

Stone Masonry

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1401. DESCRIPTION

This work shall consist of the construction of structures with stones jointed together by cement mortar in accordance with the details shown on the drawings and these specifications or as approved by the Engineer.

1402. MATERIALS

All materials used in stone masonry shall conform to Section 1000 except cement mortar for stone masonry which shall conform to Clause 1304.

1403. PERSONNEL

Only trained personnel shall be employed for construction and supervision.

1404. TYPE OF MASONRY

The type of masonry used for structures shall be random masonry (coursed or uncoursed) or coursed rubble masonry (First sort). However, for bridge work generally, course rubble stone masonry shall be used. The actual type of masonry used for different parts of structures shall be specified on the drawings.

For facing work, ashlar masonry shall be used where indicated on the drawings.

1405. CONSTRUCTION OPERATIONS**1405.1. General Requirements**

The dressing of stone shall be as specified for individual type masonry work and it shall also conform to the general requirements of IS:1597 and requirement for dressing of stone covered in IS:1129. Other specific requirements are covered separately with respect to particular types of rubble stone work.

1405.2. Laying

1405.2.1. The masonry work shall be laid to lines, levels, curves and shapes as shown in the plan. The height in each course shall be kept same and every stone shall be fine tooled on all beds joints and face full and true. The exposed faces shall be gauged out, grooved, regulated and sunk or plain moulded as the case may be. The faces of each stone between the draft be left rough as the stone comes from quarry except where sacrificial layer is to be provided or plastering is resorted to due to aggressive environment.

1405.2.2. Stones shall be sufficiently wetted before laying to prevent absorption of water from mortar.

Stratified stones must be laid on their natural beds. All bed joints shall be normal to the pressure upon them.

Stones in the hearting shall be laid on their broadest face that gives a better opportunity to fill the spaces between stones.

The courses of the masonry shall ordinarily be pre-determined. They shall generally be of the same height. When there is to be variation in the height of courses, the larger courses are to be placed at lower levels, heights of courses decreasing gradually towards the top of the wall. The practice of placing loose mortar on the course and pouring water on it to fill the gaps in stones is not acceptable. Mortar may be fluid mixed thoroughly and then poured in the joints. No dry or hollow space shall be left anywhere in the masonry and each stone shall have all the embedded faces completely covered with mortar.

In tapered walls, the beds of the stones and the planes of course should be at right angles to the batter. In case of bridge piers with batter on both sides, the course shall be horizontal.

The bed which is to receive the stone shall be cleaned, wetted and covered with a layer of fresh mortar. All stones shall be laid full in mortar both in bed and vertical joints and settled carefully in place with a wooden mallet immediately on placement and solidly embedded in mortar before it has set. Clean chips and spalls shall be wedged into the mortar joints and bed wherever necessary to avoid thick beds or joints of mortar. When the foundation masonry is laid directly on rock, the face stones of the first course shall be dressed to fit into rock snugly when pressed down in the mortar bedding over the rock. No dry or hollow space shall be left anywhere in the masonry and each stone shall have all the embedded faces completely covered with mortar. For masonry works over rock, a levelling course of 100 mm thickness and in concrete M 15 shall be laid over rock and then stone masonry work shall be laid without foundation concrete block.

Face works and hearting shall be brought up evenly but the top of each course shall not be levelled up by the use of flat chips.

For sharp corners specially in skew bridges, through stones shall be used in order to avoid spalling of corners.

In case any stone already set in mortar is disturbed or the joints

broken, it shall be taken out without disturbing the adjoining stones and joints. Dry mortar and stones thoroughly cleaned from the joints and stones and the stones reset in fresh mortar. Attempt must never be made to slide one stone on top of another, freshly laid.

Shaping and dressing shall be done before the stone is laid in the work. No dressing and hammering, which will loosen the masonry, will be allowed after it is once placed. All necessary chases for joggles, dowels and clamps should be formed before hand.

Sufficient transverse bonds shall be provided by the use of bond stone extending from the front to the back of the wall and in case of thick wall from outside to the interior and vice versa. In the latter case, bond stones shall overlap each other in their arrangement.

In case headers are not available, precast headers of M 15 concrete shall be used. Cast-in-situ headers are not permitted.

Stones shall break joint on the face for at least half the height of the course and the bond shall be carefully maintained throughout.

In band work at all angle junctions of walls, the stones at each alternate course shall be carried into each of the respective walls so as to unite the work thoroughly.

The practice of building up thin faces tied with occasional through stones and filling up the middle with small stuff or even dry packing is not acceptable.

All quoins and the angles of the opening shall be made from selected stones, carefully squared and bedded and arranged to bond alternately long and short in both directions.

All vertical joints shall be truly vertical. Vertical joints shall be staggered as far as possible. Distance between the nearer vertical joints of upper layer and lower shall not be less than half the height of the course.

Only rectangular shaped bond stones or headers shall be used. Bond stones shall overlap each other by 150 mm or more.

All connected masonry in a structure shall be carried up nearly at one uniform level throughout but when breaks are unavoidable the masonry shall be raked in sufficiently long steps to facilitate jointing of old and new work. The stepping of raking shall not be more than 45 degrees with the horizontal.

1405.3. Random Masonry (Uncoursed and Coursed)

1405.3.1. Dressing : Stone shall be hammer dressed on the face, the sides and beds to enable it to come in proximity with the neighbouring stone. The bushing on the exposed face shall not be more than 40 mm.

1405.3.2. Insertion of chips : Chips and spalls of stone may be used wherever necessary to avoid thick mortar beds or joints and it shall be ensured that no hollow spaces are left anywhere in the masonry. The chips shall not be used below hearting stones to bring these upto the level of face stones. Use of chips shall be restricted to filling of interstices between the adjacent stones in hearting and they shall not exceed 20 per cent of the quantity of stone masonry.

1405.3.3. Hearting stones : The hearting or interior filling of the wall face shall consist of rubble stones not less than 150 mm in any direction, carefully laid, hammered down with a wooden mallet into position and solidly bedded in mortar. The hearting should be laid nearly level with facing and backing.

1405.3.4. Bond stones : Through bond stones shall be provided in masonry upto 600 mm thickness and in case of masonry above 600 mm thickness, a set of two or more bond stones overlapping each other at least by 150 mm shall be provided in a line from face to back. In case of highly absorbent types of stones (porous limestone and sandstones, etc.) the bond stone shall extend only about two-third into the wall, as through stones in such cases may give rise to penetration of dampness and therefore, for all thicknesses of such masonry, a set of two or more bond stones overlapping each other by at least 150 mm shall be provided. One bond stone or a set of bond stones shall be provided for every 0.50 sq. m. of the masonry surface.

1405.3.5. Quoin stone : Quoin stone i.e. stone specially selected and neatly dressed for forming an external angle in masonry work, shall not be less than 0.03 cubic metre in volume.

1405.3.6. Plum stone : The plum stones are selected long stones embedded vertically in the interior of the masonry to form a bond between successive courses and shall be provided at about 900 mm intervals.

1405.3.7. Laying : The masonry shall be laid with or without courses as specified. The quoins shall be laid header and stretcher alternately. Every stone shall be fitted to the adjacent stone so as to form neat

and close joint. Face stone shall extend and bond well in the back. These shall be arranged to break joints, as much as possible, and to avoid long vertical lines of joints.

1405.3.8. Joints : The face joints shall not be more than 20 mm thick, but shall be sufficiently thick to prevent stone-to-stone contact and shall be completely filled with mortar.

1405.4. Square Rubble - Coursed Rubble (First Sort)

1405.4.1. Dressing : Face stones shall be hammer dressed on all beds and joints so as to give them rectangular shape. These shall be square on all joints and beds. The bed joints shall be chisel drafted for at least 80 mm back from the face and for at least 40 mm for the side joints. No portion of the dressed surface shall show a depth of gap more than 6 mm from the straight edge placed on it. The remaining unexposed portion of the stone shall not project beyond the surface of bed and side joints. The requirements regarding bushing shall be the same as for random rubble masonry.

1405.4.2. Hearting stones : The hearting or interior filling of the wall face shall consist of flat bedded stone carefully laid, on prepared beds in mortar. The use of chips shall be restricted to the filling of interstices between the adjacent stones in hearting and these shall not exceed 10 per cent of the quantity of masonry. While using chips it shall be ensured that no hollow spaces are left anywhere in the masonry.

1405.4.3. Bond stones : The requirements regarding through or bond stone shall be the same as for random rubble masonry, but these, shall be provided at 1.5 metre to 1.8 metre apart clear in every course.

1405.4.4. Quoin stone : The quoins shall be of the same height of the course in which these occur and shall be formed of header stones not less than 450mm in length. They shall be laid lengthwise alternately along each face, square in their beds which shall be fairly dressed to a depth of at least 100 mm.

1405.4.5. Face stone : Face stones shall tail into the work for not less than their heights and at least one-third of the stones shall tail into the work for a length not less than twice their height. These shall be laid as headers and stretchers alternately.

1405.4.6. Laying : The stones shall be laid on horizontal courses and all vertical joints should be truly vertical. The quoin stones should be laid header and stretcher alternately and shall be laid square

on their beds, which shall be rough chisel dressed to a depth of at least 100 mm.

1405.4.7. Joints : The face joints shall not be more than 10 mm thick, but shall be sufficiently thick to prevent stone-to-stone contact and shall be completely filled with mortar.

1405.5. Ashlar Masonry (Plain Ashlar)

1405.5.1. Dressing : Every stone shall be cut to the required size and shape, chisel dressed on all beds and joints so as to be free from all bushing. Dressed surface shall not show a depth of gap of more than 3 mm from straight edge placed on it. The exposed faces and joints, 6 mm from the face shall be fine tooled so that a straight edge can be laid along the face of the stone in contact with every point. All visible angles and edges shall be true and square and free from chippings. The corner stones (quoins) shall be dressed square and corner shall be straight and vertical.

1405.5.2. Bond stones : Through bond stones shall be provided in masonry upto 600 mm thickness and in case of masonry above 600 mm thickness, a set of two or more bond stones overlapping each other at least by 150 mm shall be provided in a line from face to back. In case of highly absorbent types of stones (porous limestone and sandstones, etc.) the bond stone shall extend only about two-third into the wall, as through stones in such cases may give rise to penetration of dampness and, therefore, for all thicknesses of such masonry a set of two or more bond stones overlapping each other by at least 150 mm shall be provided. One bond stone or a set of bond stones shall be 1.5 metres to 1.8 metres apart clear in every course.

1405.5.3. Laying : The face stone shall be laid header and stretcher alternately, the header being arranged to come as nearly as possible in the middle of stretchers above and below. Stones shall be laid in regular courses not less than 300 mm in height and all courses of the same height unless otherwise specified. No stone shall be less in width than its height or less in length than twice its height, unless otherwise specified.

1405.5.4. Joints : All joints shall be full of mortar. These shall not be less than 3 mm thick. Face joints shall be uniform throughout, and a uniform recess of 20 mm depth from face shall be left with the help of a stone plate during the progress of work.

1405.6. Pointing

Pointing shall be carried out using mortar not leaner than 1:3 by volume of cement and sand or as shown on the drawing. The mortar shall be filled and pressed into the raked out joints before giving the required finish. The pointing shall conform to Clause 1312.3 of the specification. The work shall conform to IS:2212. The thickness of joints shall not be less than 3 mm for Ashlar masonry. However, the maximum thickness of joints in different works shall be as follows:

Random Rubble	:	20 mm
Coursed Rubble	:	15 mm
Ashlar Masonry	:	5 mm

1405.7. Curing

Curing shall conform to Clauses 1309 and 1312.5

1405.8. Scaffolding

For scaffolding Clause 1310 shall apply.

1405.9. Weep Holes

Weep holes shall conform to Clause 2706.

1405.10. Jointing with Existing Structures

For Jointing with existing structures, the specifications given under Clause 1308 shall apply.

**1406. ARCHITECTURAL COPING FOR WING/RETURN/
PARAPET WALLS**

Architectural coping for wing/return/parapet walls shall conform to Clause 1313.

1407. TESTS AND STANDARD OF ACCEPTANCE

All work shall be done to the lines and levels as indicated on the drawing or as directed by the Engineer subject to tolerances as specified in these specifications.

Mortar cubes shall be taken in accordance with IS:2250 for compressive strength, consistency of mortar and its water retentivity. The frequency of testing shall be one sample for every two cubic metres of mortar subject to a minimum 3 samples for a day's work.

1408. MEASUREMENTS FOR PAYMENT

Stone masonry shall be measured in cubic metres.

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In arches, the length of arch shall be measured as the mean length between the extrados and intrados.

The work of pointing shall be measured in square metres.

Architectural coping shall be measured in linear metres.

1409. RATE

The contract unit rate for stone masonry shall include the cost of all labour, materials, tools and plant, scaffolding, sampling and testing, supervision and other expenses incidental to the satisfactory completion of the work as described herein above.

The contract unit rate for pointing shall include erecting and removal of scaffolding, all labour, materials and equipment incidental to complete pointing, raking out joints, cleaning, wetting, filling with mortar, trowelling, pointing and watering, sampling and testing and supervision as described in these specifications.

The contract rate for architectural coping shall include the cost of all labour, materials, tools and plant, sampling and testing and supervision as described in these specifications.
