



WESTERN AUSTRALIA SPECIFICATION

254

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
1	Bedding Compaction	254.17 (l)	A	SR	09/03/01

SPECIFICATION 254 - SEGMENTAL PAVING

CONTENTS

CLAUSE	PAGE
GENERAL	3
254.01 SCOPE.....	3
254.02 TERMINOLOGY.....	3
254.03 CHOICE OF PAVER TYPE, SHAPE, CLASS AND LAYING PATTERN	4
254.04 REFERENCE DOCUMENTS.....	4
MATERIALS.....	5
254.05 GENERAL	5
254.06 CONCRETE SEGMENTAL PAVERS.....	5
254.07 CLAY SEGMENTAL PAVERS.....	6
254.08 BEDDING SAND.....	6
254.09 JOINT FILLING SAND	6
254.10 CONCRETE FOR EDGE RESTRAINTS	7
CONSTRUCTION.....	7
254.11 SUBGRADE PREPARATION	7
254.12 SUBBASE	7
254.13 BASE.....	7
254.14 EDGE RESTRAINTS	8
254.15 SAND BEDDING COURSE	8
254.16 LAYING PAVERS	9
254.17 BEDDING COMPACTION	9
254.18 FILLING JOINTS.....	10
254.19 PROTECTION OF WORK	10
254.20 OPENING TO TRAFFIC	10

SPECIAL REQUIREMENTS10

254.21 RESERVED10

254.22 RESERVED10

254.23 RESERVED10

254.24 RESERVED10

254.25 RESERVED10

LIMITS AND TOLERANCES11

254.26 SUMMARY OF LIMITS AND TOLERANCES.....11

MEASUREMENT AND PAYMENT12

254.27 PAY ITEMS12

ANNEXURES

254-A LAYING PATTERNS

SPECIFICATION 254 : SEGMENTAL PAVING

GENERAL

254.01 SCOPE

1. This Specification covers the construction of both clay 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 pavers including the provision of a sand bedding course and joint filling sand, over mass concrete subbase, 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. STABILISATION, FLEXIBLE PAVEMENTS, MASS CONCRETE SUBBASE.
4. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

Quality

254.02 TERMINOLOGY

1. Concrete segmental pavers 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.
2. Concrete pavers are identified by shape as being one of the following types:

Size

Concrete Pavers

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.

3. Clay 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.

Clay Pavers

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.

5. Laying patterns of pavers are identified as being either Herringbone, Basket-weave, or Stretcher as shown in Annexure 254-A. Each of these may be laid at either 90° or 45° to the line of edge restraints. A variation of Stretcher is the Zig Zag Running Bond, also shown in Annexure 254-A.

Pattern

254.03 CHOICE OF PAVER TYPE, SHAPE, CLASS AND LAYING PATTERN

1. The choice of concrete or clay segmental pavers, the paver class (for clay pavers), shape type (for concrete pavers), shape name, colour, thickness and laying pattern shall be as shown on the Drawings for each area of application.

Type

2. Unless otherwise specified, concrete pavers for road pavements shall be placed in herringbone laying pattern and shall be in accordance with the requirements for the appropriate road application shown in Table 254.1.

Concrete

3. Unless otherwise specified, clay pavers for road pavements shall be Class 4, minimum 65mm nominal thickness, and placed in a herringbone laying pattern.

Clay

254.04 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

213	-	Earthworks
224	-	Open Drains
241	-	Stabilisation
242	-	Flexible Pavements
247	-	Mass Concrete Subbase
271	-	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 4456.0	-	Masonry units and segmental pavers - Methods of test - General introduction and list of methods.
AS/NZS 4456.3	-	Determining dimensions.
AS/NZS 4456.5	-	Determining breaking load of segmental paving units.
AS/NZS 4456.9	-	Determining abrasion resistance.
AS/NZS 4586	-	Slip resistance classification of new pedestrian surface materials

(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

254.05 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 pavers shall be delivered until the Superintendent has approved the type and quality of the pavers and noted the source of supply as compliant to the requirements of this Specification. All pavers shall have suitable "slip resistance" for pedestrian traffic and vehicular traffic with a classification "W" according to AS/NZS 4586 for the Wet Pendulum Test. Where specific levels of usage require a higher slip resistance classification, this classification shall be indicated on the Drawings. This action constitutes a **HOLD POINT**. The Superintendent's approval of the pavers sources of supply is required prior to the release of the hold point. Such approval shall not relieve the Contractor of any responsibility for supplying materials that comply with this Specification.

Slip Resistancel

HP

254.06 CONCRETE SEGMENTAL PAVERS

1. Concrete segmental pavers shall comply with the requirements of T44, T45, T46 and AS/NZS 4455 for each area of application.

Specification

2. The material requirements for concrete pavers for each application, derived from T44, are shown in Table 254.1.

Requirements

Application	Characteristic breaking load ³ (kN)	Characteristic flexural strength ³ (MPa)	Minimum Thickness (mm)	Shape ⁴ (type)	Dimensional deviations (Category - AS 4455)	Abrasion resistance (mean abrasion index)
Residential Driveways Light Traffic Medium Traffic ¹	3 5	2 3	No limit No limit	Any Any	DPA1 or DPB1 DPA1 or DPB1	7 7
Public Footpaths Low Volume High Volume and Pedestrian Malls ¹	5 5	3 3	No limit No limit	Any Any	DPB2 DPB2	5 3.5
Roads ⁴ Minor Access & Local Dist. District Distributor (B)	5 5 5	3 3 3	60 80 80	Any Any A	DPB2 DPB2 DPB2	5 5 5
Industrial Pavements ²	10	4	80	A	DPB3	7

**Table 254.1
Material Requirements for Concrete Segmental Pavers**

- Notes: 1. Capable of taking occasional 8.2-t axle loads.
 2. The resultant joint width is a combination of paver dimensional deviation and laying procedures.
 3. At 28 days.
 4. Interlocking shapes offer superior performance in road applications.

3. The pavers shall meet the requirements for the relevant application given in Table 254.1 when tested in accordance with the following test methods: **Test Methods**

- | | |
|------------------------------------|----------------|
| • characteristic breaking load | AS/NZS 4456.5 |
| • characteristic flexural strength | AS/NZS 4456.5 |
| • Minimum thickness | Not Applicable |
| • Shape type | Not Applicable |
| • Dimensional deviations | AS/NZS 4456.3 |
| • Abrasion resistance | AS/NZS 4456.9 |

254.07 CLAY SEGMENTAL PAVERS

1. Clay segmental pavers shall comply with the requirements of Part 1 - Specifying Clay Pavers, of Paver Note 1 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. **Class**

3. Unless otherwise indicated, Class 4 pavers shall be used for all road and driveway pavements, medians and traffic islands. **Roadway Class**

4. 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. **Footpath Class**

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

254.08 BEDDING SAND

1. The bedding sand shall be a well-graded sand, consisting of clean, hard, uncoated grains uniform in quality, generally passing a 4.75 millimetre 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**

254.09 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 joint filling shall be free of deleterious soluble salts or other contaminants. **Cleanliness**
- 4. Sand used for bedding is not suitable for joint filling.

254.10 CONCRETE FOR EDGE RESTRAINTS

- 1. Concrete supplied and placed for the construction of edge strips shall comply with the Specification for MINOR CONCRETE WORKS. **Specification**
- 2. Unless otherwise indicated on the Drawings, or where the edge restraint is provided by kerb and/or gutter (channel), the concrete used for edge restraints shall have a minimum 28-day characteristic compressive strength of 32MPa for edge restraints for pavers on road pavements and 25MPa for edge restraints for pavers on footpaths, cycleways, medians and driveways. **Strength**

CONSTRUCTION

254.11 SUBGRADE PREPARATION

- 1. The subgrade shall be formed to the required depth below finished surface level as shown on the Drawings or as directed by the Superintendent in accordance with the Specification for EARTHWORKS. **Levels**
- 2. The finished subgrade foundation for the provision of subbase and/or base shall be presented for the approval of the Superintendent. This action constitutes a **HOLD POINT**. The Superintendent's approval of the subgrade foundation is required prior to the release of the hold point. **HP**

254.12 SUBBASE

- 1. Where shown on the Drawings or as directed by the Superintendent a subbase or working platform shall be constructed in accordance with the relevant Specification for STABILISATION, FLEXIBLE PAVEMENTS, or MASS CONCRETE SUBBASE. **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**

254.13 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 or as directed by the Superintendent in accordance with the Specification for FLEXIBLE PAVEMENTS. **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 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 presented for the approval of the Superintendent. This action constitutes a **HOLD POINT**. The Superintendent's approval of the finished base is required prior to the release of the hold point.

HP

254.14 EDGE RESTRAINTS

1. Edge restraints in the form of kerb or edge strips shall be constructed along the perimeter of all segmental paving as shown on the Drawings or as instructed by the Superintendent. Concrete kerb and edge strips shall be constructed in accordance with the Specifications for OPEN DRAINS and MINOR CONCRETE WORKS. **Requirements**

2. Faces of edge restraints abutting pavers 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 of 20mm depth shall be formed every 5m of edge restraint length. **Joints**

5. After placing, the concrete shall be left to harden for at least 3 days unless otherwise directed by the Superintendent. The spaces at the back of the edge restraint shall then be backfilled with earth, compacted in layers not greater than 150mm thick, then topsoiled to meet surrounding of design levels. **Backfilling**

254.15 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 pavers. **Depressions**

3. For the manual placing of pavers, 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 and subject to rain shall be checked for level and rescreeded where necessary before pavers 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**

254.16 LAYING PAVERS

- | | |
|---|-------------------------------|
| <p>1. Pavers shall be uniformly placed on the screeded sand bedding to the nominated laying pattern. Pavers shall be placed so that they are not in direct contact with each other and shall have uniform 3mm nominal joint widths. The pavers shall be mixed between various pallets to ensure that any colour variation from one pallet of pavers to the next is evenly distributed over the entire paved area.</p> | Placement and Jointing |
| <p>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 pavers in the completed pavement.</p> | Sequence |
| <p>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 pavers which are smaller in size than one quarter of a full block shall not be used.</p> | Odd Shapes |
| <p>4. Access chambers, drainage gullies and similar penetrations in 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.</p> | Penetrations |
| <p>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 or equivalent approved by the Superintendent.</p> | Formed Joints |
| <p>6. On completion of subsequent bedding compaction and joint filling operations, all joints shall have widths within the range 2-4mm.</p> | Tolerance |

254.17 BEDDING COMPACTION

- | | |
|--|-------------------------------|
| <p>1. After laying the pavers 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 all pavers form a smooth surface with adjacent paver edges matching. The level difference between adjoining edges of any two pavers shall be a maximum of 2mm, to avoid trip hazards, unless approved otherwise by the Superintendent for rough textured pavers.</p> | Compaction |
| <p>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.</p> | Damage |
| <p>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.</p> | Progressive Compaction |
| <p>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 clay or 80mm thick concrete 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 3 metre 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.</p> | Finished Levels |
| <p>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.</p> | 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***

254.18 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 pavers 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***

254.19 PROTECTION OF WORK

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

254.20 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 to assist in the development of 'lock-up'. ***No Tracking***

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***

SPECIAL REQUIREMENTS

254.21 RESERVED

254.22 RESERVED

254.23 RESERVED

254.24 RESERVED

254.25 RESERVED

LIMITS AND TOLERANCES

254.26 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table 254.2 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.	254.13	
		Finished level of base other than for road pavements, to be within ± 10 mm of design levels.	254.13	
		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.	254.13	
2.	Laying Pavers (a) Joint widths	Within the range 2 -4mm.	254.16	
3.	Completed Segmental Paving (a) Surface level	Finished surface level of pavers shall not vary from design levels by more than ± 6 mm for road pavements and ± 8 mm for other than road pavements.	254.17	
		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.	254.17	
		(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.	254.17
		(c) Difference in level of adjacent pavers	= or < 2mm	254.17

Table 254.2 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT

254.27 PAY ITEMS

1. Payment shall be made for all the activities associated with completing the work detailed in the Specification on a schedule of rates basis in accordance with Pay Items 254(a) to 254(c) inclusive.
2. A lump sum price for any of these items shall not be accepted.
3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.
4. Excavation and preparation of subgrade is measured and paid in accordance with the Specification for EARTHWORKS.
5. Subbase and Base are measured and paid in accordance with the Specifications for STABILISATION, FLEXIBLE PAVEMENTS, or MASS CONCRETE SUBBASE as appropriate.
6. Edge strips are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.
7. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

Pay Item 254(a) EDGE STRIPS

1. The unit of measurement shall be the linear metre measured along the length of the edge strip.
2. The schedule rate shall include all activities involved in the excavation, forming, concreting, contraction joints, backfilling and compaction adjacent to the completed edge strip.

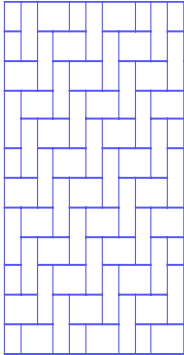
Pay Item 254(b) SEGMENTAL PAVING - ROAD PAVEMENTS

1. The unit of measurement shall be the square metre of surface of segmental paving for road and driveway pavements.
2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.
3. The schedule rate shall include all activities involved in the supply, laying and compaction of segmental pavers, bedding sand and joint filling sand, including any cutting of units, joints overlying concrete pavement joints, and concrete surrounds or aprons around surface penetrations.

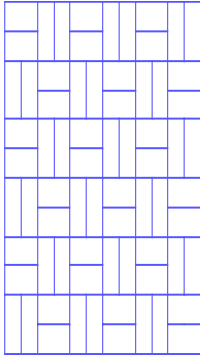
Pay Item 254(c) SEGMENTAL PAVING - OTHER THAN ROAD PAVEMENTS

1. The unit of measurement shall be the square metre of surface of segmental paving for other than road pavements, including medians, traffic islands, footpaths, cycleways and other pedestrian areas.
2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.
3. The schedule rate shall include all activities involved in the supply, laying and compaction of segmental pavers, bedding sand and joint filling sand, including any cutting of units, joints overlying concrete pavement joints, and concrete surrounds or aprons around surface penetrations.

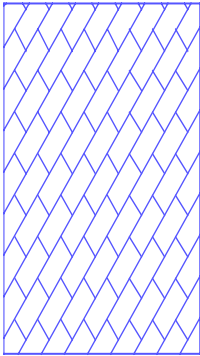
ANNEXURE 254-A
LAYING PATTERNS



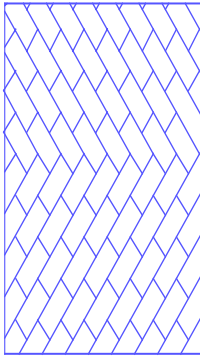
Herringbone



Basketweave



Stretcher



Zig Zag Running Bond