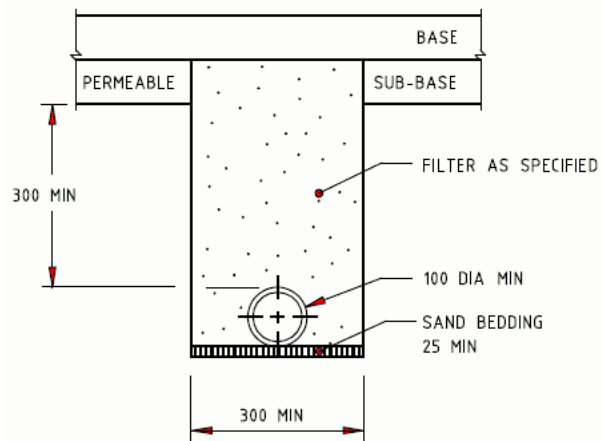
Layout, alignment and grade

Typical cross sections: Typical cross sections of subsoil and sub-pavement drains are shown in Figures 2.1 and 2.2.

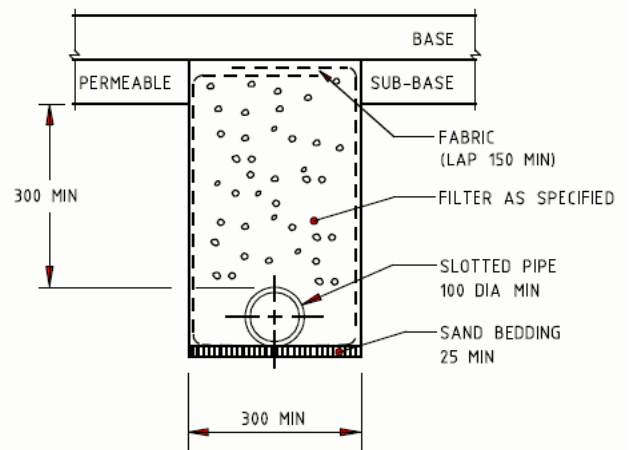
Kerbed roads: In kerbed roads, the two acceptable alternative locations for the line of the trench are directly behind the kerblines. Pavement layers must extend to at least the line of the rear of the trench.

Unkerbed roads: In unkerbed roads, locate subsoil and sub-pavement drains within the shoulder, preferably at the edge of the pavement layers as shown in Figure 2.2.

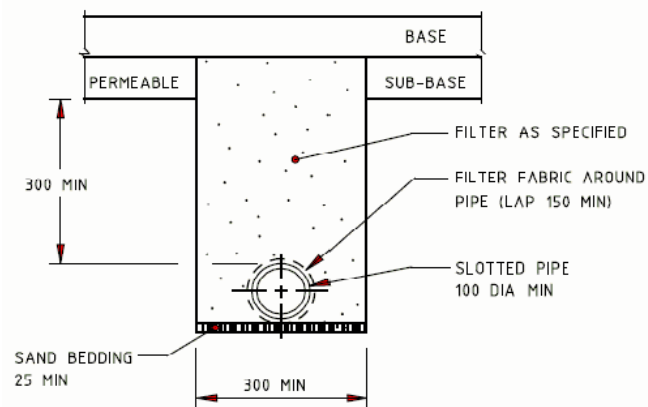
Grade: The minimum longitudinal design grade is 1.0%. For non corrugated pipes, an absolute minimum grade of 0.5% is acceptable.



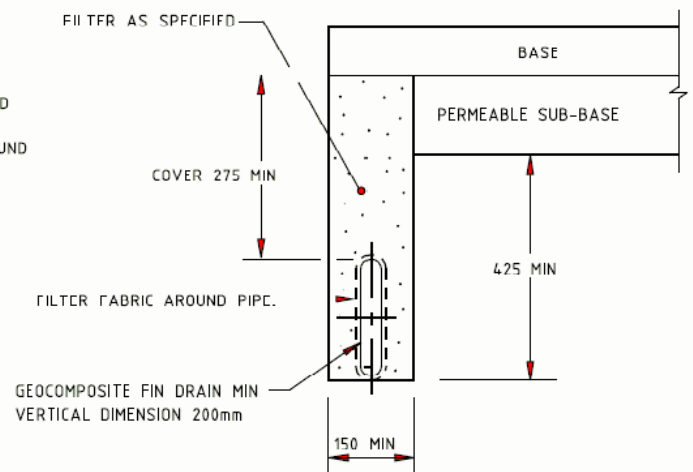
PAVEMENT DRAIN TYPE 1



PAVEMENT DRAIN TYPE 2



PAVEMENT DRAIN TYPE 3



PAVEMENT DRAIN TYPE 4

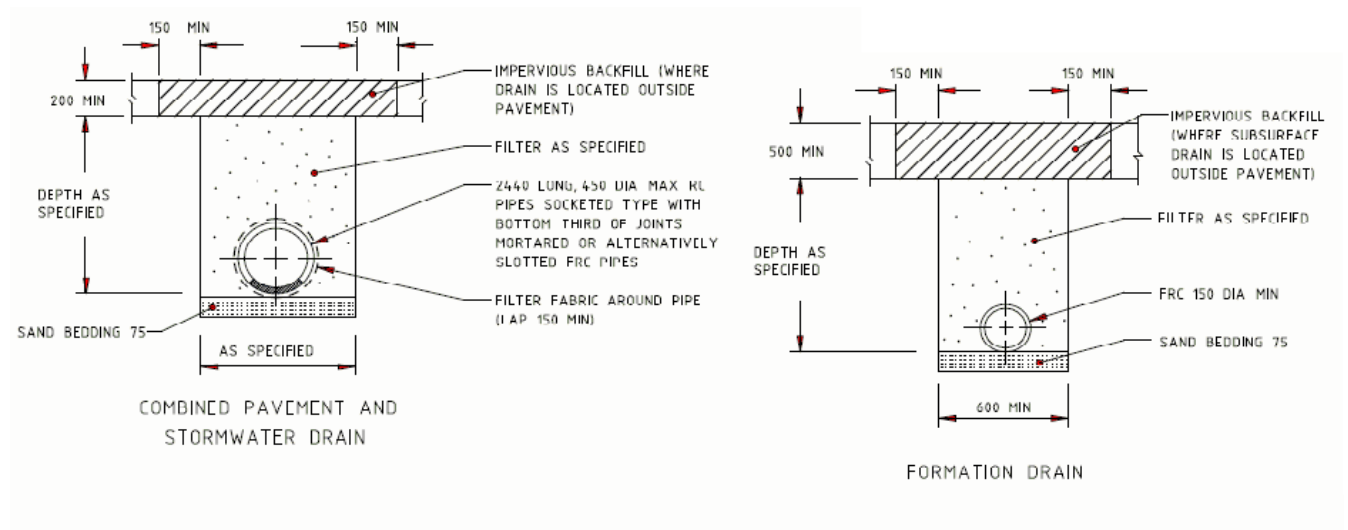


Figure 2.1 Examples of subsurface pavement drain types

Source: VicRoads (2004a)

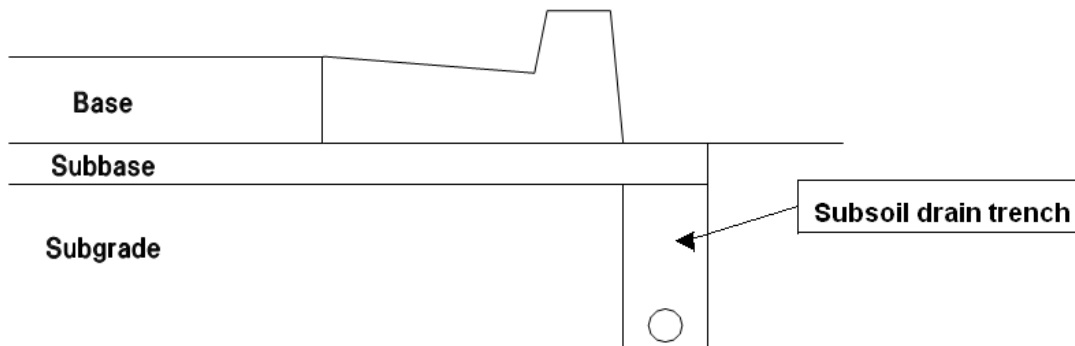


Figure 2.2 Typical subsoil drain

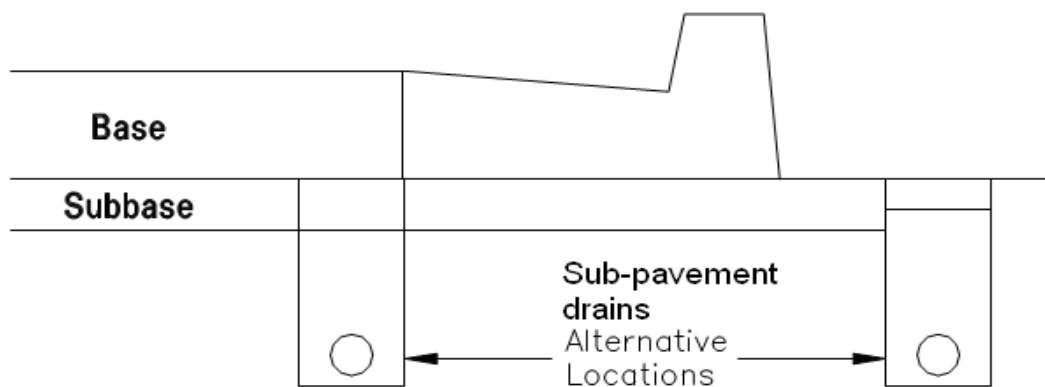


Figure 2.3 Typical sub-pavement drain

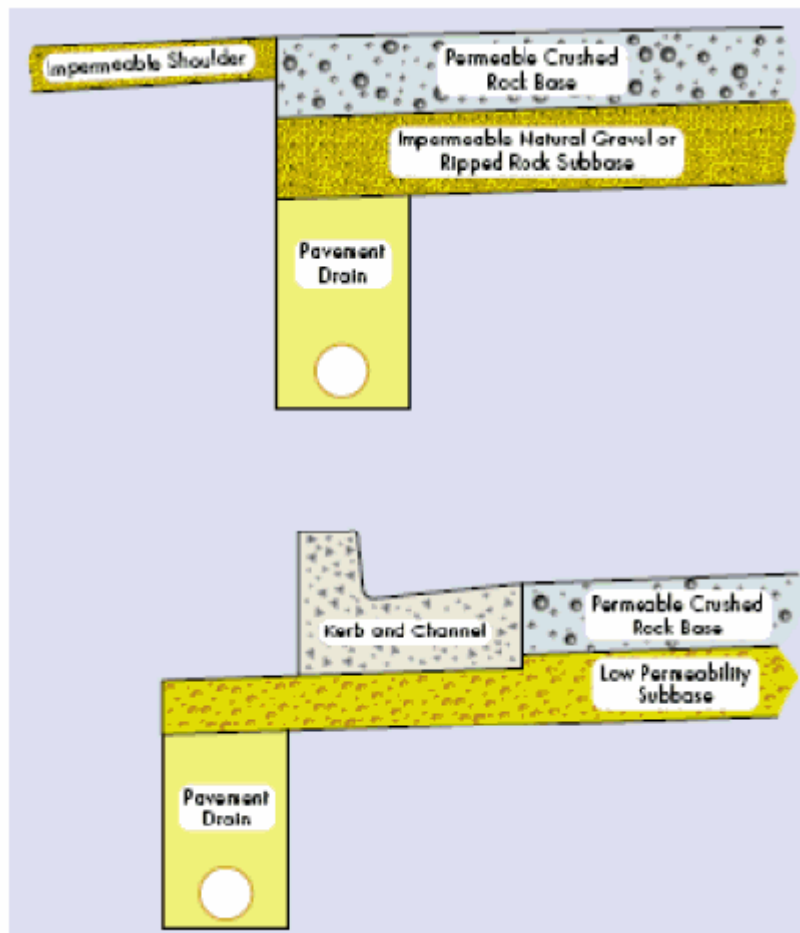


Figure 2.4: Examples of unsatisfactory pavement drainage

Source: VicRoads (2004a)

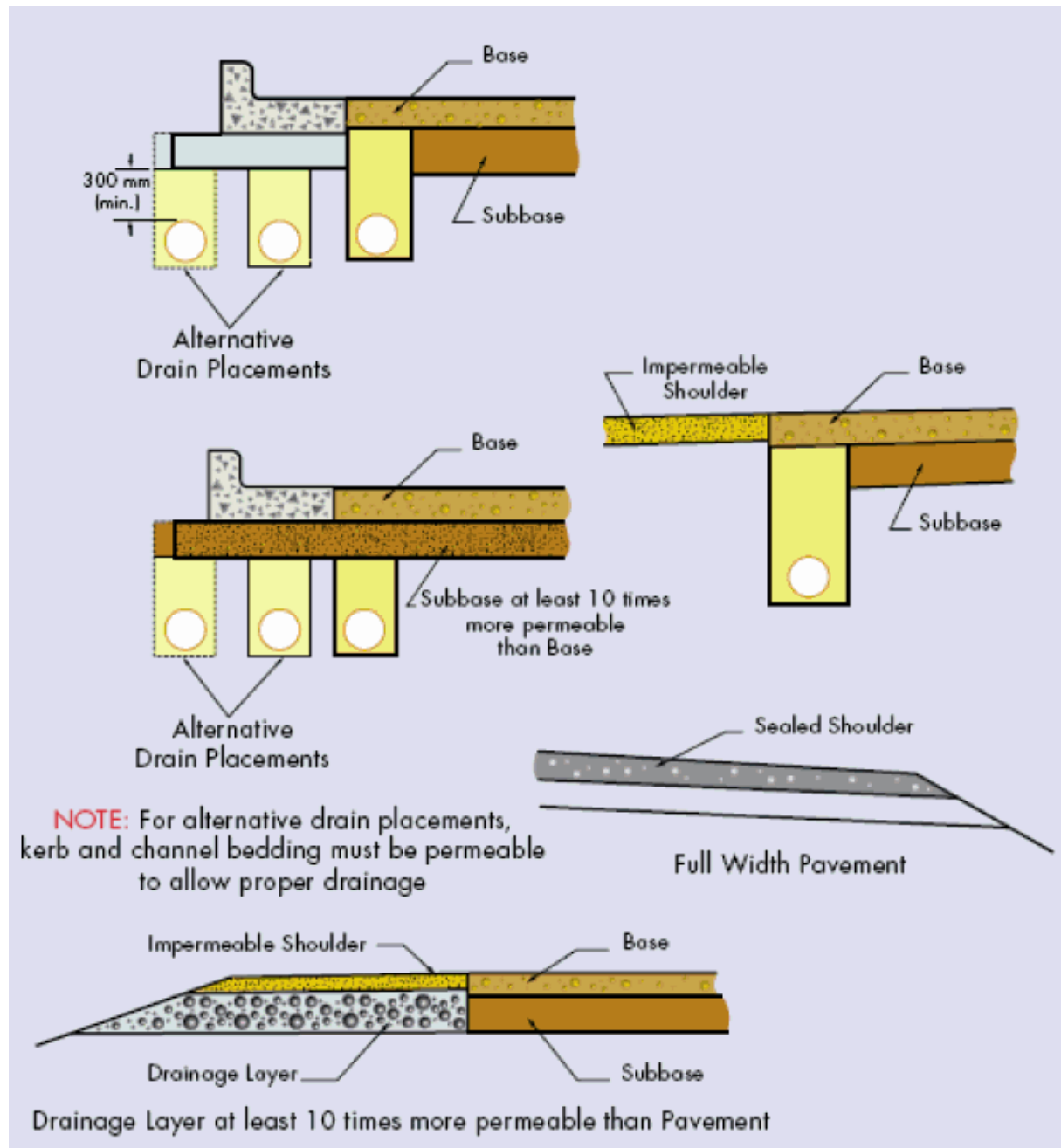


Figure 2.5: Examples of satisfactory pavement drainage

Source: VicRoads (2004a)

Trench dimensions and location:

- Trench widths - 300 mm minimum.
- Minimum depth below finished subgrade level:
 - . In earth 600 mm.
 - . In rock 450 mm.
- Locate below the invert level of any service crossings.

Outlets and salinity prevention: Space outlets at maximum intervals of 100 metres. Join into gully pits or outlet headwalls. As a salinity prevention measure and where practical, provide discharge on the downhill side of the embankment or in the cut-fill area so as to reduce the risk of recharge to the subsurface water table.

Unslotted plastic pipe: Unless otherwise authorised, if subsurface drains outlet through fill batters, specify unslotted plastic pipe of the same diameter as the main run.

Drain outlet: Install a small precast concrete headwall at the drain outlet with a marker post to assist maintenance and protect the end of the pipe.

Cleanouts: Provide cleanouts at the commencement of each run of drain, and at intervals not exceeding 80 metres. Locate cleanouts directly at the rear of kerb or at the edge of shoulder, as applicable.

Salinity prevention: In salinity affected areas, consider providing a separate drainage system for subsurface drains to discharge to a basin where controlled release or desiccation treatment and removal can be facilitated as a maintenance operation.

Saline subsurface drainage: Do not discharge directly into natural watercourses.

Reference to water quality targets: Refer to downstream watercourses quality targets - provide advice on discharge operations and maintenance compatible with water quality targets and the requirements of the relevant land and water resource authority.

Foundation drains (Formation drains)

Location: 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.

Drawings: The need to provide foundation drains may be apparent from the results of the geotechnical survey along the proposed road formation alignment, and in this case show the location on the Drawings. In addition, indicate on the Drawings the potential need for foundation drains at various locations typified as follows:

- Where the road formation traverses known swampy, flood-prone, salt affected areas or watercharged strata.
- Commonly, the need to provide foundation drains is determined during construction, and hence in this situation requirements and locations cannot be ascertained at the design stage.

Layout, alignment and grade

Typical cross section: Typical cross-sections of foundation drains are shown in Figure 2.3.

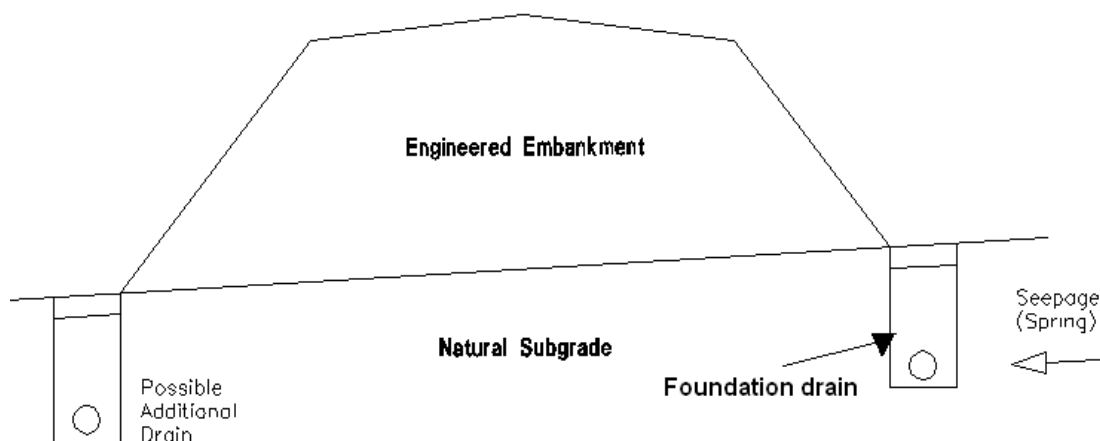


Figure 2.3 Foundation drains

Grade: The minimum design grade is 1.0%. For non corrugated pipes an absolute minimum grade of 0.5% is acceptable.

Trench dimensions: Conform to the following:

- Trench width - 300 mm minimum.
- Trench depth – vary to suit the application and ground conditions on site.

Outlets: Space outlets at maximum intervals of 150 metres or 100 metres if intermediate cleanouts are not provided.

Cleanouts: Where practicable, provide cleanouts at the commencement of each run of foundation drain and at intervals not exceeding 80 metres.

Drainage mats (Drainage blankets)

Requirement: Use the result of the geotechnical survey along the proposed road formation alignment to determine the need to design for the provision of drainage mats.

Type A mats: Select for the following functions:

- To ensure continuity of sheet flow of water under fills.
- To collect surface seepage from a wet seepage area.
- For protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water.

Timing: Construct Type A drainage mats after the site has been cleared and grubbed and before commencement of embankment construction.

Type B mats: Select for the following functions:

- To intercept water which would otherwise enter pavements by capillary action or by other means on fills.
- To intercept and control seepage water and springs in the floors of cuttings.

Timing: Construct Type B drainage mats after completion of the subgrade construction and before construction of the pavement.

2.3 MATERIALS**Subsoil and sub-pavement drain pipe**

Slotted pipe: Conform to the following:

- Location: As designated for subsoil, foundation and sub-pavement drains except for cleanouts and outlets through fill batters.
- Size: 100 mm diameter.
- Filter: Suitable geotextile filter tube.

Corrugated plastic pipe: To AS 2439.1.

Slotted rigid UPVC pipe: Type and class approved by Council.

Cleanouts and outlets: Provide 100 mm diameter unslotted pipe.

Joints, couplings, elbows, tees and caps: To AS 2439.1.

Selection criteria: Select the appropriate class of pipe on the basis of expected live loading at the surface.

Intra pavement drain pipe

Slotted thick walled UPVC pressure pipe pipe: Conform to the following:

- Location:
 - . For pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses neither less than 150 mm nor more than 200 mm.
 - . For pipes for use in Type B drainage mats.

Slotted pipe of a type and class approved by Council:

- Location: For pipes designated for intra pavement drains with crushed rock subbases having layer thicknesses exceeding 200 mm.

Standard: To AS/NZS 1477.

Filter material

Acceptable types of filter material and their use are as follows:

- Type A filter material: Use in subsoil, foundation, and sub-pavement (trench) drains and for Type B drainage mats.
- Type B filter material: Use in subsoil, foundation and sub-pavement (trench) drains.
- Type C filter material comprising crushed rock: Use in Type A drainage mats.
- Type D filter material comprising uncrushed river gravel: Use in Type A drainage mats.

Filter types: Material requirements and gradings for each type of filter material are included in the 1171 *Subsurface drainage*.

Backfill filter material

Selection: The type of filter material specified to backfill the sub-surface drainage trenches (subsoil, foundation and sub-pavement drains) depends on the permeability of the pavement layers and/or subgrade and the expected flow rate.

Filter functions:

- Type A filter material is used for the drainage of highly permeable subgrade or pavement layers such as crushed rock or coarse sands.
- 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.

Reference: Further guidance to the selection of appropriate filter material is contained in ARRB ARR368- *The collection and discharge of stormwater from the road infrastructure*.

Geotextile

Design criteria: Designate Geotextile to encapsulate the filter material to provide separation (i.e. prevent infiltration of fines) between the filter material in the trench and the subgrade or pavement material.

Requirements:

- Comply with the requirements included in 1171 *Subsurface drainage*.
- Designate for both Type A and Type B Drainage Mats.

3 DOCUMENTATION

3.1 GENERAL

Drawing requirements

Scope: Indicate the following:

- The proposed location of all subsurface drains.
- The nominal depth and width of the trench.
- The location with respect to the line of the kerb/gutter or edge of pavement.
- The location of outlets and cleanouts.

Calculations

Authorities: Submit to Council for approval with the drawings 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 worksection.