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(A Government of Kerala PPP Initiative)
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GENERAL CONDITIONS OF CONTRACT

Name of Work

Tender No

INDEX	

1. GENERAL CONDITIONS OF CONTRACT

1.1. Interpretations and Definitions

1.1.1. Singular & Plural:

Where the context so requires, words importing the singular only also include the plural and vice versa.

1.1.2. Headings and Marginal Notes to Conditions:

Headings and marginal notes to these General Conditions as well as NIT shall not be deemed to form part thereof or be taken to consideration in the interpretation or construction thereof or of the contract.

1.1.3. Words and Expressions:

In the contract (as hereinafter defined), the following **words and expressions** shall have the meaning hereby assigned to them except where the contract otherwise requires.

1.1.3.1. The "**OWNERS" /"AUTHORITY**" shall mean INKEL having its corporate and registered office at Cochin and includes duly authorised representatives of INKEL or any other person empowered in this behalf by INKEL, for the present or any other competent agency duly appointed by INKEL to act as INKEL for the purpose of the contract, to discharge all or any of its functions.

1.1.3.2. The "**CONTRACTOR**" shall mean the individual or firm or company undertaking the works and shall include legal representatives of such individual or persons composing such firm or incorporated company, or successors of such firm or company as the case may be and permitted assigns of such individual or firm or company.

1.1.3.3. The "**TENDER**" shall mean the tender submitted by the contractor for acceptance by INKEL.

1.1.3.4. The "WORK" shall mean and include all works to be executed in accordance with the contract or part thereof as the case may be and shall include all extras, additional, altered or substituted works required for the purpose of the contract.

1.1.3.5. The "**CONTRACT**" shall mean the agreement between INKEL and the contractors for the execution of the work including therein all documents such as the Notice Inviting Tender, Tender Form, General conditions of contract (GCC), Technical specifications, Schedule of Quantities, Special conditions of contract (SCC), Letter of Acceptance, agreed variation if any, drawings, work orders, and/or any other/ correspondences or negotiations, etc. All these documents taken together shall be deemed to form one Contract and shall be complementary to one another.

1.1.3.6. The "**CONTRACT VALUE/PRICE**" in the case of percentage rate contracts shall mean the estimated value of the Works as mentioned in Schedule of Quantities adjusted by the Contractor's percentage and subject to such additions thereto or deductions there from as may be under the provisions hereinafter contained and accepted by INKEL. In the case of Item Rate contracts, it shall mean the estimated value of the Works as mentioned in Schedule of Quantities adjusted by the Contractor's item rate and subject to such additions thereto or deductions there from as may be under the provisions hereinafter contained and accepted by INKEL

1.1.3.7. The "**SPECIFICATIONS**" shall mean all directions, various technical specifications, provisions and requirements attached to the contract which pertain to the method and manner of performing the work, and the materials to be furnished under the contract for the work as may be modified by INKEL, drawings, etc. for the performance of the contract in order to provide the unforeseen conditions or in the best interest of the work. It shall also include the latest revised version of the relevant B.I.S specification, IRC, MoRTH and other relevant codes.
1.1.3.8. The "**SITE**" shall mean the lands and/or other places on, under, in or through which the work is to be executed under the Contract including any other lands or places which may be allotted by INKEL or used for the purposes of the Contract.
1.1.3.9. The "**LETTER OF ACCEPTANCE**" shall mean intimation by letter, telegram, telex or fax to the tenderer that the tender has been accepted in accordance with the provisions contained therein.
1.1.3.10. The "**ENGINEER-IN CHARGE**" shall mean the Engineering Officer appointed by INKEL or its duly authorised representative who shall direct, supervise and be in charge of the works for any purpose of this contract.
1.1.3.11. "**TEMPORARY WORKS**" shall mean all temporary works of every kind required in or about the execution, completion or maintenance of the Works.
1.1.3.12. "**FORM**" means forms appended to these regulations.
1.1.3.13. "**LABOUR**" means workers employed by a contractor directly or indirectly through a sub-contractor, or by an agent on his behalf.
1.1.3.14. The term "**SUB-CONTRACTOR**" used herein refers to a party or parties having a direct contract with the Contractor, to whom any part of the contract has been sublet by the Contractor with the consent in writing of the Engineer-in-Charge.
1.1.3.15. "**DRAWINGS**" means the Drawings referred to in the contract and any modification of such drawings approved in writing by the Engineer-in-Charge and such other drawings as may from time to time be furnished or approved in writing by the Engineer-in-Charge, as well as shop drawings which may have to be prepared by the Contractor and are approved by the Engineer-in-Charge.
1.1.3.16. When the words "**Approved", "Subject to approval", "satisfactory", "equal to" "determined by", "accepted", "permitted", etc. are used, the approval, judgement, direction, etc.** implied is understood to be a function of the Engineer-in-Charge and shall have the same effect as if performed by INKEL.

1.2. SITE

1.2.1. The intending tenderer shall inspect and examine the site and its surrounding and shall satisfy himself before submitting his tender as to the nature of the ground and subsoil (as far as is practicable), the form and nature of the Site, the quantities and nature of work and materials necessary for the completion of the works and the means of access to the Site, the accommodation he may require and ensure the availability of communication facilities, water sources and power. The tenderer shall obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his tender. No extra charges consequent on any misunderstanding or otherwise shall be allowed.
1.2.2. Entry into the project area will be restricted.

1.3. SCOPE OF WORK

1.3.1. The Scope of work essentially consists of activities covered in the Bid Synopsis.
1.3.2. The scope of work further includes variation or modification of design, quantity or quality of work, addition, omissions or substitution of any work, under the instruction of INKEL. Such instructions shall be complied forthwith.
1.3.3. The contractor shall provide all necessary labour, materials, equipments, management and supervisory personnel to complete the works provided under this contract in time.

1.4. ASSIGNMENT AND SUB-CONTRACTING

1.4.1. Assignment
The contractor shall not assign the contract or any part thereof for any benefit on interest therein or there under without the written permission of INKEL.

1.4.2. Sub-contracting
The contractor shall not sub-contract the whole of the contract. The contractor shall not sub-contract any part of the works without the written consent of INKEL and such consent, if given, shall not relieve the Contractor from any liability of obligation under the contract and the Contractor shall be responsible for the acts, default and neglects of the subcontractor, his agents, employees or workmen as fully as if they were the acts, defaults or neglects of the Contractor or his agents, servants, or workmen.

1.5. DRAWINGS

1.5.1. The drawings, if any, shall be supplied with the tender documents. These drawings shall be signed and submitted along with the tender documents. However, these drawings are purely indicative of the scope of work. The Contractor shall prepare working drawings necessary for the approval by the Engineer-in-charge at the time of execution.

1.5.2. Issue of the drawings
Drawings "**approved for construction"** if any, will be issued to the Contractor progressively during the contract period and the Contractor shall arrange for the execution of the works and the procurement of materials accordingly. The Contractor shall give adequate notice in writing to INKEL or its authorised representative regarding any further drawings or specifications that may be required for the execution of the works or otherwise under the contract.

1.5.3. Copies of the drawings to be kept at the site
One copy of the drawings furnished to the Contractor as aforesaid shall be kept at the site and the same shall at all reasonable times be available for inspection and use by INKEL or its authorised representative or by any other person authorized by INKEL in writing.

1.5.4. Issue of further drawings and instructions
INKEL shall have full power and authority to supply to the Contractor from time to time through its authorised representative, during the progress of the works such

further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of the works and the Contractor shall carry out and be bound by the same.

1.5.5. Ownership of drawings

All drawings supplied to the Contractor are deemed to be the property of INKEL. The Contractor should not divulge or use, except for the purpose of this contract, any information contained in the drawings.

1.5.6. Execution as per Drawings

The Contractor must not vary or deviate from the drawings in any respect while executing the work or executing any extra work of any kind whatsoever, unless authorized by INKEL.

1.5.7. Plans and drawings to be submitted by the contractor

The Contractor shall submit the following information in triplicate to INKEL for approval within the time stipulated.

A general tentative layout plan of construction plant and equipments for the execution of work shall be submitted within 15 days from the date of receipt of the letter of acceptance.

1.5.8. Layout and details of temporary works that the contractor wants to carryout to fulfil his obligation under the contract. Within 7 days INKEL will give its approval/comments sufficient to proceed with the work or objections/instructions to the Contractor based on which the drawings shall be revised and submitted again for approval by the Contractor.

1.5.9. All these plans and drawings submitted by the Contractor and approved by INKEL shall become part of the contract.

1.6. ROYALTIES AND PATENT RIGHTS

All royalties or other sums payable in respect of the supply and use in carrying out the work as desired by or referred to in the Schedule of Quantities of any patented articles, process or inventions shall be deemed to have been included in the contract price and the Contractor shall indemnify INKEL from and against all claims, proceedings, damages, costs and expenses which may be brought or made against INKEL or to which he may be put by reason of the Contractor infringing or being held to have infringed any patent rights in relation to any such articles, process and inventions.

1.7. GENERAL OBLIGATIONS

1.7.1. Inspection of site before submission of tender

The Contractor shall inspect and examine the site and its surroundings, and shall satisfy himself before submitting his tender, as to the nature of the ground, form and nature of the site, the quantities and nature of work and materials and its availability, required for the completion of works, the means of access to the site, the local labour conditions, the accommodation he may require and in general shall obtain all necessary information as to the risks, contingencies and other circumstances which may influence or affect his tender.

1.7.2. Sufficiency of tender

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Schedule of Quantities, which rates and prices shall, except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.

1.7.3. Clarification before submitting tender

Should the Contractor notice any discrepancy or error in the statement made, or quantities or units shown against items, he shall immediately bring to the notice of INKEL and obtain the clarification before submitting the tender. The tender shall be based on such clarifications received and shall be recorded as such in the covering letter to the tender, failing which INKEL shall have the right to ask the Contractor to execute the work according to the statement made or quantities or units shown in the tender, without any compensation.

1.7.4. Rates quoted for finished work

The rates quoted in the tender by the Contractor must be for the finished work as per the drawings and specifications.

1.7.5. Location of work

Unless specifically mentioned in the item, the work described therein may be at any location or elevation.

1.7.6. Tender open for acceptance

The tender shall remain open for acceptance for a period of 3 months from the date of submission of the tender.

1.7.7. Commencement of work

The Contractor shall commence the work at site, within 7 days of issue of the Letter of Acceptance or handing over of the site or being advised by INKEL unless otherwise specified, and shall proceed with the same with due expedition.

1.7.8. Programme of work

Soon after the issue in writing of the Letter of Acceptance, the contractor shall submit to INKEL for his approval, a programme to match with the planned completion of the whole job showing the order of procedure and method in which he proposes to carry out the works and shall whenever required by INKEL or its authorised representative, furnish further detailed programme and particulars in writing of the Contractor's arrangements for carrying out the works and of the constructional plant and temporary works, which the Contractor intends to supply, use or construct as the case may be. The submission to INKEL and approval by INKEL or its authorised representative of such programmes or particulars shall not relieve the Contractor of any of his duties or responsibilities under the contract.

1.7.9. Progress of Work

Contractor shall submit to the engineer in charge a weekly report on the progress/ status with reasons for delay if any, resources at site including materials, equipments etc. in the approved format.

1.7.10. Contractor's Employees and Technical Staff

The Contractor shall provide and employ at site in connection with the project management, all the personnel they have offered to employ in the pre-qualification papers filed before INKEL, if any.

Only such technical assistants who are skilled and experienced in their respective fields and such-agents, foreman and leading hands who are competent to give proper supervision of the work are required to supervise.

a) Minimum qualification and experience of Principal Technical Representative for civil works shall be at least a Graduate Civil Engineer with 5 years of minimum experience of work or retired Executive Engineer (Civil) possessing at least recognised Diploma in Civil Engineering

b) Recovery to be affected from the contractor in the event of not fulfilling the provisions mentioned in the clause above

Rs 25,000/- per month	for Graduate Engineer
Rs 20,000/- per month	for Diploma Holder

1.7.11. Removal of Workmen

INKEL shall be at liberty to object to and require the contractor to remove forthwith from the works any person employed by the Contractor in or about the execution or maintenance of the works who in the opinion of INKEL, misconduct himself or is incompetent or negligent in the proper performance of his duties or whose employment is otherwise considered by INKEL to be undesirable and such person shall be replaced by the Contractor without delay by a competent substitute approved by INKEL.

1.7.12. Communication to be in writing

All references, communications, correspondences made by INKEL, or its authorised representative to the Contractor concerning the works shall be in writing and no reference, communication, or complaint which is not in writing, shall be recognized.

1.7.13. Occupation and use of land

No land, building belonging to or in the possession of INKEL shall be occupied by the Contractor. The Contractor shall not use, or allow to be used, the site for any purpose other than that for executing the works.

1.7.14. Construction of site-shed

Any site-shed, proposed to be temporarily constructed by the Contractor for his office work, storage of materials, etc. shall conform to the standard sketch, or to the plan approved by INKEL. Permission for the construction of such sheds shall be obtained in writing.

1.7.15. Materials and tools

All materials required for the execution of the works other than those mentioned in the Notice Inviting Tender shall be supplied by the contractor. Materials so supplied shall have the approval of INKEL before use in the works. All the rejected materials shall be removed at once from the site of work at the Contractor's own cost.

INKEL shall exercise the liberty to procure excess material/supply required material, at the rate quoted by contractor in the tender form.

1.7.16. Payment of Tollages

The Contractor shall pay all tollages and other royalties, rent and other payments or compensations, if any, for getting stone, gravel, sand, clay and all other materials required for the works.

1.7.17. Setting Out

The Contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of the works any error shall appear or arise in the position, level, dimensions or alignment of any part of the works, the Contractor on being required to do so by INKEL or its authorised representative, shall at his own cost rectify such errors to the satisfaction of INKEL or its representative. The checking of any setting out shall not relieve the Contractor from the responsibility of true and proper setting out of the works. The Contractor shall provide all necessary instruments, appliances and labour required by INKEL or its authorised representative for checking if any, of the setting out. The Contractor shall carefully protect and observe all bench marks, site levels, pegs and other things used in setting out the works. The rates quoted for the work shall also include the cost of reference and level pillars and other dismantling, when no longer required.

1.7.18. Damages to persons and property

The Contractor shall indemnify and keep indemnified INKEL against all losses and claims for injuries or damages to any person or property whatsoever which arise out of or in consequence of the construction and maintenance of works and against all claims, demands, proceedings, damages, costs, charges, expenses whatsoever in respect thereof or in relation thereto.

1.7.19. Co-operation with other agencies

The Contractor shall co-operate with the work of other agencies or Contractors that may be employed or engaged by INKEL and as far as it relates to the Contractor's work. The sequence of work shall be so arranged that the work of other agencies can also progress simultaneously.

1.7.20. Barricade around excavated trenches etc.

The Contractor shall at his own cost provide around excavation, temporary barricading with bellies and bamboo with warning signals during day and night and shall maintain it so long as the trenches are not filled up. Similar barricades shall also be provided at all dismantling work, erection of structural, sheeting work, etc. No extra claim shall be entertained for providing, maintaining and removing such barricades.

1.7.21. Fabrication drawings

Contractor shall prepare at his own cost all fabrication drawings of all structural steel works and bar bending schedule for R.C.C works and submit them to INKEL for their approval at least before 7 days of commencing the fabrication. All the details like sizes, capacities, dimensions, arrangement of fabrication, etc. should be clearly indicated in these drawings.

1.7.22. Protection of underground services

The contractor must take precautionary measures to protect the underground and other service lines viz. cables, water and sewer lines etc. and observe any special instructions which may be given in this regard by INKEL.

1.7.23. Dewatering trenches and pits

The tendered rates shall always be deemed to have taken into account the cost of removal of silt and materials that may slip in the trenches and pits and dewatering the trenches and pits of water accumulated or collected through seepage or subsoil water or rain water. The contractor shall in no case be entitled to claim any extra amount for the above work. The contractor shall remain prepared with necessary pumps and equipment for dewatering the trenches or pits so as to avoid unnecessary delay and possible damages to the property.

1.7.24. Work in or around operating plant or offices etc.

Where the work is being carried out in or around an operating plant where the plant must be uninterrupted, the Contractor shall work only at specified place and times as mutually arranged between the Contractor and INKEL. Similar arrangement must be made while executing works inside the offices, buildings, etc. without causing disturbance to the office work. For this, the work may be required to be done during off-hours and Sundays. No extra will be allowed beyond the rates quoted for doing work in the manner described above.

1.7.25. Work in shifts and on off-days

The Contractor shall work in one or more shifts and also on Sundays and off days to complete the work on time, if so required by INKEL for which INKEL shall not be liable to pay any extra. If instructed by INKEL, the Contractor should carry out the work in the night also.

1.7.26. Site order book

A site order book must be maintained and always be available at site to record the instructions by INKEL or its authorised representative. The Contractor must see that the instructions noted therein are properly carried out.

1.7.27. Delay in obtaining materials supplied by INKEL

If INKEL has undertaken to supply any material specified in the special conditions at rates and conditions cited therein, the contractor shall keep himself in touch with day-to-day position regarding the supply of materials from INKEL and so adjust the progress of the works that the labour may not remain idle nor there be any other claim due to or arising from delay in obtaining the materials.

1.7.28. Record of materials supplied by INKEL

The contractor shall maintain an account of different materials obtained from INKEL for executing the works under the contract. INKEL shall have the right to check the stock of materials at all times.

1.7.29. Materials obtained from Excavation

The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work, etc. as property of INKEL and such materials shall be disposed off to the best advantage of INKEL according to the instructions issued by the Engineer-in-Charge.

1.7.30. Treasure Trove, Fossils etc.

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered at the site shall be the absolute property of INKEL and the Contractor shall take reasonable precautions to prevent his workmen or any other person from removing or damaging any such article or thing. The Contractor shall immediately upon discovery thereof and before removal acquaint the Engineer-in-Charge with such discovery and carry out the Engineer-in-Charge's directions as to the disposal of the same at the expense of INKEL.

1.7.31. Safe storage of materials

The contractor shall be responsible for the safe storage of materials supplied by INKEL, if any, for execution of the works. Surplus materials lost or damaged or unaccounted for or made unserviceable by the Contractor shall be charged as determined INKEL.

1.7.32. Transport of materials

Unless otherwise specified, all the materials supplied by INKEL shall be transported by the Contractor from INKEL's store/yard, to the site of work at no extra cost.

1.7.33. Site to be kept clean

The surplus spoils and dismantled debris shall be removed to a place as directed by INKEL and stacked, levelled and dressed as directed. Re-handling charges will not be allowed.

1.7.34. Conflict in meaning between Schedule of Quantities and Specifications

The Schedule of Quantities shall be read in conjunction with the Technical specifications, and in the event of conflict in meaning between the two, the corresponding item in the unit rate specifications shall always have precedence over the technical specifications.

1.8. CONTRACTOR LABOUR REGULATIONS

1.8.1. Labour Rules

In respect of all labour directly or indirectly employed on the works by the Contractor, the Contractor shall comply with the provisions of the **Contractor Labour (Regulations and** Abolition**) Act 1970, Minimum Wages Act 1948, Payment of Wages Act, 1936 , Industrial Disputes Act, 1947, Provident Fund Act, 1972, Maternity Benefit Act, 1961, and Mines Act, 1952 or any amendments thereof and all legislation and rules of the State and/or Central Government or that of other local authorities, framed from time to time**, governing the protection of health, sanitary arrangements, wages, welfare and safety for labour employed on building and construction works and for bonus, retirement benefits, retrenchment/layoff, compensation and all other matter liabilities of INKEL to employees. The rules and the other statutory obligations with regard to fair wages, welfare and safety measures, maintenance of registry, etc. will be deemed to be part of the contract.

1.8.2. Employment of labour

The Contractor shall employ labour in sufficient numbers either directly or through sub-contractors to maintain the required rate of progress and of quality to ensure workmanship of the degree specified in the Contract and to the satisfaction of the Engineer-in-Charge.

1.8.3. Compensation to workmen

The Contractor shall at all times indemnify and keep indemnified INKEL against all claims for compensation under the provisions of the Workmen's Compensation Act, 1923 or any other law for the time being in force by or in respect of any workmen employed by the Contractor in carrying out the contract and against all cost and expenses or penalties incurred by INKEL in connection therewith. In any case in which, by virtue of the provision of the said act, INKEL is obliged to pay compensation to a workman employed by the Contractor in executing the works, INKEL shall recover from the Contractor the amount of the compensation so paid and without prejudice to the rights of INKEL under the said Act. INKEL shall be at liberty to recover such amount or any part thereof by deducting it from the Performance Guarantee or from any amount due by INKEL to the Contractor, whether under this contract or otherwise without prejudice to any other remedy that may be available to INKEL, in law. INKEL shall not be bound to contest any claim made against it under the said Act, except on the written request of the Contractor and upon his giving to INKEL full security for all costs for which INKEL might become liable in consequence of contesting such claims.

1.8.4. Accident or injury to workmen

INKEL shall not be liable for, in respect to any damages or compensation payable as per regulations or in consequence of any accident or injury to any workmen or other person in the employment of the Contractor and the contractor shall indemnify and keep indemnified INKEL against all such damages and compensation and against all claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

1.8.5 Safety Code

The Contractor shall at his own expense arrange for the safety provisions as appended to in these conditions or as required by the Engineer-in-Charge, in respect of all labour directly or indirectly employed for performance of the works and shall provide all facilities in connection therewith. In case the Contractor fails to make arrangements and provide necessary facilities as aforesaid, the Engineer-in-Charge shall be entitled to do so and recover the cost thereof from the Contractor.

1.8.6. Preservation of peace

The Contractor shall take requisite precautions to prevent any riotous or unlawful behaviour by or amongst his workmen and/or others employed on the works by him, for the preservation of peace and protection of the inhabitants and security of property in the neighbourhood of the works.

1.8.7. Age limit of labour

The age limit for employment of labour shall be in strict accordance with the existing labour legislation. The Contractor shall not employ in connection with the Works any person who has not completed his eighteen years of age.

1.8.8. Return of labour employed

The Contractor, if required by INKEL, shall return in detail in such form and at such interval as INKEL may prescribe showing number of different classes of labour employed in the work from time to time by the Contractor.

1.8.9. Employment Card

The Contractor shall issue an employment card to each worker on the day of work or entry into his employment. If a worker has already any such card with him issued by

the previous employer, the contractor shall merely endorse that Employment Card with relevant entries. On termination of Employment the Employment Card shall again be endorsed by the contractor and returned to the worker.

1.8.10. Register of Workmen

A register of workmen shall be maintained in the form appended to these regulations and kept at the work site or as near to it as possible, and the relevant particulars of every workman shall be entered there in within THREE days of his employment.

1.8.11. Fixation of Wage Periods

The Contractor shall fix wage period in respect of which wages shall be payable under intimation to INKEL.

1.8.12. Welfare Fund

All moneys that are recovered by the Engineer-in-Charge by way of workers' dues which could not be disbursed to workers within the time limit prescribed above, due to reasons such as whereabouts of workers not being known, death of a worker, etc. and also amount recovered as penalty, shall be credited to a fund to be kept under the custody of INKEL for such benefit and welfare of workmen employed by contractors.

1.8.13. Model Rules for Labour Welfare

The Contractor shall at his own expense comply with or cause to be complied with Model Rules for Labour Welfare as appended to these Conditions or rules framed by Government from time to time for the protection of health and for making sanitary arrangement for workers employed directly or indirectly on the works. In case the Contractor fails to make arrangements as aforesaid, the "Engineer-in-Charge shall be entitled to do so and recover the cost thereof from the Contractor.

1.8.14. Payment of Wages:

1.8.13.1. Wages due to every worker shall be paid to him directly.

1.8.13.2. When employment of any worker is terminated by or on behalf of the contractor, the wages earned by him shall be paid before expiry of the day succeeding the one on which his employment is terminated.

1.8.15. Inspection of Books and other Documents:

The Contractor shall allow inspection of the Registers and other documents prescribed under these Regulations by Inspecting Officer and the Engineer-in-Charge or his authorised representative at any time.

1.8.16. Amendments

Central Government may, from time to time, add to or amend these Regulations and issue such directions as it may consider necessary for the proper implementation of these Regulations or for the purpose of removing any difficulty which may arise in the administration thereof.

1.8.17. Application of the regulations

Interpretation, etc; on any question as to the application, interpretation or effect of these Regulations, the decision of the Chief Labour Commissioner Government of Kerala shall be final and binding.

1.9. MATERIAL TESTS AND WORKMANSHIP

1.9.1. Quality of Materials, Workmanship and Tests

All materials and workmanship shall be of the respective kinds, described in the contract and in accordance with INKEL or its authorised representative's instructions and shall be subject, from time to time, to such tests as INKEL or its authorised representative may direct at the place or any of such places. The contractor shall provide such assistance instruments, machines, labour and materials, as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the works for approval as may be required by INKEL.

1.9.2. Construction of Prototypes or Samples of Work.

The Contractor shall construct prototypes or samples of work as laid down in the contract or as instructed by INKEL. Such prototypes or samples or work, after approval by INKEL, shall serve as the standards to be achieved in the final construction.

1.9.3. Cost of samples

All samples shall be supplied by the Contractor at his own cost.

1.9.4. Cost of tests

The cost of making any test as per specifications shall be borne by the Contractor, and the Contractor should arrange for all facilities like meters, instruments as required for carrying out such tests.

1.9.5. Inspection of operation

INKEL or its authorised representative shall at all times have access to the works and to the site and to all workshops and places where materials, manufacturers articles or machinery are being obtained for the works and the Contractor shall afford every facility for every assistance in obtaining the right to such access.

1.9.6. Examination of work before covering up

No work shall be covered up or put out of view without the approval of INKEL or its authorised representative and the Contractor shall afford full opportunity to INKEL or its authorised representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The contractor shall give due notice to INKEL's authorised representative wherever any such work or foundations is or are ready or about to be ready for examination and INKEL's authorised representative shall without unreasonable delay, unless he considers it unnecessary, advise the Contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

1.9.7. Uncovering and making openings

The Contractor shall uncover any part of the works or make openings in or through the same as INKEL may, from time to time, direct and shall reinstate and make good such part or parts to the satisfaction of INKEL. If any such part or parts have been covered up or put out of view after compliance with the requirements and found to be executed in accordance with the contract, the expenses of uncovering, making openings in or through, reinstating and making good the same shall be borne by INKEL but, in any other case, all such expenses shall be borne by the contractor and shall be recoverable from him by INKEL and deducted by INKEL from any money due,

which may become due to the Contractor, without prejudice to any other remedy that may be available to INKEL, by law.

1.9.8. Removal of improper work and materials

INKEL or its authorised representative shall during the progress of the works have power to order the following in writing from time to time of which no extra payment will be made to the Contractor.

1.9.8.1. The removal from the site within such time or times as may be specified in the order, of any materials which in the opinion of INKEL or its authorised representative are not in accordance with the contract.

1.9.8.2. The substitution of proper and suitable materials.

1.9.8.3. The removal and proper re-execution notwithstanding a previous test thereof or interim payment thereof of a work which in respect of materials or workmanship is not in the opinion of INKEL or its authorised representative in accordance with **contract.**

1.9.9. Suspension of work

The Contractor shall, on receipt of the order in writing of the Engineer-in-Charge, suspend the progress of the work or any part thereof for such time and in such manner as the Engineer-in-Charge may consider necessary for any of the following reasons.

1.9.9.1. On account of any default on part of the Contractor; or

1.9.9.2. For proper execution of the works or part thereof for reasons other than the default of the Contractor; or

1.9.9.3. for safety of the Works or part thereof.

The Contractor shall, during such suspension, properly protect and secure the Works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge/ authorised representative of INKEL

1.10. TIME OF COMPLETION AND TAKING OVER

1.10.1. Possession of site

INKEL shall give to the Contractor possession of so much of the site as may be required to enable the Contractor to commence with such reasonable proposals of the Contractor as he will make in writing to INKEL and shall, from time to time as the work proceeds give the Contractor possession of such further portions of the site as may be required to enable the Contractor to proceed with the construction of the works in accordance with the said programme or proposal.

1.10.2. Time of completion

Time is deemed to be the essence of this contract and the whole of the works shall be completed within the time stipulated or within such extended time as has been allowed under Clause 1.10.4.

1.10.3. Extension of time of completion

Should the amount of extra or additional work of any kind or changes in scope of work or other special circumstances of any kind whatsoever which may occur, be such as fairly to justify the Contractor's request for extension of time for the completion of the works, INKEL shall determine the amount of such extension and shall intimate the Contractor in writing provided that INKEL is not bound to take into account any extra

or additional work or other special circumstances unless the contractor has within 15 days, after such work has been commenced or such circumstances have arisen, submit to INKEL full and detailed particulars of any request for the extension of time to which he may consider himself to be justified.

1.10.4. FORCE MAJEURE -Extension of completion time due to strike, fire, etc.

If in the opinion of INKEL, the progress of the work has at any time been delayed by strikes, fire, inclement weather, un-avoidable casualties, etc. beyond the control of the Contractor, then the time of completion of the work may be extended for such reasonable time as INKEL may decide and this will be indicated in writing.

Force Majeure is herein defined as any cause which is beyond the control not foresee or with a reasonable amount of diligence could not have foreseen and which substantially affect the performance of the contract, such as:

(a) Natural phenomena, including but not limited to floods, draughts, earthquakes and epidemics:

(b) Acts of any government, including but not limited to war, declared or undeclared, priorities, quarantines, embargoes.

Provided either party shall within fifteen (15) days from the occurrence of such a cause notify the other in writing of such causes.

(a) The successful bidder/contractor will advise, in the event of his having resort to this clause by a registered letter duly certified by the local chamber of commerce or statutory authorities, the beginning and end of the clause of delay, within fifteen days of the occurrence and cessation of such Force Majeure condition. In the event of delay lasting over two months, if arising out of Force

(b) For delays arising out of Force Majeure, the bidder/contractor will not claim extension in completion date for a period exceeding the period of delay attributable to the causes of Force Majeure and neither company nor the bidder shall be liable to pay extra costs (like increase in rates, remobilisation advance, idle charges for labour and machinery etc.). Provided it is mutually established that the Force Majeure conditions did actually exist.

(c) If any of the Force Majeure conditions exists in the place of operation of the bidder even at the time of submission of bid he will categorically specify them in his bid and state whether they have been taken into consideration in their quotations.

The contractor or the owner shall not be liable for delays in performing his obligations resulting from any force majeure cause as referred to and/or defined above. The date of completion will, subject to hereinafter provided, be extended by a reasonable time even though such cause may occur after contractor's performance of his obligations has been delayed for other causes.

1.10.5. Liquidated Damages

If the contractor fails to complete the work within the period of completion mentioned under clause 1.10.2, the contractor shall pay or allow to INKEL Liquidated damages per day as the sum equivalent to the maximum penalty divided by 20% of the contract period in days up to a maximum of 10% of contract value as liquidated and ascertained damages, for the period from the date of stipulated completion or such extended time as the case may be, during which the work shall remain unfinished. Such damages may be deducted by INKEL from any money due or that may become

due. In the event that the contractor fails to complete the project within the additional 20% time, the employer shall take appropriate action under provisions of Clause 1.11

1.10.6. Work treated as complete

The works shall not be treated as complete until

1.10.6.1. The site is clear from all materials, site shed, etc. and INKEL is satisfied with the job done by the Contractor.

1.10.6.2. All equipments, tools, plants taken from INKEL if any, have been returned by the Contractor.

1.10.6.3. Any other material, taken on loan/transfer from other agency has been returned by the Contractor.

1.10.6.4. All power and water supply connections taken for the execution of the works have been disconnected by the Contractor.

1.10.6.5. Rectification of any damages done by the Contractor to the work executed has been completed by the Contractor.

1.10.6.6. The works shall not be considered as completed until INKEL has certified in writing that works have been virtually completed and the Defects Liability Period shall commence from the date of such certificate.

1.10.7. Taking over

After completion of works or any substantial part of the works before the completion of the whole of the works, the Contractor shall notify INKEL in writing, **who within 15 days of receipt of the said notice shall give such certificate with respect to any substantial part of the works which has been both completed to the satisfaction of INKEL and occupied by INKEL or refuse to issue the same stating the reasons thereof in writing**. When any such certificate is given in respect of a part of the works, such part shall be considered as completed for the purpose of taking over and computation of the period of maintenance of such part is such period of the work as certified. The works in whole or part shall not however, be treated
as completed for the purpose of other relevant clauses hereof are fully complied with.

1.10.8. Maintenance

1.10.8.1. For a period of twelve months commencing immediately after taking over of the work by INKEL, it shall be the Contractor's liability to replace the defective parts, rectify/reconstruct the defective work that may develop out of his own construction or those of his sub-contractors approved by INKEL arising solely from faulty materials or workmanship.

1.10.8.2. If it is necessary for the Contractor to rectify/reconstruct any defective portions of the work under the contract, the provision of this condition shall apply to the portions or work so replaced or renewed until the expiration of three months from the date of such replacement or renewal or until the end of the above mentioned period of twelve months, whichever may be later. If any defects are not remedied within a reasonable time INKEL may proceed to do the work at Contractor's risk and expenses, but without prejudice to any other rights which INKEL may have against the Contractor in respect of such defects.

1.10.8.3. The Contractor shall bear the cost of such repair/rectification carried out on his behalf at site. **Immediately upon expiry of the defects liability period, the Company shall issue a final certificate indicating that the Contractor has completed his obligation under the contract**.

1.11. TERMINATION OF CONTRACT

1.11.1. Termination of work

If the Contractor has abandoned the contract or has failed to proceed with the work due to negligence or the progress on any particular item or items of work is slow or has failed to execute the work in accordance with the terms and conditions of the contract, is persistently or frequently neglecting to carry out his obligation under the contract, then it shall be lawful for INKEL to terminate the contract forthwith under written notice and to proceed with the balance of the work through any other agencies. During the course of execution of the work, in case the Contractor has done any sub-standard work, he shall be asked in writing to dismantle and redo the same at his own expenses. If the Contractor fails to comply with the above instructions immediately, then INKEL shall proceed with the above rectification work, through another agency or agencies.

1.11.2. Back charging the contractor

Extra cost and expenses incurred for completing the balance work or carrying out the rectification of any work as mentioned above through another agency or agencies including its own department, shall be debited to Contractor's account and shall be recovered from any money due or that may become due to the contractor without prejudice to any other remedy that may be available to INKEL in law.

1.12. MODIFICATIONS, ADDITIONS AND OMISSIONS

1.12.1. Variation

INKEL shall be entitled to make any variation of the quality or quantity of the works or any part thereof that may in its opinion be necessary and for that purpose, or if for any other reason it shall, in its opinion be desirable. INKEL shall have power to order the Contractor to do and the Contractor shall do any of the following:

1.12.1.1. Increase or decrease the quantity of any work included in the contract.

1.12.1.2. Omit any portion of work.

1.12.1.3. Change the character or quality or kind of any such work.

1.12.1.4. Change the levels, lines, position and dimensions of any part of the works and

1.12.1.5. Execute additional work of any kind necessary for the completion of the works, and no such variation shall in any way vitiate or invalidate the contract by the value, if any, of all such variations shall be taken into account in ascertaining the amount of the contract price.

1.12.2. Order for variations to be in writing

No such variation shall be made by the Contractor without an order in writing of INKEL, provided that no order in writing shall be required for increase or decrease in the quantity of any item or work where such increases or decrease is the result of the actual quantities exceeding or being less than those stated in the bill of quantities which are estimates. In such cases, the Contractor shall be paid only for the actual quantity of work done as certified by INKEL at the accepted unit item rate and no compensation shall be allowed. Provided also, that if for any reason INKEL shall consider it desirable to give any such order verbally, the Contractor shall comply with

such order but it must be followed by confirmation in writing of such verbal order given by INKEL.

1.12.3. Extra Items

If the Contractor has been asked to execute any such item/work in course of construction for which the tender rates have not been quoted by him, he must undertake such work. The rates for such additional work shall be determined by INKEL on the following lines, in the order of preference.

1.12.3.1. The rate has to be derived from anyone of the quoted rates for similar items of work in the tender

1.12.3.2. In case of extra items whether altered or substituted, for which similar items do not exist in the contract, the rates shall be arrived at on the basis of provisions of standard data book and latest schedule of rates of PWD/CPWD, as applicable.

1.12.3.3. Rates based on actual observation and/or analysis of labour and materials involved in such items. For this purpose the Contractor shall submit to INKEL detailed analysis of the rate proposed by the Contractor supported by relevant vouchers.

1.12.4. Rebate/Extra

For items not covered in the schedule, rebate/extra shall be derived based on observation /analysis of labour and materials involved in such items.

1.12.5. Items of ad-hoc nature

The Contractor shall procure necessary materials and carry out miscellaneous work of ad-hoc nature specifically provided with necessary tools and tackles as may arise during execution of the contract. The actual quantum of work shall be certified and settled by INKEL and payment for the same shall be fixed on the basis of actual cost plus overheads, profits and establishments taken at 10% of the cost.

1.12.6. Claims

The contractor shall send to Engineer-in-charge an account, giving full and detailed particulars with proper analysis of all claims for additional expenses to which the Contractor may consider himself entitled to payment for any such work, notwithstanding the Contractor's failure to comply with this condition if the Contractor has at the earliest practicable opportunity notified INKEL in writing, that he intends to make a claim for such work.

1.13. MEASUREMENTS

1.13.1. Quantities

The quantities set out in the **Bill of Quantities** are the estimated quantities of the work. They are not to be taken as the actual and correct quantities of the works, to be executed by the Contractor in fulfilment of his obligations under the contract.

1.13.2. Works to be measured

INKEL shall, except as otherwise stated, ascertain and determine by measurement the value in terms of the contract. INKEL shall when it requires any part or parts of the works to be measured, give notice to the Contractor's authorized agent, who shall forthwith attend or send a qualified agent to assist its authorised representative in making such measurement, and shall furnish all particulars required by either of them. Should the Contractor not attend or neglect or omit to send such agents, then

the measurement made by INKEL shall be taken to be the correct measurement of the work.

1.13.3. Method of measurement

The works shall be measured in accordance to relevant IS codes notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract.

1.14. PROVISIONAL SUMS

1.14.1. Provisional sum shall mean a sum included in the contract price and so designated in the Bill of Quantities for execution of works or the supply of goods, materials or services or for contingencies, which sum may be used, in whole, or in part or not at all, at the direction or discretion of INKEL. The contract price shall include only such amounts in respect of the work, supply or services to which provisional sums relate as INKEL shall approve or determine.

1.14.2. The contractor shall when required by INKEL, produce all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of provisional sums.

1.15. SETTLEMENT OF DISPUTES

1.15.1. All disputes and differences of any kind whatsoever arising out of or in connection with the contract, whether during the progress of the works or after their completion shall be referred by the Contractor to the "Owner" and the Owner shall within a reasonable time after their presentation make and notify decisions thereon in writing.

1.15.2. The decisions, directions, clarifications, measurements, drawings and certificates with respect to any matter, the decision for which is specially provided for by these or other special conditions to be given and made by the Owner are matters which are referred to hereinafter as accepted matters. However, such matters may be referred to Managing Director INKEL whose decision shall be final and binding.

1.15.3. Arbitration shall not be a means of settlement of any dispute.

2. PARTICULAR CONDITIONS OF CONTRACT

2.1. GENERAL

2.1.1. The following particular conditions shall be read in conjunction with general conditions of contract and amendments/corrections thereto. If there are provisions in this special condition which are at variance with the provisions in the above mentioned documents, the provisions in these special conditions shall take precedence.

2.1.2. The work in general shall be carried out as per the nomenclature of the individual items and in the particular specifications. For item of works, not covered above, the same shall be carried out as per MoRTH Specifications, CPWD specifications, Delhi or latest PWD specifications with up to date correction slips.

2.1.3. For any other item of work, not covered above, the same shall be done as per the latest relevant BIS codes of practice.

2.1.4. For any other item of work, not covered above, the same shall be done as per the sound engineering practice as directed/approved by Engineer in charge.

2.2. EARNEST MONEY DEPOSIT

2.2.1. A bidder shall furnish Earnest Money Deposit as a Bank Guarantee in the prescribed form for consideration of his tender. Tenders submitted without the EMD shall be rejected. After evaluation and bid finalisation, the EMD of unsuccessful bidders shall be returned. The successful bidder shall have to submit the Performance guarantee.

2.3. MOBILISATION ADVANCE

2.3.1. The successful tenderer after having been offered the contract and executed the agreement with INKEL can avail a mobilization advance not exceeding 10% (Ten percentage) of the contract value against a duly executed Bank guarantee for a sum equal to 100% (One hundred percentage) of the advance sought which may be submitted in five different bank guarantees of equal amount (20% of advance) so that the same can be released on pro-rata basis**.** The validity of the Bank guarantee should be for 13 months from the date on which mobilization advance is made and shall be kept valid for the whole of the contract period and extended contract periods till the whole amount of advance together with interest is recovered. The advance will carry a simple interest of 12% (Twelve percent) per annum and will be recovered together with interest from the progressive part bills of the contractor on a pro rata basis. However the whole of the balance amount together with the balance interest amount will be recovered from the pre-final bill.(forms given in section 3)

2.4. SECURED ADVANCE

2.4.1. Secured advance will be paid for the supply of specified materials (High value items) at the quoted supply rate of materials (supported with vouchers), provided that,

2.4.1.1. The materials are in accordance with the specification for that material.

2.4.1.2. The materials are properly stored and protected against loss to the satisfaction of the Engineer-in-charge, and

2.4.1.3. Proper stock registers are maintained as required

2.4.1.4. Materials are approved and payment certified by Engineer.

2.4.2. The secured advance thus paid will be recovered from the next part bill onwards proportionate to the extent they are incorporated in the works and recovered at the same rates as above.

2.4.3. Secured advance will not be paid for any other materials, other than those mentioned above.

2.4.4. Once secured advance is paid in above mentioned manner the ownership of those materials shall be deemed to rest WITH the owner but such materials will be under the custody of the contractor and the contractor will be responsible for any loss or damage to such materials for which secured advance has been made.

2.4.5. The condition specified in clause. 2.4.1 at which secured advance is to be paid is limited to 70% of the quoted value of materials. Irrespective of any escalation or variation in the price of these materials only what is specified in clause 2.4.1 will be paid as secured advance.

2.5. PERFORMANCE GUARANTEE

Performance guarantee is to be furnished **for duration of Project and shall be in the prescribed form. It shall be from any of the scheduled public sector banks only & shall be kept valid till the end of the project. In case of any delay in completion or extension of period of completion and subsequent extension of maintenance period the contractor shall keep the validity of the Bank guarantee extended to cover all such periods.**

2.6. RESTRICTIONS IN WORKING HOURS

2.6.1 The installation activities, if any, shall be done in close co-ordination with civil/electrical /air-conditioning /fire alarm & detection system /false ceiling works, etc. and as directed by Engineer-in-charge.

2.6.2 The contractor shall note that the work front will be made available in phases. It is the responsibility of the contractor to programme the work accordingly. No compensation will be paid on account of site being made available in phases.

2.7. HANDING OVER THE SITE

2.7.1. The site shall be handed over to the contractor in phases.
2.7.2. The contractor shall plan the work as per the phasing decided by INKEL and no claim will be entertained for not handing over the entire area in one stretch. In case there are small patches which could not be handed over due to legal and technical reasons, this will not be considered as obstructions and no claim will be entertained for delays for such reasons.

2.8. WATER

Water required for the construction will have to be provided by the contractor at their own cost. It will be the responsibility of the contractor to make arrangements for drawing water and bringing it to the various construction points. Non-availability of water from the owner's property will not be a ground for any delay in work or any claim for any compensation whatsoever.

2.9. ELECTRICITY

Electricity required for the construction and general lighting of the site will have to be provided by the contractor at his own cost. Non-availability of power from KSEB will not be a ground for any delay in work or any claims for any compensation whatsoever.

2.10 MATERIALS

2.10.1. Cement

2.10.1.1. Cement required for the works should be **procured by the contractor**. Unless otherwise specified or called for by the owner, cement shall be ordinary Portland cement in 50 Kg. bags. Changing the brand or type of cement within the same structure will not be permitted.
2.10.1.2. A certified report attesting to the conformity of the cement to B.I.S specifications by the cement manufacturer shall be furnished to INKEL.
2.10.1.3. If demanded, Contractor will have to make his own arrangements for storage of adequate quantity of cement.
2.10.1.4**.** The Engineer-in-charge shall be regularly notified when supplies of cement are made to the site store. Copies of invoices shall be made available to the Engineer-in-charge and a common cement register shall be kept at his office showing **the supply stock and issue on a daily basis.**

2.10.2. Steel

2.10.2.1. All the requirement of reinforcing steel bars shall be **supplied by the contractor.** The reinforcement bars shall conform to B I S 1139 in the case of medium tensile steel deformed bars and to B I S 1786 in the case of cold twisted steel bars.
2.10.2.2. All steel shall be of grade 1 quality unless specifically permitted by INKEL. No re-rolled material will be accepted.

2.10.2.3. The reinforcing steel work will be measured and paid by measuring the lengths of reinforcing steel rods actually placed and embedded in concrete and weights calculated at the following unit rates for different diameters.

6mm dia	0.222 kg/m
8mm dia	0.395 kg/m
10mm dia	0.617 kg/m
12mm dia	0.888 kg/m
16mm dia	1.579 kg/m
20mm dia	2.467 kg/m
25mm dia	3.855 kg/m
32mm dia	6.316 kg/m

All wastage and other losses will be on contractors account

2.10.2.4. The Engineer-in-charge shall be regularly notified when supplies of steel are made to the site. Copies of invoices shall be made available to the Engineer-in-charge and a common stock register of steel materials shall be kept in his office.

2.10.3. Other Materials

2.10.3.1. All other materials required for the work is also to be procured by the contractors. All materials that are brought to the site for use in the work shall confirm to the relevant BIS specification.

2.10.3.2. All materials to be used in the works shall have the specific approval of the Engineer-in-charge as to its quality and grade. If any batch of material are found unacceptable and rejected by the Engineer-in-charge the same shall be removed from the site without demure.

2.10.3.3. In the event where there are no standard specifications for any material, the judgment of the Engineer-in-charge will be final as to its quality for incorporating the same in the works.

2.11. LANDSCAPE MAINTENANCE:

2.11.1. The contractor shall do the maintenance of the plants, shrubs and lawns executed by them for a period of 3 months free of cost. After the expiry of free maintenance period, this shall be handed over to the owner in good condition.

2.12. SUPERVISORY STAFF

2.12.1. The contractor shall appoint the required number of experienced and qualified supervisory staff at the site as directed by the Engineer-in-charge.

2.13. CONFORMITY TO IE ACT, IE RULES AND REGULATIONS

2.13.1. All electrical works shall be carried out in accordance with the provisions of Indian Electricity Act-1910, Indian Electricity Rules, 1956 amended up to date (date of call of tender unless specified otherwise) and the state electrical inspectorate.

2.13.2. The works shall also conform to relevant Indian standard Codes of Practice (COP) for the type of work involved.
2.13.3. Materials to be used in work shall be ISI marked.
2.13.4. In all electrical works, relevant safety codes of practices shall be followed.

2.14. BYE-LAWS

2.14.1. The contractor shall comply with all bye-laws and regulations of local and statutory authorities having jurisdiction over the works and shall be responsible for obtaining prior approval, if any, and payment of all fees and other charges, giving and receiving of all necessary notices and keeping the Engineer-in-Charge informed of the said compliance with the bye-laws, payments made, notices issued and received.
2.14.2. The Contractor shall indemnify INKEL against all claims in respect of royalties, patent rights, design trademarks of name or other protected rights in respect of any plant, machine, work or materials used for or in connection with the work or temporary works and from and against all claims, demands proceedings, costs, charges and expenses whatsoever in respect of or in relation thereto. The Contractor shall defend all actions arising from such claims.
2.14.3. The Electrical works shall be carried out as per local electrical inspectorate standards/specifications/guidelines and the contractor shall get the approval and safety certificate from the inspectorate after the completion of work and before Energisation.
2.14.4. The Contractor shall comply with proper and legal orders and directions of local or public authority or municipality and abide by their rules and regulations and pay all fees and charges which may be liable during the contract period.
2.14.5. Site office
A site office of size 4m x 3m with required furniture is to be provided by the contractor for the use of INKEL

2.15. PHASING OF WORKS

The work has to be carried out in phases as directed by the Engineer-in-charge from time to time so that the total project work can progress smoothly and as per planned schedule.

2.16. PERFORMANCE TESTING

2.16.1. The contractor should conduct such performance tests as indicated in the tender and produce sufficient documentary proof that the system is functioning perfectly during the defects liability period.

2.17. GUARANTEE

2.17.1. At the close of work and before issue of final completion certificate by the Engineer-in-charge, the contractor shall furnish a guarantee as per clause 2.19.3 and shall indemnify INKEL against defective materials and workmanship for a period of

one year after completion. The Contractor shall hold himself fully responsible for re installation or replace free of cost to INKEL during the defect liability period as stipulated hereunder:

2.17.2. Any defective material supplied by the Contractor or defective workmanship of the Contractor.

2.17.3. Any material supplied by INKEL which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor**.**

2.18. PAYMENT TERMS

2.18.1. Interim bills shall be submitted by the Contractor. The payment shall be made in the following manner.

2.18.2. Request for Approval of works- to be raised by contractor in prescribed format to engineer in charge. This has to be duly approved and attached along with bill to effect any payment

2.18.3. Secured Advance as per clause 2.4 safeguarded against loss due to any cause whatsoever covered by an insurance to the satisfaction of the Engineer-in-charge.

2.18.4. An amount of 5% of project cost shall be deducted from each bill as retention amount, subject to a maximum of 5% of the contract value. The contractor may opt for 100% of retention money if a bank guarantee is furnished for the duration of defects liability period.

2.18.5. The payment terms for the work shall be as per Clause 1.32.1 and 1.36 of Notice Inviting Tender.

2.18.6. All the payments are made, after deducting there from, the amounts already paid, the retention money, income tax and other amounts as may be deductible or recoverable in terms of the contract.

2.19. STRUCTURAL ALTERATIONS TO EXISTING BUILDINGS

2.19.1. No structural member in the building shall be damaged /altered, without prior approval from the Engineer-in-Charge.

2.19.2. Structural provisions like openings, pipes if any, provided by INKEL for the work, shall be used. Where these require modifications, such works shall be carried out by the contractor, at his cost after the prior approval of Engineer-in- Charge.

2.19.3. All cut out openings in floors provided by INKEL shall be closed, after installing the cables in accordance with the item therefore in the schedule of work.

2.19.4. All cuttings made by the contractor in connection with the works shall be filled by him to the original finish. No extra payment will be given in this regard.

2.20. IMPORTANT POINTS

2.20.1. INKEL reserves the right to inspect the materials at the work site. All arrangements for conducting the inspection/testing at the work site shall be the responsibility of the contractor.

2.20.2. The contract agreement shall be executed on a non-judicial stamp paper of value not less than Rs.100/-, and the cost of the stamp paper shall be borne by the contractor.
2.20.3. The tender shall be valid for 90 days from the date of opening of price bid.
2.20.4. All materials, tools and tackles, equipment, labour skilled and semi-skilled including their housing, sanitation, procurement of food stuff, medical aid etc. are to be arranged by the contractor. Cost of transportation of labour and materials shall be borne by the contractor.
2.20.5. The contractor shall stock the material at the site of work strictly as per the instructions of the Engineer-in-charge keeping in view of the operational requirements of INKEL.
2.20.6. In the event of any dispute of any kind related to the works, decisions of the Engineer-in-charge shall be final and binding.
2.20.7. The contractor shall be responsible for any damage resulting from his negligence to existing facilities and installations if any and will restore, replace or repair any such damages at his cost to the complete satisfaction of the Engineer-in-charge.
2.20.8. The rate for all items of works shall be considered all inclusive of pumping out or bailing out water due to rain, flood or other cause, if applicable and no extra payment shall be made on this account.
2.20.9. Contractor has to comply with necessary statutory requirements on Contract Labour Regulations and Abolition Act 1970 as well as comprehensive insurance for his workmen before deploying them on the job.
2.20.10. The tenderer has to select the equipment meeting the general/technical specifications mentioned in the tender.
2.20.11. The drawings enclosed in the tender are only tentative and the tenderer has to prepare detailed working drawings and confirm that these meet the requirements.
2.20.12. The drawings enclosed are for reference only. The tenderer has to check the exact requirements of items suitable to the site conditions.
2.20.13. The tenderer has to return the original tender document duly signed and stamped in all pages.
2.20.14. Tenders with incomplete/ambiguous details are liable to be rejected without seeking any further clarifications.
2.20.15. Any variation in terms and conditions from general/special conditions for payment of EMD, Performance guarantee, etc. are not acceptable to INKEL.
2.20.16. INKEL shall not be responsible for any postal delay in respect of receipt of tender document, etc. It is the responsibility of the tenderer to make sure that the tender is received in time.
2.20.17. The tender document shall be submitted in a sealed cover to address specified in the NIT (Super scribing name of work, due date & time.)
2.20.18. Tenderer shall not make any alteration to the published tender document.
2.20.19. Catalogue/brochure/technical information with drawings of all equipment/machinery/item shall also be enclosed along with the Tender.
2.20.20. Contractor has to bear all the costs incurred in obtaining approvals from local statutory authorities for the works. No charges will be reimbursed by INKEL on this account.

2.21. OTHER CONDITIONS

2.21.1. For the work the contractor has to use equipments such as rotovator, compressor, Roller etc. in addition to the normal items. The equipments the contractor is said to possess as declared in the pre-qualification should be utilized for the work. For the bitumen work the contractor has to use equipments such as batching plant, compressor, etc. in addition to the normal items.
2.21.2. The expansion joints for the kerbs, if any, shall be provided at 5m interval or as required for the available length. The expansion joints have to be with straight edges and close together.
2.21.3. The initial levels of the area shall be taken and recorded before the in the presence of the authorised representative of INKEL.
2.21.4. Setting out of the boundary of the plots shall be done correctly as in the drawing. Boundary stones have to be laid on all corners of the plot firmly. This has to be done along with the setting up of the roads.
2.21.5. Vertical walls of duct are to be concreted to get an even surface without honey combing. No patching or plastering shall be allowed. The excavation for trenches shall be allowed for the dimension of the trench plus 10cm on both sides for shuttering placing only. Any shoring required has to be provided for the vertical face of the sandy soil without any extra claim.
2.21.6. The various works shall be done true to line, level and grade. The periodical checking of these by INKEL shall not absolve the contractor of his responsibility regarding the accuracy of the works. In case of any deviation or discrepancy in line, level or grade at the meeting faces, the contractor shall make well, the discrepancy at his own cost and without any compensation for the additional work if any involved. INKEL has the unquestioned right, if need be, to rectify the discrepancies and recover the cost from the contractor.
2.21.7. The work whether fully completed or incomplete, all materials, machinery, plants, tools etc. shall remain at the risk and in the sole charge of the Contractor until the complete work has been delivered to the owner and until the completion certificate has been issued by INKEL.
2.21.8. The site order book has to be maintained by the contractor in the site office. INKEL and its authorised representative(s) shall enter orders regarding the work in the book. All entries there in shall be signed by the contractor or his authorized representative. It is the responsibility of the contractor to follow the instructions given in the site order book.
2.21.9. The landscaped area has to be dressed and levelled.
2.21.10. All the items of work are to be executed as per relevant I.S. specifications.
2.21.11. The Contractor has to agree and strictly abide to all the conditions stipulated in the tender and any offer with deviation or request for deviation are liable to be rejected.

INKEL Limited
Door No. 7/473ZA – 5 & 6,
2nd Floor, Ajiyal Complex,
Kakkanad,
Cochin – 682030

3. FORMS FOR DIFFERENT DEEDS

3.1. ARTICLES OF AGREEMENT

This Articles of Agreement made this .....Day of (Month) of (Year) at Cochin, between INKEL Limited, a company incorporated under the Companies Act, 1956 having its Registered Office at Door No. 7/473ZA – 5 & 6, 2nd Floor, Ajiyal Complex, Kakkanad, Cochin – 682030 (hereinafter referred to as "INKEL" which expression shall include its heirs, administrators, successors, executors and assigns) of the one part and M/s ----------(NAME OF CONTRACTOR) (hereinafter referred to as the 'Contractor' which expression shall unless the context requires otherwise include its administrators, successors, executors and permitted assigns) of the other part.

WHEREAS, INKEL, is desirous of constructing of and has caused Drawings & Specifications for the work has invited tenders as per Tender No----------.

And WHEREAS (NAME OF CONTRACTOR) ----------had participated in the above referred tender vide their tender dated_____ and has agreed to execute upon and subject to the conditions set forth herein and to the conditions set forth in the **special conditions, unit rate specifications, technical specifications & the schedule of quantities and conditions of contract (all of which are collectively hereinafter referred to as the said conditions and forming part and parcel of this articles of agreement)**, the work shown upon the said drawings and/or described in the said specifications and included in the said schedule of quantities at the respective rates therein set forth, amounting to the sum as therein arrived at or such other sum as shall become payable there under (hereinafter referred to as the said **contract price**). INKEL has accepted their aforesaid tender and awarded the contract for _____**(name of work)**.on the terms and conditions contained in its Letter of _____ and the documents referred to therein, which have been unequivocally Acceptance accepted by (NAME OF CONTRACTOR) vide their acceptance letter dated _____resulting into a contract.

NOW IT IS HEREBY AGREED AND THEREFORE THIS DEED WITNESSETH AS UNDER:

ARTICLE 1.0 – AWARD OF WORK

1.1 SCOPE OF WORK

INKEL has accepted the tender of and has awarded the work to _____(NAME OF CONTRACTOR) for the work of _____ on the terms and conditions contained in its Letter of Acceptance No. .....dated_____ and the documents referred to therein. The award of the work has taken effect from..... (DATE) i.e. the date of issue of aforesaid Letter of Acceptance. The terms and expressions used in this agreement shall have the same meanings as are assigned to them in the "Tender Documents" referred to in the succeeding Article.

1.2 The contractor shall offer every reasonable facility for the carrying out of all works relating to installation of sanitary works and fittings, permanent water supply, electrical installations/fittings, lifts, telephone, air conditioning, etc. in the manner

laid down in the said conditions and shall make good any damages done to walls, floors, etc., at his cost after the completion of such works.

ARTICLE 2.0 – CONTRACT DOCUMENTS

2.1 The contract shall be performed strictly as per the terms and conditions stipulated herein and in the following documents attached herewith (hereinafter referred to as Tender Documents).
(a) INKEL **Notice inviting Tender vide No. _____ dated _____** and INKEL's tender document consisting of:
(i) General Conditions of Contract (GCC) along with amendments / errata to GCC (if any) issued.
(ii) Special Conditions of Contract (SCC) including Appendices & Annexures,
(iii) Technical Specifications
(iv) Bill of Quantities along with amendments/corrigendum of schedule items, if any
(v) _____
(b) (NAME OF CONTRACTOR) letter proposal dated _____ and their subsequent "communication"
(i) Unconditional Acceptance of Tender dated _____.
(ii) _____
(iii) _____
2.2 INKEL's detailed Letter of Acceptance No. _____ dated _____ including Schedule of Quantities, Agreed time schedule, Contractor's Organization Chart and list of Plant and Equipments submitted by Contractor and all the aforesaid contract documents referred to in Article 2.0 above shall form an integral part of this Agreement, in so far as the same or any part thereof conform, to the tender documents and what has been specifically agreed to by INKEL in its Letter of Acceptance. Any matter inconsistent there with, contrary or repugnant thereto or any deviations taken by the Contractor in the TENDER but not agreed to specifically by INKEL in its Letter of Acceptance, shall be deemed to have been withdrawn by the Contractor without any cost implication to INKEL.
2.3 The Contract is neither a fixed lumpsum contract nor a piece work contract, but is a contract to carry out the work in respect of the entire works to be paid for according to actual measured quantities at the rates contained in the schedule of rates and probable quantities or as provided in the said conditions.
2.4 The plans, agreement and documents mentioned herein above shall form the basis of this contract.

ARTICLE 3.0 – CONDITIONS & CONVENANTS

3.1 The Scope of Work, Consideration, Terms of Payments, Performance Guarantee, Taxes wherever applicable, Insurance, Agreed Time Schedule, Compensation for delay and all other terms and conditions contained in INKEL's Letter of Acceptance No. _____ Dated _____ are to be read in conjunction with other aforesaid Tender Documents. The Work shall be duly performed by the Contractor strictly and faithfully in accordance with the terms of this Tender.

3.2 The scope of work shall also include all such items which are not specifically mentioned in the Contract Documents but which are reasonably implied for the satisfactory completion of the entire scope of work envisaged under this contract unless otherwise specifically excluded from the scope of work in the Letter of Acceptance.
3.3 Contractor shall adhere to all requirements stipulated in the Tender documents. It is specifically understood that the Contractor shall not be eligible for or entitled to claim any amount except to the extent allowed or due under the terms of this contract.
3.4 **Time is the essence of the Contract** and it shall be strictly adhered to and the progress of work shall confirm to agreed works schedule / contract documents and Letter of Acceptance. The Contractor does hereby agree to commence the work within **seven days** from the date of receipt of letter of acceptance and immediately after handing over of site as provided for in the said conditions and to complete the entire works within the specified period subject nevertheless to the provisions for extension of time.
3.5 This Agreement constitutes full and complete understanding between the parties and terms of the presents. It shall supersede all prior correspondence to the extent of inconsistency or repugnancy to the terms and conditions contained in Agreement. Any modification of the Agreement shall be effected only by a written instrument signed by the authorized representative of both the parties.
3.6 INKEL shall pay the contract price or such other sum that may become payable at times and in the manner hereinafter specified in the said conditions. The total contract price for the entire Scope of this Work as detailed in Letter of Acceptance is `_____ (Rupees _____ only), which shall be governed by the stipulations of the tender document.
3.7 In consideration of the said **contract price** to be paid at the time and in the manner set forth in the conditions, the contractor shall upon and subject to the conditions of the contract execute and complete the work shown upon the said drawings and described in the said specification and the schedule of quantities at the agreed rate.
3.8 The said **conditions** and **appendix** thereto shall be read and construed as forming part of this agreement and the parties hereto shall respectively abide by and submit themselves to the said conditions and perform the agreement on their part respectively according to the said conditions.

ARTICLE 4.0- NO WAIVER OF RIGHTS.

4.1 Neither the inspection by INKEL or the Engineer-in-charge or any of their officials, employees or agents nor order by INKEL or the Engineer-in-charge for payment of money or any payment for or acceptance of, the whole or any part of the work by INKEL or the Engineer-in-charge nor any extension of time nor any possession taken by the Engineer-in-charge shall operate as waiver of any provisions of the contract, or of any power herein reserved to INKEL, or any right to damage herein provided, nor shall waiver of any breach in the Contract to be a waiver or any other or subsequent breach.

4.2 The Contractor agrees that he shall indemnify and keep indemnified INKEL against all losses and claims for injuries or damages to any person or property whatsoever which may arise out of or in consequence of the construction or maintenance of the works and against all claims, demands, proceedings, damages, cost, charges, expenses whatsoever in respect thereof or in relation thereto.

ARTICLE 5.0 – GOVERNING LAW AND JURISDICTION

5.1 The Laws applicable to this contract shall be the Laws in force in India and jurisdiction of Kerala High Court(s) only.
5.2 Notice of Default
Notice of default given by either party to the other party under the Agreement shall be in writing and shall be deemed to have been duly and properly served upon the parties hereto, if delivered against acknowledgement due or FAX or by registered mail duly addressed to the signatories at the address mentioned herein above.

ARTICLE 6.0 – SETTLEMENT OF DISPUTES

6.1 If the dispute and/or difference whatsoever arising under the agreement or in connection there with including any question relating to existence, meaning and interpretation of the agreement or any alleged breach thereof, if not settled, the same shall be referred to an arbitrator nominated by INKEL and the disputes shall be settled in accordance with the provisions of the Arbitration & Conciliation Act, 1996.

The several parts of this contract have been read by the Contractor and fully understood by them.
IN WITNESS WHEREOF, the parties through their duly authorized representatives have executed these presents on the day, month and year first above mentioned.

For and on behalf of: For and behalf of:

(NAME OF CONTRACTOR) M/s INKEL Limited

WITNESS: WITNESS:

1.

2.

3.2. PROFORMA OF PRELIMINARY AGREEMENT

(To be executed on stamp paper of value Rs.200/- and submitted along with tender)

Preliminary agreement entered into on this ..... (Day) of (Month) of (Year) between INKEL Limited, Door No. 7/473ZA – 5 & 6, 2nd Floor, Ajiyal Complex, Kakkanad, Cochin – 682030 (hereinafter called INKEL) on one part and Shri..... ..... (Name and Address of the Contractor) (Hereinafter called the Contractor) on the other part for the execution of the agreement as well as the execution of the work.

And whereas in the Notice Inviting Tender it is stated as follows:

Before commencing the work within **seven days** of the date when the letter of acceptance of tender has been issued to him, the tenderer shall deposit an additional sum of `..... (Performance Guarantee AS BANK GUARANTEE) which together with the amount of earnest money deposited shall be treated as guarantee for the proper fulfilment of the same and he shall execute an agreement for the work in the scheduled form of agreement. If he fails to do this or fails to maintain a specified rate of progress, the performance guarantee shall be forfeited to INKEL and fresh tenders shall be called for or the matter otherwise disposed. If as a result of such measures due to the default of the tenderer to pay the requisite deposit, sign the contract, to take possession of the work, cause any loss to INKEL, the same will be recovered from him as arrears of revenue. Recoveries to this or any other account will be made from the sum that may be due to contractor on this or any other contracts or under the Revenue Recovery Act or otherwise as INKEL may decide.

Now therefore those present witness and it is mutually agreed as follows:

1. The terms and conditions for the said contract having been stipulated in the said tender form to which the contractor has agreed, a copy of which is appended, and which forms part of this agreement, it is agreed that the terms and conditions stipulated there in shall bind the parties to this agreement, except to the extent to which they are abrogated or altered by express terms and conditions herein, agreed to and in which respect the express provisions herein shall supersede those in the said tender form.

2. The Contractor hereby agrees and under take to perform and fulfil all the operations and obligations connected with the execution of the said contract work.

3. If the Contractor does not come forward to execute the original agreement after the said work is awarded and letter of acceptance issued in his favour or commits breach of any of the conditions of the contract as stipulated in the concerned clause of the Notice Inviting Tender as quoted above within the period stipulated, INKEL may rearrange the works otherwise or get it done otherwise at the risk and cost of the contractor and the loss so sustained by INKEL can be realized from the Contractor under the **Revenue Recovery Act** as if arrears of land revenue as assessed, quantified and fixed by an adjudicating

authority consisting of INKEL or any other officer or officers authorized by INKEL taking into consideration the prevailing rates and after giving due notice to the Contractor. The decision taken by such authorized officer or officers shall be final and conclusive and shall be binding on the contractor.

4. The contractor further agrees that any amount found due to INKEL under or by virtue of this agreement shall be recoverable from the Contractor from his EMD and his properties, movable and immovable as arrears of land revenue under the provision of the Revenue Recovery Act for the time being in force or in any other manner as INKEL may deem fit in this regard.

In witness where of Sri……Authorised Signatory, M/s INKEL Limited and Sri…….. , The Contractor, have set their hands on the day and year first above written,

Signed by Sri ……..…, Authorised Signatory, INKEL Limited.

In the presence of witnesses

1. ……..

2. ……..

Signed and delivered by Sri. ……... , The Contractor,
In the presence of witnesses

1. ……

2. ……

3.3. FORM OF BANK GUARANTEE ISSUED BY THE BANK

Acceptable forms of securities for following are attached
I. EMD
II. Performance guarantee
III. Mobilization Advance

Tenderers should not submit the Performance Guarantee and Advance Payment Forms at the time of bid submission. Only the successful tenderer will be required to provide the Performance Guarantee and Advance payment securities.

The value of Stamp Paper for executing the above shall be as per the prevailing Rules and Regulations

3.3.1. FORM OF BANK GUARANTEE FOR EMD

(To be executed in non-judicial stamp paper)

1. In consideration of the Authorised Signatory of INKEL Limited (hereinafter called "INKEL") having demanded from Sri..... (Hereinafter called "Contractor") the production of a Bank Guarantee for `..... (Rupees.....) as **Earnest Money Deposit** for the due fulfilment by the Contractor of the terms and conditions in the Notice inviting Tender for the work of _____

we, ... (indicate the name of Bank) hereinafter referred to as "Bank") at the request of the Contractor do hereby undertake to pay to INKEL an amount not exceeding `..... (Rupees..... .....) on demand by INKEL.

2. We, ...(indicate the name of Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demure, merely on a demand from INKEL stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding `.....

3. We, (indicate the name of Bank) undertake to pay to INKEL any money so demanded not withstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal.

The payments so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor (s) shall have no claim against us for making such payment.

We .....(indicate the name of Bank) further agree that the guarantee here in contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of INKEL under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till the Authorised Signatory on behalf of INKEL certifies that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor (s) and accordingly discharges this guarantee.

We .....(indicate the name of Bank) further agree with the INKEL that INKEL shall have the fullest liberty without our consent and without affecting in any manner our obligations here under to vary any of the terms and conditions of the said Contract from time to time or to postpone for any time any of the powers exercisable by INKEL against the said Contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved

from our liability by reason of any such variation, or extension being granted to the said Contractor (s) or for any forbearance, act or omission on the part of INKEL or any indulgence by INKEL to the said Contractor(s) or by any such manner or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

4. We..... (Indicate the name of Bank) lastly undertake not to revoke this guarantee except with the previous consent of INKEL in writing.

5. This guarantee shall be valid up to ..... unless extended on demand by INKEL. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to `.....(Rupees .....only and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Dated this ..... (Day) of (Month) of (Year)

(Indicate the name of the Bank)

Seal and signature of authorized signatories of the Bank.

3.3.2. FORM OF BANK GUARANTEE for PERFORMANCE GUARANTEE

INKEL Limited,
Door No. 7/473ZA – 5 & 6,
2nd Floor, Ajiyal Complex,
Kakkanad,
Cochin – 682030

Dear Sirs:
Guarantee No:
Amount of Guarantee:
Guarantee cover from:
Last Date for lodgement of claim:

This deed of guarantee executed by the (INDICATE THE NAME OF THE BANK), constituted under the (Subsidiary Bank) Act, 1959 and having its Central Office at…… (Hereinafter referred to as "the Bank") in favour of INKEL Ltd (herein after referred to as "the beneficiary") for an amount not exceeding `……at the request of …… (Hereinafter referred to as the Contractor).
This guarantee is issued subject to the condition that the liability of the Bank under this Guarantee is limited to a maximum of ` ……and the guarantee shall remain in full force up to ……(date of expiry) and cannot be invoked otherwise than by a written demand or claim under this guarantee served on the Bank on or before the…… (Last date of claim).
SUBJECT TO AS AFORESAID

In consideration of the **Authorised Signatory of INKEL Limited** (hereinafter called "INKEL") having demanded from ……(name of the contractor), having its registered Office at……(hereinafter called "Contractor") the production of a Bank Guarantee for `……as security for the due fulfilment by the Contractor of terms and conditions in the agreement for the work of _____.

We, (indicate the name of the bank) (hereinafter referred to as the "Bank") at the request of the Contractor do hereby undertake to pay INKEL an amount not exceeding `……on demand by INKEL.

We, (indicate the name of the bank), do hereby undertake to pay the amount due and payable under this guarantee without any demure, merely on demand from INKEL stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor. Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding `……
We, ……(indicate the name of the bank), undertake to pay INKEL any money so demanded not withstanding any dispute or disputes raised by the

Contractor in any suit or proceeding pending before any court or tribunal relating thereto, our liability under this present being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such payment.

We,……(indicate the name of the bank), further agree that the guarantee here in contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of INKEL under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till the Authorised Signatory on behalf of INKEL certifies that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor and accordingly discharges this guarantee.

We, (indicate the name of the bank), further agree with **INKEL Limited** that INKEL shall have the fullest liberty without our consent and without affecting in any manner our obligations here under to vary any of the terms and conditions of the said contract from time to time or to postpone for any time any of the powers exercisable by INKEL against the said Contractor and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor or for any forbearance, act or omission on the part of INKEL or any indulgence by INKEL to the said Contractor or by any such manner or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.
We, (indicate the name of the bank), lastly undertake not to revoke this guarantee except with the previous consent of INKEL in writing.

This guarantee shall be valid up to ……..unless extended on demand by INKEL.
Notwithstanding what has been stated above, our liability under this guarantee is restricted to `……Our guarantee shall remain in force until…… (Date of expiry) unless a demand or claim under this guarantee is made on us in writing on or before……. (Date of expiry) all our rights under this guarantee shall be forfeited and we shall be released and discharged from all liabilities under this guarantee thereafter.

Dated on the . . . . . (Day) of (month) of (year)

(Indicate the name of the Bank)

Seal and signature of authorized signatories of the Bank

3.3.3. FORM OF BANK GUARANTEE FOR MOBILISATION ADVANCE

INKEL Limited,
Door No. 7/473ZA – 5 & 6,
2nd Floor, Ajiyal Complex,
Kakkanad,
Cochin – 682030

Dear Sir:
Guarantee No.:
Amount of Guarantee:
Guarantee Cover from ..... to last date for lodgement of claim.

This Deed of Guarantee executed by the (indicate the name of the Bank)..... .....constituted under the subsidiary bank Act, 1959 having its Head Office at.....and amongst other places, a branch at ..... (Hereinafter referred to as 'The Bank') in favour of INKEL Limited, Cochin (hereinafter referred to as 'INKEL') for an amount not exceeding ` ..... (Rupees .....) at the request of ..... (Hereinafter referred to as the 'Contractor').

This guarantee is issued subject to the condition that the liability of the Bank under this Guarantee is limited to a maximum of `..... (Rupees .....) and the guarantee shall remain in full force up to ..... (Date of expiry) and cannot be invoked otherwise than any written demand or claim under this Guarantee served on or before ..... (Last date)

In consideration of the Authorised Signatory of INKEL Limited, (hereinafter called 'INKEL') having demanded from Shri ..... (hereinafter called 'Contractor') the production of Bank Guarantee for `.....(Rupees.....) as security for the mobilization advance given to the Contractor the recovery / adjustment of which shall be as per the terms and conditions in the agreement for the work of _____.

We, the Bank at the request of the Contractor do hereby undertake to pay to the INKEL an amount not exceeding ..... (Rupees.....) on demand by INKEL.

We, the Bank do hereby undertake to pay the amounts due and payable under this guarantee without any demure, merely on a demand from INKEL stating that the amount claimed is required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding `..... (Rupees.....)

We undertake to pay to INKEL any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payments so made by us under this bond shall be a valid discharge of our liability for payment there under and the contractor(s) shall have no claim against us for making such payment.

We, the Bank further agree that the guarantee here in contained shall remain in full force and effect during the period taken for the completion of the said work and repayment of full mobilization advance paid, and all claims on account of this is satisfied or discharged or till the Authorised Signatory on behalf of INKEL, certifies that the recovery/adjustment of mobilization has been completed as per conditions of the said agreement and that the contractual obligation with regard to mobilization advance have been fully and properly discharged by the said contractor(s) and accordingly discharges this agreement. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).
We the Bank lastly undertake not to revoke this guarantee except with the previous consent of INKEL in writing.

This guarantee shall be valid up to..... unless or otherwise extended on demand by INKEL. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to `.....(Rupees.....) and unless a claim in writing is lodged with us within three months of the date of expiry or the extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Notwithstanding anything contained in the text above, our liability under this guarantee is limited to ..... (Rupees.....)and our guarantee shall remain in force until.....(date of expiry) or such extended period as above, unless a demand or claim under this guarantee is made on us in writing on or before .....(date of expiry), as such extended as above, all your rights under the said guarantee shall be forfeited and we shall be relieved and discharged from all liabilities there under:

Dated the ..... Day) of (month) of (year)

For

Seal and Signature of authorized signatories of the Bank.

3.4. COMPLETION CERTIFICATE

- Name of WORK:
- Name of CONTRACTOR:
- Date of LETTER OF ACCEPTANCE:
- Completion Date:
- Defects Liability period:
- Contract value as per Agreement:

It is certified that the above work has been completed as per the terms and conditions of the CONTRACT.

Date: Engineer - in-Charge

3.5. KVAT
THE KERALA VALUE ADDED TAX RULES, 2005
FORM NO.20
Declaration (To be filled before the Awarder by Contractor)
(See Rule 42 (1)

Sl.No. DATE DD/MM/YY
TIN *
PIN *
CIN *

TO Status
VAT Presumptive Tax Payer Compounded Tax Payer
Payer

M/s. ..... (O's appropriate)

Gentlemen,

I/We request you to kindly effect deduction of tax at source (TDS) in respect of the Works Contract executed/being executed by me/us a per particulars furnished hereunder.

1. Work Order No. & Date :
2. Work site address :
3. Gross value of contract :
4. Payment relating to this declaration :
5. Progressive payment already received including this declaration :
6. Total assessable value of works contract relating to this declaration :
7. Taxable value of works contract relating to this Declaration :
8. VAT due on 4% taxable works contract :
9. VAT due on 12.5% taxable works contract :
10. Total VAT due and deductible as TDS :
11. Total compounded tax @ 2% deductible on total assessable value :

I/We _____ _____ _____

S/o _____ _____ _____
on behalf of M/s_____
_____ _____ Hereby affirm and declare that the particulars furnished herein are true, correct and complete to the best of my knowledge and belief and that nothing is concealed therein.

SEAL Signature of authorized person

4. TECHNICAL SPECIFICATIONS

4.1. GENERAL

4.1.1. The following Technical specifications, code of practice etc. referred herein form a part of the Item Specifications and work shall be executed accordingly. Items which are not covered under Technical Specification shall be carried out as per relevant IS Specifications or as per manufacturer's specifications or as directed by Engineer-in-charge.

4.1.2. In case of discrepancy between Technical specification and Item specifications provided along with Bill of Quantities, the Item Specification shall prevail.

4.1.3. All the measurements shall be as per latest edition of B.I.S.

4.2. EARTH WORK

4.2.1. Applicable Codes

4.2.1.1. 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.

a) IS4081: Safety code for blasting and related drilling operation.
b) IS1200: Method of measurement of building works.
c) IS3764: Safety code for excavation work.
d) IS3385: Code of practice for measurement of Civil Engineering works.
e) IS2720: Part II Determination of moisture content.
Part VIII Determination of moisture content dry density relation using light compaction.
Part XXVIII Determination of dry density of soils, in-place by the sand replacement method.
Part XXIX Determination of dry density of soils, in-place, by the core-cutter method.

4.2.2. General

4.2.2.1. 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 levelling, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines, etc. It is necessary to establish permanent benchmark at such point which will not be affected by subsequent work. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to the established reference/grid lines at 5 m intervals or nearer as determined by the Engineer-in-charge based on ground profile.

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

4.2.2.3. In firm soil if the excavation is deeper than 2 m and in loose, soft or slushy soil, the width of the step shall be suitably increased or the sides sloped or shoring

and strutting may be done as per the instructions of the Engineer-in-charge without any extra cost.

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

4.2.2.5. The trenches which are ready for concreting shall be got approved by the Engineer-in-charge.

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

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

4.2.3. Classification

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

4.2.4. All kinds of soils

These shall include all kinds containing kankar, sand, silt, moorum and/or shingle, gravel, clay, loam peat, ash, shale, etc., which can generally be excavated by spade, pick-axe and shovel and which is not classified under soft and decomposed rock, and hard rock defined below. This shall also include embedded rock boulders not bigger than 1 metre in any dimension and not more than 200 mm in any one of the other two dimensions. These shall also include rock, boulders, slag, chalk, slate, hard mica schist, laterite etc., which are to be excavated with or without blasting or could be excavated with picks, hammer, crow bars, wedges. This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock boulders not bigger than 1 metre in any dimension and not more than 500 mm in any one of the other two dimensions Rubble masonry to be dismantled will also be measured under this item.

4.2.5. Hard Rock

This shall include rock which cannot be easily excavated with pick-axes, hammer, crow bars and wedges but has to be either heated where blasting is prohibited or has to be blasted. They shall be stacked separately for measurement as directed by the Engineer-in-charge.

4.2.6. Lead

Lead for disposal of excavated material inside the site and at convenient places in the surrounding areas have been specified in the respective items of work and no other extra lead is intended.

4.2.7. Earth work in excavation in rocks

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

4.2.7.2. Specific permission of the Engineer-in-charge will have to be taken by the Contractor for blasting rock and he shall also obtain a valid blasting licence from the authorities concerned. If permission for blasting is refused by the Engineer-in-charge, the rock shall be removed by wedging, pick barring, heating and quenching or other approved means. All loose/loosened rock in the sides shall be removed by barring wedging, etc. The unit rates for excavation in hard rock shall include the cost of all these operations.

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

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

4.2.8. Filling in plinth with selected excavated earth

4.2.8.1. Plinth shall be filled in layers 15-30 cm, of thickness or as specified in Items specification watered and compacted with hand rammers as directed by the Engineer-in-charge, so as to avoid any settlement at later stage. For the final layer the surface shall be flooded with water and water allowed to stand for 24 hours. The finished level of the filling shall be trimmed to the level specified.

4.2.8.2. Where specified in the Item description given in the Schedule of Quantities that the compaction of the plinth fill shall be carried out by means of 10/12 tonnes rollers smooth wheeled, sheep-foot or wobble wheeled rollers. As rolling proceeds, water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill.

4.2.9. Filling excavated earth in ground for land development

4.2.9.1. No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by the Engineer-in-charge.

4.2.9.2. Filling shall be carried out as indicated in the drawings and as directed by the Engineer-in-charge. If no compaction is called for, the fill may be deposited to the full height in one operation and levelled. If the fill has to be compacted, it shall be placed in layers not exceeding 600 mm and levelled uniformly and compacted before the next layer is deposited.

4.2.9.3. As and when field compaction is called for, test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankments as well. The tests for field compaction shall be specified by the Engineer-in-charge and the Contractor shall arrange to carry out such tests to the satisfaction of the Engineer-in-charge.

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

4.2.9.5. The fill shall be carried out to such dimensions and levels as indicated on the drawings after the stipulated compaction. The fill shall be considered as incomplete if the desired compaction has not been obtained.

4.2.10. Filling in plinth and ground with earth brought from outside

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

4.2.10.2. If any material is rejected by the Engineer-in-charge, Contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be disposed of by uniform spreading within the site as instructed by the Engineer-in-charge.

4.2.10.3. At places where backfilling is required, the same shall be carried out with local sand if directed by Engineer-in-charge. The sand used shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to Contractor's account. The surface of the consolidated sand shall be dressed to require level or slope. Construction of floors or other structures on sand fill shall not be started until the Engineer-in-charge has inspected and approved the fill.

4.3. BORED CAST-IN-SITU PILE FOUNDATION

4.3.1. The tenderer has to acquaint himself with the site condition before tendering for the work.

4.3.2. The contractor shall be responsible for the correctness of location of pile points as given with the pile layout drawing which will be supplied to the contractor. If any lateral shift or tilt of the pile is noticed, the contractor will have to drive alternate pile at his own cost as directed by the Engineer-in-charge whose decision shall be final. Any excess quantity of RCC pile cap if necessitated due to driving such alternate pile will have to be done by the contractor, at his own cost.

4.3.3. Piles have to be socketed in hard rock by 500mm.

4.3.4. The length of pile for payment shall be from bottom of the pile cap to the bottom tip of pile.

4.3.5. Concreting of pile shall be done up to ground level and later chipped off up to cut-off level by the contractor. Charges for these shall be deemed to have been included in the rate quoted for piling.

4.3.6. Main steel of piles shall be kept projecting from the top to the extent of 50 times the diameter of the bar for use as dowels in pile cap/grade beam.

4.3.7. Cement and steel to be used on the work shall conform to prevailing IS standards.

4.3.8. Any ground with high water table or in soft soil having unstable pile bores, boring and under ream may be carried out with suitable drilling works.

4.3.9. The bentonite suspension used for piling work shall satisfy the following requirements:

4.3.10. The liquid limit of bentonite when tested in accordance with IS2720 (Part V) 1965 shall be more than 300 percent and less than 450 percent.

4.3.11. The sand content of the bentonite powder shall not be greater than 7 percent.

4.3.12. Bentonite solution should be made by mixing it with fresh water using pump for circulation. The relative density of the bentonite solution should be about 1.12.

4.3.13. Concreting shall be done as soon as possible after completing the pile bore. The bore hole full of drilling mud should not be left unconcreted for more than 12 to 24 hours depending upon the stability of bore hole.

4.3.14. For placing concrete in pile bores, a funnel should be used and method of concreting should be such that the entire volume of the pile bore is filled up without the formations of voids and/or mixing of soil and drilling fluid in the concrete.

4.3.15. In the empty bore holes for piles a small quantity of concrete is poured to give about a 100 mm layer of concrete at the bottom. Reinforcement is lowered next and positioned correctly. Then concrete is poured to fill up the bore hole. Care should be taken that soil is not scrapped from sides if rodding is done for compaction. Vibrators shall not be used.

4.3.16. In case the pile bore is stabilized with drilling mud or by maintaining water head within the bore hole, the bottom of bore hole shall be carefully cleaned by flushing it with fresh drilling mud, and pile bore will be checked for its depth immediately before concreting.

4.3.17. Concreting shall be done by tremie method. The tremie should have a valve at its bottom and lowered with its valve closed at the start and filled up with concrete. The valve is then opened to permit the flow of concrete which permits the upward displacement of drilling mud. The pouring should be continuous and tremie is

gradually lifted up such that the tremie pipe opening remains always in the concrete. In the final stage the quantity of concrete in tremie should be enough so that on final withdrawal some concrete spills over the ground.

4.3.18. The work shall be done as per IS2911 (Part I/Section II) 1979 latest edition.

4.4. CONCRETE AND ALLIED WORKS

4.4.1. Applicable Codes

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

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

4.4.2. Materials

a) IS 269: Specification for ordinary, rapid hardening and low heat Portland cement

b) IS 455: Specification for Portland blast furnace slag.

c) IS 1489: Specification for Portland-Pozzolana cement

d) IS 4031: Methods of physical tests for hydraulic cement

e) IS 650: Specification for standard sand for testing of cement

f) IS 383:Specification for coarse and fine aggregates from natural sources for concrete

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

h) IS 516: Methods of test for strength of concrete

i) IS 1199: Methods of sampling and analysis of concrete

j) IS 2396 (I) IS 5640: Flakiness Index of aggregates

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

l) IS 432(Part I & II): Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement

m) IS 1139: Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement

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

o) IS 1785: Specification for plain hard drawn (Part I) steel wire for pre-stressed concrete

p) IS 1786: Specification for cold twisted steel bars for concrete reinforcement

q) IS 2090: Specification for high tensile steel bars used in pre-stressed concrete

r) IS 4990: Specification for plywood for concrete shuttering work

s) IS 2645: Specification for integral cement water-proofing compounds

4.4.3. Equipment

a) IS 1791: Specification for batch type concrete mixers

b) IS 2438: Specification for roller pan mixer

c) IS 2505: Specification for concrete vibrators immersion type

d) IS 2506: Specification for screed board concrete vibrators

e) IS 2514: Specification for concrete vibrating tables

f) IS 3366: Specification for pan vibrators

g) IS 4656: Specification for form vibrators for concrete

h) IS 2722: Specification for portable swing weigh-batchers for concrete (single and double bucket type)

i) IS 2750: Specification for steel scaffoldings

4.4.4. Codes of Practice

a) IS 456: Code of practice for plain and reinforced concrete

b) IS 1343: Code of practice for pre-stressed concrete

c) IS 457: Code of practice for general construction of plain and reinforced concrete for dams and other massive structures

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

e) IS 3935: Code of practice for composite construction

f) IS 3201: Criteria for design and construction of precast concrete trusses

g) IS 2204: Code of practice for construction of reinforced concrete shell roof

h) IS 2210: Criteria for the design of RC shell structures and folded plates

i) IS 2751: Code of practice for welding of mild steel bars used for reinforced concrete construction

j) IS 2502: Code of practice for bending and fixing of bars for concrete reinforcement

k) IS 3558: Code of practice for use of immersion vibrators for consolidating concrete

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

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

n) IS 2571: Code of practice for laying in-situ cement concrete flooring

4.4.5. Construction Safety

IS 3696: Safety code for scaffolds and ladders

4.4.6. Measurement

IS 1200: Method of measurement of building works

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

4.4.7. General

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

4.4.8. Materials

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

4.4.9. Cement

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

4.4.9.2. Unless otherwise specified the cement shall be ordinary Portland cement in 50 kg bags. The use of bulk cement will be permitted only with the approval of the Engineer-in-charge.

4.4.9.3. A certified report attesting to the conformance of the cement to IS specifications by the cement manufacturer's chemist shall be furnished to the Engineer-in-charge if demanded.

4.4.9.4. Cement held in storage for a period of sixty (60) days or longer shall be tested. Should at any time the Engineer-in-charge have reasons to consider that any cement is defective, then irrespective of its origin, and/or manufacturers test certificate, such cement shall be tested immediately at the Contractor's cost at an approved laboratory and until the results of such tests are found satisfactory, it shall not be used in any work. The Contractor shall not be entitled to any claim of any nature on this account.

4.4.9.5. If the cement is supplied by the Client, Contractor will have to make his own arrangements for the storage of cement. If supplies are arranged by owner, cement will be issued in quantities to cover work requirements of one month or more, as deemed fit by the Engineer-in-charge and it will be the responsibility of the Contractor to ensure adequate and proper storage. The storage arrangements shall be such that there is no dead storage. The storage arrangement shall be approved by the Engineer-in-charge.

4.4.10. Aggregates

4.4.10.1. Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete. Fine aggregate is aggregate all of which passes through 4.75 mm IS sieve. Coarse aggregate is aggregate most of which is retained on 4.75 mm sieve. Specification mentioned against various item of work may also be followed.

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

4.4.10.3. Aggregates shall, except as noted above, consist of natural sands, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and/or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and

consistency that will work readily into position without segregation and shall be based on the mix design and preliminary tests on concrete specified later.

4.4.11. Sampling and testing

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

4.4.12. Storage of Aggregates

4.4.12.1. All coarse and fine aggregates shall be stacked in stock separately in stock piles in the materials yard near the work site or if instructed in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer.

4.4.13. Screening and Washing

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

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

4.4.14. Water

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

4.4.14.2. In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

4.5. BRICK AGGREGATES

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

4.6. MIX DESIGN

4.6.1. In case of concrete works, mix design may be necessary as per IS456 for certain items as decided by the Engineer-in-charge. All concrete in the works shall be of design mix as defined in IS 456, unless it is a nominal mix concrete such as 1:3:6, 1:4:8, 1:5:10.

4.6.2. It shall be very clearly understood that whenever the class of concrete such as M 20 is specified, it shall be the Contractor's responsibility to ensure that minimum crushing strength stipulated for the respective class of concrete is obtained at works. The maximum total quantity of aggregate by weight per 50 kg of cement shall not exceed 250 kg except when otherwise specifically permitted by Engineer-in-charge.

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

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

4.6.5. While fixing the value for water-cement ratio for preliminary mixes, assistance may be derived from the graph (appendix IS456) showing the relationship between the 28 day compressive strengths of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS269.

4.6.6. Preliminary tests

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

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

4.6.6.3. Mixing shall be done by a mixer machine as per IS516 in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in colour. The coarse aggregate shall then be added, mixed and water added and mixed thoroughly for a period of not less than 3 minutes until the resulting concrete is uniform in appearance. Each mix of concrete shall be of such a quantity as to leave about 10% excess concrete after moulding the desired number of test specimens.

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

4.6.6.5. Compression tests of concrete cubes shall be made as per IS516 on 15 cm cubes. Each mould shall be provided with a metal base having a plane surface so as to support the mould during filling without leakage. The base plate shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing concrete the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits:

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

4.6.6.7. Concrete test cubes shall be moulded by placing fresh concrete in the mould and compacted as specified in IS516.

4.6.6.8. Curing shall be as specified in IS516. The cubes shall be kept in moist air of at least 90% relative humidity at a temperature of 27 Degree Centigrade plus or minus 2 Degree Centigrade for 24 hours plus or minus half hour from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds and kept immersed in clean, fresh water and kept at 27 Degree Centigrade plus or minus 2 Degree Centigrade temperature until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

4.6.6.9. Testing of specimens

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

4.6.7. Proportioning, consistency, batching and mixing of concrete

4.6.7.1. Aggregate

The proportions which shall be decided by conducting preliminary tests shall be by volume. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete mixing. The supply of properly graded aggregate of

uniform quality shall be maintained over the period of work, the grading of aggregates shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stocked in separate stock piles. The grading of coarse and fine aggregate shall be checked as frequently as possible as determined by the Engineer-in-charge, to ensure maintaining of grading in accordance with the samples used in the preliminary mix design. The material shall be stock piled well in advance of use.

4.6.8. Cement

4.6.8.1. The cement shall be measured by weight.

4.6.9. Water

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

4.6.9.2. The water cement (W/C) ratio will be decided by Engineer-in-charge on weight basis and this shall be strictly followed at site.

4.6.10. Proportioning by Water/Cement ratio

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

4.6.11. Consistency and slump

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

Placing Conditions	**Degree of Workability**	**Slump (mm)**
Blinding concrete: Shallow sections; Pavements using pavers	Low	25-75

Mass concrete: Lightly reinforced sections in slabs, beams, walls, columns:Floors; Hand placed pavements; Canal lining; Strip footings	Medium	50-100
Heavily reinforced sections in slabs, beams, walls, columns;Slip formwork;	High	75-100
Pumped concrete ,Trench fill;*In-situ pilling, Tremie concrete*	Very high	100-150

4.6.11.2. Slumps for Various Types of Construction

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

4.6.12. Sampling and testing concrete in the field

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

a) One concrete cube testing machine suitable for 15 cm cubes of 100 tonnes capacity with proving calibration ring.

b) Twelve cast iron cube moulds of 15 cm size

c) One Lab. balance to weigh up to 5 kg with sensitivity of 10 gm.

d) One set of sieves for coarse and fine aggregates

e) One set of slump cone complete with tamping rod.

f) A set of measures from 5 litres to 0.1 litre.

g) One electric oven with thermostat up to 120 Degree Centigrade.

h) One flakiness gauge

i) One elongation index gauge

j) One sedimentation pipette

k) One Pyconometer

l) Two calibrated glass jar of 1 litre capacity

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

4.6.12.3. At least 6 test cubes of each class of concrete shall be made for every 15.0 cum of concrete or part thereof. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The laboratory test results shall be tabulated and furnished to

Engineer-in-charge. The Engineer-in-charge will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength. The cubes shall be tested on 7th and 28th day from the day of casting of the cubes.

4.6.13. Admixtures

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

4.6.14. Air entraining agents

Where specified and approved by the Engineer-in-charge, neutralised vinyl resin or any other approved air-entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6260, air entraining admixtures for concrete. The recommended total air content of the concrete is 4% plus or minus 1%. The method of measuring air content shall be as per IS1199.

4.6.15. Water reducing admixtures

Where specified and approved by the Engineer-in-charge water reducing lignosulfonate mixture shall be added in quantities specified by the Engineer-in-charge. The admixtures shall be added in the form of a solution.

4.6.16. Retarding admixtures

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

4.6.17. Water proofing agent

Where specified and approved by the Engineer-in-charge, water proofing agent conforming to IS 2645 shall be added in quantities specified by Engineer-in-charge

4.6.18. Optional tests

4.6.18.1. The Engineer-in-charge may order tests to be carried out on cement, sand, coarse aggregate and water in accordance with the relevant Indian Standards. Tests on cement shall include (i) fineness test (ii) test for normal consistency (iii) test for setting time (iv) test for soundness (v) test for tensile strength (vi) test for compressive strength (vii) test for heat of hydration by experiment and by calculations in accordance with IS 269. Tests on sand shall include (i) sieve test (ii) test for organic

impurities (iii) decantation test for determining clay and silt content (iv) specific gravity test (v) test for unit weight and bulkage factor. Tests on coarse aggregate shall include (i) test for sieve analysis (ii) specific gravity and unit weight of dry loose and rodded aggregate (iii) soundness and alkali aggregate reactivity (iv) petro graphic examination (v) deleterious materials and organic impurities (vi) test for aggregate crushing value. Any or all these tests would normally be ordered to be carried out only if the Engineer-in-charge feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by contractor at site or at an approved test laboratory.

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

4.6.19. Preparation prior to concrete placement

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

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

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

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

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

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

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

4.6.19.8. No concrete shall be placed in wet weather or on water covered surface. Any concrete that has been washed by heavy rains, the work shall be entirely removed, if there is any sign of cement and having been washed from the concrete mixture. To

guard against damage which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete, suitably drains and sumps shall be provided.

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

4.6.20. Transportation

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

4.6.20.2. Concrete must be placed in its final position before it becomes too stiff to work. On no account, water shall be added after the initial mixing concrete which has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by the Engineer-in-charge.

4.6.20.3. All equipment used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipelines and other equipment shall be thoroughly cleaned after each period of placement.

4.6.21. Procedure for placing of concrete

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

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

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

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

4.6.21.5. The following specifications shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved. The control of placing shall begin at the mixer discharger, concrete shall be discharged by a vertical drop into the middle of the bucket or hopper and this principle of a vertical discharge of concrete shall be adhered to thoroughly all stages of delivery until the concrete comes to rest in its final position.

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

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

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

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

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

4.6.21.11. When pumping is adopted, before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

4.6.21.12. When pneumatic placer is used, the manufacturer's advice on layout of pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's

advice shall be followed regarding concrete quality and all other related matters when pumping or pneumatic placing equipment is used.

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

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

4.6.22. Compaction

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

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

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

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

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

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

4.6.22.7. Form attached vibrators shall be used only with specific authorisation of the Engineer-in-charge.

4.6.22.8. The surface vibrators will not be permitted under normal conditions. However for thin slabs, vibration by specially designed vibrators may be permitted upon approval of the Engineer-in-charge.

4.6.22.9. The formation of stone pockets or mortar bondages in corner and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to sufficient depth and shape for through bonding, as directed by the Engineer-in-charge.

4.6.23. Placement interval

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

4.6.24. Special provision in placing

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

4.6.25. Placing concrete through reinforcement steel

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

4.6.26. Bleeding

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

4.6.27. Curing, protecting, repairing and finishing

4.6.27.1. Curing

4.6.27.1.1. All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or ponded water continuously saturated covering of sacks, canvas, hessian, polythene sheets or other absorbent materials, or

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

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

4.6.27.1.3. Curing of concrete made of high alumina cement and super sulphated cement shall be carried out as directed by the Engineer-in-charge.

4.6.27.1.4. Fresh concrete shall be kept continuously wet for a minimum period of 15 days from the date of placing of concrete following a lapse of 12 to 14 hours after the laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened. Water shall be applied uniformly to concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

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

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

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

4.6.27.1.8. Surface coating type compounds shall be used only on special permission of the Engineer-in-charge. Curing compounds shall be liquid type white pigmented. Other curing compounds shall be used on surfaces where future blending with concrete, water or acid proof membrane or painting is specified.

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

4.6.28. Protecting fresh concrete

Fresh concrete shall be protected from defacements and damage due to construction operation by leaving forms in place for an ample period as specified later in these specifications. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by the Engineer-in-charge shall also be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion or contact with other materials, etc., that may impair the

strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that workmen enter the area of freshly placed concrete, the Engineer-in-charge may require that bridges be placed over the area.

4.6.29. Repair and replacement of unsatisfactory concrete

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

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

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

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

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

4.6.29.6. A 5 mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete which shall be well consolidated with a wooden float. The concrete patch shall be built up in 10 mm thick layers. After an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and smooth finish obtained by wiping with hessian, a steel trowel shall be used for this purpose. The mix for patching shall be of same materials and in the same proportions as that used

in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

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

4.6.29.8. The patched area shall be covered immediately with an approved non-staining water saturated material such as gunny bag which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by fine spray of sprinkling for not less than 10 days.

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

4.6.30. Finishing

4.6.30.1. The type of finish for formed concrete surface shall be as follows, unless, otherwise specified by the Engineer-in-charge.

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

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

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

4.6.30.5. Surfaces which will be exposed to the weather and which would normally be level, shall be sloped for drainage. Unless the drawing specifies such as stair treads, walls shall be sloped across the width approximately 1 in 30 broader surface such as walkways, roads, parking areas and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete subfloors to be covered either concrete topping, terrazzo or quarry tile and similar surfaces shall be smoothly screeded and levelled to produce even surfaces. Surface irregularities shall not exceed 6 mm. Surfaces which will not be covered by backfill, concrete or tile toppings such as outside decks, floors of galleries and sumps, parapets, gutters, sidewall floors and slabs shall be consolidated, screeded and floated. Excess water and laitance shall be removed before finishing. Floating may be done with hand or power tools and started as the screeded surface has attained a stiffness to permit finishing operation and these shall be the minimum required to produce a surface uniform in texture and free from screed marks or other imperfections. Joints edges of panels and forms linings shall be of uniform size and be as large as practicable and installed with closed joints.

Upon removal of forms, the joint marks shall be smoothed off and all blemishes, projections etc., removed leaving the surfaces reasonably smooth and unmarked.

4.6.31. Integral cement concrete finish

When specified on the drawings and integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawing as per IS2571. The surface shall be compacted and then floated with a wood float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or trowelling of finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

4.6.32. Exposed Concrete finish/Rendering

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

4.7. FORM WORK

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

4.7.1. Design of formwork

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

4.7.2. Type of formwork

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

4.7.3. Form work requirements

4.7.3.1. Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, braces, ties, straps, etc., shall be used to hold the forms in proper position without any distortion whatsoever until the concrete is set sufficiently to permit removal of forms. Forms shall be strong enough to permit the use of immersion vibrators. In special cases form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete. Faces coming in contact with the concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight splits or other defects. Joints shall be sufficiently tight to prevent loss of water or any fine material from concrete.

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

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

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

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

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

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

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

4.7.4. Formwork for Slope Surfaces

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

4.7.4.2. The formwork shall also be built so that the boards can be removed one by one from the bottom up as soon as the concrete has attained sufficient stiffness to

prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 4 horizontal: 1 vertical shall be formed as required herein.

4.7.5. Formwork for Curved Surfaces

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

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

4.7.6. Formwork for Exposed Concrete Surfaces

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

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

4.7.6.3. To achieve a finish which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets. The sheets shall be arranged in an approved pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features, sills, window heads or change in direction of the surface. All joints between shuttering plates or panels shall be vertical or horizontal unless otherwise directed. Suitable joints shall be provided between sheets. The joints shall be arranged and fitted so that no blemish or mark is imparted to the finished surfaces.

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

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

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

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

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

4.7.6.9. In order to obtain exposed concrete work of uniform colour it shall be necessary to ensure that the sand used for all exposed concrete work shall be of approved uniform colour. Moreover the cement used in the concrete for any complete element shall be from single consignment.

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

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

4.7.7. Bracings struts and props

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

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

4.7.8. Mould Oil

4.7.8.1. Care shall be taken to see that the faces of form work coming in contact with concrete are perfectly cleaned and two coats of mould oil or any other approved material applied before fixing reinforcement and placing concrete. Such coating shall

be insoluble in water, non-staining and not injurious to the concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and/or other items to be cast in the concrete shall not be placed until coating of the forms is complete and the adjoining concrete surface shall also be protected against contamination from the coating material.

4.7.9. Chamfers and fillets

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

4.7.10. Wall ties

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

4.7.11. Reuse of forms

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

4.7.12. Removal of forms

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

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

4.7.12.3. In normal circumstances (generally where temperatures are above 20 Degree Centigrade) forms may be removed after expiry of the following periods:

	Ordinary Portland cement concrete	Rapid hardening Portland cement
Walls columns and vertical sides of beams	24 to 48 hrs as directed by the Engineer-in-charge	24 hrs.
Slabs proos left under	3 days	2 days
Beam soffits prods left under	7 days	4 days

Removal of props to slabs:		
Spanning up to 4.5m	7 days	4 days
Spanning over 4.5m.	14 days	8 days
Removal of props to beams & arches		
Spanning up to 6m	14 days	8 days
Spanning over 6m	21 days	12 days

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

4.7.12.5. Reinforced temporary openings shall be provided as directed by the Engineer-in-charge to facilitate removal of formwork which otherwise may be inaccessible.

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

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

4.8. REINFORCEMENT STEEL

4.8.1. General

4.8.1.1. Reinforcement bars, if supplies are arranged by contractor, shall be either plain round mild steel bars grade I as per IS 432 (Part I) or medium tensile steel bar as per IS 432 (Part I) or hot rolled mild steel and medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars as per IS1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS1566. Substitution of reinforcement will not be permitted except upon written approval from the Engineer-in-charge.

4.8.1.2. Plain round mild steel bars grade II as per IS 432 (Part I) may be used with prior approval of Engineer-in-charge in writing and with 10% increase in the reinforcement area but its use shall not be permitted in structures located in earthquake zones subjected to severe damage (as per IS 1895) and for structures

subject to dynamic loading (other than wind loading), such as frames supporting rotary or reciprocating machinery, etc.

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

4.8.2. All concrete in the works shall be of design mix as defined in IS 456, unless it is a nominal mix concrete such as 1:3:6, 1:4:8 or 1:5:10. Whether reinforced or otherwise, all design mix concrete works to be carried out under this specification shall be divided into the following classifications:

4.8.3. Providing, fabricating and placing in position reinforcement steel

4.8.3.1. The quality of the steel shall be as mentioned in the materials section. The bars shall be fabricated as per the drawings. Laps and splices for reinforcement shall be as shown on the drawings. Splices in adjacent bars shall be approved by the Engineer-in-charge. The bars shall not be lapped unless the length required exceeds the maximum available lengths of bars at site.

4.8.4. Bending

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

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

4.8.5. Fixing

Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the drawings by the use of block, spacers and chairs as per **IS2502** to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be strongly bound together at all such points with two no.16 gauge annealed soft iron wire. The vertical distance required between successive layers of bar in beams or other members shall be maintained by providing of mild steel spacer bars at such intervals that the main bars do not perceptibly sag **between adjacent spacer bars.**

4.8.6. Cover

4.8.6.1. Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows:

i. At each end of reinforcing bar, not less than 25 mm nor less than twice the diameter of the bar whichever is less.

ii. For a longitudinal reinforcing bar in a column, not less than 40 mm, nor less than the diameter of the bar. In case of columns of minimum dimensions of 20 cm or under, with reinforcing bars of 12 mm and less in diameter, a cover of 25 mm may be used.

iii. For longitudinal reinforcing bars in a beam, 25 mm nor less than the diameter of the bar.

iv. For tensile, compressive, shear, or other reinforcement in a slab or wall not less than 12 mm or less than the diameter of such reinforcement.

v. For any other reinforcement not less than 12 mm nor less than the diameter of such reinforcement.

4.8.6.2. For footings and other principal structural members in which the concrete is deposited directly against the ground, cover to the bottom reinforcement shall be 75 mm. If concrete is poured on a layer of lean concrete the bottom cover may be reduced to 50 mm.

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

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

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

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

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

4.8.6.8. The correct cover shall be maintained by cement mortar cover blocks. Reinforcement for footings, beams and slabs on sub-grade shall be supported on precast concrete blocks as approved by Engineer-in-charge. The use of pebbles or stones shall not be permitted.

4.8.7. Pre-cast slabs and Boundary blocks

Casting of pre-cast slabs and boundary blocks etc. shall be carried at the central casting yards which are to be erected by the Contractor to his convenience and curing shall be done by flooding water for minimum of 15 days. The drawing of the paving

slabs illustrates typical dimensions of slab. The cover slab is proposed for the drains only for the width of the road at the entry to the plots. The kerbs formed along the cable trenches and dividers are to be of perfect shape and straight with the expansion joints etc. For casting of paving slab perfect machined steel shuttering as per actual dimensions and right angles should be used. The edges of the slabs shall be perfect square with no honey combing. The finish of the slabs for all sides has to be obtained simultaneous to concreting and no patching or plastering shall be allowed. The slabs of any buckling or defects shall be rejected. The surfaces stone wash finish of the pre-cast slabs have to be done simultaneously with casting of the slab. We expect perfect finish for the surface with the stone surface exposed by the stones strongly and adhering to the base. The sealing notch in the side wall of duct has to be perfectly made so that the slab when placed shall have a perfect seating and an even level surface. No cement mortar levelling shall be allowed. Conveying of slabs has to be done carefully without any damage to sides/corners.

4.8.8. Inspection

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

4.9. MASONRY WORKS

4.9.1. Applicable codes and specifications

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

IS1077 - Common burnt clay building bricks
IS3102 - Classification of burnt clay bricks
IS2180 - Burnt clay building bricks, heavy duty
IS3495 - Method of sampling and testing clay building bricks
IS2691 - Burnt clay facing bricks
IS2221 - Code of practice for brick work
IS2185 - Load bearing hollow concrete blocks
IS5498 - Lime-cement-cinder hollow concrete blocks
IS3115 - Lime-cement cinder solid blocks
IS1597 - Code of practice for construction of stone masonry (Part I)

4.9.2. Brick

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

4.9.4. They shall be sound, hard and homogenous in texture, well burnt in kiln without being verified, table moulded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square edges and paralleled faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing ungrounded particles and which absorb water more than 1/5th of their weight when

soaked in water for twenty four hours shall be rejected. Over burnt or under burnt bricks shall be liable to rejection. These bricks shall give a clear ringing sound when struck.

4.9.5. Samples of bricks shall be submitted to the Engineer-in-charge for approval, before starting the brickwork. Bricks supplied shall conform to these approved samples. Brick samples shall be got tested as per IS3495 by the Contractor at no extra cost. Bricks rejected by the Engineer-in-charge shall be removed from the site of works within 24 hours.

4.9.6. Mortar

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

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

4.9.6.3. The Contractor shall arrange for test on mortar samples if so directed by the Engineer-in-charge re-tempering of mortar shall not be permitted.

4.9.7. Workmanship

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

4.9.7.2. All brick work shall be plumb, square and true to dimensions. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be levelled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes. No broken bricks shall be used except as closers. Care shall be taken that the bricks forming the top corners and ends of the wall shall be properly radiated and keyed into position. Holes kept in masonry for scaffolding shall be closed before plastering. All interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work where this is not possible, the work shall be raked back accordingly to bond (and not saw toothed) at an angle not exceeding 45o.

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

4.9.7.4. All brick work shall be built tightly against columns, floor slabs or other structural member.

4.9.7.5. Where drawings indicate that structural steel columns are to be fireproofed with brick work, the brick shall be built closely against all flanges and webs with all spaces between the steel and bricks works filled solid with mortar. Steel members partly embedded in brickwork and not indicated to be fireproofed with concrete shall be covered with not less than 12 mm thick mortar unless directed otherwise by Engineer-in-charge.

4.9.7.6. The work shall be cured for 15 days.

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

4.10. RUBBLE MASONRY

4.10.1. Stones for this work shall be hard, durable rock, close or fine grained and uniform in colour free from veins, flaws and other defects and shall conform to IS1597 (Part I). The stones shall be laid in mortar proportions specified for the particular item of work. Stones shall be got approved.

4.10.2. For all work below ground level the masonry shall be uncoursed random rubble with ordinary quarry dressed stones or hearting and faced with selected quarry dressed stones.

4.10.3. For all work above ground level the masonry shall be random rubble faced with hammer dressed stones with squared quoins at joints and corners.

4.10.4. No stones shall tail into the wall, either with a point or to length less than 11-2 times its height. The thickness of the joints shall not exceed 12 mm.

4.10.5. Spauls and pinnings shall not be allowed to show on the face of the wall. Two bond stones each of minimum area of 500 sq cm for every 1.0 sq m of each wall face shall be provided. These shall be through stones in walls 600 mm thick and under, in walls thicker than 600 mm the length of bond stones shall be 2/3 times the thickness of walls. The stones for hearting of the wall shall not be less than 150 mm in any

direction. Chips and spauls shall be wedged in to avoid thick mortar beds and joints. The wall faces, corners and joints or openings shall be truly vertical the quoins shall be of selected stones, neatly dressed with chisel to form the required angle and laid header and stretcher alternatively.

4.10.6. The exposed face of the work shall be carefully and neatly pointed with mortar in all joints on the other side the joints shall be neatly struck with trowel while the mortar is fresh.

4.10.7. Mortar

4.10.7.1. The mortar for the work shall be as specified in the respective item of work. Curing of masonry shall continue for a minimum of ten days.

4.11. SOLID CONCRETE BLOCK MASONRY - Conforming to IS 2185 (Part 1): 2005

The solid concrete blocks are used as load bearing units and shall have a block density not less than 1800 kg/m3.

Physical Requirements

4.11.1 ***General***

4.11.1.1 All units shall be sound and free of cracks or other defects which interfere with the proper placing of the unit or impair the strength or performance of the construction. Minor chipping resulting from the customary methods of handling during delivery, shall not be deemed grounds for rejection.

4.11.1.2 Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall be free of chips, cracks, or other imperfections, except that if not more than 5 percent of a consignment contains slight cracks or small chippings not larger than 25 mm, this shall not be deemed grounds for rejection.

4.11.2 ***Dimensions***

The overall dimensions of the units when measured shall be in accordance with as given in IS 2185 (Part 1): 2005 Annex B subject to the tolerances mentioned therein.

4.11.3 ***Block Density***

The block density when determined shall conform to the requirement as given in IS 2185 (Part 1): 2005 Annex C.

4.11.4 ***Compressive Strength***

The minimum compressive strength at 28 days being the average of eight units, and the minimum compressive strength at 28 days of individual units, when tested in the manner described in IS 2185 (Part 1): 2005 Annex D shall be as prescribed in Table below.

Type	*Grade*	*Density of Block*	*Minimum Average Compressive Strength of Units*	*Minimum Compressive Strength of Individual Units,*
		kg/m2	*N/mm²*	*N/mm²*
Hollow (open and closed cavity) load bearing unit	A(3.5)	Not less than 1500	3.5	2.8
	A(4.5)		4.5	3.6
	A(5.5)		5.5	4.4
	A(7.0)		7.0	5.6
	A(8.5)		8.5	7.0
	A(10.0)		10.0	8.0
	A(12.5)		12.5	10.0
	A(15.0)		15.0	12.0
	B(3.5)	Less than 1500 but not less than 1 100	3.5	2.8
	B(5.0)		5.0	4.0
Solid load bearing unit	C(5.0)	Not less than 1800	5.0	4.0
	C(4.0)		4.0	3.2

4.11.5 ***Water Absorption***

The water absorption, being the average of three units, when determined in the manner prescribed in IS 2185 (Part 1): 2005 Annex E shall not be more than 10 percent by mass.

4.11.6 ***Drying Shrinkage***

The drying shrinkage of the units when unrestrained being the average of three units, shall be determined in the manner described in IS 2185 (Part 1): 2005 Annex F and shall not exceed 0.06 percent.

4.11.7 ***Moisture Movement***

The moisture movement of the dried blocks on immersion in water, being the average of three units, when determined in the manner described in IS 2185 (Part 1): 2005 Annex G, shall not exceed 0.09 percent

4.12. INTERLOCKING PAVER LAYING WORKS

4.12.1 ***Surface to receive Tiles***

Tiling shall be carried out on completed WMM or well compacted sub base as per the particular requirement set for the project.

4.12.2 ***Laying of Heavy duty paver tiles***

The Heavy duty paver tiles shall be laid over a bedding sand layer of specified thickness conforming to the grading as specified in IRC SP 63:2004 and shown below. Average thickness of laying course shall be 20-40mm and the moisture content shall be 4% by weight.

IS Sieve Size	% by weight passing
9.52mm	100
4.75mm	95-100
2.36mm	80-100
1.18mm	50-95
600 microns	25-60
300 microns	10-30
150 microns	0-15
75 microns	0-10

The material shall be free from clay, silt and deleterious matter. The bedding layer shall be checked for profile correctness. Walking and driving over the bedding layer shall not be permitted. Joint filler shall be of following grade requirement. Cement shall not be used.

IS Sieve Size	% by weight passing
2.36mm	100
1.18mm	90-100
600 microns	60-90
300 microns	30-60
150 microns	15-30
75 microns	0-10

A. Frequency of testing

At least one week prior to commencement of the work, the Contractor shall draw up a Quality Assurance Plan (QAP) and documentation for all aspects of the work and submit for review. Contractor shall establish a lab for the entire above test to be done at site.

B. Test for materials

i. Coarse aggregates

1. Before the commencement of the works, at least 3 samples in accordance with the procedure laid down in IS:2430 shall be taken for each quarry source to ascertain the quality, suitability and fitness of the available material for use in the works. Fresh test shall be conducted, in case there is any change in the source or the type of rock being quarried. The proposal, along with a copy of test reports, shall be submitted to the Engineer for review and comments, if any.

2. Aggregate having more than 0.5% of sulphate as SO_3 with water absorption more than 2% of its own weight shall not be used.

3. In case of doubt, the alkali-aggregate reactivity shall be tested in accordance with IS:2386 (Part 6). Coarse aggregates having positive alkali-silica reaction (ASR) shall not be used.

4. The maximum value of flakiness index for coarse aggregates shall not exceed 35%.

ii. Sand /Fine aggregates

1. All fine aggregates shall confirm to IS: 383 and test for conformity shall be carried out as per IS:2386 (Part I to VIII). The fineness modulus of fine aggregates shall be between 2 and 3.5.

2. Before the commencement of the works, at least 3 samples as per IS: 2430 shall be taken for each quarry source, to ascertain the quality, suitability and fitness of the available materials for use in the works and the proposal along with a copy of test reports shall be submitted to the Engineer for review and comments, if any.

3. Fine aggregates having positive alkali-silica reaction shall not be used.

iii. Water

1. Water for use in the works for mixing and curing shall be in conformity with Clause 302.4 of IRD:21.

2. Water for each source shall be tested before the start of works and thereafter every 3 months and after each monsoon, till the completion of the works and proposal along with a copy of test reports shall be submitted to the Engineer for review and comments, if any.

C. Test for paver tiles

Source of materials shall be got approved prior to commencement of work. Size tolerance shall be randomly checked as per IS 15658 : 2006. Each lot shall be subjected to test for ascertaining the crushing strength and water absorption properties.

Finished level of pavements shall have a tolerance of not more than 10mm.

The surface finish and quality of materials and works shall conform to the requirements of Clauses 902 and 903 of MoRTH Specifications. Engineer has the authority to ask for further tests if required.

4.13. WOODWORK

4.13.1. Applicable Codes

1) IS4021 - Timber door, window and ventilator frames
2) IS2202 - Wooden flush door shutters (solid core type) Part I
3) IS1003 - Timber panelled and glazed shutters (Part I & II)
4) IS4020 - Method of tests for wooden flush doors: Type tests
5) IS1761 - Transparent sheet glass for glazing and framing purposes
6) IS3097 - Specification for veneered particle boards (Exterior Grade)

4.13.2. General

4.13.2.1. Wood used for all work shall be the best of the respective class specified, and properly seasoned, suitable for joinery work should be of natural growth, uniform in texture, straight grained, free from sapwood, dead knots, open shakes, rot, decay and any other defects and blemishes.

4.13.2.2. For joints following principles to be observed:

i. At the joints the weakness of the pieces must be minimum as far as possible, to place each abutting surface in a joint as neatly as possible, perpendicular to pressure and to form and fit accurately every pair of surface that may come in contact.

ii. All joining shall be wrought on all faces and finished off by hand with sand paper with slightly rounded arises.

iii. The joints shall be pinned with hard wood pins and put together with white lead. Jointing shall be by means of mortice and tenon or dovetailed joints as approved. For external work the joints shall be coated with white or red lead before the members are put together. For internal joints where there is no chance of moisture the joint shall be glued. Driving of screws with hammer is prohibited. The screws shall be soaked in oil before driving them home. The heads of the screws and nails shall be sunk and puttied.

iv. Any joinery work which shall split, fracture, shrink or show flaws or other defects due to unsoundness, inadequate seasoning or bad workmanship, shall be removed and replaced with sound materials at the Contractor's expense.

v. Door frames shall be rebated. All dimensions shall be as per drawings. The verticals of door frames shall project about 50 mm below finished floor, surface coming in contact with brick work shall be painted with bitumen or solignum as directed by the Engineer-in-charge. The door frame shall be provided with 3 nos. MS 230x30x3 mm flat split hold fasts on each side, respectively. These hold fasts shall be embedded in masonry or concrete work with concrete block of mix 12:2:4 and size 230x300x250. The work shall conform to IS4021.

vi. The door shall be panelled or solid flush doors or as described in the item of work. All doors shall be supplied with approved fittings such as hinges, mortice lock of approved make with handles on both the sides, oxidised brass tower bolts and latch arrangements, door stops, etc., and as shown in drawings. External flush doors shall be made of weatherproof plywood as per Item Description in the Schedule of Quantities.

vii. The workmanship of all doors and window shutters shall conform to the requirements of IS1003 (Parts I & II) and IS2202 (Part I). Flush door panels shall be got tested as per IS4020 in Standard Laboratories.

viii. Beading and architraves shall conform to the shapes shown on drawings or as approved and fixed by means of screws (counter sunk or otherwise) or bolts.

4.14. GLASS

4.14.1. Sheet glass or plate glass shall be of Indian make as specified in the Schedule of Quantities/as directed. It shall be free from waves and bubbles and all defects. The thickness of the glass shall be as follows:
2 mm thick glass for panes up to 900 sq.cm. area
3 mm thick glass for panes from 900 - 5500 sq.cm. area
4 mm thick glass for panes 5500 - 8400 sq.cm. area
5.5 mm thick glass or plate glass for panes above 8400 sq.cm.

4.14.2. It should be clearly understood that glass which does not have uniform refractive index or which is wavy, will be rejected. The glazing shall be fixed with teak wood beading and putty.

4.14.3. It shall conform to IS1761. The putty shall be made up of one part of white lead, 3 parts of finely powdered chalk and adding boiled linseed oil to make a stiff elastic paste. No voids shall be left in the putty. Woodwork shall not be painted, oiled or otherwise treated before it has been approved by the Engineer-in-charge.

4.14.4. The window frame shall be provided with 2 nos. MS 230x30x3 mm flat split hold fasts on each side, respectively. These hold fasts shall be embedded in masonry or concrete work with concrete block of mix 1:2:4 and size 230x300x250 mm.

4.14.5. The type of windows shall be as specified. Each leaf of the shutter shall have one pair of hinges for a width of less than or equal to 2 feet, for width more than 2 feet extra nos. of hinges shall be provided as directed by the Engineer-in-charge at no extra cost. The glazed windows shall be provided with glass of thickness as specified in the Item Description. Architraves shall be provided as per drawing.

4.15. FINISHING WORKS

4.15.1. **Applicable Codes**

1) IS2394 - Code of practice for application of lime plaster finish
2) IS1477 - Code of practice for painting of ferrous metals in buildings and allied finishes (Part I & II)
3) IS427 - Distemper, dry colour as required
4) IS2395 - Code of practice for painting concrete, masonry and plaster surfaces
5) IS428 - Distemper, oil emulsion, colour

4.16. PLASTERING

4.16.1. The surface to be plastered shall be washed with fresh clean water free from all dirt, loose material grease, etc., and thoroughly wetted for 6 hours before

plastering work is commenced. Concrete surfaces to be plastered will however be kept dry. The wall should not be too wet but only damp at the time of plastering. The damping shall be uniform to get uniform bond between the plaster and the wall. The junction between the brick work and RCC should be fixed with chicken wire mesh/PVC strip as directed before plastering.

4.16.2. The proportion of the mortar shall be as specified under the respective items of work. Cement shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water, sand and cement shall be as mentioned in the Specifications for Concrete & Allied works. The mortar thus mixed shall be used immediately and in no case shall the mortar be allowed to stand for more than 30 minutes after mixing with water. The plaster shall be laid in a single coat. The mortar shall be splashed on the prepared surface with a trowel and finished smooth by trowelling. The plastered surface shall be rubbed with iron plate till the surface shows cement paste. The work shall be in line and level. Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

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

4.16.4. Providing & Applying Cement paint

This may be “SNOWCEM” or of equivalent make. The surface shall be prepared as specified in the specification for white wash. This shall be applied with brush on the plastered wall. The strokes shall be even and it shall be cured at least for 7 days. No patch or brush stroke shall be seen. Three coats shall be applied.

4.17. PROVIDING & FIXING CHICKEN WIRE MESH

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

4.18. FLOORING

4.18.1. **Applicable codes**

1) IS1443 - Code of practice for laying and finishing of cement concrete flooring tiles.
2) IS2114 - Code of practice for laying in situ terrazzo floor finish
3) IS 777 - Glazed earthenware tiles

4.18.2. **Providing & Laying Ceramic tiles in flooring, skirting and dado**

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

4.18.4. They should be laid on a base of 12 mm thick mortar bed (cement or lime 1:3 sand) and cement (3 kg/sqm) paste. They shall be laid truly vertical on walls and truly horizontal on floors or to slopes as directed. The joint shall be very thin, uniform and perfectly straight. The tiles in dado shall be finished in such a way that, only the tile thickness projects over the finished plaster or as specified otherwise. Where full tiles are not possible, the same should be cut or sawn to the required size and their edge rubbed to ensure straight and true joints. After the tiles are laid extra cement grout shall be removed. The joints shall be cleaned with wire brush and then the joint shall be floated with white or gray cement as approved by the Engineer-in-charge. The tiles shall be cleaned after the work is complete.

4.19. STEEL WORK

4.19.1. **Providing and fixing steel doors/windows/ventilators**

4.19.1.1. The steel doors, windows, ventilators shall conform to IS7452 and IS1036. All steel doors, windows, ventilators, louvres, etc. shall be of sizes as specified and conform to the description in the respective items of work. Whether or not specifically mentioned, all fixtures and fittings necessary for the satisfactory operation of the doors and windows shall be provided. Doors, windows and ventilators shall be obtained from an approved manufacturer. Specific approval for such purchase shall be obtained beforehand. The sample shall also be got approved before further manufacturing starts, unless this is waived in writing by the Engineer-in-charge. All steel doors shall be of pressed steel (18 gauge) flush type with or without removable transom. All doors shall be provided with a three way bolting device and locking arrangement with duplicate keys and handles on both sides and operable from either side. The Contractor shall obtain windows with friction hinges in place of windows with peg stays if so directed by the Engineer-in-charge. For centre hung and top hung ventilators suitable spring catch/pulley and chord arrangement shall be provided for facility of opening. Whenever fly meshes over windows have been called for, they shall be fixed on the window and suitable lever type or rototype arrangement shall be provided for opening or closing of the glazed panels from inside. Prior the approval of the Engineer-in-charge shall be taken before order is placed with the manufacturer.

4.19.1.2. Where specified, steel door supplied shall be airtight. For this purpose, the Contractor shall provide necessary padding material such as rubber, felt or any other approved material.

4.19.1.3. The rate quoted shall be inclusive of glazing with 4mm thick glass free from all blemishes. The workmanship shall conform to IS1081. The rate quoted shall also be inclusive of fixing doors, windows, ventilators, louvres, etc. in brick work, steel framing, etc. by making holes/drilling holes in steel work where required complete.

4.19.1.4. The rate shall also include cost of painting two coats of approved enamel paint over two coat of approved zinc chromate primer.

4.19.2. Providing and fixing inserts in concrete works

4.19.2.1. Inserts are required to be fixed/embedded as indicated in construction drawings and/or as directed by Engineer- in-charge in foundations, columns and other

miscellaneous concrete works. These inserts comprise plates, angles, pipe sleeves, anchor bolt assemblies, etc.

4.19.2.2. The rate quoted by the Tenderer shall hold good for accurately fixing the inserts at the correct levels/alignment and shall include for the cost of any temporary or permanent supports/anchors such as bars including cutting, bending, welding, etc. as required.

4.19.2.3. Steel templates shall be used by Contractor to locate and very accurately position bolts, group of bolts, inserts, embedded parts, etc. at his cost. Such templates shall be previously approved by the Engineer-in-charge. Templates shall invariably be supported such that the same is not disturbed due to vibration, movement of labourers, materials, shuttering work, reinforcement, etc. while concreting. The Contractor will have to suitably bend, cut or otherwise adjust the reinforcement in concrete at the locations of inserts as directed by the Engineer-in-charge at no extra cost to OWNER. If the Engineer-in-charge so directs, the inserts will have to be welded to reinforcement to keep them in place. Contractor shall be responsible for the accuracy of dimensions, levels, alignments and centre lines of the inserts in accordance with the drawings and for maintenance of the same until the erection of equipment/structure or final acceptance by Owner.

4.19.2.4. Contractor shall ensure proper protection of all bolts, inserts, etc. from weather and other damages by greasing or other approved means such as applying white lead putty and wrapping them with gunny bags or canvas or by other means as directed by the Engineer-in-charge to avoid damage due to movement of his labourers, material, equipment, etc. No extra claim from the Contractor on this account shall be entertained. Contractor shall be solely responsible for all the damages caused to bolts, inserts, etc. due to his negligence and in case damages do occur, they shall be rectified to the satisfaction of the Engineer –in-charge at the Contractor's cost.

4.19.3. Providing and fixing in position grill, railing, steel ladder, etc.

This work shall be carried out as per the detailed drawings. The MS sections shall be of approved quality. The welding shall be perfect and the junctions shall be ground properly. The frames shall be provided with hold fasts and the same shall be grouted with CC blocks in brick work. It shall be painted with two coats of zinc chromate primer and two coats of synthetic enamel paint of approved make and colour.

4.20. ROOFING

4.20.1. Providing, Fabricating & Erecting MS Structural steel work for trusses, purlins, girders, columns, rafters, struts, wind ties, bracings, etc.

4.20.2. All structural steel materials such as angles, RS joists, flats, tees, plates, channels, etc., shall conform to the latest edition of IS226. All structural steel shall be free from twist before fabrication. Cutting of members shall be done by shearing, cropping, sawing or gas cutting. Contact surfaces of plates and butt joints shall be accurately machined over the whole area so that the parts connected shall butt over the entire surface of contact. Welding of pieces shall be done with the approval of the Engineer-in-charge.

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

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

4.20.5. Welding shall be done in accordance with the latest edition of IS813 and IS814, the Code of Practice for use of Electric Arc welding for general Construction in mild steel. In welding it must be ensured that the base metal is in fused state when filler metal makes contact with it; filler metal does not overflow upon any unfused base metal; base metal is not cut along the weld edges; flowing metal floats the slag, oxide and gas bubbles at the surface behind advance pole. For this, the current shall be adjusted or the electrode size is changed. Welding shall be free from cracks, discontinuity, under or over size welding thickness.

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

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

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

4.20.9. Important points

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

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

4.20.10. Providing & Fixing MS holding down bolts

The MS holding down bolts of specified diameter, length and shape shall be provided as per the drawings to line & level. These shall be fixed to RCC work or brick work by grouting it with concrete. The bolt shall be provided with nuts and washers. The grease shall be applied to the threaded portion with the help of templates. If the bolts need some adjustment it shall be provided with a wooden piece 75x75 mm or 50 mm diameter GI pipe around bolt shall be provided at the time of concreting and shall be removed after initial set.

4.20.11. Providing & Fixing AC Corrugated Sheets

4.20.11.1. AC sheet and accessories shall be free from cracks, chipped edges and corners. The fixing shall be done as per the latest edition of IS 459. The spacing of the purlins shall not be more than 1.4 m for 6 mm sheets. The light shall not be visible from the joints of the AC sheets. The AC sheets to be kept on ceiling shall be placed with smooth side upward and the AC sheets to be put in cladding shall be placed with smooth side outside. The AC sheets shall have at sides a lap of half corrugation and an end lap of 150 mm minimum. The free over hangs at ends shall not be more than 300mm.

4.20.11.2. Hole for 8 mm diameter L or J bolts shall be drilled and not to be punched in the ridge of the corrugation. The diameter of the hole shall not be more than the diameter of the bolt by 1.5 mm. The bolts shall be galvanised J or L hooks polymer coated with one polymer thrust washer and nut with polymer cap. All AC sheet accessories shall be painted or white washed as specified in the item or directed by the Engineer.

4.21. WATER SUPPLY

4.21.1. Applicable codes

1) IS554: Code of practise for dimensions for pipe threads where pressure tight joints are required on the threads.
IS1239: Code of practise for Galvanised mild steel welded pipes

4.21.2. Providing & Laying underground GI pipe line

4.21.2.1. The pipes shall be galvanised mild steel welded pipes and screwed and socketed tubes conforming to the requirements of IS1239, for medium grade. They shall be of the diameter (nominal bore) specified in the description of the item. The sockets shall be designated by the respective nominal bores of the pipes for which they are intended. The pipes and sockets shall be cleanly finished well galvanised in and out and free from cracks surface flaws, laminations, and other defects. All screws, threads shall be clean and well cut. The ends shall be cut cleanly and square with the axis of the tube.

4.21.2.2. All screwed tubes and sockets shall have pipe threads conforming to the requirements of IS554. Screwed tubes shall have taper threads while the sockets shall have parallel threads.

4.21.2.3. The fittings shall be of malleable cast iron or mild steel tubes complying with all the appropriate requirements as specified for pipes. The fittings shall be

designated by the respective nominal bores of the pipes for which they are intended. The fittings shall have screw threads at the ends conforming to the requirements of IS554. Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be tapered.

4.21.2.4. The pipes and fittings shall be inspected at site before use to ascertain that they conform to the specification. The defective pipes shall be rejected. Where the pipes have to be cut or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS554 with pipe dies and tapes carefully in such a manner as will not result in slackness of joints when the two pipes are screwed together. The tapes and dies shall be used only for straightening, screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make then slack, as the latter procedure may not result in a water tight joint. The screw threads of pipes and fittings shall be protected from damage until they are fitted.

4.21.2.5. The pipes shall be cleaned of all foreign matter before being laid in jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipes. The end shall then be screwed in the socket, tee, etc., with the pipe wrench. Care should be taken that all pipes and fittings are properly joined so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Purr from the joint shall be removed after screwing. After the laying, the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter. Any threads exposed after jointing shall be painted or in the case of underground piping thickly coated approved anticorrosive paint to prevent corrosion.

4.21.2.6. If the galvanised iron pipes and fittings are laid in trenches, the widths and depths of the trenches for different diameters of the pipes shall be as in the table given below:

Diameter of pipe	Width of trench	Depth of trench
15mm to 50mm	30cm	60cm
65mm to 100mm	45cm	75cm

4.21.2.7. At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for each work in trenches. The pipes shall be painted with two coats of anticorrosive bituministic paint of approved quality. **The pipes shall be laid on a layer of 7.5 cm sand and filled up to 15 cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth.** The surplus earth shall be disposed off as directed when excavation is done in rock the bottom shall be cut deep enough to permit the pipes to be laid on a cushion of sand 7.5 cm minimum. In case of bigger diameter pipes where the pressure is very high thrust blocks of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 grade stone aggregate of 20 mm

nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground sand spreading it over a sufficient area.

4.21.3. Test

4.21.3.1. After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost.

4.21.3.2. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6 kg/sq.cm (60 meter). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off, takes and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped the test pressure should maintain without loss for at least half an hour. The pipes and fittings shall be tested in sections as the work of laying proceeds, keeping the joints exposed for inspection during the testing.

4.21.4. Providing & Laying concealed in structure GI pipe line

4.21.4.1. For internal work the pipes shall be concealed in the brick masonry. Chasses or zarries shall be cut in the walls and the pipes shall be laid. The pipes shall not ordinarily be buried in solid floors. Where unavoidable, pipes may be buried for short distances provided adequate protection is given against damage, but the joints in pipes shall not be buried. Where directed by the Engineer-in-charge, MS sleeve shall be fixed at a place where a pipe is passing through a wall or floor for inception of the pipe and to allow for expansion movements and contraction and other. In case the pipe is embedded in walls or floors it should be painted with anticorrosive bituministic paint of approved quality. The pipe should not come in contact with lime mortar or lime concrete as the pipe shall be laid in layer of sand filling done under concrete floors or as directed by the Engineer-in-charge. **The floor and wall shall be finished same as the surrounding surface after the completion of the work.**

4.222. SANITARY WORKS

4.22.1. Applicable codes

a. IS458: Code of practise for concrete pipe

b. IS651: Code of practise for salt-glazed stoneware pipes and fittings

c. IS1729: Code of practise for sand and cast iron spigot and socket, soil, waste and ventilating pipes fittings and accessories

d. IS5329: Code of practise for sanitary pipe work above ground for building

e. IS3114: Code of practise for laying cast iron pipes

f. IS1726: Code of practise for cast iron manhole covers and frames

b. IS783: Code of practice for laying of concrete pipes.

a. IS2326: Automatic flushing cisterns for urinals.

b. IS2470: Code of practice for design and construction of septic tanks.

c. IS2556: Vitreous sanitary appliances

d. IS774: Flushing Cisterns for water closets and urinals (valve less siphonic type).

e. IS775: Cast iron brackets and supports for wash basins and sinks.

f. IS781: Sand-cast brass screw-down bib taps and stop taps for water services.

g. IS1068: Electroplated coatings of nickel and chromium on iron and steel.

h. IS1536: Centrifugally cast (spun) iron pressure pipes for water, gas and sewage.

i. IS1626: Asbestos cement building pipes, gutters and fittings (spigot and socket types)

j. IS1703: Ball valves (horizontal plunger type) including floats (spigot and socket types)

k. IS1742: Code of practice for building drainage.

l. IS2470: Code of practice for design and construction of septic tanks.

m. IS2963: Non-ferrous waste fittings for wash basins and sinks.

n. IS.3311 Waste plug and its accessories for sinks and wash basins.

o. IS.5434 Non-ferrous alloy bottle traps for marine use.

4.22.2. Scope of work

The scope of work includes providing and fixing sanitary fixtures, providing and laying drainage lines and all items of work described in Schedule of Quantities.

4.22.3. Drawings

Checked and approved drawings showing location of sanitary and water supply fixtures will be furnished to the Contractor and all drawing so furnished shall form a part of this specification. The Contractor shall refer these drawings for all information contained thereon which pertains to and required for this work.

4.22.4. All connected works will be measured and paid under respective items of work unless specifically mentioned otherwise.

4.22.5. Providing & Laying non-pressure Hume pipe

4.22.5.1. The pipe shall be with or without reinforcement as required and of the class as specified. These shall conform to IS456. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process while unreinforced cement concrete pipes by spun or pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws, the external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding. The unreinforced pipes (non pressure pipes) shall withstand a test pressure equivalent to 0.7 kg/sq.cm (7 m head) of water.

4.22.5.2. Concrete used for the manufacture of unreinforced and reinforced concrete pipes and collars shall not be leaner than 1:2:4 (1cement: 2coarse sand: 4 graded stone aggregate). The maximum size of aggregate should not exceed one third of the thickness of the pipe or 20 mm whichever is smaller. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own

weight. The minimum cover for reinforcement of spun pipes and for all other pipes shall be as given below:

Pipe thickness	Spun pipes (mm)	Pipes other than spun pipe (mm)
Less than 30 mm	9	12
30 mm to 75 mm	12	18
75 mm and over	18	18

4.22.5.3. Where the pipe shall be bedded directly on soil, the bed shall be suitably rounded to fit the lower part of the pipe, the cost for this operation being included in the rate for laying the pipe.

4.22.5.4. Loading, transporting, and unloading of concrete pipes shall be done with care. Handling shall be as to avoid impact. Gradual unloading by inclined plane or by chain block is recommended. All pipe sections and connections shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used. Pipes shall be lowered into the trenches carefully. Mechanical appliances may be used. Pipes shall be laid true to the line and grade as specified. The laying of the pipe shall proceed upgrade of a slope.

4.22.5.5. If the pipes have spigot and socket joints, the socket ends shall face up-stream. In the case of pipes with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directed.

4.22.5.5.1. In case where the foundation conditions are unusual such as in the proximity of trees or holes under existing or proposed tracks, manholes etc., the pipe shall be encased all-round in 15 cm thick cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size) or compacted sand or gravel.

4.22.6. In case where the natural foundation is inadequate the pipes shall be laid either in concrete or cradle supported on proper foundations or on any other suitably designed structure. If a concrete cradle bedding is used the depth of concrete below the bottom of the pipe shall be at least 1/4th of the internal diameter of the pipe subject to a minimum of 10cm and a maximum of 30cm. The concrete shall extend up the sides of the pipes at least at a distance of 1/4th of the outside diameter for pipes 300 cm and over in diameter. The pipe shall be laid in this concrete bedding before the concrete has set, pipes laid in trenches in earth shall be bedded evenly and firmly and as far up the haunches of the pipes as to safely transit the load expected from, the backfill through the pipe to the bed. This shall be done either by excavating the bottom of the trench to fit the curve of the pipe or by compacting the earth under the curve of the pipe to form an even bed. Necessary provision shall be made for joint wherever required. When the pipe is laid in a trench in rock, hard clay, shale or other hard material the space below the pipe shall be excavated and replaced with an equalising bed of concrete, sand or compacted earth. In no case shall pipe be laid directly on such hard material. When the pipes are laid completely above the ground

the foundations shall be made and sufficiently compacted to support the pipe line without any material settlement. Alternatively the pipe line shall be supported on rigid foundations at intervals. Suitable arrangements shall be made to retain the pipe line in the proper alignment such as by shaping the top of the supports to fit the lower part of the pipe. The distance between the supports shall in no case exceed the length of the pipe. The pole shall be supported as far as possible close to the joints. In no case shall the joint come in the centre of the span. Care shall be taken to see that superimposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted. Suitably designed anchor blocks at change of directions and grades for pressure line shall be provided where required.

4.22.6.1. Jointing of the pipes shall be done as described below:

Collar shall be spaced symmetrically over the two pipes and the space between collar and pipe filled with cement mortar 1:1 thoroughly rammed with caulking tools. The joint shall be finished with a fillet sloping at 45$_o$ joints shall be protected and cured for about 10 days. If specified in the item specification wedge shaped groove in the end of the pipe shall be filled with a special bituminous plastic compound for bitumen soaked spun yarn. The collar shall then be slipped over the end of pipe and next pipe butters well against the plastic compound by suitable appliance so as to compress the plastic compound in the grooves, care being taken not to disturb concentricity and level of the pipes.

4.22.7. Providing & laying stoneware pipe

4.22.8. All pipes with spigot and socket ends shall conform to IS651 and shall be of grade 'A' as specified. These shall be sound, free from visible defects such as fire cracks or hair cracks. The glaze of the pipe shall be free from crazing. The pipes shall give a sharp clear sound when struck with a light hammer. There shall be no broken blisters.

4.22.9. The approximate thickness of 60 cm long pipes shall be as given in the table.

Internal diameter of the pipe (mm)	Thickness of the barrel and socket (mm)	Weight of each pipe per M (kg)
100	12	14
150	16	22
200	17	33
230	19	44
250	20	52
300	25	79
350	30	100
400	35	128
450	38	147

4.22.10. The length of pipes shall be 60 cm exclusive of the internal depth of the socket. The pipe shall be handled with sufficient care to avoid damage to them.

4.22.11. All pipes shall be laid on a bed of 15 cm cement or lime concrete as specified, projecting on each side of the pipe to the width of the trench which shall be nominal diameter of pipe + 400 mm. The pipes with their crown level at 1.20 m depth and less from ground shall be covered with 15 cm thick concrete above the crown of the pipe and sloped off to meet the outer edges of the concrete, to give a minimum thickness of 15 cm all round the pipe. Pipes laid at a depth greater than 1.20 m at crown shall be concreted at the side up to the level of the centre of the pipe and sloped off from the edges to meet the pipe tangentially. The concreting shall be done as per specifications for concrete. The pipes shall be carefully laid to the alignment levels and gradients shown on the plans and sections, great care shall be taken to prevent sand, etc., from entering the pipes. The pipes between two manholes shall be laid truly in a straight line without vertical or horizontal undulation. The pipe shall be laid with socket up the gradient. The body of the pipe shall for its entire length rest on an even bed of concrete and places shall be formed in the concrete to receive the socket of the pipe.

4.22.12. Where pipes are not bedded on concrete the trench floor shall be left slightly high and carefully bottomed up as pipe laying proceeds, so that the pipe barrels rest on firm and undisturbed ground. If the excavation has been carried to below the desired levels, shall be made up with concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded brick bat of 40 mm nominal size) for which no extra payment shall be made.

4.22.13. If the floor of the trench consists of rock or very hard ground that cannot easily be excavated to a smooth surface the pipe shall be laid on a levelling course of concrete as desired. When SW pipes are used for storm water drainage, no concreting will normally be necessary. The cement mortar for jointing will be 1:3 (1cement: 3 fine sand), testing of joints will also not be done.

4.22.14. Tarred gasket of hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be slipped home well into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly home so as to fill not more than 1/4th of the total depth of the socket.

4.22.15. The reminder of the socket shall be filled with stiff mixture of cement mortar in the proportion of 1:1 (1 cement: 1 fine sand) when the socket is filled, a fillet shall be formed round the joint with a trowel forming an angle of 45o with the barrel of the pipe. After a day's work an extraneous material shall be removed from the inside of the pipe. The newly made joints shall be cured.

4.22.16. Water Test

4.22.16.1. Stoneware pipes used for sewers shall be subjected to a test pressure of 1.5 m head of water at the highest point of the section under test. The test shall be carried out by suitably plugging the low end of the drain and the ends of the connection if any and filling the system with water. A buckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head. Or the top may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation. Where leakage will be visible the defective part of the work shall be removed and made good.

4.22.16.2. In cases where pipes are not bedded in concrete special care shall be taken in refilling trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street surfaces and dangers to foundations, etc. The backfilling materials shall be packed by hand under and around the pipe, and rammed with a shovel and light tamper. The method of filling will be continued up to the top of pipe. The refilling shall rise evenly on up to the top of pipe. The refilling shall rise evenly on both sides of the pipe continued up to 60 cm above the top of pipe so as not to disturb the pipe. No tamping should be done within 15 cm of the top of pipe. The remainder of the backfill shall not be done until 7 days have elapsed for brick sewers and 14 days for concrete sewers, unless local conditions or materials are suitable for the earlier placing of load on the pipes. The tamping shall become progressively heavier as the depth of the backfill increases.

4.22.16.3. In measuring the length of sewer pipes, laid length between faces of manholes shall only be measured omitting lengths of channels between inside faces of walls of manholes or chambers.

4.22.17. Providing & Laying CI WW line concealed in structure with cement joint

4.22.17.1. All cast iron pipes and fittings shall be of approved ISI make, shall be of uniform thickness with strong and deep sockets, free from flaws, air holes, cracks, hand holes and other defects and conform, to IS1729. The pipes and fittings shall be true to shape, smooth and cylindrical and shall ring clearly when struck over with a light hand hammer. All pipes and fittings shall be properly cleaned of all foreign material before being fixed.

4.22.17.2. The annular space between the socket and spigot shall be filled with a gasket of hemp or spun yarn soaked in neat cement slurry. The joint shall then be filled with stiff cement mortar 1: 2 (1 cement: 2 fine sand) well pressed with caulking tool and finished smooth on top at an angle of 45o. The joint shall be kept wet for not less than 7 days by tying a piece of gunny bag and kept moist. Joints shall be perfectly air and water tight.

4.22.17.3. 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.

4.22.17.4. The connection between the main pipe and branch pipes shall be made by using branches and bends with access doors for cleaning. Floor traps shall be provided with 25 mm dia puff pipe where the length of the waste is more than 1800 mm or the floor trap is connected to a waste stack through bends.

4.22.17.5. All cast iron pipes and fittings including joints shall be tested by a smoke test to the satisfaction of the Engineer and left in working order after completion. The smoke test shall be carried out as stated under:-

4.22.17.6. Smoke shall be pumped into the pipe at the lowest end from a smoke machine, which consists of a bellow and burner. The material usually burnt is fresh cotton waste which give out a clear pungent smoke which is easily detectable sight as well as by smell if there is leaking at any point of the pipeline.

4.22.18. Water test and air test shall be conducted as stipulated in IS5329.

4.22.19. Providing & Laying concealed PVC rain water line

The strength of the pipe shall be 4kg/sq cm. It shall be of approved make. It shall be provided with all necessary specials. It shall be jointed with adhesive as per the manufacturer's specifications.

4.22.20. Providing & constructing manholes

4.22.20.1. Manholes of different types and sizes as specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as directed by the engineer. The size indicates the inside dimensions of the manhole.

4.22.20.2. Excavation and back filling shall be as per respective specifications.

4.22.20.3. Manhole shall be built on a bed of brickbat cement concrete 1:4:8 (1 cement: 4 sand : 8 brickbats of 40mm nominal size). The thickness of the bed concrete shall be 150mm unless otherwise specified.

4.22.20.4. Brick work shall be in cement mortar 1:6 (1cement: 6 sand). The external joints of the brick masonry shall be finished smooth. The joints of the pipes with the masonry shall be made perfectly leak-proof with cement concrete 1:2:4.

4.22.20.5. The brick walls of the manholes shall be plastered inside with 12mm thick cement plaster 1:4 (1 cement: 4 sand) finished smooth with a floating coat of neat cement.

4.22.20.6. Channels and benching shall be in cement concrete 1:2:4 (1cement: 2 sand: 4 graded stone aggregate).

4.22.20.7. All manholes deeper than 1.0m shall be provided with CI foot rest. These shall be embedded 20 cm deep with 20x20x10 cm blocks of cement concrete 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate). The block with CI foot rest placed in its centre shall be cast-in-situ along with the masonry and the surface finished with 12mm thick cement plaster 1:4 (1 cement : 4 sand) finished smooth. Foot rests shall be fixed 30cm apart vertically and staggered the wall. The top foot rest shall be 45 cm below the manhole cover. Foot rests shall be painted with coal tar, the portion embedded in cement concrete block painted with thick cement slurry before fixing.

4.22.20.8. The depth of channels and benching shall be as indicated in the table given below.

Internal diameter of the pipe (mm)	Thickness of the barrel and socket (mm)	Weight of each pipe per M (kg)
100	12	14
150	16	22
200	17	33
230	19	44
250	20	52
300	25	79
350	30	100
400	35	128
450	38	147

4.22.21. CI manhole covers and frames shall conform to IS1726. The covers and frames shall be cleanly cast and they shall be free from air and sand holes and from cold struts. They shall be neatly dressed and carefully trimmed. All casting shall be free from voids whether due to shrinkage, gas inclusion or other causes. Cover shall have a raised chequered design on the top surfaces to provide an adequate non slip grip. The cover shall be capable of easy opening and closing. It shall be fitted in the frame in workmanship like manner. The cover shall be gas tight and water tight. Covers and frames shall be coated with a black bituminous paint. It shall not flow when exposed to a temperature of 63 Degree Centigrade and shall not be brittle as to chip off at temperature of 0 Degree Centigrade.

4.22.22. Manhole cover and frame shall conform to medium duty of 500 mm internal diameter and shall weigh not less than 75kg unless otherwise mentioned in the item description. (Weight of cover 58kg and weight of frame 58kg).

4.22.23. Manholes shall be measured in numbers. The depth of the manhole shall be reckoned from top level of CI cover to the invert levels of channel. The depth shall be measured correct to centimetres.

4.22.24. Sewers of unequal sectional area shall not be jointed at the same invert level in a manhole. The invert of the smaller sewer at its junction with main shall be, at a height at least 2/3 the diameter of the main, above the invert of the main. The branch sewer should deliver sewage in the manhole in the direction of main flow and the junction must be made with care so that flow in the main is not impeded. No drains from house fittings for example GT, soil pipe etc. exceeding a length of 6m shall be connected unless it is inevitable.

4.22.25. The frame of the manhole cover shall be firmly embedded to correct alignment and levels in plain cement concrete 100mm thick 1:2:4 (1 cement :2 sand :4 graded stone aggregate) on top of the brick masonry. After completion of the work manhole covers shall be smeared by means of thick grease.

4.22.26. Providing & Constructing Soak pit

The earth excavation shall be carrying out to the exact dimensions as shown in the drawing. The soak pit shall be constructed of honey-comb dry brick work of 250 mm thick in cement mortar 1:6, RCC 1:2:4 precast or cast-in-situ slabs 150 mm thick for top cover with reinforcement, CI manhole cover 500 mm diameter of 80 kg weight, 150 mm diameter SW tee, outlet vent, 75 mm diameter CI pipe 2 m high fixed on masonry pedestal with cowl and bituministic painting, refilling, watering, consolidating etc., all complete.

4.22.27. Providing & Constructing Drop connection

4.22.27.1. In cases where branch sewer enters the manholes of main pipe sewer at a higher level than the main sewer, a drop connection should be provided. Pipes and specials conforming to IS1729 shall be of the same size as the branch pipe sewer.

4.22.27.2. For 150 mm and 250 mm main line if the difference in level between the water line (peak flow level and the invert level) of branch line is less than 60 cm a drop

connection may be provided within the manhole by giving a suitable ramp. If the difference in level is more than 60 cm the drop should be provided externally.

4.22.27.3. The excavation shall be done for the drop connection at the place where the branch line meets the manhole. The excavation shall be carried up to the bed concrete of the manhole and to the full width of the branch line excavation and backfilling shall be done as per respective specifications.

4.22.27.4. At the end of branch sewer line SCI tee shall be fixed to the line which shall be extended through the wall of manhole by a horizontal piece of SCI pipe to form an inspection of cleaning eye. The open end shall be provided with chain and lid. The SCI drop pipe shall be connected to the tee at the top and to the SCI bend at the bottom. The bend shall be extended through the wall of the manhole by a piece of pipe which shall discharge into the channel. Necessary channel shall be made with cement concrete of grade M-150 and finished smooth to connect the main channel. The joint between CI pipe and fittings shall be lead caulked. The joint between SCI tee and SW branch line shall be made with cement mortar 1:1 (1 cement: 1 fine sand) as for emased all round with minimum 15 cm thick concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) and cured. For encasing the concrete around the drop connection the necessary centering and shuttering shall be provided the holes made in the walls of the manhole shall be made good with brick work in cement mortar 1:5 (1 cement: 5 coarse sand) and plastered with cement mortar 1:3 (1 cement: 3 fine sand) on the inside of the manhole wall. The excavated earth shall be back filled in the trench in level with the original ground level.

4.22.28. Providing & Constructing Road gully chambers/yard gully

4.22.28.1. The chamber shall be of brick masonry and shall have a CI grating with frame fixed in 150 mm thick cement concrete of grade M-15 at the top. The size of the chamber shall be taken as clear internal dimensions of the CI frame. The chamber shall have a SW connection pipe, the length of which between road gully chamber and the point of discharge to drain or to open ground shall be measured separately. The chamber shall be built at the locations indicated in drawings.

4.22.28.2. Bed concrete, brick work, plastering, RCC work, excavation, backfilling, etc. shall be as per details given on the drawing and in compliance with the requirements laid down in the specifications for the respective items.

4.22.28.3. The MS grating cover shall be hinged to the frame to facilitate its openings for cleaning and repairs. The weight of grating shall be 75 kg minimum.

4.22.28.4. After the completion of the work the exposed surfaces of the grating and the frame shall be painted with two coats of synthetic enamel paint.

4.23. LIST OF APPROVED BRAND / MAKE

Description	Approved Brand / Make
Cement	Malabar/ Ultratech/ ACC/ India Cements/Dalmiya or equivalent approved by INKEL
Steel	SAIL/ TISCO/ IISCO/ Vizag or equivalent approved by INKEL
Paints & Distemper	ICI/Berger/AsianPaints/Garware/Jenson & Nicholson/Dulex/Jotun or equivalent approved by INKEL
Primer	Berger / Asian
Water proofing cement paint	Super Snowcem / Super Shelcem
Floor / Wall Tiles	Orient Bell/ Johnson/ Nitco/ Somany /Cera or equivalent approved by INKEL