

<b>1173 PAVEMENT DRAINS</b>
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**1 GENERAL****1.1 RESPONSIBILITIES****Objectives**

General: Provide sub-pavement drains, intra-pavement drains and edge drains, as documented.

**Performance**

Requirements: Construct the works as documented or directed by the Superintendent.

**1.2 CROSS REFERENCES****General**

Requirement: Conform to the following:

- 0136 General requirements (Construction).
- 0152 Schedule of rates – supply projects.
- 0161 Quality (Construction).
- 0167 Integrated management.
- 1101 Control of traffic.
- 1112 Earthworks (Roadways).
- 1141 Flexible pavement base and subbase.
- 1144 Asphaltic concrete (Roadways).
- 1171 Subsurface drainage.

**1.3 REFERENCED DOCUMENTS****Standards**

General: The following documents are incorporated into this worksection by reference:

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 1289.5.4.1-2007	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

**Other publications**

<i>AUSTROADS</i>	
AGPT10-2009	Guide to pavement technology Part 10 - Subsurface drainage

**1.4 INTERPRETATION****Abbreviations**

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

CI: Cast iron.

HDPE: High Density Polyethylene.

**Definitions**

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

Edge drains: For drainage of rigid pavements.

Intra-pavement drains: For drainage of pavement layers of a flexible pavement where the subbase material is a macadam crushed rock or open graded asphaltic concrete.

Panel drain: Corrugated flat plastic pipe.

Selected material zone: The top part of the Upper zone of formation in which material of a specified higher quality is required.

Sub-pavement drains: For drainage of the pavement layers where the subbase is not a macadam crushed rock.

## 1.5 SUBMISSIONS

### Approval

Submissions: To the Superintendent's approval.

### Documents

Submit the following for approval:

- Filter materials: Refer to **WITNESS POINTS**.
- Components: Submit technical details of:
  - . Geotextiles to *1171 Subsurface drainage*.
  - . Pipes and fittings to *1171 Subsurface drainage*.
- Execution details: Proposals for timing and sequence of activities.

~~Design: [complete/delete]~~

~~Drawings: [complete/delete]~~

- Work as executed drawings.

~~Calculations: [complete/delete]~~

~~Manuals: [complete/delete]~~

~~Samples: [complete/delete]~~

~~Evidence of type tests: [complete/delete]~~

~~Warranties: [complete/delete]~~

## 1.6 HOLD POINTS AND WITNESS POINTS

### Notice

General: Give notice so that the documented inspection and submissions may be made to the **HOLD POINT table** and the **WITNESS POINT table**.

#### HOLD POINTS table

Item/Clause title	Requirement	Notice for inspection	Release by
<b>EXECUTION</b>			
<b>Sub-pavement drains - Laying of pipe</b>	Submit bedding of compacted filter material laid to line and grade	1 working day before covering	<i>Principal Certifying Authority</i>
<b>Intra-pavement drains - Laying of pipe</b>	Provide certification that drain has adequate crushing strength	3 working days before ordering	<i>Principal Certifying Authority</i>
<b>Intra-pavement drains - Laying of pipe</b>	Submit details of proposed method of securing pipes	7 days before pipe laying	<i>Principal Certifying Authority</i>
<b>Edge drains - Laying of pipe</b>	Submit details of proposed method of securing pipes	7 days before pipe laying	<i>Principal Certifying Authority</i>

#### WITNESS POINTS table

Item/Clause title	Requirement	Notice for inspection
<b>EXECUTION</b>		
<b>Establishment - Location</b>	Mark location of drains consistent with drawings or directions	7 days prior to commencing works
<b>Sub-pavement drains - Laying of pipe</b>	Laid to documented line and level	1 working prior to Backfilling
<b>Sub-pavement drains -</b>	Backfill to documented level.	3 working days prior covering

Item/Clause title	Requirement	Notice for inspection
<b>Backfilling</b>		
<b>Edge drains - Excavation</b>	Demonstrate proposal for strip filter if required.	3 working days
<b>Edge drains - Laying of pipe</b>	Laid to documented line and level	Progressive
<b>Clean outs – Field testing</b>	Perform flushing test	3 working days from completion

## 2 PRE-CONSTRUCTION PLANNING

### 2.1 SCHEDULING

#### Program of the works

Program the works as follows:

- Plan sequence of activities.
- Address time and program sequence of **HOLD POINTS** and **WITNESS POINTS**.

## 3 MATERIALS

### 3.1 GENERAL

#### Filter material and impervious material

Description: Conform to *1171 Subsurface drainage*: Capable of placing and compaction and as shown on the drawings. This is a **WITNESS POINT**.

#### Geotextiles and pipes

General: Conform to *1171 Subsurface drainage*.

## 4 EXECUTION

### 4.1 PROVISION FOR TRAFFIC

#### General

Control of traffic: Conform to the following:

- Conform with worksection *1101 Control of traffic*.
- Conform with **Traffic Guidance Scheme** in *1101 Control of traffic*.

### 4.2 ESTABLISHMENT

#### Location

Layout: Construct pavement drains as shown on the drawings and as directed. This is a **WITNESS POINT**.

#### Existing underground services

Excavation: Do not excavate by machine within 1 m of existing underground services.

Location: DIAL 1100 BEFORE YOU DIG is a free service, from anywhere in Australia, of locating underground pipe and cables (possible within two working days). See [www.1100.com.au](http://www.1100.com.au).

### 4.3 ORDER OF CONSTRUCTION

#### Sub-pavement drains

Sequence: Construct sub-pavement drains as soon as possible after earthworks are completed in the area of the drain.

Ground water: If stabilisation of the subgrade is required, construct the sub-pavement drain after completion of stabilisation except that where excessive ground water is encountered, construct sub-pavement drains prior to stabilisation of the subgrade.

Excessive groundwater: Where a Selected Material Zone is specified and excessive ground water is encountered, sub-pavement drains may be installed in two stages as follows:

- Stage 1: Standard sub-pavement drains installed below the base of the cutting prior to placement of select material in the Selected Material Zone.
- Stage 2: Extension of sub-pavement drain to top of the Selected Material Zone after placement of selected material.

#### **Intra-pavement drains**

Sequence: Construct intra-pavement drains after the completion of the layer below the crushed rock macadam or 40 mm open graded asphaltic concrete subbase and preceding the construction of the subsequent layers.

#### **Edge drains**

Sequence: Construct edge drains after the construction of the rigid pavement and before the placement and compaction of verge material.

### **4.4 SUB-PAVEMENT DRAINS**

#### **Excavation**

Trench dimensions: Trim the trenches 300 mm wide to the required line and to a depth of 600 mm below the bottom of the subbase or below the base of the cutting where two stage construction of the sub-pavement drain is required.

Trench grade: Construct the bottom of the trench at the same grade as the design pavement surface except where the grade of the roadway is less than 0.5%, increase the depth of the trench to provide a grade of 0.5% in the trench. Excavate the bottom of the trench to prevent localised ponding of water.

Two-stage construction: If a subpavement drain is constructed in two stages, conform to the following:

- Carry out excavation for Stage 2 after placement and compaction of the Selected Material Zone.
- Excavate the Stage 2 trench to the same line and width as Stage 1 and to a depth to provide a clean, full contact with the filter material previously placed in Stage 1.

Disposal: Dispose of all excavated material to waste or incorporate into fills.

#### **Laying of pipe**

Bedding: 50 mm thick compacted filter material laid to the documented line and grade.

This is a **HOLD POINT**.

Filter material type: As shown on the drawings or as directed.

Pipe: 100 mm diameter corrugated slotted plastic piping or the corrugated flat plastic panel drain on the compacted bed as shown on the drawings.

Tolerance: Deviation < 100 mm from the documented line. This is a **WITNESS POINT**.

Joints: Minimise joints in the pipeline.

Joint construction: Proprietary external joint coupling. Fit the inlet end of the pipe with a proprietary PVC cap.

#### **Backfilling**

Filter material: Backfill the trench with filter material to the documented level. This is a **WITNESS POINT**.

Layers: Place and compact the filter material in layers with a maximum compacted thickness of 300 mm. Tamp around and over the pipe to avoid damage or disturbance to the pipe.

Compaction: Compact cohesionless material to a Density Index of 70% determined by AS 1289.5.6.1 for the full depth of the backfill

Pipe outlets:

- Backfill the trench on the outlet section of pipes discharging through the fill batters with the nominated filter material to a depth of 50 mm above the pipe.
- Backfill the balance of trench with earth backfill material of maximum particle size of 50 mm and compact for the full depth to a relative compaction of 95% (Standard compaction) to AS 1289.5.4.1.

#### Temporary plug over filter material

Requirement: In the case of sub-pavement drains of two stage construction, when it is not practical to place the pavement layers or the Selected Material Zone immediately after the construction of Stage 1.

Method: Protect the filter material placed to the top of Stage 1 from scour and/or contamination by covering with a 50 mm thick plug of compacted select fill material having a maximum particle size of 25 mm and Plasticity Index of not more than 12 as determined by AS 1289.3.3.1.

Removal: Remove this plug, any contaminated filter material and any select material covering and replace with the nominated filter material and compact immediately ahead of the placement of the pavement layer. Dispose of all excavated material to waste or incorporate in fills.

### 4.5 INTRA-PAVEMENT DRAINS

#### Excavation

Trench dimensions: Cut a 'V' shaped trench approximately 75 mm deep to the required line in the pavement layer immediately below the crushed rock macadam pavement layer. No excavation is required below a 40 mm open graded asphaltic concrete subbase layer.

Trench grade: Construct the bottom of the trench at the same grade as the roadway and ensure localised ponding of water does not occur.

Discharge pipe: If the pipe is to discharge through the fill batter, construct a trench on a grade suitable for the pipe to discharge its contents without scour. After laying the pipe, backfill the trench with fill material and compact for the full depth to a relative compaction of not less than 95% (Standard compaction) as determined by AS 1289.5.4.1.

UPVC pressure pipe: Provide thick walled slotted unplasticised PVC pressure pipe, to conform with *1171 Subsurface drainage*, with the following:

- Crushed rock subbases having not more than 10% of material passing the 9.5 mm Australian Standard sieve and having layer thicknesses neither less than 150 mm nor more than 200 mm.
- Open graded asphalt subbases having layer thicknesses neither less than 80 mm nor greater than 100 mm.

Suitability for subbases: If the subbase requires pavement drains, provide certification that the proposed type of pavement drain has adequate crushing strength in the following locations: This is a **HOLD POINT**.

- Crushed rock subbase: Depth > 200 mm.
- Asphalt subbase: Depth > 100 mm.

Inlet cap: The inlet end of the pipe to be fitted with a cap to conform with *1171 Subsurface drainage*.

Outlet length: Provide unslotted outlet pipe from the outside edge of the free-draining subbase to an outlet structure in the embankment batter and seal the pipe joints in this length of pipe with suitable couplings or mastic.

Level and alignment: Lay the pipe to the specified line and level.

Deviation: Not to deviate the pipe from the specified line by more than 100 mm at any point.

Pipe anchorage: Anchor the pipes by securing all pipes held to the layer under the free-draining subbase to prevent movement of the pipes during placement and compaction of the free-draining subbase.

Anchorage alternatives: Submit details of the proposed method of securing the pipes to the layer under the free-draining subbase. This is a **HOLD POINT**.

Alternative securing method: If the approved method of securing the pipes to the layer under the free draining subbase allows movement of the pipes, discontinue the method and submit an alternative securing method for approval.

#### **Backfilling**

Subbase: Spread subbase material, compact and trim, where appropriate, as follows:

- For crushed rock macadam subbase: To *1141 Flexible pavement base and subbase*.
- For open graded asphalt subbase: To *1144 Asphaltic concrete (Roadways)*.

Prevent damage to pipes: Place, spread and compact the subbase without damage to the intra-pavement drain pipes.

Remove and replace: If any pipes are damaged remove and replace the damaged pipes.

Layers: Place and compact the filter material in layers with a maximum compacted thickness of 300 mm. Tamp around and over the pipe to avoid damage or disturbance to the pipe.

Compaction: Compact cohesionless material to a Density Index of 70% determined by AS 1289.5.6.1 for the full depth of the backfill

## **4.6 EDGE DRAINS**

### **Excavation**

Trench dimensions: Trim the verge material to subgrade level and to the minimum width shown on the drawings.

Trench grade: Construct the bottom of the trench at the same grade as the roadway and ensure localised ponding of water does not occur. Where the grade of the roadway is less than 0.5 % excavate the trench to provide a minimum grade of 0.5%.

Discharge pipe: If the pipe is to discharge through the fill batter excavate a suitable trench to provide the required grade.

Strip filters: Do not use strip filters unless fully demonstrated and approved. This is a **WITNESS POINT**.

### **Laying of pipe**

Slotted corrugated plastic pipe: Provide 65 mm diameter slotted corrugated plastic pipe enclosed in seamless tubular filter fabric to conform with *1171 Subsurface drainage*, for edge drains unless shown otherwise on the drawings or as directed.

Slotted PVC pressure pipe: If any part of a shoulder consists of material other than concrete, install slotted thick walled PVC pressure pipe.

Securely hold in place: Secure all pipes held against the vertical face of the rigid pavement.

Approval for method of securing pipes: Submit details of the proposed method of securing the pipes against the rigid pavement. This is a **HOLD POINT**.

Bedding and alignment: Lay the pipe on a prepared bed to the documented line and level.

Tolerance: Deviation < 100 mm from the documented line at any point. This is a **WITNESS POINT**.

Joints: Minimise joints in the pipeline.

Joint construction: Proprietary external joint coupling. Fit the inlet end of the pipe with a PVC cap.

### **Backfilling**

Filter material: Cover the pipe with Type B filter material to *1171 Subsurface drainage* and as shown on the drawings.

Soaking of filter material: Mechanical compaction of this filter material is not required. Soak with water after placement of the filter material. Soak and add additional filter material as required to provide the final dimensions shown on the drawings.

Material: Backfill material to *1112 Earthworks (Roadways)* and as required for verges. Avoid damage or disturbance of the pipe.

Compaction: Relative compaction of not less than 100% (Standard compaction) to AS 1289.5.4.1.

#### 4.7 OUTLETS

##### General

Requirements and specification of outlet structures: Conform to *1171 Subsurface drainage*.

Intra-pavement drain discharge: If discharge must be constructed extend each pipe using a 60° bend and unslotted pipe to discharge through the fill batter and construct an outlet structure on the discharge end to conform with the drawings.

Edge drain: If discharge must be constructed provide unslotted pipe with a mastic sealed joint from the outlet section of a pipe at the vertical face of the rigid pavement to an outlet in the embankment batter.

##### Rodent proofing

Method: Secure outlets, including those discharging into gully pits, with galvanised wire netting to conform with the drawings.

#### 4.8 CLEANOUTS

##### Location

Details: As shown on the drawings. Do not locate pits in unsealed shoulders, drain inverts or on batter faces.

Location: At the commencement of each run of subsoil drain line and at intervals of approximately 100 - 140 m to conform with AGPT10-09.

##### Type

Clean out: Supply the standard CI caps as shown on the drawings.

##### Field testing

Method: After completion of backfilling, pump clean water into the cleanout at the commencement of each run until only clean water discharges at the outlet.

Flushing: The minimum rate of flow of flushing water at the inlet must be 100 l/min. This is a **WITNESS POINT**.

#### 4.9 MARKING OF DRAINS

##### Completion

Records: Keep a detailed record of all trench drain installations. Mark 'Work-as-Executed' drawings of the completed drainage system. Submit within 28 days of completion of the works.

Mark: Markings location and type to conform with the relevant State Road Authority and AGPT10-09.

Pegs: Treated or painted timber 75 mm diameter with 600 mm of post above ground level. Do not use the colour white.

ID plate: Attach an identification plate to the marker post or pit lid.

#### 4.10 LIMITS AND TOLERANCES

##### Application

Summary: The limits and tolerances applicable to this worksection are summarised in **Summary of limits and tolerances table**.

Summary of limits and tolerances table

Activity	Limits/Tolerances	Worksection Clause/ subclause
Excavation Trench Grade	≥ 0.5%	Sub-pavement drains Edge drains
<b>Sub-pavement drain</b>		
<b>Laying of pipe</b>		
Alignment	Deviation < 100 mm from the documented line at any point.	Sub-pavement drains
<b>Backfill</b>		
Layer thickness	300 mm max	Sub-pavement drains
Compaction (Relative) - Filter material - Backfill material	100% (Standard compaction) > 95% (Standard compaction)	Sub-pavement drains Sub-pavement drains
<b>Cleanout spacing</b>	100 - 140 m approx	Cleanouts
<b>Outlet spacing</b>	150 m max	Sub-pavement drains Intra-pavement drains Edge drains
<b>Intra-pavement drain</b>		
Backfill	> 95% (Standard compaction)	Intra-pavement drains
Alignment	Deviation < 100 mm from specified line at any point.	Intra-pavement drains
<b>Edge drains</b>		
Alignment	Deviation < 100 mm from specified line at any point.	Edge drains
Compaction (relative) of backfill material	100% (Standard compaction)	Edge drains

## 5 MEASUREMENT AND PAYMENT

### 5.1 MEASUREMENT

#### General

Payment made to the schedule of rates: To *0152 Schedule of rates – supply projects*, this worksection, the drawings and Pay items 1171.1 to 1171.5 inclusive.

Lump Sum prices: Not acceptable.

Unpriced items: For each unpriced item listed in the Schedule of Rates, make due allowance in the prices of other items.

#### Methodology

The following methodology will be applied for measurement and payment:

- Filter material and outlet structures: To conform with *1171 Subsurface drainage*.
- Subbase material, including spreading, compacting and trimming: To conform with either *1141 Flexible pavement base and subbase* or *1144 Asphaltic concrete (Roadways)*, as appropriate.
- Selected material backfill to edge drains: To conform with *1112 Earthworks (Roadways)*.



## 5.2 PAY ITEMS

Pay items	Unit of measurement	Schedule rate scope
<b>1173.1 Excavation</b>	m <sup>3</sup> - Calculated from the width, depth and length of trench. - Width: As shown on the drawings or as directed by the Superintendent. - Depth and length: As directed by the Superintendent and determined at the time of excavation.	All costs associated with the following: - Setting out and associated survey work. - Excavation for all types of material. - Separate rates for earth or rock are not acceptable. - Replacement for overexcavation for any reason. - Control of stormwater run-off, temporary drainage and erosion and sedimentation control. - Disposal of excavation material The schedule quantity is a provisional quantity.
<b>1173.2 Subsoil drain pipe</b> - 1173.2(1) 100 mm dia slotted corrugated plastic pipe. - 1173.2(2) 58 mm dia thick walled unplasticised PVC pressure pipe. - 1173.2(3) 65 mm dia slotted corrugated plastic pipe.	Linear metre - Length measured along the pipe including any slotted pipe required for outlets.	All costs associated with the following: - Supply, laying and securing of the subsoil pipe, including connections, fittings and seamless tubular filter fabric where specified. The schedule quantity is a provisional quantity.
<b>1173.3 Cleanout structures</b>	Each - Cleanout structure constructed as shown on the drawings.	All costs associated with the following: - Provision of cleanout structures - Supply and installation of lids - Recording of cleanout locations in accordance with <i>1171 Subsurface drainage</i> . The schedule quantity is a provisional quantity.