SPECIFICATION FOR PRECAST CONCRETE BLOCKS

PART 4: PAVING BLOCKS

Revision History

Issue Date	Revision	Revision Description
14/08/2011	1.0	Issue for use.
22/09/2013	2.0	Total revision in the specification requirements in all applicable clauses. This revision Issue for use and supersedes DMS 1: Part 4 previous editions which are withdrawn
03/07/2016	3.0	• New clause was added (5.6) as follow: When used as hardscapes in building projects, 50 % of hardscapes materials shall demonstrate a Solar Reflective Index (SRI) of at least 29. • Table 1 Modified (number of 3 specimens for SRI added) • Table 2 Title of table modified and to be read as follow (Thickness and chamfer correction factors for compressive strength of block having plan area more than 10000 mm2) • Table 3 was created Thickness and chamfer correction factors for compressive strength of block having plan area equal or less than 10000 mm2
14/05/2020	4.0	• Note added in clause 5. In addition to updating the reference standards to latest versions. In addition to minor editorial changes in some clauses
28/06/2020	5.0	• Annex D has been removed, and some reference standards have been deleted. Changes have been highlighted.

TABLE OF CONTENTS

FOREWORD

With a view to have a comprehensive set of unified Dubai Municipality Standards which would be consistent and appropriate to local conditions and yet be at par with International Standard, the Dubai Central Laboratory Department is formulating standards taking guidance as much as possible from International and Regional Norms.

The formulation of this Dubai Municipality Standards (DMS) Specification is in accordance with Local Order 44 issued in 1990 as amended by Local Order (1) 2012 on "Standard Specifications of Concrete Blocks Used in the Emirate of Dubai". This DMS Specifications takes into account the new developments in terms of materials, block types and manufacturing technology as well as the availability of test facilities and test methods.

In view of the above, this DM Standard Specification (DMS 1) is being formulated in five parts as follows and intended to meet the requirements of the Local Order 44: 1990 as amended by Local Order (1) 2012.

Part 1: Masonry blocks
Part 2: Filler blocks
Part 3: Autoclaved aerated concrete masonry blocks
Part 4: Paving blocks
Part 5: Concrete-polystyrene sandwich masonry blocks

1 SCOPE

This standard specifies minimum performance levels for precast concrete paving blocks.

2 REFERENCES

This standard incorporates provisions from other references. These references are cited undated at the appropriate points in the text, but latest edition of these references applies (including amendments). In case any reference is shown as dated, then that specific edition shall be used. The titles of these references are listed on the last page

3 DEFINITIONS

3.1 paving block

A precast concrete block intended for the construction of paved surfaces.

4 GENERAL REQUIREMENTS

4.1 Requirements For Materials

4.1.1 General

Only materials with suitability established in terms of their properties and performance shall be used in the manufacture of concrete paving blocks.

The suitability requirements and the acceptance criteria of the materials used shall be given in the manufacturer's production control documentation.

The material used shall conform to applicable standard or shall be shown by test or experience that it is not detrimental to the durability of the concrete masonry units or any material customarily used in masonry manufacturing.

4.1.2 Asbestos

Asbestos, or materials containing asbestos, shall not be used.

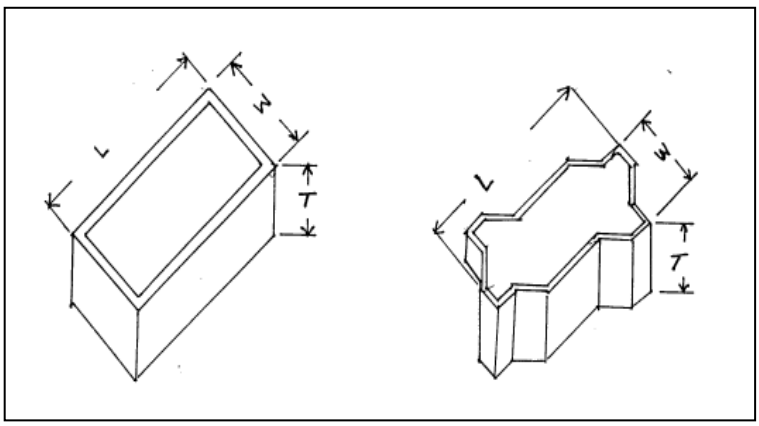
4.2 Size and Shape

4.2.1 Work Size

Paving block units shall be of any size and shape and shall have an exposed face area less than or equal to 90,000 mm², and the maximum overall dimension divided by thickness shall be less than or equal to 5, see Figure 1. The paving blocks shall not have a work size thickness less than 60 mm. All arises shall be clean, plane and uniform dimension.

4.2.2 Dimensions

The size and shape of blocks shall be as specified by the purchaser. All details, including dimensions of blocks with profiled sides, shall be declared by the manufacturer.



Rectangular paving block Non-rectangular paving block

Figure 1: Example shape of paving blocks [Length (L), Width (W) and Thickness (T)]

5 PERFORMANCE REQUIREMENTS

5.1 Dimensions and Maximum Tolerances

The maximum average dimensional deviations from the declared sizes when measured in accordance with "Annex A" shall be within the values ± 3 mm Length and width and thickness.

A sample consisting of ten (10) blocks shall be considered failed if four (4) or more measured average dimension (length, width or thickness) failed to comply with the maximum allowed deviation of ± 3 mm.

5.2 Compressive Strength

When a sample of ten (10) blocks is tested as per "Annex B" of this DMS, the average compressive strength shall not be less than 49 N/mm^2 and crushing strength of any individual block shall not be less than 40 N/mm^2.

NOTE: only For block with a work plan area less than or equal 5000 mm^2 and thickness ≥ 80mm ; the average of C.S shall not be less than 40 N/mm^2 and crushing strength of any individual block shall not be less than 35 N/ mm^2);

5.3 Water Absorption

When a sample of three (3) blocks is tested as per "Annex C", the average absorption shall not be greater than 5 % with no individual unit with a value greater than 7%.

5.4 Abrasion Resistance

When a sample of three (3) blocks is tested as per (BS EN 1338 - Annex G), no individual test result shall be greater than 20 mm.

5.5 Chloride and Sulphate Content

When a sample of one (1) block is tested in accordance with BS 1881-124:2015 – TC the acid soluble chloride content (Cl) and the acid soluble sulphate content (SO_3) shall not exceed 0.05 % and 0.7% by mass of concrete respectively.

5.6 Solar Reflective Index

When used as hardscapes in building projects, 50 % of hardscapes materials shall demonstrate a Solar Reflective Index (SRI) of at least 29.

6 DURABILITY ASPECT

Under normal exposure conditions of use in Arabian Gulf region environment, precast concrete paving blocks will continue to provide satisfactory strength, provided they conform to clause 5 above and are subject to normal maintenance.

7 VISUAL ASPECTS

7.1 Appearance

Paving blocks shall be sound and free of defects that would interfere with the proper placing on the units or impair the strength or performance of the construction and shall have uniform color and texture. The upper faces of the concrete paving blocks shall not exhibit defects such as cracking or flaking.

7.2 Special Texture

In the case of blocks produced with special surface textures, the texture shall be described by the manufacturer.

7.3 Colour

Colors may be provided in a facing layer or throughout the block at the manufacturer's discretion.

8 SAMPLE REQUIREMENTS

Table 1 - Number of specimen

Property	Number of Specimen
Compressive Strength	10
Dimension	
Abrasion resistance	3
Water Absorption	3
Chloride and sulphate content	1
Solar Reflective Index (SRI)	3

9 CONFORMITY ASSESSMENT AND CERTIFICATION

9.1 Conformity of the product with this standard shall be assessed in accordance with Dubai Municipality third party product certification schemes.

9.2 Product delivered to site shall demonstrate compliance with this standard through a Certificate of Conformity or Mark of Conformity issued by Dubai Municipality.

ANNEX A: MEASUREMENT OF DIMENSIONS AND PLAN AREA

A.1 Determination of Thickness, Length and Width

A.1.1 Apparatus

A.1.1.1 Linear measuring devices, with an accuracy of 0.5 mm.

A 1.2 Procedure

A 1.2.1 Rectangular Blocks

A 1.2.1.1 Thickness

Measure the thickness of the block at four representative positions to the nearest 1 mm.
Report the value of each measurement to the nearest 1 mm.

A 1.2.1.2 Length and Width

Measure the length and width across two opposite faces of the block to the nearest 1 mm.
Two representative positions shall be used for length measurement and three positions for width measurement.
Report the value of each measurement to the nearest 1 mm.

NOTE Care should be taken to measure each block in a sample using the same representative positions.

A 1.2.2 Non Rectangular Blocks

A.1.2.2.1 Thickness

Measure the thickness of the block at four representative positions to the nearest 1 mm.
Report the value of each measurement to the nearest 1 mm.

A.1.2.2.2 Length and Width

Measure the maximum length and maximum width declared by the manufacturer to define the shape of the block to the nearest 1 mm.
Report the value of each measurement to the nearest 1 mm.

A.2 Determination of Plan Area

A.2.1 Rectangular Paving Blocks
Calculate the plan area by multiplying the length by the width.

A.2.2 Non Rectangular Blocks

A.2.2.1 Apparatus

A.2.2.1.1 Balance, capable of weighing 100 g to an accuracy of 0.01 g.

A.2.2.1.2 Sheets of Thin Cardboard, Of Uniform Thickness.

A.2.2.2 Measurement of Plan Area

Place the block, wearing surface uppermost, on the cardboard and trace around its perimeter with a pencil. Cut out the shape accurately and weigh it to the nearest 0.01 g, using the balance
Weigh a rectangle measuring 200 mm × 100 mm, cut accurately from the same cardboard, to the nearest 0.01 g.

Calculate the plan area of the paving block as (in mm²) to the nearest 10 mm², either by using the equation:

$$As = \frac{20000\ ms}{mr}$$

Where

As: is the plan area of the paving block (in mm²)

m*s*: is the mass of the cardboard shape matching the block (in g);

m*r*: is the mass of the 200 mm × 100 mm cardboard rectangle (in g);

OR by using other means capable of measuring to 10 mm²;

OR by using the manufacturer's declared value.

ANNEX B: DETERMINATION OF COMPRESSIVE STRENGTH

B.1 Apparatus

B.1.1 Compression testing machine, conforming to BS EN 12390 - 4 Specification for compression testing machines for concrete

B.1.2 Plywood packing, Approximately 4 mm thick and larger than the specimen by a margin of at least 5 mm at all points. The packing shall be knot free.

B.2 Procedure

Measure the dimensions of each block before storing it in water and calculate the plan area, as described in annex A.

Test a sample of blocks after storing them for (24 ± 4) h in water maintained at a temperature of (20 ± 5) °C.

Wipe clean the platens of the testing machine.

Remove any loose grit or other material from the contact faces of the block. Place plywood packing between the upper and lower faces of the block and the machine platens.
Use fresh packing for each block tested.

Place the block in the machine with the wearing surface in a horizontal plane and in such a way that the axes of the block are aligned with those of the machine platens.
Apply the load without shock and increase it continuously at a rate of (15 ± 3) N/ (mm²·min) until no greater load can be sustained by the paving block or delamination occurs. Record the maximum load applied to the block.

B.3 Calculation of Compressive Strength

Calculate the crushing strength of each block to the nearest 0.1 N/mm² by dividing the maximum load by the plan area and multiplying by the appropriate factor from Table 2 and table 3 Calculate the compressive strength, expressing the value to the nearest 1 N/mm².

Table 2 — Thickness and chamfer correction factors for compressive strength of block having plan area more than 10000 mm²

Work size Thickness mm	Correction factors	
	Plain block	Chamfered block*
60 or 65	1.00	1.06
80	1.12	1.18
100	1.18	1.24
*Blocks with chamfer of work size greater than 5 mm in width		

Table 3 — Thickness and chamfer correction factors for compressive strength of block having plan area equal or less than 10000 mm²

Work size Thickness mm	Correction factors	
	Plain block	Chamfered block*
60 or 65	1.23	1.29
80	1.29	1.35
100	1.32	1.38
*Blocks with chamfer of work size greater than 5 mm in width		

Refer also to note under clause 5 for block with a work plan area less than or equal 5000 mm² and thickness ≥ 80mm

ANNEX C: WATER ABSORPTION

C.1 Apparatus

C1.1 Balance used shall be readable and accurate to 0.1 g

C1.2 Ventilated oven capable to maintain temperature more than 100°C

C.2 Test Specimens

Three specimens shall be use in water absorption.

The tests shall be performed on full-sized specimens.

C.3 Procedure

C3.1 Immersing

Immerse the test specimens in water at a temperature of (20 ± 5) °C for (24 ± 4) h. Such that the top surfaces of the specimens are 150 mm below the surface of the water. Specimens shall be separated from each other and from the bottom of the immersion tank by at least 25 mm, using wire mesh, grating, or other spacers. After immersing remove specimens from the water and allow to drain for 60±5 s by placing on coarser wire mesh, removing visible surface water with a damp cloth; weigh and record as Ws (saturated Weight) to nearest 0.1g .

C3.2 Drying

Subsequent to saturation, dry all specimens in a ventilated oven at (110 ±5°C) for not less than 24 h and until two successive weighing at intervals of 2 h show an increment of loss not greater than 0.2 % of the last previously determined weight of the specimen. Record weight of dried specimens as Wd (oven-dry weight) to nearest 0.1g.

C.4 Calculations

$$\textit{Water Absorption \%} = \frac{Ws - Wd}{Wd \times 100}$$

where: Ws = saturated weight of specimen, (g)

Wd = oven-dry weight of specimen, (g)

C.5 Report

- The report shall include the followings
- Water absorption result for each specimen to the nearest 0.1 %
- Water absorption result for average to the nearest 0.5%
- Identification of the report and the date of issue
- Description and identification of the test sample
- Date of receipt of the test sample
- Date of test performance
- Age of test specimens, if known

PUBLICATIONS REFERRED TO

ASTM C 127	STANDARD TEST METHOD FOR DENSITY, RELATIVE DENSITY (SPECIFIC GRAVITY), AND ABSORPTION OF COARSE AGGREGATE
ASTM C 128	STANDARD TEST METHOD FOR DENSITY, RELATIVE DENSITY (SPECIFIC GRAVITY), AND ABSORPTION OF FINE AGGREGATE
ASTM C 140	STANDARD TEST METHODS OF SAMPLING AND TESTING CONCRETE MASONRY UNITS
ASTM C 426	STANDARD TEST METHOD FOR LINEAR DRYING SHRINKAGE OF CONCRETE MASONRY UNITS
ASTM C 936	STANDARD SPECIFICATION FOR SOLID CONCRETE INTERLOCKING PAVING UNITS
ASTM D 512	STANDARD TEST METHODS FOR CHLORIDE ION IN WATER
ASTM D 516	STANDARD TEST METHOD FOR SULFATE ION IN WATER
BS 1881-124:2015 - TC	TRACKED CHANGES. TESTING CONCRETE. METHODS FOR ANALYSIS OF HARDENED CONCRETE
BS 6073: PART 2	PRECAST CONCRETE MASONRY UNITS. GUIDE FOR SPECIFYING PRECAST CONCRETE MASONRY UNITS.
BS EN 771-3	SPECIFICATION FOR MASONRY UNITS. AGGREGATE CONCRETE MASONRY UNITS (DENSE AND LIGHTWEIGHT

	AGGREGATES).
BS EN 772: PART 1	METHODS OF TEST FOR MASONRY UNITS - PART 1: DETERMINATION OF COMPRESSIVE STRENGTH
BS EN 772: PART 16	METHODS OF TEST FOR MASONRY UNITS PART 16: DETERMINATION OF DIMENSIONS
BS EN 12390-4	TESTING HARDENED CONCRETE. COMPRESSIVE STRENGTH. SPECIFICATION FOR TESTING MACHINES
BS EN 1338	CONCRETE PAVING BLOCKS. REQUIREMENTS AND TEST METHODS
2017 AL SA'FAT DUBAI GREEN BUILDING EVALUATION SYSTEM	GREEN BUILDING REGULATIONS & SPECIFICATIONS