

VOLUME-II TECHNICAL SPECIFICATION

SECTION: 1 GENERAL AND MATERIAL

GENERAL AND MATERIAL

GENERAL

1.0 Authority's Drawings:

The drawings listed in the Contract are the Authority's conceptual drawings and are for the purpose of Guidance only, the contractor has to prepare detailed engineering drawings based on surveys, investigations and detailed engineering designs of various components of the project.

2.0 Drawing Sheet Format:

All drawings provided by the Contractor shall be on standard size sheets, prepared on computer with AutoCAD and shall show the following particulars in a title block located in the lower right-hand corner, in addition to the name of Contractor and equipment manufacturer, date, scale, drawing number, revision number (R0 for drawings submitted initially, R1, R2, etc. for drawings submitted subsequently) and title.

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Project name: -Construction of New GIDC Office Building at Vadodara.

A blank space of 90 mm x 100 mm shall be provided for the TPQA / Officer In-Charge of the Authority's approval stamp and provision shall be made for details of revisions to be recorded.

All drawings submitted by the Tenderer/Contractor shall use the English language and SI units.

All drawings shall be clearly and fully cross-referenced to the other drawings as relevant.

3.0 Tender / Contract Drawings:

Drawings submitted by the Tenderer shall show all the essential items of the Plant offered together with sufficient details to enable the general arrangement of the Plant to be determined.

The drawings and documents to be provided by the Tenderer / Contractor shall not be limited to those listed:

4.0 Submissions and Approval of Drawings:

The following shall be the procedure for submission and approval of drawings:

The Contractor shall submit minimum 6 copies of the drawings to the Authority. All the drawings are to be signed by the Contractor or his authorized representatives.

The TPQA / Officer In-Charge of the Authority will review the drawings and, if found fit for approval, the Authority will return 2 copies to the Contractor duly approved.

In case the drawings/documents are not fit for approval but worth for review, the TPQA / Officer In-Charge of the Authority will mark the comments on the drawings and return 2 copies to the Contractor. In such case, the Contractor shall resubmit the revised drawings within two weeks as per above and the same shall be repeated till the drawings are finally approved as per sub-clause above.

If the submitted drawings/documents are not worth for review, the Contractor will be informed accordingly.

On receipt of the approved drawings as per sub-clause above, the Contractor shall submit

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CD/Pen-Drive, Soft Copy and documents to the Authority as and when demanded.

After tests on completion, the Contractor shall submit, within 15 days of the conclusion of the tests, CDs/Pen-Drive, Soft Copy, Hard Copy of the “As Built Drawings” to the Authority.

When the drawings are received by the TPQA / Officer In-Charge of the Authority after revision by the Contractor, he will only review the revision made and hence the Contractor shall carefully identify all the revised details / dimensions and also describe the revisions in the revision block.

No drawings, with corrections made after taking the prints, will be accepted.

Approval of drawings by the TPQA / Officer In-Charge of the Authority shall not relieve the Contractor of his responsibility in terms of the Contract.

5.0 Delivery, Unloading and Storing at Site:

The Contractor shall be responsible for checking all materials delivered to Site and shall keep

The TPQA / Officer In-Charge of the Authority fully informed of the state of deliveries. The Contractor shall follow all instructions of TPQA / Officer In-Charge of the Authority for proper unloading, preservation, maintenance, storage and security of materials delivered to Site until he fulfils all his obligations under the Contract.

The Contractor shall erect and maintain on the Site any temporary storage facility as required and approved by the TPQA / Officer In-Charge of the Authority.

Multiple handling and movement of materials during storage and retrieval shall be avoided.

6.0 Spare Parts:

Spare Parts required after the taking over the Plant shall be filled up by the bidder.

Spares during pre-commissioning trials, commissioning tests/maintenance, guarantee etc. shall be provided by the Contractor. The necessary spares shall be brought by the Contractor prior to the pre-commissioning test so as to avoid the downtime of equipment due to non-availability of them. All these spares have to be provided as required, by Contractor.

All spare parts shall be new, unused and strictly interchangeable with the parts for which they are intended to be replacements and shall be treated and packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be clearly marked or labelled on the outside of its packing with its description, number and purpose. When more than one spare is packed in a single case or other container, a general description of its contents shall be shown on the outside of such case or container and a detailed list enclosed. All cases, containers and other packages shall be marked and numbered in an approved manner for the purpose of identification. Spares shall be delivered to Site after the completion of erection but before start of commissioning of Plant along with technical leaflets and details. Spare parts shall be indicated in the assembly drawing showing clearly the part numbers.

All cases, containers or other packages are liable to be opened for such examination as the TPQA / Officer In-Charge of the Authority may require and packing shall be designed to facilitate opening and thereafter re-packing. In the event of some specific spares offered in the Contract being withdrawn from manufacture owing to changes in design of equipment or similar reasons viz., model being obsolete etc., the Contractor shall inform the Authority before such withdrawal so that the Authority can take timely alternative steps.

7.0 Tools:

Tools shall be delivered to site just prior to Tests on Completion.

The specified tools shall not be used for the erection of the Plant being supplied and except that the TPQA / Officer In-Charge of the Authority may call upon the Contractor to demonstrate their use or

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effectiveness, they must be handed over to the Authority in a completely new and unused condition. Should the Contractor require any such tools at site for erection, he shall provide his own.

The test equipment shall include special purpose items essential to the testing or re-calibration of related items of Facilities.

MATERIALS AND WORKMANSHIP:

1.0 Introduction:

This part of the Specification sets out the general standards of materials to be supplied and the workmanship required to be ensured by the Contractor. All component parts of the Works shall, unless otherwise specified, comply with the provisions of Authority's requirement or be subject to the approval of the Authority.

Particular attention shall be paid to a neat, orderly and well-arranged installation carried out in a methodical competent manner.

2.0 Reference Specifications and Standards:

Where reference is made in the Specification to a British Standard Specification (hereinafter abbreviated to 'B.S.') issued by the British Standards Institution of 2, Park street, London W.I., or to an Indian Standard Specification (I.S.) issued by the Bureau of Indian Standards, (earlier known as Indian Standard Institution), Manak Bhavan, 9 Bahadur shah Zafar Marg, New Delhi 110 002, or American Society for Testing and materials (ASTM) issued by ASTM 1916 Race Street, Philadelphia, P.A., 19103, U.S.A. or American National Standards Institute (ANSI) issued by ANSI 1430, Broadway, New York, N.Y., 10018, U.S.A. or Japanese Industrial Standards (JIS) issued by Japanese Standards Association, 4-1-24, Alaska, Minato-Ku, Tokyo 107, Japan or to any other equivalent or higher Standard it shall be to the latest revision of that Standard on the Tender opening date.

The Contractor may propose to the Authority, the use of any relevant authoritative internationally recognized Reference Standard.

All details, materials and utensils supplied and workmanship performed shall comply with the specified Standards. If Tenderer offers equipment to other Standards, the equipment/materials should be equal or superior to those specified and full details of the difference shall be supplied.

In the event of conflict between this Specification and the Codes for equipment, provisions of Specification shall govern. Certain specifications issued by national or other widely recognized bodies are referred to in this Specification. In referring to the Standard Specifications the following abbreviations are used:

IS:	Indian Standard
ANSI:	American National Standards Institute
API:	American Petroleum Institute
ASME:	American Society of Mechanical Engineers
ASTM:	American Society of Testing and Materials
AWS:	American Welding Society
AWWA:	American Water Works Association
ISO:	International Organization for Standardization
DIN:	Detached Institute for Norming
BS:	British Standard
IEC:	International Electrotechnical Commission
IEE:	Institution of Electrical Engineers

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IEEE:	Institute of Electrical and Electronic Engineers
NEMA:	National Electrical Manufacturers Association
AGMA:	American Gear Manufacturer's Association

3.0 Materials – General:

All materials incorporated in the Works shall be the most suitable for the duty concerned and shall be new and of reputed make/approved quality, free from imperfections and selected for long life and minimum maintenance. Non-destructive tests, if called for in the Specification, shall be carried out. All submerged moving parts of the Plant, or shafts and spindles or faces etc. in contact with them shall be of corrosion resistant materials. All parts in direct contact with various chemicals, shall be completely resistant to corrosion, or abrasion by these chemicals, and shall maintain their properties without aging due to the passages of time, exposure to light or any other cause.

4.0 Workmanship – General:

Workmanship and general finish shall be of first-class quality and in accordance with best workshop practice.

All similar items of the Plant and their component parts shall be completely interchangeable.

Spare parts shall be manufactured from the same materials as the originals and shall fit all similar items.

All parts, which can be worn or damaged by dust, shall be totally enclosed in dust proof housings. All materials incorporated in the Works shall be the most suitable for the duty concerned, free from imperfections and selected for long life and minimum maintenance. All necessary accessories required for satisfactory and safe operation of the Plant shall be supplied by the Contractor unless it is specifically excluded from his scope. Suitable provision by means of eyebolts or other means are to be provided to facilitate handling of all items that are too heavy or bulky for lifting and carrying by two men.

5.0 Welding:

Welding shall comply with the latest revision of the BS 5135 Code.

Welders shall be qualified in accordance with the requirement of the appropriate section of BS4871. The TPQA / Officer In-Charge of the Authority shall have the right to call for further qualification from time to time from any welder who in the opinion of the TPQA / Officer In-Charge of the Authority does not produce weld in accordance with the qualification. Each welder shall be assigned a number and letter. Each welding elements shall clearly be identified as to its welder marking the welder's Code adjacent to the welds. A record chart shall be maintained for each welder showing the procedures, for which he has qualified, the date of such qualification, the type of defects produced and their frequency. The TPQA / Officer In-Charge of the Authority shall disqualify the welder whose Work requires a disproportionate amount of repairs. All procedures where required shall be qualified as per BS EN 283-3.

Inspection and quality of surveillance shall not be limited to the examination of finished welds.

The techniques employed shall be based on methods which are known to produce good results and which have been verified at Site by actual demonstration.

Haphazard striking of the electrodes for establishing an arc shall not be permitted. The arc shall be struck either on the joint or on a starting tag. The starting tag shall be of the same material or a material compatible with the base metal being welded. In case of any inadvertent strike on place other than the welding, the area affected shall be ground flushed and examined by liquid penetration method.

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Generally, a stringer bead technique shall be used with a slight oscillation of necessary to avoid slag and to minimize the number of beads needed to fill exceed 3 times the wire diameter. Vertical welds shall be made in upward direction. For all pipes above 300 mm dia., welding shall be done whenever possible, by 2 welders working simultaneously along both sides of the pipe.

The root pass shall have less than 1.5 mm internal reinforcement. Defects like icicles, burn

Through and excessive “such back”, etc. shall be cause for rejection of welds.

Final welds shall be suitable for appropriate fabrication of the non-destructive examination of the weld. If grinding is necessary, the weld shall be blended into the parent metal without gouging or thinning of the parent metal in any way. Uneven and excessive grinding may be a cause for rejection. Fillet weld shall preferably be convex and free from undercutting and overlap at the toe of weld. Convexity and concavity shall not exceed 1.5 mm. The leg lengths shall not exceed the specified size by more than 1.5 mm.

All attachments such as lugs, brackets and other non-pressure parts shall also be done by qualified welders in accordance with the design details and materials specifications. Temporary attachments shall be removed in a manner that will not damage the parent metal. Areas of temporary attachments shall be dressed smooth and examined by ultrasonic or liquid penetration methods.

All tack welds shall be made using qualified procedure and welders, the number of sizes of tack welds shall be kept as small as to consist of adequate strength and joint alignments. All tack welds shall be examined visually for defects and if found defective shall be completely removed. As welding proceeds, tack welds shall be either removed completely or shall be properly prepared by grinding or filling their starting ends so that they may be satisfactorily incorporated in the welds. Unacceptable defects shall be removed by grinding machine or chipping or gouge. Flame gouging may be permitted provided gouged surfaces are ground at least by 1.0 mm below the deepest indentation.

All weld repairs shall be carried out using the approved welding procedures and welders. Re-

Welded areas shall be re-examined by the methods specified for the original welds and the TPQA/ Officer In-Charge of the Authority shall duly qualify repair procedures.

6.0 Pre-heating and Post-Heating Treatment:

Pre-heating and post heating treatment shall conform to the relevant application Codes. Pre- heating not exceeding 121 deg. C for all carbon steel construction above 25 mm thickness would be mandatory. Such pre-heating would be maintained during flame cutting, flame or arc gouging, welding and repairs and may be done by gas heating by gas torches/gas rings with neutral flame. The temperature shall be checked by temperature indicating crayons. However, such pre-heating will not be necessary for welds less than 6 mm size. In large diameter pipe fabricated out of plate materials, production control test plates in accordance with the BS 4870- part 1 Table 6 to represent 30% of the long seams and each welder’s performance would be mandatory.

7.0 Electrodes:

All electrodes shall be stored in their original sealed containers under dry conditions. Electrodes shall remain identified until consumed. All electrodes shall be dried before use. Drying ovens shall be provided in Work areas for drying purposes. Electrodes withdrawn from oven shall be promptly used and excess unused electrodes shall be promptly returned to oven.

8.0 Examination/NDT/Radiography

The various stages of examination and types shall be as stipulated in the respective fabrication Codes. Radiographic examination shall be carried out as per provisions of BS 2600 or BS 2910; Ultrasonic tests where called for shall be carried out as per provisions of BS 3926; magnetic particle tests shall be carried out as per BS 6072. Liquid penetration tests shall be carried out as per BS 6443.

9.0 Stainless Steel Welding:

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All welding consumable such as electrodes, filler weirs, argon gas for shielding and purging shall be of high quality and the proposed brand shall be furnished for approval of the TPQA / Officer In-Charge of the Authority. Weld deposits shall have similar or higher physical properties and similar chemical composition to the members joined.

All electrodes shall be purchased in sealed containers only and stored in their packing intact.

The packets opened shall be consumed as early as possible. The electrodes removed from the containers shall be kept in holding ovens at temperatures recommended by electrode manufacturer. Special care shall be taken in avoiding mixing of electrodes in the oven. The electrodes and filling wires shall be free from rust, oil, grease, earth and other foreign matter.

Argon gas with purity 99.5% shall be used for shielding and purging. The purity of gas shall be certified by the gas manufacturers.

Non-destructive examination of the welds shall be carried out to ensure quality of weld.

The electric current for welding shall be direct current, straight polarity (electrode negative).

The welding current shall be kept minimum possible to ensure minimum heat affected zone in the parent material. Other side of the weld joint shall be periodically flushed with argon gas.

10.0 Castings:

Cast steel shall be of standard grey close-grained quality. The structure of the castings shall be homogeneous and free from non-metallic inclusions and other injurious defects. All surfaces of castings, which are not machined, shall be smooth and shall be carefully fettled to remove all foundry irregularities.

Minor defects in depth not exceeding 12.5 percent of total metal thickness and which will not ultimately affect the strength and serviceability of the casting may be repaired by approved welding techniques. The TPQA / Officer In-Charge of the Authority shall be notified of large defects and no repair welding of such defects shall be carried out without prior approval of the TPQA / Officer In-Charge of the Authority. If the removal of metal for repair should reduce the stress resisting cross section of the casting by more than 25 percent, or to such an extent that the computed stress in the remaining metal exceeds the allowable stress by more than 25 percent, then casting shall be rejected. Test coupons cast simultaneously with the main castings shall be identified to check physical, chemical analysis of casting. Major defects on casting are not acceptable. Castings repaired by welding for minor defects shall be stress-relieved after such welding. Non-destructive tests as directed by the TPQA / Officer In-Charge of the Authority will be required for any casting containing defects whose extent cannot otherwise be judged, or to determine where repair welds have been properly made.

11.0 Forging:

All major stress-bearing forging shall be made to a Standard Specification. Forging shall be subjected to magnetic particle testing or dye penetration test at the areas of fillets and change in section. The testing shall be conducted after rough machining (10 microns). Any defect, which will not machine out during the final machining, will be gouged out fully, inspected by dye penetration or magnetic particle inspection to ensure that the defect is fully removed and repaired using an approved repair procedure. Any indication, which proves to penetrate deeper than 2.5% of the finished thickness of the component, shall be reported to the TPQA / Officer In-Charge of the Authority giving the details like location, length, width and depth. For the magnetic particle inspection, the choice of wet or dry particles shall be at the Contractor's discretion.

All forging shall be demagnetized after test and shall be heat-treated for the relief of residual stresses.

12.0 Design Life:

The Works as a whole shall be new, of sound workmanship, robustly designed for a long reliable operating life and shall be capable of 24 hours per day continuous operation for prolonged period in

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the climatic and working conditions prevailing at the Site, and with the minimum of maintenance. Particular attention shall be given to temperature changes, the stability of paint finish for high temperatures, the rating of engines, electrical machinery, thermal overload services, cooling systems and the choice of lubricants for possible high and prolonged operating temperatures. The Contractor shall be called upon to demonstrate this for any component part either by service records, or evidence of similar equipment already installed elsewhere or relevant type tests. Routine maintenance and repair shall as far as possible not require the services of highly skilled personnel.

The Plant shall be designed to provide easy access to and replacement of component parts, which are subject to wear, without the need to replace whole units. No parts in contact with water shall have a life from new to replacement or repair of less than five years.

Design features shall include the protection of Plant against damage caused by vermin, dirt, dust and dampness and to reduce risk of fire. Plant shall operate without undue vibration, and parts shall be designed to withstand the maximum stresses under the most severe condition of normal service. Materials shall have a high resistance to change in their properties due to the passage of time, exposure to light, temperature and any other cause, which may have a detrimental effect upon the performance or life of the Works.

Plant located outside lockable areas/buildings shall have additional features to prevent un-authorized operation.

13.0 Name Plate:

Each item of the Plant shall have permanently attached to it in a conspicuous position, a nameplate and rating plate. Upon these shall be engraved or stamped, the manufacturer's name, type and serial number of Plant, details of the loading and duty at which the item of Plant has been designed to operate, and such diagrams as may be required by the TPQA / Officer In- Charge of the Authority. All indicating and operating devices shall have securely attached to them or marked upon them designations as to their function and proper manner of use.

Nameplates, rating plates and labels shall be of a non-flame propagating material, either non-hygroscopic or transparent plastic with engraved lettering of a contrasting colour. Fixing shall be by means of non-corrosive screws; drive rivets or adhesives shall not be used.

Warning labels shall be provided where necessary to warn of dangerous circumstances or substances. Inscriptions or graphic symbols shall be black on a yellow background circumstances or substances. Inscriptions or graphic symbols shall be black on a yellow background.

Instruction labels shall be provided where safety procedures such as wearing of protective

Clothing are essential to protect personnel from hazardous or potentially hazardous conditions. These labels shall have inscriptions or graphic symbols in white on a blue background.

14.0 Nuts, Bolts, Studs and Washers:

Nuts, bolts, studs and washers for incorporation in the Plant shall conform to the requirements of the appropriate standard. Nuts and bolts shall be of the best quality of specified grade, machined on the shank and under the head and nut.

Fitted bolts shall be a light driving fit in the reamed holes they occupy, shall have the screwed portion of such a diameter that it will not be damaged in driving and shall be marked in a conspicuous position to ensure correct assembly at Site.

Washers, locking devices and anti-vibration arrangements shall be provided where necessary. Jointing hardware for the entire Plant shall be provided with sufficient spares to cater for site losses.

Where bolts pass through structural members taper washers shall be fitted, where necessary, to ensure that no bending stress is caused in the bolt. Where there is a risk of corrosion, bolts, nuts and studs shall be designed so that the maximum stress does not exceed half the yield stress of the material

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under any conditions. All bolts, nuts and washers that are subject to frequent adjustment or removal in the course of maintenance and repair shall be made of nickel-bearing stainless steel.

The Contractor shall supply all holding down, alignment and leveling bolts complete with anchorages, nuts, washers and packing required to attach the Plant to its foundations, and all bed plates, frames and other structural parts necessary to spread the loads transmitted by the Plant to concrete foundations without exceeding the design stresses.

15.0 Allowances for Wastage:

The Contractor shall supply reasonable excess quantities to cover wastage of those consumable, which will be normally subject to waste during erection, commissioning and setting to Work.

16.0 Painting – General:

The Contractor shall be responsible for the cleaning, preparation for painting, and priming or otherwise protecting, as specified, all parts of the Plant at the place of manufacture prior to packing.

Parts may be cleaned but surface defects may not be filled in before testing at the manufacturer's works. Parts subject to hydraulic tests shall be tested before any surface treatment. After test, all surfaces shall be thoroughly cleaned and dried out, if necessary by washing with an approved de-watering fluid prior to surface treatment. Except where the specification provides to the contrary all painting materials shall be applied in strict accordance with the paint manufacturer's instructions.

All protective coatings shall be suitable for use in warm humid climates. All primers, undercoats and finishes shall be applied by brush or airless spray, except where otherwise specified. Consecutive coats shall be in distinct but appropriate shades. All paints shall be supplied from the store to the painters, ready for application, and addition of thinners or any other material shall be prohibited.

17.0 Painting at Place of Manufacture:

Steel and cast-iron parts shall be sand blasted to near white cleaning before painting. Edges, sharp covers etc. shall be ground to a curve before sand blasting. A primer coat of a zinc rich epoxy resin-based coating with at least 75 microns' dry film thickness is to be provided. In addition, the parts are to be provided with adequate number of coats of coal tar epoxy polyamine coating to a dry film thickness of 175 microns including primer coating.

18.0 Painting at Site:

Immediately on arrival at the site, all items of Plant shall be examined for damage to the paint coat applied at the manufacturer's works, and any damaged portions shall be cleaned down to the bare metal, all rust removed, and the paint coat made good with similar paint.

After erection, such items, which are not finish painted, shall be done so and, items that have been finish painted at the manufacturer's works shall be touched up for any damaged paintwork. For finish painting, two coats of synthetic enamel conforming to IS: 2932 shall be applied. Dry film thickness of each coat shall be at least 25 microns.

The dry paint film thickness shall be measured by Electrometer or other instruments approved by the Authority. In order to obtain the dry film thickness specified the Contractor should ensure that the coverage rate given by the paint manufacturer would enable this thickness to be obtained. Strength of adhesion shall be measured with an adhesion tester and this value shall not be less than 10 kg/cm². Painted fabricated steel work which is to be stored prior to erection shall be kept clear of the ground and shall be laid out or stacked in an orderly manner that will ensure that no water or dirt can accumulate on the surface. Suitable packing shall be laid between the stacked materials. Where cover is provided, it shall be ventilated.

19.0 Galvanizing:

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Wherever galvanizing has been specified the hot dip process shall be used. The galvanized coating shall be of uniform thickness. Weight of zinc coatings for various applications shall not be less than those indicated below:

a) Fabricated steel:

Thickness less than 2 mm but not less than 1.2 mm	-	340 gms/sq.m
Thickness 2 mm and above	-	460 gms/sq.m

b) Fasteners

Up to nominal size M10	-	270 gms/sq.m
Over M10	-	300 gms/sq.m

Galvanizing shall be carried out after all drilling; punching, cutting, bending and welding operations have been carried out. Burrs shall be removed before galvanizing. Any Site modification of galvanized parts should be covered well by zinc rich primer and aluminum paint.

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SPECIFICATION OF MATERIALS

GENERAL

- (1) All materials to be used shall conform to the relevant specifications as per the latest edition of Indian Standard, unless otherwise stated in the detailed specifications of items of work.
- (2) All materials to be used shall be of approved quality & make as per list of approved make attached with the tender documents
- (3) Wherever a reference to any Indian Standard appears in the specification, it shall be taken to mean as a reference to the latest version of the standard.
- (4) The following specifications, standards, and codes are made a part of this specification\Tender document.

Indian Standards: specification for building materials, specification for equipment, method of test, method of measurement of building works ,code of practice for construction , safety code for demolition of building, safety code for scaffolds etc. published by the Bureau of Indian Standards

- (5) The contractor shall invariably carry out Materials & work Tests as specified in the tender document (**B1- Form**) and IS code. However, if the additional tests are required as per the opinion of the Engineer-in-charge, the same shall also have to be carried out. All such tests shall be got carried out in Government or as approved laboratories and cost thereof shall be entirely borne by the contractor. No collection of materials shall be made before it is got approved from the Engineer-in-charge.
- (6) Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.
- (7) Materials, if rejected by the Engineer-in-charge, shall be immediately removed from the site of work. If they are not removed within twenty four hours of receiving such intimation, Engineer-in-charge shall get the same removed at contractor's cost.

The Engineer-in-charge shall dispose off such materials in a manner as he chooses and the contractor shall not entitle to any compensation for the cost of such materials.

- (8) Approval to the samples of various materials given by the Engineer-in-charge will not absolve the contractor from the responsibility of replacing the defective material brought on site of materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Engineer-in-charge.
- (9) The contractor shall be responsible for observing the law, rules and regulations imposed under the "Minor Minerals Act " and such officer laws and rules prescribed by Government from time to time.

M-1 WATER

Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalies, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C: Container for transport, storage and. handling of water shall be clean. Water shall conform to the standards specified in I.S. 456-1978.

If required by Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in I.S. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or

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more or decrease of more than 10 percent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration relation or otherwise interfere with the hardening of concrete during curing or those which produce, objectionable stains or other unsightly deposits on concrete or mortar surfaces.

Hard and bitter water shall not be used for curing.

Potable water will be generally found suitable for curing mortar or concrete.

M-2 LIME

Lime shall be hydraulic lime as per I.S. 712-1973. Necessary test shall be carried out as per I.S. 6,932 (Parts I to X) 1973.

The following field tests for limes are to be carried out:

- (1) A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white colour, lime in form of porous lumps of dirty white colour indicates quick lime, and solid lumps are the unburnt lime stone.
- (2) Acid tests for determining the carbonate content in lime. Excessive amount of impurities and rough determination of class of lime.

Storage shall comply with I.S. 712-1973. The slaked lime, if stored, shall be kept in a weather proof and damp-proof shed with impervious-floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected and all rejected materials shall be removed from site of work.

Field testing shall be done according to I.S. 1624- 1974 to show the acceptability of materials.

M-3 CEMENT

Cement shall be sulphate resisting cement as per I.S. IS: 12330 – 1988 or latest revision.

M-4 WHITE CEMENT

The white cement shall conform to I.S., 80412"-E 1978.

M-5 COLOURED CEMENT

Coloured cement shall be with white or gray Portland cement as specified in the item of the work.

The pigments used for coloured cement shall be of approved quality-and shall not exceed 10% of cement used in the Mix, The mixture of pigment shall be properly grounded to have a uniform colour and shade. The pigments shall have such properties to provide-for durability under exposure to sunlight and weather.

The pigment shall have the property such that it is neither affected by the cement nor detrimental to it.

M-6 SAND

6.1 Sand shall be natural sand, clean, well graded, hard strong durable and gritty particle free from injurious-amounts of dust clay, kankar nodules, soft or flaky particles Shale, alkali, salts-organic matter, loam, mica or other deleterious substance and shall be got approved, from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test. If necessary, the sand shall be washed to make it clean.

6.2 Coarse Sand:

The fineness, modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.00. The sieve analysis of coarse shall be as under:

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I.S. sieve	Percentage by weight passing through.
4.75 mm	100
2.36 mm	90-100
1.18 mm	70-100
600 Micron	30-100
300 Micron	5-70
150 Micron	0-50

6.3. Fine Sand

The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under:

I.S Sieve Designation	Percentage by weight through Passing	I.S. Sieve Designation	Percentage by Weight Passing through
4.75mm.	100	600 Micron	40-85
2.36mm	100	300 Micron	5-50
1.18mm	70-100	150 Micron	0-10

M-7 STONE DUST

This shall be obtained from crushing hard black trap or equivalent. It shall not contain- more than 8% of silt as, determined by field test with measuring cylinder. The method of determining silt contents by field test is given as under:

A sample of stone dust to be tested shall be placed without drying in 200mm. measuring cylinder. The quantity of the sample shall be such that it fills the cylinder upto 100 mm. mark. The clean water shall be added upto 150 mm. mark. The mixture shall be stirred vigorously and the content allowed to settle for 3 hours.

The height of silt visible as settled layer above the stone dust shall be expressed as percentage of the height of the stone dust below. The stone dust containing more than 8% silt shall be washed so as to bring the silt content within the allowable limit.

The fineness modulus of stone dust shall not be less than 1.80.

M-8 STONE GRIT

Grit shall consist of crushed or broken stone and be hard strong, dense, durable, clean, of proper gradation and free from skin or coating likely to prevent adhesion of mortar. Grit shall generally be cubical in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provisions of I.S. 383-1970. Unless special stone of particular quarries is mentioned, grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious reaction with cement.

The grit shall conform to the following gradation as per sieve analysis:

I.S. Sieve Designation	Sieve	Percentage by weight through	I.S. Sieve Designation	Percentage by Weight Passing through
12.50mm.		100%	4.75mm	0-20%
10.00mm		85-100%	2.36mm.	0-25%

The crushing strength of grit will be such as to allow the concrete in which it is used to built up the specified strength of concrete.

The necessary tests for grit shall be carried out as per the requirements of I.S. 2386 (Parts I to VII) 1963, as per instructions of the Engineer-in-charge. The necessity of test will be decided by the Engineer-in-charge.

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M-9 CINDER:

Cinder is well burnt furnace residue which has- been fused or sintered into lumps of varying sizes.

Cinder aggregates shall be well burnt furnace residue obtained from furnace using coal fuel only. It shall be sound clean free from clay, dirt, ash or other deleterious matter.

the average grading for cinder aggregates shall be as mentioned below:

I.S Sieve Designation	Percentage Passing	I.S. Sieve Designation	Percentage Passing
20 mm.	100	4.75mm	70
10 mm	86	2.36mm.	52

M-10 LIME MORTAR

Lime shall conform to Specification M-2. Water shall conform to specification M-1.

Sand shall conform to specification M-6.

Proportion of Mix:

Mortar shall consist of such proportions of slaked lime and sand as may be specified in the item. The slaked lime and sand be measured by volume.

Preparation of mortar:

Lime mortar shall be prepared by wet process as per I.S. 1625-1971. Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in an even layer and ground for 180 revolutions with a sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff paste. Thoroughly wetted sand shall then be added evenly and the mixture

ground for another 180 revolutions.

Storage:

Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

Use:

All mortar shall be used as soon as possible after grinding. It should be used on the day on which it is prepared. But in no case mortar made earlier than 36 hours shall be permitted for use.

M-11 CEMENT MORTAR:

Water shall conform to specification M-1. Cement shall conform to specification M-3. Sand shall conform to M-6.

Proportion of Mix:

Cement and sand shall be mixed to specified proportion; sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50 Kg. /Bag of cement being equal to 0.0342 Cum. The mortar may be hand mixed or machine mixed as directed.

Preparation of mortar:

In hand mixed mortar cement and sand in the specified proportions shall be thoroughly mixed dry on a clean Impervious platform by turning over at least 6 times or more till a homogenous mixture of uniform colour is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly-mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed.

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The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes.

M-12 STONE COARSE AGGREGATE FOR NOMINAL MIX CONCRETE

Coarse aggregate shall be machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain-cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. "However, in case of reinforced cement concrete the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6 mm. less than the cover, whichever is smaller.

TABLE

I.S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size.			I.S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size.		
	40mm	20mm	16mm		40mm	20mm	16mm
80mm.	—	—	—	12.5mm.	—	—	—
63mm.	100	—	—	10mm.	0.5	0.02	0.30
40mm.	85-100	100	—	4.75mm.	—	0.5	0.5
20mm.	0-20	85-100	100	2.35mm	—	—	—
16mm.	—	—	85-100				

Note: This percentage may be varied somewhat by Engineer- in-charge when considered necessary for obtaining better density and strength of concrete.

The grading test shall be taken in the beginning and at the change of source of materials. The necessary test indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates, If the aggregates are covered with dust they shall be washed with water to make them clean.

M-13. BLACK TRAP OR EQUIVALENT HARD STONE COARSE.

Aggregate For Design Mix Concrete: Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard strong dense, durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregate shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement.

The necessary tests indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability of the material.

If aggregate is covered with dust, it shall be washed with water to make it clean.

M-14 BRICK BATS AGGREGATE

Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense brick. It shall be homogeneous in texture roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm. to 50 mm. size unless otherwise specified in the item. The under burnt or over burnt brick bats shall not be allowed.

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The brick bats shall be measured by volume by suitable boxes or as directed.

M-15 BRICK

The bricks shall be hand or machine moulded and made from suitable soils and klin-burnt. They shall be free from iron crack and nodules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform colour.

The bricks shall be moulded with a frog of 100mm. x 40 mm. and 10mm. to 20 mm. deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 600 mm.

The size of modular bricks shall be 190 mm. x 90 mm. x 90 mm.

The size of the conventional bricks shall be as under:

(9" x 4 3/8" X 2 3/4") 225 x 110 x 75 mm.

Only bricks of one standard size shall be used on one work. The following tolerances shall be permitted in the conventional size adopted in a particular work.

Length + 1/8" (3.0 mm) Width: $\pm 1/16$ " (1.50 mm) Height: $\pm 1/6$ " (1.50 mm)

The crushing strength of the bricks shall not be less than 35 Kg./Sq.Cm. The average water absorption shall not be more than 20 percent by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part-I to IV) 1976.

M-16 STONE

The stone shall be of the specified variety such as Granite/Trap Stone/Quartzite or any other type of good hard stones.

The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance with I.S. 1134- 1974. The minimum crushing strength of the stone shall be 200 Kg./Sq.Cm. unless otherwise specified.

The samples of the stone to be used shall be got approved before the work is started.

The Khanki facing stone shall be dressed by chisel as specified in the item for khanki facing in required shape and size. The face of stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface.

M-17 LATERITE STONE

Laterite stone shall be obtained from the approved quarry. It shall be compacted in texture, sound, durable and free from soft patches. It shall have a minimum crushing strength of 100 Kg./Sq.Cm. in its dry condition. It shall not absorb water more than 20% of its own weight, when immersed for 24 hours in water. After quarrying the stone shall be allowed to weather for some time before using in work.

The stone shall be dressed into regular rectangular blocks so that all faces are free from waviness and unevenness, edges true and square.

Those types of stone in which white clay occur, should not be used.

Special corner stones shall be provided where so directed.

M-18 MILD STEEL BARS

Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II) 1966 and shall be of tested quality. It shall also comply with relevant part of I.S. 456- 1978.

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All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust at the time of placing.

For the purpose of payment, the bar shall be measured correct upto 100 mm. length and weight payable worked out at the rate specified below:

1	6 mm.	0.22Kg/Rmt.	8	20mm.	2.47Kg/Rmt.
2	8 mm.	0.39Kg/Rmt.	9.	22mm.	2.98Kg/Rmt.
3	10 mm.	0.62Kg/Rmt.	10.	25mm.	3.85Kg/Rmt.
4	12 mm.	0.89Kg/Rmt.	11.	28mm.	4.83Kg/Rmt.
5	14 mm.	1.21Kg/Rmt.	12.	32mm.	6.3.1Kg/Rmt.
6	16 mm.	1.58Kg/Rmt,	13.	36mm.	7.99Kg/Rmt.
7	18 mm.	2.00Kg/Rmt.	14.	40mm.	9.86Kg/Rmt.

M-19 HIGH YIELD STRENGTH STEEL DEFORMED BARS / TMT/ CRS

High yield strength steel deformed bars be either cold twisted or hot/rolled, shall conform to I.S. 1739-1966 and I.S.1139-1966 respectively.

Other provision and requirements shall conform to specification No.M-18. for Mild steel bars.

M-20 HIGH TENSILE STEEL WIRES

The high tensile wires for the use in prestressed concrete work shall conform to I.S. 2090-1962.

The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength, the minimum strength shall be taken as per para 6.1 of I.S. 1785-1962, Testing shall be done as per I.S. requirements.

The high tensile steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing carborundum.

The high tensile wire shall be obtained from manufactures in coil having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

M-21 MILD STEEL BINDING WIRE

The mild steel wire-shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to I.S. 280- 1972.

The use of black wire will be permitted for binding reinforcement bars, it shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-22 STRUCTURAL STEEL

All structural steel shall conform to I.S. 226-1965. The steel shall be free from the defects mentioned in I.S. 226- 1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. Rivet bars shall conform to I.S. 1148-1973.

When the steel is supplied by the Contractor test certificates of the manufacturers shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

M-23 GALVANISED IRON SHEETS

The galvanized iron sheets shall be plain or corrugated sheets of specified in item. The G.I. Sheets all conform to I.S 277-1977. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise they shall have clean and bright surface and shall be free from dents, holes, rust or white powdery deposit.

The length and width of G.I. sheet shall be as directed as per site condition.

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M-23-A G.I. VALLEYS GUTTER RIDGES

The G.I. ridges and hips shall be of plain galvanized sheets class-3 of the thickness as specified item. These shall be 600 mm. in width and properly bent up to shape without damage to the sheets in process of bending.

Valleys gutters and flashings shall also be galvanized sheet of thickness as specific in item, Valleys shall be 900 mm. wide overall and fishing shall be 380 mm. wide overall. They shall be bent (o the required shape without damage to the sheet in the process of bending.

M-24 ASBESTOS CEMENT SHEETS

Asbestos cement sheets plain, corrugated or semi corrugated shall conform to I.S. 459-1970. The thickness of fee sheets shall be as specified in the item. The shells shall be free front all defects such as cracks, holes deformities, chipped edges or otherwise damaged.

Ridged-& Hips

Ridges and hips shall be of same thickness at that of A.C. sheets. The types of ridges suitable for the type of sheets and locations.

Other accessories to be used in roof such as flashing pieces, caves filler pieces, valley gutters, north light and ventilator curves, barge boards etc. shall be standard manufacture and shall be suitable for the type of sheets and location.

M-25 MANGALORE PATTERN ROOF TILES

The Mangalore pattern tiles shall conform to I.S. 654-1972 for Class AA or Class 'A' type as specified in item. Samples of the tiles to be provided shall be got approved from the engineer in charge. Necessary tests shall be carried out as directed.

M-26 SHUTTERING

The shuttering shall be either of Wooden planking of 30 mm. minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical ballies properly cross braced together so as to make the centering rigid. In places of bullie props, brick pillar of adequate section built in mud mortar may be used.

The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men working over it and other incidental loads associated with it. The shuttering snail have smooth and even surface and its joints shall not permit leakage of cement grout.

If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

The props shall consist of bullies having 100 mm. minimum diameter measured, at mix length and 80 mm, at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm; thick and minimum bearing are if 0.10 sq. m. laid on sufficiently hard base.

Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering" without jerking the concrete.

The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planed on the sides and surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

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The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacturer may be applied in place of soap solution. In case of steel shuttering either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted.

The shuttering for beams and slabs shall have camber of 4 mm. per meter (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-Charge.

M-27 EXPANSION JOINTS- PREMOULDED FILLER:

The item provides for expansion joints in R.C.C. frame structures for internal joints, as well as exposed joints, with the use of premoulded bituminous joint filler.

Premoulded bituminous joint filler, i.e., performed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected.

Thickness of the pro-moulded joint filler shall be 25 mm. unless otherwise specified.

Premoulded bituminous joint filler shall conform to I.S. 1838-1961

M-28 EXPANSION JOINTS-COPPER STRIPS & HOLD FASTS:

The item provides for expansion joints in R.C.C. frame structure for internal joint as well as for exposed joints with the use of necessary copper strip and holdfasts.

Copper sheet shall be of 1.25 mm. thick and of 1.25 mm. width with the 'U' shape in the middle. Copper strip shall have holdfast of 3 mm. diameter copper rod fixed to the plate soldered on strip at intervals of about 30 cm. or as shown in the drawing or as directed. The width of each flange (horizontal side) of the copper plate to be embedded in the concrete work shall be 25 mm. Depth of 'U' to be provided in the expansion joint, in the copper plate shall be of 25 mm.

M-29 TEAK WOOD:

The teak wood shall be of good quality as required for the item to be executed. When the kind of wood is not specifically mentioned, good Indian teak wood as approved shall be used.

Teak wood shall generally be free from large, loose, dead or cluster knots, flaws, shakes, warps, twists, bends, or any other defects. It shall generally be uniform in substance and of straight fibres as far as possible. It shall be free from rot, decay, harmful fungi and other defects of harmful nature which will affect the strength durability of its usefulness for the purpose for which it is required. The colour shall be uniform as far as possible. Any effort like painting, using any adhesive or resins materials made to hide the defects shall render the pieces liable to rejection by the Engineer in-charge.

All scantlings; planks etc. shall be sawn in straight lines and planes in the direction of grains and of uniform thickness.

The tolerances in the dimensions shall be allowed at the rate of 1.5 mm. per face to be planed.

First class teak wood: First class teak wood shall have no individual hard and sound knots, more than 6 sq. cm. size and the aggregate area of such knots shall not be more than 1% of area of piece. The timber shall be closed grained.

Second Class Teak wood: No individual hard and sound knots shall be more than 15 sq. cms. in size and aggregate area of such knots shall not exceed 2% of the area of piece.

M-29. A. NON-TEAK WOOD:

The non-teak wood shall be chemically treated, seasoned as per IS Specifications and of good quality. The type of wood shall be got approved Before collecting the same on site. Fabrication of wooden

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members shall be started only after approval.

For this purpose, wood of Bio, Kalali, Siras, Bchda, Jamun, Sisoo will be used for door frames whereas only Kalali, Siras, Halda, Kalam etc, will be permitted for shutters after proper seasoning and chemical treatment.

The non-teak wood shall be free from large, loose, dead or cluster knots, flows shakes, warps, bends or any other defect. It shall be uniform in substance and of straight fibers as far as possible. It shall be free from rots, decay harmful fungi and other defects of nature which effect the strength, durability or its usefulness for the purpose for which it is required. The colour of wood shall be uniform as far as possible. The scantlings planks etc. shall be sawn in straight lines and planes in the direction of grain and uniform thickness.

The department will use the Agency to produce certificate from Forest Department in event of Dispute and the decision of the Department shall be final and binding to me contractor.

The tolerance in the dimension shall be allowed as 1.5 mm. per face to be planed.

M-30 WOODEN FLUSH DOOR SHUTTERS (SOLID CORE):

The solid core type flush door shutters shall be decorative or non-decorative type as specified in the drawing. The-size and thickness of the shutter shall be as specified in drawings or as directed. The limber, species for core shall be used as per I.S. 2202 - (Part-I) 1980. The timber shall be free from decay and insect attack. Knots and knot holes less than half the width of cross-section of the members in which they occur may be permitted. Pitch pockets, pitch streaks and harmless pin holes shall be permissible except in the exposed edges of the core members. The commercial plywood, cross-bands shall conform to I.S. 303-1275.

The face panel of the shutters shall be formed by gluing by the hot press process on both face of the core with either ply wood or cross-bands and face veneers. The hopping rebating opening of glazing Venetian etc. shall be provided if specified in the drawing.

All edges of the door shutters shall be square. The shutters shall be free from twist or warp in its plane. Both faces of the shutters shall be sand papered to smooth even texture.

The shutters shall be tested for

End immersion test: The test shall be carried out as per I.S. 2202 (part-I) 1980. There shall be no delamination at the end of the test.

Knife Test: The face panel when tested in accordance with I.S. 1659-1979 shall pass the test.

Glue adhesion test: The flush door shall be tested for glue adhesive test in accordance with KS.2202 (Pan 4) 1930, The shutters shall be considered to have passed the test if no delamination occurs in the glue lines in the plywood and if no single delamination more than 80 mm. in length and more than 3 mm. in depth has occurred in the assembly glue lines between the plywood face and the style and rail. Delamination at the corner shall be measured continuously around the corner. Delamination at the knots, knot holes and other permissible wood defects shall not be considered in assessing the sample.

The tolerance in size of solid core type flush door shall be as under:

In Normal thickness ± 1.2 mm.

In Normal height ± 3 mm.

The thick of the shutters shall be uniform throughout with a permissible variation of not more than 0.8 mm. when measured at any two points.

M-31 ALUMINIUM DOORS, WINDOWS, VENTILATORS

Aluminum alloy used in the manufacture of extruded window sections shall conform to I.S. designation HEA-WP of I.S.: 733-3975 and also to I.S. Designation WVG-WP of I.S. 1285-1975. The Section shall be as specified in the drawing and design. The fabrication shall be done as directed.

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The hinges shall be cast or extruded aluminum hinge of same type as in window but of large size.

The hinges shall normally be of 50 mm. projecting type. Non-projecting type of hinges may also be used if directed. The handles of door shall be of specified design. A suitable lock for the door operable either from outside or inside shall be provided. In double shutter door, the first closing shutter shall have concealed aluminum alloy bolt at top and bottom.

M-32 ROLLING SHUTTERS:

The rolling shutters shall conform to I.S. 6248-1979. Rolling shutters shall be supplied of specified type with accessories. The size of the rolling shutters shall be specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm. wide for shutters upto 3.5mm., width not less than 125 mm. thick and 80 mm; wide for shutters 3.5 mm in width and at above unless otherwise specified.

Guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) joint construction. The thickness of sheet used shall not be less than 3.15mm.

Hood covers shall be made of M.S. Sheets not less than 0.92 mm. thickness. For shutters having width 3.5 Meter and above, the thickness of M.S. Sheet for the hood cover shall be not less than 1.25 mm.

The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in all position. The spring pipe shaft etc. shall be supported on strong M.S. or malleable C.I. brackets. The brackets shall be fixed on or under the lintel as specified with raw plugs and screws bolts etc.

The rolling shutters shall be of self-rolling type up to 8 Sq. in. clear area without ball bearing and up to 12 sq. m. clear area with ball bearing. If the rolling shutters are larger, then gear operated type shutters shall be used.

The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

The shutters shall be completed with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

M-33 COLLAPSIBLE STEEL-GATE:

The collapsible steel gate shall be in one or two leaves and size as per approved drawings or as specified. The gate shall be fabricated from best quality mild steel channels, flats etc. Either steel pulleys or ball bearings shall be provided in every double channel. Unless otherwise specified the particulars of collapsible gate shall be as under:

- (a) Pickets: These shall be of 20 mm. M.S., channels of heavy sections unless otherwise shown on drawings. The distance centre to centre of pickets shall be 12 cms. with an opening of 10 cms.
- (b). Pivoted M.S. flats shall be 20 mm x 6 mm.
- (c) Top and bottom guides shall be from tee or flat iron of approved size.
- (d) The fittings like stoppers, fixing hold fasts, locking cleats, brass handles and cast-iron rollers shall be of approved design and size.

M-34 WELDED STEEL WIRE FABRIC:

Welded steel wire fabric for general purpose shall be manufactured from cold drawn steel wire "as drawn" or galvanised steel conforming to I.S. 226-1975 with longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to I.S. 4948-1974. It shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be rustproof. The type of mesh shall be oblong or square as directed. The mesh sizes and size of wire for square as well as oblong welded steel wire fabric shall be as directed the steel wire fabric in panels shall be in one whole piece in each panel as far as stock size permit.

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M-35 EXPANDED METAL SHEETS:

The expanded metal sheets shall be free from flaws, joints, broken strands, laminations and other harmful surface. Expanded metal steel sheet shall conform to I.S. 412-1975, except that blank sheet need not be with guaranteed mechanical properties. The size of the diamond mesh of expanded metal and dimensions of strands (width and thickness) shall be as specified. The tolerance in nominal weight of expanded metal sheets shall be of + 10 percent.

Expanded metal in pannels shall be in one whole piece panel each as far as stock size permit. The expanded metal sheets shall be coated with suitable protective coating to prevent corrosion.

M-36 MILD STEEL WIRE (WIRE GAUZE JALI):

Mild steel wire, may be galvanized, as indicated. All finished steel wire shall be well cleanly drawn to the dimensions and-size of wire as specified in item. The wire shall be sound, free from splits, surface flaws, rough jagged and imperfect edges and other harmful surface defects and shall conform to I.S. 280-1978.

M-37 PLYWOOD:

The plywood for general purpose shall conform I:S. 303- 1975.

Plywood is made by cementing together thin boards or sheets of wood into panels. There are always an odd number of layers 3, 5, 7, 9 ply etc. The plies are placed so that grain of each layer is right angle to the grain in the adjacent layer.

The chief advantages of plywood over a signal board of the same thickness is the more uniform strength of the plywood, along the length and width of the plywood and greater resistance to cracking and splitting with change in moisture content,

Usually synthetic resins are used for gluing, phenolic resins are usually cured in a hot press which compresses and simultaneously heats the plies between hot plates which maintain a temperature of 90 degree. C. to 140 degree C. and a pressure of 11 to 14 Kg/Sq. Cm. on the wood. The times of healing may be anything from 2 to 60 minutes depending upon thickness.

When water glue are used, the wood absorbs so much water that the finished plywood must be dried carefully. When synthetic resins are use as adhesive finished plywood must be exposed to an atmosphere of controlled humidity until the proper amount of moisture, has been absorbed.

According to I.S. 303-1975 the plywood for general purpose shall be of three grades namely BWR, WWR and CWR, depending upon the adhesives used for bonding and veneers, and it will be farther classified into six types namely AA. AB. AC, BB, BC and C,C based on the quality of the two faces, each face being of three finds namely, A, B. and C. After pressing, the finished ply wood should be reconditioned to moisture content not less than 8 percent and not more than 16 percent.

Thickness of ply wood Boards:

TABLE

Board	Thickness	Board,	Thickness	Board	Thickness	Board	Thickness
3 ply	3 mm.	5 ply	5 mm	7ply.	9 mm	9ply.	13 mm
	4 mm.		6 mm		13 mm		16mm.
	5 mm.		8 mm		16 mm		19mm.
	6 mm.		9 mm				
						11Ply.	19mm.
							22mm.
							25mm.

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All glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes blisters and other defects. The kind of glass to be used shall be mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of glass panes shall be uniform. The specifications of different kinds of glass shall be as under:

Sheet Glass: In absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 73 Kg/Sq.m. for panes upto 600 mm x 600 mm.

For panes larger than 600 mm. x 600 mm. and upto 800 mm. x 800 mm. the glass weighing not less than 8.75 Kg/Sqm. shall be used. For bigger panes upto 900 mm. x 900 mm. glass weighing not less than 11.25 Kg/Sq. m. shall be used.

Sheet glass shall be patent, flattened glass of best quality and for glazing and framing purposes shall conform to I.S.: 1761 -1960. Sheet glass of the specified colours shall be used, if so, shown on detailed drawings or so specified. For important buildings and for panes with any dimension over 900 mm. plate glass of specified thickness shall be used.

Plate Glass: When plate glass is specified, it shall be 'Polished patent plate glass' of best quality. It shall have both the surface ground flat and parallel and polished to obtain clear undisturbed vision and reflection. The plate glass shall be of the thickness mentioned in the item or as shown in the detailed drawing or as specified. In absence of any specified thickness the thickness of plate glass to be supplied shall be 6mm and a tolerance of 0.20 mm. shall be admissible.

Obscured Glass: This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figured, ribbed or fluted or frosted glass as may be specified as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed.

Wired Glass: Glass shall be with wire netting embedded in a sheet of plate glass electrically welded 13 mm. Georgian square mesh may be used. Thickness of glass shall be less than 6 mm. Wired glass shall be of type and thickness as specified.

M-39 ACRYLIC SHEETS:

Acrylic sheet shall be of thickness as specified in the item and of an specified shape and size as the case may be. Panels may be flat or curved. It should be light in weight. It shall be colorless or coloured or opaque as specified in the item. Colourless sheet shall be as transparent as the finest optical glass, its light transmission rate shall be about 95%. Transparency shall not be affected for the sheets of larger thickness. It shall be extremely resistant to sunlight, weather and low temperatures. It shall not show any significant yellowing or change in physical properties or loss of light transmission over a longer period of use. The sheet shall be impact resistant also. Sheets should be available in complete range of standard transparent, translucent and opaque colors. Sheets shall be of such quality that they can be cut bent and jointed as desired. Solution for the joints shall be used as per the requirement of manufacturer.

M-40 PARTICLE BOARD:

The particle boards used for face panels shall be of best quality free from any defects. The particle boards shall be made with phenolaldehyde adhesive. The particle boards shall conform to I.S.: 3087-1965. "Specification for wood particle board for general purpose". The size and the thickness shall be as indicated.

M-41 EXPANDED POLYSTYRENE OR FRAMED STYROFOAM SLABS:

The expanded polystyrene ceiling boards and files shall be of approved make and shall be of size, thickness, finish and colour as indicated. It shall be of high density and suitable for use as insulating material. The insulating material shall be like slab of Thermocole etc.

M-42 RESIN BONDED FIBRE GLASS:

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The resin bonded fibre glass tiles, or rolls shall be of approved make and shall be of sizes, thickness and finish as indicated.

For test of Mineral wool thermal insulation Blanket I.S.: 3144/1965 shall be followed.

Insulation wool blanket shall be with following coverings on one or both sides as indicated.

- (1) Bituminized hessian Kraft paper suitable for use in position where moisture has to be excluded.
- (2) Hessian cloth or Kraft paper for keeping out dust.
- (3) G.I. wire netting, suitable for surfaces to be plastered over.

M-43 FIXTURES AND FASTENINGS:

General:

The fixtures and fastenings, that is, butt, hinges, tee and strap hinges, sliding door bolts, tower bolts, door latch, bath room latch, handles, door stoppers, casement window fasteners, casement stays and ventilators catch shall be made of the metal as specified in the item or its specifications.

They shall be of iron, brags, aluminum, chromium plated iron, chromium plated brass, copper oxidized iron, copper oxidized brass or anodised aluminum as specified.

The fixtures shall be heavy, medium or light type. The fixtures and fastenings shall be smooth finished and shall be such as will ensure ease of operation.

The samples of fixtures and fastenings shall be got approved as regards quality and shape before providing them in position.

Brass and anodised aluminium fixtures and fastenings shall be bright finished.

Holdfasts: Holdfasts shall be made from mild steel flat 30 cm. length and one of the holdfasts shall be bent at right angle and two nos. of 6 mm. diameter holes shall be made in it for fixing it to the Frame with screws. At the other end, the holdfast shall be forked and bent at right angles in opposite directions.

Butt hinges:

Railway standard heavy type butt hinges shall be used when so specified. 43.3.2. Tee and strap hinges shall be manufactured from M.S. Sheet.

Siding door bolts (Aldrops): The aldrops as specified in the item shall be used and shall be got approved.

Tower bolts (Barrel Type): Tower bolts as specified in the item shall be used and shall be got approved.

Door latch: The size of door latch shall be taken as the length of latch.

Bathroom Latch: Bathroom latch shall be similar to tower bolt.

Handle: The size of the handles shall be determined by the inside grip length of the handles. Handles shall have a base plate of length 50 mm. more than the size of the handle.

Door Stoppers: Door stoppers shall be either floor door stopper type or door catch type. Floor stopper shall be of overall size as specified and shall have a rubber cushion.

Door Catch: Door catch shall be fixed at a height of about 900 mm. from the floor level so that one part of the catch is fitted on the inside of the shutter and the other part is fixed in the wall with necessary wooden plug arrangements for appropriate fixity. The catch shall be fixed 20 mm. inside the face of the door for easy operation of catch.

Wooden Door Stop with hinges: Wooden door stop of size 100 mm x 60 mm x 40 mm shall be fixed on the door frame with a hinge of 75 mm size and at a height of 900 mm. from the floor level.

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wooden door stop shall be provided with 3 coats of approved oil paint.

Casement window Fastener: Casement window fastener for single leaf window shutter shall be left or right handed as directed.

Casement stays (Straight Peg Stay): The stays shall be made from a channel section having three holes at appropriate position so that the window can be opened either fully or partially as directed. Size of the stay shall be 250 mm. to 300 mm. as directed.

Ventilator Catch: The pattern and shape of the catch shall be as approved.

Pivot: The base and socket plate shall be made from minimum 3 mm. thick plate and projected pivot shall not be less than 12 mm. diameter and 12 mm. length and shall be firmly riveted to the base plate in case of iron pivot and in single piece base plate in the case of brass pivot.

M-44 PAINTS:

(A) Oil paints:

Oil paints shall be of the specified colour and shade, and as approved. The ready mixed paints shall only be used. However, if ready mixed paint or specific shade or tint is not available, white ready mixed paint with approved strainer will be allowed. In such a case, the contractor shall ensure that the shade of the paint so allowed shall be uniform.

All the paints shall meet with following general requirements:

- (i) Paint shall not show excessive setting in a freshly opened full can and shall easily be redispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, leveraging, caking or colour separation and shall be free from lumps and skins.
- (ii) The paint as received shall brush easily, possess good leveraging properties and show no running or sagging tendencies.
- (iii) The paint shall not skin within 48 hours in three quarters filled closed container.
- (iv) The paint shall dry to a smooth uniform finish free from roughness, grit, unevenness and other imperfections.

Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures whatsoever.

(B) Enamel Paints:

The enamel paint shall satisfy in general requirements as mentioned in specification of oil paints. Enamel paint shall conform to I.S. 2933-1975.

M-45 FRENCH POLISH:

The French polish of required tint and shape shall be prepared with the below mentioned ingredients and other necessary materials:

- (i) Denatured spirit of approved quality (ii) Chandras (iii) Shellac (iv) Pigment.

The French polish so prepared shall conform to I.S.: 348-1968.

M-46 MARBLE CHIPS FOR MARBLE MOSAIC TERRAZZO:

The marble chips shall be of approved quality and shades. It shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks decay and weathering.

The size of various colours of marble chips ranging from the smallest upto 20 mm. shall be used where the thickness of top wearing layer is 6 mm. size. The marble chips of approved quality and colours only as per grading as decided by the Engineer-in-charge shall be used for marble mosaic tiles or works.

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The marble chips shall be machine crushed. They shall be free from foreign matter, dust etc. Except as above, the chips shall conform to I. S.: 2114-1962.

M-47. FLOORING TILES:

(A) PLAIN CEMENT TILES:

The plain cement tiles shall be general purpose type. These are the tiles in the manufacture of which no pigments are used. Cement used in the manufacture of tiles shall be as per Indian Standards.

The tiles shall be manufactured from a mixture of cement and natural aggregates by pressure process. During

manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg/Sq. Cm. The proportion of cement to aggregate in the backing of the tiles shall be not less than 1:3 by weight. The wearing face through the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm. size. The proportions of cement to the marble chips aggregate in the wearing layer of the tiles shall be three parts of cement to one-part chips by weight. The minimum thickness of wearing layer shall be 3 mm. The colour and texture of wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist conditions continuously at least for seven days and subsequently, if necessary, for such long period as would ensure their conformity to requirements of I.S.: 1237-1980 regarding strength resistance to wear and water absorption.

The wearing face of the tiles shall be plain, free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tile. All angles shall be right and all edges shall be sharp and true.

The size of tiles shall generally be square shape 24.85 Cm. x 24.85 Cm. or 25 Cm. x 25 Cm. The thickness of tiles shall be 20 mm.

Tolerance of length and breadth shall be plus or minus one millimeter. Tolerance on thickness shall be plus 5 mm.

The tiles shall satisfy the tests as regards transverse strength resistance to wear and water absorption as per I.S: 1237-1980.

(B) PLAIN COLOURED TILES:

These tiles shall have the same specification as per plain cement tiles as per (A) above except that they shall have a plain wearing surface wherein pigments are used. They shall conform to I.S. 1237-1980.

The pigment used for colouring cement shall not exceed 10 percent by weight of cement used in the mix. The pigments synthetic or otherwise, used for colouring tiles shall have permanent colour and shall not contain materials detrimental to concrete.

The colour of the tiles shall be specified in the item or as directed.

(C) MARBLE MOSAIC TILES:

These tiles have, the same specifications as per plain cement tiles except the requirements as stated below:

The marble mosaic tiles shall conform to I. S. 1237-1980. The wearing face of the tiles shall be mechanically ground and filled. The wearing face of tiles shall be free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tiles. All angles shall be right angles and all edges shall be sharp and true.

Chips used in the tiles be from smallest upto 20 mm. size. The minimum thickness of wearing layer of tiles shall of 6 mm. For pattern of chips to be used on the wearing face, a few samples with or without their full size photographs as directed shall be presented to the Engineer-in-charge for approval.

Any particular samples, if found suitable shall be approved by the Engineer-in-charge, or he may ask

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for a few more samples to be prepared indicating roughly the particular sized chips to be more-or less in the samples presented. The samples have to be made by the contractor till a suitable sample is finally approved for use in the work.

The Contractor shall ensure that the tiles supplied for the work shall be in conformity with the approved sample only, in terms of its dimensions, thickness of backing layer and wearing surface, materials, ingredients, colour shade, Chips, distribution etc. required.

The tiles shall be prepared from cement conforming to Indian Standards or coloured Portland cement generally depending upon the colour of tiles to be used or as directed.

(D) CHEQUERED TILES:

Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per

(A) above and the latter as per marble mosaic tiles as per (C) except as mentioned below:

The tiles shall be of nominal size of 250 mm. x 250 mm. or as specified. The centre-to-centre distance of chequer shall not be less than 25 mm. and not more than 50 mm. The overall thickness of the tile shall be 22 mm.

The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than 3 mm. The chequered shall be plain, coloured or mosaic as specified. The thickness of the upper layer measured from the top of the chequers shall not be less than 6 mm. The tiles shall be given the first grinding with machine before delivery to site.

Tiles shall conform to relevant I.S. 1237-1930.

(E) CHEQUERED TILES FOR STAIR CASES:

The requirements of these tiles shall be the same as chequered as per (D) above except in following respects;

- (1) The length of a tile including nose shall be 330 mm.
- (2) The minimum thickness shall be 28 mm.
- (3) The nosing shall have also the same wearing layer as at the top.
- (4) The nosing edge shall be rounded.
- (5) The front portion of the tile for a minimum length of 75 mm. from and including the nosing shall have grooves running parallel to nosing and at centre not exceeding 25 mm. Beyond that the tiles shall have normal chequer pattern.

M-48 ROUGH KOTAH STONE:

The kotah stones shall be hard, even, sound, and regular in shape and generally uniform in colour. The colour of the stone shall generally be green. Brown colour stones shall not be allowed for use. They shall be without any softveins, cracks or flows.

The size of the stones to be used for flooring shall be of size 600 mm x 600 mm and/or size 600 mm x 450 mm, as directed. However smaller sizes will be allowed to be used to the extent of maintaining required pattern. Thickness shall be as specified.

Tolerance of minus 30 mm. on account of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be + 3 mm.

The edges of stones shall be truly chiselled and table rubbed with coarse sand before paving. All angles and edges of the stone shall be true, square and free from chipping and me surface shall be true and plain.

When machine cut edges are specified, the exposed edges and the edges at joints shall be machine cut.

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The thickness of the exposed machine cut edges shall be uniform.

M-49 POLISHED KOTAH STONES.

Polished kotah stone shall have the same specifications as per rough kotah stone except as mentioned below:

The stones shall have machine polished smooth surface. When brought on site, the stones shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, platforms, sink, veneering, sills, steps, etc. where machine polishing after the stones are fixed in situ is not possible, shall be double polished.

M-50 DHOLPUR STONE SLAB:

Dholpur stone slab shall be of best quality as approved by the Engineer-in-charge. The stone slab shall be even, sound and durable, regular in shape and of uniform colour.

The size of the stone shall be specified in the item or detailed drawings or as approved by the Engineer-in-charge. The thickness of the stone shall be as specified in the item of work with the permissible tolerance of plus or minus 2 mm. The provisions in respect of polishing as for polished Kotah stone shall apply to polished Dholpur stone also. All angles and edges of the face of the stone slab shall be fine chiselled or polished as specified in the item of work and all the four edges shall be machine cut.

All angle and edges of the stone slab shall be true and plane.

The sample of stone shall be got approved from the Engineer-in-charge for shade and tint for a particular work. It shall be ensured that the stones to be used in a particular work shall not differ much in shade or tint from the approved sample. M-51. Marble Slab:

Marble slab shall be white or of other colour and of best quality as approved by the Engineer-in-charge.

Slabs shall be hard, uniform and homogeneous in texture. They shall have even crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and edges machine cut true and square. The rear face shall be rough to provide key for the mortar.

Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer-in-charge. Size of the slab shall be minimum 450 mm x 450 mm. and preferable- 600 mm x 600 mm. However, smaller sizes will be allowed to be used to the extent of maintaining required pattern.

The slab shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished slab to be used shall be deposited by the Contractor in the office for reference.

Except as above, the marble slabs shall, conform to I.S. 1130-1969.

M-52 GRANITE STONE SLAB:

Granite shall be of approved colour and quality. The stone shall be hard, even, sound regular in shape and generally uniform in colour. It shall be without any soft veins, cracks or flaws.

The thickness of the stone shall be as specified in the items.

All exposed face shall be double polished to tender truly smooth and the even reflecting surface. The exposed edges and corners shall be rounded off as directed. The exposed edges shall be machine cut and shall have uniform thickness.

M-53 P.V.C FLOORING:

P. V.C sheets for P.V.C. floor covering shall be of homogeneous flexible type, conforming to I.S. 3452-1966. The

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P.V.C. covering shall neither develop any toxic effect while put to use nor shall give off any disagreeable odour.

Thickness of flexible type covering tiles shall be as specified in the description of the item.

The flexible type shall be backed with hessian or other woven fabric. The following tolerances shall be applicable on the nominal dimension of the sheet rolls or tiles:

- (a) Thickness 0.15 mm
- (b) Length or Width:
 - 1. 300 mm. square tiles ± 0.20 mm.
 - 2. 600mm. square tiles ± 0.30 mm
 - 3. 900mm square tiles ± 0.40 mm.
 - 4. Sheets and rolls + 0.10 percent

Adhesive:

The adhesive for PVC flooring shall be of the type and make recommended by the manufacturers of PVC sheets/tiles.

M-54 FACING TILES:

The facing tiles (burnt clay facing bricks) shall be free from cracks, flaws and nodules of free lime. They shall be thoroughly burnt and shall have plane rectangular faces with parallel sides and sharp straight right edged faces. The texture of the finished surface that will be exposed when in place, shall conform to an approved sample consisting not less than four stretcher bricks each representing the texture desired. The facing tiles shall have a pleasing appearance, sufficient resistance to penetration by rain and greater durability than common bricks. The tiles shall conform to I.S. 2691-1972.

The standard size effacing brick tiles shall be 19 x 9 x 4 cms. The facing brick tiles shall be provided with frog which shall conform to I.S. 1077-1976.

The permissible tolerance in dimensions specified above shall be as follows:

Size Tolerance for

1st class Brick	2nd class Brick
19 Cm. ± 6 mm.	± 10 mm.
9cm. ± 3 mm.	± 7 mm.
4cm. ± 1.5 mm	± 3 mm.

The tolerance for distortion or warpage of face or edges of individual brick from a plane surface and from a straight line respectively shall be as follows:

Facing dimensions Permissible tolerance Max. below 19 cms. Max. 2.5mm.

-do- above 19 cm. Max. 3.0 mm.

The average compressive strength obtained as a sample of five dies when tested in accordance with the procedure laid as per I.S. 1077-1976 shall be not less than 175 Kg/Sq. Cm. The average compressive strength of any individual bricks shall be not less than 160 Kg/Sq.Cm.

The average water absorption for five bricks files shall not exceed 12 percent of average weight of brick before testing.

The absorption for each individual bricks snail not exceed 25 percent.

The brick tiles when tested in accordance with I.S. 1077-1976, the rate of efflorescence shall not be more than 'Slightly effloresced.'

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M-55 WHITE GLAZED TILES:

The tiles shall be of best quality as approved by the Engineer-in-charge. They shall be flat and true to shape. They shall be free from cracks, crazing, spots, chipped edges and corners. The glazing shall be of uniform shade.

The tiles shall be nominal size of 150 mm. x 150 mm. unless otherwise specified. The maximum variation from the stated sizes, other than the thickness of tile, shall be plus or minus 1.5 mm. The thickness of tile shall be 6 mm. Except as above the tiles shall conform to I.S. 777 1970.

M-56 GALVANISED IRON PIPES AND FITTINGS:

Galvanised iron pipe shall be of the medium type and of required diameter and shall comply with I.S.I 239-1979. The specified diameter of the pipes shall refer to the inside diameter of the bore. Clamps, screw and all galvanised iron fittings shall be of the standard 'R' or equivalent make.

M-57 BIB COCK AND STOP COCK:

A bib cock is a draw off tap with a horizontal inlet and free outlet. A stop cock is a valve with a suitable means of connection for insertion in a pipe line for controlling or stopping the flow.

They shall be of screw down type and of brass chromium plated and of diameter as specified in the description of the item. They shall conform to I.S. 781-1977 and they shall be of best Indian make. They shall be polished bright.

The minimum finished weight of bib cock and stop cock shall be as given below:

Diameter	Bib cock	Stop cock
8 mm	0.25 Kg.	0.25 Kg.
10 mm.	0.30 Kg.	0.35 Kg.
15 mm.	0.40 Kg.	0.40 Kg.
20 mm.	0.75 Kg.	0.75 Kg.

M-58 GUN METAL WHEEL VALVE:

The gun metal wheel valve be of approved quality. These shall be gun metal fitted with wheel and shall be of gate valve opening full way and of the size as specified. These shall conform to I.S. 778-1971.

M-59 WHITE GLAZED PORCELAIN WASH BASIN:

Wash basin shall be of white porcelain first quality best Indian make and it shall conform to I.S. 2556 (Part-IV) 1972 and I.S. 771-1979.

The size of the wash basin shall be as specified in the item, Wash basin shall be of one-piece construction with continued over-flow arrangements. All internal angles shall be designed so as to facilitate cleaning. Wash basin shall have single tap hole or two holes as specified. Each basin shall have a circular waste hole which is either rabbled or beveled internally with 65 mm. diameter at top and 10 mm. depth to suit the waste fitting. The necessary stud slot to receive the bracket on the underside of (The basin shall be provided. Basin shall have an internal soap holder recess which shall fully drain into the bowl.

White glazed pedestal of the quality and colour as that of the basin shall be provided where specified in the item. It shall be completely recessed at the back for reception of supply and wash pipe. It shall be capable of supporting the basin rigidly and adequately and shall be so designed as to make the height from floor to top of the rim of basin 750 mm. to 800 mm. as directed.

M-60 EUROPEAN TYPE WATER CLOSET/WITH LOW LEVEL FLUSHING:

The European type water closet shall be white glazed porcelain first quality and shall be of wash down

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type conforming to I.S. 2556-1973 and I.S. 771-1979.

‘S’ trap shall be provided as required with water seal not less than 50 mm. The solid plastic seat and cover shall be of the best Indian make conforming to I.S. 2548-1980. They shall be made of molded syntactic materials which shall be tough and hard with high resistance to solvents and shall be free from blisters and other surface defects and shall have chromium plated brass hinges and rubber buffer of suitable size.

M-61 ORISSA TYPE WATER CLOSET:

The specification of Orissa type white glazed water closet of first quality shall conform to I.S. 2556 (Pan-III) 1981 and relevant specification of Indian type water closet except that pan will be with the integral squatting pan of size 580 mm. x 440 mm. with raised footrest.

M-62 INDIAN TYPE WATER CLOSET:

The Indian type white glazed water closet of first quality shall be of size as specified in (the item and conforming to I.S.

771-1979 and I.S. 2556 (Part-II) 1981. Each pan shall have integral flushing ring of suitable type with adequate number of holes around as directed to have satisfactory flushing. It shall also have an inlet at back or front for connecting flush pipe as directed. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and surface shall be uniform and smooth.

Pan shall be provided with 100 mm. diameter ‘P’ or ‘S’ trap with approximately 50 mm. water seal and 50 mm. diameter vent horn.

M-62. A FOOT RESTS:

A pair of white glazed-earthen ware rectangular foot rests of minimum size 250 mm. x 130 mm. 20 mm. shall be provided with water closet.

M-63 GLAZED EARTHEN WARE SINK:

The glazed earthen-ware sink shall be specified size, colour and quality. The sink shall conform to I.S. 771 Part-II-1979. The brackets for sinks shall conform to I.S. 775-1970.

The pipes shall conform to I.S. 1239-Part-II-1973 and I.S. 404-1962 for steel and lead pipes respectively 32 mm. brass waste coupling of standard pattern with brass chain and rubber plug shall be provided with sink.

M-64 GLAZED EARTHEN WARE LIPPED TYPE FLAT BACK URINAL/CORNER TYPE URINAL:

The lipped type urinal shall be flat back or corner type as specified in the item and shall conform to I.S. 771-1979. It shall be of best Indian make and size as specified and approved by the Engineer-in-charge. The flat back or corner type urinal must be of 1st quality free from any defects, cracks, etc.

M-65 LOW LEVEL ENAMEL FLUSHING TANK:

The low-level enamel flushing tank shall be of 15 liters capacity. It shall conform to I.S. 774-197 It the flushing cistern shall be of best quality and free from any defects. The flushing tank shall have outlet 32 mm. diameter. The outlet shall be connected with W.C. Pan by lead pipe or P.V.C. pipe as specified. The flushing tank shall be provided with inlet and outlet for fixing G.I. inlet pipes and overflow pipes. The flushing cistern shall be provided with chromium plated handle for flushing. The flushing tank shall be provided with bracket of cast iron so that it can be fixed on wall at specified height. The brackets shall conform to I.S. 775-1970.

M-66 CAST IRON FLUSHING CISTERN:

The cast iron flushing cistern shall be of 15 litres capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality free from any defects. The flushing cistern shall have outlet of

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32 mm. diameter. The outlet shall be connected to lead pipe of 32 mm. diameter. The lead pipe shall conform to I.S. 404 (Part-I) 1962. For fixing G.I. inlet pipes and overflow pipe 20 mm. dia. inlet and outlet shall be provided. The flushing cistern shall be provided with galvanised iron chain and pull of sufficient length and shall be got approved from the Engineer-in-charge. The cast iron flushing cistern shall be painted with one coat of anticorrosive paint and two coats of paints. The flushing cistern shall be fixed on two C.I. brackets. The C.I. brackets shall conform to I.S. 775-1970.

M-67 FLUSH COCK:

Half turn flush cock (Heavy weight) shall be of gun metal chromium plated of diameter as specified in the description of the item. The flush cock shall conform to relevant Indian Standard.

M-68 CAST IRON PIPES AND FITTINGS:

All soil, water, vent and antisiphonage pipes and fittings shall conform to I.S. 1729-1964. The pipe shall have spigot and socket ends with head on spigot end. The pipes and fittings shall be true to shape, smooth, cylindrical, their inner and outlet surfaces being as nearly as practicable concentric. They shall be sound and nicely cast and shall be free from cracks, laps, pinholes or other imperfection and shall be neatly dressed and carefully fettled.

The end of pipes and fittings shall be reasonable square to their axis.

The sand cast iron pipes shall be of the diameter as specified in the description and shall be in lengths of 1.5 M. 1.8 M. and 2 M. including socket ends of the pipe unless shorter lengths are either specified or required at junctions etc. The pipes and fittings shall be supplied without ears unless specified or directed otherwise.

Tolerances:

The Standard weights and thickness of pipes shall be as shown in the following table:

A tolerance upto minus 10 per cent may however be allowed against these standard weights.

Sr. No.	Nominal dia. of bore	Thickness	Overall Weight of pipe excluding ears		
			1.5 m. long	1.8 m. long	2 m. long
1.	75 mm	5.0 mm	12.83 kg	16.52 kg	18.37 kg
2.	100 mm	5.0 mm	18.14 kg	21.67 kg	24.15 kg

A tolerance upto minus 15 percent in thickness and 20 mm. in length will be allowed. For fittings tolerance in lengths shall be plus 15 mm. and minus 10 mm.

The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimensions specified for the corresponding sizes of straight pipes. The tolerances in weights and thickness shall be the same as for straight pipes.

M-69 NAHNI TRAP:

Nahni trap shall be of cast iron and shall be sound and free from porosity or other defects which affect serviceability. The thickness of the base metal shall not be less than 6.5 mm. The surface shall be smooth and free from craze, ships and other flaws or any other kind of defects which affect serviceability. The size of nahni trap shall be as specified and shall be of self cleansing design.

The nahni trap shall be of quality approved by the Engineer-in-charge and shall generally conform to the relevant Indian Standards.

The Nahni trap provided shall be with deep seal, minimum 50 mm, except at places where trap with deep seal cannot be accommodated. The cover shall be cast iron. Perforated cover shall be provided on the trap of appropriate size.

M-70 GULLY TRAP:

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Gully trap shall conform to I.S. 651-1980. It shall be sound, free from defects such as fire cracks. The glaze of the traps shall be free from crazing. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters.

The size of the gully trap shall be as specified in the item.

Each gully trap shall have one C.I. grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 mm; x 300 mm., the cover with frame inside dimension, 300 mm. x 300 mm., the cover weighing not less than 4.53 Kg. and the frame not less than 2.72 Kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

M-71 GLAZE STONE WARE PIPE AND FITTING:

The pipes and fittings shall be of best quality as approved by the Engineer-in-charge. The pipe shall be of best quality manufactured from stone-ware of fire clay, salt glazed thoroughly burnt through the whole thickness, of a close even texture, free from air blows, fire blisters, crack and other imperfections, which effect the serviceability. The inner and outer surfaces shall be smooth and perfectly glazed. The pipe shall be capable to-withstand pressure of 1.5 m. head without showing sign of leakage. The thickness of the wall shall not be less than 1/12th of the internal dia. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a joint of 1 mm. around the pipe.

The pipes shall generally conform to relevant I.S. 651 -1980.

M-72 WALL PEG RAIL:

The aluminum wall peg rail shall have three aluminum pegs of approved quality and size. It shall be fixed on teakwood plank of size 450 mm. x 75 mm. x 20 mm. The teakwood shall be french polished or oil painted as specified.

M-73 G.I. WATER SPOT:

The G.I. pipes of 40 mm. dia shall be of medium quality and specials shall be of 'R' brand or equivalent brand of best approved quality.

The pipe shall have length as required for the thickness of wall in which it is fixed, and at the outside end tee and bend cut at half the length shall be provided and at other end coupling shall be provided to have better fixing. The water spout shall be provided as per detailed drawing or as directed.

M-74 ASBESTOS CEMENT PIPE (A.C. PIPE):

The asbestos cement pipe of diameter as specified in the description of the item shall conform to I.S. 1626-1980. Specials like bends, shoes, cowls, etc. shall conform to relevant Indian Standards. The interior of pipe shall have a smooth finish, regular surface and regular, internal diameter. The tolerance in all dimensions shall be as per I.S. 1626-Part-1 1980.

M-75 CRYDON BALL VALVE:

Ball valve of screwed type including polythene float and necessary lever etc. shall be of the size as mentioned in the description of item and shall conform to I.S. 1703-1977.

M-76 BITUMEN FELT FOR WATER PROOFING AND DAMP PROOFING:

Bitumen felt shall be on the fibre bases and shall be type 2, self-finished grade-2 and shall conform to I.S. 1322-1970.

M-77 SELECT EARTH:

The selected earth shall be that obtained from excavated material or shall have to be brought from outside as indicated in the item. If item does not indicate anything, the selected earth shall have to be brought from outside.

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The selected earth shall be good yellow soil and shall be got approved from the Engineer-in-charge. In no case black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones or brick bats. The clods shall be broken to a size of 50 mm or less, Contractor shall make his own arrangement at his own cost for land for borrowing selected earth. The stacking of material shall be done as directed by the Engineer-in-charge in such a way as not to interfere with any constructional activities and in proper stacks.

When excavated material is to be used, only selected stuff got approved from the Engineer-in-charge shall be used. It shall be stacked separately and shall comply with all the requirements of selected earth mentioned above:

M-78 BARBED WIRE:

The barbed wire shall be of galvanised steel and it shall generally conform to I.S. 278-1978. The barbed wire shall be of type-I whose nominal diameter for line wire shall be 2.5 mm. and point wire 2.24 mm. The nominal distance between two bars shall be 75 mm. unless otherwise specified in the item. The barbed wire shall be formed by twisting together two-line wires, one containing the barbs. The size of the line and point wires and barb spacings shall be as specified above. The permissible deviation from the nominal diameter of the line wire and point wire shall not exceed ± 0.08 mm.

The barbs shall carry four points shall be formed by twisting two-point wires, each two turns, lightly round one line wire, making altogether four complete turns. The barbs shall be so finished that the four points are set and loked at right angles to each other. The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The point, shall be sharp and cut at an angle not greater than 35 degrees of the axis of the wire forming the barbs.

The line and point wire shall be circular section free from scale and other defects and shall be uniformly galvanised. The line wire shall be in continuous length and shall not contain any weld other than those in the rod before it is drawn. The distance between two successive splices shall not be less than 15 meters.

The lengths per 100 Kg. of barbed wire I.S. type I shall be as under Nominal 1000 metre Minimum 834 Metre Maximum 1066 Metre.

M-79 URINAL

Urinal shall be approved quality white porcelain of approved quality; best Indian make and it shall conform to IS 1556-Part-II 1974 with suitable size of side collar for fixing in position. The size of urinal shall be as specified in the item. Urinal shall be of one-piece construction. All internal angles shall be designed so as to facilitate cleaning. Urinal shall have single tap hole as specified. Urinal shall have a circular waste hole which is 65mm dia and 100 mm deep to suit the waste fitting.

Necessary C.P. brass stop cock with PVC connection of specified size shall conform to I.S. 781-1977. Necessary PVC reducer with PVC waste pipe of 25mm dia shall be designed to make height from the floor to the top of the rim of the urinal 550 to 600 mm as directed

M-80 Water Proofing Cement Paint:

Water proofing cement paint of approved shade shall conform to IS-5410-1969 or as revised from time to time. Primer shall be best quality, make and as approved by the Engineer-in-charge. The materials required for work of painting shall be obtained directly from approved manufacturer or approved dealer and brought to the site in maker's drums, keys etc. with seal unbroken.

M-81 STONE FOR BELA MASONARY:

Pucca approved white stone bella of sand of uniform size shall be dressed, earth / murrumy or

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discoloured or weathered or water worn stone shall not be used. The size of bella stone shall as directed by Engineer to suit the width of wall. Corner stones & quoins shall be of good quality and should be dressed to correct angle. The corner stone shall be got approved before bringing to site.

The stone shall be free from defects like cavity, flaws, sand holes, and veins, patches of soft or loose material. The percentage of water absorption shall generally not exceed 5 % by weight. Generally, the stone shall not contain silica or chert, mica or any other deleterious material like iron oxide organics impurities etc. The crushing strength of bella stone shall not less than 300 Kg/cm². Transverse strength shall not less than 70 Kg/cm².

M-82 Vitrified floor tiles :

Vitrified floor tiles shall be of best quality & approved make as approved by the Engineer. They shall conform to the relevant I.S. codes.

Vitrified tiles using for floor finishing should confirm ISO13006/E176 group B.1.a of international standards and also should confirm of testing methods of norms EN 98.

The vitrified tiles shall be Monolithic and available in smooth, mirror polished and anti-skid finish. Their water absorption rate shall be less than 0.5%. They shall offer hard working and hardwearing floors for public buildings. The tiles shall be of ASTM or DIN standards.

The vitrified tiles shall be extremely strong breaking strength of the tiles being 1600 kg./cm², flexural strength 200 kg. / Cm² and bounding strength of 2500 kg/cm². There shall after good resistance to abrasion i.e. greater than 100. There shall be scratch resistance; their hardness on the Moh's scale shall be min. 7. They shall also to resist thermal shock up to 10 cycles. They shall have a density of 2.2 gm/cc. They shall have 0.6 co-efficient of friction for polished / unpolished surfaces.

M-82 85 mm thick pre-cast Rubber moulded interlock paver concrete block :

The 85 mm thick pre-cast Rubber molded interlock paver concrete block shall be manufactured by electrical hydraulic operated block marking machine. The block should have minimum compression strength of 300 kg. Per sq.cm. The minimum thickness of the pre-cast Rubber molded interlock paver concrete block shall be 85mm and minimum size shall be 300x300mm. The block shall be of approved make & best quality as approved by the Engineer-in-charge. The size, shape, and shade of pre-cast Rubber moulded interlock paver concrete block shall be as approved by the Engineer-in-charge. There shall be true to shape. There shall be free from crack, crazing, and spots etc.

M-83 Acrylic roof Sheets:

Acrylic roof sheets shall be of thickness as specified in the item. The shape and size of sheet shall be as directed. Acrylic roof Sheets may be flat or curved. It should be light in weight. It shall be colourless or coloured or opaque. Colourless sheet shall be as transparent as the finest optical glass. Its light transmission rate shall be about 95%. Transparency shall not be affected for the sheets of larger thickness. It shall be extremely resistant to sunlight, weather and low temperatures. It shall not show any significant yellowing or change in physical properties or loss of light transmission over a longer period of use. The sheet shall be impact resistant also. Sheet should be available in complete range of standard transparent, man lucent and opaque colors. Sheets shall be of such quality that they can be cut bent and jointed as desired. Solution for the joints shall be used as per the requirement of manufacturer.

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GENERAL SPECIFICATION FOR QUALITY CONTROL ON WORKS & MATERIALS:

(1) GENERAL

1.1) The contractor shall be responsible for the quality of the work in the entire construction work within the contract. He shall, therefore, have his own independent and adequate set up for ensuring the same.

1.2) The contractor shall provide necessary co-operation and assistance in obtaining the samples for test and carrying out the field tests as required by the Engineer-in-charge from time to time. This may include provision of labour, attendance, assistance in packing and dispatch and any other assistance considered necessary in connection with the test.

1.3) All materials to be used, all method adopted and all works performed shall be strictly in accordance with the requirements of this specification. The contractor shall set up field laboratory at the location approved by the Engineer & equip the same with adequate equipment and personnel in order to carry out all required test & quality of control work as per specification or as directed by the Engineer-in-charge. The list of equipment & the facilities to be provided shall be got approved from the Engineer-in-charge in advance.

1.4) The contractor's laboratory should be manned by a qualified materials Engineers, Civil Engineers, assisted by experienced technicians & the set up should be got approved by the Engineer.

1.5) The contractor shall carry out quality control tests on the materials & work to the frequency stipulated in subsequent paragraphs. In the absence of clear indications about method and or frequency of tests for any item, the instructions of the Engineer shall be followed.

1.6) For satisfying himself about the quality of the materials & work, quality control test will also be conducted by the Engineer, and Corporation's quality control units or consultant as approved by the Corporation, generally to the frequency set forth herein under. Additional tests may be also conducted where, in the opinion of the Engineer, need for such test exists.

1.7) For the work of embankment, sub-grade, and pavement, construction of subsequent layer of same or other materials the finished layer shall be done after obtaining permission the Engineer. Similar permission from the Engineer shall be obtained in the respect of all other items of work prior to proceeding with the next stage of construction.

1.8) The contractor shall carry out modifications in the procedure of work if found necessary, as directed by the Engineer during inspection. Works failing short of quality shall be rectified / redone by the contractor at his own cost and defective work shall also be removed from the site of work by the contractor at his own cost.

1.9) For testing of samples of soil/soil mixes, granular materials, and mixes, bituminous materials & mixes, aggregates, course etc. samples in the required quality & form shall be supplied to the Engineer by the contractor at his own cost.

1.10) For cement, quarry spauls, aggregate, bitumen, mild steel similar other materials where essential tests are to be carried out at the manufacture's plant or at laboratory other than the site laboratory, the cost of samples, sampling, testing, and furnishing of test certificate . He shall also furnish the test certificate to the Engineer.

1.11) The contractor should not that materials other than site laboratory shall be tested in Govt. recognized laboratory at his own cost.

1.12) For testing of cement concrete at site during construction, arrangement for supply of samples, sampling. testing & supply of test results shall be made by the contractor as per the frequency and number of test specified in the Hand book of Quality control for construction of roads and runways

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(IRC Special publication No.11), and the Ministry of Shipping & Transport Specifications and where the same are silent, as per the relevant IRC Standards, specifications, guidelines, Special publications and IS Standards. In the absence of relevant Indian standards, the sampling and testing procedure to be used shall be approved by the Engineer. Where the Engineer considers that in the interest of the Control of Quality on materials or workmanship, modifications, if any, are necessary, such modifications shall be carried out by the Contractor at no extra cost. The sampling and testing procedure to be used shall be approved by the Engineer and his decision shall be final and binding on the contractor.

1.13) The materials shall be tested in approved Laboratory other than site laboratory.

1.14) Norms for testing the Building Materials given in this volume shall also be followed.

1.15) The materials for embankment construction shall be got approved from the Engineer. The responsibility for arising & obtaining the land for borrowing or explore in any other way shall rest with the contractor who shall ensure smooth & uninterrupted supply of materials in the required quality during the construction period.

1.16) Similarly, supply of aggregates for construction of road pavement shall be from quarries approved by the Engineer. Responsibility for arising uninterrupted supply of material from the source shall be that of the contractor.

(2) DEFECTIVE MATERIALS:

All materials, which the Engineer/ Q.C. unit of Corporation/ Third Party Inspector appointed by the Corporation has determined as not conforming to the requirements of the contract shall be rejected whether in place or not, they shall be removed immediately from the site as directed. Materials, which have been subsequently collected, shall not be used in the work unless approval is accorded in writing by the Engineer. Upon failure of the contractor to comply with any order of the Engineer/ Q.C. unit of the Corporation / Third Party Inspector appointed by the Corporation, given under this clause. Engineer/ Q.C. unit of the Corporation / Third Party Inspector appointed shall have authority to cause the removal of rejected material and to deduct the removal & allied cost thereof from any payments due to the Contractor.

(3) CONTROL OF ALIGNMENT, LEVELS & SURFACE REGULARITY.

3.1) GENERAL:

All works performed shall conform to the lines, grades, cross sections and dimensions shown on the drawings or as directed by the Engineer-in-charge subject to the permitted tolerances described hereinafter.

3.2) HORIZONTAL ALIGNMENT:

Horizontal alignment shall be reckoned with respect to the centre line of the carriageway as shown on the drawings. The edges of the carriageway as constructed shall be corrected within a tolerance of +/- 10mm there from. The corresponding tolerance for edges of the roadway and lower layers of pavement shall be +/- 25mm.

3.3) LONGITUDINAL PROFILE:

The levels of the sub grade and difference pavement courses as constructed shall not vary from those calculated with reference to the longitudinal and cross profile of the road shown on the drawings or as directed by the Engineer-in charge, beyond the tolerance mentioned below:

1	Sub grade	+	20mm
		-	25mm
2	Sub-base	+	10mm
	(a) Flexible pavement	-	20mm
	(b) Concrete pavement	+	6mm

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3	Sub-base for flexible payment	
	(a) Bituminous course	+/- 6mm
	(b) Other than bituminous	
	(i) Machine laid	+/- 10mm
	(ii) Manually laid	+/- 15mm
4	Wearing course of flexible pavement.	
	Machine laid	+/- 6mm
	Manually laid	+/- 10mm
5	Cement concrete pavement	+/- 5mm - 6mm

Provided, however, that the negative tolerance for wearing course shall not be permitted in conjunction with the positive tolerance for base course if the thickness of the former is thereby reduced by more than 6mm for flexible pavement and 5mm for concrete pavement.

For checking compliance with the above requirement for sub-grade, sub-base & base courses, measurement of the surface levels shall be taken on a grid of points placed at 6.25m longitudinally and 3.5 mtr, transversely. For any 10 consecutive measurements taken longitudinally and transversely, not more than one measurement shall be permitted to exceed the tolerance as above, this one measurement being not in excess of 5mm above the permitted tolerance.

For checking the compliance with the above requirement for bituminous wearing courses and concrete pavements, measurement of the surface levels shall be taken on a grid of points placed at 6.25m along the length and at 0.5mtr. from the edges & at the center of the pavement. In any length of the pavement, compliance shall be deemed to be met for the final road surface, only if the tolerance given above is satisfied for any point on the surface.

3.4) SURFACE REGULARITY OF SUB GRADE & PAVEMENT COURSES:

The surface regularity of completed sub-base, base courses and wearing surfaces in the longitudinal and transverse directions shall be within the tolerance indicated in Table-1.

The longitudinal profile shall be checked within a 3 meter long straight edge/ moving straight edge as desired by the Engineer, at the middle of each traffic lane along a line parallel to the center line of the road. The maximum permitted number of surface irregularities shall be as per Table -1 below.

TABLE-1 : MAXIMUM PERMITTED NUMBER OF SURFACE IRREGULARITIES

	Surfaces of carriageways & paved shoulder				Surfaces of laybys Service area and all bituminous base courses			
Irregularity	4mm		7mm		4mm		7mm	
Length (M)	300	7	30	7	300	7	300	7
Double lane/single lane	20	9	2	1	40	1	4	2

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The maximum allowable difference between the road surface & underside of a 3 mtr, straight edge when placed parallel with or at right angles to the center line of the road at points decided by the Engineer shall be :

For pavement surface (bituminous & cement concrete) 3 mm

For bituminous base courses 6 mm

For Granular sub-base/base courses 8 mm

For sub-bases under concrete pavements 10 mm

3.5) RECTIFICATION:

Where the surface irregularity of sub grade and the various pavement courses fall outside the specified tolerance, the contractor shall be liable to rectify these in the manner described below and to the satisfaction of the Engineer-in-charge.

(i) Sub grade:

Where the surface is high, it shall be trimmed and suitably compacted. Where the same is low, the deficiency shall be corrected by adding fresh material. The degree of compaction and the type of material to be used shall conform to the relevant specifications.

(ii) Granular/ Sub base:

Same as at (i) above except that the degree of compaction and the type of material to be used shall conform to the relevant specifications.

(iii) Water Bound Macadam Base/Wet Mix Macadam Base :

Where the surfaced is high or low, the top 200 mm shall be scarified, re-shaped with added material as necessary and re-compacted to M.O.S.T. clause-404/406. The area treated as a place shall not be less than 5 meter long and 2 meters wide.

(iv) Bituminous Constructions:

For bituminous construction, other than wearing course, where the surface is low, the deficiency shall be corrected by adding fresh material and re-compacting to specifications. Where the surface is high, the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications.

For wearing course, where the surface is high or low, the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications. In all cases where the removal and replacement of a bituminous layer is involved, the area treated shall not be less than 5 meter in length & not less than 3.5 mtr, in width.

4.0) QUALITY CONTROL TESTS DURING CONSTRUCTION:

4.1) GENERAL:

The materials supplied and the works carried out by the contractor shall conform to the specifications prescribed in the preceding clauses.

For ensuring the requisite quality of construction, the materials and works shall be subjected to quality control tests, as described hereinafter by the Engineer-in-charge shall have the full authority to carry out tests as frequently as he may deem necessary to satisfy himself that the materials and works comply with the appropriate specification. Test procedure for the various quality control tests are indicated in the respective sections of the specifications or for certain tests within this section. Where

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no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted engineering practice to the directions of the Engineer-in-charge.

4.2) TESTS ON EARTH WORK FOR EMBANKMENT CONSTRUCTION:

4.2.1: Borrow materials:

- a) Sand content (I.S.:2720 -Part-4) : Two tests per 3000 cu. mts. of soil.
- b) Plasticity test (I.S.:2720-PART-5):Each type to be tested,2 tests/ 3000 M3 of soil.
- c) Density Test (I.S.:2720 -PART-8):Each type to be tested,2 tests/ 3000 M3 of soil.
- d) Each soil type to be tested, 2 tests per 3000 cu. mts. of soil.
- e) Deleterious content Test (I.S.:2720 -Part-27) as & when required by Engineer
- f) Moisture content Test (I.S.:2720 -Part-2)One test for every 250 M2 of soil.
- g) C.B.R. test on materials to be incorporated in the sub grade on soaked/ unsoaked samples (IS:2720-Part-16) one CBR test for every 3000 cu. mtr. at least or closer as and when required by the Engineer-in-charge.

4.2.2.: COMPACTION CONTROL:

Control shall be exercised by taking at least one measurement of density for each 5000 square meters of compacted area or closer as required to yield the minimum number of test results for evaluating day's work on statistical basis. The determination of density shall be in accordance with I.S. :2720 - Part-28). Test locations shall be chosen only through random sampling techniques. Control shall not be based on the result of anyone test but on the mean value of a set of 5-10 density determinations. The number of test in one set of measurements shall be 6 (if nondestructive test are carried out, the number of test shall be doubled) as long as it is felt that sufficient control over borrow material and the method of compaction is being exercised. If considerable variations are observed between individual density results, the minimum number of tests in one set of measurement shall be increased to 10. The acceptance criteria shall be subject to the condition that the mean density is not less than specified density plus:

$$\frac{1.65}{(\text{No. of samples})^{0.5}} - \frac{1.65}{(\text{No. of samples})^{0.5}} : \text{times the standard deviation.}$$

However, for earthwork in shoulders (earthen) and in the sub grade, at least, one density measurement shall be taken for every 500 square meters of the compacted area provided further that the number of tests in each set of measurements should be at least 10. In other respects, the control shall be similar to that described earlier.

4.3) TESTS ON SUB BASE AND BASES & BITUMINIOUS WORKS:

The tests and their frequencies for the different types of bases and sub-bases shall be as given in TABLE-2. The evaluation of density results for compaction control shall be on lines similar to those set on in Clause-4.2.2.

TABLE-2:CONTROL TEST & THEIR MINIMUM FREQUENCY FOR SUB-BASE / BASE / BITUMEN WORK.(As per MoRTH 5th revision , Table no-900-3 ,4& 6)

(Sr No. 10-15 given below are for frequency of quality control tests for pavement concrete)

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MATERIAL TESTING SCHEDULE**CONTROL TEST & THEIR MINIMUM FREQUENCY**

SR.NO.	TYPE OF CONSTRUCTION & MATERIALS.	TEST		FREQUENCY
1	E/w for embankment with excavated stuff /selected soil having MDD not less than 19.5 KN / m ³	1)	M.D.D. Test	As Required.
		2)	Moisture content prior to compaction.	One Test per 200 m ³
		3)	Density of compacted layer.	One test per 500 m ³
		4)	Deleterious constituents.	As required.
2	Granular sub-base (Quarry spall)	1)	Gradation	One test per 400 m ³
		2)	Atterberg limits	-do-
		3)	Moisture content prior to compaction.	One test per 450 m ³
		4)	Density of compacted layer.	One test per 1000 Sq.M
		5)	Deleterious constituents.	As required
		6)	C.B.R. value	As required.
3	W.B.M.	1)	Aggregates Impact value	One test per 1000 m ³ of aggregates.
		2)	Grading	One test per 250 m ³
		3)	Flakiness index & elongation index (Total)	One test per 500 m ³ of Aggregate
		4)	Atterberg limits of binding material.	One test per 50 m ³ of Binding Material
		5)	Atterberg limits of portion of aggregate passing 425 micron sieve.	One test per 100 m ³ of aggregates.
4	Wet Mix Macadam	1)	Aggregates Impact value	One test per 1000 m ³ of aggregates.
		2)	Grading	One test per 200 m ³
		3)	Flakiness index & elongation index (Total)	One test per 500 m ³ of Aggregate
		4)	Atterberg limits of portion of aggre. passing 425 micron sieve.	One test per 200 m ³ of Binding Material
		5)	Density of compacted layer.	One test per 1000 m ³ of aggregates.
5	Paving Bitumen		Nos. of tanker	No. of test.

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SR.NO.	TYPE OF CONSTRUCTION & MATERIALS.	TEST		FREQUENCY
	/bitumen emulsion		1 2 to 15 16 to 50 51 to 150 151 to 500 Above 501	1 2 3 5 8 13
6	Prime coat / Tack coat	1 2 3	Quality of binder Binder temperature for application. Rate of spread of binder.	Two samples per lot to be subjected to all or some tests as directed by the Engineer As regular close intervals. Three tests per day.
7	Surface dressing.	1 2 3 4 5 6 7 8 9 10 11. 12.	Quality of binder Agg. impact value / Los angles abrasion value. Flakiness index & elongation index Stripping value of aggregate. Water absorption of aggregates. Water sensitivity of Mix Grading of aggregate Temperature of binder at the time of application. Polishing stone value. Soundness (Magnesium & Sodium sulphate) Rate of spread of materials Percentage of Fractured phases.	Number of samples per lot and tests as per IS: 73, IS:217 and IS: 8887 as applicable. One test per 200 Cu.m of each source and whenever there is change in quality of aggregates. One test per 100 Cu.m of each source and whenever there is change in quality of aggregates. One test of each source and whenever there is change in quality of aggregates. -do- -do- Two test per day At regular close intervals. One test of each source and whenever there is change in quality of aggregates. One test of each source and whenever there is change in quality of aggregates. Three test per day One test per 100 cu.mt of aggregate

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SR.NO.	TYPE OF CONSTRUCTION & MATERIALS.	TEST		FREQUENCY
8	B.M. & SDBC.	1	Quality of binder	Number of samples per lot and tests as per IS: 73, IS:217 and IS: 8887 as applicable.
		2	Agg. impact value / Los angles abrasion value.	One test per 200 Cu.m of each source and whenever there is change in quality of aggregates.
		3	Flakiness index & elongation index	One test per 350 Cu.m of each source
		4	Stripping value of aggregate. Water sensitive of mix .	Same as Mentioned under Serial No. 7
		5	Grading of aggregates.	Same as Mentioned under Serial No. 7
		6	Water absorption of aggregates. Soundness (Magnesium & sodium sulphate) Percentage of Fractured phases. Binder content & aggregate grading.	Same as Mentioned under Serial No. 7
		7		Same as Mentioned under Serial No. 7
		8		Same as Mentioned under Serial No. 7
		9	Control of temperature of binder & aggregate for mixing & of the mix at the time of laying & rolling. Rate of spread of mixed materials. Density of compacted layer.	Same as Mentioned under Serial No. 7
		10		Same as Mentioned under Serial No. 7
		11		Same as Mentioned under Serial No. 7
		12		1 test per 700 m2 area.
		13		At regular interval.

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SR.NO.	TYPE OF CONSTRUCTION & MATERIALS.	TEST		FREQUENCY
9	DBM / BC	1	Quality of binder	Number of samples per lot and tests as per IS: 73, IS:217 and IS: 8887 as applicable.
		2	Agg.impact value / Los angles abrasion value.	One test per 350Cu.m of each source and whenever there is change in quality of aggregates.
		3	Flakiness index & elongation index	One test per 350 Cu.m of each source and whenever there is change in quality of aggregates
		4	Soundness Test	One test of each source and whenever there is change in quality of aggregates.
		5	Water absorption of aggregates	One test of each source and whenever there is change in quality of aggregates.
		6	Sand equivalent test.	One test of each source and whenever there is change in quality of aggregates.
		7	Plasticity Index	One test of each source and whenever there is change in quality of aggregates.
		8	Polished stone Value	One test of each source and whenever there is change in quality of aggregates.
		9	Percentage of Fractured phases.	One test of each source and whenever there is change in quality of aggregates.
		10	Mix grading.	One test of each source and whenever there is change in quality of aggregates.
		11	Stability & Voids analysis of mix including theoretical maximum specific of loose mix	One test per 350 cu.mt of aggregates when crushed gravel is used
		12	Moisture susceptibility of mix	One set of tests on individual constituents and mixed aggregate from the dryer for each 400 tonnes of mix subject to minimum of two tests per plant per day
		13	temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling	Three test for stability, flow value, density and void contents for each 400 tonnes of mix subject to a minimum of two tests per plant per day
		14	binder content	One test for each mix type whenever there is change in quality of aggregates.
		15	Rate of spread of Mix	

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SR.NO.	TYPE OF CONSTRUCTION & MATERIALS.	TEST		FREQUENCY
			material. Density of compacted layer.	At regular intervals. One set for 400 tones of mix subject to minimum of two tests per day per plant. After every 5th truck load One test per 700 sq.mt area
10	Cement	1)	Physical & chemical test. IS – 269,455,1489, 8112 & 12269.	Once for each source of supply and occasionally when called for in case of long/improper storage, Besides, the Contractor also will submit daily data on cement released by the Manufacturer.
11	Sand	1) 2) 3)	Silt content Fineness modules. Gradation	1 sample per 150 m3 1 sample per 150 m3 1 sample per 150 m3
12	Course & fine aggregates.	1)	Gradation IS: 2386 (Part-1)	One test for every day's work of each section of course aggregate and fine aggregate as above or as approved by Engineer-in-charge.
		2)	Deleterious constituents IS: 2386 (Part-2)	-do-
		3)	Water absorption IS: 2386 (Part-3)	Regularly as required to a minimum of one test a day for course aggregate and two tests a day for fine aggregate and as directed by Engineer-in-charge.
13	Course aggregate	1)	Los angles abrasion value of aggregate impact value IS: 2386 (Part-4)	Once for each source of supply and subsequently on monthly basis.
		2)	Soundness IS: 2386 (Part-5)	Before approving the aggregates and every month subsequently
		3)	Alkali aggregate reactivity IS: 2386 (Part-7)	-do-

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SR.NO.	TYPE OF CONSTRUCTION & MATERIALS.	TEST		FREQUENCY
14	Water		Chemical test IS: 456	Once for approval of source of supply subsequently only in case of doubt or as directed by the Engineer-in-charge.
15	Concrete	1)	Strength of concrete IS: 516	As per frequency tests shown on the page No. 19 of B-1 agreement attached herewith.
		2)	Course strength on hardened concrete IS: 516	As per the requirement of Engineer.
		3)	Workability of fresh concrete – Slump test IS: 1199.	One test per each dumper load at both Batching plant site and paving site initially when work starts. Subsequently sampling may be done from alternate dumper.
		4)	Thickness determination	From the level data of concrete pavement surface and sub-base at grid points of 5/6.25 m x 3.5 m
		5)	Thickness measurement for trial length.	3 cores per trial length
		6)	Verification of level of string line (SWD PCC lining work) and sub structure and structure (Head wall for CD works)	String line or steel forms shall be checked for level at an interval of 5 mtr. Or 6.25 mtr. The level tolerance allows shall be +/- 2mm. These shall be got approved 1-2 hours before the commencement of the concreting activity.
16	M.S./H.Y.S.D./TMT bars	1) 2) 3)	Ultimate tensile strength Yield stress (Proof stress) Percentage elongation	1 sample / 40 MT for each diameter.
17	Structural steel	1) 2) 3)	Ultimate tensile strength Yield stress (Proof stress)	1 sample / 20 MT for each dimension of steel component

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SR.NO.	TYPE OF CONSTRUCTION & MATERIALS.	TEST		FREQUENCY
			Percentage elongation	
18	Bricks	1) 2)	Compressive strength Water absorption	1 Test / 50000 No. (5 bricks)
19	Plain tiles / mosaic tiles/flooring tiles/vitrified tiles/wall tiles	1) 2) 3)	Transversesstrength Abrasion Water absorption	1 Test / 2000 No. (12 tiles)
20	Cement concrete cubes	1) 2)	Compressive strength for 7 days Compressive strength for 28 days	1 samples / 1-5 M3 2 samples / 6-15 M3 3 samples / 16-30 M3 4 samples / 31-50 M3 4+1 samples for each additional 50 M3 or part thereof.
22	Cement mortar	1)	Compressive strength	As per the requirement of Engineer

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SECTION: 2 CONCRETE

CONCRETE

1.0 Applicable Codes with latest revisions.

Materials:

- IS.12330 – 1988 Specification for 53 grade Sulphate resisting cement.
- IS.455 Specification for Portland slag cement.
- IS.1489 Specification for Portland- Pozzolana cement (Part 1&2).
- IS:8112 Specification for 43 grade ordinary Portland cement.
- IS:12269 Specification for 53 grade ordinary Portland cement.
- IS:12330 Specification for sulphate resisting Portland cement.
- IS:383 Specification for coarse and fine aggregates from natural sources for concrete.
- IS:432 Specification for mild steel and medium (tensile steel bars and hard-drawn steel) wires for concrete reinforcement. (Part 1 and 2)
- IS:1786 Specification for high strength deformed steel bars and wires for Concrete reinforcement.
- IS:1566 Specification for hard-drawn steel wire fabric for concrete Reinforcement.
- IS:9103 Specification for admixtures for concrete.
- IS:2645 Specification for integral cement water- proofing compounds.
- IS:4990 Specification for plywood for concrete shuttering work.

2.0 Material Testing:

- IS.4031 Methods of physical tests for hydraulic cement (Parts 1 to 15)
- IS:4032 Method chemical analysis of hydraulic cement.
- IS:650 Specification for standard sand for testing of cement.
- IS:2430 Methods for sampling of aggregates for concrete.
- IS: 2386 Methods of test for aggregates for concrete (Parts 1 to 8)
- IS:3025 Methods of sampling and test (physical and chemical) for water used in industry.
- IS:6925 Methods of test for determination of water-soluble chlorides in Concrete admixtures.

3.0 Material Storage:

- IS:4082 Recommendations on stacking and storing of construction Materials at site.

4.0 Concrete Mix Design:

- IS:10262 Recommended guidelines for concrete mix design.
- SP:23 (S&T) Handbook on Concrete Mixes

5.0 Concrete Testing:

- IS.1199 Method of sampling and analysis of concrete.
- IS:516 Method of test for strength of concrete.
- IS:9013 Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.

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- IS:8142 Method of test for determining setting time of concrete by Penetration resistance.
- IS:9284 Method of test for abrasion resistance of concrete.
- IS:2770 Methods of testing bond in reinforced concrete.

6.0 Equipment:

- IS:1791 Specification for batch type concrete mixers.
- IS:2438 Specification for roller pan mixer.
- IS:4925 Specification for concrete batching and mixing plant.
- IS:5892 Specification for concrete transit mixer and agitator.
- IS:7242 Specification for concrete spreaders.
- IS:2505 General Requirements for concrete vibrators: Immersion type.
- IS:2506 General Requirements 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:11993 Code of practice for use of screed board concrete vibrators.
- IS:7251 Specification for concrete finishers.
- IS:2722 Specification for portable swing weigh batchers for concrete (Single and double bucket type).
- IS:2750 Specification for steel scaffoldings.

7.0 Codes of Practice:

- IS:456 Code of practice for plain and reinforced concrete.
- IS:457 Code of practice for general construction of plain and reinforced Concrete for dams and other massive structures.
- IS:3370 Code of practice for concrete structure for storage of liquids (Part 1 to 4).
- IS:3935 Code of practice for composite construction.
- IS:2204 Code of practice for construction of reinforced concrete shell roof.
- IS:2210 Criteria for the design of reinforced concrete shell structures and Folded Plates.
- IS:2502 Code of practice for bending and fixing of bars for concrete Reinforcement.
- IS:5525 Recommendation for detailing of reinforcement in reinforced Concrete works.
- IS:2751 Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.
- IS:9417 Specification for welding cold worked bars for reinforced concrete construction.
- 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:4326 Code of practice for earthquake resistant design and construction of building.
- IS:4014 Code of practice for steel tubular scaffolding (Parts 1 & 2)
- IS:2571 Code of practice for laying in situ cement concrete flooring.

IS:7861 Code of practice for extreme weather concreting: Part 1 Recommended practice for hot weather concreting.

8.0 Construction Safety:

IS: 3696 Safety code for scaffolds and ladders.

IS:7969 Safety code for handling and storage of building materials.

IS:8989 Safety code for erection of concrete framed structures.

9.0 General:

The TPQA / Officer In-Charge of the Authority shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment and the quality control system. Such an inspection shall be arranged and the TPQA / Officer In-Charge of the Authority's approval obtained, prior to starting of concrete work. This shall however, not relieve the Contractor from any of his responsibilities. All materials which do not conform to the Specifications shall be rejected.

Materials should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected. Materials complying with codes/standards shall generally be used. Other materials may be used after approval of the TPQA/ Officer In-Charge of the Authority and after establishing their performance suitability based on previous data, experience or tests.

10.0 Materials: Cement:

For structures of the work, Cement shall be ordinary Portland cement conforming to IS: 269, IS: 8112 or IS: 12269. However, in any case, cement grade shall not be lower than 53 grades.

Only one type of cement shall be used in a particular unit. The source of supply, type or brand of cement within the same structure or portion thereof shall not be changed without approval from the TPQA / Officer In-Charge of the Authority.

Cement which is not used within 90 days from its date of manufacture shall be tested at a laboratory approved by the TPQA / Officer In-Charge of the Authority and until the results of such tests are found satisfactory, it shall not be used in any work.

Aggregates (General):

Aggregates shall consist of naturally occurring stones (crushed or uncrushed), gravel and sand.

They shall be chemically inert, strong, hard, clean, durable against weathering, of limited porosity, free from dust/silt/ organic impurities/deleterious materials and conform to IS:383. Aggregates such as slag, crushed over burnt bricks, bloated clay ash, sintered fly ash and tiles shall not be used.

Aggregates shall be washed and screened before use where necessary or if directed by the TPQA/ Officer In-Charge of the Authority.

Aggregates containing reactive materials shall be used only after tests conclusively prove that there will be no adverse effect on strength, durability and finish, including long term effects, on the concrete.

The fineness modulus of sand shall neither be less than 2.2 nor more than 3.2.

The maximum size of coarse aggregate shall be as stated on the drawings but in no case greater than 1/4 of the minimum thickness of the member.

Plums 160 mm and above of a reasonable size may be used in mass concrete where directed.

Plums shall not constitute more than 20% by volume of the concrete.

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Water:

Water to be used for both mixing and curing shall conform to IS:456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.

Reinforcement:

All reinforcement steel shall be TMT FE 500 / 500D conforming to relevant I.S. for all RCC structure with conforming to IS-1786.with **fusion bonded epoxy coating**.

All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirt, dust, or any other substance that will destroy or reduce bond.

All Grade of reinforcement steel shall be FE 500.

Admixtures:

Accelerating, retarding, water-reducing and air entraining admixtures shall conform to IS: 9103 and integral water proofing admixtures to IS: 2645.

Admixtures may be used in concrete as per manufacturer's instructions only with the approval of the TPQA / Officer In-Charge of the Authority. An admixture's suitability and effectiveness shall be verified by trial mixes with the other materials used in the works. If two or more admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be no increase in risk of corrosion of the reinforcement or other embedment.

Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts.

Samples and Tests:

All materials used for the works shall be tested before use.

Manufacturer's test certificate shall be furnished for each batch of cement/steel and when directed by the TPQA / Officer In-Charge of the Authority samples shall also be got tested by the Contractor in a laboratory approved by the TPQA / Officer In-Charge of the Authority. TPQA / Officer In-Charge of the Authority may appoint separate third-party inspection for the material testing to ensure the quality of the work. The Contractor shall replace the defective material as an outcome of these tests.

Sampling and testing shall be as per IS:2386 under the supervision of the TPQA / Officer In-Charge of the Authority.

Water to be used shall be tested to comply with requirements of IS:456.

The Contractor shall furnish manufacturer's test certificates and technical literature for the admixture proposed to be used. If directed, the admixture shall be got tested at an approved laboratory.

Storing of Materials:

All materials shall be stored in a manner so as to prevent its deterioration and contamination which would preclude its use in the works. Requirements of IS:4082 shall be complied with.

The Contractor will have to make his own arrangements for the storage of adequate quantity of cement. If such cement is not stored properly and has deteriorated, the material shall be rejected. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. Storage arrangement shall be approved by the TPQA / Officer In-Charge of the Authority. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order of receipt.

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Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.

The Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.

The reinforcement shall be stacked on top of timber sleeper to avoid contact with ground/water. Each type and size shall be stacked separately.

11.0 Concrete:

General

Concrete grade shall be as designated on drawings. In concrete grade M15, M20 etc. the number represents the specified characteristic compressive strength of 150X150X150 mm cube at 28 days, expressed in N/mm² as per IS:456. Concrete in the works shall be "DESIGN MIX CONCRETE" or "NOMINAL MIX CONCRETE". All concrete works of grade M5, M7.5 and M10 shall be NOMINAL MIX CONCRETE whereas all other grades, M15 and above, shall be DESIGN MIX CONCRETE. Concrete grade shall not be lower than M-25 for building and M-40 for water retaining structures

12.0 Design Mix Concrete:

Mix Design & Testing

For Design Mix Concrete, the mix shall be designed according to IS:10262 and SP:23 to provide the grade of concrete having the required workability and characteristic strength not less than appropriate values given in IS:456. The design mix shall be cohesive and does not segregate and should result in a dense and durable concrete and also capable of giving the finish as specified. For liquid retaining structures, the mix shall also result in water tight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

The minimum cement content for Design Mix Concrete shall be as per Appendix-A of IS:456 or as given below, whichever is higher.

Grade of Concrete	Minimum Cement Content in Kg/m³ of Concrete
M15	290
M20	360
M25	380
M30	410
M35	425
M40	440

The minimum cement content stipulated above shall be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The CONTRACTOR's quoted rates for concrete shall provide for the above eventuality and nothing extra shall be paid to the CONTRACTOR on this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the CONTRACTOR.

It shall be the Contractor's sole responsibility to carry out the mix designs. He shall furnish to the AUTHORITY at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS:516 shall comply with the requirements of IS:456

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Grade of Concrete	Minimum Compressive Strength N/sq.mm at 7 days	Specified Characteristic Compressive Strength N/sq.mm at 28 days
M 15	10.0	15.0
M 20	13.5	20.0
M 25	17.0	25.0
M 30	20.0	30.0
M 35	23.5	35.0
M 40	27.0	40.0

A range of slumps which shall generally be used for various types of construction unless otherwise instructed by the TPQA / Officer In-Charge of the Authority is given below:

Structure/Member	Slump in millimeters	
Reinforced foundation walls and	75	25
Plain footings, caissons and	100	25
Slabs, Beams and reinforced walls	75	25
Pump & miscellaneous Equipment Foundations	100	25
Building columns	50	25
Pavements	50	25
Heavy mass construction	50	25

13.0 Batching & Mixing of Concrete:

Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value.

Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account for moisture content in the aggregates. Water-cement ratio specified for use by the TPQA / Officer In-Charge of the Authority shall be maintained. Each time when the work stops, the mixer shall be cleaned out, and while recommencing, the first batch shall have 10% additional cement to allow for sticking in the drum.

Arrangements should be made by the Contractor to have the cubes tested in an approved laboratory or in field with prior consent of the TPQA / Officer In-Charge of the Authority. Sampling and testing of strength and workability of concrete shall be as per IS:1199, IS:516 and IS:456, IS 3370.

14.0 Nominal Mix Concrete

Mix Design & Testing

Mix design and preliminary tests are not necessary for Nominal Mix Concrete.

However, works tests shall be carried out as per IS:456. Proportions for Nominal Mix Concrete and Water Cement Ratio may be adopted as per Table 3 of IS:456. However, it will be the Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

15.0 Batching & Mixing of Concrete:

Based on the adopted nominal mixes, aggregates shall be measured by volume. However, cement shall be by weight only.

16.0 Formwork:

Formwork shall be all inclusive and shall consist of shoring, bracings, sides of footings, walls, beams and columns, bottom of slabs etc. including ties, anchors, hangers, inserts, false work, wedges etc.

The design and engineering of the formwork as well as its construction shall be the responsibility of the Contractor. However, if so desired by the TPQA / Officer In-Charge of the Authority,

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The drawings and calculations for the design of the formwork shall be submitted to the TPQA /Officer In-Charge of the Authority for approval.

Formwork shall be designed to fulfill the following requirements:

Sufficiently rigid and tight to prevent loss of grout/ slurry or mortar from the concrete at all stages and appropriate to the methods of placing and compacting.

Made of suitable materials.

Capable of providing concrete of the correct shape and surface finish within the specified tolerance limits.

Capable of withstanding without deflection the worst combination of self-weight, reinforcement and concrete weight, all loads and dynamic effects arising from construction and compacting activities, earthquake, wind and weather forces.

Capable of easy striking out without shock, disturbance or damage to the concrete.

Soffit forms capable of imparting a camber if required.

Soffit forms and supports capable of being left in position if required.

Capable of being cleaned and/or coated if necessary immediately prior to casting the concrete; design temporary openings where necessary for these purposes and to facilitate the preparation of construction joints.

The formwork may be of timber, plywood, steel, plastic or concrete depending upon the type of finish specified. Sliding forms and slip form may be used with the approval of the TPQA / Officer In-Charge of the Authority. Timber for formwork shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps and other surface defects. Joints between formwork and between formwork and structures shall be sufficiently tight to prevent loss of slurry from concrete, using seals if necessary.

The faces of formwork coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before fixing reinforcement. All rubbish, particularly chippings, shavings, sawdust, wire pieces dust etc. shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air.

Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be reused. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of the TPQA / Officer In-Charge of the Authority. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.

Permanent formwork shall be checked for its durability and compatibility with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.

Wire ties passing through beams, columns and walls shall not be allowed. In their place bolts passing through sleeves shall be used. Formwork spacers left in situ shall not impair the desired appearance or durability of the structure by causing spilling, rust staining or allowing the passage of moisture.

For liquid retaining structures, sleeves shall not be provided for through bolts nor shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25 mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the formwork.

Where specified all corners and angles exposed in the finished structure shall have chamfers or fillets of 20 mm x 20 mm size.

Forms for substructure may be omitted when, in the opinion of the TPQA / Officer In-Charge of the Authority, the open excavation is firm enough (in hard non-porous soils) to act as a form. Such

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excavations shall be larger, as approved by the TPQA / Officer In-Charge of the Authority, than that required as per drawing to compensate for irregularities in excavation.

The Contractor shall provide adequate props carried down to a firm bearing without overloading any of the structures.

The shuttering for beams and slabs shall be so erected that the side shuttering of beams can be removed without disturbing the bottom shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be built up in sections as placing of concrete proceeds or windows left for placing concrete from the side to limit the drop of concrete to 1.0m or as approved by the TPQA / Officer In-Charge of the Authority. The Contractor shall temporarily and securely fix items to be casted (embedment / inserts) in a manner that will not hinder the striking of forms or permit loss of grout.

Formwork showing excessive distortion, during any stage of construction, shall be repositioned and strengthened. Placed concrete affected by faulty formwork, shall be entirely removed and formwork corrected prior to placement of new concrete.

The striking time for formwork shall be determined based on the following requirements:

Development of adequate concrete strength.

Permissible deflection at time of striking form work.

Curing procedure employed - its efficiency and effectiveness.

Subsequent surface treatment to be done;

Prevention of thermal cracking at re-entrant angles;

Ambient temperatures; and

Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).

Under normal circumstances (generally where temperatures are above 20°C) forms may be struck after expiry of the time period given in IS:456 unless approved otherwise by the TPQA / Officer In-Charge of the Authority. For Portland Pozzolana/slag cement the stripping time shall be suitably modified as approved by the TPQA / Officer In-Charge of the Authority. It is the Contractor's responsibility to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not undergo excessive deformation and resist surface damage and any stresses arising during the construction period.

17.0 Reinforcement Workmanship

Reinforcing bars supplied bent or in coils shall be straightened cold without damage. No bendings shall be done when ambient temperature is below 5°C. Local warming may be permitted if steel is kept below 10° C. All bars shall be accurately cut and bent gradually and according to the sizes and shapes shown on the drawings/ schedules or as directed by the TPQA / Officer In-Charge of the Authority. Re-bending or straightening incorrectly bent bars shall not be done without the approval of the TPQA / Officer In-Charge of the Authority.

Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by the TPQA / Officer In-Charge of the Authority prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause spilling of the concrete cover. Binding wire shall be 16-gauge soft annealed wires. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.

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Substitution of reinforcement, laps/splices not shown on drawing shall be subject to TPQA / Officer In-Charge of the Authority's approval.

18.0 Tolerances:

Tolerance for formwork and concrete dimensions shall be as per IS:456 unless specified otherwise.

Tolerances specified for horizontal or vertical building lines or footings shall not be construed to permit encroachment beyond the legal boundaries.

The formwork shall be designed and constructed to the shapes, lines and dimensions shown on the drawings within the tolerances given below:

(a)	Deviation from specified dimensions of cross section of columns and beams	-6mm + 12 mm
(b)	Deviations from dimensions of footings (Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel or dowels)	
	1) Dimension in plan	12mm + 50mm
	2) Eccentricity	0.02 times the width of the footing in the direction of deviation but not more than 50
	3) Thickness	±0.05 times the specified thickness

19.0 Preparation Prior to Concrete Placement:

Before concrete is actually placed in position, the inside of the formwork shall be cleaned and mould oil applied, inserts and reinforcement shall be correctly positioned and securely held, necessary openings, pockets, etc. provided.

All arrangements-formwork, equipment and proposed procedure, shall be approved by the TPQA/ Officer In-Charge of the Authority. Contractor shall maintain separate Pour Card for each pour as per the format enclosed.

20.0 Transporting, Placing and Compacting Concrete:

Concrete shall be transported from the mixing plant to the formwork with minimum time lapse by methods that shall maintain the required workability and will prevent segregation, loss of any ingredients or ingress of foreign matter or water.

In all cases concrete shall be deposited as nearly as practicable directly in its final position. To avoid segregation, concrete shall not be re handled or caused to flow. For locations where, direct placement is not possible and in narrow forms the Contractor shall provide suitable drops and "Elephant Trunks". Concrete shall not be dropped from a height of more than 1.0m.

Concrete shall not be placed in flowing water. Under water, concrete shall be placed in position by tremie or by pipeline from the mixer and shall never be allowed to fall freely through the water.

While placing concrete the Contractor shall proceed as specified below and also ensure the following:

Continuously between construction joints and pre-determined abutments. Without disturbance to forms or reinforcement.

Without disturbance to pipes, ducts, fixings and the like to be cast in; ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.

Without dropping in a manner that could cause segregation or shock.

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In deep pours only when the concrete and formwork designed for this purpose and by using suitable chutes or pipes.

Do not place if the workability is such that full compaction cannot be achieved.

Without disturbing the unsupported sides of excavations; prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the linings progressively as concrete is placed.

If placed directly onto hardcore or any other porous material, dampen the surface to reduce loss of water from the concrete.

Ensure that there is no damage or displacement to sheet membranes.

Record the time and location of placing structural concrete.

Concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer. Concrete shall be compacted during placing with approved vibrating equipment without causing segregation until it forms a solid mass free from voids thoroughly worked around reinforcement and embedded fixtures and into all corners of the formwork. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn slowly till air bubbles cease to come to the surface, leaving no voids. When placing concrete in layers advancing horizontally, care shall be taken to ensure adequate vibration, blending and melding of the concrete between successive layers. Vibrators shall not be allowed to come in contact with reinforcement, formwork and finished surfaces after start of initial set. Over-vibration shall be avoided.

Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by the TPQA / Officer In-Charge of the Authority. The slump shall be held to the minimum necessary for conveying concrete by this method. When concrete is to be pumped, the concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

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 before the start of subsequent placement. Placing shall stop when concrete reaches the top of the opening in walls or bottom surface of slab, in slab and beam construction, and it shall be resumed before concrete takes initial set but not until it has had time to settle as approved by the TPQA / Officer In-Charge of the Authority. Concrete shall be protected against damage until final acceptance.

21.0 Mass Concrete Works:

Sequence of pouring for mass concrete works shall be as approved by the TPQA / Officer In-Charge of the Authority. The Contractor shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete if directed.

22.0 Curing:

Curing and protection shall start immediately after the compaction of the concrete to protect it from:

Premature drying out, particularly by solar radiation and wind;

Leaching out by rain and flowing water;

Rapid cooling during the first few days after placing;

High internal thermal gradients;

Low temperature or frost;

Vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.

All concrete, unless approved otherwise by the TPQA / Officer In-Charge of the Authority, shall be cured by use of continuous sprays or ponded water or continuously saturated coverings of

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sacking, canvas or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.

Where a curing membrane is approved to be used by the TPQA / Officer In-Charge of the Authority, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. The curing compound to be used shall be approved by the AUTHORITY before use and shall be applied with spraying equipment capable of a smooth, even textured coat.

Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened.

23.0 Construction Joints and Keys:

Construction joints will be as shown in the drawing or as approved by the AUTHORITY. Concrete shall be placed without interruption until completion of work between construction joints. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made with the approval of the TPQA / Officer In-Charge of the Authority.

Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as approved by the TPQA / Officer In-Charge of the Authority.

Before resuming concreting on a surface which has hardened all laitance and loose stone shall be thoroughly removed by wire brushing/hacking and surface washed with high pressure water jet and treated with thin layer of cement slurry for vertical joints and horizontal layers.

When concreting is to be resumed on a surface which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this, a layer of concrete not exceeding 150 thickness shall be placed and well rammed against the old work. Thereafter work shall proceed in the normal way.

24.0 Foundation Bedding:

All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft or spongy areas shall be cleaned out and back filled with either soil-cement mixture, lean concrete or clean sand compacted as approved by the TPQA / Officer In-Charge of the Authority. The surfaces of absorptive soils shall be moistened.

Concrete shall not be deposited on large sloping rock surfaces. The rock shall be cut to form rough steps or benches by picking, barring or wedging. The rock surface shall be kept wet for 2 to 4 hours before concreting.

25.0 Finishes: General

The formwork for concrete works shall be such as to give the finish as specified. The Contractor shall make good any unavoidable defects as approved consistent with the type of concrete and finish as specified. Defects due to bad workmanship (e.g. damaged or misaligned forms, defective or poorly compacted concrete) will not be accepted. The Contractor shall construct the formwork using the correct materials and to meet the requirements of the design and to produce finished concrete to required dimensions, plumbs, planes and finishes.

Surface Finish Type F1:

The main requirement is that of dense, well-compacted concrete. No treatment is required except repair of defective areas, filling all form tie holes and cleaning up of loose or adhering debris. For surfaces below grade, which will receive waterproofing treatment, the concrete shall be free of surface irregularities, which would interfere with proper and effective application of waterproofing material specified for use.

Surface Finish Type F2:

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The appearance shall be that of a smooth dense, well-compacted concrete showing the slight marks of well fitted shuttering joints. The Contractor shall make good any blemishes.

Surface Finish Type F3:

This finish shall give an appearance of smooth, dense, well-compacted concrete with no shutter marks, stain free and with no discoloration, blemishes, arises, air holes etc. Only lined or coated plywood with very tight joints shall be used to achieve this finish. The panel size shall be uniform and as large as practicable. Any minor blemishes that might occur shall be made good by the Contractor.

Integral Cement Finish on Concrete Floor:

In all cases where integral cement finish on a concrete floor has been specified, the top layer of concrete shall be screened off to proper level and tamped with tamper having conical projections so that the aggregate shall be forced below the surface. The surface shall be finished with a wooden float and a trowel with pressure. The finish shall be continued till the concrete reaches its initial set. No cement or cement mortar finish shall be provided on the surface. Where specified, a floor hardener as approved by the TPQA / Officer In-Charge of the Authority shall be supplied and used as recommended by the manufacturer.

The formwork for concrete works shall be such as to give the finish as specified. The Contractor shall make good any unavoidable defects as approved consistent with the type of concrete and finish specified; defects due to bad workmanship (e.g. damaged or misaligned forms, defective or poorly compacted concrete) will not be accepted. The Contractor shall construct the formwork using the correct materials and to meet the requirements of the design and to produce finished concrete to required dimensions, plumbs, planes and finishes.

26.0 Repair and Replacement of Unsatisfactory Concrete:

Immediately after the shuttering is removed, all the defective areas such as honey-combed surfaces, rough patches, holes left by form bolts etc. shall be inspected by the TPQA / Officer In-Charge of the Authority who may permit patching of the defective areas or reject the concrete work.

All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

Rejected concrete shall be removed and replaced by the Contractor.

For patching of defective areas all loose materials shall be removed and the surface shall be prepared as approved by the TPQA / Officer In-Charge of the Authority.

Bonding between hardened and fresh concrete shall be done either by placing cement mortar or by applying epoxy. The decision of the TPQA / Officer In-Charge of the Authority as to the method of repairs to be adopted shall be final and binding on the Contractor. The surface shall be saturated with water for 24 hours before patching is done with 1:5 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as approved by the TPQA / Officer In-Charge of the Authority.

27.0 Vacuum Dewatering of Slabs:

Where specified floor slabs, either grade or suspended, shall be finished by vacuum dewatering including all operations such as poker vibration, surface vibration, vacuum processing, floating and troweling as per equipment manufacturers recommendation. The equipment to be used shall be subject to the TPQA / Officer In-Charge of the Authority's approval.

28.0 Hot Weather Requirements:

Concreting during hot weather shall be carried out as per IS:7861 (Part I).

Adequate provisions shall be made to lower concrete temperatures which shall not exceed 40° C at the time of placement of fresh concrete.

Where directed by the TPQA / Officer In-Charge of the Authority, the Contractor shall spray non-wax based curing compound on unformed concrete surfaces.

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29.0 Cold Weather Requirements.

Concreting during cold weather shall be carried out as per IS: 7861 (Part II).

The ambient temperature during placement and up to final set shall not fall below 5°C. Approved antifreeze/accelerating additives shall be used where directed.

For major and large-scale concreting works the temperature of concrete at times of mixing and placing, the thermal conductivity of the formwork and its insulation and stripping period shall be closely monitored.

30.0 Liquid Retaining Structures:

The Contractor shall take special care for concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.

The minimum level of surface finish for liquid retaining structures shall be as defined elsewhere. All such structures shall be hydro-tested.

The Contractor shall make all arrangements for hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipe lines etc.

The Contractor shall also make all temporary arrangements that may have to be made to ensure stability of the structures during construction.

Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement/epoxy pressure grouting, guiniting or such other methods as may be approved by the TPQA / Officer In-Charge of the Authority. All such rectification shall be done by the Contractor to the entire satisfaction of the TPQA / Officer In-Charge of the Authority.

31.0 Testing Concrete Structures for Leakage:

Hydro-static test for water tightness shall be done at full storage level or soffit of cover slab, as may be directed by the TPQA / Officer In-Charge of the Authority, as described below:

In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven-day period for absorption after filling with water.

In the case of structures whose external faces are buried and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling; the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs. Over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period for seven days shall be taken as an indication of the water tightness of the structure. The TPQA / Officer In-Charge of the Authority shall decide on the actual permissible nature of this drop in the surface level, considering whether the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

Each compartment/segment of the structure shall be tested individually and then all together.

For structures such as pipes, tunnels etc. the hydrostatic test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

Optional Tests:

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If the Authority feels that the materials i.e. cement, sand, coarse aggregates, reinforcement and water are not in accordance with the Specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the TPQA / Officer In-Charge of the Authority, as per relevant IS Codes. Contractor shall have to pay for these tests.

In the event of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths, the TPQA / Officer In-Charge of the Authority reserves the right to order the Contractor to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure, etc. The TPQA / Officer In-Charge of the Authority also reserves the right to ask the Contractor to dismantle and re-do such unacceptable work. Alternately TPQA / Officer In-Charge of the Authority also reserves the right to ask the CONTRACTOR to dismantle and re-do such unacceptable work.

32.0 Grouting: Standard Grout:

Grout shall be provided as specified on the drawings.

The proportion of Standard Grout shall be such as to produce a flow able mixture consistent with minimum water content and shrinkage. Surfaces to be grouted shall be thoroughly roughened and cleaned. All structural steel elements to be grouted shall be cleaned of oil, grease, dirt etc. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete shall be saturated with water and just before grouting, water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by the TPQA / Officer In-Charge of the Authority. The grout proportions shall be limited as follows:

Use	Grout Thickness	Mix Proportions	Water Cement Ratio(max)
a) Fluid mix	Under 25mm	One-part Portland Cement to one-part sand	0.44
b) General mix	25mm and over but less than 50mm	One-part Portland Cement to 2 parts of sand	0.53
c) Stiff mix	50mm and over	One-part Portland Cement to 3 parts of sand	0.53

Non-Shrink Grout:

Non-shrink grout where required shall be provided in strict accordance with the manufacturer's instructions / specifications on the drawing.

Inspection:

All materials, workmanship and finished construction shall be subject to continuous inspection and approval of TPQA / Officer In-Charge of the Authority. Materials rejected by the TPQA / Officer In-Charge of the Authority shall be expressly removed from site and shall be replaced by Contractor immediately.

Clean-Up:

Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris, scraps of wood, etc. resulting from the work shall be removed and the premises left clean.

Acceptance Criteria:

Any concrete work shall satisfy the requirements given below individually and collectively for it to be acceptable.

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Properties of constituent materials;
 Characteristic compressive strength;
 Specified mix proportions;
 Minimum cement content;
 Maximum free-water/cement ratio;
 Workability;
 Temperature of fresh concrete;
 Density of fully compacted concrete;
 Cover to embedded steel;
 Curing;
 Tolerances in dimensions;
 Tolerances in levels;
 Durability;
 Surface finishes;
 Special requirements such as;
 Water tightness
 Resistance to aggressive chemicals
 Resistance to freezing and thawing
 Very high strength
 Improved fire resistance
 Wear resistance
 Resistance to early thermal cracking

The TPQA / Officer In-Charge of the Authority's decision as to the acceptability or otherwise of any concrete work shall be final and binding on the Contractor. For work not accepted, the TPQA/ Officer In-Charge of the Authority may review and decide whether remedial measures are feasible so as to render the work acceptable. The TPQA / Officer In-Charge of the Authority shall in that case direct the Contractor to undertake and execute the remedial measures. These shall be expeditiously and effectively implemented by the Contractor. Nothing extra shall become payable to the Contractor by the Authority for executing the remedial measures.

33.0 Water stops: Material:

The material for the PVC water stops shall be a plastic compound with the basic resin of polyvinyl chloride and additional resins, plasticizers, inhibitors, which satisfies the performance characteristics specified below as per IS:12200. Testing shall be in accordance with IS:8543.

- | | | |
|----|------------------------|----------------------------------|
| a) | Tensile strength | :3.6 N/mm ² minimum |
| b) | Ultimate elongation | : 300 % minimum |
| c) | Tear resistance | :4.9 N/mm ² minimum |
| d) | Stiffness in flexure | : 2.46 N/mm ² minimum |
| e) | Accelerated extraction | |
| f) | Tensile strength | :10.50 N/mm ² minimum |
| h) | Ultimate elongation | : 250% minimum |

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- i) Effect of Alkali : 7 days
- j) Weight increase : 0.10% maximum
- k) Weight decrease : 0.10% maximum
- l) Hardness change : ± 5 points
- m) Effect of Alkali ; 28 days
- n) Weight increase : 0.40% maximum
- o) Weight decrease : 0.30% maximum
- p) Dimension change : $\pm 1\%$

PVC water stops shall be either of the bar type, serrated with center bulb and end grips for use within the concrete elements or of the surface (kicker) type for external use.

PVC water stops shall be of approved manufacture. Samples and the test certificate shall be got approved by the TPQA / Officer In-Charge of the Authority before procurement for incorporation in the works. Alternatively, G.I. sheet of 18 gage (1.3mm) thick and 200mm wide can be used by the contractor as construction joints.

Alternatively, contractors can use G.I sheet 200mm wide and 18 gauge thick as construction joints.

34.0 Workmanship:

Water stops shall be cleaned before placing them in position. Oil or grease shall be removed thoroughly using water and suitable detergents. Water stops shall be procured in long lengths as manufactured to avoid joints as far as possible. Standard L or T type of intersection pieces shall be procured for use depending on their requirement. Any non-standard junctions shall be made by cutting the pieces to profile for jointing. Lapping of water stops shall not be permitted. All jointing shall be of fusion welded type as per manufacturer's instructions. Water stops shall be placed at the correct location/level and suitably supported at intervals with the reinforcement to ensure that it does not deviate from its intended position during concreting and vibrating. Care shall also be taken to ensure that no honey-combing occurs because of the serrations/end grips, by placing concrete with smaller size aggregates in this region. Projecting portions of the water stops embedded in concrete shall be thoroughly cleaned of all mortar/ concrete coating before resuming further concreting operations. The projecting water stop shall also be suitably supported at intervals with the reinforcement to maintain its intended position during concreting so as to ensure that it does not bend leading to formation of pockets. In addition, smaller size aggregates shall be used for concreting in this region also.

35.0 Preformed Fillers and Joint Sealing Compound:

Materials:

Preformed filler for expansion/isolation joints shall be non-extruding and resilient type of bitumen impregnated fibres conforming to IS:1838 (Part I).

Bitumen coat to concrete/masonry surfaces for fixing the preformed bitumen filler strip shall conform to IS:702. Bitumen primer shall conform to IS:3384.

Sealing compound for filling the joints above the preformed bitumen filler shall conform to Grade 'A' as per IS:1834.

Workmanship:

The thickness of the preformed bitumen filler shall be 25mm for expansion joints and 50mm for isolation joints around foundation supporting rotatory equipment's. Contractor shall procure the strips of the desired thickness and width in lengths as manufactured. Assembly of small pieces/thicknesses of strips to make up the specified size shall not be permitted.

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The concrete/masonry surface shall be cleaned free from dust and any loose particles. When the surface is dry, one coat of industrial blown type bitumen of grade 85/25 conforming to IS:702 shall be applied hot by brushing at the rate of 1.20 kg/m². When the bitumen is still hot the preformed bitumen filler shall be pressed and held in position till it completely adheres. The surface of the filler against which further concreting/masonry work is to be done shall similarly be applied with one coat of hot bitumen at the rate of 1.20 kg/m².

Sealing compound shall be heated to a pouring consistency for enabling it to run molten in a uniform manner into the joint. Before pouring the sealing compound, the vertical faces of the concrete joint shall be applied hot with a coat of bitumen primer conforming to IS: 3384 in order to improve the adhesive quality of the sealing compound.

Expansion joints between beams/slabs shall be provided with 100mm wide x 4mm thick mild steel plate at the soffit of RCC beams/slabs to support and prevent the preformed joint filler from dislodging. This plate shall be welded to an edge angle of ISA 50 x 50 x 6mm provided at the bottom corner, adjacent to the expansion joint of one of the beams/slabs, by intermittent fillet welding. Steel surfaces shall be provided with 2 coats of red oxide zinc chrome primer and 3 coats of synthetic enamel paint finish.

CONCRETE POUR CARD					
POUR NO.:				DATE:	
DRG. NO.:				STRUCTURE:	
CONCRETE GRADE/QUANTITY/:				MAX. AGGREGATE SIZE/	
SLUMP:				START / COMPLETION TIME:	
SL. NO	ITEM				Remarks If Any
1	BEFORE CONCRE	CENTRE LINE S CHECKED		YES/NO	
2		FORMWORK AND STAGING CHECKED FOR ACCURACY, STRENGTH & FINISH		YES/NO	
3		REINFORCEMENT CHECKED		YES/NO	
4		COVER TO REINFORCEMENT CHECKED		YES/NO	
5		VERIFIED TEST CERTIFICATE FOR CEMENT/STEEL		YES/NO	
6		ADEQUACY OF MATERIALS/ EQUIPMENT FOR POUR		YES/NO	
7		EMBED PARTS (LOCATION & PLUMB) CHECKED	CIVIL	YES/NO	
			MECH.	YES/NO	
			ELEC.	YES/NO	
8	SOFFIT(S) & POUR TOP(T) LEVELS CHECKED BEFORE (B) & AFTER (A) FORM REMOVAL			S(B)	
				T(B)	
				S(A)	

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CONCRETE POUR CARD			
		T(A)	
9	CONSTRUCTION JOINTS LOCATION & TYPE		
	EXPANSION JOINTS – LOCATION AND TYPE		
10	CEMENT CONSUMPTION IN KGS.		
10A	REINFORCEMENT CONSUMPTION DIA WISE IN KGS		
11	NUMBER OF CUBES AND IDENTIFICATION MARKS		
12	TEST CUBE RESULTS (7 DAYS / 28 DAYS)		
13	CONCRETE CONDITION ON FORM REMOVAL	V.GOOD/GOOD/FAIR/POOR	
Contractor's Representative		Engineer-in-charge's Representative	

NOTES: EACH POUR TO HAVE SEPARATE CARDS, IN TRIPLICATE ONE EACH FOR CLIENT, CONTRACTOR & SITE OFFICE.

UNDER REMARKS, INDICATE DEVIATIONS FROM DWGS. & SPECIFICATIONS, CONGESTION IN REINFORCEMENT IF ANY, UNUSUAL OCCURRENCES SUCH AS FAILURE OF EQUIPMENTS, SINKING OF SUPPORTS / PROPS. HEAVY RAINS AFFECTING CONCRETING, POOR COMPACTION, IMPROPER CURING, OTHER DEFICIENCIES, OBSERVATIONS ETC.

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SECTION: 3 EARTHWORKS

SPECIFICATIONS

EARTHWORK

Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

IS 3764 -1992	Excavation work-Code of Safety.
IS 2720	Methods of test for soils:
(Part-1)-1983	Part 1 Preparation of dry soil samples for various tests.
(Part-2)-1986	Part 2 Determination of Water Content.
(Part-4)-1985	Part 4 Grain size analysis.
(Part-5)-1985	Part 5 Determination of liquid and plastic limit.
(Part-7)	Part 7 Determination of water content-dry density relation using light
(Part-9)	Part 9 Determination of dry density -moisture by constant weight of soil method.
(Part-14)- 1983	Part 14 Determination of density index (relative density) of cohesionless soils.
(Part-22)- 1978	Part 22 Determination of organic matter.
(Part-26)- 1987	Part 26 Determination of pH Value.
(Part-27)- 1987	Part 27 Determination of total soluble sulphates.
(Part-28)- 1974	Part 28 Determination of dry density of soils in place by the sand replacement method.
(Part-33)- 1971	Part 33 Determination of the density in place by the ring and water
(Part-34)- 1972	Part 34 Determination of density of soil in place by rubber balloon method.
(Part-38)- 1976	Part 38 Compaction control test (Hilf Method).

General:

The contractor shall fill all the plots reserved for PS in this tender with selected and approved soil by engineer in charge up to plinth level.

The Contractor shall furnish all tools, plant, instruments, qualified supervisory personnel, labor, materials, any temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein for completion of the work in accordance with the Authority's Requirements.

The Contractor shall survey the site before excavation and set out all lines and establish levels for various works such as grading, 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 established reference/grid lines at 8m intervals or nearer, if necessary, based on ground profile and thereafter properly recorded.

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The excavation shall be carried out to correct lines and levels. This shall also include, where required, proper shoring to maintain excavations and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night.

Excavated material shall be dumped in regular heaps, bunds, riprap with regular slopes within the lead specified and leveling the same so as to provide natural drainage. Rock/soil & murrum excavated shall be stacked properly as approved by the TPQA / Officer In-Charge of the Authority. As a rule, all softer material shall be laid along the center of heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately. Top soil shall be stock piled separately for later re-use.

Clearing:

The area to be excavated / filled shall be cleared of fences, trees, plants, logs, stumps, bush, vegetation, rubbish, slush, etc. and other objectionable matter. If any roots or stumps of trees are encountered during excavation, they shall also be removed. The material so removed shall be disposed off as approved by the TPQA / Officer In-Charge of the Authority. Where earth fill is intended, the area shall be stripped of all loose/ soft patches, top soil containing objectionable matter/ materials before fill commences.

Excavation:

All excavation work shall be carried out by mechanical equipment unless, in the opinion of TPQA / Officer In-Charge of the Authority, the work involved requires it to be carried out by manual methods.

Excavation for permanent work shall be taken out to such widths, lengths, depths and profiles as are shown on the drawings provided by the Contractor or such other lines and grades as may be agreed with the TPQA / Officer In-Charge of the Authority. Rough excavation shall be carried out to a depth of 150mm above the final level. The balance shall be excavated with special care.

Soft pockets shall be removed below the final level and extra excavation filled up with lean concrete as approved by the TPQA / Officer In-Charge of the Authority. The final excavation should be carried out just prior to laying the blinding course.

To facilitate the permanent works the Contractor may excavate, and also backfill later, outside the lines shown on the drawings provided by the Contractor as agreed with the TPQA / Officer In-Charge of the Authority. Should any excavation be taken below the specified elevations, the Contractor shall fill it up with concrete of the same class as in the foundation resting thereon, up to the required elevation.

All excavations shall be to the minimum dimensions required for safety and ease of working. Prior approval of the TPQA / Officer In-Charge of the Authority shall be obtained by the Contractor in each individual case, for the method proposed for the excavation, including dimensions, side slopes, dewatering, disposal, etc. This approval shall not in any way relieve the Contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope.

Rock: General:

Rock' means a natural aggregate of mineral crystals, which for its excavation would normally require the use of heavy pneumatic/hydraulic breaker and/or cutting equipment or explosives. The term shall exclude any material that can be removed by ordinary excavating machinery and which in any individual mass has a volume not exceeding 1m³ or 0.25m³ where the net width of excavation is less than 2 m. Ordinary excavating machinery means a hydraulic back hoe with rated output of 50 kW or less.

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Before classification of material as rock the Contractor shall demonstrate to the satisfaction of the TPQA / Officer In-Charge of the Authority his inability to excavate it without resort to heavy percussion tools complete with rock bits, hydraulic wedges or blasting. Excavation by the use of explosive will not normally be permitted except for pipeline.

Material shall not be classified as rock unless the TPQA / Officer In-Charge of the Authority has agreed to such classification on the basis of such a demonstration before its excavation. Excavations where rock has been encountered and classified as such shall not be backfilled before examination of the excavated faces by the TPQA / Officer In-Charge of the Authority to enable the extent of the rock excavation to be determined.

Excavation by the Use of Explosives

Unless otherwise stated herein, I.S. Specification "IS: 4081: Safety Code for Blasting and related Drilling Operations" shall be followed. 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 excavation, in the soundest possible condition. The quantity and strength of explosives used shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by TPQA / Officer In-Charge of the Authority, shall be taken during the blasting operations and care shall be taken that no damage is caused to adjoining buildings or structures as a result of blasting operations. In case of damage to permanent or temporary structures, Contractor shall repair the same to the satisfaction of the TPQA / Officer In-Charge of the Authority. As excavation approaches its final lines and levels, the depth of the charge holes and number of explosives used shall be progressively and suitably reduced.

The contractor shall obtain a valid Blasting License from the authorities concerned. 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 possible from the area to be blasted. TPQA / Officer In-Charge of the Authority's prior approval shall be taken for the location proposed for the magazine.

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 blasting operations, the following points shall be observed.

- i) Contractor shall employ a competent and experienced supervisor and licensed blaster in-charge of 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 TPQA / Officer In-Charge of the Authority 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 200 m radius from the firing point, at least 15 minutes before firing time by sounding warning whistle. The area shall also be given a warning by sounding a distinguishing whistle.
- 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 TPQA / Officer In-Charge of the Authority; a trench shall have to be cut by chiseling 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 6 (six) holes at a time shall be set off successively. If the blasts do not tally with the number fired, the misfired holes shall be

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carefully located after half an hour and when located, shall be exploded by drilling a fresh hole along the misfired hole (but not nearer than 600 mm from it) and by exploding a new charge.

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 filled with stemming, which may consist of sand or stone dust or similar inert material.

vii) Contractor shall preferably detonate the explosives electrically.

viii) The explosives shall be exploded by means of a primer, which shall be fired by detonating a fuse instantaneous detonator (F.I.D) or other approved cables. The detonators with F.I.D. 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 gelatin with detonator and fuse wire may be used. Underwater or for excavation in rock with substantial accumulated seepage electric detonation shall be used.

x) Holes for charging explosives 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.

xii) Any rock excavation beyond an over break limit of 75 mm shall be filled up as instructed by TPQA / Officer In-Charge of the Authority, with concrete of strength not less than M10. Stopping in rock excavation shall be done by hand trimming.

xiii) Contractor shall be responsible for any accident to workmen, public or Authority's 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 as applicable at the place of excavation.

Stripping Loose Rock:

All loose boulders, detached rocks partially and other loose material which might move there with not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of TPQA / Officer In-Charge of the Authority, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion, which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of TPQA / Officer In-Charge of the Authority, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed.

Classification of Strata:

The decision regarding, classification of strata shall rest with the TPQA / Officer In-Charge of the Authority and his decision shall be final and binding to the contractor.

All the materials encountered in the excavation shall be classified as under: -

ORDINARY SOIL AND SOFT MURRUM:

These will include all materials of an earthy or sandy nature, which can be easily ploughed or small shingle, and gravel, which can be easily removed.

HARD MURRUM:

This shall include all kinds of disintegrated rock or shale or undated clay which can be removed with a shovel without difficulty and which do not require blasting.

SOFT ROCK:

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This shall include all materials which is rock or hard conglomerate, all decomposed and whether rock, highly fissured rock old masonry and also soft rock boulders bigger than 1/2 cubic meter and other varieties of rock. Which do not require blasting and which can be removed with the pie crowbars wedges and hammer.

HARD ROCK:

This shall include rocks, occurring in masses, which could best be removed by chiseling or by blasting.

Fill, Backfilling and Site Grading: General:

All fill material shall be subject to the TPQA / Officer In-Charge of the Authority's approval. If any material is rejected by TPQA / Officer In-Charge of the Authority, the Contractor shall remove the same forthwith from the site. Surplus fill material shall be deposited/disposed off as directed by TPQA / Officer In-Charge of the Authority after the fill work is completed.

No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with to the approval of the TPQA / Officer In-Charge of the Authority.

Material:

To the extent available, selected surplus spoil from excavation shall be used as backfill. Backfill material shall be free from lumps, organic or other foreign material. All lumps 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 murrum or earth to fill the voids and the mixture used for filling.

If fill material is required to be imported, the Contractor shall decide to bring such material from outside borrow pits. The material and source shall be subject to the prior approval of the TPQA / Officer In-Charge of the Authority. The approved borrow pit areas shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Topsoil containing foreign material shall be removed. The materials so removed shall be disposed of as directed by TPQA / Officer In-Charge of the Authority. The Contractor shall provide the necessary access roads to borrow areas and maintain the same if such roads do not exist.

Filling in pits and trenches around foundations of structures, walls, etc.

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 not exceeding 15 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of TPQA / Officer In-Charge of the Authority. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless the TPQA / Officer In-Charge of the Authority is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to a proper profile to the approval of the TPQA / Officer In-Charge of the Authority.

Plinth Filling:

Plinth filling shall be carried out with approved material as described hereinbefore in layers not exceeding 15 cm, watered and compacted with mechanical compaction machines. The TPQA / Officer In-Charge of the Authority may, however, permit manual compaction by hand tampers where he is satisfied that mechanical compaction is not possible. The finished level of the filling shall be trimmed to the level/slope specified.

The thickness of each unconsolidated fill layer can in this case be up to a maximum of 300 mm. The Contractor will determine the thickness of the layers in which fill has to be consolidated depending on the fill material and equipment used and the approval of the TPQA / Officer In-Charge of the Authority obtained prior to commencing filling.

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The compacted surface shall be properly shaped, trimmed and consolidated to an even and uniform gradient. All soft spots shall be excavated, then filled and consolidated.

Sand Filling in Plinth and Other Places:

Where backfilling is required to be carried out with local sand it shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water for 24 hours to ensure maximum consolidation. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the TPQA / Officer In-Charge of the Authority has inspected and approved the fill.

Filling in Trenches:

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipe and drains have been tested and passed. The backfilling material shall be properly consolidated taking due care so that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling up to a level 30 cm above the top of the pipe shall be done with fine materials such as earth, murrum, etc. The filling up to the level of the centerline of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the centerline of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

General Site Grading:

Site grading shall be carried out as indicated in the drawings and as approved by the TPQA / Officer In-Charge of the Authority. Excavations shall be carried out as specified in the Authority's Requirements. Filling and compaction shall be carried out as specified in above and elsewhere unless otherwise indicated below.

If no compaction is called for, the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 225 mm and leveled uniformly and compacted as indicated above, before the next layer is deposited.

To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by the Contractor.

Field compaction tests shall be carried out in each layer of filling until the fill to the entire height has been completed. This shall hold good for embankments as well. The fill will be considered as incomplete if the desired compaction has not been obtained.

The Contractor shall protect the earth fill from being washed away by rain or damaged in any other way, the Contractor shall remove the affected material and make good.

If so specified, the rock as obtained from excavation may be used for filling and leveling to indicate grades without further breaking. In such an event, filling shall be done in layers not exceeding 50 cms approximately. After rock filling to the approximate level, indicated above has been carried out, the void in the rocks shall be filled with finer materials such as earth, broken stone, etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken

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material and earth shall be laid and consolidation carried out by a 12-ton roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

Fill Density:

The compaction, under the plant road area and building plinths shall comply with minimum 95% compaction by Standard Proctor at moisture content differing not more than 4% from the optimum moisture content. The Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained. In other areas the soil should be backfilled and compacted suitably as specified by the TPQA / Officer In-Charge of the Authority.

Timber Shoring:

Closetimberingshallbedonebycompletelycoveringthesidesofthetrenchesandpitsgenerally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as approved by the TPQA / Officer In-Charge of the Authority. The boards shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal walling of strong wood at maximum 1.2 meter spacing, strutted with bullies or as approved by the TPQA / Officer In-Charge of the Authority. The length of the bully struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical walling, which in turn shall be suitably strutted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by the TPQA / Officer In-Charge of the Authority. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of excavations, trenches, pits, etc. from collapsing.

Timber shoring may also be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only under instructions from the TPQA / Officer In-Charge of the Authority.

The withdrawal of the timber shall be done carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded with, systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber.

In the case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of the TPQA / Officer In-Charge of the Authority. In all other respects, the Authority's Requirements for close timbering shall apply to open timbering.

In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. The load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut.

Dewatering:

The Contractor shall ensure that the excavation and the structures are free from water during construction and shall take all necessary precautions and measures to exclude ground/rain water so as to enable the works to be carried out in reasonably dry conditions in accordance with the construction planning. Sumps made for dewatering must be kept clear of the excavations/trenches required for further work. The method of pumping shall be approved by TPQA / Officer In-Charge of the Authority, but in any case, the pumping arrangement shall be such that there shall be no movement of

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subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction. The dewatering shall be continued for at least (7) seven days after the last pour of the concrete.

The Contractor shall, however, ensure that no damage to the structure results on stopping of dewatering.

The Contractor shall study the sub-soil conditions carefully and shall conduct any tests necessary at the site with the approval of the TPQA / Officer In-Charge of the Authority to test the permeability and drainage conditions of the sub-soil for excavation, concreting etc., below ground level.

The scheme for dewatering and disposal of water shall be approved by the TPQA / Officer In-Charge of the Authority. The Contractor shall suitably divert the water obtained from dewatering from such areas of site where a buildup of water in the opinion of the TPQA / Officer In-Charge of the Authority obstructs the progress of the work, leads to unsanitary conditions by stagnation, retards the speed of construction and is detrimental to the safety of men, materials, structures and equipment.

When there is a continuous inflow of water and the quantum of water to be handled is considered in the opinion of TPQA / Officer In-Charge of the Authority, to be large, a well point system- single stage or multi stage, shall be adopted. The Contractor shall submit to the TPQA / Officer In-Charge of the Authority, details of his well point system including the stages, the spacing, number and diameter of well points, headers etc., and the number, capacity and location of pumps for approval.

Rain Water Drainage:

Grading in the vicinity of excavation shall be such as to exclude rain/ surface water draining into excavated areas. Excavation shall be kept clean of rain and such water as the Contractor may be using for his work by suitably pumping out the same. The scheme for pumping and discharge of such water shall be approved by the TPQA / Officer In-Charge of the Authority.

SECTION: 4 ITEMWISE SPECIFICATIONS

GENERAL TECHNICAL SPECIFICATIONS

These specifications shall apply to all such road and bridge works as are required to be executed under the Contract or otherwise directed by the Engineer-in-Charge (hereinafter referred to as the Engineer). In every case, the work shall be carried out to the satisfaction of the Engineer and conform to the location, lines, dimensions, grades, and cross-sections shown on the drawings or as indicated by the Engineer. The quality of materials, processing of materials as may be needed at the site, salient features of the construction work and quality of finished work, measures for safety of workers and public and traffic arrangements during execution shall comply with the requirements set forth in succeeding sections. Where the drawings and Specifications describe a portion of the work in only general terms, and not in complete detail, it shall be understood that only the sound engineering practice is to prevail, materials and workmanship of the best quality are to be employed and the instructions of the Engineer are to be fully complied with.

The latest edition of all specifications/standards till 3 months before the final date of submission of the tender, shall be adopted.

DEFINITIONS

The words like Contract, Contractor, Engineer (synonymous with Engineer-in-Charge), Drawings, Employer, Government, Works and Work Site used in these Specifications shall be considered to have the meaning as understood from the definitions of these terms given in the General Conditions of Contract.

AASHTO:	American Association of State Highway and Transportation Officials
ASTM:	American Society for Testing and Materials
BS:	British Standard published by the British Standards Institution
BIS:	Bureau of Indian Standards
BOQ:	Bill of Quantities
CBR:	California Bearing Ratio
IRC:	Indian Roads Congress
IS:	Indian Standard published by the Bureau of Indian Standards
QA:	Quality Assurance
MoRT&H:	Ministry of Road Transport and Highways
BAUDA:	Bharuch Ankleshwar Urban Development Authority

PUBLIC UTILITIES

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The contractor shall be responsible to coordinate with service provider/ concerned authorities for shifting of utilities and removal of encroachments etc. and making the site unencumbered from the project construction area required for completion of work. This shall include initial and frequent follow-up meetings / actions / discussion with each involved service provider / concerned authorities. The contractor will not be entitled to any additional compensation for the delay in shifting of utilities and removal of encroachments by the service provider / concerned authorities.

The information contained in the Bid Documents concerning the public utility services such as water, sewer, power transmission lines, telephone lines and oil/gas pipelines, OFC cables, etc. may not be exhaustive, and it shall be the responsibility of the Contractor to ascertain the utilities that are likely to be affected by the works through site investigations and collection of information from the concerned utility owners. In addition to that the contractor shall arrange metal detector for locating underground utilities exist beneath the existing areas and should take care of such utilities so that such services can be saved from damages.

Any utility likely to be affected by Contractor's work should be brought to the notice of the Engineer in-charge and such work shall be undertaken only after getting written clearance from the Engineer in-charge.

The Contractor may be required to carry out certain works for and on behalf of the various bodies and the Contractor shall also provide, with the prior approval of the Engineer, such assistance to the various bodies as may be authorized by the Engineer.

Arrangement for traffic during construction

General

The Contractor shall at all times, carry out work on the highway in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. For all works involving improvements to the existing highway, the Contractor shall, in accordance with the directives of the Engineer, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement or along a temporary diversion constructed close to the highway. Before taking up any construction or maintenance operation, the Contractor shall prepare a Traffic Management Plan for each work zone and submit it to the Engineer for prior approval. This plan should include inter alia

- i) A qualified safety officer with support staff to serve as a site safety team
- ii) Provision of traffic safety devices as per IRC:SP 55 with the following specifications
 - a) Signages of retro-reflective sheet of high intensity grade\
 - b) Delineators in the form of cones/drums made of plastic/rubber having retro-reflective red and white bands, at a spacing of 5 m long with a reflective tape to be tied in between the gaps of cones/drums. A bulb using solar energy is to be placed on the top of the cone/drum for delineation in the dark hours and night.
 - c) Barricades using iron sheet with adequate iron railing/frame painted with retro-reflective paint in the alternate yellow and black & white stripes. Warning lights at 5 m spacing shall be mounted on the barricades and kept lit in dark hours and night.
 - d) Road markings with hot applied thermoplastic paint with glass beads.
- iii) Safety measures for the workers engaged including personal protection equipment

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- iv) First aid and emergency response arrangements
- v) Details and drawings of arrangements in compliance with other sub-Sections of this Section.

Traffic Safety and Control

Before commencement of any construction, the Contractor shall prepare and submit details of the arrangements he proposes to make for passing traffic during construction, design of barricades, signs, markings, lights, flags etc. and get the same approved by the Engineer.

The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen as per the traffic management plan submitted by the Contractor and approved by the Engineer, referred to in Sub-Section 112.1. Before taking up any construction, an agreed phased programme for the diversion of traffic on the highway shall be drawn up in consultation with the Engineer.

The barricades erected on either side of the carriageway/portion of the carriageway closed to traffic, shall be of strong design to resist violation, and painted with alternate black and white stripes. Red lanterns or warning lights of similar type shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise.

At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriageway) the channel for traffic shall be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the Engineer. At night, the passage shall be delineated with lanterns or other suitable light source.

One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns/ lights.

On both sides, suitable regulatory/warning signs as approved by the Engineer shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be of approved design and of reflective type, as directed by the Engineer.

FIELD LABORATORY

The Contractor shall arrange to provide fully furnished and adequately equipped field laboratory. The field laboratory shall preferably be located adjacent to the site office of the Engineer and provided with amenities like water supply, electric supply etc. as for the site office of the Engineer in Section 120.2.

The floor space for the field laboratory shall include space for the storage of samples. The remaining space shall be provided for the installation of equipment, laboratory tables and cup boards, working space for carrying out various laboratory tests, besides a wash basin, toilet facility and a curing tank for the curing of samples, around 4 m x 2 m x 1 m in size and a fume chamber. Wooden/concrete working table with a working platform area of about 1 m x 10 m shall be provided against the walls, also providing wooden cupboards above and below the working tables to store accessories such as, sample moulds etc. At least 4 racks of slotted angles and M.S. sheets the size 1800 mm x 900 mm x 375 mm and at least 6 stools for laboratory test operators of Godrej or equivalent make shall also be provided

There shall also be provided a concrete paved area, for storing samples adjacent to the laboratory, of about 300 sqft and another 200 sqft shall be suitably roofed with open sides giving protection against sun and rain.

Within 14 (fourteen) days of the commencement date, the Contractor shall prepare and submit a layout plan and details of the laboratory building and make/supplier of the equipment to the Engineer for his approval.

The field laboratory to be provided under the Contract shall be ready and finished and fully equipped condition not later than 2 months after the receipt of Notice to Commence Work, and the field laboratory with all equipment/instrument shall be to the entire satisfaction of the Engineer. During the period specified, the laboratory tests shall be performed in another laboratory proposed by the Contractor and approved by the Engineer.

Laboratory Equipment

The following items of laboratory equipment as a minimum shall be provided in the field laboratory:

The equipment and instruments shall be new and shall be quality certified by Bureau of Indian Standards (BIS). **All the laboratory equipment's measuring load/ displacement should have digital display.**

Sr. No	Sub No.	Item, Specifications	Nos. required
		A: General	
(i)		Balance	
	(a)	7 kg to 10 kg capacity semi –self indicating Electronic Type –Accuracy 1 gm	2
	(b)	500 gm capacity semi-self indicating Electronic Type – Accuracy 0.01 gm	1
	(c)	Pan balance 10 kg capacity – Accuracy 0.5 gm	6
	(d)	Platform Scale – 300 kg capacity	1
(ii)		Ovens – Electrically operated, thermostatically controlled	
	(a)	From 100°C to 220°C – Sensitivity	2
(iii)		Sieves, as per IS 460-1962	
	(a)	IS Sieves 450 mm internal dia. of sieve sets as per BIS of required sieve sizes complete with lid and pan	2 set

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Sr. No	Sub No.	Item, Specifications	Nos. required
	(b)	IS sieve 200 mm internal dia. (brass frame and steel or brass wire cloth mesh) consisting of sieve sets of required sieve sizes complete with lid and pan	2 set
(iv)		Sieve shaker capable of taking 200 mm and 450 mm dia. Sieves electrically operated with time switch assembly (As per BIS)	1
(v)		200 tonnes compression testing machine	1
(vi)		Stop watches 1/5 sec. Accuracy	2
(vii)		Glassware comprising of Beakers, Pipettes, dishes, measuring cylinders (100 to 1000 cc capacity) glass rods and funnels, glass thermometers range 0°C to 100°C and metallic thermometers range 300°C	6 each
(viii)		Hot plates 200 mm dia (1500 watt)	2
(ix)		Enamel trays	
	(a)	600 mm x 450 mm x 50 mm	10
	(b)	450 mm x 300 mm x 40 mm	10
	(c)	300 mm x 250 mm x 40 mm	6
	(d)	Circular plates of 250 mm dia.	6
(x)		Water Testing Kit	1
(xi)		First aid Box	1
		B: For Soils	
(i)		Water still	1
(ii)		Liquid limit device with Casagrande and ASTM grooving tools as per IS: 2720	1
(iii)		Sampling pipettes fitted with pressure and suction inlets, 10 ml Capacity	2 set
(iv)		Compaction apparatus (Proctor) as per IS:2720 (Part 8) complete with collar, base plate and hammer	1 set
(v)		Modified AASHTO compaction apparatus as per IS. 2720 (Part 7) 1974 or Heavy Compaction Apparatus as per IS complete with collar, base plate and hammer	1 set
(vi)		Sand pouring cylinder with conical funnel and tap and complete as per IS 2720 (Part 28) 1974 including modified equipment	6
(vii)		Sampling tins with lids 100 mm diameter x 75 mm ht 1/2 kg capacity and miscellaneous items like moisture, tins with lid (50 grams) etc.	12
(viii)		Lab CBR testing equipment for conducting CBR testing, load frame with 5 Ton capacity, electrically operated with speed control as per IS:2720 (Part 16), and consisting of following:	1 set
	(a)	CBR moulds 150-mm diameter – 175-mm ht complete with collar, base plate etc.	12
	(b)	Tripod stands for holding dial gauge holder	12
	(c)	CBR plunger with settlement dial gauge holder	1
	(d)	Surcharge weight 147-mm diameter 2.5 kg. wt with central hole	12
	(e)	Spacer disc 148-mm dia, 47.7-mm ht. With handle	12
	(f)	Perforated plate (Brass)	12
	(g)	Soaking tank for accommodating 6 CBR moulds	
	(h)	Proving rings of 1000 kg, 2500 kg and 5000 kg capacity	1 each
	(i)	Digital Dial gauges	10
(ix)		Standard Penetration test equipment	1
(x)		Nuclear Moisture Density Meter or equivalent	2
(xi)		Speedy moisture meter complete with chemicals	6
(xii)		Unconfined compression test apparatus	1 set

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Sr. No	Sub No.	Item, Specifications	Nos. required
		C: For Cement, Cement Concrete and Materials	
(i)		Water still	1
(ii)		Vicat needle apparatus for setting time with plungers, as per IS. 269-1967	1
(iii)		Moulds	
	(a)	150 mm x 300 mm ht cylinder with capping component	12
	(b)	150mmx150 mm x150mm cubical for compressive strength	60
	(c)	150mmx150 mm x700mm beam for flexural strength	30
(iv)		Concrete permeability apparatus	1
(v)		High frequency mortar cube vibrator for cement testing	1
(vi)		Concrete mixer power driven, 1 cu ft capacity	1
(vii)		Variable frequency and amplitude vibrating table size 1 metre x 1 metre, as per the relevant British Standard	1
(viii)		Flakiness & Elongation test apparatus	2
(ix)		Aggregate impact test apparatus as per IS 2386 (Part 4) 1963	2
(x)		Los Angeles abrasion apparatus as per IS. 2386 (Part 4) 1963	1
(xi)		Flow table as per IS 712-1973	1
(xii)	(a)	Equipment for slump test	4
	(b)	Compaction factor test equipment	1
(xiii)		Equipment for determination of specific gravity for fine and coarse aggregate as per IS 2386 (Part 3) 1963	2
(xiv)		Flexural attachment to compression testing machine	1
(xv)		Core cutting machine with 150 mm dia. Diamond cutting edge	2
(xvi)		Needle vibrator	1
(xvii)		Vibrating hammer as per BS specification	1
(xviii)		Air entrainment meter	1
(xix)		0.5 Cft, 1 Cft cylinder for checking bulk density of aggregate with tamping rod	1
(xx)		Soundness testing apparatus for cement	1
(xxi)		Flexural Beam testing machine with accessories	1
		E: For Control of Profile and Surface Evenness	
(i)		Digital Level complete with all accessories	1
(ii)		Auto level	4
(iii)		Aluminum staff	8
(iv)		Total Station with all accessories	2
(v)		3 metres straight edge and measuring wedge	2 sets
(vi)		Camber templates 2 lane	
	(a)	Crown type cross-section	2 set s
	(b)	Straight run cross-section	2 sets
(vii)		Steel tape	
	(a)	5 m long	as reqd.
	(b)	10 m long	as reqd.
	(c)	20 m long	as reqd.
	(d)	30 m long	as reqd.
	(e)	50 m long	as reqd.

Note :

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1. The laboratory set-up must be complete including a set of reference standards, adequately staffed and operational to the satisfaction of the Engineer before commencement of the works.
2. Following survey instruments from item in E above shall be made available exclusively for the use of Engineer during the tenure of the contract.
 - i) Auto level – 2 nos.
 - ii) Total station – 1 set
 - iii) Aluminum staff – 4 nos.

Maintenance

“The Contractor shall arrange to maintain the field laboratory including sample store yards in a satisfactory manner until the issue of Taking over Certificate for the complete work. Maintenance includes all activities described in Clause 120.4 and maintenance of equipment and running of the same including chemicals and consumables.”

Rate

The construction, supply, installation, maintenance, and operation including all expenses involved in connection thereto for the field laboratory shall be incidental to the work and shall not be paid for separately.

ITEM WISE DETAILED TECHNICAL SPECIFICATION FOR CIVIL WORKS

Item No. 01:- Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials (C) By mechanical means in area of light jungle.

CLEARING AND GRUBBING :

1 Scope

This work shall consist of cutting, removing and disposing of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness, rubbish etc., which in the opinion of the Engineer are unsuitable for incorporation in the works, from the area of road land containing road embankment, drains, cross drainage structures and such other areas as may be specified on the drawings or by the Engineer. It shall include necessary excavation, backfilling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging, and disposal of cleared materials with all leads and lights. Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these Specifications.

2 Preservation of Property/Amenities

Roadside trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers and all highway facilities within or adjacent to the highway which are not to be disturbed shall be protected from injury or damage. The Contractor shall provide and install at his own cost, suitable safeguards approved by the Engineer for this purpose.

During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional works to that effect vide Clause 306. Before start of operations, the Contractor shall submit to the Engineer for approval, his work plan including the procedure to be followed for disposal of waste materials, etc., and the schedules for carrying out temporary and permanent erosion control works as stipulated in Clause 306.3.

3 Methods, Tools and Equipment

Only such methods, tools and equipment as are approved by the Engineer and which will not affect the property to be preserved shall be adopted for the Work. If the area has thick vegetation/roots/trees, a crawler or pneumatic tyred dozer of adequate capacity may be used for clearance purposes. The dozer shall have ripper attachments for removal of tree stumps. All trees, stumps, etc., falling within excavation and fill lines shall be cut to such depth below ground level that in no case these fall within 500 mm of the subgrade. Also, all vegetation such as roots, under-growth, grass and other deleterious matter unsuitable for incorporation in the embankment/subgrade shall be removed between fill lines to the satisfaction of the Engineer. All branches of trees extending above the roadway shall be trimmed as directed by the Engineer.

All excavations below the general ground level arising out of the removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface at these points conform to the surrounding area.

Ant-hills both above and below the ground, as are liable to collapse and obstruct free subsoil water flow shall be removed and their workings, which may extend to several metres, shall be suitably treated.

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4 Disposal of Materials

All materials arising from clearing and grubbing operations shall be taken over and shall be disposed of by the Contractor with all leads and lifts. The rates deemed to include credit towards value of usable materials and salvage value of unusable materials. The offset price of cut trees and stumps as per guidelines/ estimates of State Forest Department shall be deducted from the amount due to the Contractor and deposited with the State Forest Department. The rate is deemed to account for this off-set price also.

5 Measurements for Payment

Clearing and grubbing for road embankment, drains and cross-drainage structures shall be measured on area basis in terms of hectares. Clearing and grubbing of borrow areas shall be deemed to be a part of works preparatory to embankment construction and shall be deemed to have been included in the rates quoted for the embankment construction item and no separate payment shall be made for the same. Cutting of trees upto 300 mm in girth including removal of stumps and roots, and trimming of branches of trees extending above the roadway shall be considered incidental to the clearing and grubbing operations.

Cutting of trees, excluding removal of stumps and roots of trees of girth above 300 mm shall be measured in terms of number according to the sizes given below :-

- i) Above 300 mm to 600 mm
- ii) Above 600 mm to 900 mm
- iii) Above 900 mm to 1800 mm
- iv) Above 1800 mm

Removal of stumps and roots including backfilling with suitable material to required compaction shall be a separate item and shall be measured in terms of number according to the sizes given below:-

- i) Above 300 mm to 600 mm
- ii) Above 600 mm to 900 mm
- iii) Above 900 mm to 1800 mm
- iv) Above 1800 mm

For the purpose of cutting of trees and removal of roots and stumps, the girth shall be measured at a height of 1 metre above ground or at the top of the stump if the height of the stump is less than one metre from the ground.

6. Rates

1. The Contract unit rates for one hector for the various items of clearing and grubbing shall be payment in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work. These will also include removal of stumps of trees less than 300 mm girth excavation and back-filling to required density, where necessary, and handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads. Ground levels shall be taken prior to and after clearing and grubbing. Levels taken prior to clearing and grubbing shall be the base level and will be accordingly used for computation of quantity of material arising due to clearing and grubbing, including the computation of unsuitable material, if any, which may be required to be removed as per the approval of the Engineer. The levels taken subsequent to clearing and grubbing shall be the base level for computation of earthwork for embankment. Clearing and grubbing shall be restricted to 150 mm only for payment purpose. Where clearing and grubbing is done a level beyond 150 mm, the excess excavation shall be made good as per Clause 301.3.3 and 301.6 to the satisfaction of the Engineer prior to taking up earthwork. This shall not be paid and shall be treated as part of clearing and grubbing.

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2 .The Contract unit rate for cutting trees of girth above 300 mm shall include handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads.

3 .The Contract unit rate for removal of stumps and roots of trees girth above 300 mm shall include excavation and backfilling with suitable material to required compaction, handling, giving credit towards salvage value disposing of the cleared materials with all lifts and leads.

4 .The Contract unit rate is deemed to include credit towards value of usable materials and salvage value of unusable materials. The off-set price of cut trees and stumps as per guidelines/ estimates of State Forest Department shall be deducted from the amount due to the Contractor and deposited with the State Forest Department. The rate is deemed to account for this off-set price also.

5 .Where a Contract does not include separate items of clearing and grubbing, the same shall be considered incidental to the earthwork items and the Contract unit prices for the same shall be considered as including clearing and grubbing operations.

6.Unit of measurement is Hectare.

Item No: 02:- Excavation for foundation in Loose or Soft soil upto 1.50 m depth including sorting out and stacking of useful materials and disposing off the excavated stuff with all lead and lift as directed by Engineer in charge.

SCOPE :

This specification covers the general requirements of earthwork in excavation in different materials, site grading, filling in areas as shown in drawing, filling back around foundations and in plinths, conveyance and disposal of surplus soils or stacking them properly as shown on the drawings and as directed by the Engineer and all operations covered within the intent and purpose of this specification.

APPLICABLE CODES:

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

IS : 1200	-	Method of measurement of building and civil engineering works.
(Part 1)		Part 1 Earthwork
(Part 27)		Part 27 Earthwork done by mechanical appliances.
IS : 3764-1992	-	Excavation work-code of safety
IS : 2720	-	Methods of test for soils
(Part 1)-1973	-	Part 1 Preparation of dry soil samples for various tests.
(Part 2)-1986	-	Part 2 Determination of water content
(Part 4)	-	Part 4 Grain size analysis
(Part 5)	-	Part 5 Determination of liquid and plastic limit

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- (Part 7) - Part 7 Determination of water content-dry density relation using light compaction.
- (Part 9) - Part 9 Determination of dry density-moisture content relation by constant weight of soil method.
- (Part 14) - Part 14 Determination of density index (relative density) of cohesion less soils.
- (Part 28) - Part 28 Determination of dry density of soils in place, by the sand replacement method.
- (Part 33) - Part 33 Determination of the density in place by the ring and water replacement method.
- (Part 34) - Part 34 Determination of density of soil in place by rubber balloon method.
- (Part 38) - Part 38 Compaction control test (Hilf Method).

DRAWINGS:

The Engineer will furnish drawings wherever, in his opinion, such drawings are required to show areas to be excavated/filled grade level, sequence of priorities etc. The Contractor shall follow strictly such drawings.

GENERAL :

- 1.0 The Contractor shall furnish all tools, plants, instruments, qualified supervisory personnel, labour, materials any temporary works, consumables, any and everything necessary, whether or not such items are specifically stated herein for completion of the job in accordance with the specification requirements.
- 1.1 The contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for grading, 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 established reference/grid lines at 15 m. intervals or nearer as determined by the Engineer based on ground profile. These shall be checked by the Engineer and thereafter properly recorded.
- 1.2 The excavation shall be done to correct lines and levels. This shall also include, where required, proper shoring to maintain excavations and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for ensuring safety.
- 1.3 The rates quoted shall also include for dumping of excavated materials in regular heaps, burs, riprap with regular slopes as directed by the 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 the Engineer. As a rule, all softer material shall be laid along the center of heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.
- 1.4 The topsoil shall be stock piled for later re-use.

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CLEARING :

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

PRECIOUS OBJECTS, RELICS, OBJECTS OF ANTIQUITY, ETC. :

All gold, silver, oil, minerals, archaeological and other findings of importance, trees cut or other materials of any description and 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 the Owner and the Contractor shall duly preserve the same to the satisfaction of the Owner and from time to time deliver the same to such person or persons as the Owner may from time to time authorize or appoint to receive the same.

CLASSIFICATION :

All materials to be excavated shall be classified by the Engineer, into one of the following classes and shall be paid for at the rate tendered for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of the Engineer regarding the classification of the material shall be final and binding on the Contractor and not be a subject matter of any appeal or arbitration.

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

(a) Ordinary and Hard Soils

These shall include all kinds of soils containing kankar, sand, silt, murrum and/or shingle, gravel, clay, loam, peat, ash, shale, etc., which can generally be excavated by spade, pick axes 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 longer than 1 metre in any one direction and not more than 200 mm in any one of the other two directions.

(b) Soft and Decomposed Rock

This shall include rock, boulders, slag, chalk, slate, hard micascist, laterite and all other materials which in the opinion of Engineer is rock, but does not need blasting and could be removed with picks, hammer, crow bars, wedges, and pneumatic breaking equipment. The mere fact that the Contractor resorts to blasting for reasons of his own, shall not qualify for classification under ‘Hard Rock’.

This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock boulders not longer than 1 meter in any direction and not more than 500 mm in any one of the other two directions. Masonry to be dismantled will also be measured under this item.

(c) Hard Rock

This shall include all rock occurring in large continuous masses which cannot be removed except by blasting for loosening it. Harder varieties of rock with or without veins and secondary minerals which, in the opinion of the Engineer require blasting shall be considered as hard rock. Boulders of rock occurring in such sizes and not classified under (a) and (b) above shall also be classified as hard rock. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item, unless a separate provision is made in the Schedule of Quantities.

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EXCAVATION :

All excavation work shall be carried out by mechanical equipment unless, in the opinion of the Engineer, the work involved and time schedule permit manual work.

Excavation for permanent work shall be taken out to such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by the Engineer. Rough excavation shall be carried out to a depth 150 mm above the final level. The balance shall be excavated with special care. Soft pockets shall be removed even below the final level and extra excavation filled up as directed by the Engineer. The final excavation if so instructed by the Engineer, should be carried out just prior to laying the mud-mat.

The Contractor may, for facility of work or similar other reasons excavate, and also backfill later, if so approved by the Engineer, at his own cost outside the lines shown on the drawings or directed by the Engineer. Should any excavation be taken below the specified elevations, the Contractor shall fill it up, with concrete of the same class as in the foundation resting thereon, upto the required elevation. No extra shall be claimed by the Contractor on this account.

All excavation shall be done to the minimum dimensions as required for safety and working facility. Prior approval of the Engineer shall be obtained by the Contractor in each individual case, for the method he proposes to adopt for the excavation, including dimensions, side slopes, dewatering, disposal, etc. This approval, however, shall not in any way relieve the Contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for if the slips are due to the negligence of the Contractor.

Excavation shall be carried out with such tools, tackles and equipment as described hereinbefore. Blasting or other methods may be resorted to in the case of hard rock; however not without the specific permission of the Engineer.

The Engineer may also direct that in some extreme case, the rock may be excavated by heating and sudden quenching for splitting the rock. Firewood shall be used for burning and payment shall be made for such work as called for in the schedule of quantities.

STRIPPING LOOSE ROCK :

All loose boulders, semi detached rocks (along with earthy stuff which might move therewith) not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of the Engineer, to fall or otherwise endanger the workmen, equipment, or the work, etc., shall be stripped off and removed away from the area of the excavation. The method used shall be such as not to shatter, or render unstable or unsafe the portion which was originally sound and safe.

Any material not requiring removal as contemplated in the work, but which, in the opinion of the Engineer, is likely to become loose or unstable later shall also be promptly and satisfactorily removed as directed by the Engineer. The cost of such stripping will be paid for at the unit rates accepted for the class of materials in question.

TIMBER SHORING :

SCOPE

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This specification covers the general requirements of timber shoring for excavation of trenches, pits, open excavation etc.

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as directed by Engineer. The boards shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal walling of strong wood at maximum 1.2 metres spacing's, strutted with ballies or as directed by Engineer. The length of the ballie struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical walling, which in turn shall be suitably strutted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by engineer. It shall be the responsibility of contractor to take all necessary steps to prevent the sides of excavations, trenches, pits, etc., From collapsing.

Timber shoring may be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only under instructions from Engineer.

The withdrawal of the timber shall be done very carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded with systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber. No claim shall be entertained for any timber which cannot be withdrawn and is lost or buried.

In the case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of Engineer. In all other respects, specification for close timbering shall apply to open timbering.

In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking for sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. Load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut. If, however, Engineer directs any timbering to be left-in, keeping in mind the type of construction or any other factor.

MODE OF MEASUREMENT:

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 / structures to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. Excavation in side slopes will not be paid for. The Contractor may make such allowance in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety or excavation. Reasonable working space, beyond concrete dimensions and shuttering where considered necessary in the opinion of the Engineer will be allowed in excavation and considered for payment. However, if concreting is proposed against the excavated sides, no such over-excavation will be permitted. In such cases over-excavation shall be made good by the Contractor with concrete of the same class as in the foundations at his cost.

Trench excavation for pipelines shall be measured using the dimensions detailed in the standard section shown on the Drawings. Excavation beyond the widths or depths required will not be paid for, any additional concrete or bedding material required as a result of over-excavation at the Contractor's expense.

Measurement shall be made on cubic meter basis.

Item No: 03:- Excavation for foundation in Loose or Soft soil from 1.50 m.to 3.00 m. depth including sorting out and stacking of useful materials and disposing off the excavated stuff with all lead and lift as directed by Engineer in charge.

Any soil which generally require close application of picks or jumpers or scarifiers to. loosen it stiff clay, gravel and stone etc. fall under this category.

WORKMANSHIP :

The relevant technical specifications of ITEM NO: 02 shall be followed except that the excavation work shall be carried out in loose or soft soil.

MODE OF MEASUREMENTS & PAYMENT :

The relevant mode of measurement & payment of ITEM NO: 02 shall be followed.

The rate shall be for unit of one cubic meter.

Item No: 04:- Excavation for foundation in Loose or Soft soil from 3.00 m. to 5.00 m. depth including sorting out and stacking of useful materials and disposing off the excavated stuff with all lead and lift as directed by Engineer in charge.

Any soil which generally require close application of picks or jumpers or scarifiers to. loosen it stiff clay, gravel and stone etc. fall under this category.

WORKMANSHIP :

The relevant technical specifications of ITEM NO: 02 shall be followed except that the excavation work shall be carried out in loose or soft soil.

MODE OF MEASUREMENTS & PAYMENT :

The relevant mode of measurement & payment of ITEM NO: 02 shall be followed.

The rate shall be for unit of one cubic meter.

Item No: 05:- Earthwork for embankment including breaking clods, dressing with all lead and lift and including watering rolling and consolidation of subgrade in layers at O.M.C. to required dry density including filling the depression which occur during the process using power roller 8T to 10T.(E) From Borrow area within 3.0KM. lead

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This work shall be consisting of laying and compacting embankment of selected soil brought from outside other than GIDC land. The embankment shall be constructed in accordance with the requirement of these specifications and in conforming with lines, grades and cross sections shown on the drawing or as directed by Engineer in charge.

1) MATERIALS:

Soil

The selected soil shall be obtained from outside sources/area other than GIDC land. The contractor will have to make his own arrangement to get sources /area for obtaining the selected soil of approved quality with all lead and lifts at his own cost. The general specifications for collection of road materials attached here with shall also followed.

The source / quarries arranged by the contractor to obtain the selected soil shall have got approved from the Executive Engineer prior to use in the work.

The sample of selected soil collected from approved quarries shall be got tested at Govt. recognized laboratory as may be directed to the contractor at his own cost. The results shall conform to the standard requirement set down hereunder. The selected soil of the approved quality shall be only permitted for use in the work.

Fly-Ash

Use of fly-ash shall conform to the Ministry of Environment and Forest guidelines. Where fly-ash is used the embankment construction shall conform to the physical and chemical properties and requirements of IRC:SP:38-2001, "Guidelines for Use of Fly ash in Road Construction". The term fly-ash shall cover all types of coal ash such as pond ash, bottom ash or mound ash.

Embankment constructed out of fly ash shall be properly designed to ensure stability and protection against erosion in accordance with IRC guidelines. A suitable thick cover may preferably be provided at intervening layers of pond ash for this purpose. A thick soil cover shall bind the edge of the embankment to protect it against erosion. Minimum thickness of such soil cover shall be 500 mm.

Lime

Lime for lime-soil stabilization work shall be commercial dry lime slaked at site or pre-slaked lime delivered to the site in suitable packing. Unless otherwise permitted by the Engineer, the lime shall have purity of not less than 70 percent by weight of Quick-lime (CaO) when tested in accordance with IS:1514. Lime shall be properly stored to avoid prolonged exposure to the atmosphere and consequent carbonation which would reduce its binding properties.

GENERAL REQUIREMENTS:

The material to be used for the work shall be natural murrum / soil. The selected soil shall be free from logs/stumps, roots, rubbish or any other matter likely to deteriorate or to affect the stability of the embankment / Sub grade.

If inferior quality of selected soil is used in the work, same shall be removed by the contractor at his own cost.

PHYSICAL REQUIREMENT :

The selected soil shall conform to the physical requirement set forth in table below.

TABLE

Sr.No.	Kind of material	Requirement
1	Selected soil	Maximum laboratory dry unit weight when tested as per IS-2720 (Part-A) value not less than 15.2 KN/Cum. Mini CBR 8%.

The Engineer-in-charge may however relax this requirement by taking into account the availability of materials for construction and other relevant factors.

2) CONSTRUCTION OPERATIONS:

SITE CLEARANCE:

Immediately prior to the laying of selected soil, original ground/Sub-grade/ Sub- base shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water if necessary and rolled with one or more pass of 80/100 KN static weight vibratory roller, with plain drum or heavy pneumatic tired roller of minimum 200/300 KN weight having a minimum tire pressure of 0.70 MN/m² as directed by the Engineer-in-charge. The relevant specification of M.O.R.T. & H. clause No.201 shall also be followed.

SETTING OUT:

After clearing the site or preparing the sub-grade/sub-base, the alignment of the road shall be properly set out true to lines curves, slopes, grades and sections as shown in the plan or as directed by the Engineer-in-charge. The contractors shall provide all labours and materials such as lime, string, pegs, nails, bamboos, stones, mortar, concrete etc. required for setting out, establishing temporary & permanent bench marks center line stones & other marks and giving profiles, alignments and other marks, as long as they are required for the marks and long as opinion of the Engineer-in-charge.

DEWATERING:

M.O.R.T. & H. Clause No.305.3.2 shall be followed.

COMPACTING GROUND SUPPORTING EMBANKMENT/SUB-GRADE:

The original ground shall be leveled to facilitate placement of first layer of embankment mix with water & then compacted by rolling so as to achieve minimum dry density.

SPREADING MATERIALS IN LAYERS & BRINGING TO APPROPRIATE MOISTURE CONTENT:

Earth work shall not be proceeded until the foundation of embankment have been inspected by the Engineer-in-charge for satisfactory condition and approval.

The selected soil shall be spread on the prepared building foundation with the help of a drag spreader, motor graders or other approved means. The thickness of loose layers shall be so regulated that the maximum thickness of the each layer after consolidation does not exceed 200 mm or required thickness, shown on the drawing or as directed by the Engineer-in-charge. Successive layers of soil shall not be placed until the layer under construction has been thoroughly compacted to the requirements set down hereunder and accepted by the

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Engineer in charge. The motor grader blade shall have hydraulic control suitable for initial adjustment and maintain the same so as to achieve specific slope and grade.

The operation of laying the successive layers of selected soil shall have to be suitably synchronized with the consolidation work.

Moisture content of the selected soil shall be checked at the site of placement prior to commencement of compaction, if found to be out of agreed limit, the same shall be made good. Where water is required to be added in such construction, water shall be sprinkled from a water tanker fitted with sprinkle capable of applying water uniformly with a controllable rate of flow to variable widths of surface but without any flooding. The water shall be added uniformly & thoroughly mixed in murrum by blading, discing or harrowing until a unit of moisture content is obtained through out the depth of the layer.

If the selected soil delivered to the building bed is too wet, it shall be dried, by aeration and exposure to the sun, till the moisture content is acceptable for compaction. Such circumstances arises, where owing to wet weather the moisture content cannot be reduced to the required amount by the above procedure, compaction shall be suspended.

Moisture content of the each layer of selected soil shall be checked in accordance with IS: 2720 (Part-2) and unless otherwise mentioned, shall be so adjusted, making due allowances for evaporation losses, that at the time of compaction, it is in the range of 1 percent above to 2 percent below the optimum moisture content determined in accordance with corresponding to IS : 2720 (Part-7) of IS : 2780 (Part – 8). After water has been added the material shall be processed by mechanical or other approved means if so directed by the Engineer-in-charge until the layer is uniformly wet confirming to M.O.R. T. & H. specification clause no. 305.3.5.2

COMPACTION :

Only the compaction equipment approved by the Engineer shall be employed to compact the selected soil.

The compaction shall be done with the help of vibrator roller of 80 to 100 KN static weight with plain Batch type Hot Mix Plant or heavy pneumatic tired roller of minimum 200/300 KN weight having a minimum tyre pressure of 0.70 MN/M2 as approved by the Engineer-in-charge, capable for achieving required compaction. The contractor shall demonstrate the efficiency of the equipment he intends to use by carrying out compaction trials. The procedure to be adopted this site trials shall first be submitted to the Engineer-in-charge for approval.

Immediately there after rolling shall be started with approved roller or other approved plant. Rolling shall commence at the edges and progress towards the center longitudinally except that on super elevated portions it shall progress from the lower to the upper edge parallel to the center line of the pavement. Each pass of roller shall uniformly overlap not less than on third of the track made in the proceeding pass. During rolling the grade and camber shall be checked and any high spots or depressions which become apparent corrected by removing or adding fresh material. Rolling shall be continued till the density achieved is at least 100% of the maximum dry density for the material determined as per IS : 2720 (Part – 8). The surface of any layer of selected soil on completion of compaction shall be well closed free from movement under compaction plant from compaction planes, ridges, cracks or loose material. All loose segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

FINISHING OPERATIONS :

The embankment shall be finished in conformity with the alignments, levels, cross sections and dimensions shown on the plans or as directed by the Engineer-in-charge. Finishing operations shall include work of shaping and dressing the sub-base / shoulders and the side slopes to conform to the cross section.

When earthwork operations have been subsequently completed, the road way area shall be cleared of all debris and ugly scrubs in the construction area, responsible for objectionable appearance shall be eliminated. The defective portion shall be removed and re-constructed as directed by the Engineer-in-charge.

The surface finish of construction shall conform to the requirement as per general technical specification for quality control on works and materials attached herewith.

M.O.R.T.& H. specification clause no. 305.3.9 shall be also followed.

3) ARRANGEMENT OF TRAFFIC :

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M.O.R.T. & H. specification clause no.112 shall be followed.

4) QUALITY CONTROL OF WORK :

Control on the quality of materials and works shall be exercised by the Engineer-in-charge in accordance with these specifications and general technical specifications for quality control on works and materials attached herewith. The Engineer-in-charge shall have the right to modify the frequencies of testing according to the needs.

5) MODE OF MEASUREMENTS AND PAYMENT :

Earthwork for embankment with selected soil shall be measured as compacted and finished work in position in cubic meters. the finished and compacted thickness to be paid on volume basis shall be computed in the following manner. Levels shall be taken before & after construction at a grid of points 10m or 30m center to center longitudinally in straight but 5 meters at curves. normally on two lane roads, the levels shall be taken at four position transversely at 0.75 and 2.75meters from either edge of the carriage way or as directed by the Engineer-in-charge and on single lane roads these shall be taken at two positions transversely being at 1.25m from the either edge of the carriage way or as directed by the Engineer-in-charge. The measurement may be taken at closer intervals also if so desired by the Engineer-in-charge. The average thickness of the layer of selected soil in any area shall be the arithmetical mean of the difference of levels before and after construction at all the grid points falling in that area, provides that thickness of finished work shall be limited to those shown on the drawings or approved by the Engineer-in-charge in writing.

The contractor shall sign day to day leveling work and also original cross section, longitudinal section in token of his acceptance etc. The working sections both longitudinal and cross of the sub-grade shall be taken by the Engineer-in-charge before the work is started. The contractor or his authorized representative shall attend day to day leveling work and sign with date the field book daily in token of this acceptance. If there is any disagreement the contractor shall inform of it in writing to the officer concerned with specific reference the cognizance of any complaint taken, merely not signing of the level book shall not be deemed as disagreement. The contractor shall maintain the finished work to proper formation and grade till this item is finally measured and accepted by department. The measurement shall be taken on compacted work.

The contract unit rate for earthwork for embankment with selected soil, shall be payment in full for carrying out the required operations including full compensation for

- i) Cost of arrangement of land as a source of supply of selected soil of required quality for construction.
- ii) Setting out
- iii) Compacting ground surrounding embankment sub-grade except where removal & replacement of unsuitable material or loosening and re compacting is involved.
- iv) Scarifying or cutting continues horizontal benches 300mm wide on side slope of existing embankment and sub-grade as applicable.
- v) Cost of watering.
- vi) Spreading in layers, bringing to the appropriate moisture content and compacting to specifications requirement.
- vii) Shaping & dressing the top and slope of the embankment & sub-grade including rounding of corners.
- viii) Excavation in murrum / soil from borrow pits including transporting the material to embankment & sub-grade side with all lead and lift.
- ix) All materials, labours, tools, equipment's and incidental necessary to complete the work to the specifications.
- x) Dewatering.
- xi) Keeping the embankment / completed formation free of water as per M.O.R.T. & H. clause 311.
- xii) Carrying out required tests for Quality control.
- xiii) Making arrangement of traffic.
- xiv) Furnishing of all material to be incorporated in the work including all royalty, fee, rent & all lead & lift.

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The contract unit rate shall be for a unit of one cubic meter.

Item No: 06:- Filling available excavated earth in trenches. plinth, sides of foundations etc. in layers not exceeding 20 cm. In depth consolidating each disposed layer by ramming and watering etc. Complete as directed by Engineer in charge.

WORKMANSHIP :

The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken.

As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, brick bats: mortar dropping etc., and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars, where rammer cannot be used.

The plinth shall be similarly filled with earth in layers not exceeding 20 cms. adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated. The finished level of filling shall be kept to shape intended to be given to floor.

In case off large heavy duty flooring like factory flooring, the consolidation may be done by power rollers, where so specified. The extent of consolidation required, shall also be as specified.

The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

MODE OF MEASUREMENTS & PAYMENT :

The payment shall be made for filling in plinth and trenches. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

The rate shall be for a unit of one cubic meter.

Item No: 07:- Providing and laying Rubble soling with sand in foundation below PCC and watering and compacting the same etc. completed.

WORKMANSHIP :

Rubble Soling is a base structure of any foundation which is located under the Plain Cement Concrete of any type of Foundation like Footing, Raft, Road, Trimix, etc. general thickness of rubble soling is 230 mm. Rubble soling is done to prepare the uniform level surface on Hard Base or on backfilled surface to work clearly and above rubble soling PCC work will be done for plain level surface. If any level difference in base of the ground then we are doing plum concrete and rubble soling with the heap of rubble and PCC.

Supplying and stacking of hand broken crushed stone aggregate chippings etc. of hard rubble stone of 40 mm to 63 mm size nominal size free of disintegrated pieces. Deleterious and organic matter including filling boxes with all lead and lift etc. Complete for work.

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The item shall be carried out as per IS code of practice for Rubble Soling.

MODE OF MEASUREMENTS& PAYMENT :

The payment for this item shall be made at the unit contract rate per cubic meter for the quantity , limited to the dimensions shown in the drawing or as directed by the Engineer-in-charge as specified in I.S. 1200-Part-I of 1974.

The contract rate shall be for a unit of one Cubic meter.

Item No: 08:- Anti-Termite System: Providing and laying of permanent piping technology anti-termite treatment before flooring work by installing LLDP (Low linear density polyethylene) tube of 8 mm O.D. & 6.4 mm I.D. with inbuilt pressure compensation chip every 30 cm interval in the tube, having working pressure of 2 Kg/cm² and release rate of 1.9 ltr/hour fixed by P-clips and nails. The LLDP pipe shall be installed at the entire periphery of the building and at internal network of building at a depth of 20 to 200 mm under floor at every 2 to 3 mtr. c/c distance (adjusted as per building layout) & ends of loop pass through a PVC elbow of minimum 32 mm ID at junction box of wall and floor level, entering into a steel reinforced grooved flexible pipe of minimum 22 mm ID leading into junction box and the loops shall terminate in junction boxes & test every junction during injecting chemicals for termite control treatment. The piping shall be covered with cement mortar/PCC for protection. The anti termite chemical Imidacloprid 30.5% SC mix as per IS-6313 (part III) shall be injected by the pressure pump diluted with water @ 10.5 ml/5 ltr of water at the rate of 2 Kg/sq.cm @ 5 Ltr/SMT. The contractor shall submit approved line plan for piping system and junction boxes duly approved by Engineer-in-Charge with bond of 5 year warranty.(ii) Anti Termite chemical injected area (Chemical injecting incl. labour cost)

SCOPE OF WORK :

The work shall consist of:

1. Providing and installing a **permanent anti-termite piping system** below flooring level prior to floor finishing.
2. Laying **LLDP (Low Linear Density Polyethylene) piping network** along:
 - o Entire periphery of the building
 - o Internal grid network at 2–3 m c/c (or as per approved layout)
3. Providing junction boxes, PVC elbows, flexible steel-reinforced pipes and accessories.
4. Pressure testing the system before chemical injection.
5. Injecting approved anti-termite chemical through the installed piping system.
6. Testing every junction during chemical injection.
7. Submitting:
 - o Approved line plan of piping layout
 - o Shop drawings of junction boxes
 - o Performance guarantee as specified.

MATERIALS :

1 LLDP PIPE

- Material: Low Linear Density Polyethylene (LLDP)

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- Outer Diameter: 8 mm
- Inner Diameter: 6.4 mm
- Working Pressure: 2 Kg/cm²
- Release Rate: 1.9 Litre/hour
- Inbuilt pressure compensation chip at every 30 cm interval
- Resistant to chemicals and soil corrosion

2 JUNCTION BOXES

- Installed at wall–floor junction
- Suitable size to accommodate loop terminations
- Properly sealed with removable cover
- Accessible for future maintenance

3 PVC ELBOW

- Minimum 32 mm internal diameter
- Installed at wall-floor junction to protect pipe entry

4 STEEL REINFORCED FLEXIBLE PIPE

- Minimum 22 mm internal diameter
- Grooved and flexible
- Connecting LLDP loop to junction box

5 FIXING ACCESSORIES

- P-clips
- Galvanized nails
- Clamps and supports as required

6 ANTI - TERMITE CHEMICAL

- Chemical: Imidacloprid 30.5% SC
- Conforming to IS: 6313 (Part III)
- Dilution: 10.5 ml per 5 litres of water
- Application Rate: 5 litres per square meter
- Injection Pressure: 2 Kg/cm²

WORKMANSHIP :

LAYOUT & APPROVAL

- Contractor shall prepare piping layout plan showing:
 - Peripheral piping
 - Internal grid network
 - Junction box locations
- Layout shall be approved by Engineer-in-Charge before execution.

INSTALLATION OF PIPING

- Pipes shall be laid at a depth of 20 mm to 200 mm below finished floor level.
- Pipes shall be installed:

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- Along full building periphery.
 - At internal spacing of 2–3 m c/c (adjusted as per structural layout).
- Pipes shall be securely fixed using P-clips and nails.
- Loop ends shall:
 - Pass through 32 mm PVC elbow
 - Enter into 22 mm steel reinforced flexible pipe
 - Terminate inside junction box
- Entire system shall be pressure tested before flooring.

TESTING

- All junctions shall be tested during chemical injection.
- System shall be checked for:
 - Leakage
 - Uniform discharge
 - Proper pressure

Any leakage or defective portion shall be rectified before final acceptance.

CHEMICAL INJECTION

1. Chemical solution shall be prepared as per manufacturer's specification.
2. Injection shall be carried out using pressure pump at:
 - 2 Kg/cm² pressure
 - 5 litres per square meter coverage
3. Entire network shall be charged uniformly.
4. Injection record shall be maintained.

PROTECTION

- Installed system shall be protected from damage during subsequent construction.
- Any damaged pipe shall be replaced at contractor's cost.

MODE OF MEASUREMENTS & PAYMENT :

Measurement shall be carried out as follows:

ANTI - TERMITE PIPING SYSTEM

- Measured in Square Meter (SMT) of treated area.
- Rate shall include:
 - Supply of LLDP pipe
 - Junction boxes
 - PVC elbows
 - Flexible pipes
 - Fixing materials
 - Installation
 - Testing

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- Labour
- All incidental charges

CHEMICAL INJECTION

- Measured in Square Meter (SMT) of area injected.
- Rate shall include:
 - Supply of Imidacloprid chemical
 - Dilution
 - Injection using pressure pump
 - Labour cost
 - Testing of junctions

No separate payment shall be made for:

- P-clips
- Nails
- Clamps
- Minor accessories
- Testing

Item No: 09:- Providing and laying PCC 1:3:6 (1-cement : 3 coarse sand : 6 M/c stone aggregate 20 / 40mm nominal size) in foundation concrete / floor concrete incl. machine mixing, ramming, consolidation & curing etc. incl. cost of form work if required etc. complete at all levels as directed by Engineer in charge.

MATERIALS :

Cement shall be of approved make (List of approved make attached with Technical Bid) and shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

Coarse aggregate shall conform to M-10 of Specification of Materials attached herewith.

Water shall conform to M-1 of Specification of Materials attached herewith.

WORKMANSHIP :

The proportion of cement, sand and machine crushed coarse aggregate shall be 1:3:6 (1 – cement : 3 - coarse sand : 6 - machine crushed stone aggregate 40MM nominal size) by volume and work shall be carried out as per C-2 of Code of practice attached herewith & IS : 456 – 1978 (IS code of practice for plain and reinforced cement concrete).

The work shall be executed in accordance with best modern practices.

MODE OF MEASUREMENT & PAYMENT :

The mode of measurement shall as specified in I.S. 1200-Part-II- 1974 or as revised from time to time so far as applicable for measurement of cement concrete work. The concrete shall be measured for its length, breadth and depth, limiting dimensions to those specified on plan or as directed.

The contract rate shall be for a unit of one cubic meter.

Item No: 10:- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all levels for RCC FOOTING

MATERIALS :

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Grit shall conform to M-8. Coarse aggregate shall conform M-12 B.

The shuttering to be provided shall be of ordinary timber planks and shall conform to M-26.

The dimensions of scantlings and battens shall conform to the design. The strength of the wood shall not be less than that assumed in the design.

GENERAL :

The designation ordinary M-100, M-150, M-200, M-250. specified as per I.S. Corresponding approximately to 1:3:6, 1:2:4, 1:1½:3 and 1:1:2 nominal mix of ordinary concrete by volume respectively.

The ingredients required for ordinary concrete containing one beg of cement of 50 Kg. By weight (0.0342 Cu. M.) for different proportions of mix shall be as under:

Grade of concrete	Total quantity of dry aggregate by volume per 50 Kgs. Of cement to be taken as the sum of individual volume of fine and coarse aggregates, maximum	Proportion of fine aggregate to coarse aggregate	Quantity of water per 50 Kgs. Of cement maximum.
M-100 (1:3:6)	300 Litres	Generally 1:2 for fine aggregate to coarse aggregate by volume but subject to and upper limit of 1:1 ½ and lower limit 1:3	34 Liters
M-150 (1:2:4)	220 “		32 Liters
M-200 (1: 1 ½:3)	160 “		30 Liters
M-250 (1:1:2)	100 “		27 Liters

The water cement ratios shall not more than those specified in the above table. The cement content of the mix specified in the Table shall be increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction so that the watercement-ratio specified in the Table is not exceeded.

Workability of the concrete shall be controlled by maintaining a water-cement-ratio that is bound to give a concrete mix which is just sufficiently wet to be placed and compacted without difficulty with the means available.

The maximum size of coarse aggregate shall be as large as possible within the limits specified but in no case greater than one fourth of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and to fill corners of the form.

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For reinforced concrete work, coarse aggregate having a nominal size of 20 mm. are generally considered satisfactory.

For heavily reinforced concrete members as in the case of ribs of main beams, the nominal maximum size of coarse aggregate should usually be restricted to 5 mm. less than the minimum clear distance between the main bars, or 5 mm. less than the minimum cover to the reinforcement whichever is smaller.

Where the reinforcement is widely spaced as in solid slabs, limitations of size of the aggregate may not be important and the nominal maximum size may sometimes be as great as or greater than the minimum cover.

Admixture may be used in concrete only with approval of Engineer-in-charge based upon the evidence that with the passage of time, neither the compressive strength of concrete is reduced nor are other requisite qualities of concrete and steel impaired by the use of such admixtures.

The form work shall conform to the shape lines and dimension as shown on the plans and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete. Adequate arrangements shall be made by the contractor to safe-guard against any settlement of the form work during the course of concreting and after concreting. The form work of shuttering, centering, scaffolding bracing etc. shall be as per design.

Cleaning & Treatment of forms:

All rubbish, particularly chippings shaving and saw dust shall be removed from the interior of the form before the concrete is placed and the form work in contact with concrete shall be cleaned and thoroughly wetted or treated. The surface shall be then coated with soap solution applied before concreting is done, Soap solution for the purpose shall be prepared by dissolving yellow soap in water to get consistency of paint. Alternatively, a coat of raw linseed oil or form oil of approved manufacture may be applied in case steel shuttering is used. Soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Care shall be taken that the coating does not get on construction joint surface and reinforcement bars.

Stripping time:

In normal circumstances and where ordinary cement is used forms may be struck after expiry of following periods.:

- (a) Sides of walls columns and vertical faces of beam 24 to 48 hours.
- (b) Beam soffits. (Props left under) 7 days.
- (c) Removal of props slabs
 - (i) Slabs spanning up to 4.5 m. 7 days.
 - (ii) Spanning over 4.5 mm. 14 days.
- (d) Removal of props to beams and Arches
 - (i) Spanning upto 6 m. 14 days.
 - (ii) Spanning over 6 m. 21 days.

Procedure when removing the form work:

All form work shall be removed without such shock or vibrations as would damage the reinforced concrete surface. Before the soffit form work and struts are removed, the soffits and the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened.

Centering:

The centering to be provided shall be got approved. It shall be sufficiently strong to ensure absolute safely of the form work and concrete work before, during and after pouring concrete. Watch should be kept to see that behavior of centering and form work is satisfactory during concreting. Erection should also be such that it would allow removal of forms in proper sequence without damaging either the concrete or the forms to be removed. The props of centering shall be provided on firm foundation or base of sufficient strength to carry the loads without any settlement. The centering and form work shall be inspected and approved by the Engineer-in-charge before concreting. But this will not relieve the contractor of his responsibility for strength, adequacy and safety of form work and centering. If there is a failure of form work or centering, contractor shall be responsible for the damages to the work, injury to life and damage to property.

Scaffolding:

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All scaffolding, hoisting arrangements and ladders etc. required for the facilitating of concreting shall be provided and removed on completion work by contractor at his own expense. The scaffolding, hoisting arrangements and ladders etc. shall be strong enough to act and shall be subject to the approval of the Engineer-in-charge. However, contractor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workman etc.

The scaffolding, hoisting arrangements and ladders shall allow easy approach to the work spot and afford easy inspection.

The rate is applicable to all conditions of working and height upto 4 mts. The rate shall include the cost of materials and labour for various operations involved such as:

- (a) Splayed edges, notching, allowance for overlaps and passing at angles, battens centering, shuttering, strutting, propping bolting, nailing, wedging, easing, striking and removal.
- (b) Filletting to form stop chamfered edges or splayed external angles not exceeding 20 mm. widths to beams, columns and the like.
- (c) Temporary opening in the forms for pouring concrete, if required, removing rubbish etc.
- (d) Dressing with oil to prevent adhesion of concrete with shuttering, and
- (e) Raking or circular cutting.

Re-Use:

Before-re-use, all forms shall be inspected by Engineer-in-charge and their suitability ascertained. The forms shall be scarred, cleaned, and joints gone over, repaired where required. Inside surface shall be retreated to prevent adhesion of concrete.

The relevant specifications of item No. 5.4.1. of ordinary concrete shall be followed except that the concrete mix shall be designed from preliminary tests, the proportioning of cement and aggregates shall be done by weight and necessary precautions shall be taken in the production to ensure that the required work cube strength is attained and maintained. The controlled concrete shall be in grades of M-100, M-150, M-200, M-250, M-300, M-350, & M-400, with prefix controlled added to it. The letter 'M' refers to mix and numbers specify 28 days works cube compressive strength of 150 mm. cubes of the mix expressed in Kg./Cmt.

The proportion of cement, sand and coarse aggregates shall be determined by weight the weight batch machine shall be used for maintaining proper control over the proportion of aggregates as per mix design.

The strength requirements of different grade of concrete shall be as under: Grade Of Concrete		Compressive strength of 15 cms. Cubes in Kg./Cmt. At 28 days, conducted in accordance with I.S. 516-1959.
Preliminary test Minimum.		Work test Minimum.
M-150	200	150
M-200	260	200
M-250	320	250
M-300	380	300
M-350	440	350
M-400	500	400

In all cases, the 28 days compressive strength specified in above table above be the criteria for acceptance or rejection of the concrete. Where the strength of a concrete mix as indicated by tests, lies in between the strength of any two grades specified in the above table, such concrete shall be classified in for all purposes as concrete belonging to the lower of the two grades between which its strength lies.

WORKMANSHIP :

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The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with means available except where it can be shown to the satisfaction of the Engineer-in-charge, that the supply of properly graded aggregate of uniform quality can be maintained till the completion of work. Grading of aggregate shall be controlled by obtaining the coarse aggregates, in different sizes and being in them in the right proportions as required. Aggregate of different sizes shall be stocked in separate stock piles. The required quantity of material shall be stock piled several hours, preferably a day before use. The grading of coarse and fine aggregate shall be checked as frequently as possible, the frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests.

In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag a reasonable number of bags shall be weighted separately to check the net weight. Where cement is weighted from bulk stocks at site and not by bags, it shall be weighted separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment's shall be maintained in clean and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge, according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates, I.S. 2389 (Part-III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates due to variation in their moisture content. The controlled cement concrete shall be in Grade of M - 250. (Minimum Cement level 380.00 Kg & fly ash replacement is not valid in mix design)

The controlled cement concrete work shall be carried out as per C-5 of Code of practice attached herewith, IS: 456 – 1978 and IS: 2502 – 1983.

MODE OF MEASUREMENT & PAYMENT:

The measurement of various member of R.C.C. shall be taken as per respective items of schedule "B" and specifications and as per IS: 1200-Part-II- 1974 or as revised from time to time so far as applicable for measurement of cement concrete work.

The contract rate shall be for a unit of one cubic meter.

Item No: 11:- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete COLUMN UP TO GROUND FLOOR LEVEL & FIRST FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 12 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete COLUMN AT ALL FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

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Item No: 13 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at RCC Double height Columns at all floor level.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 14 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete FOR RCC BEAM UP TO GROUND FLOOR LEVEL & FIRST FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 15 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete FOR RCC BEAM AT ALL FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 16 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete AT RCC Double height BEAMS at all floor level.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 17 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all levels for RCC SLAB at GROUND FLOOR & FIRST FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

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Item No: 18 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete for RCC SLAB AT ALL FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 19 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all levels for RCC SLAB (Double height)

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 20 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all levels for RCC SILL and LINTEL & Coping

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 21 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all floor levels for RCC STAIRCASE

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 22 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete for RCC WALL UP TO GROUND FLOOR & FIRST FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 23 :- Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all levels for RCC WALL AT ALL FLOOR LEVEL

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The item shall be executed as per the relevant specifications & mode of measurement of above Item No 10.

Item No: 24 :- Providing TMT Bar FE 500D reinforcement for R.C.C. work including bending, binding and placing in position complete up to floor two level. (for all floors)

GENERAL :

This work shall consist of furnishing and placing coated, T.M.T. or high strength deformed reinforcement, bars (intentioned) of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer in charge. The T.M.T. FE 500D bar shall be TATA, JINDAL, JSW brand as directed by Engineer-in-charge.

MATERIALS:

T.M.T (Thermos Mechanically Treated) bars shall be of approved make (List of approved make attached with Technical Bid) and shall conform to **M-15** of Specification of Materials attached herewith. Mild steel binding wire shall conform to **M-16** of Specification of Materials attached herewith.

TMT Bars Reinforcements may be either TMT/medium tensile steel or high strength deformed bars. TMT bars reinforcement for RCC work shall conform to IS 1786 FE-500D and shall be of tested quality. It shall also comply with relevant part of IS 456-1966. All reinforcement shall be clean and free from dirt, paint, grease or oil, oil scale or loose or thick rust at the time of placing. All steel shall be procured from original producers no rerolled steel shall be incorporated in the work. Only new steel shall be delivered to the site every bar shall be inspected before placing to its position and defective brittle or burnt bar shall be discarded cracked ends of bars shall be discarded.

PITCH :

Distance between bars shall be as specified in drawings and as directed by the Engineer in Charge. All bars shall be placed at an accurate distance from each other and shall be bind tightly to maintain the desired pitch Suitable means shall be provided for holding bars securely in position

BINDING WIRE :

Mild steel binding wire shall be of 1.63 mm or 1.22 mm (16 to 18-gauge diameter and shall conform IS 280-1972. The use of black wire will be permitted for binding reinforcement bars. It shall be free from dirt, paint, grease or oil, oil scale or loose or thick rust and any other undesirable coating which may prevent adhesion of cement mortar at the time of binding. Only new binding wire shall be delivered to the site all binding wire shall be inspected before binding to its position and defective brittle, rusted, used wire, shall be discarded

PROTECTION OF REINFORCEMENT :

Uncoated reinforcing steel shall be protected from rusting or chloride contamination. Reinforcements shall be free from rust, mortar, loose mill scale, grease, oil or paints. This may be ensured either by using reinforcement fresh from the factory or thoroughly cleaning all reinforcement to remove rust using any suitable method such as sand blasting, mechanical wire brushing, etc. as directed by the Engineer. Reinforcements shall be stored on bricks, racks or platforms and above the ground in a clean and dry condition and shall be suitably marked to facilitate inspection and identification. Portions of uncoated reinforcing steel and dowels projecting from concrete shall be protected within one week after initial placing of concrete with a brush coat of neat cement mixed with water to a consistency, of thick paint. This coating shall be removed by lightly tapping with a hammer or other tool not more than one week before placing of the adjacent pour of concrete. Coated reinforcing steel shall be protected against damage to the coating. If the coating on the bars is damaged during transportation or handling and cannot be repaired, the same shall be rejected.

WORKMANSHIP :

The work shall consist of furnishing and placing reinforcement to the shape and dimensions shown as on the drawings or as directed by The Engineer in charge. Reinforcing steel shall conform accurate to the

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dimensions given in the bar bending schedules shown on relevant drawing. Fabrication and placing of Mild steel reinforcement in position shall conform to C-7 of Code of practice attached herewith & IS: 2502 - 1983.

BENDING OF REINFORCEMENT :

Bar bend schedule shall be furnished by the Contractor and got approved by the Engineer before start of work. Reinforcing steel shall conform to the dimensions and shapes given in the approved bar bending Schedules. Bars shall be bent cold to the specified shape and dimensions or directed by the Engineer using a proper bar bender operated by hand power to obtain the correct radius of bends and shape. Bars, shall not be bent or straightened in a manner that will damage parent material or the coating bars bent during transport or handling shall, be straightened before being used on work and shall not be heated to facilitate straightening.

PLACING OF REINFORCEMENT :

The reinforcement cage should generally be fabricated in the yard at ground level, and then shifted and placed in position. The reinforcement shall be placed strictly, in accordance with the drawings and shall be assembled in position, only when structure is otherwise ready for placing of concrete. Prolonged time gap, between assembling of reinforcements and casting of concrete, which may result in rust formation on the surface, shall not be permitted.

Reinforcement bars shall be placed accurately in position as shown on the drawings. The bars, crossing one another shall be tied together at every intersection with binding wire (annealed), conforming to IS: 280 to make the skeleton of the reinforcement rigid such that the reinforcement does not get displaced during placing of concrete, or any other operation. The diameter of binding wire shall not be less than 1 mm.

Bars shall be kept in position usually by the following methods:

In case of beam and slab construction, industrially produced polymer cover blocks of thickness equal to the specified cover shall be placed between the bars and formwork subject to satisfactory evidence that the polymer composition is not harmful to concrete and reinforcement. Cover blocks made of concrete may be permitted by the Engineer, provided they have the same strength and specification as those of the member.

In case of dowels for Columns and walls the vertical reinforcement shall be kept in position by means of timber templates with slots in them accurately, or with cover blocks tied to the Reinforcement Timber templates shall be removed after the concreting has progressed up to a level just below their location.

Layers of reinforcements shall be separated by spacer bars at approximately One meter intervals. The minimum diameter of spacer bars shall be 12 mm or: equal to maximum size of main reinforcement or maximum size of coarse aggregate, whichever is greater. Horizontal reinforcement shall not be, allowed to sag between supports.

Necessary stays, blocks, metal chairs, spacers, metal hangers supporting wires etc, or other subsidiary, reinforcement shall be provided to fix the reinforcements firmly in its correct position.

Use of pebbles, broken stone, metal pipe, brick, mortar or wooden blocks etc as devices for positioning reinforcement shall not be permitted. Placing and fixing of reinforcement shall be inspected and approved by the Engineer before concrete is deposited.

LAPPING :

All reinforcement shall be furnished in full lengths as indicated on the drawing. No splicing of bars, except where shown on the drawing; will be permitted without approval of the Engineer. The lengths of the splice shall be as indicated on drawing or as approved by the Engineer. Where practicable, overlapping bars shall not touch each other, and shall be kept apart by 25mm or 1:1.1/4 times the maximum size of coarse aggregate, whichever is greater; if this is not feasible, overlapping bars shall be bound with annealed steel binding wire, not less than 1 mm diameter and twisted tight in such a manner as to maintain minimum clear cover to the reinforcement from the concrete surface. Lapped splices shall be staggered or located at points, along the span where stresses are low.

WELDING :

Splicing by welding of reinforcement will be permitted only if detailed on the drawing or approved by the Engineer. Weld shall develop an ultimate strength equal to or greater than that of the bars connected. While
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welding may be permitted for TMT. reinforcing bars conforming to IS: 432, welding of deformed bars conforming to IS: 1786 shall in general be prohibited. Welding may be permitted in case of bars of other than S 240 grade including special. Welding grade of S 500 grade bars conforming to IS: 1786, for which necessary chemical analysis has been secured and the carbon equivalent (CE) calculated from the chemical composition using the formula: $CE = C + Mn + Cr + Mg + V + Ni + Cu$ are 0.4 or less.

The method of welding shall conform to IS: 2751 and IS: 9417 and to any supplemental specifications to the satisfaction of the Engineer

Bars shall be bent cold to the specified shape and dimensions or as directed by Engineer in charge using the proper bender tool, operated by hand or power to attain proper radius of bends. Bars shall not be bending or straightened in a manner that will injure the material. Bars bent during transport or handling shall be straightened before being used in the work. Bars shall not be heated to facilitate bending. Unless otherwise specified a 'U' type hook at the end of each bar shall invariably be provided to main reinforcement. The radius of the bane shall not be less then twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times of the diameter of the round bar. In case of bars which are not round and in case of deformed bars, the diameter shall be taken as the diameter of circle having an equivalent effective area the hooks shall be suitably encased to prevent any spiting of the concrete.

All reinforcement bars shall be accurately placed in exact position shown on the drawings and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm in size and by using say blocks or metal chairs spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals, Bars shall not be allowed to sag between supports not displaced during concreting or any other operations of the work All devices used for positioning shall be of not corrodible material wooden and metal supports shall not extended to the surface of the concrete, except where shown in drawings. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing shall not be allowed. Pieces of broken stone or brick and wooden blocs shall not be used Layers of bars shall be separated by spacer bars pre-cast mortar blocks or other approved devices. Reinforcement after bending placed in position shall be maintained in a clean condition until completely embedded in concrete, Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To prevent reinforcement form corrosion, concrete cover shall be provided as indicated on drawings. All bars protruding from concrete and to which other bars are to be sliced and which are likely to be exposed for a period exceeding 10 days shall be protected by a thick coat of neat cement grout

Bars crossing each other where required shall be secured by binding wire (annealed) of size not less than 1 mm in such a manner that they do not slip over at the time of fixing and concreting. As far possible bars of full length shall be used In case this is not possible, overlapping of bars shall be done as directed by the Engineer in charge When practicable overlapping bars shall not touch each other, but be kept apart by 25 mm Where no feasible overlapping bars shall be bound with annealed wires not less than 1 mm thick twisted tight

The overlaps shall be staggered for different bars and located at points along the span where neither sheer not bending moments is maximum. Whenever indicated on drawing or desired the Engineer in charge bars shall be joined by coupling which shall have a cross section sufficient to transmit the full stresses of bars The end of the bars that are joined by coupling shall be upset for sufficient length so that the effective cross section at the base of threads is not less than the normal cross section of the bar. Threads shall be standards threads Steel for coupling shall conform to IS 226. When permitted or specified on the drawings joints of reinforcement bars shall butt-welded so as to transmit their full stresses Welded joints shall preferably be located at points when steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section not more than 20 percent of the rods are welded Only electric arc welding using a process which excludes air form the molten metal and conforms to any or other special provisions for the work shall be accepted Suitable means shall be provided for holding bars securely in position during welding It shall be ensured that no voids are left in welding and when welding is done in two or three stages previous surface shall be cleaned properly Ends of bars shall be cleaned of all loose scale rust stages paint and other foreign matter before welding Only competent welders shall be employed on the work. The M S electrodes used for welding shall conform IS 814 Welded pieces of reinforcement shall be tested. Specimen shall be taken form the actual site and their number shall frequency to test shall be as directed by the Engineer in charge

MODE OF MEASUREMENTS & PAYMENT :

For the purpose of payment the bar shall be measured correct up to 10 mm length and
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weight payable works out at the rate specified below

Sr No.	Dia Of Bar	Unit Weight/Rmt
1	6mm	0.222 Kg/Rmt
2	8mm	0.395 Kg/Rmt
3	10mm	0.617 Kg/Rmt
4	12mm	0.889 Kg/Rmt
5	14mm	1.21 Kg/Rmt
6	16mm	1.58 Kg/Rmt
7	18mm	2.00 Kg/Rmt
8	20mm	2.469 Kg/Rmt
9	22mm	2.988 Kg/Rmt
10	25mm	3.858 Kg/Rmt
11	28mm	4.84 Kg/Rmt
12	32mm	6.321 Kg/Rmt
13	36mm	8.00 Kg/Rmt
14	40mm	9.877 Kg/Rmt

Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work. Where welding or coupling is resorted to, in place lap joints, such joints shall be measured for payment as equivalent length of overlap as per design requirement. From the length so measured, the weight of reinforcement shall be calculated in Kg. on the same basis of as per table given above. Length shall include hooks at the ends. Wastage and annealed steel wire for binding shall not be measured and the cost of these items shall be deemed to be included in the rate for reinforcement. The rate for reinforcement includes cost of steel binding wires, cutting, bending, placing in position, binding and fixing in position as shown on the drawings and as directed. It shall also include all devices for keeping reinforcement in approved position, cost of joining as per approved method and all wastage and spacer bars.

The contract rate shall be for a unit of one kilogram for completed item as directed.

The payment will be made on one-kilogram basis of the finished work.

Item No: 25 :- Providing and fixing 200 mm wide, approved quality chicken wire mesh at junction of brick work and RCC work or two dissimilar surfaces, at all heights fixed by nails, rowal plugs or tag by cement mortar 1:3 before applying the plaster, including curing, scaffolding all complete as directed.

SCOPE OF WORK :

This item includes supplying and fixing of 20-gauge chicken mesh (Crimp Jali) of approved size and type at all masonry and RCC junctions to prevent crack formation due to differential thermal expansion or settlement. The mesh shall be fixed in line, level, and plumb as per drawings and instructions of the Site Engineer.

MATERIALS :

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1. Chicken Mesh (Crimped Jali) :

Gauge: 20 gauge (approximately 0.9 mm thickness).

Mesh Opening: Typically 12 mm x 12 mm to 25 mm x 25 mm (to be approved).

Type: GI (Galvanized Iron) wire, crimped for better grip.

Width: Minimum 100 mm (50 mm on each side of the junction).

Length: As required.

The wire shall be rust-resistant and free from sharp burrs or defects.

2. Fasteners :

1.5” to 2” GI nails for fixing into masonry and concrete.

Additional binding wire or clamps, if required.

3. Surface Preparation :

Clean the surface of both RCC and masonry to remove dust, oil, mortar residue, or loose particles.

Ensure surfaces are dry and free from any coatings that may hinder proper fixing.

4. Fixing Procedure:**Placement of Mesh :**

Chicken mesh shall be cut to the required length and width.

Mesh must overlap the RCC and masonry equally — minimum 50 mm on each side.

Installed centrally along the joint to bridge the RCC-masonry interface.

Fixing :

The mesh shall be stretched tightly along the joint to prevent sagging or bulging.

Fix securely using GI nails at intervals not exceeding 200 mm c/c along the length of the joint.

If the surface is concrete, and nailing is not possible, approved adhesives or anchoring methods shall be used.

Level & Plumb :

Mesh shall be fixed in true line, level, and plumb to avoid surface undulation.

Ensure mesh is flush with the surface to avoid plaster thickness irregularity.

5. Finishing :

Once fixed, the mesh shall be embedded in plaster as per plastering specifications.

Care shall be taken to ensure the mesh is not displaced during plastering.

The plaster coat should fully cover the mesh with a minimum thickness of 12 mm (or as specified).

6. Measurements :

Unit of Measurement: The rate shall be for a unit of one square meter.

Measurements shall be taken along the length of the junction where the mesh is applied, with specified width (usually 100 mm).

No deduction shall be made for openings up to 0.1 Sqm.

7. Rate to Include:

The quoted rate shall be inclusive of:

Supplying of approved quality 20 gauge chicken mesh (crimped).

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Cutting, placing, and fixing with all nails or fasteners.
 Labour, tools, and tackles.
 All wastages, overlaps, and incidentals.
 Complete in all respects to the satisfaction of the Site Engineer.

8. Quality Control:

The material shall be inspected before use to ensure conformity to size and gauge.
 Proper supervision during fixing to maintain alignment and coverage.
 Any rusted or damaged mesh shall be rejected.

9. Safety & Cleanliness:

Workers must use gloves while handling mesh to prevent injuries.
 The site shall be cleaned of wire cuttings, nails, and debris after completion.

Item No: 26 :- Brickwork using common burnt clay building bricks having crushing strength not less than 35 Kg./Sq. Cm. in foundation and plinth in cement Mortar 1:6 (1-Cement : 6 - fine sand). Conventional in Foundation & Plinth (Upto 10 ton).

Item No: 27 :- Brickwork using common burnt clay building bricks having crushing strength not less than 35 Kg./Sq. Cm. in foundation and plinth in cement Mortar 1:6 (1-Cement : 6 - fine sand). GROUND & FIRST FLOOR (Upto 10 ton).

Item No: 28 :- Brickwork using common burnt clay building bricks having crushing strength not less than 35 Kg./Sq. Cm. in foundation and plinth in cement Mortar 1:6 (1-Cement : 6 - fine sand). SECOND FLOOR & TERRACE FLOOR(Upto 10 ton).

MATERIALS :

The common burnt clay building bricks of 1st class shall conform to M-13 of Specification of Materials attached herewith.
 Cement mortar of proportions 1:6 i.e. 1 part of cement & 6 part of coarse sand shall conform to M-9 of Specification of Materials attached herewith.

WORKMANSHIP :

The burnt brick masonry work shall conform to C-9 of Code of practice attached herewith & IS: 2212 -1962. The work shall be executed in accordance with best modern practices.

MODE OF MEASUREMENT & PAYMENT :

Thickness of the wall shall be taken as under or actual thickness whichever is less for the purpose of measurement and payment.

1. Brick wall -9" (23 cms)
2. Brick wall -13 1/2" (35 cms)
3. Brick wall -18" (46 cms)

Except as above, the mode of measurement shall be as specified in I.S.: 1200-1976 (Part-III) or as revised from time to time so far as applicable.

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The contract rate shall be for a unit of one Cubic Meter.

Item No: 29 :- Half brick masonry in common burnt clay building bricks having crushing strength not less than 35 Kg / Sq.Cm. in Cement mortar 1:3 (1-Cement:3-coarse sand) with 2 Nos of 6mm Mild steel round bars after every three course embedded in Cement Mortar in Conventional in GROUND & FIRST FLOOR

Item No: 30 :- Half brick masonry in common burnt clay building bricks having crushing strength not less than 35 Kg / Sq. Cm. in Cement mortar 1:3 (1-Cement:3-coarse sand) with 2 Nos of 6mm Mild steel round bars after every three course embedded in Cement Mortar in Conventional in SECOND FLOOR

MATERIALS:

The common burnt clay building bricks of IInd class having crushing strength not less than 35 kg/cm² shall conform to M-13 of Specification of Materials attached herewith.

Cement mortar of proportion 1:3 i.e. 1 part of cement & 3 part of sand shall conform to M-9 of Specification of Materials attached herewith.

The mild steel bar shall conform to M-14 of Specification of Materials attached herewith.

WORKMANSHIP:

The burnt brick masonry work shall conform to C-10 of Code of practice attached herewith.

The work shall be executed in accordance with best modern practices.

Two Nos. of 6 mm diameter M.S. bar shall be placed at every 3rd course during construction as directed by the Engineer-in-charge.

MODE OF MEASUREMENT & PAYMENT:

The measurement shall be as specified in I.S. -1200-1976 (Part-III) or as revised from time to time so far as applicable. The rate is inclusive of 2 Nos. of 6mm bars at every 3rd course.

The contract rate shall be for a unit of one Sq. Meter.

Item No: 31 :- Providing 10mm thick cement plaster in single coat on brick/concrete walls/ceiling for interior plastering for all floor levels and finished even and smooth in (i) Cement mortar 1:3 (1 cement : 3 Sand)

MATERIALS :

Cement shall be of approved make (List of approved make attached with Technical Bid) and shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

Cement mortar in proportion 1:3 (1-cement: 3 coarse sand) shall conform to M-9 of Specification of Materials attached herewith.

Water shall conform to M-1 of Specification of Materials attached herewith.

WORKMANSHIP :

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Plastering work shall be carried out as per C-31 of Code of practice attached herewith & IS: 1661-1972.
The work shall be executed in accordance with best modern practices.
For scaffolding, relevant specification of C-9 of Code of practice attached herewith shall be followed

PREPARATION OF BACK-GROUND :

The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, efflorescence, and other foreign matter by water or by brushing. Smooth surface shall be toughened by wire brushing if it is not hard and by hacking if it is hard. In case of concrete surface, if a chemical retarded has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the readers if left on the surface. Trimming of projections on brick/concrete surfaces where necessary shall be carried out to get an even surface.

Raking of joints in case of masonry where necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.

The work shall not be soaked but only damped evenly before applying the plaster. If the surface becomes dry, such area shall be moistened again.

For external plaster, the plastering operation shall be started from top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supports of the ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

APPLICATION OF PLASTER :

The plaster about 15x15 cms. shall be first applied horizontally and vertically at not more than 2 meters intervals over the entire surface to serve as gauge. The surfaces of these gauges shall be truly in plane of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness, then brought to a true surface by working a wooden straight edge reaching across the gauges with small upward and sideways movements at a time. Finally, the surface shall be finished off true with a trowel or wooden float according as a smooth or a smooth or a sandy granular texture is required Excessive troweling or overworking the float shall be avoided. All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Hounding or chamfering, corners, arises junctions etc. shall be carried out with proper templates to be size required.

Cement plaster shall be used within half an hour after addition of water. And mortar or plaster which is partially set shall be rejected and removed forthwith from the site.

In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically, when recommencing the plaster, the edges of the old work shall be scraped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearer than 15 cm. to any corners or arises. It shall not be closed on the body of features such as plaster bands and cornices not at the corners or arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be packed up later on.

Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking of walls shall be avoided and only as much water as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air or dry weather shall be prevented by hanging matting or gunny bags on the outside of the plaster and keeping them wet

MODE OF MEASUREMENT & PAYMENT :

The rate shall include the cost of all materials, labour and scaffolding etc. involved in the operations described under workmanship. All plastering shall be measured in square meters unless otherwise specified. Length breadth or height shall be measured correct to a centimeter. Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooves or open joints in brick work, stone work etc. or space between laths. Thickness of plaster shall be average thickness with minimum 10 mm. at any point on this surface. This item includes plastering up to floor two level.

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The measurement of wall plastering shall be taken between the walls or partition (dimensions before plastering being taken) for length and from the top of floor or skirting to ceiling for height. Depth of cover of cornices if any shall be deducted.

Soffits of stairs shall be measured as plastering on ceilings, following soffits shall be measured separately.

For jambs, soffits, sills etc. for openings not exceeding 0.5 sq. mt each in area for ends of joints beams, posts, girders, steps etc. not exceeding 0.5 sq. mt each in area and for openings exceeding 0.5 sq. mt and not exceeding 3.00 sq. mt. in each area deductions and additions shall be made in the following manners.

No deductions shall be made for ends of joints, beams, posts etc. and openings not exceeding 0.5 sq. mt each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings, for finish to plaster around ends of joints, beams posts etc.

Deduction for openings exceeding 0.5 sq. mt but not exceeding 3 sq. mt. each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings, (i) When both faces of all wall are plastered with same plaster, deduction shall be made for one face only, (ii) When two faces of wall are plastered with different types of plasters or if one face is plastered and the other pointed, deductions shall be made from the plaster or pointing on the side of frame for door, window etc. on which width of reveals is less than that on the other side but no deductions shall be made on the other side. Where width of reveals on both faces of all are equal, deductions of 50% of area of opening on each face shall be made from areas of plaster and / or pointing as the case may be.

For openings having door frames equal to or projecting beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall.

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

The contract rate shall be for a unit of one Sq. Meter of plastering of specified thickness.

Item No: 32 :- Providing 15mm thick Cement Plaster in single coat on brick/concrete wall for interior plastering upto floor two level finished even and smooth in Cement mortar 1:4 (1-cement :4-sand) at all floor level

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 31.

The contract rate shall be for a unit of one Sq. Meter of plastering of specified thickness of visible area.

Item No: 33 :- 20mm thick sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12mm thick backing coat of C.M. 1:3 (1-cement : 3-sand) and 8mm thick finishing coat of C.M. 1:1 (1-cement : 1-sand) etc. complete.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 31.

The contract rate shall be for a unit of one Sq. Meter of plastering of specified thickness of visible area.

Item No: 34 :- Providing 20 mm thick Water Proof cement plaster for sunk in single coat on brick / concrete wall for interior plastering up to floor two level finished even and smooth (ii) Cement mortar 1:3 (1-cement ,3- sand) and mixing waterproofing materials of approved brand (sika) and manufacture in cement mortar in proportion recommended by the manufacturer for All Floor.

Waterproofing material used shall be of approved manufacturers and shall be used according to the manufacturer's specifications.

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Clean the surface to be treated and apply a coat of Cement wash using mixture of Cement and Water in proportion (1 bag : 80 liters). The waterproof application's purpose is to protect the masonry walls from moisture and dampness. This plaster is made of cement and sand mix in the ratio of 1:3. Provide and apply minimum 20 mm. thick waterproof plaster with cement mortar (1:3) & add mixture or water proofing agent for waterproof plaster as approved and as directed by engineer in charge. This layer shall be cured for 21 days by spreading clean Hessian / jute cloth which should be kept wet throughout the curing period. The item shall be executed as per the relevant specifications of Item No: 31.

The contract rate shall be for a unit of one Sq. Meter of plastering of specified thickness of visible area.

Item No: 35 :- Providing and laying brickbat cement concrete 1:5:10 (1-Cement:5-finesand:10-graded brickbat aggregates 40mm nominal size) and curing complete including waterproofing material - for toilet floor at all levels

MATERIALS :

Cement shall be of approved make (List of approved make attached with Technical Bid) and shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

brickbat shall conform to M-12 of Specification of Materials attached herewith.

Water shall conform to M-1 of Specification of Materials attached herewith.

WORKMANSHIP :

The proportion of cement, sand and machine crushed coarse aggregate shall be 1:3:6 (1 – cement : 5 - coarse sand : 10 - graded brickbat aggregates 40 mm nominal size) by volume and work shall be carried out as per C-2 of Code of practice attached herewith & IS : 456 – 1978 (IS code of practice for plain and reinforced cement concrete). The work shall be executed in accordance with best modern practices.

MODE OF MEASUREMENT & PAYMENT :

The mode of measurement shall as specified in I.S. 1200-Part-II- 1974 or as revised from time to time so far as applicable for measurement of cement concrete work.

The contract rate shall be for a unit of one cubic meter.

Item No: 36 :- Providing and laying intergrated cement based proprietary water proofing treatment of required thickness over the roof including 10mm thick waterproofing cement plaster in cement mortar 1:3 and CHINA MOSAIC fitting and finally finishing the surface with white cement slurry and sloping out terrace slabs with following specification laid to required slope not flattar than 1:80 (the thickness of water proofing treatment near rainwater outlet or the lowest point of the finished slope shall not be less than 45mm including treating the vertical surface of the parapet wall up to 20cms height above finished level of terracing including finishing the top with joint less water proofing plaster, curring testing etc complete Rate is including ten years performance of guarantee bond to be given on stamp paper (No extra shall be paid for increase in thickness for proper slope

(A)Applying and grouting a slurry coat of neat cement using 2.75 kg/sqm of cement admixed with proprietary water proofing compound conforming to IS-2645 and 10mm thick water proofing cement plaster in cement Mortar 1.3 over the RCC slab including cleaning the surface before treatments.

(B) Laying cement concrete using broken brick bats 25mm 40mm size with 50% of cement mortar 1:4 (1 Cement : 4 coarse sand) over 10mm thick water proofiing cement plaster in cement mortar 1:3 (1

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cement :3 coarse sand) admixed with proprietary water proofing compound conforming to IS 2645 to required slope and treating similarly the adjoining walls up to 200mm height including rounding of junctions of walls.

(C) After two days of proper curing applying a seceond coat of cement slurry

(D) finishing the surface with china mosaic pieces laid on 10mm thick joint less cement plaster of mix 1:3 (1 cement : 3 coarse sand) with water proofing compound conforming to IS-2645 and finaly finishing the surface with trowel with neat cement slurry

(E) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing for final test All above operations to be done in order and as directed and specified by the Engineer in charge

(F) Including design and pattern of china mosaic as per Architectural drawings and as approved by the Architect and Engineer-in-Charge (EIC).

MATERIALS:

Cement shall be of approved make (List of approved make attached with Technical Bid) and shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

Brickbats aggregate shall conform to M-12 of Specification of Materials attached herewith.

Water shall conform to M-18 of Specification of Materials attached herewith.

All materials involved in the work shall confirm to relevant M of Specification of Materials attached herewith.

Waterproofing material used shall be of approved manufacturers and shall be used according to the manufacturer's specifications.

WORKMANSHIP :

The surface to be water proofed shall be cleaned thoroughly and shall be free from oil and other foreign materials. Prepared surface shall receive the following treatment.

Area shall be cleaned of all loose materials and shall be treated with neat cement slurry and mixed with water proofing compound to seal the cracks, pores etc. appearing on the surface.

Applying and grouting a slurry coat of neat cement using 2.75 kg/sqm of cement admixed with proprietary water proofing compound conforming to IS-2645 and 10mm thick water proofing cement plaster in cement Mortar 1:3 over the RCC slab including cleaning the surface before treatments.

After the slurry coat, a layer of B.B.C.C. (Brick Bat Cement Concrete) of 100 mm thickness shall be laid over tarfelt to the required slope as shown in drawing. Proportion of B.B.C.C. shall be 2 parts of brickbat and one part of lime mortar (1:2) i.e. 1 part of lime and 2 parts of sand) with 50% of C.M. 1:5 (1 Cement: 5 coarse sand) admixed with waterproofing compound over 20 mm thick layer of C.M. 1:5

A coat of cement slurry admixed with water proofing compound shall be applied to the brick bat layer.

A layer of cement mortar (1:3) with water proofing compound shall be applied on the second slurry coat and joints of brick bat layer shall be filled up completely to give a finished plain surface

After 48 hours of laying of B.B.C.C., a bedding of cement mortar (1:5), 18 to 25 mm thick bedding of C.M. 1:4 (1 Cement: 4 coarse sand) admixed with waterproofing compound shall be provided and on top of this layer, 10 mm thick neat cement slurry 2.75 kg/sq.mt on cement admixed with water proofing component be provided.

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Immediately on application of cement grout, assorted pieces of coloured glazed china previously soaked in water shall be set closely on the fresh surface and properly tamped to get the required top surface. The surface after completion of work shall be cleaned with sawdust or with diluted acid, if directed by Engineer-in-Charge. The finished surface shall be cured for 10 days. If so directed by the Engineer, a border colour or white mosaic shall be provided, without any extra cost. Tarfelt, brickbat coba and china mosaic shall be taken up the parapet walls to a height of 100-150 mm. Necessary vatas shall be provided towards drain as directed. Measurement shall be in square metres correct to two decimal places. Length and breadth of the actual laid area shall be measured and paid. No extra shall be paid for vatas and work carried over parapet.

The work shall be executed in accordance with best modern practices.

FORM OF GUARANTEE BOND:

Contractor I/ We _____ here by guarantee that work will remain unaffected and will not be in anyway damaged by water, rain and will not leak from surface for a period of for 3 years after completion of work as per terms and conditions of the contract and damaged that might be caused on account of water, rain and or similar of dampness of leakage from walls or above floor. the guarantee shall remain in force for the period of 10 years from the completion of the work under the contract and it shall remain binding to the contract for period of 10 years.

Deposit of 10 % of total amount shall be kept with the executing authority for aperiod of Three year (At least passing of one Monsoon after execution. A Guarantee bond shall be given in written on stamp paper for the guarantee of work. Any leakage found in the work shall be repaired without any extra cost. 50 % of deposit shall be released after one monsoon passed & 50 % deposit will be released after Three years.

MODE OF MEASUREMENT & PAYMENT:

The contract rate shall be for a unit of one Sq. Meter of china mosaic type water proofing treatment of specified thickness of visible area.

Item No: 37 :- Providing & laying full body Vitrified tiles flooring over 20 mm (average) base of cement mortar 1:6 (1 cement: 6 coarse sand) on new surface or fixing on existing flooring by adhesive material including dismantling of existing flooring and jointed with color cement slurry including Making 3mm spacer at joint of tiles and fill the spacer with epoxy jointing material ,finised with flush pointing & cleaning the surface etc complete selection as directed by Architect/Engineer in Charge.(Size: 1.20Mt. X 0.60 Mt.)

MATERIALS :

Water shall conform to M-1 of Specification of Materials attached herewith.

Cement mortar shall conform to M-9 of Specification of Materials attached herewith.

Tiles shall conform to M-56 of Specification of Materials attached herewith. Its selection as directed by Architect/Engineer in Charge. (Size: 1.20Mt. X 0.60 Mt.).

WORKMANSHIP :

Bedding:

The sub grade shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface tamped and corrected to desired level and allowed to harden enough to offer a rigid cushion to tiles and to enable the monsoon to place wooden planks across and squat on it.

The tiles shall be laid on cement mortar bedding of 20 mm. thick in C.M. 1:6. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The base shall be cleared and well wetted. The proportion of the cement mortar shall be as specified in the item.

Fixing tiles:

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The tiles before laying shall be soaked in water for at least two hours. Neat gray cement grout at 33 kg/Cement/Sq. mt. of honey like consistency shall be spread over the mortar bedding as directed. The edges of the tiles shall be smeared with neat cement slurry. The tiles shall be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

The tiles shall not have staggered joints. The joints shall be true to centre line both ways. The Nahni trap coming in the flooring shall be so positioned that its grating shall replace only one tile as far as possible. Where full size tiles cannot be fixed they shall be cut (Swan) to the required size and the edges rubbed smooth to ensure straight and true joints. The joints shall be filled with grey cement grout with wire brush or trowel to a depth of 5 mm. and loose material removed. White cement shall be used for pointing the joints. After fixing the tiles finally in an even plane the flooring shall be kept wet and allowed to nature undisturbed for 7 days. Providing & laying full body Vitrified tiles 9mm thick flooring over 20 mm (average) base of cement mortar 1:6 (1 cement: 6 coarse sand) on new surface or fixing on existing flooring by adhesive material including dismantling of existing flooring and jointed with color cement slurry including 3mm Making spacer at joint of tiles and fill the spacer with epoxy jointing material finished with flush pointing & cleaning the surface etcn complete selection as directed by Architect/E.I.C.

Cleaning:

The surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, it shall be carefully washed, cleared by dilute acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the construction.

MODE OF MEASUREMENT & PAYMENT:

The measurement shall be taken on Sq. Meter basis as per IS : 1200 or as revised from time to time so far as applicable

The contract rate shall be for a unit of one Sq. Meter of visible surfaces.

The rate shall be for a unit of one square meter.

Note: The flooring work shall be done as per right angle & as per architectural drawings & as suggestion by architect/E.I.C.

Item No: 38 :- Providing and fixing Fullbody vitrified tiles (dado work) of size 1200 mm × 600 mm on wall surface using approved polymer-based chemical adhesive, including dismantling of existing finish where required, surface preparation, fixing tiles in true line, level and alignment, maintaining 3 mm joints with spacers, filling joints with epoxy jointing material, finishing with flush pointing and cleaning complete, as directed by Architect/Engineer-in-Charge. (Size -1.20Mt. X 0.60 Mt.) make:Sommany,Nitco,Kajariya

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 37.

Item No: 39 :- Providing and laying 18mm thick polished GRANITE STONE SLAB flooring ,trade of step ,riser of step Laanding , door sill (umra) on 20mm (average) thick base of cement mortar 1:6 (1 cement : 6 coarse sand) laid over and jointed with coloured cement slurry including rubbing and polishing and including making half round moulding to toe of treads etc.. complete as directed by Engineer in Charge.

MATERIALS :

Signature of the Contractor

Double polished granite slab of approved colour having 18 mm thickness in single piece shall be of approved quality and shall conform to M-31 of Specification of Materials attached herewith. Granite stone shall be hard even sound, and regular in shape and generally uniform in colour. The colour of the stone shall generally be green. Brown coloured shall not be allowed for use. They shall be without any soft veins cracks or flaws the Thickness shall be as specified 18-20 mm .

Tolerance of minus 30 mm. on accounts of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be +3 mm.

The edges of stones shall be truly chiseled and table rubbed with coarse sand before paving. All angles and edges of the stones shall be true, square and free chipping and surface shall be true and plain.

When machine cut edges are specified the exposed and the edges at joints shall be machine cut the thickness of the exposed machine cut edges shall be uniform.

The stones shall have machine polished surface. When brought on site, the stones shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, sink, veneering, sills, steps, etc. where machine polishing after the stones are fixed in situ is not possible shall be double polished.

Cement mortar proportion 1:1 (1-cement: 1 coarse sand) shall conform to M-9 of Specification of Materials attached herewith.

White cement shall conform to M-4 of Specification of Materials attached herewith.

Water shall conform to M-1 of Specification of Materials attached herewith.

WORKMANSHIP :

Granite stone of approved quality shall be laid evenly to level and slope as directed by Engineer in charge over a bed of a base layer consisting of cement mortar 1:6 (1 cement: 6 coarse sand by volume) or Lime Mortar 1:1.5 (1 lime : 1.5 lime putty by volume)

The mixing for base layer shall be done intimately, The operation shall be carried out on clean water tight platform, and cement sand shall be first mixed dry in the required proportion to obtain uniform colour and then the mortar shall be mixed for at least two minutes after addition of water. In case of cement mortar, that has suffered because of evaporation of water the same shall be re-tempered by adding water as frequently as needed to restore the requisite consistency but its re-tempering shall be permitted only within thirty minute from the time of addition to water at the time of initial mixing.

Cement and sand for base layer shall be mixed in proportion as specified in the item, Cement and sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

Curing shall be started as soon as the mortar used for finished has hardened sufficiently so as to be damaged when watered. It shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages. During hot weather, all finished or partly finished work shall be covered or wetted in such manner as will prevent rapid drying of the flooring work. Joints of flooring shall be through and continuous throughout the building as directed by Engineer in charge. joints shall be filled with a stiff mixture of gray cement surly. The flooring work shall be finished by rubbing and mirror polishing after the the work of flooring is set properly. The rate of flooring is inclusive of 7.5 cm thick skirting using same stone of Granite stone strips including providing and laying in true line and level including filling the joints with gray cement slurry with rubbing and polishing as directed by Engineer in charge

MODE OF MEASUREMENT & PAYMENT :

The unit rate flooring shall include the cost of all materials, tools and plant etc. complete. The payment will be made on square Meter basis of the finished work.

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Item No: 40 :- Providing and fixing 18 mm thick, first quality black polished Granite Stone approved by the Client/Architect, for Door and Window frames, lintels, jambs and sills, laid in cement mortar (1:3), including cutting, dressing, proper fixing, making hairline joints, filling joints with white cement/pigment/joint filler, rounding of edges, edge polishing and finishing, with granite fixed in single piece.

The item shall also include jamb framing moulding, photo frame detailing, grooves, rebates and all necessary edge profiles as per detailed drawings, complete as directed by the Architect/Engineer-in-Charge.

MATERIAL :

Water shall conform to M-1 of Specification of Materials attached herewith.

Cement shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

Coarse aggregate shall conform to M-10 of Specification of Materials attached herewith.

Machine polished Granite stone slab 18mm thick (Single piece not more than 150 cm) as per design. granite stone shall be hard even sound, and regular in shape and generally uniform in colour. The stones shall have machine polished surface. When brought on site, the stones shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, sink, veneering, sills, steps, etc. where machine polishing after the stones are fixed in situ is not possible shall be double polished.

WORKMANSHIP :

Granite stone of approved quality shall be laid evenly to level and slope as directed by Engineer in charge over a bed of a base layer consisting of cement mortar 1:2 (1 cement: 2 coarse sand by volume)

Cement and sand for base layer shall be mixed in proportions of 1:2 (1 cement : 2 coarse sand by volume) Cement and sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency before mixing platform shall be thoroughly cleaned before changing from one type of cement to another.

The mixing for ` layer shall be done intimately, The operation shall be carried out on clean water tight platform, and cement sand shall be first mixed dry in the required proportion to obtain uniform colour and then the mortar shall be mixed for at least two minutes after addition of water. In case of cement mortar, that has suffered because of evaporation of water the same shall be re-tempered by adding water as frequently as needed to restore the requisite consistency but its re-tempering shall be permitted only within thirty minute from the time of addition to water at the time of initial mixing.

Cement and sand for base layer shall be mixed in proportion as specified in the item, Cement and sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

Curing shall be started as soon as the mortar used for finished has hardened sufficiently so as not to be damaged when watered. It shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages; During hot weather, all finished or partly finished work shall be covered or wetted in such manner as will prevent rapid drying of the flooring work.

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Joints of flooring shall be through and continuous throughout the building as directed by Engineer in charge joints shall be filled with a stiff mixture of gray cement surly

Providing & fixing 18 to 20mm thick GRANITE STONE at Door ,window sill, jams &sofit by keeping 225mm wide outer strip resting on sill towards outside & 100mm wide inner strip resting on outer strip by overlapping 25mm towards inside at sill and 300mm wide strip at jams & at soffit and fixing with CM (1 cement: 2 coarse sand), Araldite and screws if necessary including mirror polishing and making half round moulding on both the sides and finishing with colour cement etc. complete as directed by E.I.C.

PROPORTION OF MIX :

The proportion of cement and sand for base layer shall be one part of cement.: 2 (two) parts of sand and shall be measured by volume.

MODE OF MEASUREMENT & PAYMENT :

The unit rate flooring shall include the cost of all materials, tools and plant required for mixing, laying of base layer in true level and slope as required applying & placing stones in position, compacting, finishing, curing mirror polishing, to complete the structure or its components as shown on the drawings and according to these specifications. They shall also include the cost of making, fixing and removing of all scaffolding and forms required for the work.

The rate of plastering shall include the cost of all labour, materials tools and plant scaffolding and all incidental expenses as described herein above.

The plaster work shall be measured for its length and width, limiting dimensions to those specified on plan or as directed. The rate shall be for a unit of one square meter.

The payment will be made on square Meter basis of the finished work.

Item No: 41 :- Providing & Fixing curved shaped urinal partition of size 900 mm (H) × 450 mm (W), made of 8 mm thick frosted toughened glass with polished edges, including necessary curving as per design, complete with chrome finished stainless steel brackets/supports, fittings and fixtures of Jaquar or equivalent make. The work shall include cutting, edge finishing, fixing in proper line & level, using suitable fasteners, gaskets and sealant, including all materials, hardware and labour charges, complete at all levels as directed by the Architect/Engineer-in-Charge.

MATERIALS :

- 8 mm thick frosted toughened safety glass conforming to relevant IS standards.
- Chrome finished stainless steel brackets, supports and fittings of Jaquar or equivalent approved make.
- Approved quality silicone sealant, rubber gaskets, screws, anchors and fixing accessories.
- All hardware to be corrosion-resistant and suitable for wet areas.

WORKMANSHIP :

- Glass shall be factory toughened and curved to the approved shape and dimensions.
- All exposed edges shall be machine polished and free from chips, cracks or defects.
- Partitions shall be installed in true line, level and plumb.
- Fixing brackets and supports shall be securely anchored to the wall/floor as required.
- Protective films shall remain intact until completion of works.
- The completed installation shall be rigid, stable and free from vibration or movement.

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MODE OF MEASUREMENT& PAYMENT :

- Measurement shall be made in **Numbers (Nos.)** of completed urinal partitions installed and accepted.
- Rate shall include supply of glass, curving, polishing, fittings, brackets, sealant, fixing accessories, labour, handling, transportation, cutting, installation, cleaning and all incidental works required for complete execution.
- No separate payment shall be made for hardware, fasteners, sealants, wastage, scaffolding, lead, lift or any ancillary items necessary for completion of the work.

Item No: 42 :- THREE TRACK WINDOW Providing and fixing factory made uPVC glazed/wire mesh windows/doors comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler (where ever required) extruded profiles having 6 mm thick High performance glass minimum wall thickness of 1.70 mm for Series R1 and R2 profiles and 2.10 mm for Series R3 and R4 profiles conforming to EN: 12608 in any shape, colour and design duly reinforced with galvanized mild steel section made of required shape & size as per CPWD Specification, uPVC extruded glazing beads, interlocks and Inline sash adaptor (where ever required) of appropriate dimension, EPDM gasket, hardware, SS 304 grade fasteners of minimum 8 mm dia with countersunk head, comprising of matching polyamide PA6 grade sleeve for fixing frame to finished wall as per IS 1367 : Part 1 to 14, plastic packers, plastic caps and necessary stainless steel screws etc. Profile of frame, sash & mullion (if required) shall be mitred cut and fusion welded/mechanically jointed duly sealed at all corners, including drilling of holes for fixing hardware and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant over backer rod of approved size and quality, all complete as per approved drawing conforming to CPWD specification & direction of Engineer-in-Charge. Section of steel reinforcement and cross sections of uPVC profiles to be as per design approved by Engineer-in-Charge. Using R3 series with frame (98 mm & above)x (40 mm & above) & sash (30 mm & above)x (55 mm & above) with zinc alloy (zamak) powder coated handle on two end panels along with multi-point locking system (Height upto 1.8 metre).

MATERIALS :

- Lead-free multi-chambered uPVC profiles conforming to EN 12608.
- R3 Series outer frame size 98 mm × 40 mm or larger.
- R3 Series sash size 30 mm × 55 mm or larger.
- Galvanized steel reinforcement sections as per approved design.
- 6 mm thick high-performance clear/tinted glass as specified.
- Fibre/SS wire mesh shutter as specified.
- uPVC glazing beads, interlocks and sash adaptors.
- EPDM gaskets and weather seals.
- Zinc alloy (Zamak) powder-coated handles.
- Multipoint locking system, rollers and accessories.
- SS 304 grade fasteners, anchors and screws.
- Approved weatherproof silicone sealant and backer rod.

WORKMANSHIP :

- Profiles shall be cut accurately and fusion welded at corners.
- Reinforcement shall be securely fixed within profiles as per approved design.
- Frames shall be installed true to line, level and plumb.
- Sliding shutters shall operate smoothly without obstruction.
- Hardware shall be fixed firmly and function properly.
- All joints shall be weather-tight and water-tight.

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- Gaps between frame and wall shall be sealed with approved silicone sealant over backer rod.
- Protective film shall remain in place until completion and handover.
- Finished window shall be free from distortion, scratches, cracks or visible defects.

MODE OF MEASUREMENT & PAYMENT :

- Measurement shall be made in **Square Metres (Sq.M.)** of finished window opening area measured overall between outer dimensions of frame.
- No deduction shall be made for mullions, transoms or intermediate members.
- Rate shall include frame, sliding shutters, glass, wire mesh shutter, reinforcement, hardware, locking system, handles, rollers, gaskets, sealants, fasteners, fabrication, transportation, installation, testing, cleaning and all incidental works required for complete installation.
- No separate payment shall be made for steel reinforcement, sealants, packers, accessories, wastage, scaffolding, lead, lift or any ancillary items necessary for completion of the work.

Item No: 43 :- Providing and applying Exterior Weather Resistant Textured wall finish made from emulsified acrylic polymers, siliceous aggregated marble chips and quarts powder of jotun or equivalent having average thickness of 2 mm with approved color and textured finishes as per company's specification and standards laid on external rough plaster for all heights after necessary preparatory coating incl. application of necessary preparatory coat, scaffolding, curing and priming.

Item should be include as Providing and applying of surface cleaning then crack filling with nerolec perma crack filler then dholpur texture two coats then one coat of nerolec parma damp protect exterior primer on wall surfaces after thoroughly brushing the surface free from mortar droppings and other foreign matter. Item includes making the surface even and smooth by sand papers. then after required for the work with weather proof nerolec exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials. Providing and applying Exterior Weather Resistant Textured wall finish made from emulsified acrylic polymers, siliceous aggregated marble chips and quarts powder of Jotun or equivalent having average thickness of 2 mm with approved color and textured finishes as per company's specification and standards laid on external rough plaster for all heights after necessary preparatory coating incl. application of necessary preparatory coat, scaffolding, curing and priming.

MODE OF MEASUREMENT:

The rate shall be for a unit of one square meter.

Rates are inclusive of all the material and labour and scaffolding work, cleaning of the floors etc.& 8 years warranty etc. complete as directed & suggested by Architect & EIC.

Item No: 44 :- Providing & fixing Steel work, grill work, stair ladders, Entry Gate, parking shed ,etc welded in built up/rolled steel sections framed work including cutting, hoisting, fixing in position and applying a priming coat of read lead paint. (A)In beams and joists, channels angles Tees, flats, with connecting plates or angle cleats as in main and cross beams. Hip and jack rafters, purlins conneted to common rafters etc completed as directed by architect / Engineer In charge.

MATERIALS :

The structured steel work shall conform to M-17. Red lead paint shall conform to I.S : 102-1962.

WORKMANSHIP :

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The steel sections as specified or required, shall be cut, square and to correct lengths, as per drawings and design. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of member, except as indicated in the drawing or as directed. All straightening and shaping to form shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in such a manner as not to impair the strength of the metal. All operations shall be done in cold state unless otherwise directed/permitted. Steel riveted or bolted in built up sections, frame work.

The steel structure as shown in the drawings or as per direction of the Engineer-in-charge shall be laid out on a level platform to full scale and to full size in parts. A steel tape shall be used for measurements to ensure maximum accuracy.

Wooden templates 12 mm. to 19 mm. thick or metal sheet template shall be made to correspond to each connecting gussets plate and rivet holes shall be accurately marked on them and drilled. The templates shall be laid on the steel members and holes of the steel members shall also be marked for cutting. The base of steel column and the position of Anchor bolts shall be carefully set out

All stiffeners shall be formed by pressure and where practicable the metal shall not be cut and welded in making these. In major work, or where so specified, shop drawings giving complete details and information for the fabrication of the component parts of the structure including location, type, size, (origin and details of rivets, bolts or weld shall be prepared in advance of the actual fabrication and as distinctly marked or stenciled with paint with the identification mark as given in the shop drawings. The bars shall be thickened at the ends, so as to provide for screwed threads and gradually tapered off to meet their normal section.

Great accuracy shall be observed in fabrication of various member, so that these can be assembled without being unduly packed, stained, or forced into position and when built up, shall be true and free from twists, bends, buckles, or open joints.

Before making holes in individual members for fabrication the steel work intended to be riveted or bolted together shall be as aligned or clamped properly and tightly so as to ensure close abutting or lapping of the surfaces of the different members. All stiffeners shall bear tightly both at top and bottom without being drawn or caulked. The abutting joints shall be cut or crossed true and straight and fitted close together. Web splice plates and stiffeners under stiffened shall be cut to fit within 3 mm. or flange Angles Web plates of Girders shall have no cover. Plates, shall have their ends flush with the top of angles forming the flanges unless otherwise required. The web plates when spliced shall have clearance of not more than 6 mm. The erection, clearance for created ends of members connecting steel shall preferably be not greater than 1.5 mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm. at each end but where for a practical reason greater clearance is necessary, suitably designed seating shall be provided.

Rollers shall be accurately tuned to gauge. These straight and smooth and free from flaws. The roller bearing shall be provided with adequate arrangements for holding the girders or truss resting on it. In columns caps and bases, the ends of stiffeners with the attached gussets Angles, channels etc after riveting together shall be accurately mechanized so that the parts connected butt against each other over the entire surfaces of contact connecting angles or channels shall be fabricated and placed in position with greater accuracy so that they are not unduly reduced in thickness by machining. The ends of bearing stiffeners shall be mechanized or ground to fit tightly both at the top and bottom. All holes shall generally be drilled to the required size and at required, position. Sub punching shall be permitted provided it is done 3 mm. or less in diameter and reamer thereafter to the required size. The holes for rivets and bolts shall be larger by 0.4 to 6 mm. than the nominal diameter of rivets or black bolts depending upon the diameter of rivets.

Holes shall have their axis perpendicular to the surface bored through. The drilling or reaming shall be free from burrs, and the holes should be clean and accurate holes for counter sunk bolts shall be made in such a manner that their heads fit flush with the surface after fixing.

The fabrication work shall be completed in workshop as far as it is practicable to do so. Site joints shall be done with rivets and fitted bolts or black bolts, as shown in the drawings or as directed. Generally the following principles shall govern the use of rivets turned and fitted bolts, and black bolts.

- (i) Rivets and turned and fitted bolts shall be used where the connections are such that slip under load has to be avoided.
- (ii) Black bolts may be used very sparingly where a force is carried through a connection without impact, vibration or reversal of stresses.

Riveting:

The parts assembled for riveting shall be in close contact with each other and the bearing stiffeners shall bear tightly both at top and bottom without being drawn or caulked. Members to be riveted shall be properly pinned or bolted and rigidly held together while riveting. Drifting of holes shall not be permitted. Except to draw the parts together and the drifting tools so used shall have maximum diameter not exceeding, thenominal diameter of rivets or bolts. Drifting done during assembling shall not distort the metal or enlarge the holes.

The shanks of rivets shall project beyond the plate-surface sufficiently so as to fill hole thoroughly and form the required head after riveting.

The riveting shall be done by hydraulic or pneumatic process. However, where such facilities are not available, hand riveting may be permitted. The rivet shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than 10 mm. may be fitted cold. Rivets shall be of heat finish with heads full and of equal size. All loose, burnt or badly formed rivets with concentric or deficient heads shall be cut out and replaced. The heads of rivets shall be central to shanks and shall grip the assembled member firmly. In cutting out rivets, care shall be taken so as not to injure assembled members, caulking or reequipping shall not be permitted.

For testing rivets, a hammer weighing approximately 0.25 kg shall be used. Both heads of the rivets shall be tapped, slack rivets will give a hollow sound and a jar.

All rivet heads shall be painted with red lead paint within a week of their fixing.

All bolt heads and nuts shall be hexagonal and of equal size unless specified otherwise. The screwed heads shall conform to I.S. 1363-1960 and the threaded surface shall not be tapered. The bolts shall be of such length so as to project two clear threads beyond the nuts when fixed in position and these shall fit in the holes without any shakes. The nut shall be fit in the threaded ends of bolts properly.

Where turned and fitted bolts are required to be used in place of rivets shall be provided with washers not less than 6 mm. thick so that the nut when tightened shall not bear on the unthreaded body of the bolt. Tapered washers shall be provided for all heads and nuts bearing on leveled surfaces. The threaded portion of the bolt shall not be within the thickness of the parts bolted together, the faces of the bolt heads and nuts abutting against steel members shall be machine finished. Where there is a risk of the nut being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of locknuts, spring washers, cross-cutting or hammering down of threads as directed.

Bolts, nuts, and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. The whole steel work shall be painted with a coat of priming coat of red lead, as per relevant specification of painting.

MODE OF MEASUREMENTS & PAYMENT :

The steel work shall be measured in general as under:

- (a) All work shall be measured on the basis of finished dimensions as fixed at site and measured net unless specified otherwise.
- (b) The weight of steel sections, steel rods, and steel strips in finished work shall be calculated on standard weight on the same basis on which steel is supplied to Contractor by department or those given in relevant I.S. : if steel is arranged by the contractor.
- (c) The weight of steel plates and strips shall be taken from relevant I.S. based on 7.35 kg./ sq. meter for every millimeter sheet thickness if steel is supplied to the contractor by department.
- (d) Unless otherwise specified, weight of cleats, brackets, packing pieces, bolts, nuts, washer, distance pieces, separators, diaphragm gusset (taking overall square dimensions) fish plates etc. shall be added to the weight of respective items.
- (e) In riveted work allowance is to be made for weight of rivet heads. No deductions shall be made for rivet or bolt holes excluding holes for anchor or holding down bolts.
- (f) For forged steel and steel castings, weight shall be calculated on the basis of 7850 kg./cum.
- (g) Unless otherwise specified, no allowance shall be made for the weld metal in case of welded steel structure.
- (h) Dimensions other than cross sections and thickness of plates shall be measured to nearest 0.001m
- (i) Mill tolerance shall be ignored when weight is determined by calculation.

The rate includes cost of all material, labour, erection, hoisting scaffolding, protective measure, required for proper completion of the item of work. This shall also include conveyance and delivery handling, loading, unloading and storing etc. required for completing the item described above including necessary wastage involved.

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The rate shall be for a unit of one Quintal.

Item No: 45 :- Painting two coats (excluding priming coat) on new steel and other metal surface with enamel paint, brushing, interior to give an even shade including cleaning the surface an even shade including cleaning the surface of all dirt, dust and other foreign matter etc. complete as directed by Engineer Incharge.

MATERIALS :

Synthetic enamel paint shall be of best quality and approved make (as per list of approved make attached with the Technical Bid) and shall conform to IS-1932-1964 or as revised from time to time.

Read lead paint shall be of best quality and approved make (as per list of approved make attached with the Technical Bid) and shall conform to IS-102-1962.

WORKMANSHIP :

The work shall be carried out as per C-15 of Code of practice attached herewith Painting work shall be carried out as per C-15 of Code of practice attached herewith & latest IS code of practice for painting work to steel surface.

The work shall be executed in accordance with best modern practices.

The entire work shall be carried out in best workmanship like manner.

It should be carried out as Applying priming coat over new steel and other metal surface after and including preparing the surface by thoroughly cleaning, oil, grease, dirt and other foreign matter and scoured with brushes fine steel wood, scrapers and sand paper with ready mixed priming paint brushing red lead. Painting two coats (including 1 Priming coat) on new steel and other metal surface with enamel paints brushing, interior to give an even shade incl. clean the surface of all dirt, dust and other foreign matter. (work for all the floors)

MODE OF MEASUREMENT & PAYMENT :

The item shall be measured as finished work in Sq.Mt. and the rate shall be for Sq.Mt.

Item No: 46 :- Supplying and fixing stainless steel hand Railing of Grade 304 (16 gauge thick sections) with glossy finish consisting of 32mm x 32mm size vertical posts 900 Heigh at maximum spacing @ 750 mm c/c with suitable cups at top rail of 50 mm x 50 mm & intermediate horiztal rails 3 nos of 16 mm x 16 mm size etc complete at all levels including bending to required profile. Tungsten insert gas welding & all required accessories, grinding & labour etc complete as per design fixing with base slab/concrete or side wall/RCC by hilty or equivalent fastenre and plates as per Drawing and instruction of Engineer-in-Charge.(work for all floors)

MATERIALS :

A. Steel Railings and Steel Sleeves:

1. Pipe shall be standard weight pipe conforming to latest IS code. Steel tubing shall conform to ASTM A501 or as designated on the drawings.

2. Galvanized pipe and tubing shall be required when designated on the drawings.

3. Sleeves shall be galvanized on all surfaces.

4. Weathering steel shall be required when designated on the DRAWINGS.

5. Stainless steel hand Railing of Grade 304

6. Stainless steel hand Railing having 16-gauge thick sections

WORKMANSHIP :

Signature of the Contractor

Whole work should be carried out as per requirement and as directed by Engineer-in-charge.

It should be carried out as follows.

Providing and fixing S.S. (8% nickel, SS304) PIPE RELLING of 0.90m height as pattern shown in drawings at STAIRCASE with anchoring 0.075m in RCC or masonry including 50mm dia. SS pipe 18 gauge @ 1.40 kg./m as hand rail, and 16mm dia. SS pipe 18 gauge @ 0.45 kg./m as intermediate horizontal member including welding, grinding, fixing in position with necessary fixtures and fastenings (base SS cap 50mm dia. hole, SS pipe cap 16mm hole & 16mm) and polishing etc. complete as per detailed drawings & directed by E.I.C.

MODE OF MEASUREMENT & PAYMENT :

The rate shall be on Running metre basis of railing. The rate shall include providing and fixing all pipe railing work with necessary jointing welding labour for fixing the in position, etc. complete.

The Item shall be measured and paid as finished work on Running Metre basis.

Item No: 47 :- Designing, fabricating, testing, protection, installing and fixing in position semi (grid) unitized system of structural glazing (with open joints) for linear as well as curvilinear portions of the building for all heights and all levels, including:

(a) Structural analysis & design and preparation of shop drawings for the specified design loads conforming to IS 875 part III (the system must passed the proof test at 1.5 times design wind pressure without any failure), including functional design of the aluminum sections for fixing glazing panels of various thicknesses, aluminium cleats, sleeves and splice plates etc. gaskets, screws, toggles, nuts, bolts, clamps etc., structural and weather silicone sealants, flashings, fire stop (barrier)-cum-smoke seals, microwave cured EPDM gaskets for water tightness, pressure equalisation & drainage and protection against fire hazard including

(b) Fabricating and supplying serrated M.S. hot dip galvanised / Aluminium alloy of 6005 T5 brackets of required sizes, sections and profiles etc. to accommodate 3 Dimentional movement for achieving perfect verticality and fixing structural glazing system rigidly to the RCC/ masonry/structural steel framework of building structure using stainless steel anchor fasteners/ bolts, nylon seperator to prevent bimetallic contacts with nuts and washers etc. of stainless steel grade 316, of the required capacity and in required members.

(c) Providing and filling, two part pump filled, structural silicone sealant and one part weather silicone sealant compatible with the structural silicone sealant of required bite size in a clean and controlled factory / work shop environment, including double sided spacer tape, setting blocks and backer rod, all of approved grade, brand and manufacture, as per the approved sealant design, within and all around the perimeter for holding glass.

(d) Providing and fixing in position flashings of solid aluminium sheet 1 mm thick and of sizes, shapes and profiles, as required as per the site conditions, to seal the gap between the building structure and all its interfaces with curtain glazing to make it watertight.

(e) Making provision for drainage of moisture/ water that enters the curtain glazing system to make it watertight, by incorporating principles of pressure equalization, providing suitable gutter profiles at bottom (if required), making necessary holes of required sizes and of required numbers etc. complete. This item includes cost of all inputs of designing, labour for fabricating and installation of aluminium grid, installation of glazed units, T&P, scaffolding and other incidental charges including wastages etc., enabling temporary structures and services, cranes or cradles etc. as described above and as specified.

The item includes the cost of getting all the structural and functional design including shop drawings checked by a structural designer, dully approved by Engineer-incharge. The item also includes the cost of all mock ups at site, cost of all samples of the individual components for testing in an approved laboratory, field tests on the assembled working structural glazing as specified, cleaning and protection till the handing over of the building for occupation. In the end, the Contractor shall provide a water tight structural glazing having all the performance characteristics etc. all complete as required, as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer in Charge.

MODE OF MEASUREMENT & PAYMENT :

The rate shall be on Sq. metre basis of lift glass facade. The rate shall include as per item description, as specified, as per the approved shop drawings and as directed by the Engineer in Charge etc. complete.

The Item shall be measured and paid as finished work on Square Metre basis.

Item No: 48 :- Providing and supplying Spandrel Glass Panels comprising of 6 mm thick heat strengthened monolithic float glass of approved colour and shade with reflective soft coating on surface # 2 of approved colour and shade so as to match the colour and shade of the IGUs in the vision panels etc. ,all complete for the required performances as specified, as per the Architectural drawings, as per the approved shop drawings, as specified, and as directed by the Engineer- in- Charge.

MATERIAL :

Spandrel Glass Panels comprising of 6 mm thick heat strengthened monolithic float glass of approved colour and shade with reflective soft coating on surface # 2 of approved colour and shade so as to match the colour and shade of the IGUs in the vision panels etc., all complete for the required performances as specified, as per the Architectural drawings, as per the approved shop drawings, as specified, and as directed by the Engineer- in- Charge.

For payment, only the actual area of glass on face # 1 of the glass panels (but excluding the area of grooves and weather silicone sealant) provided and fixed in position, shall be measured in sqm.(Payment for fixing of Spandrel Glass Panels in the curtain glazing is included in cost of relevent Item). (i) Coloured tinted float glass 6mm thick substrate with reflective soft coating on face # 2, having properties as visible Light transmittance (VLT) of 25 to 35 %, Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28) and U value of 3.0 to 3.3 W/m2 degree K etc.

The properties of performance glass shall be decided by technical sanctioning authority as per the site requirement.

MODE OF MEASUREMENT AND PAYMENT :

No payment shall be made for weight of screws, bolts, nuts etc.

The rate shall be for unit of one Sq.mt.

Item No: 49 :- Providing and fixing elevation feature GRC brackets as PER ELEVATION DWG IN 30 mm thk. for the locations as per the drawings. at all levels made from GRC make Glass fibre reinforced concrete (GRC) using white cement, Quartz Sand, AR Fibres, Water Plasticizers & COLOR in approved shape, size and length as per the design and drawings and as per specifications, mix design. The typical GRC items should be of sizes as per the drawings. Fixing of GRC items shall be with help of S.S Screws Fixtures, M.S Angle Cleats, Fissure Plug, and Dowel Pin proper alignment as per drawings (Shop drawings to be submitted by the contractor before the work start). As per approved paint, shade & Finishing with GRC powder & filling the joints with Epoxy sealant neatly between GRC items and primary structures. The fins should be

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in absolute straight plumb line and length and joints between channels should be neatly filed to make seamless uniform surface across the entire elevation of the building without any visibility to joints.

MATERIALS :

- Minimum **30 mm thick GRC sections** unless otherwise indicated in drawings.
- GRC mix comprising:
 - White Portland Cement.
 - Washed and graded Quartz Sand.
 - Alkali Resistant (AR) Glass Fibres.
 - Water reducing plasticizers/admixtures.
 - Integral colour pigments where specified.
- Average compressive strength, flexural strength and density shall conform to approved GRC manufacturer's standards.
- Surface finish to be smooth, uniform, free from cracks, honeycombing, warping, pinholes and other defects.

FABRICATION :

- GRC brackets shall be factory moulded to the required profiles, shapes, curves and dimensions as per approved architectural drawings and shop drawings.
- All edges, corners, grooves, projections and decorative details shall be accurately formed.
- Reinforcement and stiffeners shall be incorporated wherever required to ensure structural stability and durability.
- Shop drawings, fixing details and structural calculations shall be submitted and approved prior to commencement of fabrication.

FIXING SYSTEM :

- Fixing shall be carried out using approved mechanical fixing system comprising:
 - Stainless Steel (SS 304/316) Screws and Fasteners.
 - M.S. Angle Cleats, Brackets and Supports with hot-dip galvanization or approved anti-corrosive treatment.
 - Dowel Pins, Anchor Bolts and Fissure Plugs.
 - Stainless Steel Inserts and Embedded Fixing Components.
- Fixing arrangement shall be designed to safely withstand dead load, wind load and thermal movements.
- All brackets shall be installed true to line, level and plumb as per approved drawings.

JOINT TREATMENT & FINISHING :

- Joints between adjacent GRC members and between GRC and primary structure shall be filled with approved epoxy sealant or polyurethane sealant.
- Surface imperfections shall be repaired using matching GRC repair mortar/GRC powder mix.
- Joints shall be finished to achieve a uniform and seamless appearance.
- No visible gaps, cracks, undulations or misalignments shall be accepted.
- Final surface shall match approved texture, colour and finish.

WORKMANSHIP :

- GRC fins, brackets and decorative members shall be installed in perfect alignment maintaining continuous straight lines throughout the elevation.
- All horizontal and vertical members shall be maintained in true line and plumb.
- Junctions and connections shall be neatly finished to provide a monolithic appearance.

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- Adequate precautions shall be taken during handling, transportation and erection to prevent damage.

QUALITY ASSURANCE :

- GRC manufacturer shall provide material test certificates and quality assurance documents.
- Samples/mock-ups shall be approved prior to bulk production.
- Any damaged, cracked or defective units shall be replaced at contractor's cost.

MODE OF MEASUREMENT AND PAYMENT :

Measurement shall be made in **Square Metres (Sq.m.)** of exposed surface area of GRC brackets/features installed and accepted, unless otherwise specified in BOQ.

WARRANTY CLAUSE :

The contractor shall provide a **5 (Five) Year Warranty** from the date of completion against defects in materials, manufacturing, colour finish, fixing system and workmanship of GRC elements. Any defects, cracks, deformation, loosening of fixings or failures occurring during the warranty period shall be repaired or replaced by the contractor at no extra cost to the Employer. Warranty shall be supported by both the manufacturer and installer.

Item No: 50 :- Providing and fixing elevation feature GRC Triangle design as PER ELEVATION DWG IN 30 mm thk. for the locations as per the drawings. at all levels made from GRC make Glass fibre reinforced concrete (GRC) using white cement, Quartz Sand, AR Fibres, Water Plasticizers & COLOR in approved shape, size and length as per the design and drawings and as per specifications, mix design. The typical GRC items should be of sizes as per the drawings. Fixing of GRC items shall be with help of S.S Screws Fixtures, M.S Angle Cleats, Fissure Plug, and Dowel Pin proper alignment as per drawings (Shop drawings to be submitted by the contractor before the work start). As per approved paint, shade & Finishing with GRC powder & filling the joints with Epoxy sealant neatly between GRC items and primary structures. The fins should be in absolute straight plumb line and length and joins between channels should be neatly filed to make seamless uniform surface across the entire elevation of the building without any visibility to joints.

MATERIALS :

- White Portland Cement conforming to relevant IS standards.
- Washed and graded Quartz Sand.
- Alkali Resistant (AR) Glass Fibres.
- Approved water-reducing plasticizers and additives.
- Integral colour pigments as approved by Architect.
- Minimum 30 mm thick GRC section unless otherwise specified.
- Uniform texture, colour and finish throughout the work.

FABRICATION :

- GRC Triangle Panels shall be factory moulded to the exact dimensions, geometry and profiles indicated in approved architectural and shop drawings.
- Panels shall be free from cracks, warping, honeycombing, shrinkage defects, pinholes and surface imperfections.
- Adequate ribs, stiffeners and reinforcement shall be incorporated wherever required for structural stability.
- Shop drawings, fabrication details and fixing methodology shall be submitted and approved before commencement of work.

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FIXING SYSTEM :

- Installation shall be carried out using approved mechanical fixing systems comprising:
 - Stainless Steel (SS 304/316) Screws and Fasteners.
 - M.S. Angle Cleats and Brackets with hot-dip galvanization or approved anti-corrosive coating.
 - Dowel Pins, Fissure Plugs and Anchor Fasteners.
 - Embedded inserts and support accessories as required.
- Fixing arrangement shall safely resist self-weight, wind loads and thermal movements.
- All panels shall be fixed true to line, level and plumb in accordance with approved drawings.

JOINT TREATMENT & FINISHING :

- Joints between adjacent GRC panels and between GRC and structural elements shall be neatly sealed with approved Epoxy/PU Sealant.
- Surface corrections and repairs shall be carried out using matching GRC repair mortar/GRC powder.
- Final finish shall be smooth, uniform and seamless with approved colour, texture and appearance.
- No visible joints, cracks, gaps, waviness or alignment defects shall be permitted.

WORKMANSHIP :

- All triangular feature elements shall be installed in perfect alignment maintaining the required geometry and pattern throughout the elevation.
- Horizontal, vertical and inclined members shall be true to line, level and plumb.
- Joints and connections shall be finished to achieve a monolithic and aesthetically uniform appearance.
- Proper protection shall be provided during transportation, storage and installation to prevent damage.

QUALITY ASSURANCE :

- Manufacturer's test certificates for GRC materials shall be submitted.
- Mock-up/sample panel shall be approved before bulk production.
- Any damaged or defective panels shall be replaced by the contractor at no additional cost.

WARRANTY CLAUSE :

The contractor shall provide a **10-year warranty** against defects in materials, manufacturing, colour finish, fixing systems and workmanship. Any defects occurring during the warranty period shall be repaired or replaced by the contractor at no extra cost to the Employer.

MODE OF MEASUREMENT AND PAYMENT :

Measurement shall be made in **Square Metres (Sq.m.)** of actual exposed GRC surface area installed and approved at site.

Item No: 51 :- Providing and fixing elevation feature GRC Rectangle design as PER ELEVATION DWG IN 30 mm thk. for the locations as per the drawings. at all levels made from GRC make Glass fibre reinforced concrete (GRC) using white cement, Quartz Sand, AR Fibres, Water Plasticizers & COLOR in approved shape, size and length as per the design and drawings and as per specifications, mix design. The typical GRC items should be of sizes as per the drawings. Fixing of GRC items shall be with help of S.S Screws Fixtures, M.S Angle Cleats, Fissure Plug, and Dowel Pin proper alignment as per drawings (Shop drawings to be submitted by the contractor before the work start). As per approved paint, shade & Finishing with GRC powder & filling the joints with Epoxy sealant neatly between GRC items and primary structures. The fins should be in

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absolute straight plumb line and length and joints between channels should be neatly filed to make seamless uniform surface across the entire elevation of the building without any visibility to joints.

MATERIALS :

- Glass Fibre Reinforced Concrete (GRC) panels/elevation features of approved make, **30 mm thick**, manufactured using **White Cement, Washed Quartz Sand, Alkali Resistant (AR) Glass Fibres, Water, Plasticizers, Pigments/Colour Additives** and other approved admixtures.
- GRC shall be produced as per approved mix design and manufacturer's recommendations.
- Panels shall be cast in approved rectangular profiles, shapes, sizes and lengths as shown in architectural elevation drawings.
- Fixing accessories shall comprise **Stainless Steel Screws, Stainless Steel Fixtures, M.S. Angle Cleats, Dowel Pins, Anchor Fasteners, Fissure Plugs, Brackets and other necessary hardware.**
- M.S. components shall be hot-dip galvanized or treated with approved anti-corrosive coating before installation.
- Approved epoxy sealant for joints.
- GRC repair/filling powder and approved finishing materials matching the panel colour and texture.
- Approved exterior-grade paint/coating wherever specified in drawings.

WORKMANSHIP :

- Contractor shall submit detailed shop drawings, fixing details and panel layout drawings for approval prior to commencement of work.
- GRC units shall be factory manufactured under controlled conditions and cured adequately to achieve specified strength and durability.
- All panels shall be true to dimensions, free from cracks, honeycombing, warping, chips or surface defects.
- Fixing shall be carried out using approved stainless steel fixtures, M.S. angle cleats, dowel pins and anchors as per approved shop drawings and manufacturer's recommendations.
- All fixing systems shall be designed to safely withstand dead loads, wind loads and service loads.
- Panels shall be installed true to line, level and plumb with uniform spacing and proper alignment throughout the elevation.
- Joints between adjacent GRC members shall be neatly finished and sealed with approved epoxy sealant to achieve a watertight and seamless appearance.
- Visible joints, gaps, undulations or misalignments shall not be permitted.
- Surface imperfections shall be repaired using matching GRC filler material and finished to obtain a uniform texture and colour.
- Completed elevation features shall maintain continuous straight lines, sharp edges and consistent profiles across the entire façade.
- All cutting, drilling, lifting, scaffolding, staging, protection and cleaning required for complete installation shall be included.

MODE OF MEASUREMENT AND PAYMENT :

- Measurement shall be made in **Square Metres (Sq.m.)** of the actual exposed finished surface area of GRC elevation features installed and accepted.
 - No separate measurement shall be made for returns, grooves, rebates, joints, cut-outs, edge treatments, fixing hardware, cleats, anchors, dowels, sealants, scaffolding, lifting arrangements or wastage.
 - The rate shall include manufacturing, mould preparation, reinforcement, colouring, transportation, handling, lifting, erection, fixing system, joint treatment, sealing, finishing, touch-up work and all materials, labour, tools, equipment and incidental works required for complete execution of the item.
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Item No: 52 :- Providing and fixing factory made 18 mm thick single extruded WPC (Wood Polymer Composite) solid plain white colour board Jali, CNC (Computer numeric control) routed of approved design by Engineer-in-charge which are machine cut for duct/shaft covering, partitions and facades comprising of virgin polymer of K value 58-60 (Suspension Grade), calcium carbonate and natural fibers (wood powder/ rice husk/wheat husk) and non toxic additives(maximum toxicity index of 12 for 100 gms) having minimum density of 650 kg/cum and screw withdrawal strength of 1800 N (Face) minimum compressive strength 50 N/mm², modulus of elasticity 850 N/mm² and resistance to spread of flame of Class A category with properties of being termite/borer proof, water/ moisture proof and fire retardant and fixing on M.S (mild steel) frame made of 25 x 25 x 1.5 mm square hollow box section including applying a priming coat of approved steel primer, placed at grid made at 1.0 x 1.0 m or as per requirement at site with necessary stainless steel fasteners and SS screws etc., all complete as per direction of Engineer-In- Charge.

MATERIALS :

- 18 mm thick factory-made single extruded **WPC (Wood Polymer Composite) solid board** of approved make and shade.
- WPC board manufactured from virgin PVC polymer (K Value 58–60), calcium carbonate, natural fibres and non-toxic additives.
- Minimum density: **650 kg/m³**.
- Minimum compressive strength: **50 N/mm²**.
- Minimum modulus of elasticity: **850 N/mm²**.
- Minimum screw withdrawal strength: **1800 N (Face)**.
- Flame spread resistance: **Class A** category.
- Material shall be termite-proof, borer-proof, moisture-proof and fire-retardant.
- Supporting frame of **25 x 25 x 1.5 mm thick M.S. square hollow box sections** with one coat of approved anti-corrosive steel primer.
- Stainless steel screws, fasteners, brackets and fixing accessories of approved quality.

WORKMANSHIP :

- WPC panels shall be factory fabricated and CNC routed as per approved drawings and design patterns.
- All panels shall be accurately cut with smooth edges and uniform finish.
- M.S. framework shall be properly aligned, levelled, welded and securely anchored to the supporting structure.
- Welded joints shall be ground smooth and coated with approved steel primer.
- WPC jali panels shall be fixed rigidly to the framework using stainless steel screws and approved fixing accessories.
- Panels shall be installed true to line, level and plumb with uniform joints and proper alignment.
- Necessary cutting, edge finishing, drilling, lifting, scaffolding and cleaning shall be carried out to complete the work in all respects.
- Finished surface shall be free from cracks, warping, distortion, scratches or visible defects.

MODE OF MEASUREMENT AND PAYMENT :

- Measurement shall be made in **Square Metres (Sq.m.)** of the actual installed and accepted visible area of WPC jali.
- No separate measurement shall be made for cut-outs, patterns, openings, wastage, overlaps, screws, fasteners, brackets, framework, supports or accessories.
- The rate shall include supply, fabrication, CNC cutting, M.S. framework, primer coating, transportation, lifting, erection, fixing and all labour, materials and incidental works required for completion of the item.

Item No: 53 :- Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the materials with water at OMC in mechanical mix plant carriage of mixed materials by tipper to site, laying in uniform layers (Layer should not be more than 200 mm) with paver in sub base/base course on well prepared surface and camber with Sensor paver consolidation by vibratory road roller to achieve the desired density by using machine crushed chips as per required gradation mixing with required optimum quantity of water incl material, labour, plant and machinery and equipment etc. complete by plant mix method. (Using mechanical paver) .

WET MIX MACADAM SUB-BASE/BASE

SCOPE :

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared sub-grade/sub- base/ base or existing pavement as the case may be in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be upto 200 mm with the approval of the Engineer.

MATERIALS :

Aggregates

Physical Requirements

Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 percent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400-12.

If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS:2386 (Part-5).

Table 400-12: Physical Requirements of Coarse Aggregates for Wet Mix Macadam for Sub-base/Base Courses

S. No.	Test	Test Method	Requirements
1)	Los Angeles Abrasion value or Aggregate Impact value	IS:2386 (Part-4)	40 percent (Max.)
		IS:2386 (Part-4) or IS:5640	30 percent (Max.)
2)	Combined Flakiness and Elongation indices (Total)	IS:2386 (Part-1)	35 percent (Max.)*

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To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The values of flakiness index and elongation index so found are added up.

Grading Requirements

The aggregates shall conform to the grading given in Table 400-13.

Table 400-13 : Grading Requirements of Aggregates for Wet Mix Macadam

IS Sieve Designation	Percent by weight passing the IS Sieve
53.00 mm	100
45.00 mm	95–100
26.50 mm	—
22.40 mm	60–80
11.20 mm	40–60
4.75 mm	25–40
2.36 mm	15–30
600.00 micron	8–22
75.00 micron	0–5

Material finer than 425 micron shall have Plasticity Index (PI) not exceeding 6.

The final gradation approved within these limits shall be graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

Construction Operations

Preparation of Base

Clause 404.3.1 shall apply.

Provision of Lateral Confinement of Aggregates

While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer and following the sequence of operations described in Clause 404.3.3.

Preparation of Mix

Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled addition of water and forced/ positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. The plant shall have following features:

For feeding aggregates– three/ four bin feeders with variable speed motor

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Vibrating screen for removal of oversize aggregates

Conveyor Belt

Controlled system for addition of water

Forced/positive mixing arrangement like pug-mill or pan type mixer

Centralized control panel for sequential operation of various devices and precise process control

Safety devices

Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to

22.4 mm size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

Spreading of Mix

Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared sub-grade/sub-base/base in required quantities. In no case shall these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.

The mix may be spread by a paver finisher. The paver finisher shall be self-propelled of

adequate capacity with following features:

Loading hoppers and suitable distribution system, so as to provide a smooth uninterrupted material flow for different layer thicknesses from the tipper to the screed.

Hydraulically operated telescopic screed for paving width upto to 8.5 m and fixed screed beyond this. The screed shall have tamping and vibrating arrangement for initial compaction of the layer.

Automatic levelling control system with electronic sensing device to maintain mat thickness and cross slope of mat during laying procedure.

In exceptional cases where it is not possible for the paver to be utilized, mechanical means like motor grader may be used with the prior approval of the Engineer. The motor grader shall be capable of spreading the material uniformly all over the surface.

The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine particles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.

The Engineer may permit manual mixing and /or laying of wet mix macadam where small quantity of wet mix macadam is to be executed. Manual mixing/laying in inaccessible/ remote locations and in situations where use of machinery is not feasible can also be permitted. Where manual mixing/laying is intended to be used, the same shall be done with the approval of the Engineer.

Compaction

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After the mix has been laid to the required thickness, grade and crossfall/camber the same shall be uniformly compacted to the full depth with suitable roller. If the thickness of single compacted layer does not exceed 100 mm, a smooth wheel roller of 80 to 100kN weight may be used. For a compacted single layer upto 200 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 kN with an arrangement for adjusting the frequency and amplitude. An appropriate frequency and amplitude may be selected. The speed of the roller shall not exceed 5 km/h.

In portions having unidirectional cross fall/superelevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the center line of the road, uniformly over-lapping each preceding track by at least one-third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1 m away from any preceding stop.

In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the center parallel to the center line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.

Any displacement occurring as a result of reversing of the direction of a roller or from any other cause shall be corrected at once as specified and/or removed and made good.

Along forms, kerbs, walls or other places not accessible to the roller, the mixture shall be thoroughly compacted with mechanical tampers or a plate compactor. Skin patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling should not be done when the sub-grade is soft or yielding or when it causes a wave- like motion in the sub-base/base course or sub-grade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 m straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and crossfall. In no case shall the use of unmixed material be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material as determined by the method outlined in IS:2720 (Part-8).

After completion, the surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and re compacted.

Setting and Drying

After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

Opening to Traffic

No vehicular traffic shall be allowed on the finished wet mix macadam surface. Construction equipment may be allowed with the approval of the Engineer.

Surface Finish and Quality Control of Work

Surface Evenness

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The surface finish of construction shall conform to the requirements of Clause 902.

Quality Control

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

Rectification of Surface Irregularity

Where the surface irregularity of the wet mix macadam course exceeds the permissible tolerances or where the course is otherwise defective due to sub-grade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area, re-shaped with added premixed material or removed and replaced with fresh premixed material as applicable and recompact in accordance with Clause 406.3. The area treated in the aforesaid manner shall not be less than 5 m long and 2 m wide. In no case shall depressions be filled up with unmixed and ungraded material or fines.

Arrangement for Traffic

During the period of construction, arrangements for traffic shall be done as per Clause 112.

MODE OF MEASUREMENT & PAYMENT:

Wet mix macadam shall be measured as finished work in position in cubic metres.

The contract unit rate shall be for a unit of one cubic meter.

Item No: 54:- Brick work in superstructure above plinth level and up to floor five level in cement mortar 1:3 (1 cement : 3 coarse sand), including centering, scaffolding, and shuttering complete, with common burnt clay F.P.S. (non-modular) bricks of class designation 7.5, including brick cornices, molded shapes, decorative profiles, necessary grooves, cornice steps, and projections as per approved architectural detail drawings. The work shall include cutting, shaping, and finishing of bricks required for cornices, moldings, grooves, and steps, true to line, level, and plumb. All brickwork shall be neatly finished with uniform joints, and all cornices, moldings, grooves, steps, and projections shall conform to the approved architectural drawings.

MATERIAL :

- **Common Burnt Clay F.P.S. (Non-Modular) Bricks** of Class Designation **7.5** conforming to relevant IS specifications, well-burnt, sound, uniform in size, shape and colour, free from cracks, flaws and other defects.
- Cement shall be Ordinary Portland Cement (OPC) or PPC of approved make conforming to relevant IS standards.
- Sand shall be clean, well graded coarse sand, free from silt, clay, organic matter and deleterious substances.
- Cement mortar shall be prepared in the proportion of **1:3 (1 Cement : 3 Coarse Sand)** by volume using potable water.
- Water used for mixing and curing shall be clean and free from harmful impurities.

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WORKMANSHIP :

- Bricks shall be thoroughly soaked in water before use until air bubbles cease to rise.
- Brick masonry shall be constructed in cement mortar 1:3 in proper bond, maintaining true line, level and plumb.
- Courses shall be laid horizontally with vertical joints staggered and joints fully filled with mortar.
- Thickness of mortar joints shall generally not exceed 10 mm.
- Brickwork shall include construction of **cornices, moulded shapes, decorative profiles, grooves, cornice steps, offsets, projections and architectural features** as shown in approved drawings.
- Necessary cutting, dressing and shaping of bricks shall be carried out neatly to achieve the required profiles and architectural details.
- All projections, grooves, cornices and mouldings shall be accurately formed to the dimensions indicated in the drawings and finished with sharp, clean edges.
- Temporary centering, formwork, templates and supports required for forming architectural features shall be provided and removed after completion.
- Brickwork shall be properly scaffolded and protected during construction.
- Masonry shall be carried up uniformly and adequately cured for a minimum period of 7 days.
- Finished brickwork shall be free from bulging, cracks, misalignment, uneven joints and surface irregularities.
- All architectural details shall be executed true to line, level, plumb and approved profiles.

MODE OF MEASUREMENT & PAYMENT :

- Measurement shall be made in **Cubic Metres (Cum)** of finished brick masonry work.

Item No: 55:- Forming groove of uniform size from 12x12 mm and upto 25x15 mm in the top layer of washed stone grit plastered surface as per approved pattern, including providing and fixing aluminum channels of appropriate size and thickness (not less than 2 mm), nailed to the under layer with rust proof screws and nails and finishing the groove complete as per specifications and direction of the Engineer-in-Charge.

MATERIAL :

- **Aluminum Channels:**
Aluminum channels shall be of approved make, shape, and size, suitable for forming grooves of sizes ranging from **12 mm × 12 mm up to 25 mm × 15 mm**, with a **minimum thickness of 2 mm**. The channels shall be straight, free from warping, dents, or surface defects.
- **Fixing Accessories:**
Rust-proof screws and nails (galvanized or stainless steel) of approved size and quality shall be used for fixing the aluminum channels to the under layer.
- **Plaster Materials:**
Washed stone grit, cement, sand, water, and admixtures (if any) shall conform to **relevant IS codes** and CPWD/PWD specifications for washed stone grit plaster.

WORKMANSHIP :

Grooves shall be formed in the top layer of washed stone grit plaster strictly as per the approved drawings, patterns, and sample.

- Aluminum channels shall be **fixed accurately to line, level, and plumb** before plastering, ensuring uniform groove width and depth throughout.

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- The channels shall be securely anchored to the under layer using rust-proof screws and nails at proper spacing to prevent movement during plaster application.
- Plastering shall be carried out carefully around the channels to avoid displacement, cracking, or uneven edges.
- After the plaster has sufficiently set, the aluminum channels shall be **carefully removed without damaging** the finished plaster surface.
- The grooves shall be **cleaned, neatly finished, and made uniform**, with sharp and straight edges matching the surrounding washed stone grit finish.
- Any defective or damaged work shall be rectified at no extra cost, to the satisfaction of the Engineer-in-Charge.

MODE OF MEASUREMENT & PAYMENT :

The grooves shall be measured in running metres (RM) along their center line.

- No extra payment shall be made for:
 - Fixing and removal of aluminum channels
 - Screws, nails, scaffolding, or tools
 - Wastage of materials
 - Overlaps, junctions, or end treatments
- The rate shall be deemed to include all materials, labor, and incidental charges necessary for completing the item as specified.

Item No: 56:- Providing, hoisting and fixing above plinth level up to floor five level precast reinforced cement concrete in mouldings as in cornices, windows sills etc, including setting in cement mortar 1:3 (1 cement : 3 coarse sand) cost of required centering, shuttering but, excluding the cost of reinforcement, with 1:1.5:3 (1 cement : 1.5 coarse sand (zone-III) derived from natural sources : 3 graded stone aggregate 20 mm nominal size derived from natural sources).

MATERIAL :

- Precast Reinforced Cement Concrete (RCC) mouldings, cornices, window sills, bands, projections and similar architectural elements manufactured from concrete of mix proportion **1:1.5:3 (1 Cement : 1.5 Coarse Sand : 3 Graded Stone Aggregate 20 mm nominal size)** or equivalent approved design mix.
- Cement shall conform to relevant IS specifications and shall be of approved make.
- Fine aggregate shall be clean, well-graded coarse sand (Zone III) derived from natural sources and free from deleterious matter.
- Coarse aggregate shall consist of hard, durable, graded stone aggregate of 20 mm nominal size derived from natural sources.
- Water used for mixing and curing shall be clean and potable.
- Cement mortar for bedding and fixing shall be in the proportion **1:3 (1 Cement : 3 Coarse Sand)**.
- Reinforcement steel shall be measured and paid separately and is excluded from this item.
- All inserts, anchor bolts, lifting hooks and fixing accessories required for safe handling and installation shall be of approved quality.

WORKMANSHIP :

- Precast RCC members shall be cast in rigid moulds to the required shape, profile and dimensions as shown in approved architectural and structural drawings.
- Concrete shall be machine mixed, properly compacted and adequately cured to achieve the specified strength and surface finish.

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- All precast elements shall be free from cracks, honeycombing, segregation, chipped edges, warping and other defects.
- Units shall be carefully transported, handled, hoisted and installed without causing damage.
- Necessary centering, shuttering, staging, lifting arrangements and temporary supports required during installation shall be provided.
- Precast members shall be fixed in position with cement mortar 1:3, maintaining correct line, level, slope and alignment.
- Joints between adjacent units and adjoining structural members shall be neatly finished and made good to achieve a uniform appearance.
- Cornices, mouldings, window sills and other architectural features shall conform accurately to the approved profiles, dimensions and details shown in drawings.
- Exposed surfaces shall have a smooth, dense and uniform finish and shall be properly cured and protected until completion.
- Any damaged or defective precast member shall be removed and replaced at the contractor's cost.

MODE OF MEASUREMENT & PAYMENT:

Measurement shall be made in **Cubic Metres (Cum)** of finished precast RCC work fixed in position and accepted.

Item No: 57:- Providing & Fixing 6 mm thick lexan Polycarbonate multi wall roofing sheet fixed with hilti screw and rubber silicon sealer and alluminium strip of size 50 x 3 mm etc. complete and directed by Enginner in charge

Supplying, fitting & fixing polycarbonate sheet of approved make & brand conforming to IS:14443-1997 and having 50 micron UV protection layer under co-extrusion technology, Fire rating being B-s1 as per EN13501-1 certification, fitted and fixed with 60mm wide aluminium channel section top and bottom member in dry-glaze sandwich system, (unit wt. of top and bottom members: 0.375 kg/m & 0.69 kg/m) of approved brand and profile, EPDM quality rubber gaskets, anti-dust tape, end closer "C" channel and 75 mm long Self tapping screw being drilled through the centre leg of the bottom section with nuts placed at 300 mm apart without anyway puncturing the polycarbonate sheet, EPDM Washer 16 mm dia. & 3 mm thick washer etc. complete strictly as per manufacturers specification and direction of Engineer-in Charge. (Payment to be made on area of finished work).
In Roof: - Natural/ Blue/Green/ Bronze/ Opal/Metallic grey colour with 2 wall 10 mm overall thickness (wt.1.70kg/sqm, Ugvalue being 3.1 W/m2K, Min. cold bending radius of 1200 mm)

MODE OF MEASUREMENT AND PAYMENT :

Payment to be made on area of finished work of polycarbonate sheet roofing. The rate shall be for a unit of one square meter.

Item No: 58:- Constructing of Cooking platform (sandwich type) 80cm high resting on Kota stone / granite stone in C.M 1:3 with providing and fixing 25 mm thick rough kota stone at bottom and 25mm thick Polish kota stone/ Granite stone (single piece) top and polished kota stone/ granite stone (single piece) 25mm thick on top with 75mm high machine cut polished Granite round moulded facia patty including polishing etc . complete as per drawing and specification without stainless steel sink including necessary cutting for sink & making hole for gas pipe and fixing P.V.C bend of 25mm dia.

MATERIAL :

- Cooking platform of **sandwich type construction**, 800 mm high or as shown in drawings.

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- Base slab comprising **25 mm thick rough Kota stone** fixed in Cement Mortar 1:3.
- Top counter finished with **25 mm thick polished Kota Stone or Granite Stone (single piece wherever possible)** of approved colour, pattern and quality.
- Vertical facia comprising **75 mm high machine-cut polished Granite moulded round-edge facia patty** fixed with approved adhesive and cement mortar.
- Cement shall be OPC/PPC of approved make conforming to relevant IS standards.
- Sand shall be clean, well-graded coarse sand free from impurities.
- PVC bend of **25 mm diameter** for gas pipe passage.
- Approved stone adhesive, fixing materials and joint filling compounds wherever required.

WORKMANSHIP :

- Cooking platform shall be constructed to the dimensions, levels and details shown in approved drawings.
- Supporting masonry/RCC structure shall be prepared true to line, level and plumb before fixing stone slabs.
- The bottom layer of 25 mm thick rough Kota stone shall be laid in Cement Mortar 1:3 and properly bedded.
- The top surface shall be finished with **25 mm thick polished Kota Stone/Granite Stone in single piece as far as practicable**, ensuring a smooth and level working surface.
- Necessary cut-outs for sink, tap fittings, gas pipe openings and service penetrations shall be made neatly without causing cracks or damage to the stone.
- A **25 mm dia PVC bend** shall be fixed at the gas pipe location as directed.
- Front exposed edge shall be finished with **75 mm high machine-cut polished granite moulded facia patty** with rounded profile as approved.
- All exposed stone surfaces shall be machine polished and finished to a smooth, even and glossy appearance.
- Joints shall be kept to a minimum, neatly aligned and filled with matching approved material.
- Finished platform shall be true to line, level and slope where required and free from cracks, chips, stains and visible defects.
- Necessary curing, cleaning and protection of finished surfaces shall be carried out until handing over.

MODE OF MEASUREMENT AND PAYMENT :

- Measurement shall be made in **Running Metres (Rmt.)** of completed cooking platform measured along the centre line of the platform.
- Width and thickness as specified in the item shall be deemed included in the rate.
- No separate measurement shall be made for rough Kota base, polished top slab, facia patty, sink cut-outs, gas pipe holes, PVC bend, polishing, moulding, edge finishing, adhesives, mortar bedding, scaffolding or wastage.
- The rate shall include all materials, labour, transportation, cutting, polishing, moulding, fixing, curing, cleaning and all incidental works required for complete execution of the item.

Item No: 59:- Sandwich Type – Kalinga over Kota :Providing & fixing sandwich type washroom platform consisting of top layer of 18 mm thick Kalinga stone of approved shade and finish, fixed over 20 mm thick Kota stone base, forming a total sandwich thickness of 150 mm (6 inches), including necessary cutting, dressing, edge polishing, moulding, and fixing in cement mortar (1:3) with proper leveling and slope. The work shall include backing support, filling joints with white cement/pigment, providing necessary grooves, rebates, and finishing edges, complete in all respects as directed by the Engineer-in-Charge.

MATERIAL :

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- Top layer comprising **18 mm thick Kalinga Stone** of approved shade, colour, texture and finish, free from cracks, stains, laminations and other defects.
- Base layer comprising **20 mm thick Kota Stone** of approved quality, properly dressed and free from defects.
- Sandwich-type platform assembly having an overall finished thickness of **150 mm (150 mm deep fascia/profile)** as shown in approved drawings.
- Cement shall be OPC/PPC of approved make conforming to relevant IS standards.
- Sand shall be clean, well-graded coarse sand free from deleterious materials.
- Cement mortar for bedding and fixing shall be in the proportion **1:3 (1 Cement : 3 Coarse Sand)**.
- White cement with matching pigments for joint filling and finishing.
- Approved adhesives, fillers and fixing accessories wherever required.

WORKMANSHIP :

- The platform shall be fabricated and installed as a **sandwich type construction** consisting of 18 mm thick Kalinga Stone fixed over a 20 mm thick Kota Stone base.
- Supporting masonry/RCC structure shall be prepared true to line, level and dimensions before installation.
- Kota stone base shall be properly bedded and fixed in Cement Mortar 1:3.
- Kalinga stone top shall be fixed over the Kota stone base with approved adhesive and mortar bedding to obtain a rigid and durable assembly.
- Necessary cutting, dressing, shaping and finishing shall be carried out to achieve the required dimensions and profiles.
- Exposed edges shall be machine polished and finished with straight, chamfered or moulded profiles as specified in the drawings.
- Necessary grooves, drip courses, rebates, sink cut-outs, faucet holes and service openings shall be neatly formed wherever required.
- Proper slope shall be maintained towards the wash basin to ensure drainage of water.
- Joints shall be kept uniform and filled with white cement mixed with matching pigments to achieve a seamless appearance.
- All visible surfaces shall be polished and finished uniformly without scratches, chips, cracks or unevenness.
- The completed platform shall be true to line, level and alignment and securely fixed in position.
- Cleaning, polishing and protection of the finished work shall be carried out until handing over.

MODE OF MEASUREMENT AND PAYMENT :

- Measurement shall be made in **Square Metres (Sq.m.)** of the finished top surface area of the washroom platform.
- No separate measurement shall be made for Kota stone backing, edge moulding, fascia formation, grooves, rebates, cut-outs, polishing, joint filling, adhesives, bedding mortar, wastage or incidental works.
- Sink cut-outs, tap holes and service openings shall not be deducted from the measured area.
- The rate shall include supply of Kalinga stone, Kota stone base, cement mortar, adhesives, polishing, moulding, edge finishing, cutting, fixing, labour, tools, transportation and all materials required for complete execution of the work.

TECHNICAL SPECIFICATION FOR RAIN WATER HARVESTING

Item No: 60:- Excavation for foundation in Dense or Hard soil upto 1.50m depth including sorting out and stacking of useful materials and disposing of the excavated stuff with all lead and lift as directed by Engineer in charge.

GENERAL :

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Any soil which generally yields to the application of pickaxes and shovels, phawaras rakes or any such ordinary excavating implement or organic soil, gravel silt, sand turf loam, clay, peat etc., fall under this category

CLEARING THE SITE :

The site on which the structure is to be built shall be cleared, and all obstructions loose stone, materials and rubbish of all kind bush wood and trees shall be remove! as directed. The materials so obtained shall be property of the Government and shall be conveyed und stacked as directed within 50 m lead. The roots of the trees coming in the sides shall be cut and coated with a hot asphalt

The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

SETTING OUT :

After clearing the site the centre lines will be given, by the Engineer-in-charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all 'parts of the work. Contractor shall supply labours materials, etc. required for setting out the reference marks and bench 'marks and shall maintain them as long as required and directed.

EXCAVATION :

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary shoring and shutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transversely as directed by removing and watering as required. No. earth filling will be allowed for bring it to level. If by mistake or any excavation is made deeper or wider than, that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.5 m depth shall be measured under this item.

DISPOSAL OF THE EXCAVATED STUFF :

The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering etc. The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 50 M. and all lift.

MODE OF MEASUREMENT & PAYMENT :

The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Engineer-in-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to stopping and sloping back as found necessary on account of conditions of soil and requirements of safety.

The rate shall be for a unit of one cubic meter.

Item No: 61:- Excavation for foundation in Dense or Hard soil from 1.50 m. to 3.00 m. depth including sorting out and stacking of useful materials and disposing of the excavated stuff with all lead and lift as directed by Engineer in charge.

Any soil which generally require close application of picks or jumpers or scarifiers to. loosen it stiff clay, gravel and stone etc. fall under this category.

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WORKMANSHIP :

The relevant technical specifications of Item No : 60 shall be followed except that the excavation work shall be carried out in dense or hard soil.

MODE OF MEASUREMENT & PAYMENT :

The relevant technical specifications of Item No : 60 shall be followed.

The rate shall be for unit of one cubic meter.

Item No: 62 :- P/L PCC 1:3:6 (1-cement : 3 coarse sand : 6 M/c stone aggregate 20 / 40mm nominal size) in foundation concrete / floor concrete incl. machine mixing, ramming, consolidation & curing etc. incl. cost of form work if required etc. complete at all levels.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 09.

Item No: 63:- Brickwork using common burnt clay building bricks having crushing strength not less than 35 Kg./Sq. Cm. in foundation and plinth in cement Mortar 1:6 (1-Cement : 6 - fine sand). Conventional in Foundation & Plinth (Upto 10 ton).

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 26.

Item No: 64 :- Providing 15mm thick cement plaster in single coat on brick/concrete walls for interior plastering upto floor two level and finished even and smooth in (i) Cement mortar 1:4 (1-cement: 4-sand)

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 32.

Item No: 65 :- Supplying and laying of screened rounded gravel of 25 to 90 mm, 20 to 50 mm and 5 to 20 mm size filling in layers or packing around stainer pipe etc. complete.

SCOPE :

This standard lays down the requirements for gravel for use as pack material in tubewells for water supply.

PHYSICAL CHARACTERISTICS :

The gravel selected for packing tubewells shall consist of hard quartz (about 96 percent SiO₂) or other suitable material, with an average specific gravity of not less than 2.5. Not more than 10 percent by weight of the material shall have a specific gravity of less than 2.25. The gravel shall contain not more than two percent by weight of thin flat or elongated pieces. In the case of such pieces, the larger dimensions shall not be more than 3 times the smallest dimensions.

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The quartz shall be of sub-rounded to rounded grains with minimum angular features.

The gravel for use as pack shall be free from impurities, such as shale, mica, felspar, clay, sand, dirt, loam, hematite, and organic materials.

POROSITY :

The porosity of the gravel when laid as a pack shall not be less than 25 percent.

GRAVEL SIZES:

The gravel conforming to this standard shall be of the following grades: Particle Size Distribution — The particle size distribution of gravel shall be determined by screening through standard sieves in accordance with IS:460-1962*. The percentage distribution of the sizes shall be determined from a graph in which the percentage of material passing through each sieve is plotted against the standard aperture of that sieve.

Any size, say D20, will thus indicate that the cumulative weight of all the grains smaller than this size is 20 percent of the total weight of the test sample. The uniformity coefficient of the gravel, that is, the ratio of its D20 to D10 sizes shall not exceed 2. A material with uniformity coefficient less than 2 shall be classified as uniform and if greater than 2 it shall be taken as non-uniform. The limiting sizes given in 4.1 are the minima and maxima, and the stacks containing smaller or bigger sizes as shown by sieve analysis shall be rejected.

HARDNESS :

The gravel shall have a hardness of not less than 5 in Moh's scale.

PACK AQUIFER RATIO :

The pack aquifer ratio (P/A ratio) is defined as the ratio of 50 percent size (D30) of the gravel pack to the 50 percent size of the aquifer. The size of gravel when used as pack in tubewells shall be decided in accordance with the size of the aquifer material proposed to be tapped. The gravel size shall be limited as below: a) Uniform aquifer with uniform gravel pack. Pack aquifer ratio — 9 to 12.5 b) non-uniform

aquifer with uniform gravel pack. Pack aquifer ratio — 11 to 15.5 The thickness of gravel pack shall be limited to 13 to 18 cm. However, artificial gravel pack may not be necessary if

the effective size (D10) of the aquifer is greater than 0.3 mm and its uniformity coefficient is greater than 5.

SAMPLING :

The method of drawing, reducing and packing the samples as given in clauses 5, 6 and 7 respectively of IS : 1811-1961* shall be followed.

Each sample shall be not less than ten litres.

The gross sample selected from each sub-lot shall be individually tested for physical characteristics, porosity, particle size distribution and hardness.

Criteria for Conformity — The consignment is declared in conformity to the requirements of this standard if the following conditions as applicable are satisfied: a) In case the maximum limit for a requirement is specified, the value of the expression $+0.5 R$ is less than or equal to the value specified. b) In case the minimum limit for a requirement is specified the value of expression $-0.5 R$ is greater than or is equal to the value specified. NOTE 1

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— The average X is the sum of the test results divided by the number of tests. NOTE 2 — The range R is the difference between the maximum and minimum of the test results.

PACKING :

The gravel shall be supplied in quantities to be mutually agreed to between the supplier and the purchaser.

MODE OF MEASUREMENT & PAYMENT :

The payment shall be made on Cubic meter Basis.

Item No: 66 :- Drilling of Pilot Bore hole in alluvial strata by direct rotary rig of 250 to 300 mm dia. for a depth of 110 meters.

The drilling shall be done by mud flush direct circulation rotary rig with hydraulic movements fitted with heavy duty reciprocating mud pump. The contractor shall have to drill 3.0 meters extra depth below the bottom of casing pipe without any extra cost.

All tools and equipment required for drilling operation should be brought to site of work by contractor at his own cost. Arrangement of fresh potable (i.e. not higher than 2000 PPM) water for drilling operation should be done by contractor at his own cost in unavoidable circumstances drilling water of salinity higher than 2000 PPM may be considered after obtaining the permission of Engineer in charge.

The drilling agency has to collect and furnish following information.

Samples of drilled cuttings from different strata shall be collected at suitable intervals preferably at every 2 meters depth drilled and across intervals if a change in the strata is met with the opinion of the Executive Engineer or his agent shall be binding to the contractor. The samples should be washed properly as the drilling is in progress. An accurate drilling time log shall be kept indicating the time taken for drilling every two meters.

This log will enable interpretation regarding the nature of formation (hard, soft, un-consolidated etc) which has bearing on the water yielding capacity of the formation.

ELECTROLOGGING TEST :

The contractor should inform well in advance to Engineer in charge for the above test after completion of 300 mm diameter pilot bore hole. In no case logging test in pilot bore hole exceeding 300mm diameter size shall be carried out. The logging electrode must reach at specified depth of bore hole as stated in the schedule. Otherwise, second time

Logging test should be carried out. The charge for second time logging shall be borne by the contractor.

In case of drilling area having sticky / plastic clay strata where contractor has drilled pilot bore of 300mm diameter R. R. Bit for successful logging. Even if the logging is not possible in 300mm diameter because of expanding nature of clay, the agency is not required to pay the re-logging charges

Reaming 450mm diameter bore hole to 250 / 300mm diameter bore hole up to desired depth as specified in Schedule - B in all alluvial strata including soft and hard rock by using best quality of bentonite powder. The drilling shall be done by mud flush direct rotary Rig including lowering, jointing of ERW / MS pipes strainer pipes etc. during welding alignment of pipe should be checked with spirit level. Carting of pipes to site including

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welding, jointing etc. complete as directed by Engineer in charge for specified depth and as per pipe assembly given is to be done by the contractor.

In case, Cement sealing is proposed below the total depth of housing, then the upper reaming shall be continued up to the upper limit of cement sealing. The lowering of pipe assembly at required depth of 3meters more reaming should be carried out beyond the full depth of pipe assembly to ensure the safe lowering against any cutting remaining in the bore hole. No payment will be made for this 3-meter extra drilling.

The pipe assembly (as per the size of tube well) suggested by hydrologist should be lowered as per instruction of Engineer in charge and pipe lowering work shall be started by mutual understanding with in charge Deputy Executive Engineer. Contractor should ensure that each joint of pipe assembly perfectly welded.

The required suggested size of casing, case type trapezoidal strainer pipes etc. shall be brought by contractor as per pipe assembly. The pipes should be lowered in a vertical position necessary steel bedded Plates should brought by contractor. No extra cost for welding rods. There should not be air gap left so that there is no chance of water leakage from outside of pipe assembly throughout welding joints in housing length of pipe assembly. Welding of each joint has to be done initially by 8 SWG welding rod followed by removal of extra slag / flux there after second line of welding shall be carried out to ensure perfect welding joint, welding rod shall be of reputed make.

If the bore is required to be drilled more than specified depth the contractor shall be bound to carry out such additional works including drilling jointing and lowering casing and strainer pipes etc. as may be necessary. The relevant specifications regarding drilling, lowering, jointing, welding of pipes and strata samples etc. shall also be completed.

The gravel packing around housing, casing and strainer pipes shall have to be carried out by the contractor.

Before gravel packing is started, it should be ensured that the thickness of mud plaster is reduced to minimum and perfect back washing should be carried out.

The tube well should be gravel packed with at least minimum calculated quantity. The gravel packing operation shall be continued till filter is constructed around the slotted pipe or screen, so as to ensure that no sand flows in the tube well under normal operational conditions of the tube well. After gravel packing no mud slurry should remain at bottom and it should be cleaned by fresh water.

Record of quantity of gravel packed in the bore should be kept by contractor and should be supplied along with strata chart.

Extra quantity of gravel should be used, if required, during development of the bore. Clay packing (if required) should be done by the contractor by providing sticky clay balls only as desired by Engineer in charge during or after developing the bore with Air compressor etc.

MODE OF MEASUREMENT & PAYMENT :

The rate for payment shall be per One running meter of drilling.

TECHNICAL SPECIFICATION FOR PLUMBING WORK

Part A - WATER SUPPLY PLUMBING & SANITARY FITTING

Item No: 67 :- Providing and fixing to wall ceiling and floor 6.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low density, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.

(i) (20 mm) External , (ii)(25 mm) External

MATERIAL :

- Providing and fixing **6.0 Kg.F/cm² working pressure polythene pipes** of **20 mm and 25 mm outside diameter**, low density type, suitable for fixing on wall, ceiling and floor.
- The work shall include **polythene pipes, special flange compression type fittings, wall clips, clamps, bends, tees, elbows, couplers, connectors, screws, rawl plugs, jointing materials, labour, tools and tackles**, including making good the wall, ceiling and floor wherever disturbed, complete as per direction of the Engineer-in-Charge.

WORKMANSHIP :

- The polythene pipes shall be fixed neatly on wall, ceiling and floor in proper line, level and alignment. Pipes shall be firmly secured with suitable wall clips/clamps at required spacing.
- All joints and connections shall be made with **special flange compression type fittings** to ensure leak-proof performance. Proper care shall be taken while cutting, joining and fixing the pipes so that there is no damage, leakage or blockage in the pipe line.
- After fixing, the pipe line shall be tested for leakage and satisfactory working pressure. Any cutting or damage done to wall, ceiling or floor during fixing shall be made good properly to match the existing surface. The entire work shall be carried out complete as per specification and as directed by the Engineer-in-Charge.

MODE OF MEASUREMENT & PAYMENT :

- The measurement shall be taken in **running metre (Rmt.)** for each diameter of pipe, i.e. **20 mm and 25 mm**, as actually fixed at site and accepted by the Engineer-in-Charge.
- The rate shall include the cost of **pipes, all special flange compression type fittings, wall clips/clamps, jointing materials, labour, tools and tackles, fixing, testing, making good the wall, ceiling and floor**, and all incidental works required to complete the item in all respects.

Item No: 68 :- Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low density, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.

(i) (32 mm) External , (ii)(40 mm) External

MATERIAL :

- Providing and fixing **10.0 Kg.F/cm² working pressure polythene pipes** of **32 mm and 40 mm outside diameter**, low density type, suitable for fixing on wall, ceiling and floor.
- The work shall include **polythene pipes, special flange compression type fittings, wall clips, clamps, bends, tees, elbows, couplers, connectors, screws, rawl plugs, jointing materials, labour, tools and**

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tackles, including making good the wall, ceiling and floor wherever disturbed, complete as per direction of the Engineer-in-Charge.

WORKMANSHIP :

- The polythene pipes shall be fixed neatly on wall, ceiling and floor in proper line, level and alignment. Pipes shall be properly secured with suitable wall clips/clamps at required spacing.
- All joints and connections shall be made with **special flange compression type fittings** to ensure proper and leak-proof jointing. Proper care shall be taken during cutting, jointing and fixing of pipes so that there is no damage, leakage or blockage in the pipeline.
- After fixing, the pipeline shall be tested for leakage and satisfactory working pressure. Any cutting, holes or damage made in wall, ceiling or floor during fixing shall be made good properly to match the existing surface. The complete work shall be carried out as per specification and as directed by the Engineer-in-Charge.

MODE OF MEASUREMENT & PAYMENT :

- The measurement shall be taken in **running metre (Rmt.)** for each diameter of pipe, i.e. **32 mm and 40 mm**, as actually fixed at site and accepted by the Engineer-in-Charge.
- The rate shall include the cost of **pipes, special flange compression type fittings, wall clips/clamps, jointing materials, labour, tools and tackles, fixing, testing, making good the wall, ceiling and floor**, and all incidental works required to complete the item in all respects.

Item No: 69 :- Providing and fixing in position cowl vent to pipes. (i) (75 mm) Terrace , (ii)(100 mm) Terrace

MATERIALS :

Item should be include as Providing & Fixing 75 mm dia, 100 mm dia PVC -U SWR COWL VENT of (FIINOLEX / SUPREME) brand of working pressure 4 kg/sq.cm including jointing with adhesive solvent cement including fixing then same in true line and level etc complete as directed by EIC. Recommended brands/manufactures of all items are attached in this volume (Note: If any item make is not mention in tender then contractor has to approve the make from GIDC/Architect Consultant)

WORKMANSHIP :

The work shall be carried out as per direction of Engineer-in-charge.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on number basis of complete item.

The contract rate shall be for a unit of one number.

Item No: 70 :- Providing and fixing screw down bib taps of following size.(B) Brass chromium plated screws down Bib Tap. (15 mm)

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Providing and fixing screw down bib taps of following size.(B) Brass chromium plated screws down Bib Tap. (15 mm)

MODE OF MEASUREMENT & PAYMENT :

The rate shall be for a unit of Each number.

Item No: 71 :- Providing and fixing Gun metal check or non-return fullway wheel valve. (i) 15 mm dia , (ii) 25 mm dia , (iii) 32 mm dia , (iv) 40 mm dia

MATERIALS :

15 mm. Dia, 25 mm Dia, 32 mm Dia, 40 mm Dia Gun metal screw down bib tap or non-return full way wheel valve with all necessary required material shall conform to M-37 of Specification of Materials attached herewith. Recommended brands/ manufactures of all items are attached in this volume (Note: If any item make is not mention in tender then contractor has to approve the make from GIDC/Architect Consultant)

WORKMANSHIP :

The work shall be carried out in best workmanship like a manner and as per direction of Engineer-in-charge. Relevant specification of Item No. 54 above shall be followed.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on number basis of complete item.

The contract rate shall be for a unit of one number.

Item No: 72 :- Providing and fixing ball cock of approved. quality as directed.(B) Abonite (i) 50 mm dia

MATERIALS :

The Brass chromium plated ball cock of 50 mm diameter shall be of Jaguar continental brand & make. Recommended brands/ manufactures of all items are attached in this volume (Note: If any item make is not mention in tender then contractor has to approve the make from GIDC/Architect Consultant)

WORKMANSHIP :

The work shall be carried out in best workmanship like a manner and as per direction of Engineer-in-charge.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on number basis of complete item.

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The contract rate shall be for a unit of one number.

Item No: 73 :- Providing laying and jointing in true line and level U.P.V.C. Pipe (SCH- 40) for cold water including fittings as approved by Engineer In Charge. Pipe shall be fixed on the wall with the help of clamp at every two metre C/C or shall be concealed as directed including necessary fittings etc. including testing of pipe and joints and fixing the same with adhesive (i) 15 mm dia , (ii) 25 mm dia , (iii) 40 mm dia , (iv) 50 mm dia

MATERIALS :

The UPVC tube (Medium grade) of 15mm to 50 mm dia shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to IS Specification of Materials. All UPVC fittings, screws, clamps etc. shall be standard of “R” or equivalent make. All the pipes and fittings shall have ISI certification mark. Fine ham and white zinc for fixing of the fittings shall be of approved quality.

Cement mortar of proportions 1:3 i.e., 1 part of cement & 3 part of coarse sand shall conform to M-9 of Specification of Materials attached herewith.

WORKMANSHIP :

The work shall be carried out as per C-40 of Code of practice except work shall be carried out for UPVC pipes attached herewith.

Finishing work of groove / hole made in the wall & RCC work shall be done similar to wall and RCC work finishing. Finishing work of groove / hole shall be carried out as per direction of the Engineer & as per standard practice.

The work shall be executed in accordance with best modern practices.

TESTING: Pipeline laid shall be tested to a hydraulic pressure of 6kg/cm² and being maintained for minimum two hours. All leakages, defects etc; shall be rectified.

The entire work shall be carried out in best workmanship like a manner and as per direction of Engineer-in-charge.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on the Running meter basis for length of pipe laid along the center line of the pipe from end to end.

The measurement shall be taken in accordance with IS Code so far as applicable.

The contract rate shall be for a unit of one meter length including all fittings.

Item No: 74 Providing, laying and jointing in true line and level U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp at every 2000 mm center to center or
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shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials.

- (i) 110 mm dia (110mm dia x 149mm length x 145mm height),
- (ii) (ii) 160 mm dia (160mm dia x 210mm length x 196mm height)

MATERIAL :

The Material of 110 diameter, 160 diameter U.P.V.C (Type B) conforming to IS 13592-1992. The specials and fitting required shall be of best quality.

WORKMANSHIP :

The U.P.V.C. Pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid U.P.V.C. Pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during, installation or when pipe line is in service.

Above ground installation of rigid U.P.V.C. pipe should be undertaken after preparations are observed for their protection against direct sun rays and mechanical damage.

The rigid U.P.V.C.. pipe lines should not be kept exposed above ground when it passes through public places, railway lines, road side and footpaths.

U.P.V.C.. pipes shall be supported at the following intervals:

20 mm dia. 500 mm.

32 mm. dia. 900 mm.

25 mm. dia. 750 mm.

Closer support spacings shall be provided if recommended by the manufacture

The guide lines indicated by the manufacturer regarding, handling, transportation, storing laying and jointing of pipes shall be kept in view during execution.

U.P.V.C.. pipes shall be fixed on wall with wooden plugs and suitable plastic clamps.

JOINTING THE PIPES :

The pipes and sockets shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement joint. Since solvent cement is aggressive to U.P.V.C., care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Empty solvent cement tins, brushes rags, or paper impregnated with cement should not be buried in the trenches. They should be gathered, not left scattered about, as they can prove to be a hazard to animals, which may chew them.

If manufacture recommends its own methods of jointing, the same shall be adopted after necessary approval from the Engineer- in-charge.

LAYING PIPES IN TRENCHES :

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The pipe shall be laid over uniform relatively soft fine grained soil found to be free of presence of hard objects such as large flints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.

The pipes laid underground shall not be less than one metre from the ground level. The pipe shall be positioned in the trenches so as to avoid any induced stresses due to deflection. Any deviation required shall be obtained by using proper type of rubber ring joints.

MODE OF MEASUREMENT & PAYMENT :

The unit rate shall be for a unit of one running metre.

Item No: 75 Providing and fixing PVC SWR Nahni trap IS 14735 for drain - 100 mm diameter with jali of the following nominal diameter of self cleansing design with C.I screed down or hinged grating including the cost of cutting and making good the walls.

MATERIALS :

PVC Nahni trap shall conform to M-43 of Specification of Materials attached herewith.

WORKMANSHIP :

Fixing of PVC Nahni Trap with all required fittings shall be carried out as per C-46 of Code of practice attached herewith.

The work shall be executed in accordance with best modern practices.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on the Number basis of complete item.

The contract rate shall be for a unit of One Number.

Item No: 76 Providing erecting and fixing double coated ISI water tank of required capacity each with all necessary fittings and connection etc. complete on terrace

GENERAL :

This work shall consist of Providing and fixing PVC water tank of specified capacity with necessary G I fittings including 25 mm dia. G.I. over flow pipe, ball valve, of the shape and dimensions shown on the drawings and conforming to these Specifications or as approved by the Engineer in charge.

PVC Water tank

PVC Water tank of specified capacity and of I.S.I. mark of approved in liters of approved make and quality equivalent to syntax product. Net capacity shall be net volume of water stored between the lowest level of overflow and lowest specified level.

Nipple

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Galvanize pipe nipple shall be of approved make and of best quality Relevant specification given in Booklet of Building specification shall be applied for the execution of this item

Ball valve

Ball valve shall confirm specification no 23.00.5 (A) on page 172 of specification booklet for building works. Ball valve shall be of approved make and of best quality. Relevant specification given in Booklet of Building specification shall be applied for the execution of this item

Connections

Connections shall be of approved make and of best quality. Relevant specification given in Booklet of Building specification shall be applied for the execution of this item

WORKMANSHIP :

Tank shall be approved quality and as per IS standard make. Material used in manufacturing tank shall be confirmed to relevant IS code. The material of tank and lead and fittings which may come in contact of water should be such that it does not impart any taste, colour or odor. It does not have any toxic effect and it does not contaminate the water. Thereby making it unbootable.

The tank shall be fixed properly in a level position and making all required necessary correction like inlet outlet flushing overflow and air vent. Tank shall be satisfying the standards of public health.

MODE OF MEASUREMENT & PAYMENT :

The payment will be made on capacity in litter's basis of the finished work.

All necessary labour materials Equipment tools and plant, conveyance including loading and unloading etc shall be provided by the Contractor as directed by the Engineer in charge. The item shall be measured for its capacity in liters limiting dimensions to those specified on plan or as directed. The measurement shall be taken on basis of water storage capacity in liter.

The rate shall be for a unit of one Litter.

Part B - DRAINAGE & SEWARAGE ITEM

Item No: 77 Providing and fixing S.W. gully trap with C.I. grating brick masonry chamber and water tight C.I. cover with frame of 300mm x 300mm size (inside) with standard weight.(i) Square mouth traps. (A) 100mm x 100mm size P type.

MATERIAL :

- (1) Water shall conform to M-1.
- (2) Cement mortar of proportion 1:5 shall conform to M-9.
- (3) Burnt brick shall conform to M-13.
- (4) The S.W. Galley trap of 100 mm. x 100 mm. size shall confirm to M-44.

WORKMANSHIP :

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Excavation for gully trap shall be done true to dimensions and levels as indicated on plans or as directed.

Fixing:

The gully trap shall be fixed over cement concrete 1:5:10 (1 cement: 5 sand : 10 graded brick bats aggregate 40 mm nominal size) foundation. 650 square and 100 mm. thick The depth of top of concrete below the ground level shall be 675 mm. The jointing of gully outlet to the branch drain shall be done similar to jointing of S.W. pipe.

Brick masonry chamber: After fixing and testing gully and branch drain, a brick masonry 300 x 330 mm. inside with bricks in CM 1:5 (1 cement: 5 sand) shall be built with a 100 mm. brick work round oh; gully trap from the top of bed concrete up to ground level. The space between the chamber walls and the trap shall be filled with cement concrete 1:5:10. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside with cement mortar 1:3 (1 cement: 3 sand) finished with floating coat of neat cement. The corners and bottom of the chamber shall be rounded of so as to slope towards the grating.

C.I. cover with frame 300 mm, x 300 mm. (inside) size shall then be fixed on the top of the brick masonry with C.C. 1:2:4 (1 Cement: 2 coarse-sand: 4 graded aggregate 20 mm. nominal size) 40 mm. thick and rendered smooth. The finished top of the cover shall be left about 40 mm. above the adjoining ground level so as to exclude the surface water from entering the gully trap.

MODE OF MEASUREMENT & PAYMENT :

The rate includes cost of all labour, materials, tools and plant etc. required for satisfactory completion of this item as described above.

The rate shall be for a unit of one number basis.

Item No: 78 Providing laying (to level or slopes) and jointing reinforced concrete Light duty non-pressure pipes I.S. class NP2 of the following internal diameter with collars and butt ends prepared for collar joints including testing of joints complete. (B) 150mm

MATERIAL :

The reinforced concrete light duly non-pressure pipes NP2 of specified diameter shall conform to I.S. 458 1971.

WORKMANSHIP :

Laying :

The pipes shall be lowered into the trenches carefully. Mechanical appliances may be used. Where necessary pipe shall be laid in straight lines or with easy curves and true to line and gradient as specified. The laying of pipe shall proceed upgrade of a slope. In the pipe spigot and socket joints, the socket ends shall face upstream. In case of pipes with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid.

In case where the foundation conditions are unusual such as the proximity of trees or holes, under existing or proposed all round in 150 mm. thick cement concrete 1:5; 10 (1 cement: 5 fine-sand: 10 graded stone aggregate 40 mm. nominal size) or compacted sand or gravel:

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In case where the natural foundation is inadequate the pipes shall be laid either in concrete cradle, supported on proper foundations or on any other suitably designed structure. If concrete bedding is used, the depth of concrete below bottom of the pipe shall be at least 1/4th of the internal diameter of the pipe subject to a minimum of 100 mm. and a maximum 300 mm. The concrete shall be extended up the sides of the pipe at least to a distance of 1/4th of the outside diameter for pipes 300 mm. and over in diameter.

The pipes shall be laid in the concrete bedding before the concrete has set. Pipes laid in trenches in earth shall be bedded evenly and firmly and as far as up to the haunches of the pipe as to safely transmit the load expected from the back fill through the pipe to the bed. This shall be done either by excavating the bottom of the trenches to fit the curve of the pipe or by compacting the earth under a round curve of the pipe to form an even bed, Necessary provision shall be made for joints wherever required.

Jointing :

The joints shall be done by slipping the collar over and clear of the end of the pipe. The recess of the end of the pipe shall be filled with jute braiding in hot bitumen. The new pipe shall then be brought forwarded until the bitumen ring in recess of first pipe is set into the recess of the second pipe. The process shall be repeated for two or three pipes which shall then jacked up so as to thoroughly compress the bitumen. The quantity of jute and bitumen shall be just enough to fill the recess when pressed hard by jacking, care being taken that no offset of the jute braiding shall be visible either outside or inside of pipe. The collar shall then be set up over the joints covering equally both the pipe and leaving, an even caulking space all round. Cement and sand mortar: 1: 1.1/2 shall then be well punched or pressed home with a caulking tool within this caulking space. Care shall be taken that the underside of the joints is properly filled with mortar.

Curing :

Every joints shall be kept wet for about 10 days for maturing. The section of the pipe line laid and jointed shall be covered immediately to protect from weather effects. Minimum bore of 100 mm. is considered adequate.

The joints shall be left exposed for observation.

Testing of Joints :

The testing of joints shall be done as per relevant specifications of item No. 24.1 (A) except that the testing of reinforced concrete pipes shall be done.

MODE OF MEASUREMENT & PAYMENT :

The measurements shall be net without any allowance for cutting and waste. The length of bends, junctions and other connections (measured along the centre line) shall be included in the total length of the pipes, the connections being numbered afterwards and paid for extra over pipes.

The size of bend, junctions, etc, shall suit the size of pipe. The bore (internal diameter of pipe) shall be the criterion for payment.

Nothing extra shall be paid separately for the use of mechanical appliances, where necessary, as described above.

The rate shall be for a unit of One running meter.

Item No: 79 Constructing Manhole with R.C.C. top slab in 1:2:4 mix (1- cement :2-coarse sand : 4-graded stone aggregate 20mm nominal size) foundation concrete 1:3:6 mix (1-cement : 3- coarse sand :6-Brick bats 40 + 50mm size) inside plastering 15mm thick with Cement Mortar 1:3 (1- Cement : 3-coarse sand) finished with a floating coat of neat cement and making channels in cement concrete 1:2:4 mix (1 Cement :2-Coarse sand :4-stone aggregate 20mm nominal size) finished smooth complete including curing and festing (i) Inside size 900mm x 1200mm and 1.5M. deep including C.I. cover with frame size 560mm diameter total weight of cover and frame to be not less than 128 kgs. (Wt. of cover 64 Kg. and Wt. of frame 64 Kg.)(A) With 230mm thick walls of brick msonry using brick having crushing strength not less than 35Kg. / Sq.cm. in Cement Mortar 1:5 (1- Cement: 5-Coarse sand) (1) A type depth 0.90 Metre for 150mm diameter sewer.

MATERIAL :

Water shall conform to M-1. Cement shall conform to M-6. Burnt bricks shall conform to M-15. Brick bats of 40 to 50 mm. size shall conform to M-14. Stone coarse aggregate of 20 mm. nominal size shall conform to M-12. Grit shall conform to M-8. Cement mortar of specified proportion shall conform to M-11. The cast iron manhole cover of 560 mm. dia. with frame shall conform to I.S. 1726-1966.

WORKMANSHIP :

The manholes of different types and sizes as specified shall be constructed in sewer line at such places and to such levels and dimension as shown in drawings of as directed.

The manholes shall be built on a bed of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 brick bats) (40 to 50 mm. nominal size) to the thickness of the bed concrete shall be 15 cms. for manhole up to 1. M. depth and 20 cms. for manholes over meter and up to over meter and up to 2 meters, depth and 30 cms. for manholes o greater depth.

Projection of bed concrete beyond the masonry wall shall be 15 cms.

Walls :

The walls of manhole shall be carried out with burnt bricks using having bricks. crushing strength not less than 35 Kg/Cms in C.M. 2 in C.M. 1:5 (1 cement : 5 coarse sand). The thickness of brick masonry wall shall be 230 mm. The jointing face of such .brick shall be well buttered with cement mortar before laying so as to ensure a full joints.

Plaster :

The inside of waits shall be plastered 15 mm. thick with C.M. 1:5 (1 cement : 5 coarse sand) and finished with floating coat of neat cement. All angles shall be rounded to 7.50 cms. radius and all rendered internal surfaces shall have hard impervious finish obtained by using a steel trowel. The external joints of masonry shall be finished smooth.

Channels & Benching :

Channels shall be semicircular in the bottom half and of diameter equal to the sewer. Above the horizontal diameter, the sides shall be extended vertically to the same level as the crown of the outgoing pipe and the top edge shall be suitably rounded off. The branch channels snail also be similarly constructed with respect to the benching but at their junction with the main channel an appropriate fall suitably rounded off in the direction of flow 'he main channel shall be given.

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The channel and benching shall be done in C.C. 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) rising at a slop in line from edges of channel. The channels of the bottom of the chamber shall be plastered with C.M. 1:2 (1 cement: 2 coarse sand) and steel troweled smooth.

Cover slab:

The cover slab of R.C.C. 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm. nominal size) 15 cms. thick reinforced with 10 mm. bars at 15 cms. C/C both ways, surface and edges finished fair. Full bearing equal to the width to the width of wall shall be given to the slab on all sides. The frame of manhole cover shall be embedded firmly in R.C.C. slab so that the top of the frame remains flush with the top of R.C.C. slab.

Testing:

Manhole shall be tested by filling with water to a depth not exceeding 1.2 M. as directed.

After completion of work, manhole cover shall be sealed by means of thick grease.

MODE OF MEASUREMENT & PAYMENT :

The depth of manholes shall be distance between the top of the manhole cover and the invert level of the main drain. The rate includes all labours, materials, tools, and plant etc. required for satisfactory completion of this item as directed above.

The rate shall be for a unit of the One number.

Item No: 80 (I) Extra rate for constructing B.B. masonry for every additional depth of 0.1M. or Part thereof over item No.24.27 (I) for depth from 0.9M to 1.5M.

(II) Extra rate for constructing B.B. masonry for every additional depth of 0.1M. GR Part thereof over item No.24.27 (I) for depth from 1.50M. to 2.25M.

MATERIAL & WORKMANSHIP :

The relevant specifications of item No. 81 shall be followed except that the depth of manhole shall be done 0.1 M. or part thereof more than 1.5 M. up to 2.25 M. The extra payment shall be made for additional depth of 0.1 M. or part thereof manhole done over and above the depth 1.50 M. up to 2.25 M.

MODE OF MEASUREMENT & PAYMENT :

The relevant specifications of item No. 81 shall be followed except that the extra rate shall be paid for 0.1 M. or part thereof additional depth of manhole provided over and above item 81.

The rate shall be for a unit of One number.

Item No: 81 Constructing Manhole with R.C.C. top slab in 1:2:4 mix (1- cement :2-coarse sand : 4-graded stone aggregate 20mm nominal size) foundation concrete 1:3:6 mix (1-cement : 3- coarse sand :6-Brick bats 40 + 50mm size) inside plastering 15mm thick with Cement Mortar 1:3 (1- Cement : 3-coarse sand) finished with a floating coat of neat cement and making channels in cement concrete 1:2:4 mix (1 Cement :2-Coarse sand :4-stone aggregate 20mm nominal size) finished smooth complete including curing and festing (i) Inside size 900mm x 1200mm and 1.5M. deep including C.I. cover with frame size 560mm diameter total weight of cover and frame to be not less than 128 kgs. (Wt. of cover 64 Kg. and Wt. of frame 64 Kg.)(A) With 230mm thick walls of brick msonry using brick having crushing strength not less than 35Kg. / Sq.cm. in Cement Mortar 1:5 (1- Cement: 5-Coarse sand) (2) B type depth 1.50 Metre for 150mm diameter sewer.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 79.

Item No: 82 Providing and fixing cast iron steps of size 500mm x 150mm x 22.5mm and painting with two coats of Anti corrosive paint etc. complete.

MATERIAL :

Recommended brands/ manufactures of all items are attached in this volume (Note: If any item make is not mention in tender then contractor has to approve the make from GIDC/Architect Consultant).

WORKMANSHIP :

Providing and fixing cast iron steps of size 500mm x 150mm x 22.5mm and painting with two coats of Anti corrosive paint etc. complete.

MODE OF MEASUREMENT & PAYMENT :

The rate shall be for a unit of Each.

Item No: 83 Constructing brick masonry chamber for underground C.I. Inspection chamber and bends with bricks having crushing strength not less than 35Kg/Cm² in C.M. 1:5 C.I. cover with frame (Light duty) 455mm x 610mm intenal dimensions total weight of cover with frame to be not less than 38Kg. (Wt. of cover 23 Kg.) and Wt. of frame 15Kg.) (R.C.C. top slabe with 1:2:4 mix (1 cement :2-coarse sand :4-graded stone aggregate 20mm size) foundation concrete 1:5:10 inside plaster 15mm thick with cement mortar 1:3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete.(i) Inside dimensions 455mmx 610mm and 450mm deep for single pipe line.

Extra over items 24.44 for every additional depth of 0.1M. of part thereof beyond 450mm depth for Brick masonry chamber.(i) for 455mm x 610mm size.

MATERIALS :

Brick shall conform to M-13 of Specification of Materials attached herewith.

Brick bat shall conform to M-12 of Specification of Materials attached herewith.

Cement mortar 1:6 & 1:3 shall conform to M-9 of Specification of Materials attached herewith.

Water shall conform to M-1 of Specification of Materials attached herewith.

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Cement shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

75mm thick pre-cast RCC cover shall be of best and approved quality.

CI manhole cover with frame shall be of size 0.61 x 0.45 mtr. and having weight not less than 38 kg.

CI manhole frame and cover shall be of best quality and make. CI manhole cover shall be of light duty and conform to relevant I.S.

WORKMANSHIP :

Work of inspection chamber shall be carried out as per C-51 of Code of practice attached herewith. The work shall be executed in accordance with best modern practices.

C.I. inspection chamber with provision of C.I. bends of specified size with bolts, nuts and felt washers for underground drain shall be enclosed in masonry chamber which shall be constructed as under:

The excavation shall be done true to dimensions and level shown in one the plans or as directed. Bed concrete shall be 15. Cms, thick C.C. 1:5:10 (1 cement : 5 coarse sand : 10 graded brick bat aggregates. The projection of bed concrete beyond the masonry walls shall be 7.5 cms. Masonry walls and plaster work shall be carried out as per relevant specifications of mention under this volume. The cover slab of R.C.C. 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm. nominal size) 15 cms. thick reinforced with 10 mm. bars at 15 cms. C/C both ways, surface and edges finished fair. Full bearing equal to the width to the width of wall shall be given to the slab on all sides. The frame of manhole cover shall be embedded firmly in R.C.C. slab so that the top of the frame remains flush with the top of R.C.C. slab.

Extra over items 24.44 for every additional depth of 0.1M. of part thereof beyond 450mm depth for Brick masonry chamber.(i) for 455mm x 610mm size.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on the Number basis of complete item.

Item No: 84 Constructing brick masonry chamber for underground C.I. Inspection chamber and bends with bricks having crushing strength not less than 35Kg/Cm² in C.M. 1:5 C.I. cover with frame (Light duty) 455mm x 610mm internal dimensions total weight of cover with frame to be not less than 38Kg. (Wt. of cover 23 Kg.) and Wt. of frame 15Kg.) (R.C.C. top slab with 1:2:4 mix (1-cement :2-coarse sand :4-graded stone aggregate 20mm size) foundation concrete 1:5:10 inside plaster 15mm thick with cement mortar 1:3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete.(ii) Inside dimensions 500mm x 700 mm and 450mm deep for pipe line with one or two inlets.

Extra over items 24.44 for every additional depth of 0.1M. of part thereof beyond 450mm depth for Brick masonry chamber.(ii) for 500mm x 700mm size.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 83.

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Item No: 85 Constructing brick masonry chamber for underground C.I. Inspection chamber and bends with bricks having crushing strength not less than 35Kg/ Cm² in C.M. 1:5 C.I. cover with frame (Light duty) 455mm x 610mm intenal dimensions total weight of cover with frame to be not less than 38Kg. (Wt. of cover 23 Kg.) and Wt. of frame 15Kg.) (R.C.C. top slabe with 1:2:4 mix (1 cement :2- coarse sand :4-graded stone aggregate 20mm size) foundation concrete 1:5:10 inside plaster 15mm thick with cement mortar 1:3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete.(iii) Inside dimensions 600mm x 850 mm and 450mm deep for pipe lines with three or more inlets.

Extra over items 24.44 for every additional depth of 0.1M. of part thereof beyond 450mm depth for Brick masonry chamber.(iii) for 600mm x 850mm size.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 83.

Part C - RA ITEM

Item No: 86 Providing and fixing on platform stainless steel Sink glossy ASIS 304 grade x 1mm thick with over all size 610x460mm & bowl size 560x410x200mm & SS Pillar cock with extention body including fixing the sink in platform & making good the same including the cost of PVC waste pipe of 32mm dia. and PVC waste coupline etc complete as directed by EIC.

MATERIAL :

White glazed vitreous china sink.

WORKMANSHIP :

The kitchen sink shall be supported on a pair of M.S. or C.I. brackets fixed in cement mortar 1:3 (1 cement: 3 coarse sand). The M.S. or C.I. brackets shall conform to I.S. 775-1962. The wall plaster on the rear shall be cut to rest over the top edge of the sink. After fixing the sink, plaster shall be made good and the surface finished to match with the existing one.

The C.P. brass trap and union shall be connected to 40 mm. nominal bore galvanised mild steel waste pipe which shall be suitably bent towards the wall and which shall discharge into an open drain leading to gully-trap or direct into the gully-trap on the ground on floor and shall be connected to a waste pipe through a floor trap on the upper floors. C.P. brass trap and union may not be provided where surface drain or a floor trap is placed directly under the sink and the waste is discharged to it vertically.

The height of front edge of the wash basin from the floor, level shall be 80 cms.

MODE OF MEASUREMENT & PAYMENT :

The rate includes cost of all labour, materials, tools and plant and other equipment required for satisfactory completion of this item as described in workmanship.

The rate shall be for a unit of One number.

Item No: 87 Providing and fixing Two way BIB cock with wall flange of genuine Jaquar ompany brand, in with model no FUS-CHR29041, water tap brand or approved ISI brand quality, fixing in
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pipeline and testing the same... etc., complete., as directed by EIC

MATERIAL :

15 mm. dia. brass screw down with bright polished finished shall conform to I.S. 781-1977. The bib cock shall be best Indian make and quality.

WORKMANSHIP :

The screw down bib cock 15 mm. as specified above shall be fixed as directed. The threaded portion shall be smeared with white or red lead and around with a few turns of fine spun yarn round the screwed end of the pipe. The bib cock shall be then screwed and fixed to water tight position.

MODE OF MEASUREMENT & PAYMENT :

The rate includes cost of all labour, materials, tools and plant etc. required for satisfactory completion of this item.

The rate shall be for a unit of One Number.

Item No: 88 Providing and fixing wash down water closet European type WC pan (Wall Hung) like JAQUAR CNS-WHT-961SPP- SIZE 365x545x360MM and P trap distance 23.5 cms with integral P trap including jointing the trap with soil pipe in cement mortar 1:1 (1 cement : 1 fine sand) including providing and fixing of 1) Health Faucet hand shower heavy duty with SS braided hose 1.2 MT long pipe to water closet - JAQUAR ALD-CHR-573 with Single Piece Slim Concealed Cistern Body with Installations Kit & "S-Type" drain pipe connection set for Wall Hung WC (without Flush Control Plate) - JCS-WHT-2400S with Control Plate Opal - JCP-CHR-152415, Toilet roll holder etc, complete

MATERIAL :

European W.C. pan shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-39 of Specification of Materials attached herewith.

25mm dia GI pipe shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-35 of Specification of Materials attached herewith.

25mm dia flush cock shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-41 of Specification of Materials attached herewith.

100 mm CI soil pipe shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-42 of Specification of Materials attached herewith.

Water shall conform to M-1 of Specification of Materials attached herewith.

Cement shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

WORKMANSHIP :

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Fixing of W.C. span with all required fittings shall be carried out as per C-44 of Code of practice attached herewith.

The work shall be executed in accordance with best modern practices. Providing and fixing wash down water closet European type WC pan (Wall Hung) like JAQUAR CNS-WHT-961SPP- SIZE 365x545x360MM and P trap distance 23.5 cms with integral P trap including jointing the trap with soil pipe in cement mortar 1:1 (1 cement : 1 fine sand) including providing and fixing of 1) Health Faucet hand shower heavy duty with SS braided hose 1.2 MT long pipe to water closet - JAQUAR ALD-CHR-573 with Single Piece Slim Concealed Cistern Body with Installations Kit & "S-Type" drain pipe connection set for Wall Hung WC (without Flush Control Plate) - JCS-WHT-2400S with Control Plate Opal - JCP-CHR-152415, Toilet roll holder -Jaquar -ACN -1151N etc, complete.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on the Number basis of complete item in all aspects.

The contract rate shall be for a unit of One Number of complete items in all aspects.

Item No: 89 Providing and fixing Wash Basin vitreous china table top wash basin size 560mm x 450 mm in colour selected by engineer-in-charge with single hole for pillar tape with CP or MS brackets painted white including cutting holes and making good the same including (1) Providing and fixing SS waste coupling of 32 mm dia size half thread with 80mm height for wash basin with rubber plug (2) Providing and fixing SS bottle trap with internal partition of 32mm size with 250mm & 190mm long wall flange connection pipes and wall flange of approved quality with necessary fitting for wash basin (3) Providing and fixing SS Pillar cock with extension body like JAQUAR FUS-CHR-29021N with necessary fittings etc. complete (4) Providing and fixing SS finish Angular Stop Cock quarter turn like Jaquar code FUS-29053 with necessary fittings (5) Providing and fixing SS finish soap dispenser with metallic bottle, Towel ring etc. Complete

MATERIAL :

The white glazed earthenware wash basin shall be 425 mm. x 340 mm. x 175mm of 1st quality and make as approved by the Engineer-in-charge. The wash basin shall conform to M-59. Wash Basin vitreous china table top wash basin shall be of approved make (List of approved make attached with the Technical Bid)

WORKMANSHIP :

The washbasin shall be fixed on the wall as and where directed. The wash basin shall be supported on a pair of M.S. or C.I. brackets fixed in C.M. 1:3 (1 cement : 3 sand). The bracket shall conform to I.S. : 775-1962. The wall plaster on the rear shall be cut to rest the top edge of the washbasin. After fixing the basing, plaster shall be made good and surface finished to match the existing one.

The brackets shall be painted white with ready-mixed paint.

The C.I. brass trap and union shall be connected to 32 mm. dia. waste pipe which shall be suitably bent towards the wall and which shall discharge into an open drain leading to a gully trap or direct in to gully-trap on the ground floor and shall be connected to a waste pipe through a floor trap on the upper floors. C.P. brass trap and union may not be provided where the surface drain or a floor trap is placed directly under the basin and the waste is discharged in to vertically.

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including (1) Providing and fixing SS waste coupling of 32 mm dia size half thread with 80mm height for wash basin with rubber plug (2) Providing and fixing SS bottle trap with internal partition of 32mm size with 250mm & 190mm long wall flange connection pipes and wall flange of approved quality with necessary fitting for wash basin (3) Providing and fixing SS Pillar cock with extension body with necessary fittings etc. complete (4) Providing and fixing SS finish Angular Stop Cock quarter turn with necessary fittings (5) Providing and fixing SS finish soap dispenser with metallic bottle, Towel ring etc. complete.

MODE OF MEASUREMENT & PAYMENT :

The rate includes cost of all labour, materials, tool and plant etc. required for satisfactory completion of this item as specified in workmanship.

The rate shall be for a unit of One number.

Item No: 90 Providing and fixing Urinal of approved quality including connection with trap and with integral longitudinal flush pipe.(A) Squating plate pattern white earthenware size of urinal 370mm x 315x 620 mm.of jaquar make code no URS -WHT-132530 including (1) Providing and fixing SS finish waste coupling of 32 mm dia size half thread with 80mm height like jauar -ALD - 709 for wash basin with rubber plug (2) Providing and fixing SS finish bottle trap with internal partition of 32mm size with 250mm & 190mm long wall flange connection pipes and wall flange like jaquar ALD-769 of approved quality with necessary fitting for wash basin (3) Sensotronic Concealed Type Flushing Valve Faucets of auto closing system for urinal like jaquar SNR-STL-51087 of approved quality and connection with waste pipe trap etc. complete

MATERIAL :

Flat Back urinal with all accessories shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-49 of Specification of Materials attached herewith.

WORKMANSHIP :

Fixing of urinal with all required fittings shall be carried out as per C-45 of Code of practice attached herewith.

The work shall be executed in accordance with best modern practices.

Make: Jaquar, Kohler, American standard or equivalent brand of shade & shape as approved by engineer-in-charge

Whole work should be carried out as per requirement and as directed by Engineer-in-charge. (All fixtures and fitting as per specification and approved by Consultants / Engineer in charge.)

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on the Number basis of complete item.

The contract rate shall be for a unit of One Number.

Item No: 91 Providing and fixing PVC SWR pipes IS 13592 for Drain - 75 mmdia

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MATERIAL :

The low-density polythene pipe of specified diameter with 10 Kg/Sq. Cm, working pressure shall conform to I.S. 3076-1968. The specials and fittings required shall be of best quality.

WORKMANSHIP :

The P.V.C. pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid P.V.D. pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during installation or when pipe line which may occur during installation or when pipe line is in service.

Above ground installation of rigid P.V.C. pipe should be under taken after preparations are observed for their protection against direct sun rays and mechanical damage.

The rigid P.V.C. pipe lines should not be kept exposed above ground when it passes through public places, railway lines, road side and foot paths.

P.V.C. pipes shall be supported at the following intervals :

-20 mm. dia 500 mm. -25 mm. dia 750.mm. -32 mm. dia.900 mm.

Closer support spacing shall be provided if recommended by the manufacture.

The guide lines indicated by the manufacturer regarding handling, transportation, storing, laying and jointing pf pipes shall be kept in view during execution.

P.V.C. pipes shall be fixed on wall with wooden plugs and suitable plastic clamps.

Jointing the pipes :

The pipes and sockets shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement joint. Since solvent cement is aggressive to P V.C. care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped of after jointing. Empty solvent cement tins, brushes, rags, or paper impregnated with cement should not be buried in the trenches. They should be gathered not left scattered about, as-they can prove to be a hazard to animals, which may chew them.

If any manufacturer recommends its own methods of jointing the same shall be adopted after necessary approval from the Engineer-in-charge.

Laying pipes in Trenches :

The pipes shall be laid over uniform relatively soft fine trained soil found to be free of presence of hard object such as large flints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.

The pipes laid underground shall not be less than one meter from the ground level. The pipe shall be positioned in the trenches so as to avoid any induced stressed due to deflection. Any deviation required shall be obtained by using proper type of rubber ring joints.

MODE OF MEASUREMENT & PAYMENT :

The description of e, item shall, unless otherwise stated be held to include where necessary. conveyance, and delivery, handling, unloading, storing fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting in position straight, cutting and waste return of packing etc.

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The length shall be measured on running meter basis of finished work. The length shall be taken along the centre line of the pipe and fittings. The pipes fixed to wall, ceiling, floors etc shall be measured and paid under this item.

All the work shall be measured in decimal system as fixed in its place, subject to tolerance given below unless otherwise stated.

(i) Dimension shall be measured to the nearest 0.01 meter. (ii) Area shall be worked out to the nearest 0.01 sq. meter.

All measurements of cutting shall unless otherwise stated be held to include the consequent waste

In case of fitting of unequal bore, the target bore shall be measured for the test.

Testing of pipe lines fittings, and joints include for providing all plant appliances necessary for obtaining access to the work to be tested and carrying out the tests

The rate includes galvanized steel tubing with screwed socket joints. to gather with all fittings (such as bends, sockets, springs, elbows, tees, crosses, short pieces, clamps and plugs, unions etc.) and fixing complete with clamping wall hooks, wooden plug etc. and also curing, screwing and waste and for making forged (or hand made) bends on piping as required. Connector shall be inserted where required or directed. The rate also includes cutting through walls, floors etc. and their making good and painting exposed threads with anti-corrosive paint as above and testing where tubes are to be fixed to wall ceiling and flooring, the rates shall not include painting of pipes, providing sleeves and sand filling under floor for which separate payment shall be made.

The rate shall be for a unit of one running meter.

Item No: 92 Providing and fixing PVC SWR P- Trap IS 14735 for Drain -110x110

MATERIAL :

The low density polythene pipe of specified diameter with 10 Kg/Sq. Cm, working pressure shall conform to I.S. 3076-1968. The specials and fittings required shall be of best quality.

WORKMANSHIP :

The P.V.C. pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid P.V.C. pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during installation or when pipe line which may occur during installation or when pipe line is in service.

Above ground installation of rigid P.V.C. pipe should be under taken after preparations are observed for their protection against direct sun rays and mechanical damage.

The rigid P.V.C. pipe lines should not be kept exposed above ground when it passes through public places, railway lines, road side and foot paths.

P.V.C. pipes shall be supported at the following intervals :

-20 mm. dia 500 mm. -25 mm. dia 750 mm. -32 mm. dia 900 mm.

Closer support spacing shall be provided if recommended by the manufacture.

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The guide lines indicated by the manufacturer regarding handling, transportation, storing, laying and jointing pf pipes shall be kept in view during execution.

P.V.C. pipes shall be fixed on wall with wooden plugs and suitable plastic clamps.

Jointing the pipes :

The pipes and sockets shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement joint. Since solvent cement is aggressive to P V.C. care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped of after jointing. Empty solvent cement tins, brushes, rags, or paper impregnated with cement should not be buried in the trenches. They should be gathered not left scattered about, as-they can prove to be a hazard to animals, which may chew them.

If any manufacturer recommends its own methods of jointing the same shall be adopted after necessary approval from the Engineer-in-charge.

Laying pipes in Trenches :

The pipes shall be laid over uniform relatively soft fine trained soil found to be free of presence of hard object such as large flints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.

The pipes laid underground shall not be less than one meter from the ground level. The pipe shall be positioned in the trenches so as to avoid any induced stressed due to deflection. Any deviation required shall be obtained by using proper type of rubber ring joints.

MODE OF MEASUREMENT & PAYMENT :

The description of e, item shall, unless otherwise stated be held to include where necessary. conveyance, and delivery, handling, unloading, storing fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting in position straight, cutting and waste return of packing etc.

The length shall be measured on running meter basis of finished work. The length shall be taken along the centre line of the pipe and fittings. The pipes fixed to wall, ceiling. floors etc shall be measured and paid under this item.

All the work shall be measured in decimal system as fixed in its place, subject to tolerance given below unless otherwise stated.

(i) Dimension shall be measured to the nearest 0 01 meter. (ii) Area shall be worked out to the nearest 0.01 sq. meter.

All measurements of cutting shall unless otherwise stated by held to include the consequent waste

In case of fitting of unequal bore, the targets bore shall be measured for the test.

Testing of pipe lines fittings, and joints include for providing all plant appliances necessary for obtaining access to the work to be tested an carrying out the tests

The rate includes galvanized steel tubing with .screwed socket joints. to gather with all fittings (such as bends, sockets springs, elbows, test, crosses, short pieces, clamps and plugs, unions etc.) and fixing complete with clamping wall hooks, wooden plug etc. and also curing, screwing and waste and for making forged (or hand made) bends on piping as required. Connector shall be inserted where required or directed. The rate also includes cutting through walls, floors etc. and their making good and painting exposed threads with anti-corrosive paint as above and testing where tubes are to be fixed to wall ceiling

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and flooring, the rates shall not include painting of pipes, providing sleeves and sand filling under floor for which separate payment shall be made.

The rate shall be for a unit of one running meter.

Item No: 93 Providing and fixing Gun metal check or non-return fullway wheel valve. (A) 50mm dia.

MATERIALS:

50 mm. dia. Gun metal screw down bib tap or non-return full way wheel valve with all necessary required material shall conform to M-37 of Specification of Materials attached herewith. Recommended brands/manufactures of all items are attached in this volume (Note: If any item make is not mention in tender then contractor has to approve the make from GIDC/Architect Consultant)

WORKMANSHIP :

The work shall be carried out in best workmanship like a manner and as per direction of Engineer-in-charge. Relevant specification of Item No. 54 above shall be followed.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on number basis of complete item.

The contract rate shall be for a unit of one number.

Item No: 94 Providing laying and jointing PVC SWR pipes IS 13592 for Drain - 50 mm dia its accessories.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No 91.

Item No: 95 Providing and fixing to the inlet mouth of rain water pipe cast iron grating 15 cm diameter and weighing not less than 440 grams.

MATERIAL :

The Material of cast iron grating conforming to latest IS code. The specials and fitting required shall be of best quality.

WORKMANSHIP :

Providing and fixing to the inlet mouth of rain water pipe cast iron grating 15 cm diameter and weighing not less than 440 grams etc. complete.

MODE OF MEASUREMENT & PAYMENT :

The unit rate shall be for a unit of one number.

Item No: 96 Providing and fixing Handicap wash down water closet European type WC pan (Wall Hung) like JAQUAR CNS-WHT-961SPP- SIZE 365x545x360MM and P trap distance 23.5 cms with integral P trap including jointing the trap with soil pipe in cement mortar 1:1 (1 cement : 1 fine sand) including providing and fixing of 1) Health Faucet hand shower heavy duty with SS braided hose 1.2 MT long pipe to water closet - JAQUAR ALD-CHR-573 with Single Piece Slim Concealed Cistern Body with Installations Kit & "S-Type" drain pipe connection set for Wall Hung WC (without Flush Control Plate) - JCS-WHT-2400S with Control Plate Opal - JCP-CHR-152415, Toilet roll holder

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including grab bar etc,complete

MATERIAL :

European W.C. pan shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-39 of Specification of Materials attached herewith.

25mm dia GI pipe shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-35 of Specification of Materials attached herewith.

25mm dia flush cock shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-41 of Specification of Materials attached herewith.

100 mm CI soil pipe shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-42 of Specification of Materials attached herewith.

Water shall conform to M-1 of Specification of Materials attached herewith.

Cement shall be of approved make (List of approved make attached with the Technical Bid) and shall conform to M-3 of Specification of Materials attached herewith.

Sand shall conform to M-6 of Specification of Materials attached herewith.

WORKMANSHIP :

Fixing of W.C. span with all required fittings shall be carried out as per C-44 of Code of practice attached herewith.

The work shall be executed in accordance with best modern practices. Providing and fixing Handicap wash down water closet European type WC pan (Wall Hung) like JAQUAR CNS-WHT-961SPP- SIZE 365x545x360MM and P trap distance 23.5 cms with integral P trap including jointing the trap with soil pipe in cement mortar 1:1 (1 cement : 1 fine sand) including providing and fixing of 1) Health Faucet hand shower heavy duty with SS braided hose 1.2 MT long pipe to water closet - JAQUAR ALD-CHR-573 with Single Piece Slim Concealed Cistern Body with Installations Kit & "S-Type" drain pipe connection set for Wall Hung WC (without Flush Control Plate) - JCS-WHT-2400S with Control Plate Opal - JCP-CHR-152415, Toilet roll holder -Jaquar -ACN -1151N, with Grab bar etc, complete

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken on the Number basis of complete item in all aspects.

The contract rate shall be for a unit of One Number of complete item in all aspects.

Item No: 97 Providing and laying in trench including UPVC Foamcore PVC pipe of SN8 grade 10KG with all jointing, fittings, etc. complete with testing. The above pipe includes excavation, refilling, CC 1:5:10 bedding, encasing etc. all civil work required to lay the pipe as per site soil condition. The scope shall also include connection to the existing network with required material & civil work.

Providing and laying in trench including UPVC Foamcore PVC pipe of SN8 grade 10KG with all jointing, fittings, etc. complete with testing. The above pipe includes excavation, refilling, CC 1:5:10 bedding, encasing etc. all civil work required to lay the pipe as per site soil condition. The scope shall also include connection to the existing network with required material & civil work.

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MODE OF MEASUREMENT & PAYMENT :

The rate shall be for a unit of Each number.

TECHNICAL SPECIFICATION FOR COMPOUND WALL WORK

Item No: 98 Excavation for foundation in Loose or Soft soil upto 1.50m depth including sorting out and stacking of useful materials and disposing of the excavated stuff with all lead and lift as directed by Engineer in charge.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 02.

Item No: 99 Excavation for foundation in Loose or Soft soil from 1.50 m. to 3.00 m. depth including sorting out and stacking of useful materials and disposing of the excavated stuff with all lead and lift as directed by Engineer in charge.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 03.

Item No: 100 Excavation for foundation in Loose or Soft soil from 3.00 m. to 5.00 m. depth including sorting out and stacking of useful materials and disposing of the excavated stuff with all lead and lift as directed by Engineer in charge.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 04.

Item No: 101 Filling available excavated earth in trenches. plinth, sides of foundations etc. in layers not exceeding 20cm. In depth consolidating each disposed layer by ramming and watering etc. complete as directed by Engineer in charge.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 06.

Item No: 102 Providing and laying Rubble soling with sand in foundation below PCC and watering and compacting the same etc. completed..

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 07.

Item No: 103 Providing and laying PCC 1:3:6 (1-cement : 3 coarse sand : 6 M/c stone aggregate 20 / 40mm nominal size) in foundation concrete / floor concrete incl. machine mixing, ramming, consolidation & curing etc. incl. cost of form work if required etc. complete at all levels as directed by Engineer in charge.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 09.

Item No: 104 Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all levels for RCC FOOTING

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The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 10.

Item No: 105 Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete COLUMN UP TO GROUND FLOOR LEVEL & FIRST FLOOR LEVEL

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 11.

Item No: 106 Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete FOR RCC BEAM at Compound wall

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 14.

Item No: 107 Providing and laying controlled cement concrete M-250 for RCC work as per detailed drawings including centering, shuttering (Only Fresh Ply), machine mixing, vibrating, scaffolding, curing, centering having double or more height wherever required & finishing etc. but excluding cost of reinforcement etc. complete at all levels for RCC SILL & COPING

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 20.

Item No: 108 Providing TMT Bar FE 500D reinforcement for R.C.C. work including bending, binding and placing in position complete.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 24.

Item No: 109 Brickwork using common burnt clay building bricks having crushing strength not less than 35 Kg./Sq. Cm. in foundation and plinth in cement Mortar 1:6 (1-Cement : 6 - fine sand). Compound Wall (Upto 10 ton).

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 26.

Item No: 110 20mm thick sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12mm thick backing coat of C.M. 1:3 (1-cement : 3-sand) and 8mm thick finishing coat of C.M. 1:1 (1-cement : 1-sand) etc. complete.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 33.

Item No: 111 Finishing wall with weather proof exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials.etc complete

MATERIALS:

Water shall conform to **M-1** of Specification of Materials attached herewith.

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Putty: Plaster filler to be used for filling up (putting) uneven surfaces, small cracks etc. shall be of approved compound and as per recommendations of the manufacturers.

The Cement primer shall be ready mixed primer of approved brand and manufacture. The primer to be used for the painting with emulsion on cement concrete surfaces, plastered surfaces etc. shall be of approved base and as per recommendations of the manufacturers.

Exterior emulsion paint shall be of weather proof exterior emulsion paint of required shade and conforming by Engineer-in-charge.

WORKMANSHIP :

The work of applying cement primer & External wall painting three coats with plastic emulsion paint shall be carried out as per **C-61** of Code of practice attached herewith & **IS : 2394-1995**.

The work shall be executed in accordance with best modern practices.

For scaffolding, relevant specification of **C-9** of Code of practice attached herewith shall be followed.

MODE OF MEASUREMENT & PAYMENT :

The measurement shall be taken as per I.S. 1200-Part-XII- 1976 or as revised from time to time so far as applicable.

The contract rate shall be for a unit of one Sq. Meter of visible area after deducting openings.

Item No: 112 Providing & fixing Steel work, Entry Gate, parking shed ,etc welded in built up/rolled steel sections framed work including cutting, hoisting, fixing in position and applying a priming coat of read lead paint. (A)In beams and joists, channels angles Tees, flats, with connecting plates or angle cleats as in main and cross beams. Hip and jack rafters, purlins conneted to common rafters etc completed as directed by architect / Engineer In charge.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 44.

Item No: 113 Painting two coats (Including priming coat) on new steel and other metal surface with enamel paint, brushing, interior to give an even shade including cleaning the surface an even shade including cleaning the surface of all dirt, dust and other foreign matter etc. complete as directed by Engineer Incharge.

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 45.

Item No: 114 Providing & Fixing 6 mm thick lexan Polycarbonate multi wall roofing sheet fixed with hilti screw and rubber silicon sealer and alluminium strip of size 50 x 3 mm etc. complete and directed by Enginner in charge

The item shall be executed as per the relevant specifications & mode of measurement of above Item No: 57.

Item No: 115 Providing and Fixing 'U' Shaped Barbed wire fencing on Existing compound wall top with verical angle of 50x50x6 mmx0.45 Mtr height, two cross angles 50x50x6 mm x 0.40 Mtr. Length, , two vertivcal angle 50x50x6 mm x 0.45 Mtrhaving 1 Horizontal rows , 2 horizontal rows at each side of cross angles ,and 2 horizontal rows at each side of verical angle and 1 horizontal rows at top side of

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barbed wire.and @ 0.10m c/c Spiral turns in each 27 mtr in length each 3.00m span and 750 mm effective dia, horizontal and two diagonal barbed wire rows on each cross angles incl. cost of barbed wires, necessary GI stappings, fixing in C.C. (1:2:4) blocks of 0.35x0.35x0.30 Mtr. size on top of compound wall, painting angles with one coat of anticorrosive primer and two coats of enamel paint of approved quality, necessary scaffolding etc. complete as per the direction of the Engineer in Charge.

MATERIAL :

- Providing and fixing ‘U’ shaped barbed wire fencing on the top of existing compound wall using vertical angles of size **50 mm x 50 mm x 6 mm, 0.45 m height**, cross angles of size **50 mm x 50 mm x 6 mm, 0.40 m length**, and required horizontal and diagonal barbed wire rows as specified.
- The work shall include **barbed wire, vertical angles, cross angles, GI stappings, C.C. blocks of size 0.35 m x 0.35 m x 0.30 m in cement concrete 1:2:4**, anticorrosive primer, enamel paint, scaffolding, labour, tools, tackles, and all necessary materials required to complete the work as per the direction of the Engineer-in-Charge.

WORKMANSHIP :

- The ‘U’ shaped barbed wire fencing shall be fixed firmly on the top of the existing compound wall at every **3.00 m span**. Vertical and cross angles shall be fixed properly in **C.C. blocks of size 0.35 m x 0.35 m x 0.30 m** with proper line, level, alignment, and spacing.
- Barbed wire shall be provided in horizontal and diagonal rows on vertical and cross angles as specified, including spiral turns at **0.10 m c/c** with **750 mm effective diameter** and **27 m length** for each span, wherever required. All barbed wire shall be tightly stretched and securely fastened with necessary GI stappings.
- All steel angles shall be cleaned properly and painted with **one coat of anticorrosive primer and two coats of enamel paint** of approved quality. The entire work shall be carried out with necessary scaffolding, safety precautions, and as per the instruction and approval of the Engineer-in-Charge.

MODE OF MEASUREMENT & PAYMENT :

- The measurement shall be taken in **running metre (Rmt.)** of completed barbed wire fencing fixed on the top of existing compound wall.
- The rate shall include the cost of all materials such as steel angles, barbed wire, GI stappings, C.C. blocks, primer, enamel paint, labour charges, scaffolding, tools and tackles, fixing, painting, finishing, and all incidental work required to complete the item in all respects.
- Payment shall be made on the basis of actual length of fencing completed and accepted by the Engineer-in-Charge.