TECHNICAL SPECIFICATION

EARTH WORK

Scope:

This section covers the works specification of earthwork in excavation in all kinds of soils including murrum, hard murrum, rock (with/without blasting) earth and sand filling in plinth, etc.

Applicable Codes:

The following Bureau of Indian Standard Codes, unless otherwise specified herein, shall be applicable.

The following codes, standards and specifications are made a part of this specification. All standards, specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions. In case of discrepancy between the item specification and those referred in the following codes herein, item specification shall prevail.

IS - 4081 Safety code for blasting and related drilling operations

IS - 1200 Method of measurement of building works.

IS - 3764 Safety code for excavation work.

IS - 3385 Code of practice for measurement of Civil Engineering works.

IS - 2720 Part II Determination of moisture content.

Part VIII Determination of moisture content dry density relation using light compaction.

Part XXVIII Determination of dry density of soils, in-place by the sand replacement method.

Part XXIX Determination of dry density of soils, in-place, by the core cutter method.

Drawings:

Engineer will furnish all necessary drawings showing the areas to be excavated, filled, sequence of priorities etc. Contractor shall follow strictly such drawings.

General:

Contractor shall provide all tools, plants, instruments, qualified supervisory personnel, labour, materials, and temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein, for completion of the Work.

Contractor shall carry out the survey of the site before excavation and set properly lines and establish levels for various works such as earthwork in excavation for levelling, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to establish reference/grid lines at 5 m intervals or nearer as determined by Engineer based on ground profile. These shall be checked by Engineer and thereafter properly recorded.

The area to be excavated/filled shall be cleared of fences, trees, plants, logs, slumps, bush, vegetation's, rubbish slush etc. and other objectionable matter. If any roots or stumps of trees are found during excavation, they shall also be removed. The material so removed shall be burnt or disposed off as directed by Engineer. Where earth fill is intended, the area shall be stripped of all loose/soft patches, top soil containing deleterious matter/materials before fill commences.

Relics, Objects of Antiquity, etc.:

All gold, silver, oil minerals archaeological and other findings of importance, all precious stones, coins, treasures, relics, antiquities and other similar things which may be found in or upon the site shall be the property of owner and Contractor shall duly preserve the same to the satisfaction of Owner and from time to time deliver the same to such person or persons as Owner may from time to time authorise or appoint to receive the same.

1.01 Earth Work in Excavation up to 1.50 M from Existing GL:

a) **Classification:**

Any earthwork will be classified under any of the following categories.

i) **All kinds of soils (Manual/Mechanical Excavators):**

These shall include all kinds containing kankar, sand, silt, murum and / or shingle, gravel, clay, loam peat, ash, shale, mud, black cotton, river or nallah bed boulders, siding of roads, paths, water bound macadam, etc.

which can generally be excavated by spade, pick-axe and shovel and which is not classified under soft and decomposed rock, and hard rock defined below. This shall also include embedded rock boulders not bigger than 1metre in any dimension and not more than 200 mm in any one of the other two dimensions.

ii) **Rock (Mechanical Excavators/ Heating, Blasting or any other approved method):**

This shall include all types of rocks (Soft/Weathered/Hard) which are to be excavated with picks, hammer, crow bars, wedges OR mechanical means such as excavators, hydraulic breakers etc. OR has to be blasted and where blasting is prohibited has to be either heated or excavated by any other approved method as directed. This shall also include excavation in macadam and tarred roads and pavements.

They shall be stacked separately as specified in relevant item of work.

b) The earth work in excavation shall be done as per the Architect and structural consultant's drawings up to required depths and levels and alignments in all sorts of soils. The depth of the foundation will be as per the Engineer's instructions. The lining work should be done by the Contractor. Roots or trees met with during the excavation shall be cut and smeared with coal tar. Excavated earth shall be stacked at least 3 m away from the trenches or as per the Engineer's instructions, so that it may not damage the sides of the excavated trenches. The sides of the excavated trenches shall be vertical and in straight line and bottom uniformly levelled watered, consolidated and ready for termite treatment.

c) In all kinds of soil if the excavation is deeper than 2 m the sides of the trenches shall be made bigger by allowing steps of 50 cm on either side so as to keep the slope 0.25 to 1 .In loose soft or slushy soil the width of the step shall be suitably increased or the sides sloped or shoring and strutting may be done as per the Engineer's instructions.

d) For excavation for drain work, the sides and the bottoms should be to the required slope, shape and gradient. The cutting shall be done from top to bottom. Under no circumstances shall undermining or under cutting be allowed. The final surface shall be neatly levelled and well compacted. The earth from the cutting shall be directly used for filling either in plinth or on grounds.

e) For excavation in trenches for pipes nothing extra shall be payable for the lift irrespective of the depth unless specifically mentioned otherwise in the Schedule of Quantities.

f) If the trenches are made deeper than specified level due to oversight or negligence of the Contractor the extra depth shall be filled up by lean

concrete of mix 1:4:8 (1-part cement; 4-part coarse sand and 8-part coarse aggregate of nominal size 20mm) and if the trench is made wider than shown in the drawings the Contractor has to make good at his own cost. The foundation trenches shall be free from water and muck, while the foundation work is in progress.

g) The trenches which are ready for concreting shall be got approved by the Engineer.

h) The excavated stacked earth shall be refilled in the trenches and sides of foundation in well compcated150-200mm thick layers and the balance surplus shall be first filled in layers in plinth and the remaining surplus shall be disposed off by uniform spreading within the site/outside the site as directed by the Engineer.

i) Adequate protective measures shall be taken by the Contractor to see that the excavation for the building foundation does not affect the adjoining structure's stability and safety. Contractor will be responsible if he has not taken precaution for the safety of the people, property or neighbour's property caused by his negligence during the constructional operations.

j) To the extent available, selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic & other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murum or earth to fill up the voids and the mixture used for filling.

k) As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris and filled with earth in layers 15 cm to 20 cm , each layer being watered, rammed and properly consolidated before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer.

l) **Mode of Measurement for Earth Work in Excavation Including Back Filling:**

i) **Lead: The maximum lead for stacking and disposal of the earth shall be within the project site/premises of the Service Recipient or as specified in Schedule of Quantities.** No extra compensation is admissible on the grounds that the lead including that for borrowed materials had to be transported over marshy or katcha land/route.

ii) All excavation shall be measured net. Dimensions for purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, tanks, rafts or other

foundations structure to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. **Working spaces and excavation inside slopes shall not be paid for. Contractor may make such allowances in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety of excavation**. However, if the excavation is deeper than 2 meters, the size of the trenches shall be made bigger by allowing steps of 50 cm on either side so as to keep slope 0.25:1. This shall be paid as per original tender rate if executed at site. However, if concreting is proposed against the additional/ extra excavation made by the Contractor shall be made good by the Contractor with concrete of the same class as in the foundations at his own cost.

iii) **Backfilling:** As per specification the side of foundations of columns, footings, structures, basement plinth, walls, tanks rafts, trenches etc. with excavated materials will not be paid for separately. It shall be clearly understood that the rate quoted for excavation including backfilling shall include stacking of excavated material as directed, excavation / and shifting the selected stacked material (earth), conveying it to the place of final backfill, consolidation compaction using plate compactor etc. as specified.

iv) The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, riprap with regular slopes as directed by Engineer within the lead specified and levelling the same so as to provide natural drainage. Rock / soil excavated shall be stacked properly as directed by Engineer. As a rule, all softer material shall be laid along the centre of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Excavated soft rock or hard rock shall be stacked separately.

(v) The pumping, dredging and bailing out of water shall also be executed by the Contractor at his own cost.

(vi) The cost of shoring and strutting as demanded by the site conditions and as instructed by the Engineer is deemed to be included in quoted rate.

No deduction shall be made from the rate if the operations as specified above such a backfilling, lead, excavation in slope, bailing out of water, shoring, strutting, etc. are not required wholly or partially during the excavation.

1.02 Earth Work in Excavation for Depth Exceeding 1.50 M but not Exceeding 3.0 M:

The general specification shall be same as for the item 1.01 given above.

Mode of Measurement: Same as item no. 1.01

1.03 Earth Work in Excavation for Depth Exceeding 3.0 M but not Exceeding 4.5 M:

The general specification shall be same as for the item 1.01 given above.

Mode of Measurement: Same as item no. 1.01

1.04 Earth Work in Excavation in Rocks up to 1.50 M from Existing Ground Level (EGL) - :

Rocks which cannot be easily excavated with pick-axes, hammer, crow bars, wedges, **mechanical means such as excavators, hydraulic breakers etc.** but has to be either heated where blasting is prohibited or has to be blasted. They shall be stacked separately.

Any secondary blasting / breaking of blasted boulders is required will have to be carried out at site before stacking. After blasting, blasted rock capable of being lifted by hand together with spalls should be stacked at site. These stacks shall then be transported to various locations at site for reuse in masonry if required and directed by Engineer-in charge.

The materials which are not usable for masonry shall be disposed off within the project site as decided by Engineer in charge. Nothing extra shall be payable on this account.

Rock tolerance of about (-6") minus six inches is permitted while blasting the hard rock. However no measurement will be payable for this tolerance depth excavated. For any rock excavation beyond (-6") minus six inches of rock tolerance, suitable deductions will be made to makeup the same with **P. C. C. (1:4:8) (1 part cement: 4 part coarse sand: 8 part stone aggregate).** It should be understood that the measurement shall be payable up to the formation level as specified in drawing only.

a) Unless otherwise stated herein, IS 4081, **safety code for blasting and related drilling operations** shall be followed. After removal of over burden, if any, excavation shall be continued in rock to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by Engineer. As far as possible all blasting shall be completed prior to commencement of construction. At all stages of excavation, precautions, shall be taken to preserve the rock below and beyond the lines specified for the excavating, in the soundest possible condition. The quantity and strength of explosive used shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by Engineer shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structure as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of Engineer at his cost. As excavation approaches its final lines and levels, the depth of the charge holes and amount of explosives used shall be progressively and suitably reduced.

b) Specific **permission** of Engineer will have to be taken by Contractor **for blasting rock** and contractor shall also obtain a valid blasting license from the authorities concerned, any fees on this account to be borne by the contractor. If permission for blasting is refused by Engineer, the rock shall be removed by wedging, pick barring, heating and quenching or other approved means/method by engineer-in-charge. All loose/loosened rock in the sides shall be removed by barring wedging, etc. The unit rates for excavation in hard rock shall include the cost of all these operations.

c) Contractor shall obtain **necessary license for storage of explosives** fuses and detonators issued to him from Owner's stores or from a supplier arranged by the Contractor, from the authorities dealing with explosives. The fees, if any, required for obtaining such license, shall be borne by Contractor. Contractor shall have to make necessary storage facilities, for the explosives etc. as per rules and regulations of local, State and Central Govt. authorities and statutory bodies. Explosives shall be kept dry and shall not be exposed to direct rays of sun or be stored in the vicinity of fire, stoves, steam pipes or heated metal, etc. No explosive shall be brought near the work in excess of quantity required for a particular amount of firing to be done and surplus left after filling the holes shall be removed to the magazine. The magazine shall be built as far as possible from the area to be blasted. Engineer's prior approval shall be taken for the location proposed for the magazine.

d) In no case shall blasting be allowed closer than 30 meters to any structure or to locations where concrete has just been placed. In the latter case the concrete must be at least 7 days old. For excavation for drain and all road works, the sides and the bottoms should be to the required slope, shape and gradient.

e) For blasting operations, the following points shall be observed:-

i) Contractor shall employ a competent and experienced supervisor and licensed blaster In-charge for each set of operation, who shall be held personally responsible to ensure that all safety regulations are carried out.

ii) Before any blasting is carried out, Contractor shall intimate Engineer and obtain his approval in writing for resorting to such operations. He shall intimate the hours of firing charges, the nature of explosive to be used and the precautions taken for ensuring safety.

iii) Contractor shall ensure that all workmen and the personnel at site are excluded from an area within 200M radius from the firing point, at least 15 minutes before firing time by sounding warning siren. The areas shall be encircled by red flags. Clearance signal shall also be given sounding a distinguishing siren.

iv) The blasting of rock near any existing buildings, equipment or any other property shall be done under cover and Contractor has to make all such necessary muffling arrangements. Covering may preferably be done by MS plates with adequate dead weight over them. Blasting shall be done with small charges only and where directed by Engineer, a trench shall have to be cut by chiselling prior to the blasting operation separating the area under blasting from the existing structures.

v) The firing shall be supervised by a Supervisor and not more than six (6) holes at a time shall be set off successively. If the blasts do not tally with the number fired, the misfired holes shall be carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along with misfired hole (but not nearer than 600 mm from it) and by exploding a new charge. Before leaving the site of work, the blaster of one shift shall inform the another blaster relieving him for the next shift, of any case of misfire and each such location shall be jointly inspected and the action to be taken in the matter shall be explained to the relieving blaster. The Engineer shall also be informed by the blaster of all the cases of misfires, their causes and steps taken in that connection.

Precaution against Misfire:-

The safety fuse shall be cut in an oblique direction with a knife. All saw dust shall be cleared from inside of the detonator. This can be done by blowing the detonator and tapping the open end. No tools shall be inserted in to the detonator for this purpose.

If there is water present or if the bore hole is damp, the junction of the fuse and detonator shall be made watertight by means of tough grease or any other suitable material.

The detonator shall be inserted into the cartridge so that about one third of the copper tube is left exposed outside the explosive. The safety fuse just above the detonator shall be securely tied in position in the cartridge. Water proof fuse only shall be used in the damp bore hole or when water is present in the bore hole.

If a misfire has been found to be due to defective fuse, detonator or dynamite, the entire consignment from which the fuse detonator or dynamite was taken shall be got inspected by the Engineer before resuming the blasting or returning the consignment.

vi) A wooden tamping rod with a flat end shall be used to push cartridges home and metal rod or hammer shall not be permitted. The charges shall be placed firmly into place and not rammed or pounded. After a hole is filled to the required depth the balance of the hole shall be filed with stemming which may consist of sand or stone dust or similar inert material.

vii) Contractor shall preferably detonate the explosives electrically.

viii) The explosive shall be exploded by means of a primer which shall be fired by detonating a fuse instantaneous detonator (FID) or other approved cables. The detonators with FID shall be connected by special nippers.

ix) In dry weather and normal dry excavation, ordinary low explosive gunpowder may be used. In damp rock, high explosive like gelatine with detonator and fuse wire may be used. Under water or for excavation in rock with substantial accumulated seepage electric detonation shall be used.

x) Holes for charging explosive shall be drilled with pneumatic drills, the drilling pattern being so planned that rock pieces after blasting will be suitable for handling without secondary blasting.

xi) When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level. Any rock excavation beyond an over break limit of 75mm shall be filled up as instruct-ed by Engineer, with concrete of strength not less than cement concrete of nominal mix with ratio 1:4:8 (1 part cement:4 part coarse sand:8 part aggrgates). The cost of filling such excess depth shall be borne by Contractor and the excavation carried out beyond the limit specified above will not be paid for. Stepping in rock excavation shall be done by hand trimming.

xii) Contractor shall be responsible for any accident to workmen, public or owners property due to blasting operations. Contractor shall also be responsible for strict observance of rules, laid by Inspector of explosives, or any other Authority duly constituted under the State and/or Union Government.

xiii) **Mode of Measurement:** It shall be measured in CuM as per item no. 1.01. **However working spaces and excavation for inside slopes shall not be paid for all depths. Contractor may make such allowances in his rates to provide for excavation in side slopes keeping in mind the nature of the rock and safety of excavation**. However, if concreting is proposed against the additional/ extra excavation made by the Contractor shall be made good by the Contractor with concrete of the same class as in the foundations at his own cost.
Volume of rock excavated shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, tanks, rafts or other foundations structure to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. No payment will be made for excavations / over break beyond payment line specified. The measurement of the earth work shall be paid as per the drawing or the requirements of the site as approved by the Engineer.

xiv) The rate quoted for excavation shall include the following jobs:

a) Refilling of the trenches as specified in SOQ and consolidating and spreading as per the Engineer‘s directions.

b) Shoring and strutting as demanded by the site conditions and as instructed by the Engineer.

c) **Other details specified in item no. 1.01 are applicable if not stated herein.**

1.05 Earth Work in Excavation in Rocks Depth Exceeding 1.50 M but not Exceeding 3.00 M:

The general specification is same as item no. 1.04

Mode of Measurement: Same as item no. 1.04

1.06 Earth Work in Excavation in Rocks Depth Exceeding 3.00 M but not Exceeding 4.5 M:

The general specification is same as item no. 1.04

Mode of Measurement: Same as item no. 1.04

1.07 Filling in Plinth with Selected Excavated Earth:

a) Filling in plinth above existing grade (NGL), in layers of 15-30 cm or as specified, watered and compacted with mechanical compaction machines or by hand as specified. The base surface shall be cleared of vegetation by up-rooting or any organic matter, prior to commencement of filling operation. Earth shall be free from shrubs, rank vegetation, grass, brushwood, organic or other any other foreign matter and deleterious materials etc. When filling reaches the finished level, the surface shall be flooded with water, if directed by the Engineer, for 24 hours, allowed to dry and then the surface is again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.

b) Where specified in the item description given in the Schedule of Quantities that the compaction of the plinth fill shall be carried out by means of 8/10/12 tonnes rollers smooth wheeled or mechanical vibro-roller or mechanical plate compactor as directed, as rolling proceeds water sprinkling shall be done to assist consolidation. Relevant field tests are to be carried out as per 14.0 (Technical Specification), Quality Control Process.

Payment for filling in plinth with selected excavated material will be made as specified / directed. Payment for this work will be made based on measurement of plinth / dimensions filled. The plinth / ground levels shall be surveyed beforehand for this purpose. **The lead shall be from/to anywhere within the project site.**

c) **Mode of Measurement** : It shall be measured in Cu.M.

1.08 Filling Excavated Earth in Ground for Land Development:

a) No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by Engineer.

b) Filling shall be carried out as indicated in the drawings and as directed by Engineer. If no compaction is called for, the fill may be deposited to the full height in one operation and levelled. If the fill has to be compacted, it shall be placed in layers not exceeding 150-300 mm or as specified and levelled uniformly and compacted before the next layer is deposited.

c) Field compaction is called for; test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankments as well.

d) Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, Contractor shall remove the affected material and make good the slip at his own cost.

e) The fill shall be carried out to such dimension and levels as indicated on the drawings after the stipulated compaction. The fill shall be considered as incomplete if the desired compaction has not been obtained. The rate shall include all operations such as lead and transport, filling, watering and consolidating as directed.

Mode of Measurement: It shall be measured in CuM.

1.09 Filling in Plinth and Ground for land development with Earth Brought from Outside:

a) Filling shall be carried out only with material from approved sources in layers of 15-30 cm or as specified, watered, levelled and compacted with mechanical compaction machines or by hand as specified. The material and source shall be subject to prior approval of Engineer. **Desired testing**

of fill material is to be carried out to ascertain the suitability as recommended by consultant and nothing extra to be paid on this account.

b) The approved area, from where the fill material is to be dug, shall be cleared of all bushes, roots plants, rubbish etc. top soil containing salts, sulphate and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed by Engineer. The Contractor shall make necessary access roads to those areas and maintain the same, if such access road does not exist, at his cost.

c) If any material is rejected by Engineer, Contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be disposed off by uniform spreading within the site as instructed by the Engineer, nothing extra to be paid on this account.

d) The compaction shall be carried out as specified in the item no. 1.07 for filling in plinth and as per item no. 1.08 for filling in ground for land development. Backfilling, plinth filling etc. with borrowed earth will be paid for under specified items.

The quoted rate shall include all operations such as clearing, excavation, loading, lead and transport, unloading, filling, levelling, watering, compaction, testing etc. to the satisfaction of engineer-in-charge as specified. Actual quantity of consolidated filling shall be measured and paid.

d) **Mode of Measurement:** It shall be measured in CuM.

1.10 Carting Away Earth out side the Site:

Carting away the excavated surplus earth /rock stuff/ debris generated out of dismantling of brick work / concrete as specified in the schedule of the quantities out side of the site as specified in SOQ including loading at site, transportation, unloading, spreading etc complete as directed.

Contractor shall maintain full record of measurement and the quantities in respect of total quantity of earth work in excavation, quantity back filled in trenches / pits after laying concrete / masonry foundations etc and quantity of surplus earth carted away and the same to reconciled intermittently during execution.

Mode of measurement: Quantity carted away shall be measured in CuM. Length, breadth and depth of the pit shall be measured where full quantity of excavated earth is carted away.

OR

80% fill measurement of earth/debris in truck shall be measured and paid for.

CONCRETE AND ALLIED WORKS

Applicable Codes:

The following codes and standards are made a part of the Specifications. All standards, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall prevail.

(a) **Materials**

IS 269 Specification for ordinary, rapid hardening and low heat Portland cement.

IS 455 Specification for Portland blast furnace slag.

IS 1489 Specification for Portland-Pozollana cement.

IS 4031 Methods of physical tests for hydraulic cement.

IS 650 Specification for standard sand for testing of cement.

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

IS 2386 (Parts I to VIII) Methods of test for aggregates for concrete.

IS 516 Methods of test for strength of concrete.

IS 1199 Methods of sampling and analysis of concrete.

IS 2396(I) IS 5640 Flakiness Index of aggregates

IS 3025 Methods of sampling and test (physical and chemical water used in industry).

IS 432 (Part I & II)	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.
IS 1139	Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement
IS 1566	Specification for plain hard drawn steel wire fabric for concrete reinforcement.
IS 1785 (Part I)	Specification for plain hard drawn steel wire for pre-stressed concrete.
IS 1786	Specification for cold twisted steel bars for concrete reinforcement.
IS 2090	Specification for high tensile steel bars used in pre stressed concrete
IS 4990	Specification for plywood for concrete shuttering work.
IS 2645	Specification for integral cement water-proofing compounds.

(b) **Equipment**

IS 1791	Specification for batch type concrete mixers
IS 2438	Specification for roller pan mixer
IS 2505	Specification for concrete vibrators immersion type
IS 2506	Specification for screed board concrete vibrators
IS 2514	Specification for concrete vibrating tables.
IS 3366	Specification for pan vibrators
IS 4656	Specification for form vibrators for concrete.
IS 2722	Specification for portable swing weigh-batchers for concrete (single and double bucket type)
IS 2750	Specification for steel scaffoldings

Codes of Practice

IS 456:2000 Code of practice for plain and reinforced concrete.

IS 1343 Code of practice for pre-stressed concrete

IS 457 Code of practice for general Construction of plain and reinforced concrete for dams and other massive structures

IS 3370 (Part I to V) Code of practice for concrete structures for storage of liquids.

IS 3935 Code of practice for composite construction

IS 3201 Criteria for design and construction of pre cast concrete trusses.

IS 2204 Code of practice for construction of reinforced concrete shell roof

IS 2210 Criteria for the design of RC shell structures and folded plates.

IS 2751 Code of practice for welding of mild steel bars used for reinforced concrete construction.

IS 2502 Code of practice for bending and fixing of bars for concrete reinforcement.

IS 3558 Code of practice for use of immersion vibrators for consolidating concrete.

IS 3414 Code of practice for design and installation of joints in buildings

IS 4014 Code of practice for steel tubular, (Part I&II) scaffolding.

IS 2571 Code of practice for laying insitu cement concrete flooring.

(c) **Construction Safety**

IS 3696 Safety code for scaffolds and ladders

(d) **Measurement**

IS 1200 Method of measurement of building works.

IS 3385 Code of practice for measurement of civil engineering works.

The above mode of measurements shall be applicable only if it is not given specifically in the tender document.

General

The quality of materials, method and control of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise shall conform to the applicable portions of this specification.

Engineer shall have the right to inspect the source/s of material/s, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and engineer's approval obtained, prior to starting of concrete work.

Materials

The ingredients to be used in the manufacture of standard concrete shall consist solely of standard type Portland cement, clean sand, natural coarse aggregate, clean water and admixtures.

1) Cement

a) If the Contractor is instructed to supply cement, then the following points shall be applicable:

i) Unless otherwise specified the cement shall be Ordinary **Portland Cement (OPC) / Portland Pozzolana Cement (PPC)** in 50 kg bags. The use of bulk cement will be permitted only with the approval of Engineer.

ii) A certified report attesting to the conformance of the cement to IS specifications by the cement manufacturer's chemist shall be furnished to engineer if demanded.

iii) Cement held in storage for a period of Ninety (90) days or longer shall be tested. Should at any time Engineer have reasons to consider that any cement is defective, then irrespective of its origin, and/or manufacturers test certificate, such cement shall be tested immediately at contractor's cost at a National Test Laboratory / approved laboratory and until the results of such tests are found satisfactory, it shall not be used in any

work. Contractor shall not be entitled to any claim of any nature on this account.

iv) A cement stores shall be constructed and maintained as detailed under (b) (i) here under for storing specified quantity of cement for the project.

b) If the cement is supplied by the NDDB

i) Contractor will have to make his own arrangements for the storage of minimum 50MT of cement or the capacity as directed by Engineer-in-charge. If supplies are arranged by NDDB, cement will be issued in quantities to cover work requirements of one month or more, as deemed fit by Engineer and it will be the responsibility of contractor to ensure adequate and proper storage. Cement in bulk may be stored in bins or silos, which will provide complete protection from dampness contamination and minimize taking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contract with moisture from ground and so arranged as to provide ready access damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangements shall be such that there is no dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be approved by Engineer. Consignments of cement shall be stored as received and shall be consumed in the order of their delivery.

2) Aggregates

a) Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete. Fine aggregate is aggregate all of which passes through 4.75 mm IS sieve. Coarse aggregate is aggregate most of which is retained on 4.75 mm sieve

b) All fine and coarse aggregates proposed for use in the work shall be subject to Engineer's approval and after specific materials have been accepted, the source of supply of such materials should not be changed without prior approval of Engineer.

c) Aggregates shall, except as noted above, consist of natural sands, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength

and/or durability of concrete. The grading of aggregates shall be such as to produce dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the mix design and preliminary tests on concrete specified later.

d) **Sampling and testing**

Samples of the aggregates for mix design and determination of suitability shall be taken under the supervision of Engineer and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates, shall be furnished to Engineer in advance of the work for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by contractor.

e) **Storage of Aggregates**

All coarse and fine aggregates shall be stacked in stock separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and with earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rackers shall be used for lifting the coarse aggregates from bins or stockpiles. Coarse aggregate shall be piled in layers not exceeding 1.20 meters in height to prevent coning or segregation. Each layer shall cover the entire area of the stockpile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

f) **Specific Gravity**

Aggregate except as noted above and for other than lightweight concrete shall consist of natural or crushed sand shall conform to IS 383. The sand shall be clean sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt or other deleterious substances, which can be injurious to the setting qualities/strength/ durability of concrete.

3) **Machine made Sand**

Machine made sand will be acceptable, provided the constituent rock / gravel composition shall be sound, hard dense, non-organic uncoated and durable against weathering.

a) **Screening and Washing**

Sand shall be prepared for use for such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions.

b) **Foreign Material Limitations**

The percentages of deleterious substances in sand delivered to the mixer shall not exceed the following: **As per latest provision in IS 383**

c) **Gradation**

Unless otherwise directed or approved, the grading of sand shall be within the limits indicated hereunder:

IS Sieve Designation	**Percentage passing for**			
	Grading Zone I	Grading *Zone II*	Grading Zone III	Grading Zone IV
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of sieves other than 600 micron IS sieve, by total amount not exceeding 5 percent, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV.

d) **Fineness Modulus**

The sand shall have a fineness modulus of not less than 2.2 or more than 3.2. The fineness modulus is determined by adding the Cumulative percentages retained on the following IS sieves sizes 4.75mm, 2.36 mm, 1.18 mm 600 micron, 300 micron and 150 micron and dividing the sum by 100.

4) Coarse Aggregate

a) Coarse aggregate for concrete, except as noted above and for other than lightweight concrete shall conform to IS 383. This shall consist of natural or crushed stone and gravel and shall be clean and free from elongated, flaky or laminated pieces adhering coatings, clay lumps, coal residue, clinkers slag, alkali, mica, organic matter or other deleterious matter.

b) **Screening and Washing**

Natural gravel and crushed rock shall be screened and/or washed for the removal of dirt or dust coating, if so demanded by Engineer.

c) **Grading**

Coarse aggregate shall be graded in both cases the grading shall be within the following limits.

IS Sieve Designation	% passing for single sized aggregate of nominal size (mm)					% passing for graded aggregate of nominal size (mm)			
	40	20	16	12.5	10	40	20	16	12.5
63mm	100	-	-	-	-	100	-	-	-
40mm	85 - 100	100	-	-	-	95 100	100	-	-
20mm	0-20	85-100	100	-	-	30-70	95-100	100	-
16mm	-	-	85-100	100	-	-	-	90-100	-
12.5mm	-	-	-	85-100	100	-	-	-	90-100
10mm	0.5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85
4.75mm	-	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36mm	-	-	-	-	0-5	-	-	-	-

The pieces shall be angular in shape and shall have granular or crystalline surfaces, Friable, flaky and laminated pieces, mica and shale, if present, shall be only in such quantities that will not, is the opinion of Engineer affect adversely

the strength and/or durability of concrete. The maximum size of coarse aggregate shall be 75 mm for class concrete 40-mm for class B concrete and 20mm for class C concrete. The maximum size of coarse aggregate shall be the maximum size specified above, but in no case greater than 1/4 of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. Plums above 150 mm and up to any reasonable size can be used in plain very concrete work of large dimensions up to a maximum limit of 20% of volume of concrete when specifically approved by Engineer. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5mm less than the minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per IS 2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% of its oven dry weight in air, as determined by IS 2386.

d) **Foreign Materials Limitations**

The percentages of deleterious substance in the coarse aggregate delivered to the mixer shall not exceed the following: **As per latest provision in IS 383**

5) Water

a) Water used for both mixing and curing shall be free from injurious amounts of deleterious materials. Potable waters are generally satisfactory for mixing and curing concrete.

b) In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS-456 -2000. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

c) Average 28 days compressive strength of at least three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water.

d) The initial setting time or test block made with the appropriate set cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than plus minus 30 seconds form the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of IS 4031.

e) Where water can be shown to contain an excess of acid, alkali sugar or salt, engineer may refuse to permit its use. As a guide, the following concentrations represent the maximum permissible values:

i) To neutralize 100 ml sample of water, using phenolphthalein as indicator, it should not require more than 5 ml of 0.2 normal NaOH. The details of test shall be as given in IS 3025 (part 22).

ii) To neutralise 100 ml sample of water using Mix Indicator as an indicator, it should not require more than 25 ml of 0.02 normal H_2SO_4. The details of test shall be given in IS 3025 (part 23).

iii) Percentage of solids when tested in accordance with the method indicated below shall not exceed the following:

	Percent	**Test as per**
Organic	200 mg/L	IS 3025-1964 (part 18)
Inorganic	3000mg/L	- Do --
Sulphate (as SO4 Alkali)	400 mg/L	IS 3025-1964 (part 24)
Chlorides (as Cl)	500 mg/L	IS 3025-1964 (part 32)
Suspended matter	2000 mg/L	IS 3025-1964 (part 17)

6) Brick aggregates

The brickbats shall be of new bricks well burnt, hard, durable and broken to sizes, well graded. It shall be free from dust; the size shall be of 37mm and down. It shall be free from earth and other impurities.

7) Reinforcement Steel

a) Reinforcement bars, if supplies are arranged by contractor, shall be either plain round mild steel bars grade I as per IS 432 (part I) or medium tensile steel bar as per IS 432 (Part I) or hot rolled mild steel and medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars as per IS 1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566. Substitution of reinforcement will not be permitted except upon written approval from Engineer.

b) Plain round mild steel bars grade II as per IS:432(part I) may be used with prior approval of Engineer in writing and with 10% increase in the reinforcement area but its use shall not be permitted in structures located in earthquake zones subjected to severe damage (as per IS:1895) and for structures subject to dynamic loading (other than wind loading), such as frames supporting rotary or reciprocating machinery etc.

c) All reinforcement shall be clean, free from grease, oil, paint, loose mill scale, loose rust, dust, bituminous material or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used.

2.01 Providing and laying Brickbat Cement Concrete 1:4:8 (1part cement: 4 part coarse sand: 8 part brickbats of size 37mm and down).

The brickbats, sand and cement shall be of quality as described in the materials section above. The materials shall be mixed in volumetric proportions in concrete mixer only. The concrete shall be laid in layers of 150mm thick or as specified and well consolidated with rammer of weight 4.5 to 5.5 kg steel rammers of base area 300 Sq. cm till slurry comes on top before the next layer is laid. Curing shall be done for 7 days. For joints the edge of the concrete shall be finished off with a slope not steeper than 2:1 and well roughened. The **rate** shall include cost the shuttering to be provided

Mode of Measurement: This shall be measured in CuM. The bed concrete provided for flooring / below foundation or as specified shall be paid for under this item.

2.02 Providing and laying Cement Concrete 1:5:10 (1 part cement: 5 part coarse sand: 10 part graded stone aggregate of nominal size 37 mm and down.)

The coarse aggregate, cement and coarse sand shall be of quality as specified in the materials section 2.01 and the other procedures are same as that specified in Item spec. no. 2.01.

Mode of measurement: Same as per Item spec. no. 2.01

2.03 Providing and laying plain cement concrete 1:4:8 (1 part cement: 4 part coarse sand: 8 part graded stone aggregate of nominal size 37 mm and down.

The coarse aggregate, cement and coarse sand shall be of quality as specified in the materials section 2.01 and the other procedures are same as that specified in Item spec. no. 2.01.

Mode of measurement: Same as per Item spec. no. 2.01

2.04 Providing and laying plain cement concrete 1:3:6(1 part cement: 3 part coarse sand: 6 parts graded stone aggregate of nominal size 37 mm and down.

The general specifications shall be same as per Item spec. no. 2.03 but for the volumetric proportions of the coarse sand and the stone aggregate which shall be 3:6 instead of 4:8 and stone aggregate size 20mm & down.

Mode of measurement: Same as per Item spec. no. 2.01

2.05 Providing and laying RCC of mix M20 for structures at all levels below and up to highest plinth level.

Mix Design

a) All concrete in the works shall be of design mix as defined in IS 456: 2000, unless it is a nominal mix concrete. Whether reinforced or otherwise, all design mix concrete works to be carried out under this specification shall be divided into the following classifications:

b) MINIMUM COMPRESSIE STRENGTH OF 15 CM CUBES AT 7 AND 28 DAYS AFTER MIXING, CONDUCTED IN ACCORDANCE WITH IS 516

Class	Preliminary test (N/SqMM)		Work Test N/SqMM		Max. size of aggregate mm	Minimum Cement Content per CuM
	At 7 days	At 28 days	At 7 days	At 28 days		
M 40	35.0	54.0	27.0	46.0	20	550 Kg
M 35	31.0	45.0	23.5	39.0	20	470 Kg
M 30	28.0	42.0	20.0	33.0	40 or 20	420 Kg
M 25	23.5	35.0	17.0	28.0	40 or 20	370 Kg
M 20	19.4	29.0	13.5	22.0	40 or 20	320 Kg
M 15	14.0	17.0	10.0	16.0	40 or 20	300 Kg

c) It shall be very clearly understood that whenever the class of concrete such as M20 is specified it shall be the Contractor's responsibility to ensure that minimum crushing strength stipulated for the respective class of concrete is obtained at works. The maximum total quantity of aggregate per 50 Kg of cement shall not exceed 450 Kg except when otherwise specifically approved by Engineer.

d) To fix the grading of aggregates, water cement ratio, workability and the quantity of cement required to give preliminary and works cubes of the minimum strength specified, the proportions of the mix shall be determined by weight/volume. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to Indian Standard Specifications.

e) Whenever there is a change either in required strength of concrete or water cement ratio or workability or the source of Aggregates and/or cement, preliminary tests shall be repeated to determine the revised proportions, of the mix to suit the altered conditions.

f) While fixing the value for water cement ratio for preliminary mixes, assistance may be derived from the graph (appendix IS 456 showing the relationship between the 28 day compressive strengths of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS 269.

g) If the contractor is intending to use Ready Mixed Concrete (RMC), he should get approval of the Engineer/Owner/Architect before placing RMC into the structure/ permanent work. Ready Mixed Concrete (RMC) shall be allowed from the sources and RMC manufacturing plants belonged

to/owned by the main approved cement manufacturers stipulated as per the Section V, Appendix – IV, Form of Bid. Stages of approval start from the particular grade of concrete, source of concrete and its constituents with necessary mentioned tests, No. of trial mixes, Cube test results (the test results of concrete for 7 days and 28 days strength should be reported by the supplying firm independently apart from field tests at site) etc, as per the relevant IS Codes and as per the Engineer's requirements at any stage, without any extra cost implication to the Contract in any manner either for supply, testing, placing concrete in to place with all necessary material, labour, plant and equipments, safety measures and any statutory duties, taxes, other liabilities in this regard. Contractor must ensure that the RMC should be placed in position within 2 ½ hours from loading of concrete into transit mixer. Relevant documents like trip sheet should be sent along with each mix. Contractor must ensure that the minimum cement content for particular grade shall follow as specified in technical specification. Testing of RMC (fresh/hardened) shall comply relevant IS Codes (IS 4926:1976 reaffirm 1990).

Preliminary tests

a) Test specimens shall be prepared with at least two different water/cement ratios for each class of concrete, consistent with workability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce concrete of required consistency and to give the specified strength. It will be the Contractor's sole responsibility to carry out these tests and he shall therefore furnish to Engineer a statement of proportions proposed to be used for the various concrete mixes.

b) Materials shall be brought to the room temperature and all materials shall be in a dry condition. The quantities of water, cement and aggregates for each mix shall be determined by weight/volume to an accuracy of 1part in 1000 parts.

c) Mixing shall be done by a mixer machine as per IS 516 in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in colour. The coarse aggregate shall then be added, mixed and water added and mixed thoroughly for a period of not less than 3 minutes until the resulting concrete is uniform in appearance. Each mix of concrete shall be of such a quantity as to leave about 10% excess concrete after moulding the desired number of test specimens.

d) The consistency of each mix of concrete shall be measured immediately after mixing, by the slump test in accordance with IS 1199. If in the slump test, care is taken to ensure that no water or other materials is lost, the materials used for the slump test may be remixed with the reminder of the concrete for making the specimen test cubes. The period of re-mixing shall be as short as possible yet sufficient to produce a homogeneous mass.

e) Compression tests of concrete cubes shall be made as per IS 516 on 15 cm cubes. Each mould shall be provided with a metal base having a plane surface to support the mould during filling without leakage. The base plate shall be preferably attached the to mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing, concrete the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits:

Height and distance between the opposite faces of the mould shall be of specified size plus minus 0.2mm. The angle between the adjacent internal faces and between internal faces and top and bottom planes of mould shall be 90 Deg. plus/minus 5 Deg. The interior faces of the mould shall be plane surfaces with a permissible variation 0.03mm.

f) Concrete test cubes shall be moulded by placing fresh concrete in the mould and compacted as specified in IS 516.

g) Curing shall be as specified in IS 516. The cubes shall be kept in moist air of at least 90% relative humidity at a temperature of 27 Deg. Cent. plus minus two Deg. Cent. for 24 hours plus minus half hour from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds, kept immersed in clean fresh water, and kept at 27 Deg. Cent. plus minus 2 Deg. Cent. Temp. Until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

h) **Testing of specimens**

The strength shall be determined based on not less than five cubes test specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to Engineer. The test result

shall be accepted by Engineer if the average compressive strengths of the specimens are tested subject to the condition that only one out of the five consecutive test may give a value less than the specified strength for that age. The Engineer may direct the Contractor to repeat the tests if the results are not satisfactory and to make such changes, as he considers necessary to meet the requirements specified. All these preliminary tests shall be conducted by the Contractor at his own cost in an approved laboratory.

Proportioning consistency, batching and mixing of concrete

Proportioning

a) **Aggregate**

The proportions, which shall be decided by conducting preliminary test, shall be by volume. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete mixing. The supply of properly graded aggregate of uniform quality shall be maintained over the period of work, the grading of aggregates shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stocked in separate stockpiles. The grading of coarse and fine aggregate shall be checked as frequently as possible as determined by Engineer, to ensure maintaining of grading in accordance with the samples used in preliminary mix design. The material shall be stock piled well in advance of use.

b) **Cement**

The cement shall be measured by volume / weight

c) **Water**

Only such quantity of water shall be added to the cement and aggregates in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with the strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of material or the collection of excessive free water on the surface of the concrete.

The water cement (W/C) ratio is defined as the volume of water in the mix (including the surface moisture of the aggregates) divided by the volume of cement in the mix. The actual water cement ratio to be adopted shall be determined in each instance by the Contractor and approved by the Engineer.

d) **Proportioning by water/Cement ratio**

The W/C ratio specified for use by Engineer shall be maintained. The Contractor shall determine the water content of the aggregates as frequently as directed by Engineer as the work progress and as specified in IS 2386 (Part-III) and the amount of water added at the mixer shall be adjusted as directed by Engineer so as to maintain the specified W/C ratio. To allow for the variation in volume of aggregates due to variation in their moisture content suitable adjustments in the volume of aggregates shall also be made.

e) **Consistency and slump**

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined, the consistency of the mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump tests, compacting factor tests, in accordance with IS 1199 shall be conducted from time to time to ensure the maintenance of such consistency.

The following tabulation gives a range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer.

SLUMPS FOR VARIOUS TYPES OF CONSTRUCTION:

Only sufficient quantity of water shall be added to concrete during mixing to produce a mix of sufficient workability to enable it to be well consolidated to be worked in to the corners of the shuttering and around the reinforcement, to give the specified surface finish, and to have the specified surface strength. The following slumps shall be adopted for different kinds of works:-

Name of Work	***When vibrator used***	***When vibrator not used***
Mass concrete in foundations, footings retaining walls and pavements.	10mm to 25mm	50 mm to 75 mm
Thin sections of floors of less than 75mm thick	25mm to 40mm	75 mm to 100 mm

For Reinforced cement concrete work:

Name of Work	***When vibrator used***	***When vibrator not used***
Mass concreting in foundations, footings retaining walls and pavements	10mm to 25mm	80 mm
Beams, slabs, columns	25mm to 40mm	100 mm to 125 mm
Thin shells, folded plates etc	40mm to 50mm	125 mm to 150 mm

The concrete mix shall be in the proportion as arrived at as per the mix design and all the ingredients to be measured by weight (i.e. by weigh batching).All concrete work shall be carried by weigh batching only. In case if it is approved by the Engineer, the equivalent volume of coarse and fine aggregates based on the bulk density can be adopted. Contractor shall make available weigh scale of appropriate capacity at site for intermittent checking the weight of the ingredients so measured by volume during the concreting operation.

Sampling and testing concrete in the field:

a) Facilities required for sampling materials and concrete in the field shall be provided by the Contractor at no extra cost. The following minimum equipment with operator shall be made available at Engineer's request (all must be in serviceable condition):

i) One concrete cube testing machine suitable for 15 cm cubes, of 100 tonnes capacity with proving calibration ring. The machine should be powered driven type, calibrated and certification of calibration shall be produced by the contractor.

ii) Forty-Eight cast iron cube moulds of 15 cm size, for Mortar: 12 cubes moulds

iii) One Lab. balance to weigh up to 20 kg with sensitivity of 10gm and one up to 100 kg with sensitivity of 10 grams or as directed
iv) One set of sieves each for coarse and fine aggregates & power-driven Sieve shaker
v) Three sets of slump cone complete with tamping rod
vi) A set of measures from 5 litre to 0.10 litre
vii) One electric oven with thermostat up to 120 Deg. Cent.
viii) One flakiness gauge
ix) One elongation index gauge
x) One sedimentation pipette
xi) Two Pycnometers
xii) Three calibrated glass jars of 1 litre capacity.
xiii) Two Modified proctor mould
xiv) Five nos. core cutters
xv) Digital Vernier callipers – 1 no.
xvi) Hydrometer
xvii) Thickness gauge
xviii) Electronic measuring tape – 2 nos., Steel tapes (5.0 mtrs, 15 mtrs, 30 mtrs)
xix) Film/paint thickness measuring equipment (DFT machine - electronic)
xx) Temperature gun (temperature measuring equipment – electronic)
xxi) Rapid moisture machine
xxii) Sampling trays, sampling equipment

The above list of the facility is an indicative and is not limiting. The contractor shall arrange necessary laboratory equipment / glassware etc as may be required as per relevant IS specification / code of practice or as advised by the Structural Consultants.

Arrangement can be made by the contractor to have the cubes tested in an approved laboratory in lieu of a testing machine at site at his expense, with the prior consent of the Engineer.

b) **Acceptance criteria for the cement concrete cubes tested at project sites (as per IS 456-2000-Amendment-4 May 2013** - Value of standard deviation should be established on the basis of results of 30 samples as provided in Table 11 of the above Code. Accordingly acceptance criteria of mean of the group of 4 non-overlapping consecutive test specified in Table 11 should be followed.

The samples where individual variations are more than +/- 15 % of average of three specimens should be declared invalid as per the provisions of the Clause 15.4 of the Code.

Frequency of sampling of concrete of each grade and sampling procedure to be adopted shall be in accordance with clause no 15.2 of IS 456:2000.

An additional set of test cube if asked by the Engineer shall be cast and taken by the contractor which may be kept for record / verification at later date.

C) At least six test cubes of each class of concrete shall be made for every 15.0 CuM. of concrete or part thereof. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The laboratory test results shall be tabulated and furnished to Engineer. Engineer will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength. The cubes shall be tested on 7th and 28th day from the day of casting of the cubes.
The requirement of number of samples shall be determined by the Engineer and as such 1 sample for quantity of concrete up to 5 CuM 2 samples for quantity from 6 to 14 CuM to be taken.

An additional set of test cube if asked by the Engineer shall be cast and taken by the contractor which may be kept for record / verification at later date.

Admixtures:

a) Admixtures may be used in concrete only with the approval of Engineer based upon evidence that, with the passage of time, neither the compressive strength nor its durability reduced. Calcium chloride shall not be used for accelerating setting of the cement for any concrete containing reinforcement, or embedded steel parts. When calcium chloride is permitted to be used, such as in mass concrete works, it shall be dissolved in water and added to the mixing water in an amount not to exceed 1.5% of the volume of the cement in concrete. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instructions, in the manner, and with the control specified by Engineer.

b) **Air entraining agents:**

Where specified and approved by Engineer, neutralised vinyl resin or any other approved air-entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6260, air entraining admixtures for concrete. The recommended total air content of the concrete is 4% plus minus 1%. The method of measuring air content shall be as per IS 1199.

c) **Water reducing admixtures:**

Where specified and approved by Engineer water reducing Napthalene base/ Polycarboxylate ether mixture shall be added in quantities specified by Engineer. The admixtures shall be added in the form of a solution.

d) **Retarding admixtures:**

Where specified and approved by Engineer, retarding agents shall be added to the concrete mix in quantities specified by Engineer.

e) **Water proofing agent:**

Where specified and approved by Engineer, water proofing agent conforming to IS: 2645 shall be added in quantities specified by Engineer.

Optional tests:

a) Engineer may order tests to be carried out on cement, sand, coarse aggregate and water in accordance with the relevant Indian Standards. Tests on cement shall include (i) fineness test (ii) test for normal consistency (iii) test for setting time (iv) test for sound-ness (v) test for tensile strength (vi) test for compressive strength (vii) test for heat of hydration by experiment and by calculations in accordance with IS: 269. Tests on sand shall include (i) sieve test (ii) test for organic impurities (iii) decapitation test for determining clay and silt content (iv) specific gravity test (v) test for unit weight and bulkage factor. Tests on coarse aggregate shall include (i) test for sieve analysis (ii) specific gravity and unit weight of dry loose and rodded aggregate (iii) soundness and alkali aggregate reactivity (iv) pertrographic examination (v) deleterious materials and organic impurities (vi) test for aggregate crushing value. Any or all these tests would normally be ordered to be carried out only if Engineer feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by contractor at site or at an approved test laboratory. Testing fees, the Contractor shall have to pay.

b) If the works cubes do not give the stipulated strengths Engineer reserves the right to ask contractor to dismantle such portions of the work, which in his opinion are unacceptable and re-do the work to the standard stipulated at contractor's cost.

In such case when the concrete fail to pass the routine tests the Engineer can order the contractor to undertake **non-destructive tests like Rebound Hammer test**. The field test to be carried out in accordance with procedure described in IS 13311 (Part II).When making rebound hammer test each result should be the average of at least 12 readings. The readings shall be taken and as per the procedure in the relevant IS 13311 (Part II) and calibration charts available from manufacturer to be used for interpretation. This non-destructive test shall be carried out through an approved agency at contractors cost.

c) **Load test on members or any other tests**

i) In case of any work being suspected of faulty material or workmanship or both, Engineer requiring its removal and reconstruction may order the contractor that it should be load tested in accordance with the following provisions.

ii) The test load shall be 125 % of the maximum superimposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of the concrete. During the test, struts strong enough to take the load shall be placed in position leaving a gap under the members. The test load shall be maintained for 24 hours before removal.

iii) If within 24 hours of the removal of the load, the structure dose not show a recovery of at least 75 percent of the maximum deflection shown during the 24 hours under load the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the test if the recovery after the second test is not at least 75 percent of the maximum deflection shown during the second test. If the structure is certified as failed by Engineer, the cost of the load test shall be borne by the contractor.

iv) If the maximum deflection in mm, shown during 24 hours under load is less than 40(L x L)/ D, where L is the effective span in M ; and D, the overall depth of the section in mm, it is not necessary for recovery to be measure and recovery provisions of (iii) shall not apply. This will be governed by relevant IS.

v) Any other tests e.g. taking out in approved manner concrete cores examination and tests on such cores removed from such parts of the structure as directed by Engineer, Non destructive testing etc. shall be carried out by contractor if so directed.

vi) Should the results of any test prove unsatisfactory, or the structure shows signs of weakness, undue deflection or faulty construction the contractor shall remove and rebuild the member or members involved or carry out such other remedial measures as may be required by Owner. the Contractor shall bear the cost of so doing, unless the failure of the member or members to fulfil the test conditions is proved to be solely due to faulty design.

Concrete in alkali soils and alkaline water

Where concrete is liable to attack from alkali salts or alkaline water, special cements containing low amount of Tricalcium Aluminates shall be used, if so specified in the drawings. Such concrete shall have a minimum 28 days compressive strength of 250 kg per Sq. cm and shall contain not less than 370 kg of cement per cubic metre of concrete in place. If specified, additional protection shall be obtained by the use of a chemically resistant, stone facing or a layer of plaster of Paris covered with suitable fabric, such as jute thoroughly impregnated with tar.

Preparation prior to concrete placement

a) Before the concrete is actually placed in position, the insides of the formwork shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottom of columns and walls forms to permit removal of saw dust, wood shavings, binding wire, rubbish dirt etc. Openings shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/holes shall be later suitably plugged.

b) The various agencies shall be permitted ample time to install drainage and plumbing lines in floor and trench drains, electrical conduits, hangers, anchors, inserts, sleeves, bolts, frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawings or as is necessary far the proper execution of the work Contractor shall cooperate fully with all such agencies and shall permit the use of scaffolding form work etc. by other agencies at no extra cost.

c) All embedded parts, inserts etc. supplied by Owner or Contractor shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

d) Anchor bolts shall be positioned and kept in place with the help of proper manufactured templates .The use of all such templates, fixture etc. shall be deemed included in the rates.

e) Slots, openings, holes, pockets etc. shall be provided in the concrete work in the positions indicated in the drawings or as directed by Engineer.

f) Prior to concrete placement all work shall be inspected and approved by Engineer and if found unsatisfactory, concrete shall not be poured until after all defects have been corrected at Contractor's cost. Cat ladders shall be provided on the reinforcement to facilitate labour movement.

g) Approval by Engineer for all materials and work as required herein shall not relieve contractor from his obligation to produce finished concrete in accordance with the drawings and specifications.

h) No concrete shall be placed in wet weather or on water covered surface. Any concrete that has been washed by heavy rains, the work shall be entirely removed, if there is any sign of cement and sand having been washed from the concrete mixture. To guard against damage, which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete, suitable drains and sumps shall be provided.

i) Immediately before concrete placement begins, proposed surfaces except framework, which will come in contract with the concrete to be placed, shall be covered with a bonding mortar.

Transportation:

a) All buckets, containers or conveyors used for transporting concrete shall be mortar tight. Irrespective of the method of transportation adopted, concrete shall be delivered with the required consistency and plasticity without segregation or loss of slump. However, chutes shall not be used for transport of concrete without the written permission of Engineer and concrete shall not be re handled before placing.

b) Concrete must be placed in its final position before it becomes too stiff to work. On no account, water shall be added after the initial mixing concrete

that has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by Engineer.

c) All equipment used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans bucket. Hoppers, chutes, pipelines, transit mixers and other equipment shall be thoroughly cleaned after each period of placement.

Procedure for placing of concrete:

a) Before any concrete is placed, the entire placing program, consisting of equipment, layout proposed procedures and methods shall be submitted to engineer for approval if so demanded by Engineer and no concrete shall be placed until Engineer's approval has been received. Conveyor for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing without segregation of materials, considering the size of the job and placement location.

b) Concrete shall be placed in its final position before the cement shall normally be compacted in its final position within fifteen minutes of leaving the mixer and once compacted it shall not be disturbed.

c) Concrete, in all cases, be deposited as nearly as practicable directly in its final position, and shall not be re handled or caused to flow in a manner which will cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible, and in narrow forms, contractor shall provide suitable drop and elephant trunks to confine the movement of concrete. Special care shall be taken when concrete is dropped from a height especially if reinforcement is in the way, particularly in columns and thin walls.

d) Except when otherwise approved by Engineer, concrete shall be placed in shovels or other approved implements and shall not be dropped from a height more than 1 M or handled in a manner, which will cause segregation.

e) The following specification shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved. The control of placing shall begin at the mixer discharge, concrete shall be discharged by a

vertical drop into the middle of the bucket or hopper and this principle of a vertical discharge of concrete shall be adhered to thoroughly all stages of delivery until the concrete comes to rest in its final position.

f) Central bottom dump buckets of a type that provides for positive regulation of the amount and rate of deposition of concrete in all dumping position shall be employed.

g) In placing concrete in large open areas, the bucket shall be spotted directly over the position designated and than lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1 M. The bucket shall be opened slowly to avoid high vertical bounce. Dumping of buckets on the swing or in any manner, which results in separation of ingredients or disturbance of previously placed concrete, will not be permitted.

h) Concrete placed in restricted forms by wheel barrows, buggies, cars, short chutes or hand shovelling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

i) Where it is necessary to use transfer chutes, specific approval of Engineer must be obtained to the type, length, slopes, s baffles, vertical terminals and timing of operations, the discharge and without segregation. To allow for the loss of mortar against the sides of the chutes, the first mix shall have less coarse aggregate. During cleaning of chutes, the wastewater shall be kept clear of the forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1 M. Chutes when approved for use shall have slopes not flatter than 1: 3 and steeper than 1: 2 chutes shall be of metal or metal lined and of rounded cross section. The slopes of all chutes sections shall be approximately the same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms.

j) Concrete may be conveyed and placed by mechanically operated equipment e.g. pumps or pneumatic placers only with the written permission of Engineer. The slump shall be held to the minimum, necessary for conveying concrete by this method.

k) When pumping is adopted, before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall be specially

designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

l) When pneumatic placer is used, the manufacturer's advice on layout of pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's advice shall be followed regarding concrete quality and all other related matters when pumping or pneumatic placing equipment is used.

m) Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 to 90 mm as directed by Engineer. These shall be placed as rapidly practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as well facilitate spreading the layer to uniform depth and texture with a minimum of shovelling. Any tendency to segregation shall be corrected by shovelling stones into mortar rather than mortar on to stones. Such a condition shall be corrected by redesign of mix or other means, as directed by Engineer.

n) The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

p) **Compaction:**

i) Concrete shall be compacted during placing the approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the forms faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over vibrate the concrete to the point those segregation results.

ii) Vibrators shall conform to BIS/IS specifications. Type of vibrator to be used shall depend on the structure where concrete is to be placed. Shutter

vibrators to be effective, shall be firmly secured to the formwork which must be sufficiently rigid to transmit the vibration and strong enough not to be damaged by it. Immersion vibrators shall have no load frequency, amplitude and acceleration as per IS 2505 depending on the size of vibrator. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

iii) The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of a lift e.g. in a column or wall.

iv) When placing concrete in layers, which are advancing horizontally as the work progresses, great care shall be exercised to ensure adequate vibration, blending and mixing of the concrete between the succeeding layers.

v) The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below with the under layer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

vi) Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come in contact with forms or finished surfaces.

vii) Form attached vibrators shall be used only with specific authorisation of Engineer.

viii) The surface vibrators will not be permitted under normal conditions. However, for thin slabs vibration by specially designed vibrators may be permitted upon approval of Engineer. Where as for cement concrete pavements appropriate surface vibrator shall be used in addition to immersion vibrator approved by the Engineer.

ix) The formation of stone pockets or mortar bondage's in corner and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to sufficient depth and shape for through bonding, as directed by Engineer.

q) **Placement interval:**

Except when placing with slip forms each placement of concrete in multiple lift work, shall be allowed to set for at least 24 hours after the final set of concrete and before the start of a subsequent placement.

r) **Special provision in placing:**

When placing concrete in walls with openings and in floors of integral slab and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls and bottom horizontal surface of the slab, as the case may be placing shall be resumed before the concrete in place takes initial set, but not until it has time to settle as determined by Engineer.

s) **Placing concrete through reinforcement steel:**

While placing concrete through reinforced steel, care shall be taken to prevent segregation of the coarse aggregate. When the congestion of steel makes placing difficult, it may be necessary to temporarily move the top steel aside to get proper placement and restore reinforcing steel to design position.

t) **Bleeding:**

Bleeding of free water, on top of concrete being deposited, in to the forms shall be caused to stop the concrete pour. The conditions causing this defect corrected before any further concreting is resumed.

Curing, protecting, repairing and finishing

a) **Curing:**

i) All concrete shall be cured by keeping it continuously damp for the period required for complete hydration and hardening to take place shall cure all concrete. Preference shall be given to the use of continuous sprays or ponded water continuously saturated covering of sacks, canvas, Hessian or other absorbent materials, or approved effective curing compounds

applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot water as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

ii) Certain types of finish or preparation for overlaying concrete must be done at certain stage of the curing process and special treatment may be required for specific concrete surface finish.

iii) Curing of concrete made of high alumna cement and super sulphate cement shall be carried out as directed by Engineer.

iv) Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete following a lapse of 12 to 14 hours after laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened. Water shall be applied uniformly to concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms quantity of water applied shall be controlled to prevent erosion of freshly placed concrete.

v) Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliance of hose, sprinklers and spraying devices. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by Engineer.

vi) Whenever, by the judgment of Engineer, it may be necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags, which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during the curing period.

vii) For curing of concrete in pavements, sidewalks floors, flat roofs or other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by Engineer. Special attention shall be given to edges and corners of the slabs to ensure proper protection to these areas. The ponded area shall be kept continuously filled with water during the curing period.

viii) Surface coating type compounds shall be used only by special permission of Engineer; curing compounds shall be liquid type white pigmented.

Other curing compounds shall be used on surfaces where future blending with concrete, water or acid proof membrane or painting is specified.

ix) All equipment and materials required for curing shall be on hand and ready for use before concrete is placed.

b) **Protecting fresh concrete:**

Fresh concrete shall be protected from defacements and damage due to construction operation by leaving forms in place for an ample period as specified later in this specification. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer shall also be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion or contact with other materials etc that may impair the strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during it setting period. If it is necessary that workmen enter the area of freshly placed concrete, Engineer may require that bridges be placed over the area.

c) **Repair and replacement of unsatisfactory concrete:**

i) Immediately after the shuttering is removed, the surface of concrete shall be very carefully inspected and all defective areas called to the attention of Engineer who may permit patching of the defective areas or also reject the concrete unit either partially or entirely. Rejected concrete shall be removed and replaced by contractor at no additional expense to owner. Holes left by from bolts etc. Shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing 2.36 mm IS sieve after removing any loose stones adhering to the concrete shall be finished as described under the particular items of work.

ii) Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering in the presence of Engineer and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by Engineer the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal of shuttering to remove fine or other irregularities and necessary care being taken to avoid damage to the surface. Surface irregularities shall be removed by grinding.

iii) If reinforcement is exposed or the honeycombing occurs at vulnerable positions e.g. ends of beams or columns it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer shall be final in this regard. If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25mm) the edges being cut perpendicular to the affected surface or with small under cut if possible. Anchors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place an area extending several centimetres beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

iv) The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of Engineer. Epoxy shall be applied in strict accordance with the instructions of the manufacturer.

v) Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form bottom, grout insert holes and slots cut for repair of cracks shall be repaired as follows. The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops.

A 5mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete, which shall be well consolidated with a wooden float. The concrete patch shall be built up in 10 mm thick layers. After an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and smooth finish obtained by wiping with Hessian; a steel trowel shall be used for this purpose. The mix for patching shall be of same material and in the same proportions as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

Mortar filling by air pressure (guniting) shall be used for repairing of areas too large and/or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the colour and texture of the surrounding concrete. While cement shall be substituted for ordinary cement, if so directed by Engineer, to match the shade of the patch with original concrete.

vii) The patched area shall be covered immediately with an approved non-staining water saturated material such as gunny bag which shall be kept

continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by fine spray of sprinkling for not less than 10 days.

viii) Any minor cavity in the element or water pass through a joint, the affected area shall be grouted with an approved means as approved by the Engineer. This will not however applicable to any defect which is in case established during testing.

ix) All materials, procedures and operations used in the repairing of concrete and also the finished repair work shall be subject to the approval of Engineer. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and finished.

d) **Finishing:**

i) The type of finish for formed concrete surface shall be as follows, unless, other wise specified by the Engineer.

For surfaces against which backfill or concrete is to be placed, no treatment is required except repairing of defective areas.

For surface below grade, which will receive, waterproofing treatment the concrete shall be free of surface irregularities, which would interfere with proper application of the waterproofing material which is specified for use.

Unless specified, surfaces which will be exposed when the structure is in service shall receive no special finish, except repairing of damage or defective concrete removal of fins and abrupt irregularities, fillings of holes left by form ties and rods and clean up of loose or adhering debris.

ii) Surfaces which will be exposed to the weather and which would normally be level shall be sloped for drainage. Unless the drawing specifies such as stair treads, walls shall be sloped across the width approximately 1 in 30 broader surface such as walkways. roads, parking areas and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete sub floors to be covered either concrete topping, terrazzo or quarry tile and similar surfaces shall be smoothing screeded and levelled to produce even surfaces. Surface irregularities shall not exceed 6mm. Surfaces which will not be covered by backfill, concrete or tile toppings

such as outside decks, floors of galleries and sumps, parapets, gutters, sidewalks floors and slabs shall be consolidated, screeded and floated. Excess water and laitance shall be removed before finishing. Floating may be done with hand or power tools and started as the screeded surface has attained a stiffness to permit finishing operation and these shall be the minimum required to produce a surface uniform in texture and free from screed marks or other imperfections. Joints edge panels and forms linings shall be of uniform size and are as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, projections etc, removed leaving the surfaces reasonably smooth and unmarred.

iv) **Integral cements concrete finish:**

When specified on the drawings and integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawing as per IS 2571. The surface shall be compacted and than floated with a wood float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or troweling of finish shall be permitted only after all surfaces water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

v) **Exposed Concrete finish/Rendering:**

A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings. Upon removal of forms, all fins and other projections on the surfaces shall be carefully removed, off-sets levelled and voids and damaged sections be immediately saturated with water and repaired by filling with a concrete or mortar of the same composition as was used in the surface. Then surface shall be thoroughly wetted and rubbed with carborundrum or other abrasive. Cement mortar may be used in the rubbing, but the finished surface shall be brush coated with either cement grout after rubbing. The finished surfaces shall present a uniform and smooth appearance matching with exposed concrete surface texture and style.

Mode of Measurement: This shall be paid in Cu. M

i) The unit rate for concrete work under various categories shall be all inclusive and no claims for extra payment on account of such items as leaving holes, embedding inserts etc. shall be entertained unless

separately provided for in the schedule of quantities. No extra claim shall also be entertained due to change in the number, position end/or dimensions of holes soils or openings sleeves, inserts or on account of any increased lift or scaffolding etc. All these factors should be taken into consideration while quoting the unit rates.

ii) Payments of concrete will be made on the basis of unit of the respective item specified in the Schedule of Quantities. No deduction in the concrete quantity will be made for reinforcements, inserts etc. and opening less than 0.05cu.m. Where no such deduction for concrete is made, payment for shuttering work provided for such holes, pockets etc. will not be made.

iii) Payment for beams will be made for the quantity based on the depth being reckoned from the underside of the slabs and length measured as the clear distance between supports. Payment for columns shall be made for the quantity based on height reckoned up to the underside of slabs.

2.06 Providing and laying RCC of M 25 mix for structures below & up to highest plinth level.

The general specification is same as per Item spec. no. 2.05 except change in the design mix proportion for M25 grade of concrete.

Mode of Measurement: Same as per Item spec. no. 2.05

2.07 APPLICABLE FOR M-30 RCC STRUCTURE TO ALL HEIGHTS FROM RAFT TO HIGHEST LEVEL
Providing and laying RCC of M 30 mix for structures below & up to highest plinth level.

The general specification is same as per Item spec. no. 2.05 except change in the design mix for M30 grade of concrete.

Mode of Measurement: Same as per Item spec. no. 2.05

2.08 Providing and laying M 20 mix concrete in super structures to all height from highest plinth level

The general specification is same as per Item spec. no. 2.05 except for the height.

Mode of Measurement: Same as per Item spec. no. 2.05

2.09 Providing and laying RCC of mix M25 for structures to all height from highest plinth level.

The general specification is same as per Item spec. no. 2.05 except change in the design mix for M25 grade of concrete and for the height.

Mode of Measurement: Same as per Item spec. no. 2.05

2.10 Providing and laying RCC of M 35 mix for structures below & up to highest plinth level.

The general specification is same as per Item spec. no. 2.05 except change in the design mix proportion for M35 grade of concrete.

Mode of Measurement: Same as per Item spec. no. 2.05

2.11 Providing and laying RCC of mix M35 for structures to all height from highest plinth level.

The general specification is same as per Item spec. no. 2.05 except change in the design mix for M35 grade of concrete and for the height.

Mode of Measurement: Same as per Item spec. no. 2.05

2.12 Providing and laying M 25 mix concrete in super structures above 6M and up to 12 M height

The general specification is same as per Item spec. no. 2.05 except for the change in grade of concrete & height.

Mode of Measurement: Same as per Item spec. no. 2.05

2.13 Providing and laying M 30 mix concrete in super structures above 6 M from plinth level and up to 12 M height

The general specification is same as per Item spec. no. 2.05 except for the change in grade of concrete & height.

Mode of Measurement: same as per Item spec. no. 2.05

2.14 Providing & laying RCC for equipment / machine foundation

The general specification is same as Item spec. no. 2.05(for M20) & 2.06 (for M25) but for the mix of the concrete, which shall be as specified in the item. The rate is exclusive of reinforcement steel but inclusive of centring and shuttering, providing number of holes, pockets (size and shape as shown in the drawings and as directed) and grouting the same after the machine/ equipment is erected with concrete of specified mix and finishing the same as self finish specified. The rates shall include grouting of base plates, anchor bolts, pipe sleeves including placing, aligning, levelling and maintaining it during the casting of cement concrete, protection of the threaded portion of bolts by acceptable means or protection of any surface from sticking of cement grout etc, welding the insert elements, handling/ placing the template etc complete as per equipment drawing / structural drawing etc complete. The cost of formwork, creating bolt pockets / grouting the bolts is included in the item.

Mode of Measurement Same as per Item spec. no. 2.05.

2.14A Providing & laying RCC for equipment / machine foundation

The general specification is same as Item spec. no. 2.05(for M20) & 2.06 (for M35) but for the mix of the concrete, which shall be as specified in the item. The rate is exclusive of reinforcement steel but inclusive of centring and shuttering, providing number of holes, pockets (size and shape as shown in the drawings and as directed) and grouting the same after the machine/ equipment is erected with concrete of specified mix and finishing the same as self-finish specified. The rates shall include grouting of base plates, anchor bolts, pipe sleeves including placing, aligning, levelling and maintaining it during the casting of cement concrete, protection of the threaded portion of bolts by acceptable means or protection of any surface from sticking of cement grout etc, welding the insert elements, handling/ placing the template etc complete as per equipment drawing / structural drawing etc complete. The cost of formwork, creating bolt pockets / grouting the bolts is included in the item.

Mode of Measurement Same as per Item spec. no. 2.05.

2.15 M-25 Precast Cement Concrete slab, 50 -150mm thick Pre-cast Concrete

Pre-cast concrete shall comply with relevant IS and with the following requirements:

a) All pre-cast units shall be cast on suitable cement or steel platform which shall be adequately oiled to obtain surface finish same standard as obtained in the forms. 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.

b) Side shutters shall not be struck in less than 24 hours after depositing concrete and no pre-cast unit shall be lifted until the concrete reaches strength of at least twice the stress to which the concrete may be subjected to at the time of lifting.

c) The lifting and removal of pre-cast 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 pre-cast units. The reinforced side of the units shall be distinctly marked.

d) All pre-cast 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 or curing shall be carried out as per standard practice.

e) 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.

f) The pavement slabs / trench covers top shall be appropriately finished i.e. either stripped finished or smooth finished with a smooth border including Chamfering as per details, finishing the exposed edges / corners.

g) The unit rate for pre-cast concrete members shall include formwork, mouldings, finishing, hoisting and setting in position including mortar, provision of lifting arrangement, exposed concrete finish etc. complete.

Reinforcement fixed shall be measured and paid for separately under relevant item.

Mode of Measurement:

It shall be measured in Cu. M.

2.16 Providing & erecting Formwork for structures below ground level and up to highest plinth level-

a) The formwork shall consist of shores, bracings, sides of beams and columns, bottom of slabs etc, including ties anchors, hangers inserts etc, complete which shall be properly designed and planned for the work. False work shall be so constructed that necessary adjustment can be made to compensate for take up and settlements. Wedge may be used at the top or bottom of timber shores but not at both ends to facilitate vertical adjustment or dismantling of the formwork.

b) **Design of formwork:**

The design of the formwork as well as its construction shall be the responsibility of Contractor. If so instructed, the drawings and/or calculation for the design for the formwork shall be submitted to Engineer for approval before proceeding with work, at no extra cost. Engineer's approval shall not however relieve Contractor of the full responsibility for the design and construction of the formwork. The design shall take into account the entire load vertical and lateral that the forms will be carrying live and vibration loadings.

c) **Type of formwork:**

Formwork may be of timber, plywood metal, plastic or concrete. For special finishes the formwork may be lined with plywood, steel sheets oil tempered hard board etc. Sliding forms and slip forms may be used with the approval of Engineer.

d) **Form work requirements:**

i) Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, braces, ties, straps, etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete is set sufficiently to permit removal of forms. Forms shall be strong enough to

permit the use of immersion vibrators. In special cases form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete. Faces coming in contact with the concrete shall be free from adhering grout, plaster, and paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water or any fine material from concrete.

ii) Plywood shall be used for exposed concrete surfaces; where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surfaces, these are to be rubbed finished shall be planed to remove irregularities or uneven ness in the face. Formwork with linings shall be permitted.

iii) All new and used form timber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form timber unsatisfactory in any respect shall not be used and if ejected by Engineer shall be removed from the site.

iv) Shores supporting successive members shall be placed directly over those below or be so designed and placed that the load will be transmitted directly to them. Trussed supports shall be provided for shores that cannot be secured on adequate foundations.

v) Formwork, during any stage of construction showing signs of distortion or distorted to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings, shall be repositioned and strengthened. Poured concrete affected by the faulty formwork, shall be removed completely and the formwork be corrected prior to placing of new concrete.

v) Excessive construction camber to compensate for shrinkage, settlement may impair the structural strength of members and shall not be permitted.

vii) Forms shall be so designed that their removal will not damage the concrete. Face formwork shall provide true vertical and horizontal joints, conform to the architectural features of the structure as to location of joints and be as directed by engineer.

viii) Where exposed smooth or rendered concrete finishes are required the forms shall be constructed with special care so that the resulting concrete surfaces require a minimum finish.

e) **Formwork for Slope Surfaces:**

i) Forms for sloped surfaces shall be built so that the formwork can be placed board-by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration inspection and repair of the concrete.

ii) The formwork shall also be built so that the boards can be removed one by one form the bottom up as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 4 horizontal: 1 vertical shall be formed as required herein.

f) **Formwork for Curved Surfaces:**

i) The contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form timber shall be built up of laminated spleens cut to make tight, smooth form surfaces.

ii) After the forms have been constructed, all surface imperfections shall be corrected and all surface irregularities at matching faces of form material shall be dressed to the specified curvature.

g) **Formwork for Exposed Concrete Surfaces:**

i) Where it is desired, directed or shown on the drawings to have original fair face finish of concrete surface without any rendering or plastering, formwork shall be carried out by using wood planks, plywood or steel plates of approved quality and as per direction of the Engineer.

ii) The contractor shall use one type of material for all such exposed concrete faces and the forms shall be constructed so as to produce uniform and consistent texture and pattern on the face of the concrete. Patches or forms for these surfaces will not be permitted. The formwork shall be placed so that all horizontal formworks are continuous across the entire surface.

iii) To achieve a finish which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets. The sheets shall be arranged in an approved pattern. Wherever possible, joints

between sheets shall be arranged to coincide with architectural features, sills, window heads or change in direction of the surface.

All joints between shuttering plates or panels shall be vertical or horizontal unless otherwise directed. Suitable joints shall be provided between sheets. The joints shall be arranged and fitted so that no blemish or mark is imparted to the finished surfaces.

iv) To achieve a finish which shall give the rough appearance of concrete cast against sawn boards, formwork boards unless otherwise stated shall be of 150 mm wide, securely jointed with tongue and grooved joints if required to prevent grout loss with tie rod positions and direction of boards carefully controlled. Sawn boards shall be set horizontally, vertically or at an inclination shown in the drawings. All bolt holes shall be accurately aligned horizontal and vertically and shall be filled with matching mortar recessed 5mm back from the surrounding concrete face.

v) Forms for exposed concrete surfaces shall be constructed with grade strips (the underside of which indicated top of pour) at horizontal construction joints, unless the use of groove strips is specified on the drawings. Such forms shall be removed and reset from lift to lift, they shall not be continuous from lift to lift. Sheeting of reset forms shall be tightened against the concrete so that the forms will not be spread and permit abruption irregularities or loss of mortar. Supplementary form ties shall be used as necessary to hold the reset forms tight against the concrete.

vi) For fair faced concrete, the position of through bolts will be restricted and generally indicated on the drawings.

vii) Chamfer strips shall be placed in the corners of forms for exposed exterior corners so as to produce 20 mm levelled edges except where otherwise shown in the drawings. Interior corners and edges at formed joints shall not be levelled unless shown on the drawings. Moulding for grooves, drip courses and bands shall be made in the form itself.

viii) The wood planks, plywood and steel plates used in formwork for obtaining exposed surfaces shall not be used for more than 3 times in case of wood planks, 6 times for plywood and 10 times for steel plates respectively. However, no forms will be allowed for reuse, if in the opinion of the Engineer it is doubtful to produce desired texture of exposed concrete.

ix) In order to obtain exposed concrete work of uniform colour it shall be necessary to ensure that the sand used for all exposed concrete work shall

be of approved uniform colour. Moreover the cement used in the concrete for any complete element shall be from single consignment.

x) No exposed concrete surface shall be rendered or painted with cement or otherwise. Plastering of defective concrete as a means of achieving the required finish shall not be permitted, except in the case of minor porosity on the surface, the Engineer may allow a surface treatment by rubbing down with cement and sand mortar of the same richness and colour as for the concrete. This treatment shall be made immediately after removing the formwork.

xi) The contractor shall also take all precautionary measures to prevent breaking and chipping of corners and edges of completed work until the building is handed over.

h) **Bracings struts and props:**

i) Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bearers.

ii) The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Re-propping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated being in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be left open and built up in sections as placing of concrete from the sides to limit the drop of concrete to 3M or as directed by engineer.

j) **Mould Oil:**

Care shall be taken to see that the faces of form wok coming in contact with concrete are perfectly cleaned and two coats of mould oil or any other approved material applied before fixing reinforcement and placing concrete. Such coating shall be insoluble in water, non-staining and not injurious to the concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and/or other items to be cast in the concrete shall not be placed until coating of the forms is complete;

adjoining concrete surface shall also be protected against contamination from the coating material.

k) **Chamfers and fillets:**

All corners and angles exposed in the finished structure shall be formed with mouldings to form chamfers or fillets on the finished concrete. The standard dimension of chamfers and fillers, unless otherwise specified shall be 20 mm x 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the mouldings shall be planned or surfaced to the same texture as the forms to which it is attached.

l) **Wall ties:**

Wire ties passing through the walls shall not be allowed. In their place bolts through sleeves be used.

m) **Reuse of forms:**

Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary, repaired and the inside retreated to prevent adhesion to the satisfaction of Engineer. Warped lumber shall be resized. Contractor shall equip himself with enough shuttering material to complete the job in the stipulated time.

n) **Removal of forms:**

i) Contractor shall record on the drawings and in a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed there from. The Contractor shall remove the shuttering after obtaining the approval of the Engineer.

ii) In no circumstances shall forms *be* struck until the concrete reaches strength of at least twice the stress due to self weight and any construction/erection loading to which the concrete may be subjected at the time of striking formwork.

iii) In normal circumstances (generally where temperatures are above 20 Deg. Cent.) forms may be removed after expiry of the following periods:-

Structural members	**Ordinary Portland cement concrete**

a) Walls Columns and Vertical Sides of Beams	24 hrs. or as directed by the Engineer
b) Soffit formwork to Slabs Props to be re-fix immediately after removal of formwork	3 days
c) Beam soffits props left under	7 days
d) Removal of props to slabs	
i) Spanning up to 4.5m	7 days
ii) Spanning over 4.5m	14days
e) Removal of props to beams and arches	
i) Spanning up to 6 m	14 days
ii) Spanning over 6 m	21 days

For other cements and lower temperature, striping time recommended above shall be suitably modified in conformity with the relevant IS code of practice or recommended by structural consultant. Suitable precautions need to be taken by contractor for the stripping / de-shuttering time for different members as recommended by structural consultant.

iv) Striking shall be done slowly with utmost care to avoid damage to arises and projections and without shock or vibration, by gently easing the wedges. If after removing the formwork, it is found that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

v) Reinforced temporary openings shall be provided as directed by Engineer to facilitate removal of formwork which otherwise may be inaccessible.

vi) Tie rods, clamps, form bolts etc. which must be entirely removed from walls or similar structures shall be loosened not sooner than neither 24 hours nor later than 40 hrs. after the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time. Ties, withdrawn from walls and grade beams shall be pulled towards the inside face cutting ties back from the faces of walls and grade beams will not be permitted.

vii) For liquid retaining structures no sleeves for through bolts shall be used nor shall through bolts be removed as indicated above. The bolts, in this case, shall be cut at 25 mm depth from the surface and then the hole shall be made good by polymer modified cement mortar of the same proportions as the concrete just after striking the formwork.

Necessary approach / staging for ease of the access of workmen, inspection and supervision staff, in accordance with safety requirements and as per the instructions of the Engineer to be provided for all types of framework, for all the elements at all the depth / heights the cost of such arrangements detailed here above shall be deemed to be included in the quoted unit price of the item. The rate shall include providing and erecting formwork in position as per drawings, applying oil, removal of form after the specified period.

Mode of Measurement:

It shall be measured in Sq. M The actually shuttered area shall be measured and paid for

2.17 Providing and erecting Formwork for structures in super structures to all heights above highest plinth level.

The general specification is same as per Item spec. no. 2.16 except for the change in height.

Mode of Measurement: Same as per Item spec. no. 2.16

2.17A

Providing and erecting Form Work in all heights from raft to highest plinth level of all structures for all concrete elements of any shape, size & direction.

The general specification is same as per Item spec. no. 2.16 except for form work shuttering & boxing using steel/Marine densified plywood

shuttering materials of approved quality and for in all heights from raft to highest plinth level of all structures for all concrete elements of any shape, size & direction .

Mode of Measurement: Same as per Item spec. no. 2.16

2.18 Providing and erecting Formwork laying for structures in super structures above 12 M height from highest plinth level.

The general specification is same as per Item spec. no. 2.16 except for the change in height.

Mode of Measurement: Same as per Item spec. no. 2.16

2.19 Providing and erecting false staging for formwork

The additional height for which it is required shall be as specified in the item specification.

Mode of Measurement: This shall be measured and paid for in Sq. m The plan area of the structure shall be measured for all members except RCC walls and gable ends. For RCC walls and gable ends the elevation area shall be measured for payment under this item.

2.20 Extra over and above for the form work for exposed RCC work

Extra over and above Item spec. no. 2.16 or 2.17 or 2.18 for the form work for exposed RCC work The specification for the nature of shuttering shall be as specified in the item 2.16under the sub-head shuttering for exposed concrete works. The work shall be finished including rendering as detailed under relevant item of concrete and also as stated under Item spec. no. 2.16.

Mode of Measurement: Only the surfaces / face(s) of the element which are given such exposed finish shall be measured in Sq. M

2.21 Providing and laying DPC 50mm thick

This shall be of plain cement concrete of mix M-20 or as specified in the item specification. The top surface of the masonry shall be levelled properly before laying the concrete. The side shuttering shall be vertical and strong. There should not be any honey combing. Curing shall be done

for 7 days. After the curing period is over the surface shall be cleaned with brush and kerosene shall be applied over it. Then hot bitumen of grade 80/ 100 shall be applied @ 1.7 kg/Sq. M over the concrete surface. It shall be applied uniformly without any blank space.

Mode of Measurement: It shall be measured in Sq. M

2.22 Providing and laying cement concrete M- 20 at all heights above 12 M from the highest plinth level

Specifications as per Item spec. no. 2.05 except for change for grade of concrete.

Mode of Measurement: Same as per Item spec. no. 2.05

2.23 Providing and laying cement concrete M- 25 at all heights above 12 M from the highest plinth level

Specifications as per Item spec. no. 2.05 however for providing and laying cement concrete at all heights above plinth level and up to 12 M.

Mode of Measurement: Same as per Item spec. no. 2.05

2.24 Supplying and mixing water proofing compound

The waterproofing compound of approved make shall be added to cement concrete or cement mortar as instructed by the Engineer. The proportion of the compound to be added shall be as per the Manufacturer's specifications.

Mode of Measurement: The quantity of compound added shall be measured and paid for. The unit shall be as specified in the item specification.

2.25 Providing, fabricating and placing in position Reinforcement steel

The quality of the steel shall be as mentioned in the materials section. The bars shall be fabricated as per the drawings. Laps and splices for reinforcement shall be as shown on the drawings. Engineer shall approve splices in adjacent bars. The bars shall not be lapped unless the length required exceeds the maximum available lengths of bars at site or should be provided as specified in the drawing.

Bending

a) Reinforcing bars supplied bent or in coils, shall be straightened before they are cut to size. Straightening of bars shall be done in cold and without damaging the bars. This is considered as a part of reinforcement bending fabricating work.

b) All bars shall be accurately bent according to the sizes and shapes shown on the detailed working drawings/bar bending schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and bend in a manner that will injure the material, bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 32mm in diameter that may be bent hot if specifically approved by Engineer. Bars bent hot shall not be heated beyond cherry red colour (not exceeding 845 deg. C.) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only if the means used for straightening and re-bending shall not injure the material. No reinforcement shall be bent when in position in the work without approval whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by design shall not be used.

Fixing

a) Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the drawings by the use of block, spacers and chairs as per IS 2502 to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be strongly bound together at all such points with two numbers 16 to 18 gauge annealed soft iron wire or GI wire as specified in the tender. The vertical distance required between successive layers of bar in beams or other members shall be maintained by providing of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

Cover

a) Nominal cover is the design depth of concrete cover to all steel reinforcement, including links. Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows:

i) At each end of reinforcing bar, not less than 25 mm or not less than twice the diameter of the bar whichever is less.

ii) For a longitudinal reinforcing bar in a column, not less than 40mm, or less than the diameter of such bar. In case of columns of minimum dimensions of 20 cm or under, whose reinforcing bars do not exceed 12 mm, a nominal cover of 25 mm may be used.

iii) For longitudinal reinforcing bars in a beam 25 mm or not less than the diameter of the bar.

iv) For tensile, compressive, shear, or other reinforcement in a slab or wall not less than 20mm or not less than the diameter of such reinforcement.

vi) For footings minimum cover of shall be 50 mm. In case concrete is deposited on prepared ground surface other than PCC the cover shall be to the bottom reinforcement shall be 75 mm.

vii) For concrete surfaces exposed to the weather or the ground after removal of forms, such as retaining walls, footing sides and top etc. not less than 50 mm for bars larger than 16 mm diameter and not less than 40 mm for bars 16 mm diameter or smaller.

viii) Increased cover thickness shall be provided, as indicated on the drawings, for surfaces exposed to the action of harmful chemicals (or exposed to earth contaminated by such chemical, acid, alkali, saline atmosphere, sulphurous smoke, etc.

ix) For reinforced concrete members, totally or periodically immersed in sea water or subject to sea water spray, the cover of concrete shall be 50mm more than those specified in (i) to (v) above.

x) For liquid retaining structures the minimum cover to all steel shall be 40mm or the diameter of the main bars, whichever is greater. In the presence of sea water and soils and waters of a corrosive character the cover shall be increased by 10 mm.

xi) Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing dense impermeable concrete with approved protective coatings, as specified by the Engineer.

xii) Concrete / Cement mortar cover blocks of same strength with MS wire grouted or PVC cover blocks of approved quality shall be provided to maintain the correct cover. Concrete / PVC cover blocks to be tied / fixed with reinforcement steel bars to ensure the bar remains in position. The use of pebbles or stones shall not be permitted.

Inspection

Erected and secured reinforcement shall be inspected, jointly measured and recorded and approved by Engineer prior to placement of concrete.

Mode of Measurement

Lengths of reinforcement steel including spacers & chairs shall be measured to the nearest centimetre and converted to weight using IS coefficients. The actual quantity of steel embedded in concrete as calculated and approved by Engineer, irrespective of the level or the height at which the work is done shall be taken. The unit rate for reinforcement shall include all rolling margin, wastages, binding wire, cover blocks etc. for which no separate payment shall be made. Laps as shown in drawings or as approved by Engineer and minimum number of chairs and spacer bars required to keep the reinforcement in position shall be paid for.

When steel is supplied by the owner, the cost of this quantity of steel plus wastage as specified in clause 5.0 of Section VI shall be recovered at issue rate from the Contractor. Rolling margin shall be paid as per clause 6.0 of Section VI.

No wastage and rolling margin for over weight shall however be payable when steel is supplied by the contractor whereas for under weight it should be paid at actual if allowed to use.

2.26 Providing, fabricating and placing in position Reinforcement steel-High Strength Deformed Bars-CTD/TMT (Thermo Mechanically Twisted/treated) bars.

High Strength Deformed Bars (HSDB)/TMT– reinforcement steel shall be confirming to latest IS 1786 as per the specifications detailed under Item spec. no. 2.25. The HSDB/TMT shall be of minimum grade Fe 415/500 for

concrete reinforcement. The chemical composition shall when analysed as per relevant parts of IS 228 shall conform to the provisions of IS 1786.

Mode of measurement: Same as per Item spec. no. 2.25

2.27 Providing and placing in position bitumen impregnated fibber board

The bitumen-impregnated fibre board shall be of approved make and thickness as specified. This shall be placed in locations before concreting as per drawing / instructed by the Engineer in the expansion / construction joints. The work shall be done at all levels without any extra cost. The thickness of the board shall be as specified in the item specification.

Mode of Measurement: It shall be measured in Sq. M.

2.28 Providing and laying bituminous mastic

This shall be of approved make and quality. The joint / grooves to be cleaned of all the dust or loose/ organic matter/ any foreign material etc. and dried before application of a primer coat of flow able bitumen painting before filling the gap / groove with bituminous mastic The top of the mastic shall be finished smooth with a camber at the centre as shown in the drawings / directed by the Engineer. The joints shall be of uniform width and care shall be taken for proper bonding of the joints.

Mode of Measurement: This shall be measured in RM for specified width and depth as per the item in the Schedule of Quantities.

2.29 Supply and filling the pockets with free flow ready mix high strength cementitious grout

Providing and Grouting the foundation bolts/pockets, base plates with ACC Shrinkkomp grade-2/ GP2 of FOSROC **ready mixed non shrink, free flow, self levelling, cementitious grout** making holes if necessary in concrete as directed and as per the recommendations of the manufacturer. The pocket shall be cleaned off the dust or any foreign matter before grouting The work shall be measured based on the size of pockets actually grouted or size of pockets shown in the approved drawing, whichever is less. Similarly, in case of grouting below the base plate of machine / equipment, measurement shall be based on the area of grout and the thickness as per the drawing or as per actual whichever is less.

Mode of Measurement: The pockets shall be measured and shall paid for in CuM.

2.30 Providing and filling Silicon sealant

Silicon sealant should be of approved make and grade for construction/expansion joints application for the buildings. The work should include cleaning the joints and providing primer etc. as per specifications of the manufacturer and sealing/finishing etc. for size 10 mm wide x 6 to 8mm deep, complete as directed.

Mode of Measurement: This shall be measured in Running Meter.

MASONRY WORKS

Applicable codes and specifications

The following codes, standards and specifications are made a part of this specification. All standards, tentative specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

IS: 1077 Common burnt clay building bricks

IS: 3102 Classification of burnt clay bricks

IS: 2180 Burnt clay building bricks, heavy duty.

IS: 3495 Method of sampling and testing clay building bricks

IS: 2691 Burnt clay facing bricks

IS: 2221 Code of practice for brick work

IS: 2185 Load bearing hollow concrete blocks

IS: 5498 Lime-cement-cinder hollow concrete blocks

IS: 3115 Lime-cement cinder solid blocks

IS: 1597 Code of practice for construction of stone masonry (Part I).

3.01 Providing and constructing brick masonry in any shape CM in foundation and up to highest plinth level

a) Bricks used in works shall be bricks of specified crushing strength as described in the Schedule of Quantities. They shall have the following general properties:

They shall be sound, hard, and homogenous in texture, well burnt in kiln without being vitrified, table moulded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square edges and paralleled faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing ungrounded particles and which absorb water more than 1/5th of their weight when soaked in water for twenty-four hours shall be rejected. Over burnt or under burnt bricks shall be liable to rejection. The bricks shall give a clear ringing sound when struck.

b) **Samples of bricks** shall be submitted before starting the brickwork to the Engineer for approval. Bricks supplied shall conform to the approved samples. Brick sample shall be got tested as per IS 3495 by Contractor at no extra cost. Bricks rejected by Engineer shall be removed from the site of works within 24 hours.

c) **Mortar**

i) Mix for cement mortar shall be as specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one complete bag of cement containing 50 kgs. of cement forms one unit. The sand shall be free from clay shale, loam, alkali, and organic matter and of sound, hard, clean and durable particles. Sand shall be approved by the engineer. If so directed by the engineer sand shall be thoroughly washed till it is free of any contamination.

ii) For preparing cement mortar the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall preferably be machine **mixed**, through mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 30 minutes of mixing. Mortar left unused in the specified period shall be rejected.

iii) The Contractor shall arrange for test on mortar samples if so directed by the engineer re-tempering of mortar shall not be permitted.

d) **Workmanship**

i) All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work shall be as specified in the respective item of work. Brick work 230 mm thick and over shall be laid in English bond unless otherwise specified. While laying bricks shall be pressed in to the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

ii) All brickwork shall be plumb, square and true to dimensions. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be levelled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes. No broken bricks shall be used except as closures. Care shall be taken that the bricks forming the top

corners and ends of the wall shall be properly radiated and keyed into position. Holes kept in masonry for scaffolding shall be closed before plastering. All interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work where this is not possible, the work shall be raked back accordingly to bond (and not saw toothed) at an angle not exceeding 45 dig.

iii) Bricks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6mm and not more than 10 mm. The face joint shall be raked to a minimum depth of 12mm by raking tools daily during the progress of work when the mortar is still green so as to provide a proper key for the plaster or pointing to be done. Where plastering or pointing is not required to be done the joints shall be uniform in thickness and be struck flush and finished at the time of lying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If the mortar in the lower course has begun to set the joints shall be raked out to a depth of 12 mm before another course is laid.

iv) All brickwork shall be built tightly against columns, floor slabs or other structural member.

v) Where drawings. Indicate that structural steel columns are to be fireproofed with brickwork the brick shall be built closely against all flanges and webs with all spaces between the steel and bricks works filled solid with mortar. Steel member's partly embedded in brickwork and not indicated to be fireproofed with concrete shall be covered with not less than 12mm thick mortar unless directed otherwise by engineer.

vi) The work shall be cured for 15 days.

(a) Miscellaneous inserts in masonry e.g. sleeves, wall ties, anchors, conduits, structural sheet, steel lintels etc. shall be installed by the Contractor. Furnishing fixing of any of these inserts by the Contractor will be paid for separately under steelwork. Openings, arches, etc. shall be provided as shown on the drawings, chasses, pockets etc, shall be provided as shown on the drawings to receive rain water pipes etc. Wall ties and flashing shall be built into the brickwork in accordance with the drawings and specifications.

The rate includes necessary single or double scaffolding, centring, soaking of bricks, raking out joints and curing the work all complete.

(f) **Mode of Measurement:**

i) Brick work of thickness one brick i.e. 230 mm and above shall be paid in units of CuM.

In all cases, the quantities measured shall be executed after making necessary deductions for openings etc. as given below: -

No deductions shall be done for openings up to 1000 sq. cm., ends of dissimilar materials, drainage holes, window/door holdfasts, concrete lintel bearings, landing slab bearing, beam bearing, chimney flues, cut-outs, iron fixtures, pipes up to 30cm diameter.

ii) It shall be clearly understood that the rates quoted by the Contractor shall be valid for brickwork in all shapes including elliptical, irregular shape etc. and include leaving openings, cutting chases in brickwork as per drawings/ instructions of the Engineer.

3.02 Providing and constructing masonry in any shape in super structure at all levels above highest plinth level.

The general specification is same as per Item spec. no. 3.01. The item includes scaffolding, staging etc as required.

Mode of Measurement: Same as per Item spec. no. 3.01

3.02(b) Providing and constructing "Fly Ash Brick Masonry" in foundation at all levels below and up to highest plinth level.

The general specification is same as per Item spec. no. 3.01. But for Fly ash bricks masonry work using (230 /250 mm x 115/125 mm x 75 mm size) with minimum Crushing strength of 50 kg./sqcm & it includes scaffolding, staging etc as required.

Mode of Measurement: Same as per Item spec. no. 3.01(a)

3.02(c) Providing and constructing "Fly Ash Brick Masonry" in Super structure at all heights above highest plinth level.

The general specification is same as per Item spec. no. 3.01. But for Fly ash bricks masonry work using (230 /250 mm x 115/125 mm x 75 mm size) with minimum Crushing strength of 50 kg./sqcm & it includes scaffolding, staging etc as required.

Mode of Measurement: Same as per Item spec. no. 3.01(a)

3.03 Providing and constructing 115 mm brick masonry in partition at all levels

The bricks shall be laid with stretchers. The proportion of the mortar shall be as specified in the item description. The quality of the bricks shall be as specified in the item 3.01. Two nos. of 6mm diameter MS bars or 25mm x 1.2 mm deep iron band kept at every fourth or third course as specified in BOQ . The rate includes necessary single or double scaffolding, centring, soaking of bricks, providing and placing of 2 nos. of 6 mm diameter MS bars or 25mm x 1.2 mm thick iron band ,raking out joints and curing the work all complete.

Mode of Measurement: The brick work shall be measured in sq.m. The deductions shall be as specified in the item 3.01.

3.04 Providing and constructing 115 mm "Fly ash bricks masonry" in partition at all levels CM in 1:4 (1 part of cement:4 part of coarse sand)

The general specification is same as per Item spec. no. 3.03. But for Fly ash bricks masonry work using (230 /250 mm x 115/125 mm x 75 mm size) with minimum Crushing strength of 50 kg./sqcm & it includes scaffolding, staging etc as required.

Mode of Measurement: Same as per Item spec. no. 3.03

FINISHING WORKS

Applicable Codes

IS:2394 Code of practice for application of lime plaster finish.

IS:1477 Code of practice for painting of ferrous metals in buildings and allied finishes (part I &II)

IS: 427 Distemper, dry colour as required

IS:2395 Code of practice for painting concrete, masonry and plaster surfaces.

IS:428 Distemper, oil emulsion, colour as required.

5.01 Providing & Applying Cement plaster 12 mm thick

The surface to be plastered shall be washed with fresh clean water free from all dirt, loose material grease etc. and thoroughly wetted for 6 hours before plastering work is commenced. Concrete surfaces to be plastered will however be kept dry. The wall should not be too wet but only damp at the time of plastering the damping shall be uniform to get uniform bond between the plaster and the wall. The junction between the brickwork and RCC should be fixed with chicken wire mesh/PVC strip as directed before plaster.

The proportion of the mortar shall be as specified under the respective items of work. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water, sand and cement shall be as mentioned in the Specifications for Concrete & allied works. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to stand for more than 30 minutes after mixing with water. The plaster shall be laid in a single coat. The mortar shall be splashed on the prepared surface with a trowel and finished smooth by trowelling. The plastered surface shall be rubbed with iron plate till the surface shows cement paste. The work shall be in required line, level and plumb including cutting and providing grooves of 20mm x6mm or as per the details. Curing of plaster shall be started as soon as the applied plaster has hardened enough so as

not to be damaged. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

The plaster shall be carried out on jambs, lintel and sill faces top and undersides, etc. as shown in the drawing or as directed by the engineer.

Mode of Measurement:

The quantity of work to be paid for under this item shall be calculated by taking the projected surface of the area plastered after making necessary deductions for openings, doors, windows etc. as given below:-

i) No deductions shall be made for opening or end steel joints, beams, post girders etc. up to 0.5 SqM area. No addition shall be made for joints, soffits and sills of such openings. This is applicable to both the sides of the wall.

ii) Where opening exceeds 0.5 SqM but does not exceed 3 SqM and also when only one side of the wall is treated and other side is not treated, deduction shall be made if the width of the reveal on the treated sides is less than that on the untreated side but if the width of the reveal is more then no deduction nor addition shall be made for reveals for jambs, soffits, sills etc.

iii) For openings more than 0.5 SqM but not exceeding 3 SqM and also when both the sides of the wall is plastered with the similar plaster, deduction shall be made for one face only. But when both the sides treated with different plaster, then deduction shall be made from the side on which the reveal is less and no deduction on the other side.

iv) For openings whose respective areas exceed 3 SqM deduction shall be made for the full opening of the wall treatment on both faces while at the same time jambs, sills and soffits shall be measured in sq m for payment. In measuring the jambs deduction shall not be made for the area in contact with the frames of doors, windows etc.

v) If the average thickness of the plaster is more than the specified thickness due to any account nothing extra shall be paid for the same.

vi) Nothing extra shall be paid for double scaffolding and the rate is applicable for work at all levels.

It shall be measured in SqM**.**

5.02 Providing & Applying Cement plaster 19 mm thick

The general specification is same as Item spec. no. 5.01 but for 19 mm thickness of the plaster. The plaster work shall be carried out in single or two layers as specified in schedule of quantities, the first layer being 12 mm thick and the second layer being 7mm thick. The proportions of the mortar for both the layers shall be as specified in the item specification. The first layer shall be splashed against the prepared surface with a trowel to obtain an even surface. The second layer shall then be applied and finished leaving an even and uniform surface, trowel finished unless otherwise directed by the engineer. The plastered surface shall be rubbed with the iron plate till the cement paste comes on the surface. Grooves of 20mm 10mm or of specified size as per drawings / instructions of the Engineer shall be cut and provided and finished as per the drawings. These grooves shall be formed in the first coat and then finished in second coat. This includes double scaffolding. All the scaffolding holes if any, shall be bridged and finished in the first coat of plaster.

Mode of Measurement: Same as per Item spec. no. 5.01.

5.03 Providing & Applying lime punning to the plastered surface

The plastered surface shall be finished smooth by trowelling on the surface with neeru (lime cream). Neeru shall be properly slaked fat lime with addition of 10 % cement to prepare neeru for bond as per the instructions of Engineer. The neeru shall be applied at the rate of 2.2 kg per SqM.

Mode of Measurement: Same as per Item spec. no. 5.01

5.04 Providing and Applying 19mm sand faced plaster

This shall be applied in 2 coats. The first coat or the base coat should be 12 mm and shall be continuously carried out without break to the full length of wall or natural breaking points such as doors, windows etc. The base coat shall be splashed on to the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. The mortar

proportion for this base coat shall be as specified in the respective item of work. The base coat shall be cured for at least seven days

The second coat shall be 7mm thick. Before application of the second coat, the base coat shall be evenly damped. This coat shall be applied from top to bottom in one operation and without joints, finish shall be straight, true and even. The mortar proportions of this coat shall be as specified under the respective item work. Sand to be used for the second coat and for finishing work shall be as specified in the item description. The second coat shall be finished with sponge to give proper finish. Grooves of 20mm 10mm or of specified size as per drawings / instructions of the Engineer shall be cut and provided and finished as per the drawings. These grooves shall be formed in the first coat and then finished in second coat. This includes double scaffolding. All the scaffolding holes if any, shall be bridged and finished in the first coat of plaster.

Mode of Measurement: Same as per Item spec. no.5.01.

5.05 Providing & Applying rough cast plaster

This shall be carried out in two coats. The base plaster shall be of 12 mm thick and of specified proportion of cement mortar. It shall be roughened to receive the top coat. The top coat shall be 7mm thick. It shall be of 3 parts cement, 6 parts coarse sand & 4 parts of 6mm single or crushed stone aggregate. General specifications are same as of Item spec. no. 5.04.

Mode of Measurement: Same as per Item spec. no.5.01.

5.06 Providing & applying water-proof cement plaster

The plaster shall be of specified thickness and of specified mortar proportions. The contractor shall use approved waterproofing admixture manufactured by reputed manufacturer in the mortar for plasterwork. The quantity to be used shall be in accordance with the manufacturer's instructions, however subjected to the approval of the Engineer. The use of Calcium chloride shall be prohibited unless specifically allowed by engineer and shall conform to IS: 2645. The plaster shall be cured at least for 7 days.

General specification shall be same as item no. 5.01

Mode of Measurement: It shall be measured in SqM. The quantity of waterproofing material used in this item shall be measured and paid for separately.

5.07 Providing & Applying neat cement

The specification same as per item 5.03 except that neat cement is applied to the plaster surface in place of lime neeru.

Mode of Measurement: Same as per Item spec. no. 5.01

5.08 Providing & applying cement pointing

The dust shall be brushed out of the joints and the wall be washed with water.

The mortar shall consist of one part of cement to one part of fine sand. Mortar shall be filled into joints and well pressed with special steel trowels. The joints shall not be touched against after it has once begun to set.

The joints of the pointed work shall be neat. The lines of false joints shall be allowed.

The work shall be cured for a week after the pointing is complete. Whenever coloured pointing has to be done the colouring pigment of the colour required shall be added to cement in proportion as recommended by the manufacturer and as approved by the engineer.

Mode of Measurement: Same as per Item spec. no. 5.01

5.09 Providing & Applying White washing on new works/old work - 3 or more coats

Walls to be thoroughly scrapped with sand paper before white wash is applied. White wash shall be prepared from a good quality fat lime. Lime shall be slaked with water to the Consistency of a cream and allowed to remain under water for 2 days. It shall then be strained through a cloth and 2 kg of clean gum of approved quality shall be added for every cubic meter of lime or ready to use binding compound of approved make be added as per manufacturer's specification, as specified in the item specification or by the Engineer, and indigo up to 3gm per kg of lime dissolved in water shall then be added and stirred well.

It shall be applied with a stroke of the brush from the top downwards, another from bottom upwards over the first stroke and similarly one stroke from the right and another from the left over the first brush, before it dries. Minimum three coats shall be applied on the plastered surface for desired finish. If the desired finish is not obtained extra coats shall be applied without any extra cost.

The rate shall be applicable for carrying out the work at all heights, double scaffolding etc. all complete. Extra 20% shall be added to the area for AC corrugated sheets and 10% for semi-corrugated sheets, cornices and others.

Mode of Measurement: Same as per Item spec. no. 5.01 for plain surface.

5.10 Providing & Applying Plastic Emulsion paint

Paint to be used should be of approved make. The painting work shall be carried out as directed by the engineer, keeping however in view the recommendations of the manufacturer. Where painting with plastic emulsion is specified, all uneven surfaces shall thoroughly cleaned of all dust dirt and sand papered including rubbing the surface with 60 grit grinding stone in case of smooth plastered surface (without neat cement / neeru finished surfaces). One primer coat with cement putty shall be applied and rubbed smooth with sand paper to prepare the surface. The surface thus prepared shall be free from undulations / waviness. The prepared surface shall then be applied with minimum 2 coats of emulsion paint to be applied with roller / brush to give an even finish. The scope of work includes providing necessary scaffolding / staging. Workmanship shall conform to the requirements of IS: 2395.

Mode of Measurement : Same as per Item spec. no. 5.01 for plain surface.

5.11 Providing & Applying Cement paint

This may be "SNOWCEM" or of equivalent make to be applied over plastered surface including sand faced plaster. The surface shall be prepared cleaning the surface washing etc. This shall be applied with brush on the plastered wall. The painting work shall be carried out as per the procedure recommended by the manufacturer. The strokes shall be even and it shall be cured at least for 7 days. No patch or brush stroke shall be seen. Two or more coats to be applied in succession one after the other at a gap of 24 hours as per the instructions of the Engineer.. A pre

coat of primer as per manufacturer's specification shall be applied with out extra cost.

Mode of Measurement:
It shall be measured in SqM. The deductions for opening shall be as specified in the Item spec. no. 5.01.

5.12 **Providing & applying silicon paint**

This shall be applied over the exposed / external surface for rendering it waterproof. The paint shall be of approved quality and reputed approved make. The paint shall be applied as per the manufacturer's specification. This shall be applied with brush to achieve full coverage. Nothing extra shall be paid for applying on uneven surface such as exposed aggregate plaster.

Mode of Measurement:
It shall be measured in SqM. The deductions for opening shall be as specified in the Item spec. no. 5.01.

5.13 **Providing & fixing GI chicken wire mesh**

The GI wire mesh shall be of 24 gauge of specified width as per details / instructions of the Engineer and it shall be fixed with screws at the junction of brick masonry and RCC elements. The screw holes shall be drilled in RCC elements to ensure fixidity. If need be washers to be provided for holding. The chicken wire mesh shall not sag in between the screws. This shall be done before the application of plaster.

Mode of Measurement: It shall be measured in SqM. Measurement shall be taken before the application of the plaster.

5.14 **Providing & Applying dry distemper:**

Distemper shall be of approved make. It shall be applied by a broad stiff brush in two coats over a coat of primer. The first and second coat shall be applied only after the primer coat has thoroughly dried. The first coat shall be of a lighter tint. The shade of the distemper shall be got approved by the Engineer. Water bound and oil bound distemper shall conform to the requirements of IS: 427 and IS 428 respectively.

Mode of Measurement:

It shall be measured in SqM. The deductions for opening shall be as specified in the Item spec. no. 5.01.

5.15 **Providing & Applying Colour Wash**

The mineral colours, not affected by lime shall be added to white wash. Colour wash shall be applied the same way as white wash. Necessary and approved colouring chemical shall be added to the white wash, which has been strained. Only colour wash required for the day's work shall be prepared. If the finished surface is Powdery and comes off easily or the general appearance is streaky, the work shall be rejected. The Contractor has to redo the work at no extra cost. Indigo (Blue / Neel) shall not be added in colour wash.

Mode of Measurement: Same as per Item spec. no. 5.09.

5.16 **Providing and Applying Exposed Aggregate Plaster**

Exposed aggregate plaster shall be applied on walls at all heights above and below plinth level with 8 to10mm size hard approved variety stone chips or as specified in the item description. Stone chips to be screened, washed and dried properly. The base mortar shall be in two layers. The first layer shall be 12mm thick plaster with cement mortar 1:4 with necessary grooves of 20 to 12 mm width as shown in architect's drawing and as directed and continuously carried out to the full length of wall or natural breaking points such as doors, windows or a through joint by splashing on to the prepared surface with heavy pressure, brought to true and even surface and then lightly roughened by cross scratch lines, to provide bond for the finishing coat. If instructed water proofing admixture to be added which will be paid under relevant tender item.

The top layer shall be cement paste of thickness up to 4mm applied over the 1st layer plaster surfaces. The cement paste shall be applied on a limited area at a time so that it would not become hard before stone chips are applied. The stone chips shall then be applied after properly raking the plastered surfaces by means of floats or trowels, dashing them against the still fresh cement paste already applied. Where uniform texture is not obtained, chips shall be stuck suitably by hand. Care should be taken that application of cement paste shall be done uninterruptedly within one panel so that the joints and patches are avoided. Precautionary steps to be taken to protect the surface already done, during the process of finishing

adjoining areas so that the areas completed shall not get stained. Necessary scaffolding curing breaking the chips etc. are to be done as per the instruction of the Engineer. All the inner/ outer corners shall be finished properly up to the drip moulds in case of soffits of lintel / beams or slabs. The grooves shall be pointed with cement slurry mixed with water proofing compound to make them water proof before applying top stone chips finish without any extra cost.

Mode of Measurement: It shall be measured in SqM. The measurement shall be taken for un-plastered surface. The deductions for the openings etc shall be as specified under Item spec. no. 5.01.

5.17 **Exposed aggregate (Grit Wash) Plaster**

This is the type of finish in which aggregates particle are embedded in the plaster and exposed to give a permanent, natural and beautiful look specially for facing walls. The finish is widely used on exterior surfaces and is obtained by washing the finished surface with water thus exposing the aggregate. The aggregate used can either be white or coloured or a mixture of both in any proportion to get the desired effect. The aggregate commonly used are marble chips dolomite or calcined flint stone etc. of 3 to 10 mm size and it is advisable to add about 10% of finer aggregate size 1.5 mm for better grading. **As far as possible only marble stone aggregate should be used. Use of sand stone aggregate should be avoided**.

Raw materials

White cement of approved make

Marble Powder – Marble powder of 100-150 mm mesh free from duct, dirt and other foreign impurities.

Aggregate – Marble chips of sizes 2A/2B/3 or mixture of these three sizes. One could use a greater proportion of larger chips, if so desired.

Colouring pigments – synthetic inorganic pigments or oxide colours as per the colour / shade desired.

Water – Water used for mixing and curing should be potable quality, clean, free from salt, foreign impurities, dust, dirt, oil and grease etc.

Mix proportion

Dry Mix: The required quantity of white cement or cement as specified is mixed with marble powder and with marble chips. For preparing colour mix, the required quantity of colouring pigment should be mixed and dispersed thoroughly with white cement before mixing marble chips and sieved through a fine “malmal” cloth to obtain uniform shade.

Wet mix: To one volume of dry mix add less than half volume of water (appx. Water cement ration = 0.41) and mix well to get uniform and thick workable plastic consistency. The quantity of wet mix prepared should be consumed within one hour.

Technique of Application

Surface preparation

a) Old masonry surface: For proper adhesion of finishing plaster, it is important that the base plaster should be rough. So the surface of old masonry plaster should be chipped properly to make it rough and washed thoroughly to remove old dust or dirt and wet well before the application of finishing plaster.

b) New plastered surface: In case the base plaster is new or freshly applied and proper combing has been done, the finishing plaster can be applied directly after cleaning and curing.

c) Smooth Brick work: Where the brick work is smooth and even a base plaster of ordinary Portland cement mortar is applied before the finishing plaster of white cement mortar. For base plaster, one part of ordinary Portland cement should be mixed with 3 parts of clean sand and 2% water proofing compound. The thickness of basecoat should be made rough be combining it with wavy horizontal lines to form a key surface for the finishing plaster. After drying the surface should be cured thoroughly with water and finishing coat should be applied after 24 hours.

d) Rough Brickwork: When the brick work is rough and uneven, two layers of ordinary cement plaster should be applied. The thickness of the second layer should be about 8mm. The preparation of mortar mix and treatment of the surface will be the same as suggested above.

Application

1. Under layer of 12mm thick in cement plaster 1:4 (1cement:4 coarse sand) be applied to prepare the surface in true line and level and roughened by cross scratch lines.

2. Apply a thick coat of cement slurry over the base coat.

3. Top layer 15mm thick cement and stone grit in mix 1:1 (1cement 50% white cement 50% grey cement : 1 stone grit 12mm to 15mm) including addition of 15% marble dust to the cement.

4. The aggregate plaster finish shall be laid in panel as per Architectural drawing. Grooves of size up to 20mm to 25mm shall be provided between panels by nailing in the wall 20mm to 25mm wide and 15mm thick trapezoidal wooden beading in true plumb, line, and pattern and at corners as per architectural drawing.

5. Excess mortar on the surfaces of the aggregates shall be removed by washing with water or with a solution of dilute hydrochloric acid and then by water and finished by applying two coats of silicon paint (coat of silicon paint with labour etc shall be paid under relevant item).

6. The grit shall be broken approved natural grey colour granite stone aggregates and graded by sieving through two sieve of 15mm mesh. Only aggregate which passes through sieve of 15mm mesh and retaining on 12mm mesh shall be used in the works.

All grooves shall be pointed with neat cement paste mixed with water proofing compound as per manufacturer's specification

Prepare neat cement or coloured cement slurry and brush it within the panel shortly ahead of application of the finishing plaster. The cement or specified mortar is placed on the wall with trowel, after the water has receded sufficiently and about 30 minutes later, it re-trowelled. At this stage the surface should be made smooth by rubbing and trowelling and covering all the aggregate particles with skin with white cement / equivalent. The surface is washed after the coat has partially hardened. The water is poured lightly on the surface and rubbed simultaneously with a soft nylon brush to expose aggregate particles. Initial rubbing helps in removing the skin of J. K. white cement / equivalent and subsequent rubbing, with washing exposed aggregate particles. During rubbing, with water should be poured on the surface simultaneously to wash out the cement. Now the wooden strips should be taken out after the washing is completed.

Special care should be taken to take out the wooden strips. After 24 hours of air drying of the plaster, cure the surface thoroughly with clean water three to four times a day periodically for 7 days.

The time of washing is most important and its determination requires experience as the same is affected by temperature and other atmospheric conditions. If the washing is done early, aggregate particles will start falling down and if washing is delayed, it will be difficult to expose aggregate particles.

In case the surface of the aggregate with cement which cannot be washed off, the surface may be washed with dilute hydrochloric acid, but this acid washing is required the treatment should b done after the cement has set and fully hardened. Care should be taken to flush the residual acid thoroughly, otherwise the residual acid will tend to make the surface pale or yellow.

Precautions

a) The aggregate should be washed before use.

b) White cement and marble powder should be mixed thoroughly before further mixing with marble chips.

c) Only thick plastic consistency of White cement mortar should be maintained.

d) The plaster should be cured thoroughly at regular intervals for 7 days.

e) While washing the plaster to expose the aggregate care should be taken to not use excess water as it invites the problem of cracking.

f) Washing should start from top of the surface and subsequently go down.

g) While washing rub the surface with brush in a circular movement instead of straight rubbing.

Mode of Measurement:It shall be measured in SqM. The measurement shall be taken for un-plastered surface. The deductions for the openings etc shall be as specified under Item spec. no.5.01.

5.18 **Providing and applying wrinkle plaster**

Providing and applying wrinkle plaster in two coats at all levels. First coat shall be of 12 mm thick cement plaster in cement mortar Cement: Sand 1:4 duly roughened by combining it with wavy horizontal lines to form a key surface for the finishing plaster curing the same. All the wholes in the wall surface should be bridged and finished evenly and no spots should be seen. The second and finishing coat shall be with pure cement paste of required consistency @ 10 kgs per SqM to form uniform wrinkle finish with the help of sponge. The strokes shall be unidirectional and workmanship need to be ensured. The finishing coat for each face of the building shall be applied from top to bottom and each building shall be finished at a stretch. Cement used for the second coat i.e. finishing coat shall be from one lot of the specific make to ensure the colour is maintained even on all the faces of a building and also all the buildings in premises. The finish shall be terminated up to grooves created at the soffit of the lintel / beams / chajjas which are smooth finished as per the architectural drawings and directions of the Engineer. The scope of work includes double scaffolding, curing etc complete.

Mode of Measurement: It shall be measured in SqM. The measurement shall be taken for un-plastered surface. The deductions for the openings etc shall be as specified under Item spec. no. 5.01.

5.19 Providing and applying plain 15 mm thick smooth plaster over insulation

The general specification same as per Item spec. no. 5.01 but for Providing and applying plain 15 mm thick smooth cement plaster in C: M 1:3 over Insulated Surface, to be applied over a coat of cement slurry to be applied over the insulated surface for the bond, smooth finishing the surface with iron plate without any undulation including necessary staging / scaffolding, curing the plaster etc. complete as directed.

The surface of walls to be insulated shall be inspected jointly prior to carrying out plastering for preparation of the surface to receive insulation. The correctness of the surface shall be checked jointly on completion of insulation work and to prepare the surface for application of plastering. The line, level and plumb shall be maintained.

Mode of measurement: Same as per Item spec. no.5.01.

5.20 Providing and applying Acrylic based, Anti Fungus Exterior Paint like APEX ULTIMA (Sandtex Matt)

The general specification same as per Item spec. no. 5.11 for providing and applying 2 coats of acrylic based, anti fungus exterior paint of approved

shade and make like Asian Paints, Weather Coat of Berger or Shalimar Paints on smooth / sand faced / grit plaster finish as per as specified in the schedule of quantities, over a coat of Cement Paint in accordance with the manufacturers specifications etc complete.

Mode of Measurement: This will be measured in SqM for the area painted.

5.21 Providing and applying synthetic enamel paint / flat paint

Providing and applying synthetic enamel paint / flat paint of approved shade and makes like on walls / ceilings or any of the building elements at all heights, over new / old work including cleaning / sand papering / preparation of surface by applying cementious putty and rubbing to make the surface true without any waviness , application of approved quality paint in two or more coats to give an even finish including all the materials, labour , scaffolding with two or more coats of approved first quality enamel paint as directed.

Mode of Measurement: This will be measured in SqM for the area painted.

MISCELLANEOUS WORKS

9.01 Providing & Fixing Y-shaped angle iron post of ISA 50x50x6, 600mm long in RCC column @ 3.0 m c/c in boundary at site including supplying, fixing of 610 mm dia spiral razor wire G.I. (CONCERTINA) coil along with 7 rows of G.I. barbed wire fencing including all necessary fittings ,screws, nails, nut-bolts, labour, tools & tackles, scaffolding with one coat of primer and 2 coat of synthetic enamel paint on ISA etc. complete.

GI barbed wire

It shall be 12 to 14 gauges with 4 points barb with two wires twisted together or as specified in the item description. It shall be circular in section, free from scale and other defects and uniformly galvanised. The type, length and standard weight of the GI barbed wire shall be as specified below:

Nominal dia. of wire Line wire	Point wire	Nominal distance between two bars	Length in M/100Kg		
			Nominal	Min.	Max.
2.5	2.24	75	1000	934	1066
2.5	2.24	150	1134	1066	1200

The GI barbed wire shall be well stretched in number of rows as specified with four diagonals. The spacing shall be at least 10 cm from the top of coping and the rest shall be equidistant. The posts and struts shall be embedded in column concrete or as specified. It shall be fixed in line, level and plumb. The barbed wire shall be held to posts by means of GI staples, U clips or GI binding wire as specified. Turn buckles and straining bolts shall be used at the ends. Two struts shall be provided at the corners and at every expansion joints. The length of the strut shall be 1.5 times the length of the post. Rate to include all material as MS post, cement concrete, painting etc.

REINFORCED PUNCHED CONCERTINA COIL 610MM DIA

Supply & installation of reinforced punched concertina Coil (RPCC) 610 MM dia (before stretch), 90 gsm Zinc coating punched tape wire 2.5 to 2.6 mm dia of approved make having razor strips 0.5MM thick & width 19 mm hot galvanized in "Y" portion of MS angle supports at the top of boundary wall of approved make.

Mode of Measurement: Measurement shall be taken in running meter of boundary wall and not of individual wire. (All the 7+4 =11 wires & spiral concertina shall be measured in a group. Separate measurement of individual wire shall not be admissible.)

9.02 Providing and fixing GALVALUME sheet of 2.4 M height including MS Supports for temporary closure of the gate openings.

Providing & fixing **GALVALUME colour coated cold rolled sheets** made out of 0.5mm base metal thickness and Total Coated Thickness as 0.55mm, yield and tensile strength minimum 550 Mpa cold rolled sheet with hot dip metallic coating of aluminium zinc alloy 150 Gms/SqM, density minimum 4.8 Kg/SqM with minimum 20 microns super durable polyester paint or silicon modified polyester on top and 5 microns back-up epoxy coating at the bottom having 1015/1080mm cover width with 28.5 to 32 mm high crest at 195/200mm C/C in length as approved by the architect and with necessary suitable imported galvanised carbon steel 40micron zinc coated/minimum 20micron Zinc-Tin alloy coated Hexagonal head, self drilling & self tapping screws of ITW Buildiex (R) AS 3566 Class 3/ HILTI/BOSCH having drilling capacity minimum 6-8mm and in required diameter and length fixed using torque drill machine all complete with EPDM sealing washers with sealant.

Rate should include cost of plastic caps of approved colour of UV resistance and button bolts etc. for the fasteners.

Rates should include the cost of MS Supports to be fixed vertically by embedding minimum 300 mm in the ground and grouted with concrete and 2.4 M projected above ground, placed at a spacing of not more than 1.2 m c/c or as suitable to make the fixation stable.

Rate to include also fixing in roofing, cladding and all accessories and utilities like ridge, corner piece, aprons, barge boards, gutters, flashings, end pieces, etc., all accessories etc. complete as directed by the engineer.

The rates shall include all materials, tool / tackles, labour, scaffolding including handling and storage of the materials etc complete for all heights.

The rate to be inclusive of overlaps wastage etc.

Mode of Measurement: This shall be measured in SqM. Overlap, corrugation, wastage are inclusive in this item.

9.03 Providing and fixing 100 mm dia pipe sleeve 3 meter c/c all completed

CPVC pipes of 100 mm dia & 230 mm length to be fixed at 3 M c/c in the brick masonry wall as weep holes.

Mode of Measurement: This shall be measured in numbers.

9.03 Providing & Installing two way boom barrier.

Providing & Installing two way boom barrier (length 9 m) having both electrical & manual operational modes as per the manufacturer specification (Gandhi Automation or equivalent)

Mode of Measurement: This shall be measured in number.

ADDITIONAL NOTE TO TECHNICAL SPECIFICATION TO BE IMPLEMENTED/ ENSURED AT SITE

1. **Documentation for ancillary consumable items used in the works**

   Formal records for the consumable materials used in execution of various item of works listed below should be maintained in "**Material Receipt Register" and Reconciliation statement** for all such materials should be prepared & submitted along with the contractor's work bill to ensure that actual consumption of materials is in line with the theoretical requirement/manufacturer's specifications:

   i) Chemicals for Anti-termite treatment

   ii) Admixtures (used in concrete mix)

   iii) Water proofing chemicals/membranes/coatings

   iv) Sealants/ Boards used for expansion/construction/contraction joints

   v) Observation register for actual unit weight of reinforcement steel, structural steel, Aluminium sections, roofing sheets for which unit weights/ gauges were specified in SOQ/ approved manufacturer's specifications.

   vi) All type of painting materials (external/internal/special) including primers

   vii) Floor hardener/ special flooring joint materials

   viii) All type of coatings (Epoxy, PU etc)

   ix) All type of piping material (MS, SS,GI, PVC, uPVC, CPVC, HDPE etc)

   x) All types of roof sheeting material

   xi) Bitumen 80/100

   Contractor to submit a copy of invoice for all the aforementioned consumable materials supplied to project site as directed by Engineer - in-charge.

2. In case of materials supplied of approved makes, contractor to submit manufacture's test certificates (MTC) for each lot of materials supply of

material for physical verification (Batch number & Shelf life) by Engineer - in-charge before put to use .

3. All Flooring, Dado materials should be put in use only after physical verification by Engineer -in-charge as specified in Item specification and quality parameters.

4. In case of Cement & reinforcement steel, in addition to manufacturer's tests certificate periodical tests from the approved laboratories should also be carried out as specified in quality control section.

Quality Control Process

QUALITY CONTROL PROCESS TO BE FOLLOWED

Quality Control is an essential part of any construction process for ensuring Quality. All materials to be used, all methods adopted and all works performed are strictly to be in accordance with the requirements of the specifications and approved drawings. Quality Control measures leads to construction of improved quality, conformity and ensures utilization of better quality of materials.

The **main objective** of Quality Control (QC) is to obtain independent & objective assessment of the technical quality of all the civil, structural, electrical and all ancillary miscellaneous construction works at different stages of construction and to ensure that the buildings and structures are constructed as per desired standards and in accordance to the specifications.

The Construction contractor is responsible for implementing and supplementing a quality control procedure to ensure that all aspects of work meet the standards set forth in the specifications and is of acceptable quality. The Construction contractor is totally responsible for quality throughout and is to take all necessary measures to ensure quality by adopting correct construction practices to produce the end products of acceptable quality.

Ensuring execution of quality work of durability and uniform performance by the Contractor is the most important aspect of the Quality Control.

The basic concept of this process is that the construction Contractor constructs & performs testing as per the following format and requirement as minimum at his risk and cost to ensure a quality product.

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(A)	**EARTH FILLING (Soil)**				
1	Density of compacted layer	IS:2720 Part 8, Part 28,	1 test per 400 Sqm area per 600 mm depth of filling or part thereof	Compaction 95 % of max dry density with moisture content differing not more than 4 % of the optimum content.	Tests to be performed at site Laboratory / external laboratory.

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(B)	**CONCRETE WORK**				
1	Compressive Strength test (M20 to M55)	IS: 516 (Concrete cube compressive strength test)	Upto 5m3- 1Set, >5-15m3-2 Sets, >15-30m3-3Sets >30-50m3-4Sets Above 50m^3 - 4+one additional sample for each 50m^3 part thereof.	Acceptance criteria Specified as per IS 456:2000.	Tests to be performed at site Laboratory and periodically, once in a month minimum 1 set of six cubes to be sent at the external laboratory for 28 days strength.
2	Slump Test	IS 456: 2000, IS 1199: 1959	Nil up to 10 Cum. 1 test for every 50 Cum or part thereof per day	As per design mix /IS code	Site laboratory

3	Non Destructive Test (NDT)	IS:13311 Part 2			If required/ suggested by Structural consultant/ NDDB.
4	Core Cutting	IS:516			Same as 3

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(C)	**BRICKS**				
1	Water Absorption	IS: 3495 Part-2	One test per every 50000 Nos of bricks or part thereof for make/source. One external lab test per month must be ensured during supply period at site.	Max. 20%	Site test/ External laboratory test MTC to be obtained if available.
2	Compressive Strength	IS: 3495 Part-1		As per PO specification	
3	Efflorescence test	IS:3495 Part-3		Shall not be more than Moderate	
4	Dimension Tolerances (Limits per 20 bricks)	IS13757: 1993, IS 1077: 1992	**a) For modular** size **Length** 3720 to 3880 mm (3800 ± 80 rom) **Width** 1760 to 1840 mm (1800 ± 40 rom) **Height** (for 90mm) 1760 to 1840 mm (1800 ± 40 rom) Height (for 40mm) 760 to 840 mm (800 ± 40 rom)	b) **For non-modular** size **Length** 4520 to 4680 mm (4600 ± 80 rom) **Width** 2240 to 2160 mm (2200 ± 40 rom) **Height** (for 70mm) 1440 to 1360 mm (1400 ± 40 rom) Height (for 30mm) 640 to 560 rom (600 ± 40 rom)	

5	Physical verification	IS: 3495 1992	For each supply day	Free from cracks & flaws	

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(D)	**CEMENT**				
1	Fineness – Specific surface sqm/kg	IS 4031 Part-2	Each Consignment if MTC is not produced. & 1 test per 50 MT supplies of one Make/Grade/Type & Test per change of Make/Grade/Type subject to only 1 (one) test for each week's production of cement even if supplies are more than 50 MT	100 to 700 Based on type of cement	External lab/site lab test MTC must be obtained for each consignment
2	Setting time	IS: 4031 Part-5		Initial 30min, Final 600min.	
3	Compressive strength	IS: 4031 Part-6		Min. 43 MPa	
4	Consistency	IS: 4031 Part-4		10 % to 50 %	
5	Soundness test	IS: 4031 Part-3		Max.10mm/ 0.8 %	

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(E)	**WATER**				
1	Chloride as CL	IS: 3025 Part-32, IS: 456	Water from each source shall be got tested before the	500 mg/litre max.	External lab test.

2	Inorganic matter	IS: 3025 Part-18, IS: 456	commencement of work and thereafter once in every three months till the completion of the work	3000 mg/litre max.	
3	Organic matter	IS: 3025 Part-18, IS: 456		200 mg/litre max.	
4	Suspended solids	IS: 3025 Part-17, IS: 456		2000 mg/litre max.	
5	Sulphates (As SO_3	IS: 3025 Part-24		400 mg/litre max.	
6	PH value	IS: 3025 Part-11		6 to 8	
7	Limits of Acidity	IS: 3025 (P-22)		0.1ml to 100 ml	
8	Limits of Alkalinity	IS: 3025 P-23)		0.1ml to 100 ml	

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(F)	**REINFORCEMENT STEEL**				
1	C/S area	IS: 1786	Minimum Quantity for testing requirement shall be 8 MT per size (Dia) of reinforcement steel	As per respective diameter	External/ Site lab test and MTC must be obtained
2	0.2% Proof Strength	IS: 1786		Min. 500 N/mm2	

3	Ultimate tensile strength	IS: 1786	**A)For consignment below 100 MT** i)under 10 mm dia, one sample for each 25 MT or part thereof ii) 10mm to 16mm dia one sample for each 35 MT or part thereof iii) Over 16mm dia one sample for each 45 MT or part thereof **B)For consignment over 100 MT** i)under 10 mm dia, one sample for each 40 MT or part thereof ii) 10mm to 16mm dia one sample for each 45 MT or part thereof	Min. 8% more than actual 0.2% proof stress & > 545 N/mm2	for each consignment
4	% Elongation	IS: 1786		12.0% Min.	
5	Weight per meter	IS: 1786		As per IS Code	
6	Bend Test	IS: 1599		No cracks	
7	Re-bend Test	IS:1599, IS1786		No cracks	

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(G)	**COARSE AGGREGATE**				
1	Sieve Analysis	IS: 2386 Part-1,IS: 383	For each supply day		Site test / External lab test
2	Moisture Content	IS2386 Part-III	One test per concrete day		
3	Water Absorption	IS: 2386 Part-3,IS: 383	1 test per three months OR	Max. 2%	

4	Specific Gravity	IS: 2386 Part-3,IS: 383	change of source whichever is earlier	Min. 2.5	
5	Impact Value	IS: 2386 Part-4,IS: 383		As per IS Code	
6	Crushing Value	IS: 2386 Part-4, IS: 383: 2016		Max. 30%. If it exceeds then test for ten percent fines should be conducted & min. load for ten percent fines should be 50kN	
7	Soundness	IS: 2386 Part-5, IS: 383: 2016		In IS:383 Max 12% by Na2SO4 Max 18% by MgSO4	
8	Elongation & Flakiness Index	IS: 2386 Part-1, IS:383: 2016	For each supply day	Max. 40%	
9	Deleterious Contents	IS: 383, IS: 2386 Part-2	One test per change of source	Should be Nil	

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(H)	**FINE AGGREGATE**				
1	Gradation (Fineness modulus)	IS: 2386 Part-II	For each supply day	As per IS: 383, FM=2.2-3.20	Site test / External lab test
2	Zone of sand	IS :383		Grading should be fall within zone II, III.	

3	Silt Content (% finer than75 μ)	IS :383:2016, IS:2386 part1		Uncrushed sand-Max. 3%, Crushed sand-Max. 15%, Mixed sand-Max. 12%,	
4	Water absorption	IS:2386 Part-3	1 test per three months OR change of source whichever is earlier	Max. 2%	
5	Moisture content	IS: 2386 Part- 3	One test per concrete day		
6	Specific gravity	IS: 2386 Part- 3	1 test per Source	2.42 to 2.64	

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(I)	**ADMIXTURE**				
1	Chemical Tests	IS: 9103	Every Six Month/ Change of source whichever is earlier. **	Chemical test as per IS **(If MTC is not produced, test for each batch)	External lab test. MTC must be obtained for each batch.

(J)	MILD (STRUCTURAL) STEELs				
1	Unit Weight	IS:2062, IS4923	No test up to 8 MT. Thereafter, 1 test for every 8 MT of each category per consignment	As per IS	External lab test. MTC must be obtained.
2	Yield stress			250 N/Sqmm,	
3	Ultimate tensile strength			410 N/Sqmm	
4	Elongation (%)			23 % Min.	
5	Bend test				

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification	Remarks
(K)	GALVALUME SHEETING				
1	Thickness of sheet	IS 5523-1983 MTC from Approved	Per Category/ Per Source/ Make	As per PO/ manufacturers specification	External lab test. MTC must be obtained.
2	Coating thickness	MTC from Approved Manufacturer			
3	Standard weight of sheet	IS 1608:2005			
4	% elongation	IS 1608:2005			
5	Yield strength (N/mm2)	IS 1608:2005			
6	Ultimate tensile strength (N/mm2)	IS 1608:2005			

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirem	Remarks
(L)	**CPVC/UPVC PIPE (Potable Water)- MTC to be submitted**				

Sr. No.	Name of Test	Testing Method	Frequency of Test	Specification Requirement	Remarks
(M)	**RMC CONCRETE**				
1	Ready Mix Concrete	IS:4926			Proportion of all its constituents & their relevant test must be checked & approved from structural consultant.

Notes:-

1. External laboratory means any government engineering college/laboratory or any other laboratory having National Accreditation Board for Testing and Calibration Laboratories (**NABL**) accreditation.
2. MTC: - Manufacturers Test Certificate.
3. ASTM-American Society for Testing and Materials
4. Technical specification (Section-IV) shall also be followed.

LIST OF SUGGESTED MAKES

The following is the suggested list of products and name of the manufacturer against each product. The contractor shall quote rates for the various items of works such that their rates should be valid for all makes suggested hereunder. It will be prerogative of NDDB to approve any make out of this list or any other equivalent make. The makes specified in schedule of quantities shall have preference over the makes suggested hereunder. Wherever make is not suggested, the material should be as per relevant BIS specification.

S. N.	ITEM DESCRIPTION	Suggested Makes/Manufactures
1	OPC (Ordinary Portland Cement) / PPC (Pozzolona Portland Cement)	ULTRATECH / ACC/ AMBUJA /
2	White Cement, Putty, Primer to be applied with putty	BIRLA White / JK White / Birla Putty & Primer / JK Putty & Primer
3	CEMENTATION GROUT	FOSROC/ SIKA/SHRINKOMP/ BASF/ ARDEX ENDURA/PIDILITE/STP
4	ANTI CORROSIVE PRIMER	ASIAN OR EQUIVALENT CONFORMING TO IS – 2074
5	Water Proofing Compound / Epoxy Flooring Chemical	FOSROC/SIKA/CICO/PIDILITE/ ARALDITE/MYK SCHAUMBURG/BASF/STP
6	Water Proofing Compound, Other all Construction Chemicals, Concrete admixtures of all types, Epoxy and Resin materials etc. Acid and Alkali resistant primers/powder	FOSROC/SIKA/CICO/PIDILITE/MYK SCHAUMBURG/CIBA / BASF/STP/
7	CONCRETE ADMIXTURES	SIKA / FOSROC / BASF/CICO/ SCHAUMBURG/STP
8	Reinforcement Steel-IS1786-Fe415 or Fe500 (all diameters)	SAIL / TATA STEEL / VIZAG (RINL) /JINDAL
9	STRUCTURAL STEEL & ALL MS ELEMENTS &	SAIL / TISCO / JINDAL

	PLATES	
10	SS FITTINGS	Kich/Golden/Gerge/ ENOX
11	ALUMINIUM SECTIONS	Hindalco/Jindal/Indal/BANCO
12	PAINTS (Premium Quality)	ASIAN / BERGER / J&N / SHALIMAR/ICI / NEROLAC/ SNOWCEM INDIA LTD.
13	ANTI FUNGAL ACRYLIC EMULSION PAINT	SANDTEXTMATT OF SNOWCEM INDIA / APEX ULTIMA OF ASIAN PAINTS, WEATHERCOAT ALL GUARD OF BERGER PAINTS
14	PLASTIC EMULSION / ACRYLIC EMULSION PAINT / SYNTHETIC ENAMEL	ASIAN PAINTS / J & N / BERGER / SHALIMAR / ICI
15	CEMENT PAINT	SUPER SNOCEM / NITCOCEM / DECOCEM
16	ACID & ALKALI RESISTANT INDUSTRIAL TILE & COVING	H&R JOHSON/RESTILE/NAVIN/BELL GRANITO/PELICAN
17	MS PIPE	TATA/JINDAL /BST /QST /PRAKASH SURYA
18	MS HOLLOW SECTION	TATA / DECCAN / JINDAL
19	STAINLESS STEEL.	SALEM / JINDAL
20	uPVC PIPE / cPVC PIPE	FINOLEX/ SUPREME / ASTRAL / PRINCE/ JAIN
21	uPVC PIPE, SPECIALS AND FITTINGS / ALL PVC MATERIALS.	FINOLEX/ SUPREME / ASTRAL / PRINCE/ JAIN
22	PVC / uPVC PIPES AND FITTINGS	FINOLEX/PRINCE/ SUPREME/ JAIN/ASTRAL
23	POLYSULPHIDE SILICON SEALANT	FOSROC/SIKA/CICO/PIDILITE
24	CI SOIL, WASTE & FITTINGS (IS:3989)	NECO or equivalent approved
25	GI PIPES-MEDIUM CLASS (IS:1239)	JINDAL or equivalent approved
26	GI FITTINGS	'R' BRAND / UNIK / KS

27	GI PIPES	TATA / JINDAL(HISSAR) / BST / SURYA / ROSHNI
28	GI SHEET	SAIL / TATA / ISPAT (NIPPON)
30	Barbed Wire & Concertina Wire	TATA Wiron/Efficacy Concertina/Wonder Plus

NOTE:

1 For equivalent, ISI or approved marked items included above, if opted by contractor, specific approval to be taken by contractor for make, before procurement and use.

2 For the items not indicated above but to be used for civil & structural works, specific approval to be taken before procurement and use after submitting sample, detail of manufacturer, source of supply etc.

3 Samples for all bought out items like pipes, aluminium sections, Door & window fittings, bricks, GI colour coated sheets, sanitary & water supply fittings etc. should be brought at site and got approved before procurement.

We have noted the above and confirm that our tender is based on above approved makes.

Date: _____ **Signature and Seal of Bidder**