TECHNICAL SPECIFICATION

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FOR CIVIL WORKS

1. GENERAL

1.1 This specification establishes and defines the requirement of various materials to be used in Civil and Structural works.

1.2 Whenever any reference to IS Code is made, the same shall be taken as the latest revision (with all amendments issued thereof) as on the date of submission of the bid.

1.3 Apart from the IS Codes mentioned in particular in the various clauses of this specification, all other relevant codes related to specific job under consideration regarding quality, tests, testing and/or inspection procedures shall be applicable. Reference to some of the Codes in the various clauses of this specification does not limit or restrict the scope of applicability of other referred or relevant codes.

1.4 In case any variation/contradiction between the provision of IS Codes and this specification, the provision given in this specification shall be followed:

1.5 All materials shall be of standard quality and shall be procured from renowned sources/manufactures approved by the Engineer-in-charge. It shall be the responsibility of the Contractor, to get all materials/manufactures approved by the engineer-in-charge prior to procurement and placement of order.

1.6 Whenever called for by the Engineer-in-charge, all test of the materials as specified by the relevant IS Codes shall be carried out by the contractor in an approved laboratory and test reports duly authenticated by the laboratory, shall be submitted to the Engineer-in-charge for his approval. If so desired by the Engineer-in-charge, tests shall be conducted in the presence of the Engineer-in-charge or his authorized nominee.

1.7 Quality and acceptability of materials not covered under this specification shall be governed by the relevant IS codes. In case IS code is not available for the particular material, manufactures specifications shall be considered. The decision of the Engineer-in-charge, in this regard, shall be final and binding on the Contractor.

1.8 Whenever asked for, the contractor shall submit representative samples of materials to the Engineer-in-charge for his inspection and approval. Approval of any sample does not necessarily exempt the contractor from submitting necessary test reports for the approved material, as per the specification/relevant IS Codes.

1.9 The contractor shall submit manufacture's test reports on quality and suitability of any material procured from them and their recommendation on storage, application, workmanship etc., for the intended use. Submission of manufacturer's test reports does not restrict the Engineer-in-charge from asking fresh test results from an approved laboratory of the actual material supplied from an approved manufacture/source at any stage of execution of work.

1.10 All costs relating to or arising our of carrying out the test and submission of test reports and or samples to the Engineer-in-charge for his approval during the entire tenure of the work shall be borne by the contractor and included in the quoted rates.

1.11 Materials for approval shall be separately stored and marked, as directed by the Engineer-in-charge and shall not be used in the works till these are approved.

1.12 All rejected materials shall be immediately removed from the site by the contractor at his own cost.

2. MATERIALS

2.1 WATER:

2.1.1 Water used in construction for all civil & structural works shall be clean and free from injurious amount of oil, acids, alkalies, organic matters or other harmful substances which may be deleterious to concrete, masonry or steel. The pH value of water shall generally be not less than 6. Potable water shall be considered satisfactory. Underground water can also be used with the prior approval of the Engineer-in-charge, if it meets all the requirements of IS:456.

2.1.2 Tests on water samples shall be carried out in accordance with IS:3025 and they shall fulfill all the guidelines and requirements given in IS:456.

2.1.3 The Engineer-in-charge may require the contractor to prove, that the concrete prepared with water, proposed to be used, shall not have average 28 days compressive strength lower than 90% of the strength of concrete prepared with distilled water.

2.1.4 The Engineer-in-charge may require the contractor to get the water tested from an approved laboratory before starting the construction work and in case the water contains any oil/organic matter or an excess of acid, alkalis or any injurious amount of salts etc., beyond the permissible maximum limits given in IS:456, the Engineer-in-charge may refuse to permit its use. In case the water is supplied by the owner, contractor shall get himself satisfied regarding its quality before using the same in his works at his own expenses. In case there is any change in source of water, water samples shall be tested again to meet the specified requirements. The water test must be conducted periodically at least once in 3 months or as directed by Engineer in-charge.

2.1.5 Water shall be stored in tin barrels, steel tanks or water-tight reservoirs made with bricks/stone or reinforced concrete. Bricks/stone masonry reservoirs shall have RCC base slab and shall be plastered inside, with 1 part of cement and 4 parts of sand and finished with neat cement punning. These reservoirs be of sufficient capacity to meet the water requirement, at any stage of construction.

2.1.6 Water for curing shall be of same quality as used for concreting and masonry works. Sea water shall not be used for preparation of cement mortar, concrete as well as for curing of plain/reinforced concrete and masonry works. Sea water shall not be used for hydro testing and checking the leakage of liquid retaining structures also.

2.2 AGGREGATE

2.2.1 GENERAL

Coarse and fine aggregates for Civil and Structural works shall confirm in all respects to IS:383 (Specification for coarse and fine aggregates from natural sources for concrete). Aggregates shall be obtained from an approved source known to produce the same satisfactorily. Aggregates shall consist of naturally occurring (crushed or uncrushed) stones, gravel and sand or a combination thereof. These shall be chemically inert, hard, strong, dense durable, clean and free from veins, adherent coatings, injurious amount of alkalies, vegetable matter and other deleterious substances such as iron pyrites, coal, lignite, mica, shale, sea shells etc.

Source and type of aggregates shall be got approved by the Engineer-in-charge prior to procurement. Change in source and type of aggregates, at later stage, shall not be generally permitted; but under specific circumstances, Engineer-in-charge can allow a change in source and type of aggregate. Contractor shall produce necessary test certificates from approved laboratories regarding the quality and suitability of the proposed aggregates and submit fresh mix design for approval of the Engineer-in-charge. Any such change, if permitted by the Engineer-in-charge, shall be without any time and cost implication to the owner. Whenever there is any change in the source of material, and if the material is approved by Engineer in-charge with necessary test certificates from approved laboratory, mix design of concrete shall also be revised and approved. The concrete so approved should have the required workability with new source of materials and also the characteristic strength of the concrete. All design makes must be as per I.S. 456 / 2000

Aggregates which may chemically react with alkalies of cement or might cause corrosion of the reinforcement, shall not be used. If so desired by the Engineer-in-charge, the Contractor shall carry out alkali reactivity tests and submit the results to him for approval.

The maximum quantities of deleterious materials in the aggregates as determined in accordance with IS:2386 – Part II (Method of Test for aggregates for concrete), shall not exceed the limits defined in IS:383. No special test is required to prove the absence of such deleterious matters if the aggregates are from a known source with satisfactory prior data on the properties of concrete made with them. In case of newly developed quarry sites, the contractor shall submit necessary test results as per IS:383 and IS:2386 to the Engineer-in-charge prior to his acceptance with the requirements given in IS:2430

Coarse and fine aggregates shall be batched separately. All-in-aggregate shall be used only where specifically permitted by the Engineer-in-charge.

Separate sieve analysis and grading curves shall be prepared by the contractor for any/all batches of coarse and fine aggregates, and submitted to the Engineer-in-charge, whenever asked for, to ensure conformity with those submitted along with the mix design.

Whenever required by Engineer-in-charge, the aggregate (coarse/fine) shall be washed and/or sieved by the Contractor before use in the works to obtain clean and graded aggregate at no extra cost to the owner

Aggregates not in conformity with the specifications shall be rejected and the contractor shall immediately remove them from the site of work.

2.2.2 Coarse aggregates.

Coarse aggregates are the aggregates, which are retained on 4.75mm IS Sieve. It shall have a specific gravity not less than 2.6 (saturated surface dry basis).

These may be obtained from crushed or uncrushed gravel or stone as per clause 2.2.1 and may be supplied as single sized or graded. The grading of the aggregates shall be as per IS:383 or as required by the mix design, to obtain densest possible concrete. For this purpose, the contractor shall submit to the Engineer-in-charge at least three sets of mix design and test results, each with different gradings of coarse aggregates, proposed to be used. The Engineer-in-charge may allow “All-in-aggregates” to be used provided they satisfy the requirements of IS:383.

2.2.3 Fine Aggregates

Fine aggregates are the aggregates which pass through 4.75mm IS sieve but not more than ten percent (10%) pass through 150 micron IS sieve. These shall comply with the requirements of grading zones I, II and III of IS:383. Fine aggregates conforming to grade zone IV shall not be used for reinforced concrete works.

Fine aggregates shall consist of material resulting from natural disintegration of rock and which has been deposited by streams or glacial agencies, or crushed stone sand or gravel sand. Sand from sea shores, creeks or river banks affected by tides, shall not be used for filling or concrete works.

2.2.4 Sampling and Testing

The contractor shall carry out all tests including mix designs of concrete, at his own expense, at he start of works as well as during any stage of construction as required by the Engineer-in-charge. Test shall be carried out in accordance with IS:516 – Methods of test for strength of concrete and IS:2386 – Methods of test for aggregates for concrete. Testing shall be carried out from laboratories approved by the Engineer-in-charge. The method of sampling shall be in accordance with the requirements given in IS:2430.

2.2.5 Storage of Aggregates

Storage of all types of aggregates at site of works shall be at contractor's expense and risk and shall be stored as specified in IS:4082. Aggregates shall in no case be stored near to the excavated earth or directly over ground surface.

The contractor shall maintain sufficient quantities of aggregates, near to the place of work, required for the continuity of the work. Each type and grade of aggregate shall be stored separately on hard, firm surface having adequate slope of drainage of water.

Aggregates delivered at site in wet condition or becoming wet due to rain or any other means, shall not be used for at least 24 hours. The contractor shall obtain prior approval of the Engineer-in-charge for the use of such aggregates and shall adjust the water content in accordance with IS:2386 to achieve the desired mix. In the absence of test results, and to allow variation in mass of aggregates and water content on account of moisture content, the Contractor can make suitable adjustment in the masses as per IS:456, for preparation of nominal mix concrete only.

2.2.6 SAND

Sand for Masonry Mortars

2.3.1.1 The sand shall consist of natural sand, crushed stone and or crushed gravel sand or a combination of any of these. The sand shall be hard durable, clean and free from adherent coatings and organic matter and shall not contain the amount of clay, silt and fine dust more than specified in IS:2116.

The sand shall not contain any harmful impurities such as iron pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shells in such form or in such quantities as to affect adversely the hardening strength or durability of the mortar.

Unless found satisfactory as a result of further tests as may be specified by the Engineer-in-charge, or unless evidence of such performance is offered which is satisfactory to him, the maximum quantities of clay, fine silt, fine dust and organic impurities in the sand when tested in accordance with IS:2386, shall not be more than 5% by mass in natural sand, or crushed gravel sand or crushed stone sand. For organic impurities, when determined in accordance with IS:2386.colour of the liquid shall be lighter than that indicated by the standard solution specified in IS:2386

2.2.7 Grading of sand

The particle size grading of sand for use in mortars shall be within the limits as specified below:

GRADING OF SAND FOR USE IN MANSONRY MORTARS

IS SIEVE DESIGNATION IS : 460 (PART I)	PERCENTAGE PASSING BY MASS	REF TO METHOD OF
4.75 mm	100	IS : 2386 (Part I)
2.36 mm	90 to 100	
1.18 mm	70 to 100	
600 micron	40 to 100	
300 micron	5 to 70	
150 micron	0 to 15	

In case of sand whose grading falls outside the specified limits due to excess or deficiency of coarse or fine particles, this shall be processed to comply with the standard by screening through a suitably sized sieve and/or blending with required quantities of suitable sizes of natural sand particles or crushed stone screenings which are by themselves unsuitable. Based on test results and in the light of practical experience with the use of local materials, deviation in grading of sand may be considered by the Engineer – in-charge. The various sizes of particles of which the sand is composed shall be uniformly distributed the mass.

2.2.8 Sampling and Testing

The method of sampling shall be in accordance with IS:2430. The amount of material required for each test shall be as specified in relevant parts of IS:2386. Any test which the Engineer – in - charge may require in connection with this, shall be carried out in accordance with the relevant parts of IS:2386

If further confirmation as to the satisfactory nature of the material is required, compressive test on cement mortar cubes (1:6) may be made in accordance with IS:2250 using the supplied material in place of standard sand and the strength value so obtained shall be compared with that of another mortar made with a sand of acceptable and comparable quality.

2.2.9 Sand for Filling

Sand for filling shall meet, the requirements IS:383 and shall be natural sand, hard, strong, free from any organic and deleterious materials. Any sand proposed for filling, shall be used only after it is approved by the Engineer-in-charge. Sand obtained from sea shores, creeks or river banks affected by tides, shall not be used for filling. Fine aggregate suitable for concreting works shall be suitable for filling also. No sand below grading zone-III as per IS-383 shall be allowed for filling.

3 CEMENT

Cement to be used for civil and structural works, shall be one of the following or in combination thereof. For plain and reinforced concrete works normally 43 grade ordinary Portland cement conforming to IS:8112, shall be used. Specific requirement for any other type of cement shall be as shown in the drawings or as specified in contract or as directed by Engineer-in-charge. All masonry and plaster work shall be with PPC or other blended cement as approved by Engineer-in charge.

Specification for grade ordinary Portland cement	IS:8112
Specification for Portland slag cement	IS:455
Specification for Portland pozzolana cement	IS:1489
Specification for Masonry cement	IS:3466
Specification for high alumina cement for structural use	IS:6452
Specification for super sulphated cement	IS:6909
Specification for rapid hardening Portland cement	IS:8041
Specification for 43 grade ordinary Portland cement	IS:8112
Specification for 53 grade ordinary Portland cement	IS:12269
Specification for Sulphate Resisting Portland cement	IS:12330

3.1 Storage at Site

The storage of cement at the site of work shall be at contractor's expense and risk and shall meet the requirements of IS:4082. The cement shall be stored above ground in a suitable weather tight buildings or go down and in such a manner as to permit easy access for proper inspection and also to prevent deterioration due to moisture. Apart from this, the cement so stacked should be replaced once in three months top bag to bottom row and bottom to top to avoid clotting. Such cement in long stored condition shall be retested for properties .

All approved cement shall be arranged in batches with type, brand and date of receipt flagged on them. A maximum of eight bags shall be stacked one over the other. Cement bags shall be used in the same order as received from the manufacturer. The contractor shall maintain a register on day to day basis, giving the details of the receipt / consumption, source of supply and type of cement etc. The register shall always be accessible to the Engineer-in-charge for verification.

3.2 Test after Delivery

Each consignment of cement procured by contractor, shall after delivery at site and at the discretion of the Engineer-in-charge, be subjected to any or all of the tests and analyses, required by the relevant Indian Standard Codes. The contractor shall carry out and bear the cost of all tests and analysis required to ensure quality of cement before using in actual works.

3.3 Rejection

The Engineer-in-charge may reject at his discretion any cement, which has deteriorated owing to inadequate protection from moisture or due to induction of foreign matter or any other cause. Any cement which is considered defective, shall not be used and shall be promptly removed from the site by the contractor

4. LIME

Lime shall be stone lime and conform to the specification building Limes – IS : 712, Lime putty may be prepared from hydrated lime or quicklime. Hydrated lime shall be mixed with water to form a putty and stored with reasonable care to prevent evaporation for at least 24 hours before use.

Quick lime shall be slaked with enough water to make a cream, passed through a No. 10 sieve and then stored with reasonable care to prevent evaporation for at least 7 days before use. Quick lime or hydrated lime as instructed by the Engineer shall be used for masonry work. Hydrated lime will be supplied as hydrated lime and used for structural purposes. Fat lime will also be supplied as quick lime or hydrated lime as instructed by the Engineer and used for the finishing coat in plastering, white washing etc. Field tests according to IS:1624 shall be carried out from time to time to determine the soundness of lime.

5. Neeru:

Shall be made of class 'C' lime (i.e., pure fat lime) as mentioned in IS:712. It shall be slaked with fresh water and then sifted and reduced to a thick paste by grinding in a mill. Neeru thus prepared shall be kept moist until used and no more than what can be consumed in 15 days shall be prepared at a time.

6. Surkhi:

Shall be made by grinding well burnt bricks, bricks bats, burnt clay balls etc. the quality shall conform to IS:1344.

Brick bats etc., shall be ground in a mechanical disintegrator to a fine powder passing through IS Sieve, No.9 (2.36mm) with a residue not exceeding 10% by weight.

Surki for lime Surkhi plaster shall be ground to fine powder in a mortar mill to pass through IS Sieve of 150 micron (No. 100). Surkhi shall be stored in a weather-proof shed on a brick-paved platform.

7. STEEL

7.1 General

All steel bars, sections, plates and other miscellaneous steel materials. etc. shall be free from loose mill scales, rust as well as oil, mud, paint or other coatings. The materials, construction specifications such as dimensions, shape, weight, tolerances, testing etc., for all materials covered under this section, shall confirm to respective IS Standards.

7.2 Reinforcement Bars

Reinforcement bars, to be used for civil and structural works, shall be one of the following or in combination thereof. High strength Deformed Steel bars of grade Fe 415 conforming to IS:1786 shall normally be used. Specific requirement for any other type of reinforcement bars shall be as shown in the drawings or as specified to Contract or as directed by the Engineer-in-charge.

Specification for mild steel and medium tensile bars and hard drawn steel wire for concrete reinforcement (grade I) IS:432

Specification for hard drawn steel wire fabric for concrete reinforcement IS:1566

Specification for plain hand drawn steel wire for prestressed concrete IS:1785

Specification for high strength deformed steel bars and wires for concrete reinforcement IS:1786

Steel for general structural purposes (Grade A) IS:2062

Specification for high tensile steel bars used in prestressed concrete IS:2090

Specification for indented wire for prestressed concrete IS:6003
Specification for corrosion resistant steel IS:1786

7.3 Structural Steel

Structural steel to be used for general structural purposes shall be of grade A conforming to IS:2062. Specific requirement for any other type of structural steel shall be as shown in drawings or as specified in the contract or as directed by the Engineer-in-charge.. Structural steel sections shall conform to following IS specifications.

Steel tubes for structural purposes IS:1161

Mild steel tubes, tubulars and other wrought steel fittings IS:1239

Steel for general structural purposes (Grade A) IS:2062

Hollow steel sections for structural use IS:4923

7.4 Miscellaneous Steel Materials

Miscellaneous steel materials shall be conforming to the following IS Specification.

Expanded metal steel sheets for general purposes IS:412

Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement (grade I)

(For mild steel bars of anchor bolts, rungs, metal inserts, grating etc.) IS:432

Hexagonal head bolts screws & nuts of product grade C IS:1363

Cold formed light gauge structural steel sections IS:811

Technical supply conditions for threaded steel fasteners IS:1367

Plain washers IS:2016

Steel wire ropes for general engineering purposes IS:2266

Thimbles for wire ropes IS:2315

Building grips IS:2361

Mild steel tubes, tubulars and other wrought steel filling (for hand rail tubular sections) IS:1239

Drop forged sockets for wire ropes for general engineering purposes IS:2485

Steel chequered plates IS:3502

Hexagonal bolts and nuts (M42 to M150) IS:3138

7.5 Steel Windows & Doors:

Steel windows and doors shall be fabricated out of steel sections as in IS:226 and shall conform to IS:1038. Unless otherwise specified the details of construction etc., shall be as described under 'Specification'.

8. BRICKS

Bricks shall subject to the following, generally comply with IS 1077; the sizes, however, will be as locally available.

Bricks shall be of the quality locally available, table moulded if so specified and if locally made, well burnt but not over burnt, have plane rectangular faces with parallel sides, and sharp, right angled edges, of compact and uniform texture, without cracks, chips, flaws stones and nodules. They shall not show efflorescence, either dry or subsequent to soaking in water and shall emit a clear ringing sound, on being struck, and not absorb water more than 15% by weight. The bricks shall also have compressive strength not less than as stipulated in the item specifications .

Common clay burnt bricks of no stipulated compressive strength shall generally be as specified in the previous paragraphs but be only ground moulded, may be slightly distorted and have slightly rounded edges. They shall have a compact and uniform texture and shall not absorb water more than 15% by weight and shall have a minimum compressive strength of 35kg/cm^2 . The size of the bricks i.e., dimensions must be well within the tolerance allowed as per I.S. 1077 /1970.

9. STONE

9.1 General

All stones used for masonry works shall conform to the requirements of following IS Codes:

Method of identification of natural buildings stones	IS:1123
Recommendations for dimensions and work-manship of natural building stones for masonry work	IS:1127
Recommendations for dressing of natural building Stones	IS:1129

9.2 Quality of Stones

Stones shall be of approved quality, hard, dense, strong, sound, durable, clean and uniform in colour. They shall also be free from veins, adherent coatings, injurious amount of alkalies, vegetable matters and other deleterious substances such as iron pyrites, coal, lignite, mica, sea, shells etc. Unless otherwise approved, stones from one single quarry shall be used for any one work. The strength of stones should be adequate to carry the imposed load and shall meet all the requirements of IS:1905, taking into account the appropriate crushing strength of stone and type of the mortar used. The percentage of water absorption, when tested in accordance with IS:1124, shall not exceed 5 percent.

Stones normally used, shall be small enough to be lifted and placed by hand. The length of the stone shall not exceed 3 times the height. Width of stone on base shall not be less than 150mm and in no case exceed 3/4th thickness of the wall. Height of the stone shall not be more than 300mm.

9.3 Unloading/stacking

The stones shall be unloaded from the trucks to a site near to the place of work as defined in IS:4082 and shall be stacked on a firm ground having adequate stop for drainage. The supply of stones shall be so arranged that as far as possible at least two day's requirements of stone are available at site at any time.

10. ADMIXTURES

General Requirements for Admixtures

All concrete admixtures shall in generally comply with the following Indian Standards unless otherwise stipulated in this specification

Specification for integral cement water proofing compounds	IS:2645
Specification for other admixtures for concrete	IS:9103

Generally admixtures shall have ISI certification marks. However, even in case of BIS certified admixtures, Engineer-in-charge may require the contractor to carry out and submit any or all the tests (as specified in relevant IS Codes), from approved laboratories, over and above the manufacturer's certificate, before giving his final approval.

In case, admixtures certified by BIS are not available, the contractor shall submit to the Engineer-in-charge the type and/or proprietary brand of the admixture from only reputed manufactures along with necessary test certificates from recognized and approved laboratories or any other document directed by Engineer-in-charge for latter's final approval. In such cases, names of at least two manufacturers shall be submitted to the Engineer-in-charge for his selection. In case both the names are rejected, the contractor shall submit a fresh list of two manufacturers for approval by the Engineer-in-charge.

The Engineer-in-charge may direct the contractor to submit test results as required by IS:2645 or IS:9103 for any admixture proposed to be used in the concrete in any approved laboratory at his discretion at any stage of the work. The cost of any/all tests required to satisfy compliance with his specification shall be borne by the Contractor.

Prior approval of the engineer-in-charge shall be obtained while using water reducing admixtures in the concrete (PCC/RCC) or mortar. Other type of admixtures such as accelerating admixtures, retarding admixtures or air entraining admixtures, shall not be used unless specified on the design drawings or prior approval taken from the Head office. Once approved, utmost care shall be exercised at site by the Contractor to maintain the consistency in the quality if admixture and the concrete/mortar so produced.

The suitability and effectiveness of any admixture shall be verified by trial with the designed concrete mixes using cement, aggregates together with any other materials to be actually used in the works as per the direction of Engineer-in-charge, if two or more admixtures are to be used.

Simultaneously in the same concrete mix, the contractor must submit necessary test results from an approved laboratory to show their interaction and compatibility. Any/all tests specified in IS Codes shall be carried out only with the type of material and mix design, to be actually; used in the work site.

No admixture shall impair the durability of the concrete nor combine with the ingredients to form harmful compounds nor increase the risk of corrosion of reinforcement. Use of admixture shall not reduce the dry density of concrete. Once the proportion of admixture has been established, strict check shall be maintained not to alter the proportions of ingredients and water cement ratio of the design Mix during execution

The chloride contents in admixtures shall not exceed 2% by mass of the admixture or 0.03% by mass of the cement.

Admixtures which do not meet the requirements stipulated in this specification shall be rejected and shall not be used.

11. Water proofing compounds

Water proofing Compounds shall be mixed with only ordinary Portland cement of grade 43, conforming to IS:8112.

The permeability of the specimen with the admixture shall be less than half of the permeability with similar specimen without the use these compounds. These compounds shall be used in such proportion as recommended by manufacturer but in no case it shall exceed 3% by weight of cement.

The initial setting time of the cement with the use of these compounds shall not be less than 30 minutes and final setting time shall not be more than 10 hours. Test shall be carried out in accordance with IS:4031.

Compressive strength of specimen at 3 days shall not be less than 160kg/sq.cm nor 80% of the 3 days compressive strength of mortar cubes prepared with same cement and sand only, whichever is higher. Similarly compressive strength at 7 days shall not be less than 220kg/sq.cm nor less than 80% of the 7 days compressive strength prepared with the same cement and sand only, whichever is higher. The test to determine the compressive strength shall conform to IS:4031.

12. BITUMEN/BITUMINOUS MATERIALS

Bitumen to be used for various types of work shall meet all the requirements of relevant IS Codes as given below:-

Specification of Paving Bitumen	IS:73
Specification for Bitumen mastic for flooring	IS:1195
Specification for Bitumen felts for water proofing and damp proofing	IS:1322
Specification for Bituminous compounds or water proofing and caulking purposes	IS:1834
Specification for preformed fillers for expansion joint in concrete pavements and structures	IS:1838
Specification for bitumen mastic for use in water Proofing of roofs	IS:3037
Specification for bitumen primer for use in water Proofing and damp proofing	IS:3384
Specification for bitumen Mastic for Tanking and damp proofing	IS:5871
Specification for glass fibre base coal tar pitch &bitumen felts	IS:7193
Code of practise for damp proofing using Bitumen Mastic	IS:7198
Specification for bitumen Mastic, Anti static and electrically conducting grade	IS:8374

The type and grade shall be as shown on the drawings or as indicated in schedule of quantities or as directed by Engineer-in-charge. Tests and acceptable criteria shall be as per relevant IS Codes.

13. PVC PIPES

PVC pipes shall conform to the requirements of IS:4985.

14. WOOD/TIMBER

Second class Indian Teak wood shall be conforming to IS 4021 of good quality, well seasoned and free from defects such as cracks, dead knots, sapwood etc. No individual hard and sound knot shall be more than 15 sq.cm in size and the aggregate knot shall be more than 15 sq.cm in size and the aggregate are of such knots shall not exceed 2% of the areas of the piece. The timber shall be fairly close grained having not less than 2 growth rings per cm. width in cross-section.

14.1 Hard wood /Jackwood

Hard wood shall be first class wood conforming to IS 4021 of good quality, well seasoned and free from defects such as dead knots, cracks, sapwood etc. No individual hard and sound knot shall exceed 6 sq.cm in size with no dimension more than 50mm and the aggregate area of such knots shall not be more than 1% of the area of the place. There shall not be less than 5 growth rings per cm. width in cross-section.

Timber required to be used for form work shall be fairly dry before use. It should maintain its shape during the use and even when it comes into contact with moisture from the concrete. Storage of wood/timber shall be as per the requirement of IS:4082.

For proper identification and selection of suitable timber for form work, following codes shall be referred.

Classification of commercial timbers and their Zonal distribution	IS: 399
Specification for ballies for general purposes	IS: 3337
Specification for plywood for concrete shuttering	IS: 4990

14.2 Laminates

The Laminates are thin sheets of plywood, polymer derivatives all pressed together to form thick boards of 3mm upwards. The laminates may also glued / pressed on to block boards particle boards etc depending on the production methods and end use.
The following IS standards shall be referred to for products

Ply wood	IS:303
Marine plywood	IS:710
Decorative plywood	IS:1328
Flush doors	IS:2046
Laminates	IS:2046
Shuttering plywood	IS:4996
Laminates boards	IS:12823

For the physical and mechanical properties of these products are covered by these codes. The property of resistance to surface wear, to dry heat, water, impact, cracking, steam, etc be ascertained for the given applications.

For carpentry applications the manufactures instruction shall be followed in storage, handling, cutting, edge treatment and for use of appropriate tools.

14.3 TREATED COUNTRY WOOD

Treated wood shall be of best quality Padauk wood / Salwood chemically treated and KILN seasoned as stipulated in IS: 401 and IS: 1141 respectively with latest amendments. For the chemical treatment the following chemicals to be mixed with water in the proportion of 6:12:16 (i.e. Boric Acid / Copper Sulphate / Sodium Dychromate respectively). The moisture content of the wood after treatment and seasoning shall be in the range of 14 to 16%

Before the wood work is fixed in position and earlier to application of primer, chloro pyrifos in a ratio of 1:20 (1 part of chemical and 20 parts of kerosene / turpentine) shall be applied in all faces as a wood preservative.

No individual hard and sound knot shall exceed 25 mm in dia and the aggregate area of such knots shall not be more than 1% of the area of the place. These shall not be less than 5 growth rings per cm. width in cross-sections.

15. FLOOR TILES:

Plain cement tiles, chequered tiles, mosaic tiles, terrazzo tiles shall conform to IS:1237, compacted by mechanical vibration and hydraulically pressed, using grey cement for neutral shades. They shall be of choice shade and shall have the desired pattern of chip distributions. The sizes of chips and proportions of chips to cement in Terrazzo or mosaic floor shall be as specified in IS: 1237. The sizes and thickness of tiles shall be as specified in item Specification. The tiles shall be tested for abrasion, transverse strength, water absorption and thickness of wearing surface.

Note : Normally tiles shall be produced from an approved factory, but the contractor may manufacture them at the site itself with prior express permission in writing of the Engineer-in-charge who will satisfy themselves as to the adequacy and competence of the arrangements proposed to be made (by the contractor) for the purpose the Engineer-in-charge may refuse to give the permission/cancel the permission given if the proposed arrangements/arrangements made are not satisfactory

15.1 Glazed Tiles:

White or coloured glazed tile shall comply with IS: 777. They shall be from an approved manufacturer and shall be flat and true to shape they shall be free from cracks, crazing, spots, chipped edges and corners,. The glazing and colour shall be of uniform shade and unless otherwise specified the tiles shall be minimum 5mm thick

15.2 Other Tiles:

Burnt clay tiles for terracing, roofing and flooring, ceramic tiles, unglazed, victreous acid reisting etc., shall all conform to the relevant I.S. Codes.

15.3 Marbles:

Marble slabs for flooring, dado, veneering etc., shall be of the kind specified in the item such as white or pink Makrana, Chittor black, Bhanslana black, Jaisalmer yellow, Barado Green, Patiala (Pepsu) Grey etc., Marble from which the slabs are made , shall be of selected quality, hard, sound, dense, and homogeneous in texture, free from cracks, decay, weathering and flaws. Before starting the work the contractor shall get the sample of marble approved by the Engineer-in-charge .

The slabs shall be machine cut and machine polished Kota / Shahabad/Cuddapah/Granite will be of selected quality, hard, sound, dense and of homogeneous texture, free from cracks, decay, weathering and flaws. Stone slabs shall be of uniform colour and as approved by the Engineer-in-charge . They shall be machine cut and machine polished where so specified and shall conform to the required sizes. Thickness shall be as specified in the respective item specifications.

15.4 Ceramic Tile:

Tiles shall be of approved make and confirm to IS: 13630 / 1992 all parts. They shall be flat and true to shape and free from blisters, crazing chips, welts, crawling or other imperfections detracting from their appearances. The tiles shall be square in shape and of nominal size 300 x 300mm. Thickness of tiles shall be 8mm. Permissible deviations in length, squareness, straightness of sides and surface flatness shall not be more than +- 0.5% and that is thickness of +- 5.0%. For other types of ceramic tiles manufacturers specifications may be referred.

15.5 Granite Tiles:

Granite tiles shall be of approved shade and quality. They shall be of 10 to 23mm thick mirror polished and machine cut. The tiles to be used shall be as laid down in the drawing or as directed by the Engineer. The angles shall be right angles and all edges shall be straight and true.

15.6 Kota stone / shahabad / cuddapah

The slabs shall be of selected quality and shade, hard, sound, dense, homogenous in texture, free from cracks, decay, weathering and flaws. These shall be machine cut to the requisite size and thickness and chisel dressed underside. The slabs shall have the top (exposed) face polished before being brought to site. Before starting the work, the contractor shall get the samples of slabs approved by the Engineer-in-charge.

16 STONE CLADDING / STONE VENEERING WORK:

Every stone shall be cut to the required size and shape, so as to be free from waviness and to give truly vertical and horizontal joints. For the faces that are to remain exposed in the final position and the adjoining faces to a depth of 6mm shall be the fine chisel dressed so that when checked with 60cm straight edge, no point varies from it by more than 1 mm. The top and bottom faces that are to form the bed joints shall be chisel dressed so that variation from 60 cm straight edge at no point exceeds 3 mm. Faces which are to form the vertical joints should be chisel dressed so that variation at any point with 60 cm straight edge does not exceed 6 mm. All angles and edges that are to remain exposed in the final position shall be true, square and free form chippings. A sample of dressed stone shall be prepared for approval of Engineer-in-charge before starting the work. It shall be kept at the work site as a sample after being approved. The dressed slabs shall be of the thickness as specified, with permissible tolerance at 2 mm.

16.1 Marble:

Marble shall be hard, sound, dense and homogeneous in texture with crystaling texture as far as possible. It shall generally be uniform in colour and free from strains, cracks, decay, and weathering. Marble with streaks from the nature where specified shall be acceptable.

Every slab shall be machine cut to the required size and shape, on all sides to the full depth so that a straight edge laid along the side of the stone shall be fully in contact with it. Laying of slabs shall be as for cladding described in 2.16.7 mechanical fastness for supplying vertical elements shall be employed as approved by the Engineer-in-charge.. All angles and edges of the marbles shall be true, square and free from chippings and the surface shall be true and plane.
The thickness of the slabs shall be 20,to 25mm or as specified in the description of the item. Tolerance of +3% shall be allowed for the thickness. In respect of length and breath of slabs a tolerance of +2% shall be allowed. Sample of marble approved shall be kept at site with the Engineer-in-charge

16.2 Stone Cladding:-

Kota stone / Cudapah / Granite :-

The slabs shall be of selected quality, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be hard or machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as instructed by the Engineer-in-charge.

The slabs shall have the top (exposed) face polished. Before being brought to site unless otherwise specified. The slabs shall conform to the size required. Before starting the work the contractor shall get the samples of slabs approved by the Engineer-in-charge .

Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. Rough surfaces may be specified for this cladding as designed. The sides (edges) shall be table rubbed with coarse sand or machine rubbed. All angles and edges of the slab be true, square and free from chippings. Fixing/laying of the slabs shall be as per other stone claddings..

Fiber reinforced concrete (FRC) / Manhole covers

Materials used in the manufacture of these man hole covers are high grade concrete, reinforcing bars and steel fibers mixed with concrete. Strengths suggested are M 30 or more. The frame for the cover may be in steel fixed over the base or a steel lined concrete block . FRC is generally manufactured as precast elements at a central factory under controlled. Conditions using of mechanical means of vibrations and / or pressure to consolidate concrete.

Manufacturing process and test results shall be as indicated and guaranteed by the manufacturer these cover, like in CI cover are designed for light medium or heavy duty.

The covers shall have hooking facilities for removal and replacing.
As in the case of CI man hole covers rates / costs are to be indicated and measured inclusive of the frame to remove the cover.

PAINT

Primer coating of structural steel shall be ready mix paint of red oxide zinc chrome, conforming to IS: 2074.

Synthetic enamel to be used, for painting of structural steel, shall conform to IS: 2932.

Primer/Enamel shall be tested as per the requirements of IS: 101.

ANTITERMITE COMPOUNDS

All Polysulphide Sealants shall conform to IS: 12118 and be of approved make.

Test conditions and requirements shall be as given in the above referred IS code

Storage, test and rejection

Storage

The storage of all materials at site of work shall be at the contractor's expense and risk and shall be done as per the requirements given in IS: 4082. The contractor shall maintain the proper record of receipt/consumption. The records shall always be accessible to the Engineer-in-charge for verification.

The reinforcement bars, structural steel sections and other miscellaneous steel materials etc, shall be stored in such a way as to avoid and prevent deterioration, corrosion, bending, twisting and wrapping. In case of any damage occurring to the material on account of faulty storage or negligence by the contractor, same shall be borne by the contractor himself.

Test after Delivery

Materials supplied by the owner or contractor, shall, after delivery at site and at the discretion of Engineer-in-charge, be subjected to any or all of the tests, required by the relevant IS Codes. The contractor shall carry out and bear the cost of such tests.

Rejection

The Engineer-in-charge may reject at his discretion any material, notwithstanding the manufacturer's certificate or failing to meet the requirements of relevant IS codes for testing of materials. He may similarly reject any material, which has deteriorated or corroded etc., due to improper storage, handling or transport. Defective materials shall not be used and removed from the site by the contractor at his own expense.

TECHNICAL SPECIFICATION FOR CONCRETE WORKS

2. CONCRETE WORKS

2.1 Plain & Reinforced Cement Concrete :

Except where they are varied by the requirements of this specification the provisions of Indian Standard specifications, under IS-456-2000 for plain and reinforced concrete and IS: 1786 for high strength deformed steel bars etc., for concrete reinforcement and other relevant ISS applicable together with the latest amendments shall be held to be incorporated in this specification. It shall be the intent of these specifications to ensure that all concrete placed at various locations of the job should be durable, strong enough to carry the design loads, should wear well and practically be impervious to water. It should be free from such defects as shrinkage, cracking and honeycombing.

2.2 Proportioning the Mix :

In directed by volume batching, controlled concrete, proportions of cement to fine and coarse aggregate shall be as specified in the respective items and shall be accurately measured as in Table 'A' 2.16. These proportions are based on the assumption that the aggregates are dry. If the aggregates are moist, allowance shall also be made for bulking in accordance with IS:2386. Allowance shall also be made for surface water present in aggregate when computing water content. Surface water present shall be determined by one of the field methods described in IS:2386 (Part III). In the absence of exact data, the amount of surface water may be estimated from the values given in Table 'B' 2.16.

2.3 Mixing :

Concrete of 1:2:4 or richer mix shall be mixed in an approved mechanical mixer. The mixer and mixing platform shall be suitably protected from wind and rain. Aggregates shall be accurately measured out in boxes of approved measures and mixed dry along with cement; water shall then be added in measured quantity and mixing shall be continued until there is uniform distribution of the materials and the mass is uniform in colour and consistency but in no case shall the mixing be done for less than 2 minutes.

When hand mixing is permitted with the approval of the Engineer-in-charge it shall be carried out on a watertight mixing platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. 10% extra cement must be added for hand mix at the cost of contractor if permitted for hand mix to obtained proper workability of strength.

2.4 Consistency :

Quantity of water for making reinforced concrete shall be sufficient to ensure that concrete laid in position shall surrounded and properly grip all the reinforcement. The best consistency shall be that when the mix flows sluggishly without flattening itself out and without separation of coarse aggregate from the mortar. The degree of plasticity shall depend on the nature of the work and atmospheric temperature and whether the concrete is vibrated or hand compacted. The slumps obtained by the standard slump test carried out in accordance with the procedure laid down in IS:1199-1959 shall be adopted for different types of work.

2.5 Admixtures :

The use of admixtures such as retarders, super Plasticisers, accelerators may be allowed if approved by the structural consultant and his decision in this regard shall be final. In any case, admixtures shall before use be tested for compatibility with design requirements.

2.6 Other Chemicals :

A large number of concrete chemicals for internal/external application are available and may be deployed on case to case basis, on the approval of the Engineer-in-charge.

2.7 Transporting :

Concrete shall be conveyed from the place of mixing to the place of final deposit as rapidly as practicable by methods designed to prevent segregation or loss of any of the ingredients. If segregation does occur during transport, the concrete shall be remixed before being placed in situ. In no case, more than 30 mintues shall elapses between mixing and consolidation in position.

2.8 Placing & compacting :

Concrete shall be placed in layers of suitable thickness or in strips and compacted before initial setting commences and should not be subsequently disturbed. Method of placing shall as far as possible be continuous and be such as to preclude segregation. Special care shall be taken in accordance with IS:456 while laying concrete under extreme conditions of weather.

Transporting and depositing/placing concrete by pumps or other mechanical means such as buckets, chutes, conveyor, tremy etc., shall be with the approval of the Engineer-in-charge.

Concrete shall be thoroughly compacted during the operation of placing and thoroughly worked around the reinforcements, embedded fixtures and spaded against corners of the form work by punning, rodding, mechanically vibrating or by any other approved means, taking adequate care to ensure that the layers of reinforcement are not disturbed/displaced. Chairs and supports shall be used in adequate numbers to allow labour to pass and cross without again disturbing/displacing reinforcement. In addition, form work shall be tapped lightly by using wooden mallets at the pouring head. The number and types of vibrators to be used shall be subject to the approval of the Engineer-in-charge and in general, immersion type.

vibrators when used shall have the desired amplitude and frequency depending on the mix design, sizes of the members and the gaps between reinforcing bars. External vibrators such as shutter or screed vibrators shall also be used whenever so directed.

The intensity and duration of vibration shall be sufficient to cause complete settlement and compaction without any stratification of successive layers or separation of ingredients or formation of laitance. Vibrator shall be inserted vertically in the concrete at points not more than 45cm apart and withdrawn very slowly when air bubbles no longer come on the surface. Over vibration or vibration of very wet mixes is harmful and should be avoided. Care shall be taken to utilize the vibrator only to compact the concrete and not to spread it. Sufficient number of reserve vibrators in good working condition shall be kept on hand at all times, so as to ensure that there is no slackening or interruption in compacting.

2.9 Controlled Concrete

2.9.1 Mix Design :

Where controlled concrete is specified the mix shall be designed to produce the grade of concrete with the required workability and characteristic strength not less than the appropriate value for each grade specified in IS 456/2000. The procedure for the design shall be as prescribed in IS Code No:10262.

Design Mix concrete

The mix shall be designed to produce the grade of concrete Having the required workability and characteristic strength not less than appropriate values given in the relevant specifications.

As long as the quality of materials does not change, a mix design done earlier, shall be considered adequate for later work. However, in case the quality of materials change, the Engineer-in-charge may ask for a new design mix.

While designing the mix, the durability requirements as given in IS:456 shall also be taken into account. However, the minimum specified cement content for concrete shall be:

M15	300
M20	320*
M20	340**
M25	360
M30	400

* Severe Exposure condition

Using 43/53 grade OPC unless specified in the item of work. 43/53 grade OPC (IS:8112) shall be used in all RCC works above ground level. PPC is preferred for use in masonry and plaster and for all works below ground level including in RCC: Unit cement content remaining at minimum indicated.

Method of measurement unless otherwise stated in specification, shall be based on relevant IS specifications. Items of work/ materials specific to the locality shall be governed by the local PWD practices, unless it is explicit in tender documents.

2.9.2 Concrete Technologist :
When in any work the quantity of all concrete in reinforced cement concrete work is 400 cum. or more, the contractor shall engage a qualified and competent concrete technologist/consultant whose name shall be got approved by the Engineer-in-charge, whose duty shall be to supervise the reinforced cement concrete work right from the time, before commencement of the work, sampling of aggregate is done for designing mixes to the time when all tests ON CONCRETE WORK ARE COMPLETED. In other cases there shall be at the site a qualified civil engineer to carry out the work of the concrete technologist.

2.9.3 Testing Laboratory :
When similarly the quantity of all concrete in RCC work is 800 cum or more, the contractor shall establish a laboratory of his own at the site with all equipment, instruments and accessories and personnel necessary to carry out designing and testing concrete. In other cases the contractor shall get the designing - testing work done at approved laboratories in the city.

2.9.4. Proportions :
It is the contractor's responsibility to have the necessary tests carried out at his cost, in his own laboratory and the necessary calculations made, in accordance with IS No:10262 to arrive at the best proportion by weight of aggregate and cement to produce concrete of the desired strength, submit the details to the Engineer-in-charge which shall be called the declared Proportions. If the proposal made by the contractor is not satisfactory to the Engineer-in-charge the test and calculations shall be redone by the contractor, at his cost, under the guidance of the Engineer-in-charge, and fresh Proportions established with the approval of the Engineer-in-charge. The minimum quantity of cement to be consumed shall be as prescribed in I.S. code and in cases of short use of cement the Engineer-in-charge have the option to reject the concrete when the contractor shall remove and replace the concrete to specification or accept the concrete with the provisions and the conditions of contract operative. No deviation from declared proportions will be allowed without written authority from the Engineer-in-charge. The declared proportion may be altered to suit substantial variations in the quality of the aggregates collected at site, from time to time and every time an alteration becomes necessary the test and calculations shall be repeated. No approval for and no agreement to any declared proportion, by the Engineer-in-charge or other person shall relieve the contractor of his responsibility to produce in situ concrete of the desired quality and strength in accordance with the relevant IS Code.

2.9.5 Measurements of Ingredients :
Proportioning of the ingredients for each batch of concrete shall be carried out in an **approved weigh batching machine**, water being fed into the mixer from a calibrated tank provided with the means of adjusting the flow, due allowance being made for the weight of water carried by the coarse and fine aggregate which shall be periodically ascertained.

When the quantity of all concrete in reinforced cement concrete work is less than 400 cum. alternatively, the declared weight proportions may with the approval of the Engineer-in-charge be converted into equivalent volumetric proportion and mixing may be done in the usual manner adopted for nominal mixes.

2.9.6 Mixing, transporting, depositing, compaction, curing etc.,: The specifications shall be as for concrete, plain and reinforced earlier described. No concrete for RCC work shall be placed in position unless written authorization is obtained from the Engineer-in-charge. For all design mix concreting, mixing of concrete shall be done using weigh batching system.

2.9.7 Construction Joints:
Concreting shall be carried out end to end continuously as far as possible and when construction joints are totally unavoidable, they shall be located in predetermined positions approved by the Engineer-in-charge. The joints shall be kept at places where the shear force is the minimum and shall be straight and at right angles to the direction of main reinforcement. When the work is to be resumed on a surface which has hardened, such surface shall be roughened, swept clean, thoroughly wetted and covered with a 13mm thick layer of mortar composed of cement and sand in the same ratio as the cement and sand in the concrete mix. This 13mm layer of mortar shall be freshly mixed and placed immediately before the placing of fresh concrete.

Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or brisly brushes, care being taken to avoid dislodgement of particles of aggregate. The surface shall be thoroughly wetted and free water removed and then be coated with neat cement grout. In horizontal joints the first layer of fresh concrete to be placed on this surface shall not exceed 15cm thickness and shall be well rammed against the old work, particular attention being paid to corners.

2.9.8 Expansion Joints:
Expansion joints shall be provided where required as shown on the drawings or as directed by the Engineer-in-charge/Consultant. The joints shall be filled in with filler of approved quality and type.

2.10 Curing:
Concrete shall be carefully protected during the first stage of hardening, from harmful effects of excessive heat, dry winds, rain or running water. It shall be covered with a layer of sacking, sand, canvas, Hessian or similar absorbent material and kept constantly wet for ten days from the date of placing of concrete, alternatively the concrete being thoroughly wetted and covered by a layer of approved waterproof material which should be kept in contact with it, for seven days.

In the event curing by water is inefficient/ineffective the Engineer-in-charge may permit/may also enforce curing, on release of form work, by application of chemical sealants, but no extra charges are payable.

2.11 Form Work :

Form work shall include all temporary or permanent forms or moulds required for forming the concrete in situ together with all temporary construction required for their support. Form work shall conform to the shape, lines and dimensions as shown on the

plans and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete and shall be sufficiently watertight to prevent loss of cement slurry from the concrete. Form work or centering shall be constructed of steel or timber, aluminex, FRP, Polypropylene etc., adequately designed to support the full weight of wet concrete without deflection and retain its form during laying, ramming and the setting of concrete. Timber used shall be of properly seasoned quality to avoid deformation when wetted.

All props shall be straight and of full height and no joints shall be permitted. Props, if in timber, shall be tied and braced with thin casurina post and or wooden battens and where additional staging is necessary care shall be taken to use props of bigger diameter with bracings at 4 or 5 levels. All props shall be supported on sole plates and double wedges. At the time of removing props these wedges shall be gently eased and not knocked out.

Proprietary systems of form work and scaffolding may also be deployed in which case manufacturers' instructions on erection, bracing and removal shall be strictly followed.

Forms shall be so constructed as to be removable in sections on designed sequence, without damaging the surface of concrete or disturbing other sections. Form work must be the case of complicated structures and/or on spans of more than 12M, the details of form work shall be properly worked out by the contractor and the scheme, setting and release, shall be got approved by the Engineer-in-charge, well in advance before concrete work is to be taken up. All rubbish, chippings, shavings and saw dust shall be removed from the interior of the forms before the concrete is placed and the form work in contact with the concrete shall be cleaned and thoroughly wetted or treated with non-staining mineral oil or any other approved material. Care shall be taken to see that oil or similar other such approved material is kept out of contact with the reinforcement.

All form work shall be removed without shock or vibration and shall be cased off carefully in order to allow the structure to take up its load gradually. Forms shall not be disturbed until concrete has adequately hardened to be able to take the superimposed load coming on it and in no circumstances shall forms be struck until the concrete reaches a strength of at least twice the stress to which the concrete may be subject to, at the time of striking.

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In the normal circumstances (generally where temperatures are above 21 degrees centigrade) and where ordinary cement is used, forms may be struck after expiry of the following periods:

(a) Walls, columns and Vertical sides of beams . — 16 to 24 hours or as may be directed by Engineer-in-charge.

(b) Bottom of slabs upto 4.5m) span — 7 days

(c) Bottom of slab of above 4.5m) span, bottom of beam and arch rib upto 6m, span — 14 days

(d) Bottom of beams and arch rib) over 6m span. — 21 days
(or as revised in IS:456-2000)

However this period may be increased or decreased at the discretion of Engineer-in-charge. Special care shall be taken while striking the centering of cantilevered slabs, canopies, portal frames, folded plate construction, for which period for striking centering shall be as determined by the Engineer-in-charge.

If directed, forms shall be given an upward camber to ensure that the beams do not show any sag.

Surfaces that become exposed on removal of forms shall be carefully examined and any fins, burrs, projection etc., that there detected shall be removed. Honeycombing of minor nature, over limited areas may be finished neatly with cement mortar 1:2 only on being so permitted and as directed by the Engineer-in-charge.

Any work showing signs of damage through premature or careless removal of centering or shuttering, shall be reconstructed by the contractor at his own cost.

In any case no concrete work shall be finished, plastered or made good ("touched up" as it is loosely called) in any form unless and until the Engineer-in-charge inspect and pass the surface for such finishing, plastering or making good.

2.12 Strength :

Normal Concrete mixed in the proportions desired shall have compressive strengths after placing, of not less than the following

Sl.No.	Concrete (Mix Nominal)	Minimum Compressive strength at 7 days	Minimum Compressive strength at 28days
	1:1:2	175Kg/sq.cm,	250Kg/sq.cm.
	1:1 ½:3	140kg/sq cm	200Kg/sq cm
	1:2:4	105Kg/sq cm	150kg/sq cm

2.13 Tests :

Tests on concrete shall be carried out in accordance with IS-456 and other ISS applicable. The frequency of works test shall be such as may be ordered by the Engineer-in-charge and subject to such orders, for every 150cu.m. a batch of 6 cubes shall be made for every sample and 3 of them tested after 7 days and the remaining cubes after 28 days. The criteria for acceptance of concrete as conforming to the specified proportion/grade of concrete shall be in accordance with IS:456 and the contractor shall entirely re-do rejected work at his own cost. Strength on 28 days shall alone be considered for acceptance.

The contractor shall arrange to carry out the tests in accordance with the relevant Indian Standard specifications in an approved laboratory and the test reports in original submitted to Engineer-in-charge. The entire cost of testing shall be borne by the contractor.

2.14 Steel Reinforcement :

Reinforcement shall be accurately fabricated, placed and adequately maintained in position as shown on drawings or as directed by the Engineer-in-charge. All finished bars shall be free from cracks, surface flaws, laminations, jagged and imperfect edges. Cement mortar blocks adequately compacted and as dense as the parent concrete holding them, and well cured shall be used to give requisite cover as shown on the drawing or as directed and all intersections of bars shall be firmly tied with binding wire of 18 gauge double strand. Commercially available plastic or other cover blocks may also be used. Reinforcement shall be bent in accordance with the procedure stipulated in IS:2502-1963 and will not be straightened in such manner that will injure the material.

All reinforcement shall immediately before placing in concrete, be thoroughly cleaned of loose mill scale, loose rust, oil and grease or other deleterious matter that would destroy or reduce bond.

Reinforcement in reinforced concrete members shall not be connected by welding or coupling except in accordance with the relevant ISS and with the previous approval of the Engineer-in-charge. Cold worked HSD bars shall not be welded at

random even for tack unless approved by the Engineer-in-charge. Overlaps and joints shall be staggered and located at points along the span where neither shear nor bending moment is maximum.

Bars and rods projecting out of concrete and exposed to weather shall, unless completely enclosed/covered by virtue of suitable provision in the schedule of quantities, be protected, free of any charge, by a thick coat of cement slurry .

2.15 Cover :

Reinforcement shall have cover as shown on the R.C.C. drawings and where not specified the thickness of cover shall be as follows.

a) At each end of reinforcing bar not less than 25mm nor less than twice the diameter of such rod or bar.

b) For a longitudinal reinforcing bar in a column not less than 40mm, nor less than the diameter of such rod or bar. In the case of columns of minimum dimension of 20cm or under, whose reinforcing bars do not exceed 13mm, the cover of 25mm may be adopted.

c) For longitudinal reinforcing bar in a beam, not less than 25mm, nor less than the diameter of such rod or bar.

d) For tensile, compressive, shear or other reinforcement in a slab, not less than 13mm nor less than the diameter of such reinforcement and

e) For any other reinforcement, not less than 13mm nor less than the diameter of such reinforcement. (For Cover blocks see earlier).

TABLE `A' (For nominal mix)

Sl. No.	**Nominal Mix**	**Qty. of Aggregate required for 50 Kg of cement**		**Qty. of Water required for 50 Kg of cement**	
		Fine Cu.m	**Coarse Cu.m**	**Vibrated**	**Un-Vibrated**
				(For Dry Aggregates)	
	1:1:2	**0.035**	**0.070**	**22 Ltr.**	**27 Ltr.**
	1:1 ½ : 3	**0.052**	**0.106**	**23 Ltr.**	**30 Ltr.**
	1:2:4	**0.070**	**0.138**	**27 Ltr.**	**32 Ltr.**
	1:3:6	**0.105**	**0.210**	**28 Ltr.**	**34 Ltr.**
	1:4:8	**0.150**	**0.280**	**-**	**45 Ltr.**

TABLE `B'

Sl. No.	Aggregate	Approximate Qty. of Surface Water in Ltr. / Cu.m
	Very Wet Sand	120
	Moderately Wet Sand	80
	Moist Sand	40
	Moist Gravel or Crushed Rock	20 to 40
Coarser the aggregate, lesser the water it will carry.		

Sl. No.	Type of Work	Slumps	
		When Vibrated	When Not Vibrated
	Mass Concrete in RCC Foundation, Retaining Walls and Road Slabs.	2.5 Cms.	5 Cms.
	Beams, Slabs, Columns with simple reinforcement	Cms. To 5 Cms.	5 Cms. To 10 Cms.
	Thin Sections with congested reinforcement	5 Cms. To 10 Cms.	10 Cms. To 15 Cms.

Note : Should conditions governing slump and workability point to advisability of an increased slump, the change shall only be done by decreasing the amount of aggregate and not by increasing the amount of water.

2.16 PRE CAST CONCRETE JALI

The jali shall be of specified grade reinforced with 1.6mm mild steel wire unless otherwise specified.
Fixing: The jali shall be set in position true to plumb and level before joints sills and soffits of the openings are plastered. It shall then be properly grouted with cement mortar 1:3 (1 cement :3 coarse sand) and rechecked for levels. Finally the jambs, sills and soffits shall be plastered embedding the jail uniformly on all sides.
Measurements: the jail shall be measured for its gross superficial area. The length and breath shall not be less than that specified.
Rate : the rate shall be inclusive of materials and labour involved in all the operations described above except plastering of jambs, sills and soffits, which will be paid for under relevant items of plastering

2.17 PRECAST CONCRETE

Precast concrete shall comply with IS 456 and with the following requirements:

All precast units shall be cast on suitable bed or platform with firm foundation and free from wind.Contractor shall be responsible for the accuracy of the level or shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.
Side shutters shall not be struck in less than 24 hours after depositing concrete and no precast unit shall be lifted until the concrete reaches a strength of at least twice the stress to which the concrete may be subjected to at the time of lifting.
The lifting and removal of precast units shall be undertaken without causing shock, vibration or undue bending stresses to or in the units. Before lifting and removal takes place contractor shall satisfy Engineer or his representative that the methods he proposes to adopt for these operations shall not over stress or otherwise affect seriously the strength of the precast units. The reinforced side of the units shall be distinctly marked.
All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during ;that period each unit shall be kept constantly watered or preferably be completely immersed in water if the size of the unit so permits, otherwise curing practice shall be followed
Slots, openings or holes, pockets etc. shall be provided in the concrete work in the drawings or as directed by Engineer. Any deviation from the approved drawings shall be made good by contractor at his own expense. Without damaging any other work sleeves, bolts, inserts, etc. shall also be provided in concrete work where so specified..

2.17.1 Mode of Measurement

It shall be measured as per the item schedule. The unit rate for precast concrete members shall include formwork, mouldings, finishing, hoisting and setting in position including mortar, provision of lifting arrangement, exposed concrete finish etc. complete. Only if reinforcement is used, it shall be measured and paid for separately under item rate.

TECHNICAL SPECIFICATION FOR MASONRY WORKS

3 MASONRY WORKS

3.1 Brick Masonry Works

3.1.1 Scope

This specification establishes the materials, dressing, laying, joining. Curing, workmanship etc. for brick masonry works. Brick masonry shall also comply with all the requirements of IS:2212.

3.1.2 General Requirements

3.1.2.1 Materials: Refer materials specification no 2.9

Cement Mortar
Cement mortar shall meet the requirements of IS:2250 and shall be prepared by mixing cement and sand by volume. Proportion of cement and sand shall be 1:6 (1 part of cement and 6 parts of sand), or as directed by the Engineer-in-Charge / shown on the drawing, for brick masonry of one brick thickness or more, while 1:4 cement mortar (1 part of cement and 4 parts of sand) shall be used for brick masonry of half brick thickness. The sand being used for mortar shall be sieved. The mortar shall be used as soon as possible after mixing and before it has begun to set and in any case within initial setting time of cement after water is added to the dry mixture. Mortar unused for more than initial setting of cement, shall be rejected and removed from the site of work.

3.1.2.2Proportioning
The unit of measurement for cement shall be a bag of cement weighing 50 kgs and this shall be taken as 0.035 cubic metres. Sand shall be measured in boxes of suitable size on the basis of its dry volume. In case of damp sand, its quantitiy shall be increased suitably to allow for bulkage.

3.1.2.3Mixing
The mixing of mortar shall be done in a mechanical mixer operated manually or by power. The Engineer-in-Charge may, however, permit hand-mixing as a special case, taking into account the magnitude nature and location of work. The Contractor shall take the prior permission of Engineer-in-Charge, in writing, for using hand-mixing before the commencement of work.

3.1.2.4Mixing in Mechanical Mixer

Cement and Sand in specified proportions, by volume, shall be thoroughly mixed dry in a mixer. Water shall then be added gradually and wet mixing continued for atleast one minute. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of stiff paste. Wet mix from the mixer shall be unloaded on water-tight masonry platform, made

adjacent to the mixer. Platform shall be atleast 150 mm above the levelled ground to avoid contact of surrounding earth with the mix. Size of the platform shall be such that it shall extend atleast 300 mm alround the loaded wet mix area. Wet mix, so prepared, shall be utilised within initial setting time (thirty (30) minutes for ordinary portland cement conforming to IS : 269 after addition of water. Mixer shall be cleaned with water each time before suspending the work.

3.1.2.5Hand Mixing

The measured quantity of sand shall be levelled on a clean water-tight masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry up being turned over and over, backward and forward, several times till the mix is of uniform colour. The quantity of dry mix which can be consumed within initial setting time of cement shall then be mixed with just sufficient quantity of water to bring the mortar to the consistency of stiff paste.

3.1.3Construction Procedure

3.1.3.1Soaking of Bricks

Bricks shall be soaked in water before use for a period that is sufficient for the water to just penetrate the whole depth of bricks as well as to remove dirt, dust and sand. Proper soaking of bricks shall prevent the suction of water from the wet mortar as otherwise mortar will dry out soon and crumble before attaining any strength. The bricks shall not be too wet at the time of use as they are likely to slip on mortar bed and there will be difficulty in achieving the plumbness of wall as well as proper adhesion of bricks to mortar.

The period of soaking shall be determined at site by a field test by immersing the bricks in water for different periods and then breaking the bricks to find the extent of water penetration. The least period that corresponds to complete soaking, will be the one, to be allowed for in the construction work.

The soaked bricks shall be removed from the tank, sufficient early, so that at the time of laying, they are skin dry. The soaked bricks shall be stacked over a clean place, wooden planks or masonry platforms to avoid earth, dirt being smeared on them.

3.1.3.2Laying

Brick Work (One or more brick thickness)

Brick work (One or more brick thickness) shall be laid in English Bond unless otherwise specified. Half or cut bricks shall not be used except when needed to complete the bond. In no case the defective bricks shall be used.

A layer of average thickness of 10mm of cement mortar shall be spread on full width over a suitable length of lower course or the concrete surface. In order to check and achieve uniformity in masonry, the thickness of bed joints shall be such that four courses and three joints taken consecutively shall measure equal to four times the actual thickness of the brick plus 30 mm. Each brick with frog upward, shall be properly bedded and set in position by gently tapping with handle of trowel or wooden mallet. Its inside faces shall be buttered with mortar before the next brick is laid and pressed against it. After completion of the course, all vertical joints shall be filled from top with mortar.

All brick courses shall be taken up truly plumb; if battered is to be truly maintained. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. The level and vertically of work in walls shall be checked up at every one metre interval.

The masonry walls of structures shall be carried out progressively, leaving no adjoining part one metre lower than the other. If this cannot be adhered to, the brick work shall be raked back according to bond (and not left toothed) at an angle not more than 45 degrees but racking back shall not start within 60 centimetres of a corner. In all cases returns, buttresses, counter forts, pillars etc. shall be built up carefully course by course, and properly bonded with the main walls.

The brick work shall not be raised more than fourteen (14) courses per day.

At the junction of any two walls, the bricks shall at each alternate course, he carried into each of the respective walls so as to thoroughly unite the work.

The courses at the top of plinth and sills, at the top of the wall just below the soffit of the roof beam and at the top of the parapet, shall be laid with bricks on edge. Brick on edge course shall be so arranged as to tightly fit under the soffit of the roof beam or roof slab, restricting the mortar layer thickness upto 12 mm, however, any gap between the finished brick work and soffit of roof slab / beam shall be suitably sealed with manhole of 13 cm wide of approved quality leaving the equal gap on either side and then sealed with the mortar over chicken mesh as instructed by Engineer-in-charge.

3.1.3.3Brick Work (Half brick thickness)

For brick walls of half brick thickness, all courses shall be laid with stretches. Wall shall be reinforced with 2 nos.- 6mm diameter mild steel reinforcement bars, shall be straightened and thorougly cleaned. Half the mortar thickness for the bedding joint shall be laid first and mild steel reinforcement, one on each face of the wall, shall be embedded, keeping a side cover of 12mm mortar. Subsequently, the other half of the mortar thickness shall be laid over the reinforcement covering it fully.

The reinforcement bars shall be carried atleast 150 mm into the adjoining walls or RCC columns. In case the adjoining wall being of half brick thickness, the length of bars shall be achieved by bending the bars in plan. During casting of reinforced concrete columns, 6mm dia M.S. reinforcing bar shall be placed at every fourth course of brick masonry. At the junction of two walls, the

brick shall, at each alternate course, be carried into each of the respective walls so as to thoroughly unite the work. The brick masonry work shall not be raised more than 14 courses per day.

Brick course under the soffit of beam or slab, shall be laid by restricting the mortar thickness to 12 mm. However, any gap between the finished brick work and soffits of slab / beam, shall be suitably sealed with the thermocole of 8cm wide of approved quality leaving the equal gap on either side and then sealed with the mortar over chicken mesh as instructed by Engineer-in-charge.

3.1.3.4Circular Brick Work

The detailed specification for brick work covered under the above shall apply, in so far as these are applicable. Bricks forming skew backs, shall be dressed or cut so as to give proper radical bearing. Defects in dressing of brick shall not be covered up by extravagant use of mortar, nor shall the use of chips etc., be permitted.

The circular brick work shall be carried up from both ends simultaneously and keyed in the centre. The bricks shall be flushed with mortar and well pressed into their positions so as to squeeze out a part of their mortar and leave the joints thin and compact. All joints shall be full of mortar and thickness of joints shall be between 5 mm and 15 mm.

3.1.3.5Jointing

Joints shall be restricted to a width of 10mm with brickwork of any classification. All bed joints shall be normal to the pressure upon them i.e. horizontal in vertical walls, radial in circular brick masonry and at right angles to the face in the battered retaining walls. The vertical joints in alternate courses shall come directly one over the other and shall be truly vertical. Care shall be taken that all the joints are full of mortar, well flushed up. In case no pointing is to be done, cement mortar shall be neatly struck as the work proceeds. The joints in face which are to be plastered or pointed shall be squarely raked out to a depth of 12mm while the mortar is still green. The rake joints shall be brushed to remove loose particles. After the day's work, the faces of brick work shall be cleaned on the same day with wire brush and all mortar droppings removed.

3.1.3.6Curing

Green work shall be protected from rain or any other running water or accumulated water from any source, by suitable means. Masonry work, as it progressess, shall be kept thoroughly wet by sprinkling water at regular intervals, on all faces. Curing shall be done after 24 hours of completion of day's work and shall be done for atleast 10 days after completion. Proper watering cans with spray nozzles, rubber or PVC pipes shall be used for this purpose.

3.1.3.7Staging / Scaffolding

Staging / Scaffolding shall be properly planned and designed by the Contractor. Use of only steel tubes is permitted for staging / scaffolding. Design of staging / scaffolding shall be submitted for approval of the Engineer-in-Charge, before commencement of work.

Single scaffolding having one set of vertical support, shall be used and other end of the horizontal scaffolding member shall rest in a hole provided in the headed course. The support shall be sound and strongly clamped with the horizontal pieces over which the scaffolding planks shall be fixed. The holes left in the masonry work for supporting the scaffolding shall be filled and made good with plain cement concrete of grade 1:3:6 during plastering. Suitable access shall be provided to the working platform area. The scaffolding shall be strong enough to withstand all loads likely to come upon it and shall also meet the requirements specified in IS:2750.

Double scaffolding shall be provided for pillars less than one metre in width or for the first class masonry or for a building having more than two storeys.

The following measures shall also be considered during erection of the scaffolding / staging.

Sufficient sills or underpinnings, in addition to base plates, shall be provided, particularly, where scaffoldings are erected on soft grounds.

Adjustable bases to compensate for uneven ground shall be used.

Proper anchoring of the scaffolding / staging at reasonable intervals shall be provided in each direction with the main structure wherever available.

Horizontal braces shall be provided to prevent the scaffolding from rocking.

Diagonal braces shall be provided continuously from bottom to top between two adjacent rows of uprights.

The scaffolding / staging shall be checked at every stage for plumb line.

Wherever the scaffolding / staging is found to be out of plumb line, it shall be dismantled and re-erected afresh. Efforts shall not be made to bring it in line with a physical force.

All nuts and bolts shall be the clamps / couplings are firmly tightened to avoid slippage.

Erection work of a scaffolding / staging , under no circumstance shall be left totally to semiskilled or skilled workmen and shall be carried out under the supervision of Contractor's technically qualified civil engineer.

For smaller works or works in remote areas wooden ballies may be permitted for scaffolding / staging by the Engineer-in-Charge at his sole discretion. The contractor must ensure the safety and suitability of such works as described under above mentioned clauses.

3.1.3.8 Embedment of Fixtures

All fixtures, pipes, conduits, holdfasts of doors and windows etc. required to be built in walls, shall be embedded in plain cement concrete block of grade 1:3:6, at the required positions, as the work proceeds, unless otherwise specified.

3.1.4 Payment / Measurement

The payment of brick masonry shall be inclusive of all labour, material, scaffolding / staging sampling and testing, soaking of bricks, laying of bricks, raking of joints, cutting of bricks, provided recesses and making rectangular or round openings, with the manhole of 7 cm wide of approved quality leaving the equal gap on either side and then sealed with the mortar over chicken mesh as instrcuted by Engineer-in-Charge, curing, making of masonry platform for unloading the wet mix, embedding the fittings / fixtures including providing PCC (1:3:6) etc. all as specified for all heights and depths. Deduction for rectangular or circular openings, shall be done as per relevant IS codes.

Payment for brick work shall be made on cubic meter (cum) basis on the volume of actual work done, the thickness of wall being calculated on the basis of nominal brick length and breadth only as the case may be for brick work of one (1) or more brick thickness.

Payment for walls of less than 1 brick thick shall be made on square metre basis of the net area of brick work and shall include labour cost of providing and fixing reinforcement wherever specified.

Use of different size of brick less than specified size of 21 cm and 10 cm will not be normally allowed. However, if the specified bricks are not locally available, use of other size of bricks shall be permitted only with prior sanction. No extra payment shall be paid for the additional quantity due to extra thickness beyond specification.

Deduction for voids shall be as per IS : 1200. The rate of brick work shall include scaffolding and all items mentioned above and no extra payment shall be made for cutting bricks, if required, either for openings or for rounding or for insertions or for recesses at the time of brick wall construction. No extra payment shall be made for raking of joints.

3.1.5 Honey Comb Brick Work

The brick honeycomb work shall be done with specified class of brick, laid in specified mortar. All joints and edges shall be struck flush to give an even surface.

The thickness of the brick honeycomb work shall be half-brick only, unless otherwise specified. Openings shall be equal and alternate with half brick laid with a bearing of 2cm on either side.

MEASUREMENTS

The length and height shall be measured correct to a cm. Area shall be calculated in square metres correct to two places of decimal. Honey comb openings shall not be deducted.

3.2 STONE MASONRY

3.2.1 Scope

Stone masonry work shall comply with all the requirements of IS:1597 Part I (Rubble Stone Masonry) IS:3620 (Laterite Stone Masonry) IS;2185 Part I and IS:2572 (Concrete Block Masonry)

3.2.2 Rubble stone masonry

3.2.3. Materials

Refer specification for Materials vide specification

3.2.4 Cement Mortar

Refer under Brick Masonry Works

3.2.5 Construction Procedure

3.2.5.1 All stones shall be wetted before use. Each stone shall be placed close to the stones already laid so that the thickness of the mortar joints at the face is not more than 20mm. Face stones shall be arranged suitably to stagger the vertical joints and long vertical joints shall be avoided. Stones for hearting or interior filling shall be hammered down with wooden mallet into the position firmly bedded in mortar. Chips or sprawls of stones may be used for filing of interstices between the adjacent stones in heartening and these shall not exceed 20% of the quantity of stone masonry. To form a bond between successive courses plum stones projecting vertically by about 15 to 20cm shall be firmly embedded in the heartening at the interval of about one metre in every course. No hollow space shall be left anywhere in the masonry.

The masonry work in wall shall be carried up true to plumb or to specified batter.

Random rubble masonry shall be brought to the level courses at plinth, window sills, lintel and roof levels. Levelling shall be done with concrete comprising of one part of the mortar as used for masonry and two parts of graded stone aggregate of 20mm nominal size.

The masonry in structure shall be carried uniformly. Where the masonry of one part is to be delayed, the work shall be raked back at an angle not steeper than 45^{o}.

3.2.5.2 Bond stones

Bond or through stones running right through the thickness of walls, shall be provided in walls upto 60cm thick and incase of walls above 60cm thickness, a set of two or more bond stones overlapping each other by atleast 15cm shall be provided in a line from face of the wall to the back.

For all thickness of such walls, a set of two or more bond stones overlapping each other by atleast 15cm shall be provided.

Length of each such bond stone shall not be less than two-third of the thickness of the wall.

Where bond stones of suitable lengths are not available precast cement concrete block of 1:3:6 mix (1 cement: 3 coarse sand: 6 graded stone aggregate 20mm nominal size) of cross section not less than 225 square centimetres and length equal to the thickness of wall shall be used in lieu of bond stones. (This shall be applicable only in masonry below ground level and where masonry above ground level is finally required to be plastered).

Atleast one bond stone or a set of bond stones shall be provided for every 0.5 sqm of the area of wall surface. All bond stones shall be marked suitably with paint as directed by the Engineer-in-Charge.

3.2.5.3 Quoin and Jamb stones

The quoin and jamb stones shall be of selected stones neatly dressed with hammer or chisel to form the required angle. Quoin e less than 0.01 cum in volume. Height of quoins and jamb stones shall not be less than 15cm. Quoins shall be laid header and stretcher alternatively.

3.2.5.4 Joints

Stones shall be so laid that all joints are fully packed with mortar and chips. Face joints shall not be more than 20mm thick.

The joints shall be struck flush and finished at the time of laying when plastering or pointing is not to be done. For the surfaces to be plastered or pointed, the joints shall be raked to a minimum depth of 20mm when the mortar is still green.

3.2.5.5. Scaffolding

Single scaffolding having one set of vertical support shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry. Such holes, however, shall not be allowed in pillars under one metre in width or near the skew back of arches. The holes left in masonry work for supporting scaffolding shall be filled and made good with cement concrete 1:3:6 (1 cement: 3 coarse sand: 6 stone aggregate 20mm nominal size).

3.2.5.6 Curing

Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. Incase of masonry with fat lime mortar curing shall commence two days after laying of masonry and shall continue for atleast seven days thereafter.

3.2.5.7 Protection

Green work shall be protected from rain by suitable covering. The work shall also be suitably protected from damages, mortar dropping and rain during construction.

3.2.5.8 Measurements

The length, height and thickness shall be measured correct to a cm. The thickness of wall shall be measured at joints excluding the bushing. Only specified dimension shall be allowed; anything extra shall be ignored. Quantity shall be calculated in cubic metre nearest to two places of decimal.

he work under the following categories shall be measured separately.

(i) From foundation to plinth level (level one)

(a) work in or under water and or liquid mud.

(b) work in or under foul positions

(ii) From plinth level (level one) to top level of Compound wall.

No deduction shall be made nor extra payment made for the following:

(i) Ends of dissimilar materials (that is posts, girders, rafters purlins, trusses, corbels, steps etc.,) upto 0.1 sqm in section.

Openings each upto 0.1 sqm in area. In calculating the area of openings, any separate lintels or sills shall be included along with the size of opening but the end portions of the lintels shall be excluded and the extra width or rebated reveals, if any, shall also be excluded.

Wall plates and bed plates and bearing of chajjas and the like, where the thickness does not exceed 10cm and the bearing does not extend over the full thickness of the wall.

Note : The bearing of floor and roof shall be deducted from wall masonry.

Drain holes and recesses for cement concrete blocks to embed hold fasts for doors, windows, etc.,

Building in masonry, iron fixture, pipes upto 300mm dia, hold fasts of doors and windows etc.,

Forming chases in masonry each upto section of 350 sq.cm Masonry (excluding fixing brick work) in chimney breasts with smoke of air flues not exceeding 20 sq.dm (0.20 sqm) in sectional area shall be measured as solid and no extra payment shall be made for pargetting and coring such flues. Where flues exceed 20 sq.dm (0.20 sqm) sectional area, deduction shall be made for the same and pargetting and coring flues shall be measured in running metres stating size of flues and paid for separately. Aperture for fire place shall be deducted and no extra payment made for splaying of jambs and throating.

Apertures for fire places shall not be deducted and extra labour shall not be measured for splaying of jambs, throating and making arch to support the opening.

e) Square or Rectangular Pillars

These shall be measured as walls, but extra payment shall be allowed for stone work in square or rectangular pillars over the rate for stone work in walls. Rectangular pillar shall mean a detached masonry support rectangular in section, such that its breadth does not exceed two and a half times the thickness.

f) Tapered walls shall be measured net, as per actual dimensions and paid for as other walls.

g) Curved masonry

Stone masonry curved on plan to a mean radius exceeding 6 metres shall be measured and included with general stone work. Stone work circular on plan to a mean radius not exceeding 6 metres shall be measured separately and shall include all cuttings and waste and templates. It shall be measured as the mean length of the wall.

3.2.5.9 Rate

The rate shall include the cost of materials and labour required for all the operations described above and shall include the following:

Raking out joints for plastering or pointing done as a separate item, or finishing flush as the work proceeds.

Preparing tops and sides of existing walls for raising and extending.

Rough cutting and waste for forming gables, cores, skew backs or spandrels of arches, splays at eaves and all rough cutting in the body of walling unless otherwise specified.

Bond stones or cement concrete bond blocks.

Leading and making holes for pipes etc.,

Bedding and pointing wall plates, lintels, sills etc., in or on walls, bedding roof tiles and corrugatged sheets in or on walls.

Building in ends of joists, beams, lintels etc.,

3.2.6 Laterite Stone Masonry

3.2.6.1 Dressing

Laterite stones shall be hammer dressed into rectangular blocks so that all faces are free from waviness and unevenness, and the edges are true and square. The least thickness/ breadth shall be not less than height. The length shall generally be equal to twice the breadth, unless otherwise specified.

3.2.6.2 Laying

The dressed stones shall be laid in regular courses of not less than 15cm height. All courses in the masonry shall be of the same height unless otherwise directed. The stones shall be laid in alternate header stretcher fashion, alternative courses of header and stretchers or in any other suitable fashion as directed. The vertical joints shall break by atleast 65mm. No specific corner stones are necessary. Quoin may be provided, where so indicated.

3.2.6.3 Joints

All bed joints shall be truly vertical, the thickness of joints shall not exceed 15mm. Each stones shall be carefully laid in place with joints completely filled with mortar. On faces, where no plastering or pointing is required to be done, the joints shall be struck flush as the work proceeds. In other cases, joints shall be raked square to a minimum depth of 13mm by a racking tool during the progress of work while the mortar is still green.

3.2.6.4 Scaffolding, Curing and Protection

Scaffolding

Double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Protection

Green work shall be protected from rain by suitable covering. The work shall also be suitably protected from damage, mortar dropping and rain during construction.

Curing

Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. Incase of masonry with fat lime mortar, curing shall commence two days after laying of masonry and shall continue for atleast seven days thereafter.

3.2.6.5Measurements

The finished work shall be measured correct to a centimetre in respect of length, breadth and height. The cubical contents shall be calculated in cubic metre nearest to two places of decimal.

No deduction nor any extra payment shall be made for the following:

Ends of dissimilar materials (that is joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps etc.,) upto 0.1 sqm in section
Openings upto 0.1 sqm in area. In calculating the area of opening, any separate lintels or sills shall be included along with the size of the opening but the end portion of the lintels shall be excluded and extra width of rebated reveals, if any, shall also be excluded.

Wall plates and bed plates and bearing of chajja and the like, where the thickness does not exceed 10cm and the bearing does not extend over the full thickness of the wall.

Note : The bearing of floor and roof slabs shall be deducted from wall masonry.

Drainage holes and recesses left for cement concrete blocks to embed hold-fasts for doors and windows, building in the masonry iron fixture and pipes upto 300mm diametre.

Stone walling in chimney breasts, chimney stacks, smoke or air flues not exceeding 0.20 sqm in sectional area shall be measured as solid and no extra measurement shall be made for pargetting and coring such flues. Where flues exceed 0.20 sqm in sectional area, deduction shall be made for the same and pargetting and coring flues paid for separately.

Square, Rectangular or Circular Pillars

Shall be measured and paid for as walls, but extra payment shall be allowed for such pillars and columns over the rate for stone work in walls.

Rectangular pillars shall mean a detached masonry support, rectangular in section, such that its breadth shall not exceed two and half times the thickness.

Curved stone work

Stonework curved on a plan to a mean radius exceeding six meters shall be measured net and included with general stonework. Stonework circular on a plan to a mean radius not exceeding six meters shall be measured separately and extra payment shall be allowed and shall include all cutting and waste and templates. It shall be measured as the mean length of wall.

3.2.6.6 Rate

The rate shall include the cost of materials and labour required for all the operations described above. Stone facing or wall lining upto and not exceeding 8cm thickness shall be paid for under "Stone work for wall lining etc., (Veneer work)" The stonework of thickness exceeding 8cm shall be paid under relevant items of work.

3.2.7 Hollow and solid concrete block masonry

Hollow and Solid concrete blocks - shall conform to the requirements of IS:2185-1979. Specification for hollow and solid concrete blocks except with regard to the mix of cement concrete and sizes of aggregates which shall be as indicated. Hollow blocks shall be sound, free from cracks, broken edges, honey combing and other defects that would interfere with the proper placing of block or impair the strength or performance of construction.

3.2.7.1 Dimensions and Tolerances

Concrete masonry building units shall be made in sizes and shapes to fit different construction needs. They include stretcher, corner, double corner or pier, jamb, header, bull nose, and partition block and concrete floor units.

Concrete block-hollow (open or closed cavity) or solid shall be referred to by its nominal dimensions.

The nominal dimensions of concrete block shall be as follows:

Length 400, 500 or 600mm

Height 200 or 100mm

Width 50,75,100,150,200,250 or 300mm

In addition, block shall be manufactured in half lengths of 200, 250 or 300mm to correspond to the full lengths.

The maximum variation in the length of the units shall be not more than +5mm and maximum variation in height and width of unit, not more than 3.3mm.

3.2.7.3 Classification

Hollow (open and closed cavity) concrete blocks.

The hollow (open and closed cavity) concrete blocks shall conform to the following three grades:

Grade 'A' - These are used as load bearing units and shall have a minimum block-density of 1500 kg/cum. These shall be manufactured for minimum average compressive strengths of 3.5, 4.5, 5.5 and 7.0 N/sq.mm respectively at 28 days (See Table 3).

Grade 'B' - These are also used as load bearing units and shall have a block density less than 1500 kg/cum but not less than 1000 kg/cum. These shall be manufactured for minimum average compressive strengths of 2.0, 3.0 and 5.0N/sq.mm respectively at 28 days (See Table 3).

Grade 'C' - These are used as non-load bearings units and shall have a block density less than 1500 kg/cum but not less than 1000 kg/cum. These shall be manufactured for minimum average compressive strength of 1.5 N/ sq.mm at 28 days (see Table 3).

Grade 'D' - The solid concrete blocks are used as load bearing units and shall have a block density not less than 1800 kg/cum. These shall be manufactured for minimum average compressive strengths of 4.0 and 5.0 N/sq.mm respectively (See Table 3).

3.2.7.4 Physical requirements

Compressive strength - The average crushing strength of eight blocks, when determined in accordance with IS:2185 - 1979 shall be not less than as specified in table given below:

TABLE 3

PHYSICAL REQUIREMENTS

Type	Grade	Density of Block Kg/mm^3	Minimum Average Compressive Strength of Units N / mm^2	Minimum strength of individual units N / mm^2
(1)	(2)	(3)	(4)	(5)
Hallow (Open and closed cavity) Load bearing unit	A (3.5) A (4.5) A (5.5) A (7.0) B (2.0) B (3.0) B (5.0)	Not Less Than 1500 Less Than 1500 But Not Less Than 1000	3.5 4.5 5.5 7.0 2.0 3.0 5.0	2.8 3.6 4.4 5.6 1.6 2.4 4.0
Hallow (Open and closed cavity non load bearing units.	C (1.5)	Less Than 1500 But Not Less than 1000	1.5	1.2
Solid Load Bearing Units	D (5.0) D (4.0)	Not Less Than 1800	5.0 4.0	4.0 3.2

Drying Shrinkage - The drying shrinkage of the blocks average of three blocks), when unrestrained, shall be determined in accordance with IS:2185-1979 and shall not be exceed 0.1 per cent.

Moisture movement - The moisture movement (average of three blocks) when determined in the manner described in IS:2185-1979, shall not exceed 0.09 per cent.

d)Water Absorption - The water absorption (average of three blocks) when determined in the manner described in IS:2185-1979 shall be not more than 10 percent by mass.

e)Face shells and webs shall increase in thickness from the bottom to the top of the unit. Depending upon the core moulds used, the face shells and webs shall be flared and tapered or straight tapered, the former providing a wider surface for mortar. The thickness of the face shell and web shall be not less than the values given in Table below:

TABLE 4
Minimum face shell and web thickness

Nominal Block Width	Face Shell Thickness Minimum	Thickness of Web Minimum	Total Web Thickness per course in any 200 mm length of walling min.
(1)	(2)	(3)	(4)
100 or Less	25	25	25
Over 100 to 150	25	25	30
Over 150 to 200	30	25	30
Over 200	35	30	38

Subject to the tolerances specified in 3.2.7.2 and the provisions of (g) The face of masonry units shall be flat and rectangular, opposite face shall be parallel and all arises shall be square. The bedding surfaces shall be at right angles to the faces of the blocks.

g) Blocks with special faces shall be manufactured and supplied as directed by the Engineer-in-Charge.

3.2.7.5 Curing and Drying

The blocks shall be cured in an immersion tank or in a curing yard and shall be kept continuously moist for atleast 14 days. When the blocks are cured in an immersion tank, the water of tank shall be changed atleast every four days.

After curing, the blocks shall be dried in shade before being used on the work. They shall be stacked with voids horizontal to facilitate through passage of air. The blocks shall be allowed to complete their initial shrinkage before they are laid in wall.

3.2.7.6 Construction of masonry

For single storeyed buildings, the hollows of blocks in foundation and basement masonry shall be filled up with sand and only the top foundation course shall be of solid blocks. But for two or more storeyed buildings, solid concrete blocks shall be used in foundation courses, plinth and basement walls, unless otherwise indicated. If hollow blocks are used, their hollows shall be filled up with cement concrete 1:3:6 using 12.5mm nominal size aggregates.

3.2.7.7 Wetting of blocks

Blocks need not be wetted before or during laying in the walls. Incase the climate condition so require, the top and the sides of the blocks may only be slightly moistened so as to prevent absorption of water from the mortar and ensure the development of the required bond with the mortar.

3.2.7.8 Laying

Blocks shall be laid in mortar, as indicated and thoroughly bedded in mortar, spread over the entire top surface of the previous course of blocks to a uniform layer of not less than 10mm and not more than 12mm in thickness.

All courses shall be laid truly horizontal and all vertical joints made truly vertical. Blocks shall break joints with those above and below for not less than quarter of their length. Precast half length closers (and not cut from full size blocks) shall be used. For battered faces, bedding shall be at right angles to the face unless otherwise directed. Care shall be taken during construction to see that edges of blocks are not damaged.

3.2.7.9 Provision for door and window frames

A course of solid concrete block masonry shall be provided under door and window openings (or a 10cm thick precast concrete sill block under windows). the solid course shall extend for atleast 20cm beyond the opening on either side. For jambs of very large doors and windows either solid units are used, or the hollows shall be filled in with concrete of mix 1:3:6, using 12.5mm nominal size aggregates.

3.2.7.10 Provisions for roof

The course immediately below the roof slab shall be built with solid blocks. The top of the roof course shall be finished smooth with a layer of cement and coarse sand mortar 1:3, 10mm thick and covered with a thick coat of white wash or crude oil, to ensure free movement of slab.

3.2.7.11 Intersecting Walls

When two walls meet or intersect and the courses are to be laid up at the same time, a true masonry bond between atleast 50% of the units at the intersection is necessary. When such intersecting walls are laid up separately, pockets with 20mm maximum vertical spacing shall be left in the first wall laid. The corresponding course of the second wall shall be built into these pockets.

3.2.7.12 Piers

The top course of block in the pier shall be built in solid blocks. Hollow concrete block shall not be used for isolated piers, unless their hollows are specified to be filled with cement concrete.

Fixtures, fitting, etc., shall be built into the masonry in cement and coarse sand mortar 1:3 while laying the blocks where possible. Holdfasts shall be built into the joints of the masonry during laying.

Holes, chases, sleeves, openings, etc., of the required size and shape shall be formed in the masonry with special blocks while laying, for fixing pipes, service lines, passage of water etc., After service lines, pipes etc., are fixed, voids left, in any shall be filled up with cement concrete 1:3:6 (1 cement, 3 coarse sand: 6 stone aggregate 20mm nominal size) and neatly finished.

3.2.7.13 Finishes

Rendering shall not be done to the walls when walls are wet. Joints for plastering or pointing as specified shall be raked to a depth of 12mm. Joints on internal faces, unless otherwise indicated, shall be raked for plastering. If the internal faces of masonry are not to be plastered the joints shall be finished flush as the work proceeds or pointed flush where so indicated.

SPECIFICATION FOR WOOD WORKS

WOOD WORKS

4.1 General :

Reference shall be made to the following Indian standards:

IS 2202 Part-I	**:**	**Specifications for wooden flush door shutters (solid core type) plywood face panels.**
IS 2202 Part _ II	**:**	**Specification for wooden flush door shutters (Solid core type) practice board and hard board face panels.**
IS 1003 Part – I	**:**	**Specification for Timber panelled and glazed shutters – Door shutters**
IS 3087	**:**	**Specification for wooden particles boards(medium density)for general purposes.**
IS 3097	**:**	**Specification for veneered particles board**
IS 848		**Specification for synthetic Resin Adhesives for plywood (Phenolic and cemins plastic)**
IS 205	**:**	**Specification for non ferrous metal butt hinges**
IS 2338	**:**	**Code of Partice for finishing of wood and wood based materials (Part I & Part II)**
IS 1341	**:**	**Specification for steel butt hinges**
IS 4021	**:**	**Specification for timber door, window and ventilator frames**
IS 303	**:**	**Specification for plywood for general purposes**
IS 281	**:**	**Specification for Aldrops**
IS 204	**:**	**Specification for Tower bolt**
IS 208	**:**	**Specification for door handles**
IS 1823	**:**	**Specification for door stoppers**
IS 2209	**:**	**Specification for Mortice locks**
IS 3847	**:**	**Specification for mortice night latches**
IS 5899	**:**	**Specification for bathroom latches**
IS 7196	**:**	**Specification for hold fasts**
IS 3564	**:**	**Specification for door closers**

4.2 Material

4.2.1 Timber

4.2.1.1 Teakwood

Teakwood shall be second class Indian Teakwood conforming to IS 4021 of good quality, well seasoned and free from defects such as cracks, dead knots, sapwood etc. No individual hard and sound knot shall be more than 15 sq.cm in size and the aggregate area of such knots shall not exceed 2% of the areas of the piece. The timber shall be fairly close grained having not less than 2 growth rings per cm. width in cross-section.

4.2.1.2 Hard Wood

Hard wood shall be first class wood conforming to IS 4021 of good quality, well seasoned and free from defects such as dead knots, cracks, sapwood etc. No individual hard and sound knot shall exceed 6 sq.cm. in size with no dimension more than 50mm and the aggregate area of such knots shall not be more than 1% of the area of the piece.

There shall not be less than 5 growth rings per cm. Width in cross-sections.

Sal wood

Sal is heavier, harder, stronger, more shock resistance than teak.Its heart wood is a naturally durable wood, and usually remains immune to attack by white ants and fungi for a long period, while its sapwood is very perishable and should not be used. Well dried sal is not a really easy wood to saw and work. It is a rough constructional wood than a carpentry timber. No individual hard and sound knot shall exceed 25mm in diameter and the aggregate area of all the knots shall not exceed 1% of the area of the piece

It can be used for a variety of purposes, such as for beams, rafters, flooring, piles, bridging, tool handles, picker arms and tent pegs, etc.

4.2.1.3 Moisture content in timber

The maximum permissible percentage of moisture content for well seasoned timber shall be as per IS 287

4.2.1.4 Workmanship of wood work

Workmanship for wood and joinery shall be as per IS 1200 and IS 4021

4.2.1.5 Painting / Polishing of wood work

Painting / Polishing of wood work shall be in accordance with material specification no.10

4.3 Wooden door / window frame

Wooden door / window frame shall be made of specified wood as per item description and shall be in accordance with detailed drawings.

The wooden members of the frame shall be planed smooth and accurate to the full dimension. Rebates, rounding, moulding etc. shall be done before the members are jointed into frames.

Joints in the frame work shall be perfect with square edges and shall be pinned with hard wood / bamboo pins of 10 to 15mm dia.

Wood work shall be painted / polished or otherwise treated as specified. All exposed portions shall be coated with wood primer and concealed surface by bituminous paints as per material specification no. 10.

Before any surface treatment is applied, the wood work shall be got approved by the Engineer-in-Charge. The frames shall be fixed only after acceptance by the Engineer-in-Charge.

4.3.1 Shutters

4.3.2 Teakwood Board / Shutters

MATERIAL specification for Teak wood shall be same as specified material specification no 2.15.1

4.3.3 Hinges: Hinges shall be as provided in Bill of Quantities.

4.3.4 Workmanship

All the four edged of the door shutter shall be square. The shutter shall be free from twist or warp in its plane. In case of double shutters, the meeting of the shutters shall be rebated by one third the thickness of shutter. The rebating shall be splayed.

The shutter then shall be veneered whenever required by gluing approved shade and textured commercial type 0.5mm thick veneering conforming to class IS: of IS 303.

The veneering shall be done by gluing the veneer with BWP type, phenol formaldehyde synthetic resin conforming to IS :848 by hot press process on the shutter. Workmanship and finished of the veneering shall conform to IS :303

The exposed surfaces of the lipping of the edges shall be as directed by Engineer-in-Charge.

The shutter shall be fixed to the door frame, by means of hinges @ minimum three hinges per lead, maximum spacing of hinges being 600 mm or as per drawing with suitable sized screws.

The shutter when fitted to the frame shall satisfy all operational aspects of the door like smooth movement, proper closing against the door frame, etc.,

4.3.5 Flush Shutters

Flush door shutters shall have to be specified make door / or equivalent to conform manufactures specifications. Thickness and type of shutters shall be as specified. The shutters shall have a solid core and may be of decorative or non-decorative (paintable) as per IS 2202 (Part IS:) 1991. Thickness and type of shutter shall be specified. Lipping shall be done with battens of first class hard wood or as specified and of depth not less than 25mm and provided internally on all edges of shutters. Hinges shall be as specified in Bill of quantities.

Workmanship shall be as in 4.4.5.2

In the alternative, flush door of country wood frame treated with chemical impregnation and mechanical kilndried to 10-12% moisture content and core filled with web form of hexagonal cells made out of composite material of Lingo cellulosive fibers (for internal use); filled with water resistant low density fibre board (for external use) and provided with rails and styles of not less than 50mm in suitable locations for fixing locks, etc.

4.4 Panelled Shutters

Materials shall be as specified in 4.2.1.1 to 4.2.1.3

Paneled or glazed shutters for doors, windows, ventilators and cupboards shall be constructed in the form of timber frame work of stiles and rails with panel inserts of timber, plywood, block board, veneered particle board, fibre board wire gauge or sheet glass, the shutters, single or multi-paneled as shown in the drawings or as directed by the project thickness of shutters shall be as specified. All members of the shutter shall be straight without any wrap or bow and shall have smooth well planed face at right angles to each other.

Any wrap or bow shall not exceed 1.5mm. the right angle for the shutter shall be checked by measuring the diagonals and the difference between the two diagonals should not be more than $\pm$ 3mm.

4.4.1 Frame work

Timber for stiles and rails shall be of the same species and shall be sawn in the directions of grains sawing shall be truly straight and square. The timber shall be planned smooth and accurate to the required dimensions. The stiles and rails shall be joined to each other by plain or haunched mortice and tenon joints and the rails shall be inserted 25mm short of the width of stiles. The bottom rails shall have double tenon joints and for other rails single tenon joints shall be provided. The lock rails of door shutter shall have its centre line at a height of 800mm form the bottom of the shutters unless otherwise specified. The thickness of each tenon shall be approximately one-third the finished thickness of the members and the width of each tenon shall not exceed three times its thickness.

4.4.2 Paneling

The panel inserts shall be either framed into the grooved or housed in the rebate of stiles and rails. Timber, plywood, hardboard and particle board panels shall be fixed only with grooves. The depth of the groove shall be 12mm and its width shall accommodate the panel inserts such that the faces are closely fitted to the sides of the groove. Panel inserts shall be framed into the grooves of stiles and rails to the full depth of the groove leaving on space of 1.5 mm. Width and depth of the rebate shall be equal to half of the thickness of stiles and rails. Glass panels, asbestos panels wire gauge panels and penal inserts of cupboards shutters shall be housed in the rebates of stiles and rails. For all paneled door, I.S. 1003 / 1991 to be followed.

4.4.3 Timber panels:

Timber panels shall be preferably made of timber of large width, the minimum width and thickness of the panel shall be 150mm and 15mm respectively, unless otherwise specified. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooves joint glued together and reinforced with headless nails at regular intervals not exceeding 100mm. Depth and thickness of such joint shall be equal to one-third of thickness of panel. The panels shall be designed such that no single panel exceeds 0.5 square meter in area. The grains of timber panels shall run along the longer dimensions of the panels. All panels shall be of the same species of timber unless otherwise specified.

4.4.4 Glass panels

(If any) Glass Paneling (Glazing) shall be done with float glass of ordinary quality as specified. Glazing in the shutters of doors, windows and ventilators at bath, WC and lavatories shall be provided with frosted glass the weight of which shall not be less than 10 kg/sq.m. Frosted glass shall be fixed with frosted face on the inside. Glass panels shall be fixed by providing a thin layer of putty conforming to IS: 419 applied between glass pane and all along the length of the rebate and also between glass panes and wooden beading. Glass shall be free from flaws, scratches, cracks, bubbles.

4.4.5 Particle Board flush shutter

Particle board flush shutter shall in general conform to IS 2202

4.4.5.1. Materials

4.4.5.1.1. Particle Board

Particle board shall conform to IS 3097 and shall be three layer flat pressed teakwood based and of exterior grade (Grade-I) type-1 BWP(Boil water proof) type, bonded with phenol Formaldehyde synthetic resin conforming to IS 848.

4.4.5.1.2. Veneeers

Veneers shall conform to class-1 of IS 303 and (BS 476 Part-7)

4.4.5.1.3. Teakwood

Specification of Teakwood shall be same as specified in Clause 4.2.1.1

4.4.5.1.4. Hinges

Hinges shall be as provided in BOQ. Size of hinges shall be in accordance with shutter width and as per IS 205.

4.4.5.2 Workmanship

The particle board of required size and thickness shall be lipped on all the edges with T-type, teakwood lipping. The overall board lipping composition shall be of uniform and specified thickness and shall be properly sized in view of the operation of shutter.

All the four edges of the door shutter shall be square. The shutter shall be free from twist or warp in its plane. In case of double leaf shutters, the meeting of the stiles shall be rebated by one third the thickness of shutter. The rebating shall be splayed.

The shutter then shall be veneered on both faces by gluing approved shade and textured commercial type 0.5mm thick veneering conforming to class I of IS 303.

The veneering shall be done by gluing the veneer with BWP type, phenol formaldehyde synthetic resin conforming to IS 848 by hot press process on the shutter. Workmanship and finish of the veneering shall conform to IS 303.

The exposed surfaces of the lipping of the edges, shall be French polished in accordance with material specification no 10.

The shutter shall be fixed to the door frame, by means of hinges @ minimum 3 hinges per lead, maximum spacing of hinges being 600 mm or a per drawing with suitable sized screws.

The shutter when fitted to the frame shall satisfy all operational aspects of the door like smooth movement, proper closing against the door frame etc.

4.4.6 Medium density fibre board panel shutter

MDF board paneled shutter shall in general conform to IS 1003

4.4.6.1 Materials

4.4.6.1.1 MDF - board

Medium density fibreboard shall conform to IS 12406 Exterior grade (EGSB). It shall be dense, homogeneous and manufactured from agro based lignocellulosic fibres bonded with BWP type phenol formaldehyde synthetic resin conforming to IS 848. It shall be categorized as class I for 'Surfaces of very low flame spread' as per IS-1642.

4.4.6.1.2 Teakwood

Specifications of Teakwood shall be same as specified in clause no. 4.2.1.1

4.4.6.1.3. Synthetic enamel paint and primer

Specification of synthetic enamel paint and primer shall be same as specified in material specification no.10.

4.4.6.1.4. Hinges

Specification of hinges shall be same as specified in clause 4.4.1.2

4.4.6.2. Workmanship

Teakwood stiles top rail and bottom rail of specified thickness and size shall be provided with suitable rebate.

The MDF board shall be fitted in by means of teakwood moulded beading of appropriate cross section. The beading shall be fixed by means of approved make neoprene based adhesive and nailing.

All the four edges of the door shutter shall be square. The shutter shall be free from twist or warp in its plane. In case of double leaf shutters, the meeting of the stiles shall be rebated by one third the thickness of shutter. The rebating shall be splayed. The surface of the teakwood stiles and rails shall be coated with 2 layers of approved quality polyurethane transparent coat with stainer to achieve the desired shade.

The shutter shall be fixed to the door frame by means of hinges @ minimum 3 hinges per leaf, maximum spacing of hinges being 600 mm or as per drg. with suitable sized screws.

The shutter when fitted to the frame shall satisfy all operational aspects of door like smooth movement, proper closing against the door frame etc.

The joints between stiles / rails and the panel shall be properly finished. Extra neoprene adhesive shall be removed and no gap between panel and stiles / rails shall be permitted. Any stain of paint on the panel surface shall be properly removed.

4.4.7 Glazed wooden door shutter

4.4.7.1 Materials

4.4.7.1.1 Wood

Teakwood for various members like stiles, rails, etc. shall be as specified in clause no. 4.2.1.1

4.4.7.1.2 Glazing

Glass sheets for glazing shall be (i) 4mm thick plain glass (wt. 7.2 kg. / sqm) conforming IS 2835. or ii) 5.5mm thick wired glass conforming to IS 5437 or (iii) 6.3mm thick laminated glass conforming to IS 2553 as the case maybe as per items description or iv) 5.5m thick toughened glass.

Glass sheets shall be free from flaws, scratches, cracks, bubbles etc.

4.4.7.1.3. Hinges

Hinges shall be a specified in clause 4.4.5.1.4

4.4.7.2. Workmanship

Teakwood stiles and rails of size as specified in item description shall be cut accurately and planned smoothly to required dimensions as per drawing. The stiles and rails shall be provided with rebates for fixing the glazing and shall be jointed together to form the profile of the shutter as per drawing. The joinery work shall be approved by Engineer-in-charge. Only after such approval the joints shall be coated with white lead, pressed and secured by hardwood pins of about 6mm dia. All the four edges of the shutter shall be square. In case of double leaf doors, rebates shall be provided at the meeting of stiles. Rebates shall be splayed type and one third the thickness of the stiles.

The glass sheets for glazing shall be fixed by teak wood beading having mitred joints as per drawings and shall be fixed by means of approved neoprene based adhesive and nailing, the spacing between the nails being no more than 300mm.

All wooden surfaces shall be coated with 2 coats of approved make polyurethan with stainer mixed to achieve desired shade.

The shutter shall be fixed to the door frame, by means of hinge @ minimum 3 hinges per leaf, maximum spacing of hinges being 600mm or as per drg. with suitable sized screws.

The shutter when fitted to the frame shall satisfy all operational aspects of the door like smooth movement, proper closing against the door frame etc.

4.4.8 Flymesh shutter for door and window

Specifications for Flymesh shutter shall be similar to specification for wooden glazed door, excepting following features:

In place of glass,net of galvanished MS wire-mesh of IS gauge designation 856 wires and dia 0.56mm shall be fixed to the shutter frame with teakwood beading as per drawing

Flymesh shutter shall be for both doors as well as windows

All wooden surface shall be painted with synthetic enamel paint of approved shade in two coats over a priming coat in place of french polishing.

4.5 Measurement and Rate

Wood work in door / window frames shall be measured in cum.

Door / Window shutters shall be measured in Sq.m.

Hardwares and fitting like locks, kick/push plates, tower bolts, door closer etc. shall be paid on actual numbers provided. Length and width shall be measured to the nearest 0.01m area and volume shall be worked out to the nearest 0.01 sq.m and 0.001 cum.

Rate shall include all materials, labour, erection, protective measures, transport, conveyance, storage and other incidental expenditures as required for completion of the items.

4.6 Steel doors, windows, ventilators, rolling shutters & M.S. Grills etc.,

Steel used in the manufacturer of rolled steel sections shall not have more than 0.060 per cent of sulphur and 0.065 per cent of phosphorous. The carbon content shall not exceed 0.30 percent and shall be of weldable quality. In all other

respects, the rolled steel sections shall conform to I.S. 226-1955 and I.S.1977-1962. All steel doors, windows and ventilator must be as per I.S. 1038 / 1983. (Third revision)

Frames shall be square and flat. Both the fixed and openable frames shall be constructed of sections which have been cut to length, mitred and electrically welded at corners. Sub-dividing bar units shall be tenoned and rivetted into the frames. All frames shall have the corners welded to true right angles and welds shall be neatly cleaned off. Couplings, mullions, transom as directed by Engineer-in-charges.

Outer frames shall be provided with fixing holes centrally in the web of the sections and fixing screws and lugs shall be used for fixing the frame to masonry. Mastic cement shall be used for making the joints watertight.

Hinges shall be strong of projecting type. If directed friction type hinges shall be used in which case windows shall not be fitted with peg stays.

Projecting type hinged shutter shall be fitted with bronze or oxidised brass peg stays, 30cm long with pegs and brackets welded/rivetted to the frame.

All windows shall be provided with handles of oxidized brass or bronze, as may be specified.

Top hung ventilators shall be fixed with plain hinges rivetted/ welded to the fixed frame. Oxidized brass or bronze peg stay 30 cm long as in windows shall be provided.

Centre hung ventilators shall be hung on two pairs of brass of leaded tin bronze cup pivots rivetted to the inner and outer frames of the ventilators to permit the ventilator to swing through an angle of approximately 85 degrees. The opening positions of the ventilator shall be so balanced as to keep it open at any desired angle under normal weather conditions. A bronze spring catch shall be fitted in the centre of the top bar of the ventilator for operation of the ventilator. This spring catch shall be secured to the frame with brass screws and shall close into a mile steel malleable iron catch plate rivetted or welded to outside of the outer ventilator frame bar. A brass cord pulley wheel on mild steel or malleable iron brackets shall be provided along with cord eye.

The windows and ventilators shall be painted. All the steel surfaces shall be thoroughly cleaned free of rust, scale or dirt and millscale by picking or phosphating and before erection painted with one coat of approved primer and after erection with two finishing coats of synthetic name paint of approved shade and quality.

Glazing of specified thickness shall be provided on the outside of frames and unless otherwise specified, metal beadings of approved shape and section shall be used for fixing glasses. Special metal sash putty of approved make shall be used, if directed.

4.7 Rolling shutters :

Shall be of approved manufacture suitable for fixing in the position ordered i.e. out side, inside on or below lintel or between jambs. Shutters upto 12 sq.m (130 sq.ft) in area shall be manually operated, of 'Push up' type while bigger sizes shall be of reduction gear type mechanically operated by chain or handles unless otherwise provided in the schedule of quantities.

These shall consist of 8 gauge or as specified with 75mm (3") M.S. laths of best quality mild steel strip, machine rolled and straightended with an effective bridge depth of 16mm (5/8") and shall have convex corrugations. These shall be inter-locked together throughout their entire length with end locks. These shall be mounted on specially designed pipe shaft.

Springs shall be of approved make, coiled type. These shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in position. The spring pile shaft etc., shall be supported on strong MS or malleable cast iron brackets.

Both the side guides and bottom rail shall be jointless and Of single pieces of pressed steel.

Top cover of shaft, spring etc., shall be of the same material As that of lath.

For rolling shutter with wicket-gate night latch shall be provided free of cost.

The shutter and cover etc., shall be painted with one coat of Anticorrosive paint before fixing and two coats of synthetic enamel Paint of approved quality and shade, after fixing in position. All metal rolling shutters must be as per I.S. 6248 / 1979 (first revision)

4.8 Collapsible steel gate:

It shall consist of vertical double channels at 10cm centres. The sizes of channels/T-sections for top and bottom shall be as approved by the Engineer-in-charge. The gate shall be provided with necessary bolts, nuts, locking arrangements, stoppers and brass handles, on both sides. The gate shall be painted with one coat of anticorrosive paint before erection and two coats of synthetic enamel paint of approved quality and shade after erection.

4.9 Wrought Iron grilles:

Grilles shall be manufactured as per drawings and the welded joints shall be smooth. The grilles shall be painted with one coat of anticorrosive paint before fixing and two coats of synthetic enamel paint of approved quality and shade after fixing.

4.10 Aluminium doors, windows, Ventilators & Partitions etc.

These shall be obtained from approved and established manufacturers and shall be of aluminium alloy conforming to IS:733 and sections shall generally conform to IS:1948-1961. These shall be fabricated as per the detailed drawings.

Frames for windows, ventilators etc., shall be square and flat. Both fixed and openable frames shall be constructed of sections which have been cut to length, mitred and welded at corners. Sub-dividing bars shall be tenoned and rivetted into frames. All frames shall have corners welded to a true right angle. For side hung shutter, hinges shall, normally be of projecting type made of aluminium alloy and rivetted/welded to frames and shall have stainless steel pins. Handles, peg stays etc., shall be of approved quality aluminium or its alloy conforming to IS specifications.

All types of shutters shall be fabricated, supplied and fixed as specified in IS:1948-1961. The rate shall include supplying and fixing all fittings and fixtures required for proper and safe operation.

The doors shall be fabricated by using Standard aluminium alloy extruded section as specified in IS 1948-1961. The rate shall include supplying, fixing and fitting fixtures including approved locking arrangements as directed. All aluminium fabrication work shall be anodised to IS 6057-1970 to give an anodic film of 15 microns unless otherwise specified.

The contractor shall take care to stack the fabricated frames etc., on site under cover. They shall be handled with care, stacked on edge on level bearers and supported evenly. Before erecting, frames coming in contact with concrete, masonry, plaster or dissimilar metals shall be coated with a coat of zinc chromate conforming to IS:104-1950. The contractor shall cover all anodized finish work with a thick layerof clear transparent lacquer based on methacrylates or cellulose butyrate to protect the surface from wet cement during installation. This coating shall be removed on completion. Before handing over, the aluminium work shall be washed with mild solution of non-alkali soap and water.

4.11 Glazing

Glazing shall be glass of approved specially selected quality and thickness as specified and unless otherwise directed it shall be provided on the exterior with metal beading.

4.12 Precast reinforced concrete door and window frames

Manufacture of precast reinforced concrete door and window frames is described here. These will conform to IS:6523 in all respects unless otherwise specified. Frames shall be manufactured in an approved factory with all necessary arrangements for fixing hinges or hinges fixed at position as specified with hole for receiving tower bolt, sliding bolt etc., as specified.

4.12.1 Shape and dimensions

Precast reinforced concrete door and window frames shall be 60 x 100mm or 70m x 75mm in cross section for single shutter and 60 x 120mm for double shutter door, cross section general conforming to architects drawings. Where specified, suitable groove for receiving wall plaster shall be provided.
The overall sizes (width and height) shall be as per drawing or as specified.

4.12.2 Materials

The materials used for manufacturing of the frames shall comply with standards given in Table I of IS:6523

4.12.3 Aggregate

The aggregate used shall be of well graded mixture of clean coarse and fine aggregates. The nominal size of coarse aggregate shall not exceed 10mm.

4.12.4 Concrete

Mix of concrete shall be as specified or as directed by the Engineer-in-Charge. But the mix shall not be weaker than M 20 controlled mix and shall be suitable for producing a dense concrete without voids after proper vibration.

There shall be a minimum of three bars of 6mm. The longitudinal reinforcement for each vertical or horizontal member shall be one piece and shall be firmly held by 3mm dia ties spaced at not more than 300mm centre to centre.

The longitudinal reinforcement shall have a maximum cover of 12mm or twice the diameter of main bar, whichever is higher.

4.12.5 Casting

The entire frame may be cast complete in one piece or each of the vertical and horizontal members of the frame may be cast arately to be assembled into the complete frame at site. When the frame is cast in separate parts, one of the reinforcing bars of the vertical members of the frame shall be kept projecting so as to tennon into the corresponding hole in the horizontal member. The holes in the horizontal member for taking the projecting reinforcement from the vertical members shall be slightly larger than the bar diameter to facilitate easy insertion of the projecting bar. After assembly at site, the holes shall be grouted with cement slurry of 1 cement: 2 coarse sand.

4.12.6 Mould

The mould for casting shall preferably be of steel to ensure better surface finish of the cast frame. Provision shall be made in the mould to accommodate fixing devices for hinges and the hold fasts. Where specified, suitable rebates may also be provided to act as plaster groove.

4.12.7 Protection and Curing

After casting in moulds, during setting and in first stage of hardening the concrete shall be protected from shocks, running or surface water and the harmful effect of frost, sunshine drying winds and cold. The concrete shall be cured for atleast 7 days unless special curing methods are adopted which shall conform to IS:6523
The frames shall be matured before testing or despatch for the following periods:

Type of cement used	Period
Ordinary portland cement, portland blast furnace slag cement Portland pozzolana cement	28 days
Rapid hardening cement (to be used with approval of Engineer-in-charge)	14 days

The frames after maturing shall have sufficient strength to prevent damage when handled.

4.12.8 Arrangements for fixing of hinges to frames

Suitable arrangements for fixing hinges shall be provided in the frame by one of the following methods as directed:

Hardwood fixture: Hardwood blocks of well seasoned teak or other suitable timber 150mm long, 45 to 50mm x 30 to 40mm in cross section, one block for each of the hinge, shall be fixed in position with 6mm mild steel bolts, nuts and washers, after the frame has been cast, cured and matured. After tightening the nuts, the bolt heads and the nuts shall be suitably covered with hard wood fillets, finished flush with concrete surfaces of the frame.

Hinge directly attached to frame: L type flap hinge may be attached directly to the frame with the help of 6mm dia mild steel bolts and nuts.

Hinge welded to frame: The hinge may be welded to 3mm thick mild steel flat embedded in a frame.

4.12.9 Arrangements for door and window fixtures

Suitable arrangements shall be provided in the frame for receiving tower bolts, sliding bolts and other door and window fixtures as indicated.

4.12.10 Fastners

Arrangements for fixing the frames with holdfasts or metallic fastners shall be provided in vertical members of frames as specified. Incast of door frame, there will be 3 nos holdfasts and in case of window, there will be 2 nos holdfasts on each vertical members in contact with the opening where the frame is to be fixed. Holes to accommodate 10mm dia bolts to be fixed to holdfasts and the nuts shall be left at appropriate locations.

4.12.1 Erection

When a three piece frame is used, the vertical members shall be held in position with top member placed over them, the whole frame plumbed and firmly supported till the concrete around the holdfasts in the masonry has properly set and hardened. Cement and coarse sand mortar slurry 1:2 shall be used in grouting the joints between the vertical and horizontal members of door frame. Incase where four members are used, the bottom member shall be first placed in position and other erected on this base.,

4.13 Hardware Fittings

All hardware fittings and fixtures shall be made with structural properties to sustain safety and withstand strains and stresses to which they are normally subjected to such as opening and closing, wind pressure etc. The fittings shall generally conform to relevant specifications.
They shall be made true, clean, straight, with sharply defined profiles and unless otherwise shown or specified, with true smooth surfaces and edges, free from defects, screw holes shall be counter sunk to suit the head of wood screws.

The metal shall be treated with finish as specified in the Bill oif Quantities.

4.14 Bath and toilet doors:

PVC doors for bathrooms and toilet are made from sizes as per drawing for main outer frame and shutter shall be made from multi chamber hollow plastic section 20mm thick and shutter outer frame shall be of extruded plastic section DWUF 302 (24mm x 59mm) with hardware fittings as per the colour approved.

Alternatively Formica/Decolam laminated 30cm wide from the bottom over one side plastic coated flush door also to be onsidered. – for external doors.

For internal doors – do- as above but the laminated sheet will be of both sides.

4.15 Fixing of glass louvers in wood / steel frame ventilators

In wooden frames angular grooves will be made as shown in the drawing and glass. Louvers will be fixed at the same angle. The glass shall be rigidly fixed with by fitting the gaps in the grooves by putty etc., and all around wooden heading shall be nailed. In addition 2/3 nos of 12mm M.S. bars will be run through frame to frame horizontally.

For steel frame:

-do- as above and the glass louvres will be fixed in the U shaped MS channels riveted to the steel main frame and frame painted with an anticorrosive primer.

4.16 Providing and Fixing Meter Box Cupboard on wall

The frame shall be of specified size and class of wood. It shall be fixed with 2 no. of holdfasts and the same may be grouted with CC 1:2:4 blocks of size 230x230x300. The shutter shall be of 19mm thick nova teak. A slit shall be provided in the shutter as directed by the Engineer-in-charge 3mm thick glass shall be fixed in the slit. Architrave shall be provided as directed by the Engineer-in-charge. Fixtures as specified shall be provided. The shutter, frame and the architrave shall be painted with 3 coats of ISI approved enamel paint.

Mode of Measurement

It shall be measured in sq.m. the outer to outer of the frame shall be measured

Balustrade and hand rails in staircase

The M.S. railing to detail in staircase and landing shall be fixed along outer edges of the flights and landings with M.S. square bars and flats of specified size as per drawing and neatly welded. The top hard rail over the top flat of the baluster may be of wood of approved quality or G.I. pipes or hollow box section as specified in the drawing which will be screwed or fitted rigidly as per the direction of Engineer-in charge .

SPECIFICATION FOR FLOORING

5. FLOORING

5.1 Flooring, Skirting, Dado & Stone Veneering

All Flooring, skirting, dado, stone veneering etc., shall be executed strictly as per relevant Specification and in workmanlike manner.

5.2.1 Preparation of surface :

Before the operation for laying is started the surface of base concrete shall be thoroughly cleaned of all dirt,loose particles, caked mortar droppings and laitance if any by scrubbing with coir or steel wire brush, where the concrete has hardended so much that roughening of surface by wire brush is not possible, the surface shall be roughened by chipping or hacking at close intervals. The surface shall then be cleaned with water and kept wet for 12 hours, surplus water being removed by mopping before the topping is laid.

5.2.2 Laying :

The screed strips shall be fixed over the base concrete dividing it into suitable panels. Before placing the concrete for topping, neat cement slurry shall be thoroughly brushed into the prepared surface of the base concrete just ahead of the finish. Concrete of the specified proportion and thickness shall be laid in alternate panels to required level and slope and thoroughly tamped. The cement concrete flooring must be as per the standard practice of Karnataka PWD Shedule under flooring items and as directed by Engineer in-charge.

5.2.3 Finishing the surface:

After the concrete has been fully compacted it shall be finished by trowelling or floating with neat cement rendering. Finishing operations shall start shortly after the compaction of concrete and the surface shall be trowelled three times at intervals so as to produce a uniform and hard surface. The satisfactory resistance to wear of the flooring depends

largely upon the care with which trowelling is carried out. The time interval allowed between successive trowellings is very important.

Immediately after placing cement rendering, only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided as this tends to bring a layer rich in cement to the surface, sometime after the first trowelling, the duration depending upon the temperature, atmospheric conditions and the rate of set of cement used, the surface shall be retrowelled to close any pores in the surface and to bring to surface excess water in concrete or laitance which shall be removed. No dry cement shall be used directly on the surface to absorb moisture or to stiffen the mix. The final trowelling shall be done before the concrete has become too hard but at such a time that considerable pressure is required to make any impression on the surface.

When instead of 1:2:3 or 1:2-1/2:3-1/2 mix, 1:2:4 mix is specifed, the topping shall be rendered with 1:1 cement mortar instead of cement only.

If directed by the Engineer-in-charge, approved mineral pigment shall be added to the rendering to obtain desired colour and shade to the flooring at no extra cost, unless otherwise provided for in the schedule of quantities.

The floor shall be machine polished as per Engineer-in-charge's instructions, if so specified in the schedule of quantities.
Wherever patent stone flooring is used as a finishing on roof the joints shall be filled with an approved bitumastic filler in workmanlike manner.

5.2.4 Ironite topping:
Instead of finishing the top with rendering coat of 1:1 cement mortar, the flooring shall in this case be finished with 12mm ironite topping. Unless otherwise specified, one part of ironite and four parts of ordinary cement by weight shall be mixed dry thoroughly. This dry mixture shall be mixed with stone grit 6mm (1/4") and down size or otherwise directed in the ratio of 1:2 by volume and well turned over. Just enough water shall be added to this dry mix and the thoroughly mixed composition shall be laid and compacted to uniform thickness of 12mm. After initial set has started the surface shall be finished as directed.

5.3 Plain and colored cement tile, marble mosaic and Terrazzo tile - flooring:
The tiles shall conform to IS: 1237 1980, having the colour approved by the Engineer-in-charge and the rate shall include provision of border tiles and tiles of different colours in pattern if directed, the mosaic topping of lighter shade tiles shall be made of white cement with an approved shade pigment and neutral shade tiles shall be of grey cement with an approved shade pigment. The type of tiles shall be as specified in respective items.

The sub-grade shall be thoroughly wetted after cleaning it off of 'all dirt, laitance and loose material. A bed of lime mortar consisting of one part of lime and two parts of sand shall be laid and properly levelled to an average thickness of 20mm and the surface shall be kept slightly rough to form a satisfactory key for tiles. Neat cement paste of honey like consistency shall be spread over mortar bed, over such area at a time as would accommodate about 20 tiles. Tiles which had been soaked in water for 15 minutes and allowed to dry for the same duration shall then be fixed with a thin coat of cement paste at the back of each tile, which shall be then gently tapped with a wooden mallet till it is properly bedded and is level with adjoining tiles. Joints shall be fine and as imperceptible as possible.

After the tiles have been laid in a room or a day's fixing work is completed, surplus cement grout that may have come out of the joints will be wiped off gently and the joints cleaned. A thin slurry of coloured cement matching the colour of tiles shall be spread over and rubbed so as to seal even the thinnest joints between the tiles and make the floor surface impervious. The flooring shall be cured for 7 days. The tiles shall then be polished and finished according to IS:1443 - 1972.

5.4 Dado, Skriting and Risers:
Tiles shall conform to IS:1237 - 1980 and shall be of approved design. The tiles shall be fixed with neat cement grout on a backing coat consisting of 1:4 cement sand plaster, 12mm thick. The top and bottom junctions of tiles shall be rounded off neatly as directed. The joints shall be filled with matching coloured cement slurry of matching shade. The surfaces shall be kept wet for 7 days and then polished with carborundum stone of different grades to obtain smooth surface and fine polish.

5.5 Shahabad/Tandur/Cuddapah Stone flooring:
The floor shall be either with rough or machine cut and machine polished stones as specified in respective items of specified thickness and of approved quality and size, free from cracks and flakes and uniform in colour, with straight edges. The sides of machine cut and machine polished stones shall have perfect right angles and smooth surface. The stone slabs shall be laid and finished as described under plain cement or coloured tiles on bedding of 1:2 lime mortar of 20mm thickness. This finished stone surface thus laid shall then be polished to the required degree as approved by the Engineer-in-charge.

5.6 In dado, skirting, risers etc.:
Stone slabs shall be laid on a backing plaster of cement mortar 1:4, 12mm thick and finished as described under plain and coloured cement tile dado.

Marble Mosaic/Terrazzo in-situ work in flooring, dado, skirting etc.,:

5.7 The terrazo/mosaic (finish) topping shall consist of a layer of marble chips of selected sizes, colour and design approved by Engineer-in-charge, mixed with cement with the desired shade of pigment and shall be laid on an under layer of thickness as specified in the respective items.

5.8 For lighter shade mosaic/terrazzo white cement shall be used; for neutral shade, grey cement shall be used. The proportion of terrazzo mix shall be three parts of cement and one part of marble powder by weight. For every part of cement marble powder mix, the proportion of marble aggregate by volume shall be 1-1/2 parts unless otherwise specified.

5.9 The topping shall be mixed and laid in panels as described in IS:2114-1962 and as per decorative designs prepared by Engineer-in-charge. The dividing strips of panels shall be Aluminium or as specified in the schedule of quantities. It shall be polished as specified in IS:2114 - 1962.

5.10 Marble flooring:

Marble slabs shall be of the best Indian marble of white or other approved colour as specified in the item. They shall be hard, dense uniform and homogeneous in texture. They shall have even crystalline grains free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and edges machine out true to square. The rear surface shall be rough enough to provide a key for the mortar.

No slab shall be thinner than the specified thickness at its thinnest part, the sizes of the slabs being as specified n the respective items.

The slabs shall be laid as described under mosaic tile flooring in every respect.

5.11 White glazed tiles in flooring and dado:

White glazed tiles from an approved manufacturer conforming to IS: 777-1970 shall be used. They shall be of specified size and thickness. All specials viz, covers, internal and external angles, corners, beads, etc., shall be used wherever directed. Underlayer of specified thickness and mortar of stipulated proportion shall be laid as described in marble mosaic flooring. Tiles shall be washed clean and set in cement grout, each tile being gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern. After the tiles have been laid, surplus cement grout shall be cleaned off.

The joints shall be cleared with a wire brush or trowel to a depth of 5mm (3/16") and all dust and loose mortar removed. Joints shall, then be flush pointed with white cement. The floor shall be kept wet for seven days. After curing, the surface shall be washed with mild hydrochloric acid and clean water. The finished floor shall not sound hollow when tapped with a wooden mallet.

5.12 Marble in facia or dado:

Marble slabs of approved shape, variety, size and thickness as specified in the item shall be used. They shall be of selected quality, dense, uniform and homogeneous in texture and free from cracks or other structural defects. The exposed face shall have no veins or unsightly stains and defects. The slabs shall be of uniform milky white or coloured shade or of patterns of colours approved by Engineer-in-charge. Samples shall be got approved by the Engineer-in-charge before ordering the slabs. The surface shall be fine polished and sides machine cut, true to square.

When a single course of marble slab is to be fixed as in dado etc. the slabs shall be fixed and described below:

Stainless steel clamps to be provided at all joints. Detail Drawings for stainless steel clamps will be issued by Engineer-in-charges.

Mortar pads of 1:2 CM of uniform width shall be stuck on to the wall at close intervals and the marble slabs shall be pressed onto them firmly. The remaining cavities if any, shall then be filled with thin grout of cement mortar of the same proportion. The sound emanating from the slabs on gentle tapping will indicate if there are hollows. When the hollow cannot be filled with grout and the finished slab continues to give a hollow sound on tapping, the slab shall be removed and reset.

For facia work where more than one course is required, the marble slabs shall be fixed in the same way as described above except that at horizontal joints of the slabs, adjacent slabs shall be held together by wrought iron/copper pins passing through holes drilled into the slabs. In addition, wrought iron/copper holdfasts/dowels shall be provided to anchor the slabs to the wall. The holdfasts shall be counter-sunk into the joints of the slabs and shall be located about a metre apart subject to a minimum of one for each horizontal joint.

The facing shall be fixed truly in plumb and in perfect line or curves as shown on the plans. The courses and joints shall be as directed by Engineer-in-charge. The surface shall be protected from sun and rain and cured for ten days and shall be finally polished.

The rate shall include cost for erecting and removing double scaffolding, equipment etc.

5.12.A Polished or tool finished granite/malad/sand stone:

The facia stone/slab shall conform to the specifications under "Materials" and it shall be erected as shown on the drawing or as directed by Engineer-in-charge.

The stone or stone slab shall be of size as shown on the drawing or as directed by the Engineer-in-charge. The exposed faces, full beds and joints shall be dressed/finished as directed. The joints shall be cut square to the face and shall be at right angles to each other or as directed. The facing shall be fixed in cement mortar truly in plumb and in perfect plane, straight or curved as shown on the drawing, the bed being fully flushed with mortar. The joints shall be exactly vertical and horizontal. The thickness of joint shall not exceed 1mm to 1.5mm for machine polished/fine tooled/close punched and chisel dressed work. The stones shall break joints for about half the height of the course. Courses shall be as shown on the drawing or as directed. The gap between the facing stone and the wall shall be filled with either 1:2:4 concrete or 1:2 cement mortar. Wrought iron/ copper pins and holdfasts shall be used wherever directed; lead caulking shall be used for fixing holdfasts. The surface shall be protected from sun and rain, and cured for ten days.

The face shall be finished as specified or as directed after filling the joints with matching shade cement/ cement mortar of 1:1 proportion mixed with approved water proofing material.

The rate shall include cost for double scaffolding.

5.13 Vitrum tiles:

Tiles of colours and design as shown on the drawing or as directed by the Engineer-in-charge shall be used. They shall be fixed and finished strictly as per manufacturer's specifications and as directed. The rate shall be inclusive of cost for double scaffolding, equipment etc.

5.14 Oxy-Chloride flooring:

Oxy-Chloride flooring shall be laid strictly in accordance with IS:658 - 1982.

Materials for flooring shall be obtained in two parts viz. dry mix and magnesium chloride. The proportions of the dry mix to the gauging solution and the strength of the latter shall be as furnished by the manufacturer of the dry mix.

All mix used in the manufacture of dry mix and magnesium chloride shall comply with the requirements of IS:657-1982.

The sub floor shall be roughened to a suitable degree by chiseling, pickling or by any other suitable process and cleaned thoroughly, freed from dust, dirt, grease etc. before the oxychloride composition is laid. The cleaned surface shall be dampened with the solution of magnesium chloride of specific gravity 1.08 to 1.10. The wet mix prepared as per manufacturer's instructions shall be laid, in two layers and in panels defined by screed patterns and the surfaces finished as directed.

When marble mosaic finish is specified the surface shall be machine polished:

5.15 Vacuum dewatered flooring:

The operation described are specialist operations. The specification/procedure suggestion by such operations shall be generally in conformity with the specifications given here.

Sub-grade: Prepare surface, remove vegetation/ loose soil consolidation for the top layer and lay 230mm hard granite stone soling closely packed and the interstices filled with binding material and thoroughly watering and consolidating by a heavy roller to a consolidated thickness of 230mm and bind the top surface.

Sub-base: Lay cement concrete 1:4:8 150mm thick using 2.5cm max. size granite stone jelly.

Structural slab:

The side rail forms are set to the required level and spacing suited to the width of panel required.

Reinforcement mat and also the dowel bars which act as load transfer device across the joints is then placed. Concrete of required grade and consistancy is then placed in between the rail forms and then vibrated with poker vibrators.

Vibrated concrete is then levelled and surface vibrated with surface vibrator.

Filter pads and suction mat are then placed over the concrete surface and connected to a suction pump by means of a hose. As soon as the pump is started a vacuum is created between the top cover and the fresh concrete surface.

Immediately after vacuum dewatering the surface is power floated with a skim floater. If hard top and wearing course is specified on top of vacuum dewatered surface power floating is to be carried out after the application of hard top.

5.16 Providing and laying ceramic tiles in flooring, skirting and dado

The ceramic tiles in flooring and dado shall be of first class quality as specified in the item specification and shall be approved by the Engineer. The tiles shall be of standard size without warp and with straight edges, true and even in shape and size and of uniform colour. The tiles surface shall be of fine grained texture, dense and homogeneous. The thickness of the tile shall be as per the item specification. The tiles shall be submerged in water till the bubbles cease.

The flooring should be laid on a base as specified in schedule item. They shall be laid truly vertical on walls and truly horizontal on floors or to slopes as directed. The joint shall be very thin, uniform and perfectly straight. The tiles in dado shall be finished in such a way that, only the tile thickness projects over the finished plaster or as specified otherwise. Where full tiles are not possible, the same should be cut or sawn to the required size and their edge rubbed to ensure straight and true joints. After the tiles are laid extra cement grout shall be removed. The joints shall be cleaned with wire brush and then the joint shall be floated with white or grey cement as approved by the engineer. The tiles shall be cleaned after the work is complete.

This shall be measured in sqm. The rate quoted for flooring and dado work shall be inclusive of angles and corner pieces, cutting tiles for water points, such away that the point is in the junction of four tiles, electrical points etc.

5.17 Providing and laying polished green kota stone flooring:

Stones shall be of approved quality, size and uniform thickness, edges shall be chisel dressed and the top surfaces shall be machine polished with joints running true and parallel from side to side. Stones shall be laid on a bed of cement or lime mortar. The pattern of the flooring shall be as per the architects drawing. Thickness of mortar bedding shall be as specified in the item specification. The stone slabs shall be thoroughly wetted with clean water. Neat cement shall be spread over the mortar bed and the slabs shall be placed one by one, keeping in check the level and line of the flooring. The slabs are then gently tapped with wooden mallet till it is firmly and properly bedded. There should be no voids left. The joints should not be more than 2mm thick. The joints should be struck smooth. If specified terrazo filling of specified thickness shall be done in the joints between the kota stone slabs. The floor should be kept covered with damp sand or water for a week. Slabs should be of sizes as specified. The stone shall be machine polished and then cleaned with oxalic acid. If the contractor is asked to mop the floor with kerosene and water by the Engineer, the same shall be done without any extra cost. This shall be carried out daily atleast for 10 times for 7 days.

5.17.1 Mode of measurement

This shall be measured in sqm. The rate shall include providing and laying, curing, machine polishing, cleaning etc., complete.

5.18 Providing and laying kota stone in skirting and dado:

The stone shall be of required sizes and the thickness shall be as mentioned in the item specification. The stones shall be pre-polished and mahcine cut. The stone's edges shall be dressed fine true, straight and at right angles to each other. The stones shall be fixed over cement mortar bed 1:4 (1 cement: 4 coarse sand). The joints are filled with ordinary cement and its hand and wax polished. The joint between the top of skirting/dado and plaster shall be finished properly. The joints in the flooring shall be continued in the skirting/dado also. The work shall be cured properly.

5.18.1 Mode of measurement

This shall be measured in sqm. The triangle skirting of staircase shall also be paid under this item. If mopping of the kota stone is asked to be carried out instead of wax polishing the same shall be carried out without extra cost.

5.18.A Providing and laying granite in flooring, skirting and dado:

The approved quality of acid and alkali preventive primer shall be applied uniformly in two coats over the slab or the concrete surface. The acid-alkali proof powder shall be mixed with the cement in the proportion 2:1 (2 cement: 1 powder) or as per the manufacturers specification. The cement-powder mix and the sand shall be mixed in the ratio 1:3 and the mortar shall be prepared. The stones shall be laid on the mortar bed in level and line with even thickness of 6mm to 10mm joints all around.

The joints shall be raked to 12-19mm deep and filled with epoxy based resin. The resin is mixed with quick drier and acid-alkali proof powder. As the resin is an atmospheric hardening agent, it does not require curing. The work place shall be kept dry for the joint filling operation. The stones shall be either hand polished or machine polished cleaned with oxalic acid and then wax polished.

5.18.A.1 Mode of measurement

The work shall be measured in sqm or part thereof. The rate shall include providing and laying of stones as described above. Nothing extra shall be paid for cutting holes in the stones, machine cutting of edges, stones for steps and risers etc.,

5.19 Granite Tiles Flooring

Granite Tiles shall be approved colour and quality. They shall be of 10mm 23thick mirror polished and machine cut. The tiles to be used shall be as laid down in the drg. Or as directed by the Engineer. The angles shall be right angles and all edges shall be straight and true.

5.20 Granite tile skirting

Specification of granite tiles for skirting shall be same as for granite floor tiles. Joints shall be raked out to a depth of 15mm in masonry walls. The surface shall be thoroughly cleaned, washed and kept wet before laying 12mm thick cement mortar 1:3 (1 cement; 3 coarse sand). Cement plaster shall be allowed to harden. The plaster shall be roughened with wire brushed. Tiles washed clean shall be set in bedded mortar with a liberal coat of cement slurry at the back of tiles. These shall be tapped and corrected to proper plan and line. Joints shall be as thin as possible. Top of skirting shall be truly horizontal. Joints shall be cleaned of grey cement slurry and then be flush pointed with white cement added with matching pigment. It shall be paid in running metre measuring correctly to nearest centimeter.

5.21 Granite slab over kitchen counter:

Granite slab shall be of jet black shade and of approved quality. They shall be of 18mm thick machine cut and mirror polished. They shall be laid over RCC slab. The angles shall be right angles and all edges shall be straight and true. Joints shall be permitted when the length is more than 2 metres. Number of joints in each direction shall not be more than one number of every 2mtrs. Length beyond the initial 2 mtrs. Length. No joints shall be permitted in the direction of width.
Mortar bed shall be of cement mortar. The mortar will be of ration 1:4 (1 cement and 4 coarse sand). After properly cleaning and wetting the base, the mortar shall be evenly and smoothly spread over the base by the use of screed battens. The average thickness of the mortar bed shall be 20mm. The granite slab shall be wetted before placing in position
And leveled. The joints shall be paper thin joint. Joints shall be treated with white cement mixed with matching pigment. The exposed edges of the granite slab shall be rounded/edge polished as shown in drg.
The facia shall also be of the same quality, but of 10 mm thick as the slab over the counter and fixed with brass clips and adhesive over a base mortar of 12mm thick in cement mortar 1:3 (1 cement 3 coarse sand) the joints shall be paper thin. The slab and the facia shall be rubbed clean and polished with steel wool to give a smooth and shining surface. The slab over the counter and tiles facia shall be measured individually in sq.mts

SPECIFICATION FOR PLASTERING AND POINTING

Plastering and Pointing

6.1 Materials

Cement, sand, water and combinations shall conform to material specifications given in 2.0 to 2.2

Workmanship

6.2.1 Preparation of background surface:

The surface shall be cleaned off all dust, loose mortar droppings, traces of algae, efflorescence and other foreign matter by water or by brushing. Smooth surfaces shall be roughened by wire brushing or hacking for non-hard and hard surfaces respectively. Projections on surface shall be trimmed wherever necessary to get even surfaces. In case of brick/stone masonry, raking of joints shall be carried out wherever necessary. The masonry shall be allowed to dry out for sufficient period before carrying out the plaster work, the masonry shall not be soaked but only damped evenly thereafter before applying the plaster.

Incase of concrete work, projecting burrs of mortar formed due to the gaps of joints in shuttering shall be removed. Such surface shall be scrubbed clean with wire brushes. The surface shall be pock marked with a pointed tool at spacing of not more than 50mm centers, the pocks being made not less than 3mm deep to ensure a proper key for the plaster. The surface shall be washed off and cleaned of all oil, grease etc., and well wetted before the plaster is applied.

Sequence of Operations
For external plaster, the plastering operations shall be started from the top floor and carried downwards. For internal plaster, the plastering may be started wherever the building frame, roofing, and brickwork are ready.

The surface to be plastered, shall first be prepared as per BIS

The first underlay shall then be applied to ceilings. After the ceiling plaster is complete and scaffolding for the same removed, plastering on wall shall be started.

After a suitable time interval as detailed under various types of plaster in subsequent paras, depending upon the type of mortar, the secondary layers if required shall be applied. After a further suitable time interval as detailed under various type of plaster in subsequent paras, the finishing coat shall be applied first to the ceiling and then to the walls.

Plastering of cornices, decorative features, etc., shall be completed before the finishing coat is applied. Unless otherwise specified corners and edges shall be rounded off to a radius of 25mm, such rounding off shall be completes along with the finishing coat to prevent any joint marks showing out later.

Scaffolding/staging
Scaffolding/staging for plastering/pointing shall be as per Specification for Brick masonry, clauses

Damage rectification
Any cracks, damages, any part of work which sound hollow when tapped or found damaged or defective otherwise shall be cut out in rectangular shape and redone as directed by Engineer-in-charge.

Plain Cement Plaster

Preparation of Mortars:

The mortars of specified mix shall be used as per the specifications of 'Cement Mortar' described in BIS

Application of Plaster

One layer plaster work

To ensure even specified thickness, plaster of 150mm x 150mm shall be first applied horizontally and vertically at not more than 2 meter interval over the entire surface to serve as gauges. The surface of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall be brought to true surface by working with a wooden straight edge reaching across the gauges with small upward and sideways movements at a time. Finally the surface shall be finished off true with a trowel or wooden float to obtain a smooth texture. Excessive trowelling or overworking the float shall be avoided. All corners, arises, angles and junctions shall be truly vertical, horizontal and shall be carefully finished. Rounding or chamfering of corners, arises, junctions etc., shall be carried out with proper templates to the size required.

In suspending the work, the plaster shall be left, cut clean to line, both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped clean and wetted before plastering the adjoining area. Plastering work shall be closed on the border of the wall and nearer than 150mm to any corners or arises and shall not be closed on the body of the features such as plaster bands, cornices nor at the corners or arises.
Two layer plaster work

First or under layer
The first or underlay of the specified thickness shall be applied as described in BIS Before the first coat hardens, surface of it shall be beaten up by edges of wooden tapers and close dents shall be made on the surface.

The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days depending upon weather conditions. The surface shall not be allowed to dry during this period.

Second or finishing layer
The second layer shall be complete to the specified thickness in the same manner as for first layer

Curing
Curing shall be started 24 hours after finishing the plaster. The plaster shall be kept wet for a period of 7 days. During this period, the plaster shall be suitably protected from all damages at the contractor's expense by such means as approved by the Engineer-in-charge. The date of execution of plastering shall be marked on the plastering to ensure the proper duration of curing.

Sand face plaster

Preparation of mortar
The mortar of specified mix shall be used as per the specifications of cement mortar/described in BIS

Application of Plaster
Sand face plaster shall consist of 13mm thick (1 cement: 4 coarse sand by volume) under layer and 7mm thick (1 cement: 2 coarse sand by volume) top layer. Application of plaster shall be as described in BIS

The surface of the sand face plaster shall be finished rough with sponge or as directed by the Engineer-in-charge.

Curing
Curing shall be as described in BIS

Exposed aggregate finish plaster

Preparation of mortar
The mortar of specified mix shall be used as per the specifications of cement mortar described in BIS. White and coloured marble chips shall be of 6mm to 12mmm size out of Makrana/Ambaji, grade 1 or Dongri Chittor Brown/Rajnagar/ abu green grade-1 quality. Marble dust shall be obtained from crushing hard marble stone, it shall not be less than 1.0

Application of Plaster
Exposed aggregate finish plaster shall consist of 12mm thick plain cement plaster under layer (1 cement: 4 coarse sand by volume) finished rough and 20mm thick top layer (Under layer shall be applied in accordance with 'One layer plaster work' described in BIS)

Top layer shall be 20mm thick admixture of white cement and grey cement (mix ratio 1:1 by volume) mixed with white/coloured marble chips/pebbles of 6mm to 12mm nominal size as per item description. Mix ratio shall be 1 cement: 1 marble chips/pebbles by volume. Marble dust @ 15% by volume shall be added to the admixture. The pebbles to be used shall be well washed and drained. The admixture shall be thrown wet on the under layer while it is still plastic using strong whipping motion at right angles to the face of the wall. One coat of neat cement slurry @ 2.75 kg cement per square meter of area shall be applied on to the under layer to receive the top layer. The whole plastering laid in panels as per drawing with 12mm x 20mm grooves in between formed by holding removable wooden battons of 12mm x 25mm size over the under layer.

The top layer admixture pressed flat over the under layer filling uncovered parts by hand, so that the finished surface represents a homogeneous surface. Loose mortar etc., on the top surface shall be cleaned/removed by brushing/washing/spraying with water jet after initial setting of mortar.

Curing
Curing shall be as described in BIS

Pointing
Pointing shall be of the type specified such as flush, cut or weather struck, raised and cut etc.,

Preparation of base surface
The joints shall be raked to such a depth that the minimum depth of the new mortar measured from either the sunk surface of the finished pointing or from the edge of the brick shall be less than 20mm.

Mortar
Mortar shall be in accordance with the specifications of cement mortar described in BIS

Application of mortar and finishing
The mortar shall be pressed into the raked out joints with a pointing trowel according to the type of pointing specified, the mortar shall be spread over the corner edges or surfaces of the masonry. The pointing shall then be finished with the pointed tool. The superfluous mortar shall be cut off from the edges.

Flush pointing
The mortar shall be pressed into joints and shall be finished off flush and levelled. The edges shall be neatly trimmed with trowel and straight edges.

Cut or Weather struck pointing
The mortar shall first be pressed into joints, the top of the horizontal joints shall then be neatly pressed back by about 15mm with the pointing tool so that the joint is sloping from top to bottom. The vertical joint shall also be similarly pointed. The junctions of vertical joints with the horizontal joints shall be at true right angles incase of brick and coursed rubble masonry.

Raised and cut pointing
This type of pointing shall project from the wall facing with its edges cut parallel so as to have a uniformly raised band about 6mm and width 10mm more as directed. The pointing shall be finished to a smooth but hard surface.

Curing
Curing shall be as described in BIS

Measurement and Rate
The description of each item, unless otherwise mentioned includes wherever necessary all material, conveyance and delivery, handling, loading/unloading, storing, fabrication, hoisting, all labour for finishing the work, preparation of background surface, staging/scaffolding, application, finishing, removal of staging/scaffolding, curing and other incidental charges. The rate shall be for all heights and at all heights of work.

Plastering
Thickness of the plaster shall be the minimum thickness at any point on a surface and shall be exclusive of the key i.e. grooves or open joints in masonry. No extra payment shall be allowed for extra thickness of plaster done by contractor, drip moulds, rounding of edges making grooves, etc.,

All plastering/pointing shall be measured in square meters unless otherwise specified, length, breadth / height shall be measured correct to 0.1 meters. Soffits of stairs shall be measured as plastering on ceiling. Ceiling with projected beams shall be measured over beams and plastered side of beam shall be measured and added on ceiling.

Deductions and additions shall be made in the following manner:

No deductions shall be made for ends of joists, beams, posts, openings not exceeding 0.5 sqm area and no addition shall be made for reveals, jambs, soffits etc., of these openings mortar finish to plaster around ends of joists, beams, posts etc.,

Deductions for openings exceeding 0.5 sqm but not exceeding 3 sqm each shall be made as follows and no addition shall be made for reveals, jambs, soffits etc., of these openings.

When two faces of wall are plastered with different types of plasters or if one face is plastered and the other pointed, deduction shall be made from the plaster or pointing on the side of frame for door, window etc., on which width of reveals in lesser, but no deduction shall be made on the other side. Where widths of reveals on both faces of wall are equal, deduction of 50% of area of opening on each face shall be made.

When only one face is plastered, full deduction shall be made from plaster if width of reveal on plastered side is lesser. But if widths of reveal on both sides are equal or more on un plastered side, no deduction shall be made.

In case of openings of area above 3 sq m each, deduction shall be made for openings but jambs, soffits and sills shall be measured.

Pointing

Pointing shall be measured in square meter and deductions shall be done in accordance with BIS

6.4 Providing And Fixing Chicken Wire Mesh

The wire mesh shall be of 24 gauge and it shall be fixed with nails at the junction of brick masonry and RCC elements. The chicken wire mesh shall not sag in between the nails. This shall be done before the application of plaster.

Mode of measurement.

It shall be measured in sq.m. Measurement shall be taken before the application of the plaster. The rate includes for carrying out the work at all heights.

6.4.1 Providing and applying rough cast plaster

This shall be carried out in two layers. The base plaster shall be of 22mm thick and of specified proportion of CM. It shall be roughened to receive the top layer. The top layer shall be 7mmthick . It shall be of 3 parts cement, 6 parts coarse sand & 4 parts of 6mm to 10mm single. Or crushed stone aggregate. The plaster shall be cured atleast for 7 days.

Mode of measurement.

It shall be same as that of cement plaster.

6.4.2 Providing and applying water proof cement plaster

The plaster shall be of specified thickness and of mortar proportions. The contractor shall use approved waterproofing admixture made by reputed manufacturer in the mortar for plaster work. The quantity to be used shall be in accordance with the manufacturer"s instructions, however subjected to the approval of the Engineer in charge. The use of calcium chloride shall be prohibited unless specifically allowed by engineer and shall conform to IS:2645. The plaster shall be cured atleast for 7 days.

Mode of measurement

It shall be measured in sq.m. The rate shall include the double scaffolding., plastering and curing. The amount of water proofing material added shall be measured and paid for separately.

SPECIFICATION FOR WHITE WASHING, COLOUR WASHING,DISTEMBERING, PAINTING AND POLISHING.

7.0 WHITE WASHING, COLOUR WASHING, DISTEMPERING, PAINTING AND POLISHING

7.1 General

Reference shall be made to the following Indian Standards:

IS: 6278	:	Code of practice for white washing and colour washing.
IS: 2395	:	Code of practice for painting concrete, masonry and plaster surfaces.
IS: 712	:	Specification for building limes.
IS: 55	:	Specification for Ultramarine blue for paints.
IS: 63	:	Specification for whiting for paint and putty.
IS: 427	:	Distemper (dry) colour as required.
IS: 428	:	Distemper (Oil bound) colour as required.
IS: 5411	:	Specification for plastic emulsion paint for interior use.
IS: 2338	:	Code of practice for finishing of wood and wood (Part I, II) Based Materials
IS: 5410	:	Cement paint, colour as required.
IS: 2524	:	Code of practice for painting non ferrous metals in buildings
IS: 384	:	Brushes, paints and varnishes, flat.
IS: 486	:	Brushes, sash, tool for paints and varnishes
IS: 110	:	ready mixed paint, brushing, grey filler enamels for use over primers.
IS: 426	:	Paste filler for colour coats.
IS: 345	:	Wood filler, transparent liquid
IS: 3585	:	Ready mixed paint, aluminium brushing priming water resistant for woodwork.
IS: 426	:	Paste filler for colour coats.
IS: 106	:	Ready mixed paint, brushing, priming for enamels, for use on metals.

7.1.1 All materials required for the execution of painting work shall be obtained direct from

If in case of ready mixed paints, thinning if necessary the brand of thinner shall be as per recommendations of the manufacturer

Paint shall be applied by brushing or spraying. The brushing operations are to be adjusted to the spreading capacity advised by the manufacturer. During painting, every time after the paint has been worked out of the brush bristles, the bristles shall be opened up by striking the brush suitably.

Spray machine used may be of high pressure type or low pressure depending on the nature and location of work. After work, the brushes shall be completely cleaned off paint and shall be hung in a thinner if intended to be used afterwards. The spray guns shall be cleaned thoroughly after every break in work. The paint containers, when not used shall be kept close and free from air.

After the finishing of work, the adjacent surfaces not intended to be washed/distempered/painted/polished, shall be thoroughly cleaned of all paint patches and shall be finished in accordance with surface finishing of such surfaces.

7.2 White washing

White washing in general shall conform to IS:6278

7 .2.1 Workmanship

7 .2.1.1 Scaffolding

Wherever scaffolding is necessary, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be white/ colour washed. For white washing of ceiling, proper stage scaffolding shall be erected.

7 .2.1.2 Preparation of surfaces

The surface shall be thoroughly cleaned of all dirt, dust, mortar dropping and other foreign matter before white wash is to be applied.

All holes, cracks, patches etc., not exceeding 0.1 sqm in area shall be made good with material similar to that of the surface. Surface affected by efflorescence, moss, fungi, algae, lichen etc., shall be treated in accordance with IS:2395.

7 .2.1.3 Preparation of white wash

Pre-prepared lime wash like "Janata-Cem" may be used with prior approval of the Engineer-in-Charge.

7 .2.1.4 Application

White wash shall be applied with brush to the specified number of coats. The operation for each coat shall consist of stroke of the brush from the top to down wards, another from the down to upwards over the first stroke, similarly one stroke horizontally from right and another stroke from the left. Each coat shall be allowed to dry before the next coat is applied.

The white washing on ceiling should be done prior to that on walls.

7 .2.1.5 Protective measures

Surfaces of doors, windows, floors, etc., which are not to be white washed shall be protected from being splashed upon. Such surfaces shall be cleaned of white wash splashed if any.

7.30 Oil bound distempering

7.3.1. Workmanship

7.3.1.1. Scaffolding

Same as in BIS

7.3.1.2 Preparation of surface

Pre surface shall be thoroughly brushed free from dust, grease, mortar dropping, other foreign matter and shall be made smooth by sand papering upto the satisfaction of Engineer-in-charge and unevenness shall be made good by applying putty made of plaster of paris mixed with water including filling up the undulation and then sand papering the same after it is dry.

7.3.1.3 Primer coat

The primer coat shall be alkali resistant primer or distemper primer and shall be of the same manufacture as oil bound distemper.

If the wall surface plaster has not dried completely, alkali resistant primer otherwise distemper primer shall be applied. The mixture of alkali resistant primer shall be prepared as per approved manufacturer's instructions.

The application of primer coat shall be in accordance with BIS

7.3.1.4 Preparation of oil bound distemper

The distemper shall conform to IS:428 and shall be diluted with water or any other prescribed thinner recommended by the manufacturer.

7.3.1.5 **Application of distemper**

After the priming coat has dried for atleast 48 hours, the surface shall be lightly sand papered and dusted off avoiding rubbing off of the priming coat.

Prepared distemper shall then be applied in minimum two coats with proper distemper brushes in horizontal strokes immediately followed by vertical ones which together shall constitute one coat. The subsequent coats shall be applied only after the previous coat has dried. The finished surface shall be even and uniform without patches, marks, distemper drops etc., The application of a coat in each room shall be finished in one operation. After each days work, brushes shall be thoroughly washed in hot water and hung down to dry.

7.3.1.6 Protective measure

Same as in BIS

7.4 Waterproof cement paint

7.4.1 Workmanship

7.4.1.1 Scaffolding

Same as in BIS

7.4.1.2 Preparation of surface

Preparation of surface shall in general be in accordance with clause no.10.2.1.2 except that any unevenness shall be made good by applying putty made of plaster of paris mixed with water including filling up the undulation and then sand papering the same after it is dry.

7.4.1.3 Primer coat

The primer coat of cement primer of same manufacture as the cement paint shall be applied as in BIS

7.4.1.4 Preparation of paint

Waterproof cement paint of approved make shall be mixed with water and stirred to obtain a thick paste which shall then be diluted to brushable consistency. The proportion of mixture shall be as manufacturer's recommendation. The paint shall be mixed in such quantity which can be used up within an hour of mixing to avoid setting and thickening of the paint.

7.4.1.5 Application of paint

The surface shall be treated with minimum two coats of waterproof cement paint. No less than 24 hours shall be allowed between two coats and the subsequent coats shall be applied only after the preceding coat has become hard to resist marking by subsequent brushing.

The finished surface shall be even and uniform in shade without patches brush marks, paint drops etc., Cement paints shall be applied with a brush with relatively short stiff hog of fibre bristes.

7.4.1.6 Curing

Curing shall be started after the paint has hardened. Curing shall be done by sprinkling with water two or three times a day. This shall be done between coats and for atleast two days following the final coat.

7.4.1.7 Protective measure Same as in BIS

7.5.1 Acrylic emulsion painting

7.5.1.1 Workmanship

7.5.1.1.1 Scaffolding Same as in BIS

7.5.1.1.2 Preparation of surface

Same as in BIS under specification of oil bound distempering

7.5.1.1.3 Preparation of mix.

Plastic emulsion paint shall conform to IS:5411 (Part-1) and shall be of approved shade. Preparation of mix shall be a per manufacturer's instructions.

7.5.1.1.4 Application of paint

The paint mix shall be continuously stirred while applying for maintaining uniform consistency. Number of coats shall be as per item description. The painting shall be laid evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area with paint, brushing the surface hard at first, then brushing alternately in opposite direction 2/3 times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks, no hair marks no clogging of paint puddles shall be permitted. The full process of crossing and laying off will constitute one coat.

The paint shall be applied by means of brush or roller.

Before starting painting with plastic emulsion paint, the prepared surface shall be treated with two coats of primer consisting of cement primer, whiting and plastic emulsion paint shall start only after the preceding coat has become sufficiently hard to resist brush marking. Subsequent coats of plastic emulsion paint shall also be started after the preceding coat is dried by evaporation of water content.

The surface on finishing shall present a flat, velvety smooth finish, even and uniform shade without patches, marks, paint drops etc.,

7.5.1.1.5 Precautions

i) Brushes shall be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush. Old brushes, it used shall be completely dried of turpentine/oil paints by washing in warm soap water.

ii) No oil base putties shall be used in filling cracks/holes.

ii) Washing of painted surface shall not be done within 3-4 weeks of application.

7.5.1.1.6 Protective measures Same as in BIS

7.6.1 Acrylic Copolymer aggregate finish

7.6.1.1 Material

It shall be an acrylic based textured wall coating consisting of quartz and silica aggregate, inorganic pigments and other additives to form a crackfree, flexible, tough, waterproof coating.

7.6.1.2 Preparation of surface

The surface to be coated shall be cleaned and all dirt, dust, grease and loose particles shall be removed. Any old textured surface shall be removed with removing agent as per manufacturer's instructions.

7.6.1.3 Application

Bonding agent and water shall be mixed first. Then the flakes/granules shall be added and mixed thoroughly and kneaded till no lumps are found. The dough shall be left for 20-30 minutes before starting application. The bonding agent, flakes/granules and water shall be mixed in different ratios for different finishes as per manufacturer's specifications.

The first application shall be by steel trowel. It shall be smoothened, if the specified finish requires, by a plastic trowel.

7.7.1 Painting wood and wood based material

Synthetic enamel paint: It shall be confirmed to IS: 2932 of approved brand and colour shall be used.

7.7.1.2 Preparation of surface

Preparation of surface shall conform to IS:2338(Part-1) in general. All woodwork shall be dry and free from any foreign matter. Nails shall be punched well below the surface. The surface shall be smoothened off with abrasive paper used across the grain prior to painting with the grain prior to the staining. Any knots, resinous, or bluish sap wood, cutting out of which is not justified shall be covered with red lead conforming to IS:103

Plywood and block board shall be treated in the same manner as for wood work.

Particle boards surface shall be filled with a thin brushable filler and finished as for solid wood.

7.7.1.2 Priming

Priming shall be in accordance with IS:2338 (Part I and II). Dirt or any other extraneous material on the surface shall be removed and the priming shall be applied by brushing.

Priming shall be done on all exposed and unexposed surfaces. Unless specific otherwise all joinery work intended to be painted shall receive at least 2 coats of primer.

Type of primer shall be in accordance with Table-1 and Table-2 of IS:2338 (Part-II)

7.7.1.3 Stopping and filling

Stopping and filling shall be done after priming. Stopping shall be made to the consistency of stiff paste and shall be used to fill holes and cracks. Filler shall be used to level up slight irregularities of the surface. Filler shall be applied with a putty knife and subsequently rubbed down to a level surface with abrasive paper.

The filler coat shall be allowed to fully flatten and harden before subsequent coat is applied.

7.7.1.4 Application of Under coat

Under coat shall be applied after the surface has been primed, stopped and filled, and rubbed down to a smooth surface. Under coat may be brushed or sprayed. After drying the coat shall be carefully rubbed down and wiped clean before the next coat is applied.

The type of under coat shall be depending upon the finishing and in accordance with Table-1 and Table-2 of IS:2338 (Part-II)

7.7.1.5 Finishing

The finishing paint shall be as specified in the item description and shall be applied either by the brush or by spraying.

Reference shall be made to the Table-1 and Table-2 of IS:2338 (Part-II)

7.7.2 Application of clear finishes

For the application of clear finishes, the following procedures shall generally be adopted in accordance with IS:2338 (Part-I)

i) Filling

ii) Staining

iii) Sealing

iv) Finishing

7.7.2.1 Filling

Fillers shall be applied to prevent the excessive penetration of the finish to the surface for obtaining a smooth finish. Fillers shall be conforming to IS:345

Fillers shall be heavily applied to the wood surface by hand, using hessian or jute rag across the grain. It shall be rubbed when still wet to get better penetration. After 5-10 minutes it shall be wiped off by hand across the grain followed by a light wipe with the grain. The filled surface shall be dried preferably over night and smoothened with abrasive paper.

7.7.2.2 Staining

a.Spirit Stains

Spirit stains are solutions of spirit soluble dyes in industrial methylated spirit.

b. Oil stains

Oil stains are solutions of oil soluble dyes in linsed oil, but, usually consist of insoluble, semi-transparent pigments ground in lineseed oil and thinned with turpentine or other solvent.

c. Preparation of wood for staining

Surface intended for staining shall be kept scrupulously clean and free from greasy finger marks. It shall be prepared by careful smoothening with fine abrasive paper used in the direction of the grain.

Small cracks/nail holes shall be stopped with plastic wood/fine plaster of paris. The stopping shall be rubbed down with fine abrasive paper when hard and touched with a thinned knotting before staining. Incase of oil staining stopping shall be done after staining using tinted putty or wood filler.

d. Application of stains

Stains shall be applied by brushing, and wiping or by spraying. The stain shall be so thinned that it can be applied fairly, liberally without over staining and over lapping.

7.7.3 Sealing

A suitable sealer shall be applied on the filled and sanded surface to prevent absorption by the wood of the succeeding coats of finish and to seal stain and filler and thus preclude their bleeding into the finish coat.

Sealer may be sprayed on taking care not to flood the surface and it shall be allowed to dry hard.

When fully dry the surface shall be sanded taking care not to cut through at corners and edges. Dust shall be blown off and surface wiped with a clean rag.

7.7.3.1 Finishing

The stained surface shall be varnished, wax-polished or french polished as required after it is dried.

7.7.4 Varnishing

Varnishing of wood and wood based material shall be in accordance with IS:2338 (Part-I)

Surfaces to be varnished shall be prepared to produce a smooth, dry and matt surface and all dust and dirt shall be removed from the surface.

The varnish, shall be applied liberally with a brush and spread evenly over a portion of the surface with short light strokes to avoid frothing. It shall be allowed to flow out while the next section is being laid in. Excess varnish shall be scrapped out of the brush and then the first section be crossed, re-crossed and laid off lightly. The varnish, once it has begun to set, shall not be retouched in case of any mistake, the varnish shall be removed and the work shall be started afresh.

Where two coats of varnish are applied, the first coat shall be a hard drying under coating or flatting varnish which shall be allowed to dry hard and then be flatted down before applying the finishing coat. Sufficient time shall be allowed in between two coats.

When flat varnishing is used for finishing, a preparatory coat of hard drying undercoating of flatting varnish shall first be applied and shall be allowed to harden thoroughly.It shall then be lightly rubbed down before the flat varnish is applied. On larger areas, the flat varnish shall be applied rapidly, and the edges of each patch applied shall not be allowed to set, but shall be followed up whilst in free working conditions.

7.7.5 French Polish

French polish shall conform to IS:348. Suitable pigments shall be added to get the required colour.

The surface to be french polished shall be rubbed down to smoothness with sand paper and shall be well dusted. Pores in the surface shall be filled up with fillers.

A pad of woolen cloth covered by a fine cloth shall be used to apply the finish. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping circles applying the polish sparingly but uniformly over the entire area to give an even surface. A trace of linseed oil may be used on the face of the pad for the purpose. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall have a uniform texture and high gloss.

7.8.1 Painting of steel and other metal surface

7.8.1.1 General

Reference shall be made to the following Indian Standards IS:2524, IS:1447

7.8.1.2 Preparation of surface

The surface, before painting shall be cleaned of all rust, scale, dirt and other foreign matter with wire brushes, steel wool, scrappers, sand paper etc., The surface shall then be wiped finally with mineral turpentine which shall then be removed of grease etc., The surface then shall be allowed to dry. In case of GI surface, surface so prepared shall be treated with Mordant solution(5 litres for about 100 sqm) by rubbing the solution generously with brush. After about half an hour, the surface if required shall be retouched and washed down thoroughly with clean cold water and allowed to dry.

7.8.1.3 Application of priming and paints

Approved quality primer and paint in specified no. of coats shall be applied as per manufacturer's recommendations either by brushing or spraying. Each subsequent coat shall be applied only after the preceding coat is dried.

Measurement and rate (where painting is not included in the relevant description of item in the bills of quantities)

All work shall be measured in areas. Areas shall be worked out to the nearest 0.01 sqm and all dimensions to the nearest 0.01 metre.

Deductions shall be made in accordance with IS specification For Method of measurements

The equivalent area will be worked out in accordance with IS:1200. The rate shall include the cost of all materials, labour, scaffolding, protective measures etc., and all works involved in specification. The rate shall also include if not mentioned otherwise, conveyance, delivery, handling, unloading, storing etc.,

SPECIFICATION FOR STRUCTURAL STEEL WORKS

8. STRUCTURAL STEEL WORK

All steel work shall conform to IS:800-1962 and shall be free from defects impairing strength, durability or appearance which these shall be normally subjected. The contractor shall bear the cost of all tests.

All structural steel members brought by or handed over to the contractor shall be handled with care, stacked on edge and supported evenly.

The structural steel and rivet bars shall conform to IS:226. Before any fabrication work is commenced all plates shall be flattened and all bars and sections straightened or otherwise turned and made free from twists or other distortions. Method adopted for the purpose shall be such as not to injure the materials.

Cutting shall be effected by shearing, cropping or sawing and shall be clean, reasonably square and free from distortion. If directed the edges shall be ground. Gas cutting by mechanically controlled torch shall be permitted for mild steel only with the approval of the Architect.

It shall be the responsibility of the contractor to submit shop drawings to the Architect/Consultant. All shop drawings shall be prepared in advance of the actual fabrication and shall show full size sections and all joints and connections, thickness of material used and details of welds, bolts, rivets etc. They shall clearly distinguish between shop and field rivets, bolts and welds. Drawings shall be made in conformity with the IS code for shop drawings with due regard to speed and economy in fabrications and erection. A marking diagram allotting distinct identification marks to each separate piece of steel, sufficient to ensure convenient assembly and erection at site, shall be prepared. All shop drawings also shall show temporary bracings and connections required during fabrications and erections.

8.1. RIVETTING

All holes in plates or sections over 1mm thick must be drilled (not punched) and accurately gauged. All holes (except in purlins, runners, packing plates, lacing bars) shall be drilled to required size. All matching holes for rivets or black bolts shall be such that a guage 0.8mm less in diameter than the hole can pass freely through members assembled for rivetting and bolting. All holes for turned and fitted bolts shall be drilled and reamed, if necessary, to a tolerance of only plus 0.13mm. When the number of thickness to be rivetted exceeds three or the total thickness is 90mm or more, the holes shall be drilled or reamed in position after assembly, except when steel bushed jigs are used. Parts shall be firmly held together during such block drilling and taken apart for removal of burrs, after drilling.

All parts assembled for rivetting shall be in close contact and all bearings stiffeners shall bear tightly at both top and bottom without being drawn or caulked. All parts of rivetted members shall be temporarily pinned or bolted while

rivetting. Drifting of holes shall not be permitted except to draw the parts together and no drift used shall be larger in any part than the nominal diameter of rivet or bolt. Drifting done during assembling shall not distort metal or enlarge holes. Rivets when cold shall be of size shown on drawing and shall preferably fill the hole and form the head of standard dimension unless otherwise stated. All rivetting wherever practicable shall be done by hydraulic or pneumatic process. All loose, burnt or badly formed rivets with eccentric or deficient heads shall be cut and replaced by sound rivets. Counter sunk heads shall be provided wherever required. Caulking and recupping shall not be permitted.

8.2 Bolting:

All turned and fitted bolts shall be parallel throughout the barrel within the tolerance of only minus 0.13mm and faces of heads and nuts bearing on steel work shall be machined. All such bolts shall be provided with washers of standard size so that the nut when turned shall not bear the unthreaded body of the bolt. Heads and nuts shall be hexagonal, of whit worth screws and shall be well formed. Where the full bearing area of the rivet is to be developed, the threaded portion of the bolt shall not be within the thickness of the parts bolted together, threaded portion of each bolt shall project beyond the nut at least by one thread. Tapered washers shall be provided for all heads and nuts bearing on bevelled surfaces.

8.3 Welding:

Welding wherever indicated on the drawings shall conform to IS:814-1963 unless otherwise specified. Welding shall be carried out by experienced welders only, who if necessary shall produce testimonials about their work and if required by Architect/Consultant shall undergo qualifying tests as prescribed in IS:1181. Welding work shall be carried out as per IS:816.

Welding shall be done in flat position wherever possible an adequate steps shall be taken to maintain the correct arc length, rate of travel, current and polarity for the type of electrode and nature of work.

Steel shall not be painted or oiled and any areas where welding is to be performed shall be well cleaned to remove any paint, scale or rust immediately before welding for a distance of at least 2cm (3/4") on either side.

The work shall be securely held in position by means of tack welds, service bolts, clamps or lugs before commencing the welding so as to prevent any relative movements due to distortion, wind or other causes. When welding is liable to cause distortion, the work shall be securely held in approved frames or jigs.

Parts to be fillet welded shall be brought into contact as close as practicable and in no event shall be separated more than 4.75mm (3/16"). If the separation is 1.6mm (1/16") or greater, the size of the fillet welds shall be increased by the amount of the separation.

The separation between facing surfaces of lap joints shall not exceed 1.6mm (1/16"); the fit of joints at contact surfaces which are not completely sealed by welds, shall be close enough to exclude water after painting.

Abutting parts to be butt welded shall be carefully aligned. Misalignment greater than 3mm (1/8") shall be corrected and in making the correction, the parts shall not be drawn into a sharper slope than two degress (11mm in 30cm or 7/16" in 12").

The sequence of welding shall be such that when possible the members which offer the greatest resistance to compression are welded first.

Welded joints showing slag inclusion or lack of proper penetration shall be cut and are rewelded. Overlap of the toe of the weld and undercutting of the parent metal should be avoided and where present to a serious extent shall be rectified.

All slag shall be removed from each run before another run is super-imposed. When cold the final run shall be protected with clear boiled linseed oil and shall not be painted until approved by the Architect/Consultant or his representative.

Grinding of finished weld is permitted provided the weld is not reduced below the prescribed section. All exposed welds shall be ground smooth. Welds which have not been ground shall be scrubbed with a 10% solution of Hydrochloric acid which shall be washed off with water before paint is applied unless an alkali resisting paint is used.

8.4 Fabrication and Erection:

In order to facilitate handling, transportation and execution the contractor may fabricate the structural members in suitable sections. The details of site/connections and their locations shall be approved by the Architect/Consultant.

Frame or lattice sections intended for use as parts of composite constructions which are likely to deflect considerably during handling shall be suitably stiffened by means of steel angles.

Roof and other structures shall be supported at close intervals during the welding/bolting of site connections.

The frames of steel skeleton buildings shall be carried up true and plumb, and temporary bracings shall be introduced wherever necessay to take care of all loads to which structure may be subjected including erection equipment and operation of the same. Such bracings shall be kept in positions as long as required for safety or as deemed necessary by the Architect/Consultant.

As erection porgresses, the work shall be securely bolted to take care of all dead load, wind load and erection stresses. No rivetting or welding shall be done until the structure has been properly aligned. Rivets driven in field shall be heated and driven with the same care as taken in the shop.

In the setting or erection of steel work the individual pieces shall be considered plumb or level when the error does not exceed 1 to 500: For exterior columns the error shall not exceed 1 to 1000.

Slight bends in the members of fabricated structure shall not be straightened unless strictly necessary on account of danger of overstraining connections and rivets.,welds or bolts, connection plates. If slightly bent or twisted, the member shall be straightened cold, if bent so sharply as to require heating, the whole piece thus heated shall be subsequently annealed. No straightening whatsoever shall be carried out without the previous sanction of Architect/Consultant.

8.5 Expansion Gaps:
Particular care must be taken to ensure free expansion and contraction, wherever provided for, in drawings or special specifications.

8.6 Painting:
Painting of steel structure shall be carried out as per detailed specification under painting. Red-oxide/Lead priming coat are generally applied in fabrication shop.

8.7 Painting Joints:
The surface of all joints must be thoroughly scraped, cleaned and given the first coat of red lead paint before joining up which should be done while the paint is still wet. This procedure shall not apply to welded joints. All rivets, bolts, washers, etc., shall be thoroughly cleaned and dipped in boiled linseed oil. All machined surfaces shall be well coated with a mixture of white lead and tallow.

8.8 Measurements:
The weights of all fabricated trusses, frames, gantry girders, crane rails, fish plates, clamps, square or round bars etc., Stanchions, built up girders and purlins shall be calculated on the basis of standard net section weight according to IS Code. Net weight of cleats, brackets, packing pieces, rivets, bolts, distance pieces, separators, gussets, holding down bolts, fish plates, etc., shall be added to the respective items. No deduction shall be made for holes, bolts or rivets and waste involved in cutting or notching ends of sections or intermediate points for making connections.

No payment shall be made for butt welds. In the case of fillet welded joints, weight of fillet welds shall be as under:

Fillet weld	Weight in Kg/m
5mm	0.11
6mm	0.20
7mm	0.288
10mm	0.40
12mm	0.70
16mm	1.07

8.9 Providing and fixing Pressed steel frames for doors

They shall be made of hollow metal pressed section of approved make such as “Perfect Industrial Products”, TIL or of equivalent make. They shall be single / double rebated as of equivalent make. They shall be single / double rebated as per the Architect’s drawing. It shall be made of CR sheet and size 65 x 125 x 1 mm thick. It shall be provided with four hinges of 125 x 2 mm thick of friction type. Four hinges shall be provided per leaf of the door. The frame shall be provided with 4 hold fasts of size 150 x 20 x 3 mm for each side and the same shall be embedded in brick work with CC 1:2:4 blocks of size 300 x 23 x 230 mm. The hollow portion of the frame shall be filled with CC 1:2:4 before it is fixed.

The frame shall be painted with red oxide primer. There shall be provision in the frame for fixing of tower bolts, aldrop, louvres, mortice lock etc. The frame shall be painted with two or more coats of approved synthetic enamel paint to get a uniform finish.

8.9.1 Mode of Measurement

It shall be measured in RM. The rate shall include providing and fixing of pressed steel frame as per above specifications.

8.10 Providing and fixing pressed steel section windows for fully openable windows.

The frame shall be of size 11 x 6 x 1 mm thick or as in BOQ and it shall be of perfect Industrial Products", TIL, Senharvic, Age or of any approved make. The frames shall be double rebated. The frame shall be provided with 3 holdfasts of 100 x 15 x 3 mm long and the same shall be grouted with CC 1:2:4 in the brick work or to RCC member. Shutters shall be made for standard steel sections style F7d, sash bar of T6 and locking bar of F4b section. The hollow portion of the frame shall be filled with CC 1:2:4 before fixing the frame.

Glass of 4 mm or 5.5 mm shall be fixed with beading as per the Architectural drawing. The beading shall be of Alumnium or GI hollow square pipe of 10 sqmm and wall thickness 1.25 mm. The section shall be provided with arrangement for fixing the MS or aluminium oxidised handles and washers. The window section shall be painted with one coat of primer and two coats of synthetic enamel paint of approved make and shade.

8.10.1 Mode of Measurement

It shall be measured in sqm. The rate shall be for providing and fixing steel windows as per the above specifications.

- do – same as item 11.9 for partly openable and partly fixed windows.

do – same as item 11.8

- do – same as item 11.9 for fixed windows.

do – same as per item 11.8

-do – same as per item 11.8 but for louvered ventilators.

do – same as above but provision shall be given for fixing 4 / 5.5 mm thick glass.

Mode of Measurement

This shall be measured in sqm.

Providing and fixing MS door frame

It shall be fabricated from structural steel as per the details and drawings. All the members shall be free from rust, flakes, cracks and other fabricational defects. All holes for hinges, bolts, locking plates etc. shall be provided as per drawings / instructed. The welding shall be smooth. The frame shall be erected and fixed with MS holdfasts of specified size and grouted with cement concrete 1:2:4 (1 cement, 2 sand, 4 graded coarse aggregate of nominal size 12mm and down). The frame shall be painted with a coat of primer before erection and 3 coats of synthetic enamel paint of specified quality after erection.

Providing & fixing MS sheet door

The frame shall be of MS as specified above. The door shall be as per the Architect's design. The specified gauge MS sheet door shall be welded to the frame. It should have 3 to 6 hinges depending on the shutter size. It shall have fittings as specified in the item / Architect's drawings. The door shall be applied with a coat of primer and 2 coats of synthetic enamel paint of quality as specifed.

8.15.1 Mode of Measurement:

This shall be measured in sqm. If the frames are not included in the item then only the shutter area shall be measured and paid for. The rate shall include fabrication, provision, erection of the door, necessary fittings as specified, painting etc. all complete.

SECTION ROOFING

Providing, Fabricating and Erecting MS structural steel work for trusses, purlins, girders, columns, rafters, struts, wind ties, bracings etc.

All structural steel materials such as angles, RS joints, flats, tees, plates, channels etc. shall conform to the latest edition of IS 226. All structural steel shall be free from twist before fabrication. Cutting of members shall be done by shearing, cropping, sawing or gas cutting. Contact surfaces of plates and butt joints shall be accurately machined over the whole area so that the parts connected shall butt over the entire surface of contact. Welding of pieces shall be done with the approval of the Engineer.

The components parts shall be assembled in such a manner that they are not damaged in any way and specific cambers as shown in the drawing or as directed by the Engineer, shall be provided.

For bolted connection, where necessary washers shall be tapered or otherwise suitably shaped to give satisfactory bearing. The threaded portion of the bolt shall project beyond the nut by atleast 1.5 thread.

Welding shall be done in accordance with the latest edition of IS 813 and 814. Code of practice for use of electric arc welding for general construction in mild steel. In welding it must be ensured that the base metal is in fused state when filler metal makes contact with it ; filler metal does not overflow upon any unfused base metal ; base metal is not cut along the weld edges; flowing metal floats the slag, oxide and gas bubbles at the surface behind advance pole. For this current shall be adjusted or the electrode size is changed. Welding shall be free from cracks, discontinuity, under or oversize welding thickness.

Surface to be welded shall be free from loose mill scale, rut, grease, paint and any other foreign material. As far as possible avoid the welding at heights and at difficult position. Generally fillet welding is preferred. The parts to be welded are brought in as close contact as practicable and rigidly clamped together.

Before erection, steel work shall be thoroughly cleaned of rust, loose scale, dust, welding slag, and shall be given one coat of red oxide primer of approved make and one coat of synthetic enamel paint of approved make as specified in the item before erection and final coat of painting after the erection as directed.

Steel members shall be hoisted and put in position carefully without any damage to the member and to the building and labour. The trusses shall be lifted at such points that they do not buckle or deform or be unduly stressed. The end of the truss which faces the prevailing wind shall be fixed and the other end may be kept free to move. The steel work shall be securely fastened wherever necessary, temporarily braced, to provide for all loads to be carried by the member during erection including the load due to the erection equipment and its operation. No permanent bolting or welding is done until proper alignment has been obtained. The holes for the rivets shall be determined with the help of templates and drilled. Erection clearance of the cleared ends shall not be more than 1.5 mm and without cleating end clearance shall not be more than 3 mm. Grouting or embedding clearance shall not be more than 3mm. Grouting or embedding of structural steel members done after the approval of the alignment, level and position of the members by the Engineer.

Important Points

Before the actual execution of the job, the Contractor shall prepare fabrication drawings for all structural steel work from the structural drawings supplied to him and determine the exact cutting lengths of the members, sizes of gusset plates, welding lengths by marking out on a level platform to full scale.

Welding plan, electrodes and other equipments, scaffolding, labour shall be arranged by the Contractor at his cost. Erection equipment of required capacity, sufficient number of spare parts and staff shall be maintained by the Contractor at site at his cost.

Mode of Measurement

All structural steel members shall be measured in lengths and are converted into weights as per IS tables. All rivets, bolts shall be measured in kg. and paid for. No deduction shall be made for rivet holes and bolts. Nothing extra shall be paid for wastages.

- do – as per item 11.25.1 but with MS B class pipes.

- do – as per item 11.25.1 but with MS B class pipes as per Item description given in the Schedule of Quantities.

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