**PARTICULAR SPECIFICATIONS**

**MASSONRY WORK – STONE MASONRY**

1.0 **INDIAN STANDARDS:**

Work shall be carried out to Indian Standards and Code of practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies / conflict noticed shall be directed to the EIC for his direction / approval. However as a general rule more stringent specification shall take precedence.

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2.0 MATERIALS

2.1 Cement

The cement shall be ordinary Portland Cement conforming to IS. Approved blended cement shall be used for internal plaster, masonry, flooring, waterproofing and plumbing works. For all RCC and PCC works, approved by fly ash shall be used. For external plaster approved fly ash as per specification of item shall be used.

It shall be received in bags of 50 kg (or in bulk carriers in case of storage in silos) and each batch shall be accompanied with test certificate of the factory. Also it shall be tested before use to ascertain its strength, setting time, etc. In case cement has been stored for over 6 months from date of manufacturer or for any reasons the stored cement shows signs of deterioration or contamination, it shall be tested as per the direction of the Engineer prior to use in the works.

2.2 Fine Aggregate

1 Natural sand deposited by stream or glacial agencies as a result of disintegration of rock is best form of the aggregate. The fine aggregate shall conform to following standards.

   i) For plain and reinforced concrete:

      IS 383 Specification for coarse and fine aggregate from natural sources for concrete.

   ii) Mortar and grout:

      IS 2116 Specification for sand for masonry mortars.
iii) For plastering:

IS 1542 Specification for sand for plaster (Class A grading)

2.2.1.2 Sea sand should not be used unless approved by the Engineer. If approved, the required treatment shall be done at the contractor’s cost.

2.2.2 Sand shall be hard, durable, clean and free from adherent coating and organic matter and shall not contain any appreciable amount of clay. Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica shale or similar laminated material, alkali and organic impurities in such form or quantities as to affect the strength or durability of concrete or mortar. Also it should not contain any material liable to attack the steel reinforcement.

2.2.2.1 When tested as per IS 2386 Part I and Part II, fine aggregate shall not exceed permissible quantities of deleterious material as given in IS 383.

2.2.2.2 Fine aggregate shall be thoroughly washed at site with clean fresh water such that the percentage of all deleterious materials is within the permissible limits laid down.
2.2.3 Aggregate shall be stored in such a way that it does not get mixed with mud, grass, vegetables and other foreign matter. The Best way is to have a hard surface platform made out of concrete, bricks or planks. It should be to the approval of the Engineer.

2.3. **Water**

2.3.1 Water used for mixing and curing shall be potable conforming to IS, clean, responsibly clear and free from objectionable quantities of silt, oil, alkalis, acid, salts, sugar so as not to weaken mortar, or concrete cause efflorescence or attack the steel in RCC. While curing it shall be free of elements, which significantly affects the hydration reaction or otherwise interferes with hardening of concrete during curing, or those elements which produce objectionable stains or deposits. Potable water is generally satisfactory but it shall be tested prior use in the works.

2.3.2 Water tested shall be in accordance with IS 3025. Maximum permissible limit of deleterious materials in water as given in IS 456.

2.4 **Stone**

2.4.1 Stone to be used in masonry shall be trap, granite, quartzite, gneiss, laterite or any other type of good stone as specified in the BOQ or as approved by the Engineer. For all practical purposes good trap, granite, quartzite or gneiss shall be used unless specified otherwise in the BOQ.
2.4.2 All stones shall be free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials, etc. The percentage of water absorption shall generally not exceed 5%.

2.4.3 The strength of building stones should be adequate to carry the loads imposed. Table 1 of IS 1597 gives the minimum crushing strength of approved stones. Minimum strength shall be 200 kg/sqcm unless specified otherwise.

2.4.4 Stones used shall be small enough to be lifted and placed by hand. Length of the stones shall not exceed three times their heights, and the breadth of the base shall not be greater than three-fourths or the thickness of wall or less than 150 mm. The height of stones for rubble masonry may be up to 300 mm.

2.4.5 Stones with round faces shall not be used.

2.5 **Metal fittings**

Metal fittings shall be non-corrosive/non-ferrous. Use of iron clamps and similar fittings for embedding into the masonry work shall be avoided. If permitted by the Engineer, they shall be treated with anti-corrosive treatment.
2.6 MORTAR

2.6.1 The cement, sand and water used shall meet the Indian standard specifications.

2.6.1.1 Mortar shall be prepared by mixing fine graded aggregate with cement in the proportion specified for respective items of work as detailed in BOW. Mixing of mortar shall be done by mechanical mixers only. Hand mixing shall not be permitted.

2.6.1.2 Mortars shall be specified by proportion. Volumetric mixing shall be based on dry volumes of each ingredient. For convenience, measurement shall correspond to volume of one cement bag i.e. 0.035 cu m. Boxes shall be of size 40 X 35 X 25 cm. These shall be marked as mortar mixing boxes by red paint and shall be used throughout the contract. Hand mixing or mechanical mixing proportion shall be done with the use of these boxes.

2.6.1.3 Cement mortar shall be prepared by mixing cement, sand and non-shrinkage compound in specified proportions. Proportioning shall be carried out as detailed above. Sand shall be added suitably to allow for bulkage if required. Bulkage shall be determined as specified in IS 2386 Part III. Cement and sand added to mixer shall be thoroughly mixed and water shall be added to it gradually. After addition of water the mixer shall run for a minimum of 3 minutes. The mortar mixed shall be consumed within 30 minutes of its mixing.
3.0 WORKMANSHIP

3.1.1 Dressing and shaping of stone shall be done before being used in masonry. Quality of dressing and shaping shall be as approved by the Engineer.

3.1.2 All necessary chases for joggles, dowels and cramps should be formed in stone beforehand.

3.1.3 Sufficiently wetted, cleaned stone shall be laid to lines, levels, curves and shapes as shown in the plans. Stones shall be laid on their broadest face in mortar and settled carefully in place with a wooden mallet. Clean chips and spells, carefully selected to fit in the spaces shall be wedged to avoid thick beds or joints of mortar.

3.2 All connecting walls shall be raised together. In case one part is required to be left behind, raking back at an angle of 45 degrees or less shall be done.

3.3 It is imperative to adjust levels right at the start to achieve correct levels of window sill, roof, etc. But as this is quite difficult to achieve, it shall be part of the stone masonry work to provide cement concrete sill of mix in a ratio of 1:4:8 (1 cement, 4 sand and 8 20 m graded aggregate) of 100 to 150 m thickness in consultation with the Engineer.
3.4 Maximum thickness of joint shall be 20 mm for random rubble and 10 mm for course. Stones shall be set and laid by wooden hammer (mallet) and voids, if any, packed and consolidated by stone chips. Chips used shall not be more than 15% by volume of masonry.

3.5 Stones of full width of wall thickness shall be provided at every 600 mm centre to centre in each layer and staggered. For walls thicker than 600 mm two through stones overlapping each other at a minimum of 150 mm shall be placed.

3.6 The work shall be in perfect plumb or battered as specified.

3.7 Corners stones shall be well-dressed and chiseled. These shall be laid header and stretcher alternate. They shall not be smaller than 0.025 cum and 300 mm in length. Further it must be noted that 25% of the above shall be made from dressed corner stones.

3.8 Jambs shall be made from dressed corners.

3.9 Work of the day shall be raked to a depth of 20 mm while the mortar is green and cleaned with a coired string brush or wire brush. Stone surface shall be free of mortar or cement coats.

3.10 Vertical joints shall be staggered.

3.11 At angular junctions, stones at each alternate course shall be well bonded into the respective courses of the adjacent wall.
3.12 Masonry construction with very thin faces, tied up with occasional through stones or filled up with dry packing or small size aggregates shall be strictly prohibited.

3.13 Storey rods showing the heights of all doors and windows and other necessary information should be used at the time of construction of masonry.

3.14 Door and window frames shall be fixed with hold-fast of adequate size and strength. Iron hold fast shall be treated with anti-corrosive coating and timber to prevent attack from insects and termites. In addition, hold fast shall be securely embedded in chases with cement concrete in a ratio of 1:2:4. Frames shall preferably be fixed simultaneously as work proceeds.

4.0 Scaffolding
Scaffolding independent of masonry work i.e. double scaffolding shall be provided. It should be tied to masonry work or structure at suitable intervals in both directions. Two rows of planks shall be provided all around. Planks shall be at least 50 mm thick and well-tied to scaffolding. Railing to the outside face shall be provided. While erecting scaffolding, the following points must be noted and closely followed:
1. Minimum number of holes in the horizontal direction. Holes shall be formed by omitting header.
2. No holes in pillars under 1 meter in width.
3. No holes near the skew backs of arches.
4. Scaffolding must be sound and strong and easy to maintain.

4.2 **Protection and Curing**
Green work shall be protected from rains by suitable covering. Masonry in cement or composite mortar shall be kept constantly moist on all the faces for a minimum period of seven days. The top of masonry shall be left flooded with water at close of the day. Care shall be taken not to disturb or wash out green mortar.
In case of stone work in lime mortar, curing shall commence two days after laying of masonry and shall continue for the next seven days.

5.0 **TYPES OF STONE MASONRY:**

5.1.1 **Uncoursed / Random Rubble Masonry**
Masonry constructed by selecting stones from quarry, more or less at random, of all sizes and shapes. Cutting of stones restricted to remove inconvenient corners with scabbling or spelling hammer.

5.1.2 **Construction**
1. Individual stones shall have thickness and width of not less than 150 mm and length not less than 1.5 times its height. Stones shall be dressed with a mason’s hammer by knocking off weak corners and edges.
Face stone shall be so dressed that busing on the exposed face shall not project by more than 40 mm from the general wall surface. In case plastering is to be done, projection shall be limited to 19 mm and depression to 10 mm.

2. Bond or through stones shall be 2 pieces (nos.) per sq.m. face area shall be 0.03 sq m and for full width of masonry for walls upto 600 mm stones shall be marked distinctly.

3. For massive work with a width of a meter and above, vertical header 450 mm long or with a depth of two courses whichever is more shall be provided at the rate of one for every sq m of area in the plan.

4. Quoins (corners) shall be dressed square to the face and rough tooled to 100 mm from face, and vertical joints dressed to 40 mm from face. No quoins shall be smaller than 0.025 cu m in volume and they shall also not be less than 300 mm in length, 25% of them being not less than 500 mm in length.

5. Hearting stone shall not be less than 150 mm in any direction. In walls upto 500 mm a minimum of 30% stone shall be 0.010 cu m (10 litres) For thicker walls minimum 30% stone shall be 0.015 cum (15 litres)
6. The jambs shall be made with stones specified for quoins except that stones provided on the jambs shall have their length equal to the thickness of the wall. For walls upto 600 mm, line of headers shall be provided as specified for bond.

7. A plum stone at about 900 mm intervals shall be provided.

8. Stones shall be laid with or without courses as specified. Quoins be laid header and stretcher alternatively. Laying shall be carefully done to form neat and close joints. Face stones shall extend and bond well in the back. These shall be arranged to break joints.

5.2 Coursed Masonry

Course walling shall be built in courses which may vary in height from 150mm to 400mm but the stones in any one course shall roughly be square and of the same height.

5.3 Construction:

1. Stones received from quarry shall be dressed to have the vertical and horizontal sides perfectly straight, parallel and at right angles to adjacent sides. Bushing on the face shall not project more than 40 mm. Beds and tops shall be tooled at least 100mm from the face. Faces of vertical joints shall be square to the face and rough tooled at least 50 mm from the face.
2. Stones shall be longer in breadth than in height and shall run back into the masonry not less than 1.5 times the height. 30% of the stones shall have tailing twice their height. Further 30% of these face stones shall not be less than 0.02 cu m or 20 litres. The height shall not be less than 150 mm or as specified in the pattern in the drawing.

3. Hearting stones shall consist of flat bedded stones, carefully laid on their proper beds in mortar, chips and spells of stone, avoiding excess use of mortar and hollow spaces in masonry. These shall be limited to 10% in the first sort and 15% in the second sort. 30% of the stones shall not be less than 0.010 cum or 10 litres for walls 500 mm or less in thickness. For walls thicker than 500 mm, 30% of them shall not be less than 0.015 cum or 15 litres.

4. Quoins (corner) stones shall be twice their height or minimum 440 mm long whichever is more and shall be of the same height as that of the course. They shall be laid alternately as stretcher and header.

5. Through stones shall be a minimum 450 mm long and shall be 180 mm centre to centre for every course. They shall be about 0.05 sq m in face area and 0.03 sq m in average cross sectional area. For thicker wall (above 600 mm) they shall over-lap by at least 150 mm.

6. Thickness of joints shall be maximum 10 mm. When pointing is to be done, joints shall be raked to a depth of not less than 10 mm while the mortar is green.
6.2 **Item includes:**

The various items shall include the cost of the following irrespective of whether it is stated in the BOQ or not.

a) Material and labour for proper execution as per specification and site requirement including temporary erections like scaffolding, centering, shuttering and removal of the same. Curing and protection shall also be included as directed.

b) Racking out of joints and cleaning of stone surfaces.

c) Preparing tops and sides of existing walls.

d) Bond stones.

e) Making grooves and rebates in the adjoining work for fixing jail.

f) Extra labour involved in dressing of corner stones and jamb stones wherever required.

g) Making holes, openings, outlets etc. embedding pipes, ends of beams, joists, slabs, trusses, sills etc. whatever required during construction and neatly finishing the exposed surfaces and opening as per instructions of the Engineer.

___________________                                   _____________________________
Signature of Tenderer                             Additional Chief Engineer (I&NT)
Date:                              Date: