

## Section 7 – Generic Technical Specifications/القسم 7 - المواصفات الفنية العامة

### 1.1 CONCRETE/الخرسانة

#### 1.2

##### 1.2.1 General

Cement concrete shall consist of Portland cement, fine and coarse aggregate and water, proportionately mixed, placed and cured in accordance with these specifications for the class of concrete specified. Where the concrete is to be placed for a structure, it shall consist of furnishing all materials and constructing the structure on approved formwork to the shape, levels and dimensions shown on the Drawings or as directed by the Engineer.

##### 1.2.2 General

The classes of concrete and their respective cement contents, and minimum required compressive strengths are shown below

Class	28 day compressive strength, kg/cm <sup>2</sup>	Min. cement kg/cu.m	Max size of Aggregate
AA	260	400	40 mm**
A	210	350	40 mm**
B	154	300	40 mm**
C	105	200	50 mm

NOTE : 1. The strength values relate to cylindrical specimens tested in accordance with AASHTO T-22

\*\*2. For general use in reinforced concrete, the maximum size shall be restricted to 20 mm. For thick sections, the maximum size of 40 mm may be used.

Values specified in BS Code (BS 5328-1:1997) in the given below as per the table

Class	28 day compressive strength, kg/cm <sup>2</sup>	Min. Cement (*) kg/cu.m	Nominal Max size of Aggregate
C-40	40	325	20
C-35	35	300	20
C-30	30	300	20
C-25	25	250 (**)	20
C-20	20	220	20
C-15	15	210	20

(\*) The Cement content should be not less than 240 Kg/m<sup>3</sup> for reinforced concrete or 300 kg/Cum for prestressed concrete.

(\*\*) There is no specific value as per BS, interpolated value considered

##### 1.2.3 Materials

###### 1.2.3.1 Cement

Cement shall be Portland type, originating from manufacturers approved by the Engineer, shipped in sealed, labelled bags or bulk containers. The quality of the Portland cement shall be equivalent to AASHTO M-85, Type I or II. Where the concrete is subject to sulphate attack, sulphate resisting cement (Type V to AASHTO M-85) shall be used at no extra cost. Only one type of brand of cement shall be used in any one structural member. Mixing of types or brands shall not be permitted.

### 1.2.3.2 Fine Aggregate

Fine aggregate shall consist of natural sand, rock-crushed sand or other approved material having hard and durable particles and conforming to AASHTO M6.

It shall not contain harmful materials such as coal, mica or shale. If necessary, fine aggregate shall be washed and sieved to remove deleterious substances. It shall also meet the following requirements.

Test	Test Method	Requirement
Fineness Modulus	AASHTO M6	2.0-3.5
Sodium Sulphate Soundness loss on 5 cycles	AASHTO T104	10% Max.
Friable particles content	AASHTO T112	1% Max.
Test for organic impurities	AASHTO T21	Lighter than standard
Sand equivalent	AASHTO T17	75% Min.
Fraction passing 75-micron sieve	AASHTO T27	5% by weight max. (10% max. for crusher dust)

### 1.2.3.3 Coarse Aggregate :

The Coarse aggregate shall consist of crushed gravel or crushed stone, free from coating of clay or other deleterious substances, and confirm to AASHTO M80. It shall not contain harmful materials such as iron pyrites, coal, mica, laminated material or any materials, which may attack the reinforcement, in such a form or in sufficient quantity to affect adversely the strength and durability of the concrete. If necessary, coarse concrete aggregate shall be washed to remove deleterious substances.

The coarse aggregate shall conform to the following quality requirements:

Test	Test Method	Requirement
Sodium Sulphate Soundness loss on 5 cycles	AASHTO T104	12% max.
Los Angeles Abrasion	AASHTO T96	40% Max.
Content of Friable Particles	AASHTO T112	1% by weight Max.
Soft Fragments and Shale	AASHTO M80	Max. 5% by weight
Flaky Pieces	BS 812	20% Max.
Elongated pieces	BS 812	20% Max.
Combined quantity of chlorides calculated as sodium chloride and sulphates as sodium sulphate	ASTM D1411	1000 ppm, Max.

Grading of the aggregate shall be such as to produce a dense concrete and shall conform to the standard AASHTO grading (AASHTO M43) corresponding to the maximum nominal size of the aggregate.

### 1.2.3.4 Water

A In no case shall the water contain an amount of impurities that will cause a change in the setting time of Portland cement of more than 25% nor a reduction in the compressive strength of mortar at 14 days of more 5% when compared to the results obtained with distilled water.

Water for curing concrete shall not contain any impurities in such an amount to cause discoloration of the concrete or produce etching of the surface.

The water for mixing and curing concrete shall not contain solids and impurities more than following permissible limits.

Impurities	Permissible Limits
Organic	200 mg/l
Inorganic	3000 mg/l
Sulphates (as SO <sub>4</sub> )	500 mg/l
Chlorides (as Cl)	2000 mg/l for plain cement concrete work and 1000 mg/l for reinforced concrete work

The pH value of work shall generally be between 6 to 8.

#### 1.2.3.5 Limits for Total Chemical Impurities :

For reinforced concrete work the total chemical impurities collected from aggregates, cement, admixtures and water shall not exceed the following limits:

Impurities	Permissible limits of undesirable chemicals in concrete in percentage by weight of cement
Chlorides (as Cl ion)	0.06%
Sulphates (as SO <sub>3</sub> )	4.0%

For reinforced concrete work in coastal region and or in aggressive environment, the maximum water/cement ratio shall be limited to 0.45 with application of approved quality plasticizer.

#### 1.2.3.6 Chemical Admixtures

Chemical admixtures where permitted shall conform to the requirement of AASHTO M194. Unless otherwise specified, only Type A (Water reducing), Type B (Retarding), Type D (Water reducing and retarding), Type F (Water reducing, high range) or Type G (Water reducing, high range and retarding) shall be used.

Admixtures containing Chloride Ion (Cl) in excess of one percent by weight of the admixture shall not be used in reinforced concrete.

A Certificate of Compliance signed by the manufacturer of the admixture shall be furnished to the Engineer for each shipment of the material used in the works.

### 1.3 BLOCK WORK

#### 1.3.1 Sand Crete Blocks

Sand Crete blocks shall be manufactured locally with sand and cement in an approved vibrating pressure machine. The sand and cement should comply with the above requirements, the sand having the followings grading:

**Table 2.5 Sand Grading for Sand Crete Blocks**

Sieve Size	Percentage Passing
2.4	-100
1.2	95 - 100
0.6	25 - 85
0.3	5 - 50
0.15	0 - 10

The blocks shall be hard, sound, with sharp well defined arises, and shall be 400 mm long by 200 mm high by the specified thickness, unless otherwise instructed by the Engineer.

Immediately after molding, the blocks shall be placed on a clean level pallet and cured by continuously spraying with water or other approved means.

For a sample of twelve blocks, randomly selected, the average compressive strength shall not be less than 3 N/mm<sup>2</sup>, and no block of twelve shall be less than 2.4 N/mm<sup>2</sup>. If these requirements are not met, the whole batch from which the twelve blocks were selected will be rejected.

#### 1.3.2 Concrete Blocks

Concrete blocks shall comply with the following:

- Blocks shall not be less than 100 mm thick;
- Foundation blocks shall be filled solid with concrete as specified in the Drawings;
- No blocks shall be cut to provide bond but special blocks of 1/2 or 1/4 modular length shall be provided to ensure correct bond;
- Concrete blocks shall be kept continuously damp for 10 days after casting;
- Blocks shall be close staked with cavities vertical and continuously sprayed with water;
- For a further three weeks the blocks shall be prevented from rapid drying out and occasionally sprinkled with water. The wet stacks shall not be disturbed;
- The surface texture of blocks shall be smooth for painting; and
- All block work shall be carried out in stretcher bond.

### 1.3.3 Workmanship

#### 1.3.3.1 Dimensions

All block work shall be set out and built to the respective dimensions, thickness and heights as shown on the Drawings.

#### 1.3.3.2 Handling of Blocks

All blocks shall be carefully handled to prevent damage and protected as necessary. No cracked, chipped or broken block will be used in the Works.

#### 1.3.3.3 Wetting of Blocks

In dry weather, the suction rate of all sand Crete and concrete blocks shall be adjusted by wetting before being used, and the tops of walls left unfinished shall be wetted before work is recommenced.

#### 1.3.3.4 Flush Up

All blocks shall be well buttered with mortar before being laid and all joints shall be thoroughly flushed up as the work proceeds.

#### 1.3.3.5 Uniformity

Block work shall be carried up in a uniform manner, no one portion being raised more than one metre above another at one time. All perpends, quoins etc., shall be kept strictly true and square and the whole properly bonded together and leveled round at each floor or agreed height. Bats shall not be used except where required for bonds. A full joint of mortar is to be made where block work abuts concrete or masonry.

#### 1.3.3.6 Jointing and Pointing

Flush Joint: The face joints of the mortar whilst green are to be struck flush with the face of the brickwork or block work, and, if so required, be bag rubbed to give the required texture.

Weather Joint: The face joints of the mortar, whilst green, are to be finished with a neat weather joint as the work proceeds.

Recessed Joint: The face joints of the mortar, whilst green, are to be finished with a neat square recessed joint, and be of uniform depth of approximately 12 mm.

Pointing : The joints of the block work are to be raked out as the work proceeds, to a depth of 20 mm, and all dust carefully brushed out. As and when directed by the Engineer, the joints shall be well wetted and pointed with an approved mortar of selected mix and colour, and finished as described.

### 1.3.4 Mortars and Plasters

#### 1.3.4.1 Mixe

The mixes of mortars and plasters for block work, plastering and for external rendering shall be as described in the following table:

**Table 2.6 Mortar Mixes**

Cement	:	Sand
1	:	3
1	:	4
1	:	6
1	:	8

#### 1.3.4.2 Mixing

The ingredients for cement mortars shall be measured in proper gauge boxes on a boarded platform, the ingredients being turned over twice dry and twice whilst water is added through a sprinkler rose. Alternatively, mixing may be by means of an approved mechanical batch mixer.

#### 1.3.4.3 Additives-Mortar Plasticiser

The mortar plasticizer shall be of an approved make and shall be used in the proportions and manner recommended by the manufacturer. The proportions of the mortar mix shall if necessary be adjusted in accordance with the manufacturer's recommendations.

#### 1.3.4.4 Pigments for Colouring Mortar

Where coloured mortar or rendering is specified the pigment shall be of an approved manufacture and shall not be injurious to other ingredients of the mortar. It shall be mixed with care to ensure an even colouring throughout the mixture and a sufficient quantity shall be made to ensure completion of an area of rendering in one operation.

### 1.3.5 **Workmanship**

#### 1.3.5.1 Plastering and Rendering

The preparation of the surfaces for plastering includes raking out joints of block work to form key, dubbing out all uneven surfaces as required, temporary rules and boards, working around pipe clips and other similar obstructions and working behind pipes.

All surfaces are to be finished true and smooth.

External angles, where not protected by metal angle beads, shall be properly formed rounded angles to 10 mm radius unless otherwise directed by the Engineer.

The prices shall include for 1 m x 1 m sample panels if so directed by the Engineer.

#### 1.3.5.2 Plaster and Mortar

Plasters and Mortars shall be to the grades and mix proportions specified.

### **Application - Plaster**

Plastering to internal walls and surfaces shall be composed of the layers, as shown on Drawings.