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Government

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Part 4 Subsurface drainage

TCCS
Transport Canberra City Services

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CONTENTS

1	SUBSURFACE DRAINAGE	4
1.1	General.....	4
1.1.1	Responsibilities	4
1.1.2	Cross references	4
1.1.3	Referenced documents.....	5
1.1.4	Interpretations.....	5
1.2	Pre-design planning	6
1.2.1	Consultation	6
1.2.2	Planning.....	6
2	SUBSURFACE DRAINAGE DESIGN	7
2.1	General.....	7
2.1.1	Standards	7
2.2	Subsoil and sub-pavement drains	7
2.2.1	Location.....	7
2.2.2	Layout, alignment and grade	7
2.2.3	Trenches.....	8
2.2.4	Fittings	8
2.3	Intra pavement drains.....	8
2.3.1	General.....	8
2.3.2	Layout, alignment and grade	8
2.4	Foundation drains (formation drains)	9
2.4.1	General.....	9
2.4.2	Layout, alignment and grade	9
2.5	Drainage mats (drainage blankets)	10
2.5.1	General.....	10
3	MATERIALS.....	10
3.1.1	General.....	10
3.1.2	Subsoil and sub-pavement drain pipe.....	10
3.1.3	Intra pavement drain pipe.....	11
3.1.4	Filter and backfill material.....	11
3.1.5	Geotextile.....	11
4	DOCUMENTATION.....	11

LIST OF FIGURES

Figure 04-1	Foundation drains figure.....	9
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1 SUBSURFACE DRAINAGE

1.1 General

General: Provide design and documentation of subsurface drainage for landscaped areas, the road pavement and the subgrade, including:

- > Subsoil and foundation drains.
- > Drainage behind retaining walls.
- > Sub-pavement drains.
- > Bridge drainage.
- > Drainage mats, including Type A and Type B mats.

1.1.1 Responsibilities

1.1.1.1 Objectives

Objective: Design subsurface drainage systems to control moisture content fluctuations in the pavement and subgrade to within the limits assumed in the pavement design.

1.1.1.2 Precedence

Where any document except legislation or the *Territory Plan* issued in conjunction with this Design Standard includes technical requirements that conflict with this Design Standard the requirements of this Design Standard take precedence.

1.1.2 Cross references

1.1.2.1 Design Standards

This Design Standard references the following component standards:

- MIS 01 Street planning and design
- MIS 03 Pavement design
- MIS 08 Stormwater
- MIS 09 Bridges and related structures

1.1.2.2 Specifications

The following Specifications are related to this standard:

- MITS 02 Earthworks
- MITS 03 Underground services
- MITS 04 Flexible pavement construction
- MITS 08 Incidental works

1.1.2.3 TCCS Reference Documents

The following TCCS reference documents are related to this standard:

- Reference document 6 Design Acceptance submissions
- Reference document 7 Operational acceptance submissions
- Reference document 8 WAE quality records
- Reference document 9 Final acceptance submissions

1.1.3 Referenced documents

The following documents are incorporated into this Design Standard by reference:

1.1.3.1 Standards

AS/NZS 1477 PVC pipes and fittings for pressure applications.

AS 2439 Perforated plastics drainage and effluent pipe and fittings.

AS 2439.1 Part 1: Perforated drainage pipe and associated fittings.

AS 4139 Fibre reinforced concrete pipes and fittings.

1.1.3.2 Other publications

Austrroads

AGPT Austrroads Guide to Pavement Technology

AGPT10 Part 10: Subsurface drainage.

AGRD Austrroads Guide to Road Design

AGRD05 Part 5: Drainage Design

ARRB Australian Road Research Board.

ARR368 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.

Proprietary products: To *TCCS Products previously considered for use list*

1.1.4 Interpretations

1.1.4.1 Abbreviations

General: For the purposes of this Design Standard the following abbreviations apply:

TCCS: Transport Canberra and City Services, ACT Government and its successors.

1.1.4.2 Definitions

General: For the purpose of this Design Standard, the definitions of terms used to define the components of the road reserve are in conformance with *AS 1348, Glossary of Austrroads Terms* and *AGRD 03*.

Other definitions that pertain to this Design Standard are outlined below:

High end risers: Also known as flush points or clean outs are vertical sections that connect from ground level to subsoil drains for maintenance purposes.

Drainage types:

- > **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'.
- > **Intra pavement drains:** are intended to drain water from pavement layers on steep grades and sag curves where water flows are likely to be more parallel than transverse to the road alignment.
- > **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.
- > **Subsoil drains:** are intended for the drainage of ground water or seepage from the subgrade and/or the subbase in cuttings and fill areas.

Drainage mats:

- > **Cutting foundation 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'.
- > **Embankment foundation 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'.

1.2 Pre-design planning

1.2.1 Consultation

1.2.1.1 TCCS and other Authorities

Requirements: Consult with TCCS and other relevant Authorities during the preparation of design. In addition to the requirements of this Design Standard, identify the specific design requirements of these authorities.

1.2.1.2 Utilities services plans

Existing site conditions: Obtain plans from all relevant utilities and other organisations whose services, trees, important ecological habitats or other assets exist within the area of the proposed development. Plot this information on the relevant drawings including the plan and cross-sectional views. As a minimum, designs should refer to 'Dial-before-you-dig' information that is readily available in most areas.

Responsibility: Confirm service plans accuracy with onsite inspection and also potholing if deemed necessary. Protect existing assets to the satisfaction of asset owners.

Proposed new services: Detail any new services proposed or relocated as part of the proposed works.

1.2.1.3 Safety in Design

Requirement: Implement safety in design processes in accordance with the *Work Health and Safety Act*. Include consideration for the following:

- > Traffic management.
- > Identification and protection of existing services.
- > Maintenance operations such as inspections and cleaning.

1.2.2 Planning

1.2.2.1 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 *AGPT10*.

2 SUBSURFACE DRAINAGE DESIGN

2.1 General

2.1.1 Standards

Subsurface drainage design: To *AGPT10*.

Drainage design: To *AGRD05*.

Water quality targets: Refer to downstream water quality treatments.

2.2 Subsoil and sub-pavement drains

2.2.1 Location

Locations: Provide subsoil or sub-pavement drains on both sides of the road formation.

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 indicated on the Drawings.

The sub-soil drain should extend to the underside of the base course:

- > For granular pavements, to the bottom of the subbase.
- > For stabilised pavements, to the bottom of the lowest stabilised layer.
- > For deep lift AC pavements, to the bottom of the lowest asphalt layer.
- > For concrete pavements, to the bottom of the subbase.

If a sub-soil drain is located in the wheel path on a bus route, use 75mm thick no fines concrete capping to the sub-soil drain.

2.2.2 Layout, alignment and grade

Typical cross sections: Typical cross sections of subsoil and sub-pavement drains are indicated in *ACTSD 0301* and *0302 Subsoil Drainage Standard Details*.

Kerbed roads: In kerbed roads, the acceptable location for the line of the trench is directly in front of the kerb line.

Unkerbed roads: In unkerbed roads, locate subsoil and sub-pavement drains within the shoulder, preferably at the edge of the pavement layers as indicated in *ACTSD-0301*. Pavement layers must extend to at least the line of the rear of the trench.

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

2.2.3 Trenches

Trench dimensions and location:

- > Trench widths: 300mm minimum.
- > Minimum depth to invert below subgrade:
 - In earth: 600mm.
 - In rock: 450mm.
- > Locate below the invert level of any service crossings. If not practical, use unslotted pipe to cross the service.

2.2.4 Fittings

Outlets: Join into stormwater sumps or manholes or outlet headwalls, refer to *MIS 08 Stormwater*. 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 drain outlets through fill batters or crosses above a service crossing, specify unslotted plastic pipe of the same diameter as the main run.

High end risers: Provide flushing points at the upstream commencement of each run of drain, and at intervals not exceeding:

- > 80m for trench grade of 1% or less.
- > 110m for trench grade between 1% and 2%.
- > 150m for trench grade greater than 2%.

Locate high end risers directly at the rear of kerb or at the edge of shoulder, as applicable.

2.3 Intra pavement drains

2.3.1 General

Standard: To *AGRD 05*.

Locations: If required, provide intra pavement drains within the select material layer immediately below the pavement.

2.3.2 Layout, alignment and grade

Grade: The minimum longitudinal design grade is 0.5% towards the outlet.

Trench dimensions and location:

- > Trench width: 300mm minimum.
- > Trench depth: 300mm in the select material layer immediately below the pavement.

Outlets: Join into stormwater sumps or manholes or outlet headwalls. 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.

2.4 Foundation drains (formation drains)

2.4.1 General

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: Refer to the geotechnical survey along the proposed road formation alignment. 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, or watercharged strata.
- > Evidence of surface breakouts such as lush and dense vegetation.
- > Commonly, the need to provide foundation drains is determined during construction, situation requirements and locations may not be known at the design stage.

2.4.2 Layout, alignment and grade

Typical cross section: Typical cross-sections of foundation drains are indicated in **Figure 04-1 Foundation drains figure**.

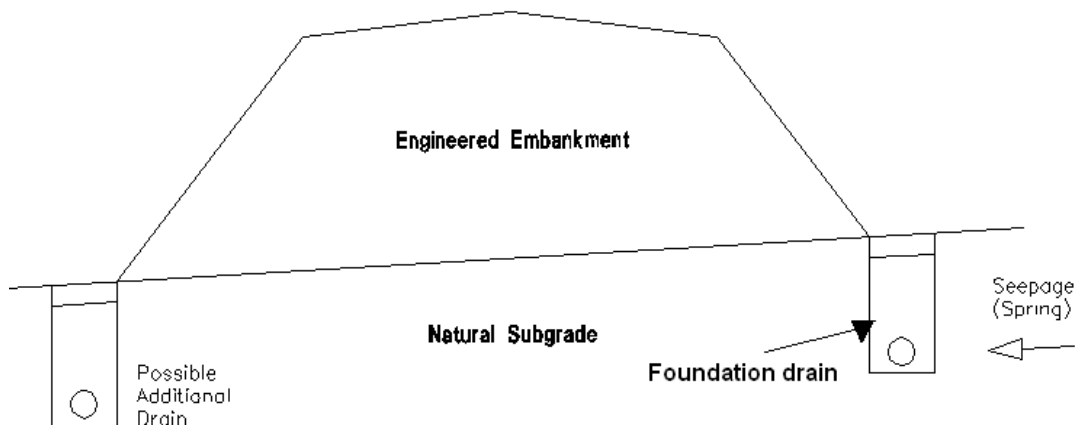


Figure 04-1 Foundation drains figure

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: 300mm 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.

2.5 Drainage mats (drainage blankets)

2.5.1 General

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.

Embankment foundation 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 after the site has been cleared and grubbed and before commencement of embankment construction.

Cutting foundation 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 after completion of the subgrade construction and before construction of the pavement.

3 MATERIALS

3.1.1 General

Requirement: Select materials that have been approved by TCCS for use in the public realm. Refer to the *TCCS approved product list*.

3.1.2 Subsoil and sub-pavement drain pipe

Slotted pipe: Conform to the following:

- > Location: As designated for subsoil, foundation and sub-pavement drains except for high end risers and outlets through fill batters.
- > Size: 100mm diameter.
- > Filter: Suitable geotextile filter sock.

Corrugated plastic pipe: To *AS 2439.1*.

Slotted rigid UPVC pipe: Refer to TCCS approved product list.

High end risers and outlets: Provide 100mm 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.
Use:

- > SN8 (Class 400) for landscape, road construction or civil works not subject to heavy vehicular traffic.
- > SN20 (Class 1000) for similar works where heavy vehicular traffic is expected.

3.1.3 Intra pavement drain pipe

Slotted pipe: Conform to the following:

- > Location: For pipes designated for intra pavement drains to drain water from pavement layers on steep grades and sag curves where water flows are likely to be more parallel than transverse to the road alignment.
- > Slotted pipe shall be Class 4 FRC to *AS4139*.

3.1.4 Filter and backfill material

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

- > 5 and 7mm aggregate filter material: Use in subsoil, foundation, and sub-pavement (trench) drains.
- > 125mm maximum size crushed rock: Use in drainage mats.
- > No fines concrete: Use in capping layer of subsoil drains on bus routes and backfill for intra-pavement drains.

Filter and backfill types: Material requirements and gradings for each type of backfill and filter material are included in;

- > *MITS 03I Subsurface Drainage* and;
- > *MITS 02C Bulk Earthworks*.

Recycled materials: Testing for contaminants to *MITS 00C Control of erosion and sedimentation*.

3.1.5 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 *MITS 03I Subsurface Drainage*.
- > Designate for both Type A and Type B Drainage Mats.

4 DOCUMENTATION

Requirements: Comply with *Reference document 6 Design Acceptance submissions*.



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