

Introduction

Concrete flags are large format pavers with a gross plan area greater than 0.08m², used in combination with a bedding course to form a surfacing layer. Flag pavers are the ideal material for constructing residential and commercial space pavements.

Strong, durable, and aesthetically appealing, a correctly laid concrete flag pavement will stand up to almost anything you can drive on it.

This datasheet specifies the material requirements for a concrete flag pavement space, subjected to vehicular and/or pedestrian use. Consult CMAA Manual PA 05 Concrete Flag Pavements – Design and Construction Guide for further information.

Generic Pavement Structure

SURFACE – The layer that includes the pavers and a course of bedding material.

JOINTS – The gaps between pavers, which are usually filled with sand to prevent displacement.

EDGE RESTRAINT – A row of pavers or other material that provides an edge to the pavement and ensures that the pavers do not move.

BASECOURSE – The layer of material placed on either the subgrade or sub-base to support the surface course.

SUB-BASE – An optional layer of soil placed between the excavated subgrade and basecourse.

SUBGRADE – The ground on which the pavement is to be placed.

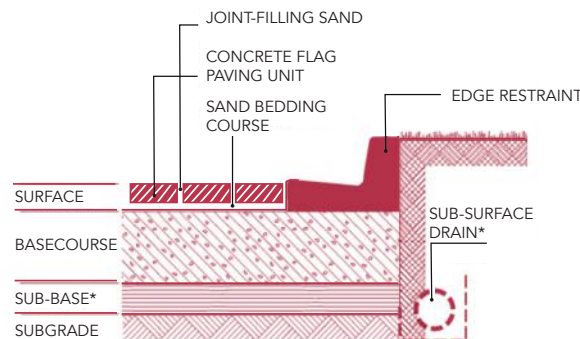


FIGURE 1 - Typical Concrete Flag Pavement Cross-Section

Paver Specification

Paving units are manufactured to strict tolerances specified by AS4455.2: Pavers and Flags. For paving units to comply with AS 4455.2, they **must have a minimum thickness of 40mm** and meet the specifications listed in this section when tested to the AS/NZS 4456 series: Masonry Units, Segmental Pavers and Flags – Methods of Test. All member manufactured products are tested to these standards and values listed on the products technical data sheet.

Breaking Load

The characteristic breaking load is the load at which failure of the unit occurs. As specified in AS 4455.2, it is to be determined in accordance with AS/NZS 4456.5: Determining the Breaking load of Segmental Pavers and Flags. The minimum requirements are shown in Table 5.

Dimensional Deviation

Paving units shall be manufactured to tolerances that enable the units to be assembled into a pavement. This pavement shall provide an even, functional surface for vehicular and/or pedestrian movements. Deviation category requirements are shown in Table 5.

Abrasion Resistance

Abrasion resistance is the ability of a surface to resist wear by friction. The paving units should provide adequate durability when exposed to external elements throughout its design life. Abrasion resistance requirements are provided in Table 5.

Slip Resistance

Slip resistance is the frictional force opposing movement of an object across a surface. The paving units must provide adequate frictional resistance to enable a person or vehicle to traverse the surface without the risk of slipping. The minimum slip resistance requirements for external ramps and pavements are provided in Table 1.

LOCATION	WET PENDULUM TEST
External ramps including sloping driveways, footpaths etc. steeper than 1 in 14	P5
External ramps including sloping driveways, footpaths etc., under 1:14, external areas (e.g. markets), external carpark areas, external colonnades, walkways, pedestrian crossings, balconies, verandas, carports, driveways, courtyards and roof decks	P4

TABLE 1: Slip Resistance Requirements for External Pavements and Ramps (Table 3B, HB198)

Pavement Base Specifications

Sub-base

A sub-base can be incorporated to provide additional load bearing strength. It is mainly used for low-strength subgrades. The sub-base should be formed from a well-graded granular material such as sand, gravel or crushed rock. Particle size of the granular materials should not exceed one-third of the sub-base layer thickness.

Basecourse

The basecourse is usually made of well-graded unbound crushed rock or natural gravel, with a maximum particle size of 26.5mm and a maximum clay content of 6% by mass. The thickness of basecourse for typical loadings and subgrade types is provided in Table 2.

PROPERTY	MAXIMUM NOMINAL AGGREGATE SIZE 20 MM	
	CLASS A	CLASS B
% PASSING SIEVE SIZE		
26.5 mm	100	100
19.0 mm	95-100	95-100
13.2 mm	78-92	78-92
9.5 mm	68-83	68-83
4.75 mm	44-64	44-64
2.36 mm	29-47	30-48
425 microns	12-20	14-23
75 microns	2-6	6-10
Liquid limit (max)	20	20
Plasticity index (max)	6	6
Los Angeles Test % loss (max)	40	40
CBR after soaking at 98% modified maximum dry density	100 (min)	80% (min)

TABLE 2: Properties of Onbound Basecourse Material (CMAA, PA05)

TRAFFIC	GRANULAR BASE THICKNESS (mm)		
	MOST SAND & ROCK SITES	MOST SILT & SOME CLAY SITES	MODERATELY REACTIVE CLAY SITES
PEDESTRIANS ONLY	Not Required	Not Required	75
PEDESTRIANS & LIGHT VEHICLES	Not Required	75	100
PEDESTRIANS & COMMERCIAL VEHICLES (>3 tonne)	75	100	150

TABLE 3: Typical Thickness of Basecourse (Table 6.2, AS 3727.1)

Bedding Course

This will be made from coarse, well graded, washed sand, that is free from organic materials. The bedding course should be laid with a nominal thickness of 25mm after compaction. Bedding sand should be of the grading limits provided in Table 4.

Jointing Sand

Jointing sand should be filled between each individual concrete flag unit. Jointing sand facilitates the interlock between units and promotes controlled movement. For concrete flag pavements it is beneficial to have a 10mm gap between pavers at every 8m interval. This helps compensate for the low number of joints between pavers. Jointing sand should be less than 3% silt/clay by weight and be within the grading limits provided in Table 4.

SIEVE SIZE	% PASSING Bedding Material	% PASSING Jointing Material
9.52 mm	100	100
4.75 mm	95-100	100
2.36 mm	80-100	100
1.18 mm	50-85	90-100
600 microns	25-60	60-90
300 microns	10-30	30-60
150 microns	5-15	15-30
75 microns	0-10	5-10

TABLE 4: Bedding and jointing material grading limits (CMAA, PA05)

Detailing Considerations

Edge Restraint

The entire perimeter of the pavement should be provided with an edge restraint. Edge restraints should be placed within 100mm of the compacted subgrade and basecourse. Suitable edge restraints include:

- vertical edge bricks laid in a small concrete trench;
- exposed or concealed concrete beam; and
- barriers constructed using pre-mixed concrete with 20MPa strength and 14mm aggregate size
- walls or existing structures

Laying Pattern

Pavements for commercial vehicle (>3tonne) shall use concrete flags laid in a herringbone, basket weave or stretcher bond respectively. The continuous joint of each must run across the direction of traffic.

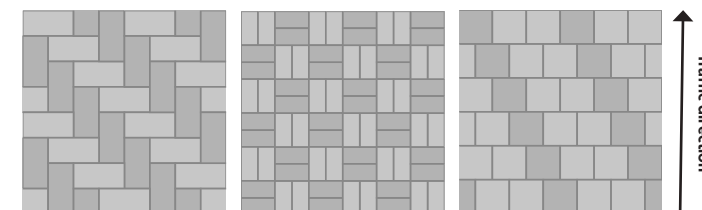


FIGURE 2 - Herringbone, basket weave and stretcher bond laying patterns

PAVEMENT APPLICATIONS MINIMUM CHARACTERISTIC BREAKING LOAD (kN)*		MINIMUM CHARACTERISTIC BREAKING LOAD (kN)*	WORK SIZE MINIMUM THICKNESS (mm)	DIMENSIONAL DEVIATION CATEGORY	MAXIMUM ABRASION INDEX (MEAN ABRASION INDEX)**		
Relevant Australian Standard		AS/NZS 4456.5 †	NA	AS/NZS 4456.3 †	AS/NZS 4456.9 †		
Residential	Pedestrian Only (e.g paths, patios and outdoor areas)	5	40	DPA1 or DPB1	No Requirement		
	Pedestrian and light vehicles only (e.g., driveways, parking spaces, and the like)	7	50	DPA2 or DPB2	No Requirement		
	Pedestrian and commercial vehicle (>3tonne)	7	60	DPA2 or DPB2	No Requirement		
					Pedestrian Traffic Volume		
					Low	Medium	High
Public Space	Pedestrian Only	5	40	DPA1 or B1	7 †	5.5	3.5
	Pedestrian and light vehicles only	7	50	DPA2 or B2	7 †	5.5	3.5

TABLE 5: Minimum Paver Unit Requirements (Table 2.8, AS 4455.2)

* At 28 days for concrete products ** At 90 days for concrete products

† Alternative means to demonstrate performance requirements are given in AS4455.2 Appendix B.