DEVELOPMENT CONSTRUCTION SPECIFICATION

C232

PAVEMENT DRAINS

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
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*

SPECIFICATION C232 : PAVEMENT DRAINS

GENERAL

C232.01 SCOPE

1. This Specification covers the installation of Sub-Pavement Drains, Intra-Pavement Drains and Edge Drains. ***Scope***

2. Pavement drains shall be constructed where and as shown on the Drawings or as directed by the Superintendent. ***Location***

3. This Specification should be read in conjunction with the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Associated Specification***

C232.02 TERMINOLOGY

1. Sub-Pavement Drains are intended for the drainage of the pavement layers where the subbase is not a macadam crushed rock. ***Sub-Pavement Drains***

2. Intra-Pavement Drains are intended for the drainage of the pavement layers of a flexible pavement where the subbase material is a macadam crushed rock or open graded asphaltic concrete. ***Intra-Pavement Drains***

3. Edge Drains are intended for the drainage of rigid pavements. ***Edge Drains***

C232.03 REFERENCE DOCUMENTS

1. Documents referenced in this specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C213	-	Earthworks
C230	-	Subsurface Drainage - General
C242	-	Flexible Pavements
C245	-	Asphaltic Concrete

(b) Australian Standards

AS 1289.3.3.1	-	Calculation of the plasticity index of a soil.
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1477	-	Unplasticised PVC (UPVC) pipes and fittings for pressure applications.

C232.04 ORDER OF CONSTRUCTION

(a) Sub-Pavement Drains

1. Sub-pavement drains shall be constructed as soon as possible after necessary earthworks are completed in the area of the drain. Where stabilisation of the subgrade is required, sub-pavement drain shall be constructed after completion of stabilisation except that where excessive ground water is encountered, sub-pavement drains may be constructed prior to stabilisation of the subgrade. ***Timing of Construction***

2. 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 Construction***

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.

(b) Intra-Pavement Drains

1. Intra-Pavement Drains shall be constructed after the completion of the layer below the MS75 or 40mm open graded asphaltic concrete subbase and preceding the construction of the subsequent layers. ***Timing of Construction***

(c) Edge Drains

1. Edge Drains shall be constructed after the construction of the rigid pavement and before the placement and compaction of verge material. ***Timing of Construction***

CONSTRUCTION

C232.05 SUB-PAVEMENT DRAINS

(a) Excavation

1. Trenches 300mm wide shall be trimmed to the required line and to a depth of 600mm 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 Dimensions***

2. The bottom of the trench shall be to the same grade as the design pavement surface except where the grade of the roadway is less than 0.5 per cent, in which case the depth of the trench shall be increased to provide a grade of 0.5 per cent in the trench. The bottom of the trench shall be excavated so that no localised ponding of water occurs. ***Trench Grade***

3. Where two stage construction of the sub-pavement is required, excavation for Stage 2 shall be carried out after placement and compaction of the Selected Material Zone. The Stage 2 trench shall be to the same line and width as Stage 1 and to a depth sufficient to provide a clean, full contact with the previously placed filter material. All excavated material shall be disposed to waste or incorporated into fills. ***Two-Stage Construction***

(b) Laying of Pipe

1. The 100mm diameter corrugated slotted plastic piping, complying with the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be laid on a bed of filter material 50mm in thickness and shall be laid to the required line and grade. ***Filter Bed***

2. The type of filter materials shall be as shown on the Drawings or as directed by the Superintendent. ***Type***

3. Joints in the pipeline shall be kept to the minimum number and, where required, shall be made using a suitable external joint coupling. The inlet end of the pipe shall be fitted with a cap. ***Jointing***

(c) Backfilling

1. The trench shall be backfilled with filter material to the level specified. The type of filter material shall be as shown on the Drawings or as directed by the Superintendent. The filter material shall be placed and compacted in layers with a maximum compacted thickness not exceeding 300mm. Tamping around and over the pipe shall be done in such a manner as to avoid damage or disturbance of the pipe. ***Filter Material***

2. The filter material shall be compacted for its full depth to a relative compaction of not less than 100 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Compaction***

3. On the outlet section of pipes discharging through the fill batters the trench shall be backfilled with the nominated filter material to a depth of 50mm above the pipe. The balance of trench shall be backfilled with earth backfill material of maximum particle size of 50mm and shall be compacted for the full depth to a relative compaction of 95 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Pipe Outlet***

4. In 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, the filter material placed to the top of Stage 1 shall be protected from scour and/or contamination by covering with a 50mm thick plug of compacted select fill material having a maximum particle size of 25mm and Plasticity Index of not more than twelve as determined by AS 1289.3.3.1. This plug, any contaminated filter material and any select material covering shall be removed and replaced with the nominated filter material and compacted immediately ahead of the placement of the pavement layer. All excavated material shall be disposed to waste or incorporated in fills. ***Temporary Plug over Filter Material***

(d) Cleanouts

1. Cleanouts are to be provided at the commencement of each run of sub-pavement drain line and at intervals of approximately 60m or as shown on the Drawings. ***Location***

2. Details of the required cleanout construction are shown on the Drawings. ***Details***

(e) Outlets

1. Outlets are to be provided at maximum intervals of 150m. Where possible sub-pavement drains shall discharge into gully pits and other stormwater drainage structures. Where not possible, an outlet shall be constructed of unslotted plastic pipe of the same diameter as the main run to discharge below the edge of the road shoulder. An outlet structure in accordance with the Drawings shall be constructed at the discharge end. ***Location***

2. The outlet shall be made rodent proof in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Rodent Proof***

3. The outlet shall be located so that erosion of the adjacent area does not occur, or shall be protected by the placement of selected stone in the splash zone of the outlet. ***Erosion Control***

C232.06 INTRA-PAVEMENT DRAINS

(a) Excavation

1. A 'V' shaped trench approximately 50mm deep shall be cut to the required line in the pavement layer immediately below the MS75 crushed rock pavement layer. No excavation is required below a 40mm open graded asphaltic concrete subbase layer. ***Type***

2. The bottom of the trench is to be to the same grade as the roadway. The bottom of the trench shall be constructed so that localised ponding of water does not occur. ***Grade***

3. Where the pipe is to discharge through the fill batter a trench shall be constructed on a grade suitable for the pipe to discharge its contents without scour. After laying the pipe the trench shall be backfilled with fill material and compacted for the full depth to a relative compaction of not less than 95 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Discharge Pipe***

(b) Laying of Pipe

1. Thick walled unplasticised PVC pressure pipe, complying with AS 1477, and having a nominal diameter of 58mm, and a minimum pipe wall thickness of 6.5mm, shall be used with crushed rock subbases having not more than 10 per cent of material passing the 9.5mm AS sieve and having layer thicknesses neither less than 150mm nor more than 200mm or open graded asphalt subbases having layer thicknesses neither less than 80mm nor greater than 100mm. ***UPVC Pressure Pipe***

2. Where crushed rock subbases require pavement drains and have a depth exceeding 200mm, the type of pavement drain will need to be certified to have adequate crushing strength and written approval of the Council to the proposed pavement drain type will be required. Similar proposal and Council approval is required for pavement drain in asphalt subbases greater than 100mm in depth. ***Subbases >200mm Pipe Crushing Strength***

3. All pipe shall be slotted except where otherwise shown on the Drawings. Details of slot sizes and spacings shall be in accordance with Annexure C232-A for thick walled unplasticised PVC pressure pipe. ***Slot Size***

4. Thick walled unplasticised PVC pressure pipe shall have square ends and shall be butt jointed. ***PVC Pipe Joints***

5. Where spigot and socket type pipes are used, the pipes shall be joined with the socket ends facing upstream. ***Socket Joints***

6. The pipe shall be laid to the specified line and level. The pipe shall not deviate from the specified line by more than 100mm at any point. ***Level***

7. The inlet ends of all pipes shall be fitted with caps. ***Inlet Caps***

8. All pipes shall be securely held to the layer under the free-draining subbase to prevent movement of the pipes during placement and compaction of the free-draining subbase. At least seven days before commencement of pipe laying, the Contractor shall submit details of the proposed method of securing the pipes to the layer under the free-draining subbase for the approval of the Superintendent. ***Pipe Anchorage***

9. Notwithstanding the Superintendent's approval to the use of a method of securing the pipes to the layer under the free draining subbase, if such securing method allows movement of the pipes, the method shall be discontinued and the Contractor shall propose an alternative securing method for approval by the Superintendent. ***Alternative Securing Method***

10. Any additional costs resulting from the use of the alternative method of securing the pipes shall be borne by the Contractor. ***Contractor's Costs***

11. The outlet length of pipe from the outside edge of the free-draining subbase to an outlet structure in the embankment batter shall be unslotted and the pipe joints in this length of pipe shall be sealed with suitable couplings or mastic. ***Outlet Length***

(c) Backfilling

1. Subbase material shall be spread, compacted and trimmed, where appropriate, as follows: ***Subbase***

(a) For crushed rock Macadam subbase, in accordance with the Specification for FLEXIBLE PAVEMENTS.

(b) For open graded asphalt subbase, in accordance with the Specification for ASPHALTIC CONCRETE.

2. Tipping, spreading and compaction of the subbase shall be undertaken in such a manner as not to damage the intra-pavement drain pipes. If any pipes are damaged as a result of the tipping, spreading and compaction of the subbase, the Contractor shall remove and replace the damaged pipes. ***Damage to Pipes***

3. The cost of the removal and replacement of such damaged pipes shall be borne by the Contractor. ***Contractor's Costs***

4. The thickness of the layer of subbase material enclosing the pipe shall be within the limits specified in Clause C232.06(b) for the type of pipe used in the intra-pavement drain. ***Subbase Layer Thickness***

(d) Outlets

1. Outlets are to be provided as shown on the Drawings or at maximum intervals of 150m. Where possible intra-pavement drains shall discharge into gully pits and other stormwater drainage structures. Where not possible, each pipe shall be extended using a 60 degree bend and unslotted pipe to discharge through the fill batter and an outlet structure constructed on the discharge end in accordance with the Drawings. ***Location***

2. The outlet shall be made rodent proof in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Rodent Proof***

3. The outlet shall be located so that erosion of the adjacent area does not occur, or shall be protected by the placement of selected stone in the splash zone of the outlet. ***Erosion Control***

C232.07 EDGE DRAINS

(a) Excavation

1. The verge material shall be trimmed to subgrade level and to the minimum width shown on the Drawings. The bottom of the trench is to be constructed at the same grade as the roadway and in such a manner that localised ponding of water does not occur. ***Width and Level***

2. Where the grade of the roadway is less than 0.5 per cent the trench shall be excavated to provide a minimum grade of 0.5 per cent. ***Grade***

3. When the pipe is to discharge through the fill batter a suitable trench shall be excavated to provide the required grade. ***Discharge Pipe***

(b) Laying of Pipe

1. Generally, 65mm diameter slotted corrugated plastic pipe enclosed in seamless tubular filter fabric, complying with the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be used for edge drains. ***Slotted Plastic Pipe***

2. Where any part of a shoulder consists of material other than concrete, slotted thick walled unplasticised PVC pressure pipe, complying with AS 1477, shall be used. Spigot and socket type pipes shall be joined with the socket ends facing upstream and the ends of each pipe shall be securely held against the vertical face of the rigid pavement. At least seven days before commencement of pipe laying, the Contractor shall submit details of the proposed method of securing the pipes against the rigid pavement for the approval of the Council. ***Slotted UPVC Pressure Pipe***

3. The pipe shall be laid on a prepared bed to the specified line and level. ***Prepared Bed***

4. Joints in the pipe shall be kept to a minimum number and shall be made using an external joint coupling approved by the Superintendent. ***Jointing***

5. The inlet end of the pipe shall be fitted with a cap. ***Inlet Cap***

6. The outlet section of a pipe from the vertical face of the rigid pavement to an outlet in the embankment batter shall be unslotted and the pipe joints in this length of pipe shall be sealed with mastic. ***Outlet Pipe***

(c) Backfilling

1. The pipe shall be covered with Type B filter material to the dimensions shown on the Drawings. ***Filter Material***

2. Mechanical compaction of this filter material is not required, however after placement of the filter material it shall be soaked with water. Where necessary additional filter material shall be added and soaked to provide the final dimensions shown on the Drawings. ***Soaking of Filter Material***

3. Backfilling over the edge drain shall be done in such a manner as to avoid damage or disturbance of the pipe. Backfill material shall be selected material as required for verges and in accordance with the requirements of the Specification EARTHWORKS. Backfilling shall be compacted to a relative compaction of not less than 100 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Procedure and Compaction***

(d) Cleanouts

1. Cleanouts are to be provided at the commencement of each run of edge drain line and at intervals of approximately 60m or as shown on the Drawings. ***Location***

2. Details of the required cleanout construction are shown on the Drawings. The standard CI caps as shown on the Drawings shall be supplied by the Contractor. ***Construction Detail***

(e) Outlets

1. Unless otherwise shown on the Drawings outlets are to be provided at maximum intervals of 150m. Where possible edge drains shall discharge into gully pits and other stormwater drainage structures. Where not possible, an outlet shall be constructed of unslotted plastic pipe of the same diameter as the main run to discharge below the edge of the road shoulder. An outlet structure in accordance with the Drawings shall be constructed at the discharge end. ***Location***

2. The outlet shall be made rodent proof in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Rodent Proof***

3. The outlet shall be located so that erosion of the adjacent area does not occur, or shall be protected by the placement of selected stone in the splash zone of the outlet. ***Erosion Control***

SPECIAL REQUIREMENTS

C232.08 RESERVED

LIMITS AND TOLERANCES

C232.09 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C232.1 below.

Item	Activity	Tolerances	Spec Clause
1.	**Excavation**		
	Trench Grade	≥0.5%	C232.05(a) C232.07(a)
2.	**Sub-Pavement Drain Backfill**		
	(a) Layer thickness	300mm max	C232.05(c)
	(b) Compaction (Relative)	100% Standard	C232.05(c)
	Filter material	>95% Standard	C232.05(c)
	Backfill material		
3.	Cleanout Spacing	60m approx	C232.05(d) C232.07(d)
4.	Outlet Spacing	150m max	C232.05(e) C232.06(d) C232.07(e)
5.	Intra-Pavement Drain		
	(a) Alignment	Deviation <100mm from specified line at any point.	C232.06(b)
6.	**Edge Drains**		
	Compaction (Relative) Backfill material	100% Standard	C232.07(c)

Table C232.1 - Table of Limits and Tolerances

MEASUREMENT AND PAYMENT

C232.10 PAY ITEMS

1. Pay Items shall be made for ALL activities associated with completing the work detailed under this Specification in accordance with Pay Items C232(a), C232(b) and C232(c).

2. A Lump Sum price for any of these items will NOT be accepted.

3. If any item, for which a quantity of work is listed is not priced by the Contractor, it is then understood that due allowance has been made in other items for the cost of the activity which has not been priced.

4. Filter material and outlet structures are measured and paid in accordance with the Specification for SUBSURFACE DRAINAGE - GENERAL.

5. Subbase material, including spreading, compacting and trimming, is measured and paid in accordance with the Specification for either FLEXIBLE PAVEMENTS or ASPHALTIC CONCRETE as appropriate.

6. Selected material backfill to edge drains is measured and paid in accordance with the Specification for EARTHWORKS.

Pay Item C232(a) EXCAVATION

1. The unit of measurement shall be the cubic metre measured as bank volume of excavation.

2. The width of trench shall be as shown on the Drawings or as directed by the Superintendent. The depth and length of excavation shall be based on the Superintendent's instructions and shall be determined at the time of excavation.

3. The schedule rate shall cover all types of material and separate rates shall not be included for earth or rock. The rate is deemed to include:

- setting out and associated survey work;
- replacement for overexcavation for any reason;
- control of stormwater run-off, temporary drainage and erosion and sedimentation control.

4. The disposal of material from drain excavation shall be included in the schedule rate for excavation.

5. The schedule quantity is a provisional quantity.

Pay Item C232(b) SUBSOIL DRAIN PIPE

C232(b)(i) 100mm dia slotted corrugated plastic pipe.
C232(b)(ii) 58mm dia thick walled unplasticised PVC pressure pipe.
C232(b)(iii) 65mm dia slotted corrugated plastic pipe.

1. The unit of measurement for Pay Items C232(b)(i), C232(b)(ii) and C232(b)(iii) shall be the linear metre measured along the length of the pipe. Any unslotted pipe required for outlets shall be included in the length.

2. The schedule rate shall cover the supply, laying and securing of the subsoil pipe.

3. The rate shall include connections, markers, fittings and seamless tubular filter fabric where specified.

4. The schedule quantity is a provisional quantity.

Pay Item C232(c) CLEANOUT STRUCTURES

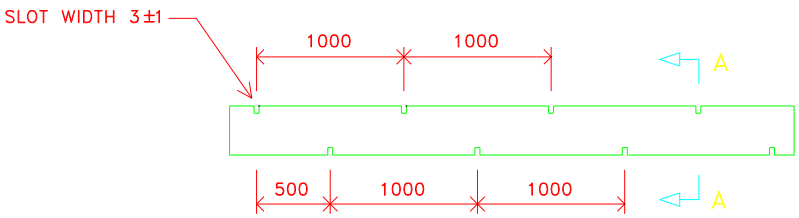
1. The unit of measurement shall be 'each' cleanout structure constructed in accordance with the Drawings.

2. The schedule rate shall include the supply and installation of lids and the recording of cleanout locations in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL.

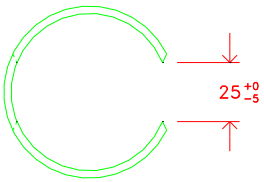
3. The schedule quantity is a provisional quantity.

ANNEXURE C232A

SLOTTING DETAILS FOR THICK WALLED UNPLASTICISED PVC PLASTIC PIPE



PLAN



SECTION A–A

Diagram not to scale
Dimensions are in millimetres

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