DEVELOPMENT CONSTRUCTION SPECIFICATION

C254

SEGMENTAL PAVING

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*
1	Measurement and Payment Pay Items	C254.27	O	JRM	17/10/00

SPECIFICATION C254 - SEGMENTAL PAVING

GENERAL

C254.01 SCOPE

1. This Specification covers the construction of both clay masonry and concrete segmental paving for road pavements, medians, traffic islands, driveways, cycleways, footpaths and other pedestrian areas.

2. The work to be executed under this Specification consists of the supply, placement and compaction of segmental paving units including the provision of a sand bedding course and joint filling sand, over bound or unbound base and/or subbase layer/s.

3. This Specification should be read in conjunction with the appropriate Specifications for the construction of the base and subbase layers beneath the segmental paving, ie. FLEXIBLE PAVEMENTS – C242, MASS CONCRETE SUBBASE – C247.

C254.02 TERMINOLOGY

Size

1. Concrete segmental paving units are units of not more than 0.10 square metres in gross plan area, manufactured from concrete, with plain or dentated sides, with top and bottom faces parallel and with or without chamfered edges.

Concrete Pavers

2. Concrete paving units are identified by shape as being one of the following types:

Shape Type A

Dentated chamfered units which key into each other on four sides, are capable of being laid in herringbone bond, and by their plan geometry, when interlocked, resist the spread of joints parallel to both the longitudinal and transverse axes of the units.

Shape Type B

Dentated units which key into each other on two sides, are not (usually) laid in herringbone bond, and by their plan geometry, when keyed together, resist the spread of joints parallel to the longitudinal axes of the units and rely on their dimensional accuracy and accuracy of laying to interlock on the other faces.

Shape Type C

Units which do not key together and which rely on their dimensional accuracy and accuracy of laying to develop interlock.

Shape Type X

Units which may or may not conform to the above definitions but which are designed to have specific characteristics to provide interlock.

Clay Pavers

3. Clay masonry pavers are manufactured from clay, shale or argillaceous materials which may be mixed with additives. Clay pavers may have square, bevelled (chamfered), rounded or rumbled edges. They are generally rectangular in shape, with the length twice the width, plus 2mm.

4. Clay pavers are classified as either Class 1, 2, 3 or 4 according to their intended application, with increasing performance requirements (and thickness) from Class 1 to Class 4. ***Classification***

5. Laying patterns of paving units are identified as being either Herringbone, Basket-weave, or Stretcher as shown in Annexure C254-A. Each of these may be laid at either 90^o or 45^o to the line of edge restraints. A variation of Stretcher is the Zig Zag Running Bond, also shown in Annexure C254-A. ***Pattern***

C254.03 CHOICE OF PAVER TYPE, SHAPE, CLASS AND LAYING PATTERN

1. The choice of concrete or clay segmental paving units, the paver dimensions, class, shape and laying pattern shall be as shown on the Drawings. ***Type***

2. If not otherwise specified, concrete paving units for road pavements shall be Shape Type A concrete paving units, 80mm thick, and placed in herringbone laying pattern. ***Thickness***

3. If not otherwise specified, clay pavers for road pavements shall be Class 4, minimum 65mm nominal thickness, and placed in a herringbone laying pattern.

C254.04 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
C224	-	Open Drains including Kerb and Gutter
C241	-	Stabilisation
C242	-	Flexible Pavements
C247	-	Mass Concrete Subbase
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving.
AS/NZS 4455	-	Masonry units and segmental pavers.
AS/NZS 4456.9	-	Masonry units and segmental pavers - Methods of test - Determining abrasion resistance.

(c) Concrete Masonry Association of Australia Specifications

T44	-	Concrete Segmental Pavements - Guide to Specifying.
T45	-	Concrete Segmental Pavements - Design Guide for Residential Access Ways and Roads.
T46	-	Concrete Segmental Pavements - Detailing Guide.

(d) Clay Brick and Paver Institute Specifications

Paver Note 1	-	Specifying and Laying Clay Pavers

MATERIALS

C254.05 GENERAL

1. The Contractor shall submit details of all proposed segmental paving materials, including bedding sand and joint filling sand. These details shall be submitted to the Superintendent for approval supported with test results from a nominated NATA registered laboratory, confirming that the constituents comply with the requirements of this Specification. ***Details Required***

2. No material shall be delivered until the Superintendent has approved the sources of supply. Such approval shall not relieve the Contractor of any responsibility for supplying materials that comply with this Specification. ***Superintendent's Approval***

C254.06 CONCRETE SEGMENTAL PAVING UNITS

1. Concrete segmental paving units shall comply with the requirements of T44, T45 and T46, and with the requirements of AS/NZS 4455. The category of paver shall be as shown on the Drawings. ***Specification***

2. Unless otherwise indicated, concrete paving units for all road and driveway pavements shall be 80mm thick with a minimum 28 day characteristic compressive strength of 45MPa. The minimum 28 day characteristic compressive strength for footpaths, cycleways, medians, traffic islands and other pedestrian areas shall be 30MPa, except where they are subject to vehicular traffic of 3 tonne gross weight or greater, in which case it shall be 45MPa. ***Strength***

3. The abrasion resistance, tested in accordance with AS/NZS 4456.9, shall conform to the recommended minimum abrasion indices contained in T44. ***Abrasion Resistance***

C254.07 CLAY SEGMENTAL PAVING UNITS

1. Clay segmental pavers shall comply with the requirements of Part 1 - Specifying Clay Pavers of Paver Note 1 - 'Specifying and Laying Clay Pavers' and with the requirements of AS/NZS 4455. ***Specification***

2. Clay pavers shall be classified as Class 1, 2, 3 or 4 in accordance with Paver Note 1 - Specifying and Laying Clay Pavers. Unless otherwise indicated, Class 4 pavers shall be used for all road and driveway pavements, medians and traffic islands. Class 2 or 3 pavers may be used for footpaths, cycleways and other pedestrian areas, except where they are subject to vehicular traffic with axle loads greater than 2.7 tonnes, in which case Class 4 pavers shall be used. Class 1 pavers shall only be permitted for low-volume pedestrian applications not subject to any vehicular traffic. ***Class***

3. The abrasion resistance as determined by the SCC Abrasion Test (Paver Note1) shall conform to the recommended characteristic abrasion losses contained in Paver Note 1. ***Abrasion Resistance***

C254.08 BEDDING SAND

1. The bedding sand shall be a well-graded sand, consisting of clean, hard, uncoated grains uniform in quality, generally passing a 4.75mm sieve. The bedding sand shall be from a single source or blended to achieve, when tested in accordance with AS 1141.11, the following grading: ***Grading***

AS Sieve	% Passing
9.52mm	100
4.75	95 - 100
2.36	80 - 100
1.18	50 - 85
600μm	25 - 60
300	10 - 30
150	5 - 15
75	0 - 10

2. The sand shall be of uniform moisture content when spread. It shall be covered when stored on site to protect it from rain penetration. ***Protection***

3. The bedding sand shall be free of deleterious soluble salts or other contaminants which may cause, or contribute to, efflorescence. ***Cleanliness***

C254.09 JOINT FILLING SAND

1. The joint filling sand shall be well graded passing a 2.36mm sieve, and when tested in accordance with AS 1141.11, having the following grading: ***Grading***

AS Sieve	% Passing
2.36mm	100
1.18	90 - 100
600μm	60 - 90
300	30 - 60
150	15 - 30
75	5 - 10

2. The sand shall be dry when spread. It shall be covered when stored on site to protect it from rain penetration. ***Protection***

3. The sand shall be free of deleterious soluble salts or other contaminants. ***Cleanliness***

4. Sand used for bedding is not suitable for joint filling.

C254.10 CONCRETE FOR EDGE RESTRAINTS

1. Concrete supplied and placed for the construction of edge strips shall comply with the Specification for MINOR CONCRETE WORKS – C271. ***Specification***

2. Unless otherwise indicated on the Drawings, or where the edge restraint is provided by kerb and/or gutter, the concrete used for edge restraints shall have a minimum 28-day characteristic compressive strength of 32MPa for edge restraints to paving units on road pavements and 25MPa for edge restraints to paving units on footpaths, cycleways, medians and driveways. ***Strength***

CONSTRUCTION

C254.11 SUBGRADE PREPARATION

1. The subgrade shall be formed to the required depth below finished surface level as shown on the Drawings in accordance with the Specification for EARTHWORKS – C213. ***Levels***

2. The finished subgrade foundation for the provision of subbase and/or base shall be subject to the approval of the Superintendent. ***Superintendent's Approval***

C254.12 SUBBASE

1. Where shown on the Drawings a subbase or working platform shall be constructed in accordance with the relevant Specification for STABILISATION, FLEXIBLE PAVEMENTS – C242, or MASS CONCRETE SUBBASE – C247. ***Specifications***

2. The subbase shall be constructed to the specified thickness, compaction and depth below finished surface level and to the design grade and crossfalls of the finished surface. ***Levels***

3. The finished subbase shall be subject to the approval of the Superintendent. ***Superintendent's Approval***

C254.13 BASE

1. The base shall be constructed to the specified thickness and depth below finished surface level, and to the design grade and crossfalls of the finished surface, as shown on the Drawings in accordance with the Specification for FLEXIBLE PAVEMENTS – C242. ***Levels***

2. The base course shall extend in width to at least the rear face of all new edge restraints. ***Extent***

3. Notwithstanding the finished level tolerances contained within the Specification for FLEXIBLE PAVEMENTS – C242 for base of ± 10mm of design levels, the level on the finished surface of the base course for road pavements to be overlain with segmental paving shall be trimmed to within + 10mm or - 0mm of design levels. The deviation from a 3m long straight edge placed anywhere and laid in any direction on the top surface of the base course for all segmental paving shall not exceed 10mm. Sand bedding material shall not be used as a levelling material to compensate for base finishing outside the above tolerances. ***Tolerances***

4. The finished surface of the base shall drain freely without ponding. ***Free Drainage***

5. The finished base shall be subject to the approval of the Superintendent. ***Superintendent's Approval***

C254.14 EDGE RESTRAINTS

1. Edge restraints in the form of kerb and/or gutter or edge strips shall be constructed along the perimeter of all segmental paving as shown on the Drawings. Concrete kerb and/or gutter and edge strips shall be constructed in accordance with the Specifications for OPEN DRAINS INCLUDING KERB AND GUTTER – C224 and MINOR CONCRETE WORKS – C271. ***Requirements***

2. Faces of edge restraints abutting paving units shall be vertical.

3. Edge restraints shall be supported on compacted base and/or subbase of the thickness as shown on the Drawings. Where not otherwise specified or indicated, the minimum thickness of compacted base beneath the edge restraints shall be 100mm adjacent to road pavements and medians, and 50mm adjacent to footpaths, cycleways and driveways. ***Support***

4. Unless otherwise shown on the Drawings, contraction joints, 20mm depth shall ***Joints***

be formed every 5m of edge restraint length.

5. After the concrete has hardened and not earlier than three days after placing, unless otherwise directed by the Superintendent the spaces at the back of the edge restraint shall be backfilled with earth, compacted in layers not greater than 150mm thick, then topsoiled to meet surrounding of design levels. ***Back Filling***

C254.15 SAND BEDDING COURSE

1. The sand bedding course shall be spread in a single uniform layer and screeded in a loose condition to the nominated design profile and levels plus that necessary to achieve a uniformly thick nominal 20-25mm layer following final compaction of the segmental paving. ***Allowance Levels***

2. Any depressions in the screeding sand exceeding 5mm shall be loosened, raked and rescreeded before laying paving units. ***Depressions***

3. For the manual placing of paving units, the bedding sand shall be maintained at a uniform loose density. For mechanised laying, the bedding sand shall be uniformly and firmly, but not fully, compacted. ***Compaction***

4. Screeded sand left overnight of subject to rain shall be checked for level and rescreeded where necessary before paving units are placed. The sand shall not be screeded more than two metres in advance of the laying face at the completion of work on any day. ***Screeding***

C254.16 LAYING PAVING UNITS

1. Paving units shall be uniformly placed on the screeded sand bedding to the nominated laying pattern. Paving units shall be placed so that they are not in direct contact with each other and shall have uniform 3mm nominal joint widths. ***Joints***

2. The first row shall be located next to an edge restraint or an established straight line, and laid at a suitable angle to achieve the required orientation of paving units in the completed pavement. ***Sequence***

3. In each row, full units shall be laid first. Edge or closer units shall be neatly cut using a paver scour, or mechanical or hydraulic guillotine, and fitted subsequently. Cut pieces of paving units which are smaller in size than one quarter of a full block shall not be used. ***Odd Shapes***

4. Access chambers, drainage gullies and similar penetrations through the pavement shall be finished against the paving with a concrete surround or apron designed to suit and fit the laying pattern, otherwise complying with the requirements for edge restraints. ***Penetrations***

5. Where pavers are placed over an isolation, contraction or expansion joint in an underlying concrete pavement, a joint is to be provided in the pavers. The joint shall consist of 10mm thick preformed jointing material of bituminous fibreboard. ***Formed Joints***

6. Any foot or barrow traffic shall use boards overlaying paving to prevent disturbance of units prior to compaction. No other construction traffic shall be allowed on the pavement prior to compaction and provision of joint filling sand. ***Construction Traffic***

7. On completion of subsequent bedding compaction and joint filling operations, no more than 10 per cent of joints along any 10 metre line along a major axis of the laying pattern shall have widths outside the range 2-4mm. ***Tolerance***

C254.17 BEDDING COMPACTION

1. After laying the paving units the sand bedding shall be fully compacted and the surface brought to design levels and surface profiles by not less than two passes of a high frequency low amplitude plate compactor which covers at least 12 units. Compaction shall continue until lipping between adjoining units has been eliminated. ***Compaction***

2. Any units which are structurally damaged during bedding compaction shall be removed and replaced. The pavement shall then be recompacted for at least one metre surrounding each replacement unit. ***Damage***

3. The paving operations shall be arranged so that the use of the plate compactor proceeds progressively behind the laying face without undue delay, and such that compaction is completed prior to cessation of construction activity on any day. Compaction shall not be attempted within one metre of the laying face except on completion of the pavement against an edge restraint. ***Progressive Compaction***

4. The finished surface level shall not vary from the design level at any point laid in any direction, by more than 6mm for all areas with Class 4 segmental pavements and 8mm for all other areas of segmental paving. Notwithstanding this, the finished surface of the segmental paving, including where the paving abuts an edge restraint other than a drainage inlet, shall not deviate from the bottom of a 3m straight edge laid in any direction, except at grade changes, by more than 6mm for road pavements and 8mm for all other areas of segmental paving. ***Finished Levels***

5. The channels formed between abutting chamfered units shall finish with their inverts not less than 5mm nor more than 10mm above adjacent drainage inlets. ***Drainage Inlets***

6. All compaction shall be complete and the pavement shall be brought to design profiles before spreading or placing sand filling in the joints. ***Joint Filling***

C254.18 FILLING JOINTS

1. As soon as practicable after bedding compaction, and in any case prior to termination of work on any day, dry sand for joint filling shall be spread over the pavement and the joints filled by brooming. ***Timing***

2. To ensure complete filling of the joints, both the filling sand and paving units shall be as dry as practicable when sand is spread and broomed into the joints. ***Condition***

3. The pavement shall then receive one or more passes of a plate compactor and the joints then refilled with sand, with the process then repeated sufficiently to ensure that the joints are completely filled. ***Process***

C254.19 PROTECTION OF WORK

1. Other than wheeled trolleys, forklifts and cluster-clamp vehicles, construction and other traffic shall not use the pavement until bedding compaction and joint filling operations have been completed. ***Restricted Use***

C254.20 OPENING TO TRAFFIC

1. As soon as practicable after the filling of joints, construction vehicles may use the pavement, and should be encouraged to traverse the greatest possible area of pavement ***No Tracking***

to assist in the development of 'lock-up'.

2. Excess joint filling sand shall be removed prior to opening to traffic. ***Excess Sand***

3. The pavement shall then be inspected by the Contractor at regular intervals up until the expiration of the Defects Liability Period to ensure that all joints remain completely filled. ***Inspections***

LIMITS AND TOLERANCES

C254.21 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C254.1 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Base**		
	(a) Surface Level	Finished level of base for road pavements to be within +10mm or -0mm of design levels.	C254.13
		Finished level of base other than for road pavements, to be within ±10mm of design levels.	C254.13
		The top surface of the base for all segmental paving shall not deviate from a 3m straight edge, laid in any direction, by more than 10mm.	C254.13
2.	**Laying Paving Units**		
	(a) Joint widths	No more than 10% of joints along any 10 metre line of joints along a major axis of the laying pattern shall have widths outside the range 2 -4mm.	C254.16
3.	**Completed Segmental Paving**		
	(a) Surface level	Finished surface level of pavers shall not vary from design levels by more than ±6mm for road pavements and ±8mm for other than road pavements.	C254.17
		Finished surface of pavers shall not deviate from a 3m straight edge, laid in any direction, by more than 6mm for road pavements and 8mm for other than road pavements.	C254.17
	(b) Level adjacent to drainage inlets	Invert level of channels between abutting chamfered units shall be not less than 5mm and not more than 10mm above the level of adjacent drainage inlets.	C254.17

Table C254.1 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C254.22 RESERVED

C254.23 RESERVED

C254.24 RESERVED

C254.25 RESERVED

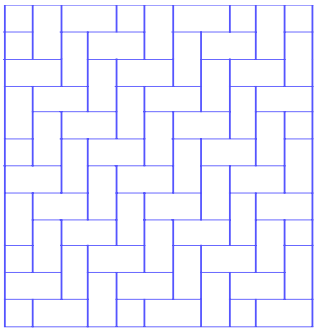
C254.26 RESERVED

MEASUREMENT AND PAYMENT

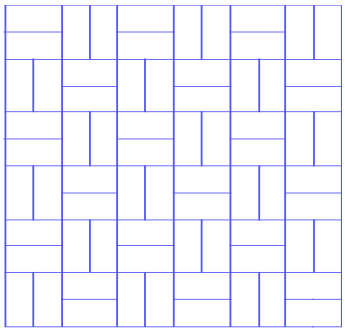
C254.27 RESERVED

ANNEXURE C254-A

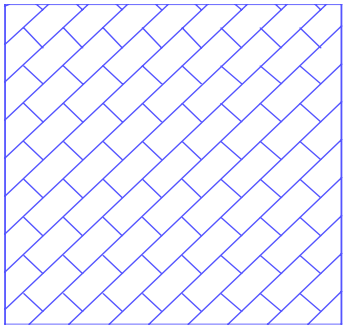
LAYING PATTERNS



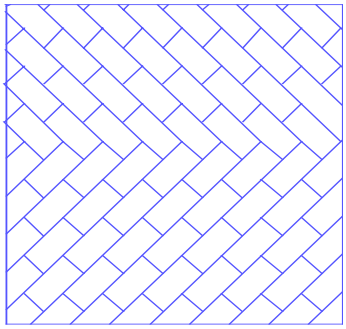
Herringbone



Basketweave



Stretcher



Zig Zag Running Bond

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