

Specifications of Building Construction (Civil) Works

1. General

The Work shall be carried out according to these Specifications whether specifically mentioned elsewhere or not. No extra in any form will be paid unless it is definitely stated as an item in the Bill of Quantities.

Whenever the Specifications are not given or when the Specifications are ambiguous, the relevant Nepal Standards or Indian Standards and further amendments will be considered as final and binding.

All Works shall be carried out simultaneously with electrical, plumbing, sanitary and other services and in co-operation with the Contractors of the above services. The Work shall be carried on till it is completed satisfactorily along with the completion of other essential services. The building Contractor shall keep the other Contractors informed of the proposed program of Work, well in advance, so that the building Work is not hindered. The Contractor shall further cooperate with other Contractors in respect of any facility required by them e.g. making holes in shuttering for sanitary, pipes, electric conduits, fan hook etc. However, no extra payment shall be admissible for such reasonable assistance and facilities afforded to other Contractors and the building Contractors shall be deemed to have taken these factors into consideration while quoting the rates.

The Work shall be related to the drawings which the Contractor is presumed to have studied. Nothing extra will be paid for any item because of its shape, location or other difficult circumstances, even if the schedule makes no distinction, as long as the item is shown in the drawings.

The sources of materials stated in the Specifications are those from which materials are generally available. However, materials not conforming to Specifications shall be rejected even if they come from the stated sources. The Contractor should satisfy himself that sufficient quantity of materials of acceptable Specification is available from the stated or other sources.

The requirements of Specifications shall be fulfilled by the Contractor without extra charges i.e. the item rates quoted shall be deemed to have taken these Specifications into account.

These are requirements the Contractor shall fulfil after the issue of Letter of Acceptance but before the Date of Commencement.

1.1 Definitions

General:

Acceptable/Approved (Approval) - Acceptable to/approved by the Engineer.

Agreed - Agreed in writing.

As detailed - As detailed on the drawings.

Authorized/ordered/rejected - Authorized/ordered/rejected by the Engineer.

Designated - Shown on the drawings or otherwise specified by the Engineer or, in relation to an item scheduled in the bid documents, descriptive of an item to be priced by a bidder.

Indicated - Indicated in or reasonably to be inferred from the contract, or indicated in

writing by the Engineer.

Instructed/directed/permitted -Instructed/directed/ permitted by the Engineer.

Satisfactory - Capable of fulfilling or having fulfilled the intended function.

Service - Any pipeline, cable, duct etc. for conveying or transmitting any fluid or other matter.

Submitted - Submitted with the tender or submitted to the Engineer, as appropriate.

Tolerances:

Deviation - The difference between the actual (i.e., measured) size or position and the specified size or position.

Permissible deviation - The specified limit(s) of deviation.

Tolerance - The range between the limits within which a size or position must lie.

Measurement and Payment:

Bill/schedule - The bill/schedule of quantities.

Billed/scheduled rate - The unit rate or price entered in the bill/schedule at which the Contractor undertakes to execute the particular work or to provide the required material, article or service, or to do any or all of these things, as set out in the item concerned.

Billed/scheduled - Listed in the bill/schedule of quantities.

Fixed charge - A charge for work that is executed without reference to time.

Method-related charge - The sum for an item inserted in the bill by the Contractor when tendering, to cover items of work relating to his intended method of executing the Works.

Time-related charge - *A charge for work the cost of which, to the Employer, is varied in proportion to the length of time taken to execute the particular item scheduled.*

Value-related charge - A charge that is directly proportional to the value of the contract.

1.2 Contractor's Office & Accommodation

Various works defined under this item are for the provision and maintenance of the Contractor's office, camps, stores, equipment yard, and workshops. The structure of the buildings shall be adequate, rainproof, spacious, airy and hygienic with proper lighting and toilet facilities. The area shall be kept neat and clean. Any garbage or sewage shall be disposed at a location and in a manner approved by the Engineer.

Space allocated for storage of various materials such as cement, reinforcement steel, and petroleum products etc. shall be clearly separated to avoid contamination.

Petroleum products shall be stored and handled in a way that avoids contamination of ground water. Workshops shall be installed with oil and grease traps for the same purpose.

Written information shall be given to and approval taken from the Engineer regarding proper establishment and maintenance of such camps. Failure in compliance with Engineer's instructions in respect of overall standard will lead to reduction or withholding of any payment due to the Contractor.

The Contractor shall provide at his own expense adequate temporary accommodation and toilet facilities for his Workmen and keep the same in good conditions. This may be done to suit Site conditions with the approval of Project Engineer. The above-mentioned temporary structures shall be removed on the completion of Works at Contractor's own cost. All materials shall belong to the Contractor.

The Contractor shall make his own arrangement for the supply of electric power and lighting as

required for construction purpose.

The Contractor shall make his own arrangement for all internal and external telephones and other communication means deemed necessary for the Works.

The Contractor shall make his own arrangement for office equipment and other consumable for his use for the Works.

1.3 Office for Engineer

The contractor shall provide and maintain offices for the use of the Engineer and his staff if provided in the contract

1.4 Safety Measures

The Contractor shall be responsible for safety of all workmen and other persons entering the Works and shall at his own expense; where not stated otherwise take all measures, subject to the Engineer's approval, necessary to ensure their safety. Such measures shall include but not be limited to:

- Provision of safety and emergency regulations for fire, gas, and electric shock prevention, together with rescue operation plan
- Safe control of flowing water
- Provision and maintenance of suitable lighting to provide adequate illumination at place of work with appropriate spares and standby unit
- Provision and maintenance of safe, sound slings, pulleys, ropes, and other lifting device
- Provision of safe access to any part of the works.
- Provision of notices in local dialect temporarily or permanently during construction at locations likely to be used by the public. Placement of such notices shall depend on the existence of the nature of work in the vicinity. These notices shall be in addition to any other statutory requirements demanded of the Contractor

The Contractor shall submit a proposal with detailed safety and emergency measures for the Engineer's approval. When the proposal has been approved, English and Nepali version of the regulations shall be made available to all of his Employees and the Engineer.

The Contractor shall ensure that all his Employees are fully conversant with the regulations, emergency and rescue procedures etc. and shall enforce a rule that will instantly dismiss any employee committing a serious breach of such regulations.

1.5 Notice Boards

The Contractor shall erect notice boards (1.2 m x 1.8 m) at the site giving details of the Contract in the format and wordings directed by the Engineer. These boards shall be erected within 14 days after the Contractor has been given the Possession of Site

The Contractor shall not erect any advertisement sign board on or along the work. The board shall be removed by the Contractor by the end of the Defects Liability Period.

2. Temporary Facilities:

2.1 Provision of Temporary Services

When the rehabilitation or replacement of existing public utilities requires their temporary disconnection, the Contractor shall provide the affected users with temporary services in at least the same standard as the original services. For water supply he may install temporary lines or arrange for regular supply by tankers. When forced to disconnect existing sewers the Contractor shall install temporary pipes of adequate size to carry off sewage from any private sewer facilities cut off by construction work. Connections to temporary pipes shall be made immediately by the Contractor upon cutting off the existing facility. No sewage shall be allowed to flow from any severed facility upon the ground surface or into trench excavation. Pipes used in temporary sewers may be plastic or approved flexible material.

Upon completion of work the Contractor shall replace all severed connections and restore to operating order the existing sanitary facilities. The Contractor without approval of the Engineer shall operate no valve or other controls in public service facilities. All users affected by such operation shall be notified by the Contractor at least one hour before the operation and advised of the probable time when service will be restored.

2.2 Protection of Adjoining Property

The Contractor shall control the movement of his crews and equipment on right-of-way including access routes approved by the Engineer so as to minimize damage to crops and property and shall endeavor to avoid marring the lands. Ruts and scars shall be obliterated and damage to land shall be corrected and the land shall be restored as closely as possible to its original conditions before final taking-over of the Works.

The Contractor shall be responsible directly to the Employer for any excessive or avoidable damage to crops or lands resulting from his operations whether on lands adjacent to right-of-way or on approved access road and deductions will be made from payment due to the Contractor to cover the amount of such excessive or avoidable damage as determined by the Engineer.

2.3 Reinstatement upon Completion

Temporary facilities shall be provided by the Contractor, only for as long as required after which he shall dismantle and remove the same from their place of use as speedily as possible. The Contractor in his yard shall safely store re-usable components. The place of use shall be cleared and reinstated immediately to at least the condition existing before the temporary facilities were provided to the satisfaction of the Engineer.

2.4 Measurement and Payment

Unless otherwise provided in the contract, no separate measurement and/or payment shall be made for all materials and works required under this clause. All costs in connection with the work specified herein shall be considered to be included with other related items of the work in the BOQ. All provision of temporary services shall be covered by a provisional sum in the BOQ. The lump sum amounts indicated in BOQ shall be paid in pro-rata basis by dividing the total amounts by contract period in months. These payments will be incorporated in the interim certificates for payment.

2.5 Publicly And Privately Owned Services

- If any privately owned service for water, electricity, drainage, etc., passing through the site is affected by the works, the Contractor shall provide a satisfactory alternative service in full working order to the satisfaction of the owner of the services and of the Engineer before terminating the existing service.
- Drawing and scheduling the affected services like water pipes, sewers, cables, etc. owned by various authorities including Public Undertakings and Local Authorities included in the contract documents shall be verified by the Contractor for the accuracy of the information prior to the commencement of any work.
- Notwithstanding the fact that the information on affected services may not be exhaustive, the final position of these services within the works shall be supposed to have been indicated based on the information furnished by different bodies and to the extent the bodies are familiar with the final position. The Contractor must also allow for any effect of these services and alternations upon the works and for arranging regular meetings with the various bodies at the commencement of the contract and throughout the period of the works in order to maintain the required co-ordination. During the period of the works, the Contractor shall agree if the public utility bodies vary their decisions in the execution of their proposals in terms of program and construction, provided that, in the opinion of the Engineer, the Contractor has received reasonable notice thereof before the relevant alterations are put in hand.
- No clearance or alterations to the utility shall be carried out unless ordered by the Engineer.
- Any services affected by the works shall be restored immediately by the Contractor who must also take all measures reasonably required by the various bodies to protect their services and property during the progress of the works.
- The Contractor may be required to carry out the removal or shifting of certain services/utilities on specific orders from the Engineer for which payment shall be made to him. Such works shall be taken up by the Contractor only after obtaining clearance from the Engineer and ensuring adequate safety measures.

2.6 Insurance of works

- **Insurance of Works**
 - The Contractor shall take out Insurance for the Works from approved agency/institution staff if provided in the contract
 - Payments made to the agency/institution and stamp charges/duties incurred if any, by the contractor in compliance of the above work shall be paid from Provisional Sum included for the item in the BOQ after submission of the insurance document to the satisfaction of the Engineer.
- **Third Party Insurance**
 - The Contractor shall take-out Third-Party Insurance from an approved agency/institution staff if provided in the contract
 - Payments made to the agency/institution and stamp charges/duties incurred if any, by the Contractor in compliance of the above work shall be paid from the Provisional Sum included for the item in the BOQ after submission of the documents to the satisfaction of the Engineer.
- **Insurance of Contractor's Workmen and Employees**
 - The Contractor shall insure against such liability as stipulated in Conditions of Particular Application.
 - The cost for works under this Sub-Clause shall be covered by the Contractor's overhead included in unit rates of other items in the BOQ.

2.7 Environmental Protection Works

The environment has been defined to mean surrounding area including human and natural resources to be affected by execution and after completion of works.

The Contractor shall take all precautions for safeguarding the environment during the course of the construction of the works. He shall abide by all prevalent laws, rules and regulations governing pollution and environmental protection.

The Contractor shall prohibit employees from unauthorized use of explosives, poaching wildlife and cutting trees. The Contractor shall be responsible for the action of his employees.

The Contractor is expected to arrange and execute the Works in such a way that existing environmental conditions are not deteriorated. Borrow pits and dumping sites used by the contractor shall be reinstated at his own cost by grass and/or tree plantation.

Written instruction/approval must be given to seek from the Engineer regarding protection and reinstatement of environment throughout the Contract period. Failure in compliance with Engineer's instructions in respect of overall standard will lead to reduction or withhold of payment. Further, any serious deterioration in the environment including pollution attributable to Contractor as determined by the Engineer, may result in deduction of actual expenditures incurred in their reinstatement done through separate agency, from any money due to the Contractor.

Environmental protection works, among others, shall also include the following:

2.8 Borrow/Quarry Sites

The Engineer shall have the power to disallow the method of construction and/or the use of any borrow/quarry area, if in his opinion, the stability and safety of the works or any adjacent structure is endangered, or there is undue interference with the natural or artificial drainage, or the method or use of the area will promote undue erosion.

All areas susceptible to erosion shall be protected as soon as possible either by temporary or permanent drainage works. All necessary measures shall be taken to prevent concentration of surface water and to avoid erosion and scouring of slopes and other areas. Any newly formed channels shall be backfilled.

Borrows/quarries shall be located away from the population centers, drinking water intakes, cultivable lands and drainage systems. The cutting of trees shall be minimized. Temporary ditches and/or settling basins shall be dug to prevent erosion. The undesirable ponding of water shall be prevented through temporary drains discharging to natural drainage channels.

Earthworks operations shall be strictly limited to the areas to be occupied by the permanent works and approved borrow areas and quarries unless otherwise permitted by the Engineer. Due provision shall be made for temporary drainage. Erosion and/or instability and/or sediment deposition arising from earthwork operations not in accordance with the Specifications shall be made good immediately by the Contractor.

The Contractor shall obtain the permission of the Engineer before opening up any borrows pits or quarries. Such borrow pits and quarries may be prohibited or restricted in dimensions and depth by the Engineer where:

- (i) They might affect the stability or safety of the works or adjacent property;
- (ii) They might interfere with natural or artificial drainage or irrigation;

(iii) They may be environmentally unsuitable.

The Contractor shall not purchase or receive any borrow materials from private individuals unless the source of such materials has been approved by the Engineer. At least 14 days before he intends to commence opening up any approved borrow pit or quarry, the Contractor shall submit to the Engineer his intended method of working and restoration. These shall include but not be limited to:

2.9 Disposal of Spoil and Construction Waste

Materials in excess of the requirements for permanent works and unsuitable materials shall be disposed off in locations and in the manner as agreed with the Engineer. The locations of disposal sites shall be such as not to promote instability, destruction of properties and public service systems. Exposed areas of such disposal sites shall be suitably dressed and be planted with suitable vegetation.

The Contractor shall plan his works in such a way that there is no spillage of POL products to the surface or sub-surface water.

2.10 Provision and Maintenance of Camps, Offices, Stores, Equipment Yards

Various works defined under this item are related to provision and maintenance of camps for work person and employees, Contractor's site offices, stores equipment yards and workshops. These camps must be adequate, rain-proof, spacious, airy and hygienic with proper lighting and materials storage facilities. The area shall be kept neat and clean.

Space allocated for storage of materials such as cement, gabion wire, reinforcing wire etc. shall in general be damp-free, rain-proof and away from petroleum products storage.

Permission may be granted by the Engineer to erect suitable camps within the right of way free of charge, if such establishments do not cause obstructions to traffic, nuisance to works execution and adverse effect to the environment.

Written information must be given to and approval be taken from the Engineer regarding proper establishment and maintenance of such camps. Failure in compliance with Engineer's instruction in respect of overall standard will lead to reduction or withholding of payment.

2.11 Provision and Maintenance of Toilets

Provision of toilets for labour and employees shall be made to avoid public nuisance as well as pollution of water courses and air. The Contractor shall construct suitable septic tanks and/or soak pits along with room of pit-type latrines. Sufficient water must be provided and maintained in the toilets. Proper methods of sanitation and hygiene should be employed during the whole project duration.

2.12 Provision of Potable Water

The Contractor shall supply potable water along with commencement of work to Contractor's staff and work person both at camps and construction-sites. This arrangement shall be enforced to avoid proliferation and generation of various water borne diseases.

The Contractor shall inform the Engineer regarding sources, installation and operation of supply of potable water within a week after the supply is commenced.

2.13 Provision of First Aid/Medical Facilities

Provision of first aid/medical facilities shall be made along with commencement of work to provide quick medical service to injured/sick work person, and employees. Services shall also include on-the-way service and other arrangements required for taking them to the nearest hospital in case of emergency.

2.14 Hazardous Materials

The Contractor shall not store hazardous materials near water surfaces. The Contractor shall provide protective clothing or appliances when it is necessary to use some hazardous substances. High concentration of airborne dust resulting in deposition and damage to crops and water resources shall be avoided. The Contractor shall take every precaution to control excessive noise resulting in disruption to wildlife and human population.

Only controlled explosives methods shall be applied and used in construction works.

2.15 Reinstatement of Environment

The Contractor shall arrange and execute works as well as related activities in such a way that environmental conditions are reinstated. He may be required to carry out filling, removal and disposal works along with plantation of grass and trees as directed by the Engineer at his own costs at identified locations to reinstate environment.

Written instruction/approval shall be given by/sought from the Engineer regarding reinstatement of environment both during and after completion of works and up to the end of Defects Liability Period.

Measurement and Payment

No separate measurement and payment shall be made for the works described in this Clause.

2.16 Survey And Setting Out

- During the period of Commencement of works the Contractor shall survey the construction area and confirm the levels. He shall immediately notify the Engineer of any discrepancies and shall agree with the Engineer any amended values to be used during the contract, including replacements for any stations missing from the original stations.
- The Contractor shall check, replace and supplement as necessary the station points and agree any revised or additional station details with the Engineer.
- All stations and reference points shall be clearly marked and protected to the satisfaction of the Engineer.
- The Contractor shall establish working Bench Marks tied with reference stations soon after taking possession of the site. The coordinates and the elevations of the reference stations shall be obtained from the Engineer. The working Bench Marks shall be near all major/medium structure sites. Regular checking of these Bench Marks shall be made and

adjustments, if any, got agreed with the Engineer and recorded.

- The Contractor shall be responsible for the accurate establishment of the centerlines based on the Drawing and data supplied. The centerlines shall be accurately referenced in a manner satisfactory to the Engineer. A schedule of reference dimensions shall be prepared and supplied by the Contractor to the Engineer.
- The existing profile and cross-sections shall be taken jointly by the Engineer and the Contractor. These shall form the basis for the measurements and payments. If in the opinion of the Engineer, design modifications of the centerlines and/or grade are advisable, the Engineer shall issue detailed instructions to the Contractor and the Contractor shall perform modifications in the field, as required, and modify the levels on the cross-sections accordingly.

2.18 As-Built Drawings

Such approved Working Drawings as have been selected by the Engineer shall be correctly modified for inclusion in the As-Built Drawings incorporating such variations to the Works as have been ordered and executed. Such drawings shall show the actual arrangement of all structures and items of equipment installed under the Contract. The Contractor shall submit 1 (one) reproducible copy and 3 (three) prints of all As-Built Drawings clearly named as such to the Engineer for approval before applying for the Taking-Over Certificate for the respective Section of the Works.

During the course of the Works, the Contractor shall maintain a fully detailed record of all changes from the approval to facilitate easy and accurate preparation of the As-Built Drawing. Irrespective of the other contractual prerequisites no Section of the Works will be considered substantially completed until the Engineer has approved the respective As-Built Drawings.

2.19 Photographs

The Contractor shall supply negatives and un-mounted positive color prints of photographs, of such portions of the works in progress and completed, as may be directed by the Engineer. The negatives and prints shall not be retouched. The negative of each photograph shall be the property of the Employer and shall be delivered to the Engineer with prints. No prints from these negatives shall be supplied to anyone without the written permission of the Engineer.

3. Notes About Measurement and Payment

3.1 Measurement

Unless specified, all measurements shall be based on "Principals of Measurement (Int.) for works of constructions." The tolerances specified in these Specifications are for evaluation of accuracies only based on which the work shall be accepted or rejected. However, the measurement of the work performed within the limits of tolerances shall be the measurement of actual work done in place, if their dimensions are less than what have been specified or instructed by the Engineer. If the actual work done in place is more than what has been specified or instructed by the Engineer, but within the limit of tolerances, the measurement shall be the measurement of the work what has been specified or instructed by the Engineer.

3.2 Payment

Unless specified in the contract, the contract unit rates and/or prices for items as set out in the Bill of Quantities are the full and the final compensation to the Contractor for:

- Supply of all materials necessary to complete the item as per relevant specifications;
- Use of materials, labours, tools, equipment, machines and other resources as per need;
- All handling, packing charges and transportation;
- Cost of supervision, quality assurance, temporary and ancillary works;
- Site commissioning;
- Maintenance and making good;
- All duties and obligations as set out in the contract
- general works such as setting out, clearance of site before setting out and after completion of works
- the preparation of detailed work program
- providing samples of various materials proposed to be used
- the detailed Design and Drawing of temporary works
- testing of materials
- any other details as required by the contract
- cost of all operations like storing, erection, moving into final position, etc. necessary to complete and protect the work till handing over to the Employer;
- the cost for safeguarding the environment
- All incidental costs, not covered under above stated.

Where the Bill of Quantities does not include the items mentioned in this Section, no separate payment shall be made for such works. The costs in connection with the execution of the works specified herein shall be considered to be included in the related items of other works specified in the Bill of Quantities or shall be considered to be incidental to the works specified. Items specified in this Section and included in the Bill of Quantities shall be paid at the contract unit rates as agreed and shown in the Bill of Quantities.

3.3 National Specifications

Certain Specifications issued by various national or other widely recognized bodies are referred to in these Specifications. Such Specifications shall be defined and referred to as National Specifications.

The Contractor may propose that the materials and workmanship be defined in accordance with the requirements of other equivalent National Specifications and he may execute the works in accordance with such National Specifications as may be approved by the Engineer. A copy of the National Specification, together with its translation into the English language if the National Specification is in another language, shall be submitted to the Engineer along with the request for its adoption.

In referring to National Specifications, the following abbreviations are used:

NS	Nepal Bureau of Standards and Metrology
IS	Indian Standards
ASTM	American Society of Testing and Materials
BS	British Standards
BSCP	British Standard Code of Practice
ISO	International Organization for Standardization
EN	European Norm
NFP	French Norm

Along with the commencement of the contract, the Contractor shall provide in his site office at least one complete set of all National Specifications referred to in these Specifications, if they are for the Sections applicable to the works. This set shall be made available for use by the Engineer.

3.4 Equivalency of Standards

Wherever reference is made in these Specifications to specific standards and codes to be met by the materials, plant, and other supplies to be furnished, and work to be performed or tested, the provisions of latest current edition or revision of relevant standards and codes in effect shall apply. Other authoritative standards which ensure a substantially equal or higher performance than the specified*, -standards and codes shall be accepted subject to the Engineer's prior review and approval. Differences between the standards specified and the proposed alternative standards shall be fully described by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event that the Engineer determines that such proposed deviations do not ensure substantially performance, the Contractor shall comply with the standards and codes specified. No payment shall be made for adoption of higher standards.

3.5 Units of Measurement, Abbreviations and Terminology:

Units of Measurement

The Symbols for units of measurement are used in these Specifications as they are given below.

M	micron = $m \times 10^{-6}$
mm	millimeter
m	meter
km	kilometer
sq. mm. or mm ²	square millimeter
sq.m. or m ²	square meter
sq. km. or km ²	square kilometer

cu. m. or m ³	cubic meter
lit or l	liter
kg	kilogram
g	gram = kgx10 ⁻³
mg	milligram = kg x 10 ⁻⁶
mg/l	milligram per litre
t	ton = kg x 10 ³
kg/m ³	kilogram per cubic meter
t/m ³	ton per cubic meter
N	Newton
N/m ²	Newton per square meter
Max	Maximum
Min	Minimum
ACV	Aggregate Crushing Value
BOQ	Bill of Quantities
CR	Crushing Ratio
dia	Diameter
hr	Hour
LS	Linear Shrinkage
MC	Moisture Content
MDD	Maximum Dry Density
min	Minute
no	Number (units), as in 6 no.
No	Number (order) as in No 6
OMC	Optimum Moisture Content
OPC	Ordinary Portland Cement
PI	Plasticity Index
PL	Plastic Limit
PM	Plasticity Modulus (PI x % passing 0.425 mm sieve)
POL	Petrol, Oil & Lubricant
ROW	Right of Way
SE	Sand Equivalent
sec	Second
SG	Specific Gravity
SI	International Standard Units of Measurements

Symbols of other units, if not covered above, shall be as per SI system set out in ISO 31/1.

Abbreviations

The following abbreviations are used in these Specifications.

SSS	Sodium Sulphate Soundness test, loss on 5 cycles
STV	Standard Tar Viscosity
TS	Tensile Strength
UC	Uniformity Coefficient
UCS	Unconfined Compressive Strength
VIM	Voids in Mix
w/c	Water cement ratio
wt	Weight
%	Percent

Terminology

The term "the Specifications" shall be construed as the Standard Specification and the Special Specification all together.

6. QUALITY CONTROL

6.1 Scope

This Section covers the Quality Control System and procedures, Quality Assurance Plan, program of tests, trials, and general procedures for acceptance as well as Laboratory arrangements and related facilities which are required for the selection and control of the quality of materials and workmanship.

6.2 Contractor Responsible for the Quality of the Works

All materials incorporated and all workmanship performed shall be strictly in conformity with the requirements of the Specifications and the Contractor shall be responsible for the quality of the works in the entire construction within the contract.

The Contractor shall provide, use and maintain on the Site, throughout the period of execution of the contract, a Laboratory with adequate Laboratory equipment operated by competent staff for carrying out tests required for the selection and control of the quality of materials and for the control of workmanship in accordance with these Specifications. The list of Laboratory equipment to be procured and Laboratory facilities to be provided shall be this specification. The Contractor shall assume that tests shall be required on all materials to be used in the works and on all finished works or part of works.

6.3 Quality Control System

The Quality Control System comprises the methods, procedures and organization for the Quality Control of the works. The Contractor shall implement the Quality Control System in the following sequences:

- a) Compliant testing for materials including Laboratory trials,
- b) Compliant testing for methods and equipment prior to the commencement of the work, including site trials or trials sections,
- c) Control testing during construction,
- d) Acceptant testing on completed works or parts of the works.

The Contractor shall carry out all necessary tests and shall report to the Engineer the results of such tests before submitting materials and/or finished works or part of works to the Engineer for approval in accordance with this Specification. In certain circumstances, tests may be carried out at the place of manufacture as per the Conditions of Contracts.

For satisfying himself about the quality of the works, quality control tests shall be conducted by the Engineer himself or by any other agencies deemed fit by the Engineer. Additional tests may also be conducted where in the opinion of the Engineer such tests are needed.

Before commencement of the work, the Contractor shall demonstrate a trial run of all construction equipment for establishing their capability to achieve the laid down Specifications and tolerances to the satisfaction of the Engineer.

The supply, testing and monitoring shall be in compliance with a Quality Assurance Plan and the provisions in the contract.

6.4 Quality Assurance Plan

The Contractor shall submit to the Engineer for his approval, the Quality Assurance Plan (QAP) which shall be based on the detailed Program of the Works.

The Quality Assurance Plan shall include the following:

- (1) The Quality Control Schedule Comprising of:
 - a) The recapitulative test schedule and testing program detailing the list of tests for compliance, Laboratory trials, site trials and trials Sections, construction control tests and their frequencies, tests for acceptance of the completed works with their dates.
 - b) Recapitulative list of "critical" acceptance testing procedures, for equipment or parts of the works which corresponds to the tasks on the Critical Path according to the construction Program.
 - c) Estimate of the number of tests to be carried out, list and number of appropriate equipment to conduct them, list of tests to be conducted outside the site Laboratory, if any, identification of the outside Laboratory where proposed to carry out the test.
 - d) List of staff assigned to the Laboratory, their position and responsibilities in the quality control procedures, their qualification and experience, general description and detailed organization of the Laboratory activities.
- (2) The list of sources of materials and/or of manufactured articles, their main characteristics, their identification mode as provided by the supplier when required; the program of supply and procurement of material and/or manufactured articles in accordance with the Program.
- (3) The list of tests and quality control procedures to be implemented by the Sub-contractors, if any, pointing out the "critical" acceptance testing procedures relating to the Sub-contracted works, which correspond to the tasks on the Critical Path included in the Sub-contracted works.

The Contractor shall implement the Quality Control in compliance with the approved QAP.

The Engineer's approval of the QAP shall not relieve the Contractor from his responsibility of the quality of the Works as per the Conditions of Contract and these Specifications nor shall the Engineer's approval of the QAP exempt the Contractor of any procedure to inform the Engineer in writing or request for the Engineer's approval or re-approval as specified in the Conditions of Contract and/or in these Specifications

The Contractor shall monitor and update the QAP on the basis of the decisions taken at the periodic review meetings or as directed by the Engineer and in accordance with the program of the works and the Conditions of Contract.

6.5 Testing Procedures and Set Of Tests

For ensuring the quality of the work, the materials and the workmanship shall be subjected to testing in accordance with procedures, sets of tests and frequencies as specified in respective Sections of these Specifications. The specified testing frequencies are not restrictive. The Engineer shall direct for the tests to be carried out as frequently as deemed necessary that the materials and workmanship comply with their Specifications.

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

6.6 Laboratory Trials to Confirm Compliance with Specifications

Concrete

Laboratory trials for concrete mixes shall be carried out by the Contractor to demonstrate that the composition of the mixes proposed for the concrete meets the requirements of the Specifications.

The compositions of concrete mixes which meet the specified requirements and are accepted by the Engineer shall be then used in the site trials carried out.

7.6. Site Trials or Trials Sections

7.6.1 Concrete

Site trials for concrete mixes shall be carried out by the Contractor to demonstrate the suitability of his mixing equipment. During the site trials, compliance with the Specifications for weighing equipment, storage of ingredients, means of transport for concrete, placing, compaction and curing shall be checked by the Engineer.

During the site trial a full-scale sequence including placing and compaction of concrete shall be carried out on a part of the works which will represent particular difficulties due to the presence of reinforcement, obstructions or others.

The Contractor shall allow in his program for conducting the site trials and for carrying out the appropriate tests, including the time required to obtain compressive strength test results at 28 days. The Contractor shall inform in writing the Engineer at least two weeks before the date he proposes to use the concrete mixes in the site trials with all relevant data including the trial program, the results of the Laboratory trial test for the proposed concrete mixes and compliance tests results of all constituents i.e. cement, aggregates, water and admixtures, if any.

7.6.2. Other Works and Equipment

Site trials for Pre-stressed Concrete Works, Painting of Structural Steelwork etc. are detailed in the relevant Sections of these Specifications.

Approval of the Engineer to a set of data recorded in a site trial shall not relieve the Contractor of his responsibilities to comply with the requirements of these Specifications

7.6.3. Control Testing During Construction

Quality Control procedure is detailed in the relevant Sections of these Specifications

7.6.4. Acceptance Tests for Completed Works or Part Of Works

Acceptance tests for other works and equipment are detailed in the relevant Sections of these Specifications.

7.6.5. Recapitulative Schedule of Tests

The tests to be carried out and their frequency for the quality control of the works are detailed in the relevant Sections of these Specifications.

The following Table recapitulates the testing schedule for the main types of works.

7.6.6. Testing Schedule

Part or component of the works	Tests	Frequency
Concrete Materials	cement: acceptance tests: Control tests: chemical composition physical properties aggregates: acceptance tests: Control tests: Grading Silt & clay content	Conservative samples for each supply and not less than every 200t or part of it. testing in case of noncompliance of the mixes or storage on site for longer than 1 month each delivery and every 100 t or part of it for fine aggregate and 250 t or part of it for coarse aggregate As frequently as required.
	Concrete • lab. Trials • site trials • control tests compressive strength	early works: every 6 m3 of each class. When compliance is established: every 20 m3 or part of it.
	Reinforcement:	
Brickworks for structures Materials mortar	quality of bricks quality of cement and sand control tests compressive strength of mortar	as required every 10 m3 of brick work or part of it.
Masonry for structures materials Mortar	quality of cement and sand control tests compressive strength of mortar dismantling of masonry (1 m_1 m)	as required every 10m3 of masonry of part of it every 30m3 of masonry or part of it

7.7. Sampling and Testing of Material away From Site

Some tests on construction material shall be conducted periodically off the site at reputable institutions as directed by the Engineer.

The frequency of tests shall be developed in the Quality Assurance Plan that shall also prescribe test results and reporting formats. However, some details on the tests are listed tentatively below.

7.8 List Of Tests To Be Conducted Off-Site Tests

(Locations subject to the approval of the Engineer)

S.No.	Description of Tests
1.	UTM Tensile Test for Re-bar
2.	Los Angeles Abrasion Test for Aggregate
3.	Specific Gravity of Aggregates

The tests listed above are subject to the Contractor's Quality Assurance Plan approved by the Engineer. The Engineer shall also determine the number of tests while executing the Works.

7.9. Payment

Payment will be made from the Provisional Sum set aside for the purpose and shall be full and final compensation for all material, labour, and equipment to complete the works as specified.

7.10. Survey and Setting

All traverse stations and reference points shall be clearly marked and protected to the satisfaction of the Engineer.

The Contractor shall provide the Engineer with all necessary assistance for checking the setting out, agreement of levels and any other survey or measurement which the Engineer needs to carry out in connection with the Works during the entire period of Contract. Such assistance shall include:

- Provision of suitably qualified surveyors to work under the direction of the Engineer as required.
- Provision of all necessary support for these surveyors including assistants, chainmen, labour, survey equipment (theodolite, levels, etc.), hand tools, pegs, and other incidental material.

The survey equipment shall be of the quality approved by the Engineer.

7.11 Use of the Contractor's Temporary Works

Unless otherwise specified under the Contract, the Contractor shall allow the Employer, the Engineer or the Nominated Subcontractor the use of temporary access, crossings and other Temporary Works at site insofar that such use is related with the Works.

7.12 Reports

The Contractor shall prepare and submit Progress Report on a monthly basis. The Reports shall highlight the targeted and achieved progress, problems at site, and brief description of the claims during the month and the Engineer's response, and other information relevant to the Project.

On completion of the Works, the Contractor shall prepare and submit a Completion Report that shall deal comprehensively on all aspects covered in the Monthly Report. Additional information such as improvement in construction methods/techniques, lessons learnt from the Project, important considerations for maintenance, etc. should also be highlighted.

7.13. Site Diary

The Contractor shall keep Site Diaries wherein full details of the work carried out during each day shall be fully recorded. The diaries shall be available for inspection by the Engineer any time during normal office hours. The Site Diaries shall include:

- Weather Conditions, rainfall/snowfall, and river water level
- Description, quantity, and location of work performed
- Shifts and working hours
- Number and category of workers working at site
- Plant in use and idle, or broken down
- Test carried out and results
- Inspection carried out by the Engineer
- Site instructions
- Visitors
- Accidents

7.14 Measurement and Payment

The cost for these works shall be covered by the Contractor's overhead included in unit rates of other items in the BOQ.

7. MATERIALS AND TESTING OF MATERIALS

7.1 Quality Of Materials

The materials supplied and used in the works shall comply with the requirements of these Specifications. They shall be new, except as provided elsewhere in the contract or permitted by the Engineer in writing. The materials shall be manufactured, handled and used skillfully to ensure completed works to comply with the contract.

8.2. Sources Of Materials

The use of any one kind or class of material from more than one source is prohibited, except by written permission of the Engineer. Such permission, if granted, shall set forth the conditions under which the change may be made. The sources or kinds of material shall not be changed without written permission of the Engineer. If the product of any source proves unacceptable, the Contractor shall make necessary arrangements for the supply of acceptable material. Any claims for compensation associated with such arrangements or changes shall not be considered, unless the source of the unacceptable material is designated in the contract as a source of material.

8.3. Inspection And Acceptance of Materials

Final inspection and acceptance of materials shall be made only at the site of the work. The Engineer reserves the right to sample, inspect, and test the materials throughout the duration of the works and to reject any materials which are found to be unsatisfactory.

A preliminary inspection of materials may be made at the source for the convenience and accommodation of the Contractor, but the presence of a representative of the Engineer shall not relieve the Contractor of the responsibility of furnishing materials complying with their Specifications.

The representative of the Engineer shall have free entry at all times to those parts of any plant which concern production of the materials ordered.

8.4 Materials and Manufactured Articles

(1) Order for Materials and Manufactured Articles

The Contractor shall, before placing any order for materials and manufactured articles for incorporation in the Works, submit to the Engineer the names of the firms from whom he proposes to obtain such materials and manufactured articles, giving for each firm a description of the materials and manufactured articles to be supplied, their origin, the manufacturer's specification, quality, weight, strength and other relevant details. The Contractor shall submit the samples of such materials and manufactured articles when

requested by the Engineer and when appropriate, manufacturer's certificates of recent test carried out on similar materials and manufactured articles shall also be submitted.

(2) Storage

All materials and manufactured articles shall be stored on site in a manner acceptable to the Engineer. The Contractor shall carefully protect all work, materials and manufactured articles from the weather and vermin.

(3) Test Certificates

When instructed by the Engineer, the Contractor shall submit to him all Test Certificates from the suppliers/manufacturers of the materials and/or manufactured articles to be used for the contract. Such certificates shall certify that the materials and/or manufactured articles concerned have been tested in accordance with the requirements of these Specifications. All Test results shall be enclosed along with such certificates. The Contractor shall provide adequate means of identifying the materials and/or manufactured articles delivered on the site with the corresponding certificates.

8.5. Defective Materials

All materials not conforming to the requirements of the contract shall be rejected whether in place or not. They shall be removed immediately from the site unless otherwise permitted by the Engineer. Even after rectification of the defects no rejected material shall be used in the work unless approved by the Engineer in writing. Upon failure of the Contractor to comply promptly with any order of the Engineer given under this Clause, the Engineer shall have authority to cause the removal and replacement of rejected material and to deduct the cost thereof from any monies due to the Contractor.

8.6. Trade Names and Alternatives

For convenience in designation in the contract, certain articles or materials to be incorporated in the work may be designated under a trade name or the name of a manufacturer and his catalogue information. The use of an alternative article or material which is of equal or better quality and of the required characteristics for the purpose intended shall be permitted, subject to the following requirements:

- (1) The proof as to the quality and suitability of alternatives shall be submitted by the Contractor. He shall also furnish all information necessary as required by the Engineer. The Engineer shall be the sole judge as to the quality and suitability of alternative articles or materials and his decision shall be the final and binding upon the Contractor.
- (2) Whenever the specifications permit the substitution of a similar or equivalent material or article, no tests or action relating to the approval of such substitute material shall be made until the request for substitution is made in writing by the Contractor accompanied by complete data as to the equality of the material or article proposed. Such request shall be made well in advance to permit approval without delaying the work.

8.7. Foreign Materials

Materials which are manufactured, produced or fabricated outside Nepal shall be delivered at a

point in Nepal as specified in the contract where they shall be retained for a sufficient time to permit inspection, sampling, and testing. The Contractor shall not be entitled to an extension of time for acts or events occurring outside Nepal and it shall be the Contractor's responsibility to deliver materials obtained from outside Nepal to the point of delivery in Nepal. The Contractor shall supply the facilities and arrange for testing required at his own cost. All testing by the Contractor shall be subject to witnessing by the Engineer.

If the welding of steel for structural steel members or the casting and pre-stressing of pre-cast pre-stressed concrete members is to be performed outside of Nepal, the following requirements shall apply:

- (1) Such fabrication shall be performed only within the plants and by fabricators who have previously established, to the satisfaction of the Engineer, that they have the experience, knowledge, trained manpower, quality control, equipment and other facilities required to produce the quality and quantity of the work required. At the option of the Engineer, prequalification of the plant and fabricator shall be established either by the submission of detailed written proof thereof or through in-plant inspection by the Engineer or his representative, or both.
- (2) The Contractor shall make written application to the Engineer for approval for such foreign fabrication at the earliest possible time and in no case later than 60 calendar days in advance of the planned start of fabrication. The application shall list the specific units or portion of a work which shall be fabricated outside of Nepal.
- (3) The Contractor shall advise the Engineer, in writing, at least 20 calendar days in advance of the actual start of any such foreign fabrication.
- (4) All documents pertaining to the contract, including but not limited to, correspondence, tender documents, working drawings and data shall be written in the English/Nepali language and all numerical data shall use the metric system of units of measurement.

8.8. Definition of General Types of Materials

The following definitions shall apply to materials in this Section and other relevant Sections.

- (1) "Topsoil" shall mean the top layer of soil that can support vegetation. It shall include all turf acceptable for turfing.
- (2) "Suitable Material" shall comprise all that is acceptable in accordance with the contract for

use in the works {and which is capable of being compacted to form a stable fill having side slopes as indicated in the Drawing. The material used in fill (except rock fill) shall not contain rock fragments with dimensions of more than 75 mm.}

- (3) "Unsuitable Material" shall mean other than suitable material and shall include:
- (a) Material from swamps, marshes or bogs;
 - (b) Peat, logs, stumps, perishable material, organic clays;
 - (c) Material susceptible to spontaneous combustion;
 - (d) Material in a frozen condition;
 - (e) Clay of liquid limit exceeding 70 and/or plasticity index exceeding 45.
- Materials stated above in d), if otherwise suitable shall be classified suitable when unfrozen.
- (4) "Well Graded Granular Material" consisting of gravel and/or sand shall conform to relevant Clause.

8.9. Sieves

IS sieves shall be used for all tests. Based on IS-460 the standard sieves series shall be as follows:

125; 90; 75; 63; 50; 45; 40; 37.5; 31.5; 25; 22.4; 20; 19; 16; 12.5; 11.2; 10; 9.5; 8; 6.3 ;5.6; 4.75; 4.00; 2.8; 2.36; 2; 1.7; 1.4; 1.18; 1; 0.85; 0.71; 0.6; 0.5; 0.425; 0.400; 0.300; 0.250; 0.212; 0.180; 0.150; 0.125; 0.090; 0.075 mm.

8.10. Soils And Gravels

8.10.1. Sampling and Samples

Sampling of soils and gravels shall be carried out as specified or as directed by the Engineer. Samples shall be prepared for testing as indicated in IS 2720 part I, except that:

- a) The mass (in g) of a sample required for sieve analysis is about 400D, D being the maximum particle size (mm).
- b) Sample containing particles larger than 19 mm size shall be prepared for compaction and CBR tests as described hereunder, provided the proportion in weight of such particles is less than 30%:

An adequate quantity of representative material shall be sieved over the 50 mm and 19 mm sieve. The material passing the 50 mm sieve and retained on the 19 mm sieve shall be weighed and replaced with an equal mass of material passing the 19 mm sieve and retained on the 4.75 mm sieve. The material for replacement shall be taken from the remaining portion of the main sample. When preparing gravel samples, the aggregations of particles shall be broken with a wooden or rubber hammer or pestle. Care shall be taken that no individual particles are crushed in the operation.

8.11. Stone, Aggregate, Sand and Fillers

(1) Sampling and Preparation of Samples

Sampling shall be carried out as per ASTM-D75 and the samples shall be prepared in accordance with IS 2386 or according to sampling procedures specified for the Standard

Methods of testing given in following Table.'

(2) Standards Methods of Testing

Tests on stone, aggregate, sand and filler shall be performed in accordance with the standard procedures given in the following tables.

Tests Procedures Applicable to Stone Aggregate and Fillers'

	Tests	Test Procedure	
	Determination of:		
i)	Particle Size Distribution (Gradation)	IS 2386	Parti
ii)	Crushing Strength of stone	IS 2386	Part 4

8.12. Cement

Ordinary Portland Cement (OPC), Portland Pozzolana Cement (PPC) shall be sampled according to IS 3535 and tested according to IS 4031.

Chemical and physical requirements for Ordinary Portland Cement and Portland Pozzolana Cement shall be in accordance with IS 269, IS 1489 respectively.

The requirements on their physical characteristics shall be:

8.12.1. Requirements on the Physical Characteristics of Cement

S.N.	Physical characteristics	OPC/PSC	Test Procedure
i)	Fineness, m ² /kg: (by Blaine's Air Permeability method)	225	IS-4031 Part 2
ii)	Setting Time:		IS 4031 Part 5
	(a) Minimum Initial Setting Time (minutes)	45	
	(b) Maximum Final Setting Time (minutes)	600	

iii)	Compressive Strength:		IS 4031 Part 6
	Minimum Average Compressive Strength of three mortar cube(N/mm ²)		
	(a) 3 days	22	
	(b) 7 days	29	
	(c) 28 days	43	

8.13. Concrete

Sampling and testing on concrete shall be carried out in accordance with the standard methods given:

8.13.1. Tests Procedures Applicable to Concrete

S.No.	Tests	Test Procedures
	<i>Determination of:</i>	
(i)	Air contents of fresh concrete	BS 1881-106
(ii)	Density of hardened concrete	BS 1881-114
(iii)	Compressive strength of concrete cubes	BS 1881-116
(iv)	Tensile splitting strength	BS 1881-117
(v)	Flexural strength	BS 1881-118
(vi)	Compressive strength of concrete cores	BS 1881-120
(vii)	Water absorption	BS 1881-122

The test specimens shall be cured at a temperature of $27^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Water to be used in concrete shall be tested as specified in BS 3148.

8.14. Reinforcing Steel

All reinforcement for use in the Works shall be tested in a Laboratory acceptable to the Engineer and two copies of each test certificate shall be supplied to the Engineer. The sampling and frequency of testing shall be as set out in the NS 84-2042 and NS 191-2045.

8.15. Paints For Structural Steelwork

The Contractor shall submit the proposal to the Engineer about the paint system to be used in the Works.

The system shall be defined at least by the following information, supported by the paint manufacturer's data sheets:

- Type of system, composition of each component,
- Minimum thickness of each coat,
- Drying time at 10°C and 20°C within a range a relevant hygrometric condition, including handling conditions, minimum and maximum time of overlap,
- Type of painting method and thinner content, (airless spray, brush, roller etc.)
- Thinner type,
- Blending ratio,
- Maximum time limit of use, by 75% of relative humidity and for a relevant range of temperature and hygrometric conditions,
- Ripening time for a relevant range of temperatures and at least for 20°C and 30°C .

- Weather conditions constraint for painting and drying, including minimum and maximum ambient temperature and temperature of surfaces to be painted.

8.16. Bricks

Bricks shall conform to NS-1-2035 with the exceptions specified

8.17. Mortar

Mortar shall comply with relevant Sub-clause.

8. CONCRETE WORK

9.1. Definitions

Structural concrete is any class of concrete which is used in reinforced, pre-stressed or un-reinforced concrete construction which is subject to stress.

Non-structural concrete is composed of materials complying with the Specification but for which no strength requirements are specified and which is used only for filling voids, blinding foundations and similar purposes where it is not subjected to significant stress.

9.2. Materials For Concrete

(1) General

The Contractor shall submit to the Engineer full details of all materials which he proposes to use for making concrete. No concrete shall be placed in the works until the Engineer has approved the materials of which it is composed. Approved materials shall not thereafter be altered or substituted by other materials without the consent of the Engineer.

(2) Cement

Cement shall be free flowing and free of lumps. It shall be supplied in the manufacturer's sealed unbroken bags or in bulk. Bagged cement shall be transported in vehicles provided with effective means of ensuring that it is protected from the weather.

Bulk cement shall be transported in vehicles or in containers built and equipped for the purpose.

Cement in bags shall be stored in a suitable weatherproof structure of which the interior shall be dry and well-ventilated at all times. The floor shall be raised above the surrounding ground level not less than 30cm and shall be so constructed that no moisture rises through it.

Each delivery of cement in bags shall be stacked together in one place. The bags shall be closely stacked so as to reduce air circulation with min gap of 500mm from outside wall. If pallets are used, they shall be constructed so that bags are not damaged during handling and stacking. Stack of cement bags shall not exceed 8 bags in height. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stacks.

Cement from broken bags shall not be used in the works. Cement in bags shall be used in the order in which it is delivered.

Bulk cement shall be stored in weather proof silos which shall bear a clear indication of the type of cement contained in them. Different types of cement shall not be mixed in the same silo.

The Contractor shall provide sufficient storage capacity on site to ensure that his

anticipated program of work is not interrupted due to lack of cement.
Cement which has become hardened or lumpy or fails to comply with the Specification in any way shall be removed from the Site.

All cement for any one structure shall be from the same source as far as possible.
All cement used in the works shall be tested by the manufacturer. The manufacturer shall provide the results of tests as given in following tables for each supply and for the last six months of his production. The Contractor shall supply two copies of each certificate to the Engineer.

9.2.2.1. Test Results for Physical Properties of Cement

Characteristics	Requirements	Nominal	Mean	Min	Max	St. Dev.
Fineness, M2/KG : (by Blaine's Air Permeability Method)	225					
Minimum Setting time (initial), min	45					
Maximum Setting time (final), min	600					
Soundness (by. Le Chatelie method) mm, maximum	10					
Minimum Average Compressive Strength of three mortar cubes, (N/mm2)						
3 days	27*					
7 days	37*					
28 days	53*					

*denotes the requirements of High Strength Portland cement.

Each set of tests carried out by the manufacturer on samples taken from cement which is subsequently delivered to site shall relate to no more than one day's output of each cement plant.

(3) Fine Aggregate

Fine aggregate shall be clean hard and durable and shall be natural sand, crushed gravel sand or crushed rock sand complying with IS 383. All the material shall pass through a 4.75 mm IS sieve and the grading shall be in accordance with IS 383. In order to achieve an acceptable grading, it may be necessary to blend materials from more than one source. The deviation from the initial fineness modulus shall be no more than ± 0.30 for ordinary concrete and ± 0.20 for high quality concrete.

However, in respect of the presence of deleterious materials the fine aggregate shall not contain iron pyrites, iron oxides, mica, shale, coal or other laminar soft or porous materials or organic matter unless the Contractor can show by comparative tests on finished concrete as per the direction of the Engineer, that the presence of such materials does not affect the properties of the concrete.

(4) Coarse Aggregate

Coarse aggregate shall be clean hard and durable crushed rock, crushed gravel or natural gravel corresponding to the following classes:

Class A: Aggregate shall consist of crushed igneous or quartzite rock from an approved source.

Class B: Aggregate shall consist of crushed quarry rock other than Class A from an approved source.

Class C: Aggregate shall consist of natural or partly crushed gravel, pebbles obtained from an approved gravel deposit. It may contain a quantity of material obtained from crushing the oversize stone in the deposit provided such material is uniformly mixed with the natural uncrushed particles.

Class D: Aggregate shall consist entirely of crushed gravel. The crushed gravel shall be produced from material retained on a standard sieve having an opening at least twice as large as the maximum size of aggregate particle specified.

Class E: Aggregate shall consist of an artificial mixture of any of the above classes of aggregate. The use of Class E aggregate and the relative proportions of the constituent materials shall be approved by the Engineer.

Coarse aggregate shall be supplied in the nominal size called for in the contract and shall be of the grading as single sized aggregate or graded aggregate of nominal size 40 mm, 20 mm, 12.5 mm and 10 mm in accordance with IS 383.

(5) Testing Aggregates

(a) Acceptance Testing

The Contractor shall deliver to the Engineer samples containing not less than 50 kg of any aggregate which he proposed to use in the works and shall supply such further samples as the Engineer may require. Each sample shall be clearly labelled to show its origin and shall be accompanied by all information called for in IS 2386 Part 1 to 8. Tests to determine compliance of the aggregates shall be carried out by the Contractor in a laboratory acceptable to the

Engineer, if the tested materials fail to comply with the Specification, further tests shall be made in the presence of the Contractor and the Engineer. Acceptance of the material shall be based on the results of such tests.

All the materials shall be accepted if the results of not less than three consecutive sets of tests executed in accordance with IS 2386 (Part 1-8) show compliance.

b) Compliance Testing/Process Control Testing

The Contractor shall carry out routine testing of aggregates for compliance with the Specification during the period that concrete is being produced for the works. The tests set out below shall be performed on aggregates from each separate source on the basis of one set of tests for each day on which aggregates are delivered to site provided that the set of tests shall represent not more than 100 tons of fine aggregate and not more than

250 tons of coarse aggregate, and provided also that the aggregates are of uniform quality.

Grading:

IS 2386 Part 1

(6) Delivery and Storage of Aggregates

Aggregates shall be delivered to site in clean and suitable vehicles. Different type or sizes of aggregates shall not be delivered in one vehicle.

Each type or size of aggregate shall be stored in a separate bin or compartment having a base such that the contamination of aggregate is prevented. Dividing walls between bins shall be substantial and continuous so that no mixing of types or sizes occurs.

The storage of aggregates shall be arranged in such a way that drying out in hot weather is prevented in order to avoid sudden fluctuations in water content. Storage of fine aggregates shall be arranged in such way that they can drain sufficiently before use in order to prevent fluctuations in water content of the concrete.

(7) Water for Concrete and Mortar

Water shall be clean and free from harmful matter and shall comply with the requirements of IS 456.

9.3. The Design of Concrete Mixes

(1) Classes of Concrete

The classes of structural concrete to be used in the works shall be as shown on the Drawing and designated in following Table, in which the class designation includes two figures. The figures indicate the characteristic strength F_{ck} at 28 days expressed in MPa (N/mm²) and the second figure is the maximal nominal size of aggregate in the mix expressed in millimeters. Letter M in the class designation stands for Mix, letters SM stand for Special Mix.

9.3.1.1. Concrete Classes and Strength

Classes of concrete	Consistence	Type of uses	Characteristic Strength (f_{ck}) MPa (N/mm ²)	Maximum Nominal Size of Aggregate (mm)	Trial mixes Minimal Target Strength $f_{td}=1.1f_{ck}$ MPa (N/mm ²)	Early works test cubes	
						Any one result (aver, of 3 cubes) MPa (N/mm ²)	Average of 3 consecutive results MPa (N/mm ²)
M 10/75	S	Ordinary	10	75	11	10	14
M 10/40	S	Ordinary	10	40	11	10	14
M 15/20	S	Ordinary	15	20	16.5	15	19
M 15/40	S	Ordinary	15	40	16.5	15	19
M 20/20	S	Ordinary	20	20	22	20	24
M 20/40	S	Ordinary	20	40	22	20	24
M 25/20	S	Ordinary	25	20	27.5	25	29
M 25/40	S	Ordinary	25	40	27.5	25	29

(2) Design of Proposed Mixes

Concrete mixes shall comply with relevant Clause.

The Contractor shall design all the concrete mixes called for in the Drawing using the ingredients which have been approved by the Engineer in compliance with the following requirements:

- (a) The aggregate portion shall be well graded from the nominal maximum size of stone down to the 150-micron size.
- (b) The cement content shall be such to achieve the strength called for but, in any case, not less than the minimum necessary as shown in following Tables
- (c) The workability shall be consistent with ease of placing and proper compaction having regard to the presence of reinforcement and other obstructions.
- (d) The water/cement ratio shall be the minimum consistent with adequate workability but in any case, not greater than 0.5 for classes of concrete from M20 taking due account of any water contained in the aggregates. The Contractor shall take into account that this requirement may in certain cases require the inclusion of a workability agent in the mix.

(3) Laboratory Trial Mixes

For each mix of concrete for which the Contractor has proposed a design, he shall prepare the number of concrete batches specified hereunder:

- (a) The slump of the concrete shall be determined.
- (b) Six tests cubes shall be cast from each batch.
- (c) The density of all the cubes shall be determined before the strength tests are carried out.
- (d) All faces shall be perpendicular to each other.
- (e) Three cubes from each batch shall be tested for compressive strength at seven days and the remaining three at 28 days.

For "Smaller Contracts works", the following compositions are suggested as a starting basis for the Laboratory trials for one m3 of concrete:

Concrete Class	Characteristic Strength N/mm	Cement (kg)	Total aggregates (kg)	Fine aggr./ Total Aggr. (%)	Water (max) (lit.)	Workability
M 15/40-1	15	250	1900	35-45	160	Stiff-
M 15/20	20	300	1875	35-45	165-	Plastic
M 20/20					170	Stiff

A "result" being the average strength of the three cubes from one batch, the average of the three results from tests at 28 days for the nominal composition shall not be less than the Minimal Target Strength shown in the Table.

One result from the modified compositions shall not be less than the nominal strength as shown on Table above.

(4) Quality Control of Concrete Production

- (a) Sampling

For each class of concrete in production at each plant for use in the works, samples of

concrete shall be taken at the point of mixing or of deposition as instructed by the Engineer, all in accordance with the sampling procedures described in BS 1881 and with the further requirements set out below.

Six 150 mm or 200 mm cubes as appropriate shall be made from each sample and shall be cured and tested in accordance with BS 1881 three at seven days and the other three at 28 days. Where information samples are required, such as for post-tensioning operations, three additional cubes shall be made.

The minimum frequency of sampling of concrete of each grade shall be as following:

For 1-5 m ³ quantity of work	-	1 no. of sample
For 5-20 m ³ quantity of work	-	2 no. of sample
For 20 m ³ and more quantity of work	-	3 no. of sample plus one additional for each 20m ³ or part thereof.

At least one sample shall be taken from each shift of work.

9. DETAILED SPECIFICATIONS OF BUILDING WORKS (CIVIL)

item	Particulars	Detailed Specification
11. A. Site Preparation Works		
	General	<p>All material from site clearance shall be the property of the Employer and depending on its nature shall, as directed by the Engineer, be either</p> <ol style="list-style-type: none"> Stockpiled for future reuse. disposed by controlled burning. disposed by tipping or side casting with all lift within 30m. <p>Topsoil, referred to in this Clause shall mean the top 100 mm layer of soil with roots and organic matter, which is capable of vegetation support.</p>
1	Site cleaning	<p>Clearing shall consist of the cutting, removing and disposal of all trees, bushes, shrubs, grass, weeds, other vegetation, anthills, rubbish, fences, top organic soil not exceeding 150 mm in thickness and all other objectionable material, resulting from the clearing and grubbing. It shall also include the removal and disposal of structures that obtrude, encroach upon or otherwise obstruct the work.</p> <p>The moving of a certain amount of soil or gravel material may be inherent to or unavoidable during the process of clearing and no extra payment shall be made for this.</p>
2. Earth Works		
	Excavation	<p>Foundation trench shall be dug to the exact width and depth and levels as indicated in the drawings or to such lesser or greater extent as the Engineer may advice. Sides of trenches shall be vertical. In case the soil does not permit vertical sides, the Contractor shall protect side with timber shoring. Excavated earth shall not be placed within 1.5 meter of the edge of the trench. The Project Engineer may direct the Contractor to place excavated earth at a particular site up to 30 meters away from the building. The bottom of the trench shall be perfectly levelled both longitudinally and transversely. The bed shall be lightly watered and well- rammed</p> <p>Trenches shall be measured as per drawings and rate shall be for complete</p> <p>No excavation or foundation work shall be filled in or covered up before the inspection and approval of the Project Engineer.</p> <p>The starting level for excavation shall be deemed to be ground level or such level as may be specified by the Project Engineer, before the commencement of the Work.</p> <p>Measurement</p> <p>Measurement of all works will be made in m³.</p> <p>Measurement for payment under the contract will be limited to the lines, grades, slopes and dimensions shown on the Drawings or as determined by the Engineer as the work proceeds on the basis of his evaluation of the soil/rock characteristics and site-conditions set forth</p>

		<p>in the Clause.</p> <p>All required and accepted excavation shall be measured from its original position. The volume shall be determined in cubic meters by average area method to be computed from the original and final cross-sections of the completed works as per the drawings or as directed by the Engineer. Where it is not practicable to use the above method of measurement, the Engineer may use volumetric method or any other method that in his opinion is best suited for accurate assessment.</p> <p>Any over-excavation shall be reinstated at the risk and cost of the Contractor as directed by the Engineer.</p> <p>Payment</p> <p>Payment for work under these clauses will be made on the basis of contract unit price indicated in the BOQ.</p> <p>The payment will be full and final compensation for all material, labour, and equipment to complete the works as specified.</p>
	Backfill	<p>Backfill in Plinth of Building and Parking</p> <p>This work shall consist of filling for construction of embankment for plinth of building, road works and parking area and includes furnishing, placing, watering, compacting and shaping suitable material obtained from approved sources in accordance to lines, levels, grades, dimensions shown on the Drawings and or as required by the Engineer. Fill material used shall not exceed 150 mm and 75 mm within the 300 mm and 150 mm of formation level respectively. Fill material shall not have organic content value exceeding 5% and soaked CBR value less than 6% unless otherwise approved by the Engineer.</p> <p>Activities involved shall be preparation of surface, scarifying, supply, and laying of suitable material in layers. Except where material is laid close to the formation level, each layer shall not exceed 300 mm in thickness before compaction. Each layer of material shall then be watered and compacted to 95% dry density at optimum moisture content. Testing shall be carried out by sand cone using relevant BS or ASTM Standards.</p> <p>The top level of such fill executed shall be regarded as the formation level.</p> <p>Common Backfill In Structures</p> <p>Common backfill includes stacked suitable material recovered from excavations or material transported from outside. This may include granular material passing through 75 mm sieve or sandy soil. The backfill material shall be spread uniformly in layers, levelled, watered and then compacted to 95% of its optimum density in layers not exceeding 200 mm for buildings works and 250 mm for others. Compaction may be done manually or with mechanical</p>

		<p>means. Manual compaction in each layer will be done using 2 to 5 kg rammers made of cast-iron or wood. Mechanical compaction shall be executed with either plate compactors, earth rammers, depending on site conditions.</p> <p>Measurement Measurement will be based first in m³ of loose volume of accepted works with 35% deduction for voids for all leads indicated in the BOQ. The measurement will be made at the disposal site.</p> <p>Payment Payment for work under this Clause will be made on the basis of contract unit price indicated in the BOQ. The payment will be full and final compensation for all material, labour, and equipment to complete the works as specified.</p>
Masonry Works		
	General	<p>Mortar Mortar shall comply with IS 2250-1981; Code of Practice for preparation and use of masonry mortar. The mortar used in work shall have the strength not less than 5 N/mm² or 7.5 N/mm² at 28 days as specified. However, if provided in the Contract, cement and sand may also be mixed in specified proportions. Cement shall be proportioned only by weight, by taking its unit weight as 1.44 ton per cubic meter and sand shall be proportioned by volume after making due allowance for bulking.</p> <p>Mixing The mixing shall be done in a mechanical mixer unless hand-mixing is permitted by the Engineer. If hand-mixing is allowed, the operation shall be carried out on a clear watertight platform. in the required proportion cement and sand shall be first mixed dry to obtain an uniform colour. Then required quantity of water shall be added and the mortar shall be mixed to produce workable consistency. The mortar shall be mixed for at least three minutes after addition of water in the case of mechanical mixing. In the case of hand mixing, the mortal shall be hoed back and forth for about 10 minutes after addition of water in order to obtain uniform consistency. Only that quantity of mortar shall be mixed at a time which can be used completely before it becomes unworkable. Any mortar that has become unworkable due to loss of water before elapsing the initial setting time of cement shall be rewet to make it workable and shall be used in the works. On no account mortar shall be used after elapsing the initial setting time of cement.</p> <p>Soaking Of Bricks Bricks shall be soaked in water for a minimum period of one hour before use. When bricks are soaked they shall be removed from the tank sufficiently in advance so that at the time of laying they are skin dry. Such soaked bricks shall be stacked on a clean place where they are not spoilt by dirt, earth, etc.</p> <p>Laying Brickwork The brick shall be built in English bond with upwards facing frog in</p>

		<p>case of 230mm thick brickwork (for chimney made and fair faced machine made bricks both).</p> <p>The brick shall be built in running stretcher bond with upwards facing frog in case of half brick wall (for chimney made, traditional dachi appa brickwork and machine made both).</p> <p>Each brick shall be set with bed and vertical joints filled thoroughly with mortar. Selected bricks shall be used for the exposed brickwork. The walls shall be taken up truly plumb. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. Vertical joints in alternate course shall come directly over the other. The thickness of brick courses shall be kept uniform and for this purpose wooden straight edge with graduation giving thickness of each brick course including joint shall be used. Necessary tools comprising of wooden straight edge, masons sprit level, square, foot rule, plumb, line and pins etc. shall be frequently and fully used by the masons to ensure that the walls are taken up true to plumb, line and levels.</p> <p>All the connected brickwork shall be carried up nearly at one level and no partition of work shall be raised more than one meter above the rest of the work. Any dislodged brick shall be removed and reset in fresh mortar.</p> <p>Before commencing any brickwork, the Contractor shall confer with other trades to ensure that all pipes, conduits, drains, sleeves, bolts, hangers, or any other materials necessary to be installed in the brickwork at the time it is built, have been fixed or provided for.</p> <p>Joints</p> <p>Bricks shall be laid that all joints are full of mortar. The thickness of joints shall be not more than 10mm. The face joints shall be raked to a minimum depth of 7mm by a raking tool during the progress of the work when the mortar is still green, so as to provide proper key for the plaster or pointing to be done. Where plastering pointing is not to be done, the joints shall be struck flush and finished at the time of laying. The face of brickwork shall be kept cleaned and mortar dropping removed.</p> <p>Openings</p> <p>Openings in brickwork for air conditioning ducts, exhaust fans, grills pipes etc. shall be provided at the time of laying brickwork without any extra cost.</p> <p>After installation of piping, conduits, grills, etc. all openings left around pipes, conduits, grills etc. shall be checked and caulked with cement mortar to render the whole work vermin proof and tidily finished.</p> <p>The rates quoted are deemed to be inclusive of closing such pre-determined openings including erection and dismantling of scaffolding if required, the placing of inserts, collars, grills etc. to be paid separately under respective items.</p> <p>Curing</p> <p>Green work shall be protected from rain by suitable covering. Masonry work in cement mortar shall be kept constantly moist on all faces for a minimum period of seven days. The top of the masonry work shall be left flooded with water so as not to disturb or washout the green mortar.</p>
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Concrete Works		

	General	<p>Mixing Concrete</p> <p>Concrete for the works shall be batched and mixed in one or more plants or concrete mixer unless the Engineer agrees to some other arrangement. If concrete mixers are used, there shall be sufficient number of mixtures including stand by mixers.</p> <p>Batching and mixing plants shall be complying with the requirements of IS 1791 and capable of producing a uniform distribution of the ingredients throughout the mass. Truck mixers shall comply with the requirements of IS 4925 and shall only be used with the prior approval of the Engineer. If the plant proposed by the Contractor does not fall within the scope of IS 1791 it shall have been tested in accordance with IS 4634 and shall have a mixing performance within the limits of IS 1791.</p> <p>All mixing operations shall be under the control of an experienced supervisor.</p> <p>The aggregate storage bins shall be provided with drainage facilities arranged so that the drainage water is not discharged to the weigh hoppers. Each bin shall be drawn down at least once per week and any accumulations of mud or silt shall be removed.</p> <p>Transportation Of Concrete</p> <p>The concrete shall be discharged from the mixer and transported to the works by means which shall prevent adulteration, segregation or loss of ingredients, and shall ensure that the concrete is of the required workability at the point and time of placing. The loss of slump between discharge from the mixer and placing shall be within the tolerances.</p> <p>The capacity of the means of transport shall not be less than the full volume of a batch.</p> <p>The time elapsing between mixing transporting placing and compaction altogether of a batch of concrete shall not be longer than the initial setting time of the concrete. If the placing of any batch of concrete is delayed beyond this period, the concrete shall not be placed in the works.</p> <p>honey combing. It shall also be carefully worked round and between water stops, reinforcement, embedded steelwork and similar items which protrude above the surface of the completed pour. All work shall be completed on each batch of concrete before its initial set commences and thereafter the concrete shall not be disturbed before it has set hard. No concrete that has partially hardened during transit shall be used in the works and the transport of concrete from the mixer to the point of placing shall be such that this requirement can be complied with.</p> <p>Concrete shall not be placed during rain which is sufficiently heavy or prolonged to wash mortar from coarse aggregate on the exposed faces of fresh concrete. Means shall be provided to remove any water accumulating on the surface of the placed concrete. Concrete shall not be deposited into such accumulations of water.</p> <p>In dry weather, covers shall be provided for all fresh concrete surfaces which are not being worked on. Water shall not be added to concrete for any reason.</p> <p>When concrete is discharged from the place above its final deposition, segregation shall be prevented by the use of chutes, down pipes, trunking, baffles or other appropriate devices.</p> <p>Forms for walls shall be provided with openings or other devices that will permit the concrete to be placed in a manner that will prevent</p>
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		<p>each place where concrete is being placed.</p> <p>Vibration shall be continued at each point until the concrete ceases to contract, air bubbles have ceased to appear, and a thin layer of mortar has appeared on the surface. Vibrators shall not be used to move concrete laterally and shall be withdrawn slowly to prevent the formation of voids.</p> <p>The vibrators shall be inserted vertically into the concrete to penetrate the layer underneath at regular spacing which shall not exceed the distance from the vibrator over which vibration is visibly effective and some extent of vibration is overlapped.</p> <p>Vibration shall not be applied by way of reinforcement nor shall the vibrators be allowed to touch reinforcement, sheathing ducts or other embedded items.</p> <p>Coarse Aggregate As per item (4) page 31</p> <p>Fine Aggregate As per item (3) page 31</p> <p>Cement As per item (2) page 30</p> <p>Water As per item (7) page 33</p> <p>Tests Regular Slump test should be carried out to control the addition of water and to maintain required consistency.</p> <p>Curing Of Concrete General Concrete shall be protected during the first stage of hardening from loss of moisture and from the development of temperatures differentials within the concrete sufficient to cause cracking. The methods used for curing shall not cause damage of any kind to the concrete. Curing shall be continued for as long as may be necessary to achieve the above objectives but not less than seven days or until the concrete is covered by successive construction whichever is the shorter period. The above objectives shall be dealt with but nothing shall prevent both objectives being achieved by a single method where circumstances permit. The curing process shall commence as soon as the concrete is hard enough to resist damage from the process. In the case of large areas or continuous pours, it shall commence on the completed Section of the pour before the rest of the pour is finished.</p> <p>Loss of Moisture Exposed concrete surfaces shall be closely covered with impermeable sheeting, properly secured to prevent its removal by wind and the development of air spaces beneath it. Joints in the sheeting shall be lapped by at least 300 mm. If it is not possible to use impermeable sheeting, the Contractor shall keep the exposed surfaces continuously wet by means of water spray or by covering with a water absorbent material which shall be kept wet, unless this method conflicts with provisions of relevant Sub- clause. Water used for curing shall be of the same quality as that used for mixing.</p>
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		<p>and the desirability of staggering joints.</p> <p>Feather edges of concrete at joints shall be avoided. Any feather edges which may have formed where reinforcing bars project through a joint shall be cut back until sound concrete has been reached.</p> <p>The intersections of horizontal and near horizontal joints and exposed faces of concrete shall appear as straight lines produced by use of a guide strip fixed to the formwork at the top of the concrete lift, or by other means acceptable to the Engineer.</p> <p>Construction joints formed as free surfaces shall not exceed a slope of 20 per cent from the horizontal.</p> <p>The surface of the fresh concrete in horizontal or near horizontal joints shall be thoroughly cleaned and roughened by means of high-pressure water, and air jets or wire brush, when the concrete is hard enough to withstand the treatment without the leaching of cement. The surface of vertical or near vertical joints shall be similarly treated if circumstances permit the removal of formwork at a suitable time.</p> <p>Hand Mixed Concrete</p> <p>Concrete for structural purposes shall not be mixed by hand. Where non structural concrete is required, hand mixing may be carried out subject to approval of the Engineer.</p> <p>For making hand mixed concrete, cement, sand and aggregate shall be batched separately by volume or by weight as applicable. Mixing shall be done in masonry platform or sheet iron tray. Then cement and sand shall be mixed dry to uniform colour. The aggregate shall be stacked in a proper shape upon which cement sand mix shall be spread and whole mix shall be turned up and down to have uniform mix of all ingredients. Then water shall be added and shall be mixed to uniform consistency.</p> <p>For hand mixed concrete the specified quantities of cement shall be increased by 10% and not more than 0.25 cubic meters shall be mixed at one time. During windy weather precautions shall be taken to prevent cement from being blown away in the process of gauging and mixing.</p> <p>Measurement Concrete</p> <p>Concrete laid in place as specified in the Drawing or directed by the Engineer shall be measured in cubic meter separately for each class. No deduction shall be made in the measurement for:</p> <p>bolt holes, pockets, box outs and cast in components provided that the volume of each is less than 0.15 cubic meters;</p>
	Reinforcement	<p>Reinforcement as plain bars and deformed bars and steel fabric shall comply with the following Indian Standards.</p> <p>IS 1786 for high strength deformed steel bars and wires. IS 1566 for steel mesh fabric.</p> <p>IS 432 mild steel and medium tensile steel bars.</p> <p>All reinforcement shall be from an approved manufacturer and, if required by the Engineer, the Contractor shall submit the ISI certification mark or other test certificate from the manufacturer acceptable to the Engineer. The Contractor shall furnish all information as manufacturer's certificate, invoice, and other relevant details to ensure the quality of steel.</p> <p>The reinforcements shall have no crack, scale or rust or foreign particles that will destroy or reduce the bond. The bars shall be accurately bent and formed to the dimension indicated in the Drawings. The Contractor shall prepare bending schedules for each structure and calculate the</p>

		<p>weight of the reinforcement. The schedule of bars and the calculations shall be submitted to the Engineer for approval.</p> <p>Binding wire used to bind reinforcements shall be annealed galvanized binding wire of 20 gauges.</p> <p>The sampling and frequency of testing shall be as set out in the NS 84-2042 and NS 191-2045. All reinforcement not complying with the Specification shall be removed from site.</p> <p>Storage of Reinforcement</p> <p>All reinforcement shall be delivered to site either in straight lengths or cut and bent. No reinforcement shall be accepted in long lengths which have been transported bent over double.</p> <p>Any reinforcement which is likely to remain in storage for a long period shall be protected from the weather so as to avoid corrosion and pitting. All reinforcement which has become corroded or pitted to an extent which, in the opinion of the Engineer, will affect its properties shall either be removed from site or may be tested for compliance with the appropriate Indian Standard at the Contractor expense.</p> <p>Reinforcement shall be stored at least 150mm above the ground on a clean area free of mud and dirt and sorted out according to category, quality and diameter.</p> <p>Bending Reinforcement</p> <p>Unless otherwise shown on the Drawing, bending and cutting shall comply with IS 2502.</p> <p>The Contractor shall satisfy himself as to the accuracy of any bar bending schedules supplied and shall be responsible for cutting, bending, and fixing the reinforcement in accordance with the Drawing. Bars shall be bent mechanically using appropriate bar benders. Bars shall be bent cold by the application of slow steady pressure. At temperatures below 5°C the rate of bending shall be reduced if necessary to prevent fracture in the steel.</p> <p>Bending reinforcement inside the forms shall not be permitted except for mild steel bars of diameter less or equal to 12 mm, when it is absolutely necessary.</p> <p>After bending, bars shall be securely tied together in bundles or groups and legibly labelled as set out in IS 2502.</p> <p>Fixing Reinforcement</p> <p>Reinforcement shall be thoroughly cleaned. All dirt, scale, loose rust, oil and other contaminants shall be removed before placing it in position. If the reinforcement is contaminated with concrete from previous operations, it shall be cleaned before concreting in that Section.</p> <p>Reinforcement shall be securely placed and fixed in position as shown in the drawing or directed by the Engineer. Unless otherwise agreed by the Engineer, all intersecting bars shall be either tied together with not less than 1.6 mm diameter soft annealed iron wire and the end of the wire turned into the body of the concrete, or shall be secured with a wire clip of a type agreed by the Engineer.</p> <p>Spacer blocks shall be used for ensuring that the correct cover is maintained on the reinforcement. Blocks shall be as small as practicable and of a shape agreed by the Engineer. They shall be made of mortar mixed in the proportions of one part of cement to two parts of sand by weight. Wires cast into the block for tying in to the reinforcement shall</p>
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Formworks		

		<p>Form works shall include all temporary or permanent forms required for forming the concrete together with all temporary construction for their support.</p> <p>Form works shall be designed and erected by the Contractor so that concrete can be properly placed and compacted in a manner that the hardened concrete conforms to the required shape, position, and level subject to the specified tolerances and standards of finish. It shall be assembled with adequate nails and /or nuts and bolts. It shall consist of wooden boards, sheet metals, and any other suitable material that prevent loss of grout when the concrete is vibrated.</p> <p>Special care shall be taken to maintain the stability of the form works and the tightness of the joints particularly during concrete vibrating operations.</p> <p>The formworks shall be as specified in the BOQ with adequate ribs for the beam, column and slabs. The Engineer shall approve the material and position of any ties passing through the concrete. The whole or part of the tie shall be capable of being removed such that any remaining part shall be embedded in the concrete by at least the specified thickness for reinforcement cover. Any holes formed by removal of ties shall be filled with concrete or mortar of approved composition.</p> <p>Form works at top shall be provided where the slope of the formed surface exceeds one in four.</p> <p>Before each concrete operation commences, form works shall be cleaned of all rubbish and other foreign particles.</p> <p>Concrete operations shall not commence until the erected form works has been inspected and approved. The Contractor shall give at least 48 hours' notice for such inspection. On rejection for any reason, the Engineer shall require another 48 hours to inspect the rectified errors.</p> <p>The inside surface of forms shall be coated with an approved material to prevent the adhesion of concrete. Such material shall be applied strictly in accordance with the manufacturer's instructions and shall not come in contact with the reinforcement or anchors.</p> <p>Construction of Formwork</p> <p>Joints in formwork for exposed faces shall, unless otherwise specified, be evenly spaced and horizontal or vertical and shall be continuous in a regular pattern.</p> <p>All joints in formwork shall be water tight. Where reinforcement projects through formwork, the form shall fit closely round the bars.</p> <p>Formwork shall be so designed that it may be easily removed from the work without damage to the faces of the concrete. It shall also incorporate provisions for making minor adjustments in position, if required, to ensure the correct location of concrete faces. Due allowance shall be made in the position of all formwork for movement and settlement under the weight of fresh concrete.</p> <p>Surfaces at slopes less than 20° may be formed by screeding. Surfaces at slopes between 20° and 30° shall generally be formed if the Contractor can demonstrate to the satisfaction of the Engineer that such slopes can be screeded with the use of special screed boards to hold the concrete in place during vibration.</p> <p>Horizontal or inclined formwork to the upper surface of concrete shall be</p>
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		<p>adequately secured against uplift due to the pressure of fresh concrete. Formwork shall also be tied down or otherwise secured against floating within the body of the concrete.</p> <p>The internal and external angles on concrete surfaces shall be formed with fillets and chamfers of the sizes shown on the Drawing unless otherwise instructed by the Engineer.</p> <p>Supports for formwork may be bolted to previously placed concrete provided the type of bolt used is acceptable to the Engineer. If metal ties through the concrete are used in conjunction with bolts, the metal left in shall not be close to the face of the concrete by less than 50mm.</p> <p>Formwork shall not be re-used after it has suffered damage which is sufficient to impair the finished surfaces of the concrete.</p> <p>Where circumstances prevent easy access within the form, temporary openings shall be provided through the formwork for cleaning and inspection.</p> <p>Before any reinforcement is placed into position within formwork, the latter shall be thoroughly cleaned and then dressed with a release agent. The agent shall be either suitable oil incorporating a wetting agent, an emulsion of water suspended in oil or low viscosity oil containing chemical agents. The Contractor shall not use an emulsion of oil suspended in water nor any release agent which causes staining or discoloration of the concrete, air holes on the concrete surface, or retards the set of the concrete or affects the strength of concrete.</p> <p>In order to avoid colour differences on adjacent concrete surfaces, only one type of release agent shall be used in any one section of the works.</p> <p>In cases where it is necessary to fix reinforcement before placing formwork, all surface preparation of formwork shall be carried out before it is placed into position. The Contractor shall not allow reinforcement or pre-stressing tendons to be contaminated with formwork release agent.</p> <p>Before placing concrete all dirt, construction debris and other foreign matter shall be removed completely from within the placing area. Before concrete placing commences, all wedges and other adjusting devices shall be secured against movement during concrete placing and the Contractor shall maintain a watch on the formwork during placing to ensure that no movement occurs. If any movement noticed, the formwork shall be set right immediately.</p> <p>Removal of Formwork</p> <p>The Contractor shall give 24 hours' notice of his intentions to strike any form works. Forms shall be removed without shock vibrations or other damage to the concrete.</p> <p>Formwork shall be carefully removed without shock or disturbance to the concrete. No formwork shall be removed until the concrete has gained sufficient strength to withstand any stresses safely to which it may thereby be subjected.</p> <p>The minimum periods which shall elapse between completion of placing concrete and removal of forms are given in Table and apply to ambient temperatures higher than 10°C. At lower temperatures or if cement other than ordinary Portland are involved, the Engineer may instruct longer periods.</p> <p>Alternatively, formwork may be removed when the concrete has attained</p>
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		<p>the strength set out in Table provided that the attained strength is determined by making test cubes and curing them under the same conditions as the concrete to which they refer.</p> <p>Compliance with these requirements shall not relieve the Contractor of his obligation to delay removal of formwork until the removal can be completed without damage to the concrete.</p> <p>If the Contractor wishes to strip formwork from the underside of arches, beams and slabs before the expiry of the period for supports set out above, it shall be designed so that it can be removed without disturbing the supports. The Contractor shall not remove supports temporarily for the purpose of stripping formwork and subsequently replace them.</p> <p>As soon as the formwork has been removed, bolt holes in concrete faces other than construction joints which are not required for subsequent operations shall be completely filled with mortar sufficiently dry to prevent any slumping at the face. The mortar shall be mixed in the same proportions as the fine aggregate and cement in the surrounding concrete and with the same materials and shall be finished flush with the face of the concrete.</p> <p>After removal of the formwork, the date of casting of concrete shall be marked on the surface of related concrete by water proof paint/marker for estimation of curing time.</p> <p>Measurement</p> <p>Except as stated below, formwork shall be measured in square meter of formwork actually in contact with the finished face of the concrete. No deduction shall be made in the measurement for openings, pipes, ducts and the like, provided that the area of each is less than 0.50 square meters. Unless otherwise stated, if the volume or area of concrete has not been deducted when measuring the concrete, formwork to form box or the void shall not be measured.</p> <p>Formwork required for lean concrete, to form construction joints and shear keys for future concrete and other construction surfaces shall not be measured and the costs shall be included in the rates for other work.</p> <p>Formwork to contraction and expansion joints shall be measured in square meter on one face only. The rates shall include for the costs stated below and for forming recesses for sealant and channels for grout. The measurement of formwork is inclusive of the measurement for formwork finished surface, shoring, staging, scaffolding and other accessories required for erection and removal of the formwork.</p> <p>Payment</p> <p>The formwork shall be paid as per the contract unit rate. The rates for formwork shall include the cost of submission of details, transportation and use of all materials for formwork, erection including provision of supports, fillets and chamfers 75 mm and less in width, bolts, ties, fixings, cutting to waste, drilling or notching the formwork for reinforcement where required, working around pipes, ducts, conduits and waterstops, temporary openings, cleaning, dressing, removal of formwork, filling bolt holes and any remedial work including all incidental works required to complete the work as per Specification.</p> <p>The payment for unformed surfaces of concrete shall be deemed included in the contract unit rate of the relevant concrete</p>
Door and Windows		

	MS Roding in window frames	As specified and instructed by the Engineer-in-Charge and detailed working drawings, if any.
	UPVC doors and windows	<p>The Upvc work as scheduled and detailed shall be fabricated as per the Drawings. Fabricated Upvc work covered by this specification shall be supplied and installed by the well-known local Upvc fabricators or manufacturer as approved by the Engineer.</p> <p>Before placing any orders the Contractor shall state the name of the window manufacturer he has selected from the list of approved manufacturers. The nominated manufacturer shall not be changed without prior approval of the Engineer.</p> <p>Manufacture Upvc work shall be fabricated in accordance with the standard Manufacturer manual and as per the Drawings showing jointing details, hardware and extrusion profiles. It will be the Upvc fabricator's responsibility to ensure that all fabricated Upvc work is carried out in accordance with the Drawings. The frame and the rebate shall be a monolithic unit. All the members shall be free of stains and any damage. If any damage or defects during delivery or after fitting in position are found, the defects shall be rectified immediately or replaced at the Contractor's expense. The Contractor shall attach all necessary product and quality specification along with the quotation. All the frames and shutters shall be of the same color.</p> <p>Workshop Drawings The contractor shall arrange for the preparation of complete workshop drawings of all fabricated Upvc work and shall submit same to the Engineer for approval.</p> <p>Hardware Fittings Hinges, handles, knobs, locks, ball catchers, bolts, door stoppers, door closers, door spring adjustable shelf fittings and other hardware fittings for doors and windows shall be of the best quality and of the specified make and approved by the Engineer. The size number, make etc. shall be as per the hardware schedules as shown on drawings or BOQ.</p> <p>Measurements It shall be done in square meter of the area done.</p> <p>Rate Rate shall be for all labour and materials, accessories, all complete</p>
Flooring Works		
	Flat Brick Soling	The flat brick soling shall be made in foundation and floor. The brick laying/ soling shall be done over the 5cm sand filling in line and level. Each brick shall be laid separately and tamped firmly in place in the sand bed. Joints between bricks shall be filled with dry sand. On completion the surface shall be true to line and level with no part deviating from true line and level by more than 20mm. No mud on sand filling shall be allowed when level is not maintained in excavation.
	Stone soling	Refer to dry stone masonry
	Sand filling	Sand filling in floor shall be done with proper ramming in 23mm layers, after sprinkling with water and consolidating. Sand shall be free from rubbish, organic materials etc. Particular care shall be

	Concrete interlocking tiles	<p>The cement concrete interlocking tiles of approved shape size and color shall be provided in cement sand mortar. These shall be either pre-cast concrete blocks or cast-in-situ concrete. Cement sand mortar used for bedding and joint shall be in 1:4 ratio.</p> <p>Laying The tiles shall be laid on either concrete or compacted sand-gravel as indicated in the Drawing.</p> <p>In the case of cement sand base , it shall be 1 part cement; 4 parts sand and mixing shall be done as per specification for mortar mixing of brick masonry work laid to the dimensions, lines and levels shown in the Drawing and well compacted by ramming or other means. Before laying the foundation of lean concrete, the base shall be leveled and slightly watered to make it damp.</p> <p>In the case of sand gravel it shall consist of a material approved by the Engineer. The tiles shall then be laid out and bedded on 12 mm thick cement sand mortar of 1:4 ratios. The gaps between the block/slabs shall not be more than 12 mm and shall be filled with 1:4 cement sand mortar.</p> <p>Tests and Standard of Acceptance Concrete shall be tested in accordance with specification for concrete and shall meet the specified criteria. All tiles shall be laid true to the lines and levels shown on the Drawing or as instructed by the Engineer.</p> <p>Measurement The work shall be measured in square meter of the area. Concrete and/or sand-gravel foundation shall be measured in cubic meters. Excavation for foundation shall not be measured. It is deemed included in the measurement of the tiles.</p>
		<p>Payment The tiles measured as above shall be paid at the contract unit rate which shall be the full and the final compensation to the Contractor. Concrete and/or sand-gravel foundation shall be paid for separately, as provided under respective Sections of these Specifications.</p>
	Kota Stone flooring	<p>Kota stone: kota stone shall be of good quality having smooth, hard surface, regular in shape, size and of uniform thickness, of good appearance, and of sharp and square edges. It shall be free from cracks and other defects. Kota stone of uniform size with more than 30cm and the minimum length of 450mm to fit in the counter and floor. No small kota stone will be allowed except in the thin wall or skirting or the edges or unless specified by engineer. The kota stone shall be of minimum thickness of 20mm. The colour shall be as per the instruction of engineer or drawings. Sample of kota stone to be used shall be submitted to the Project manager and his approval should be taken before the bulk purchase. All the kota stone supplied shall conform to the approved sample in all respect.</p> <p>Proportion Base Course: 1 part cement; 2 parts sand and mixing shall be done as per specification for mortar mixing of brick masonry work</p> <p>Dressing Each Kota stone slab shall be machine cut to required size and shape as specified in the drawing and as instructed by engineer. All angles and edges shall be true and square and free from chippings and the surface</p>

		<p>shall be true and plane. The thickness of the stone shall be as specified in the drawing. No tolerance shall be allowed for thickness.</p> <p>The contractor shall ensure that no chisel marks are visible on the surface of the stone before fixing.</p> <p>Laying</p> <p>The base shall be made rough and watered and given a cement wash and then the mortar shall be laid in 20 mm. thick layers as per instruction of Engineer. After laying mortar, it should be levelled with wooden floats. Proper slope for draining wash water shall be provided as per instruction of the Engineer. And over this, kota stone should be laid; the joints should not be more than 3 mm. The joints should be painted with white cement slurry.</p> <p>Curing</p> <p>After about two hours of laying, the surface shall be covered with wet bags and kept wet and left undisturbed for two days.</p> <p>Finish</p> <p>Finally, when the surface is absolutely dry, oxalic acid powder shall be rubbed well on the surface with grinding machine with water, and this operation shall be repeated until the surface becomes perfectly smooth and glossy. The surface shall be rubbed with wax to give a glazing surface. White cement or colour cement shall be used in joint to have the required colour as per specified or as per instruction of Engineer. Care shall be taken that the floor is not left slippery and that ordinary wax is not used under any circumstances</p> <p>If required by the Engineer, the grinding and polishing shall be done by grinding machine in 3 operations, first grinding with machine fitted with coarse Carborundum stone, second grinding with medium grade Carborundum stone and final grinding with fine grade Carborundum stone.</p> <p>Measurement</p> <p>Measurement shall be in square meter of exact length and breadth (length and height in dado) of the floor. Rate shall include materials, mixing, laying, curing, finishing, grinding, polishing and labour etc., all complete.</p>
Plaster Works		
	General	<p>Plastering shall be started from top and worked down. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. Wooden screeds 75 mm wide and of the thickness of the plaster shall be fixed vertically 2.5 to 4 meters apart to act as gauges and guides in applying the plaster. The mortar shall be laid on the wall between the screeds using the plaster's float and pressing the mortar so that the raked joints are properly filled. The plaster shall then be finished off with a wooden straight edge reaching across the screeds. The straight edge shall be worked on the screeds with a small upward and sideways motion 50 mm or 75 mm at a time. Finally, the surface shall be finished off with a plaster's wooden float. Metal floats shall not be used.</p> <p>When recommencing the plastering beyond the work suspended earlier the edges of the old plaster shall be scraped, cleaned and wetted before plaster is applied to the adjacent areas.</p> <p>No portion of the surface shall be left out in a condition to be patched up later on.</p> <p>The plaster shall be finished to a true and plumb surface and to the</p>

	Plaster Works	<p>proper degree of smoothness as required by the Engineer.</p> <p>The average thickness of plaster shall not be less than the specified thickness. The minimum</p> <p>Thickness over any portion of the surface shall not be less than the specified thickness minus 3 mm.</p> <p>Any cracks which appear in the surface and all portions, which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and re-done as directed by the Engineer.</p> <p>The surface to be plastered shall be brushed clean mortar joints of brick masonry or hollow concrete walls or any other surface to be plastered shall be raked to a depth of approximately 12mm, and the surface brushed down with a stiff brush and thoroughly wetted. The surface shall be free of all dust, loose materials, grease etc.</p> <p>The mortar shall be first dry mixed, by measuring with boxes to required proportion, and then water added slowly and gradually and mixed thoroughly to uniform consistency.</p> <p>The thickness of the plaster shall not be less than 12 mm not more than 20mm. In case of plaster thicker than 20mm, it shall be built by two or more coats each coat not exceeding 12mm in thickness.</p> <p>Cement shall be as specified above.</p> <p>Sand shall be as before specified but shall be graded to a suitable fineness in accordance with the nature of the plaster, etc., in order to obtain the finish required.</p> <p>Lime for plastering shall be as before described in clause 414 and slaked and run at least four weeks before use.</p> <p>All other mixes shall be constructed in a like manner.</p> <p>Moist curing shall be accomplished by keeping the plaster uniformly damp by suitable means. Moist curing shall start during application and continue for not less than 7 days.</p> <p><u>Hacking</u></p> <p>Prices of all paving and plastering etc. shall include for hacking concrete ceilings, beams, floors etc., by approved means and for raking out joints of walls 12mm deep to form a proper key. Plastering on walls generally shall be taken to include flush faces of lintels etc., in same.</p> <p>Surfaces to be paved or plastered must be brushed clean and well wetted before each coat is applied. All cement plaster shall be kept continually damp in the interval between application of coats and for seven days after application of the final coat.</p> <p>Dubbing out where required shall be composed of similar material to that following.</p> <p>Partially or wholly set material will not be allowed to be used or re- mixed.</p> <p><u>Finish</u></p> <p>Care shall be taken to insure that finished plaster surfaces shall be plumb, square, straight and true to line.</p> <p>Generally, all screeds and paving shall be finished smooth, even and truly level (unless specifically required to falls and currents, etc.), and paving shall be steel troweled or floated.</p> <p>Rendering and plastering shall be finished plumb, square, smooth and even.</p> <p>All surfaces to be plastered shall be thoroughly wetted before any plastering is commenced and the Contractor shall allow in his prices for</p>
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		<p>dusting external angles with neat cement to give additional strength. No plastering will be allowed to take place until all chases for service have been cut, services installed and chases made good. On no account may finished plaster surface be chased and made good.</p> <p>All Work shall be to approval and any not complying with the above shall be hacked away and replaced, as directed, and at the Contractor's expense.</p> <p><u>Arises and Angles in Plastering</u></p> <p>All arises shall be clean and sharp or slightly rounded as directed including neatly forming miters.</p> <p>All making good shall be cut out to a rectangular shape, the edges undercut to form dovetail key and finished flush with face of surrounding plaster. All cracks, blisters and other defects must be cut out made good and the whole of the paving and plastering Work left perfect on completion.</p> <p>Screeds shall be in cement and sand (1:4) and rates shall include for thoroughly hacking, cleaning and soaking the receiving structure in water. No creed shall be laid on a dry structure in any circumstances. Where changes of floor finish occur they shall be divided by strips as specified.</p> <p>The Contractor's special attention is drawn to the fact that all screeds, immediately after the initial set has taken place, will be required to be continuously covered in water by the sand trap or other approved method for at least 10 days. Any screed panel that is found to be dry before the end of this period shall be removed at the discretion of the Project Engineer.</p> <p>Waterproofed external rendering shall consist of minimum 12mm cement and sand (1:4) rendering at the rate of 2.05 litre to 41 kgs of cement all in accordance with the manufacturer's instructions and finished perfectly true and even with a wood float.</p> <p><u>External Plastering and Rendering:</u></p> <p>Waterproofed External Plaster or Rendering work shall consist of minimum 12.5mm to 16mm as detailed in the Bill of Quantity with cement/ sand ratio 1:3 or 1:4 at the rate of 1/2 gallon to 90 lbs of cement all in accordance with the manufacturer's instructions and finished perfectly true and even with a wood float.</p> <p><u>Internal Plastering and Rendering:</u></p> <p>Internal Plastering or Rendering shall consist of minimum 12.5mm to 16mm as detailed in the Bill of Quantities with cement/ sand ration 1:3, 4 finished perfectly true and even with a wood float.</p>
11. J. Paint Works		

	<p>Distemper works</p>	<p>Washable distemper of required colour as approved by the Engineer shall be used, conform to IS: 427-latest revision. Before application of the distemper the shade shall be approved by the Engineer. The paint (SKK-Japanese, Nerolac, Berger or equivalent) shall be water based washable distemper as per NS, IS specification. Only fresh distemper shall be used, hard or set shall not be used.</p> <p>Preparation of Paint</p> <p>The washable distemper powder shall be stirred slowly in clean water using 0.6 litre of water per kg of distemper or as specified by the manufacturer. Warm water shall preferably be used. It shall be allowed to stand for at least 30 minutes (or if practicable over night) before used. The mixture shall be well stirred before and during use to maintain an even consistency.</p> <p>Distemper shall not be mixed in larger quantity than is actually required for one day's work.</p> <p>Preparation of Surface</p> <p>Before new work is distempered, the surface shall be thoroughly brushed free from mortar dropping and other foreign matter and sand papered smooth. New plaster surfaces shall be allowed to washable for at least six weeks before applying distemper.</p> <p>Pitting in plaster shall be made good with plaster of Paris mixed with the colour to be used. The surface shall then be rubbed down again with fine grade sandpaper and made smooth. A coat of distemper shall be applied over the patches. The patched surface shall be allowed to washable thoroughly before the regular coat of distemper is applied.</p> <p>Application</p> <p>For new work, the treatment shall consist of a priming coat of whitening followed by the application of two or more coats of distemper till the surface shows and even colour. For each coat, the entire surface shall be coated with the mixture uniformly with proper distemper brushes in horizontal strokes followed immediately by vertical ones, which together shall constitute one coat.</p> <p>The subsequent coats shall be applied only after the previous coat has dried. The finished surface shall be even and uniform and shall show no brush marks.</p> <p>Enough distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room, which cannot be completed the same day. After each day work, the brushes shall be washed in hot water and hung down to washable. Old brushes, which are dirty or caked with distemper, shall not be used.</p> <p>On plastered, POP surface (paint shall be prepared with sand papering), putting, and two coats of primer. The paint is applied in two coats of washable distemper with roller or brush. The surface should be properly cleaned and treated with water based primer as per manufacturer's specifications. Rectification of defects in plaster/POP with broken edges should be done by using a proper colour putty, paste as per manufactures specifications.</p> <p>The surface on which paint is applied shall become hard washable in 16 hours. The necessary single / multistage scaffoldings required for the work shall be provided as detailed out under coatings. The equipment,</p>
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		<p>roller or brush used on the work should be immediately washed with water to facilitate future use.</p> <p>Measurement</p> <p>Measurement shall be in square meters of the actual covered area of the paints. Nothing extra shall be allowed for painting any rough surface e.g. external sand - faced plaster or work in short width or surface in any shape. The rate shall include for two or more coats inclusive of materials, labour, scaffolding all complete.</p>
J4	Weather coat paint works	<p>Cement paint of required colour shall be of ready mixed type in sealed container of approved brand (Snowcem India Ltd., or equivalent brand or manufacture) r conforming to IS: 5410 - latest revision, approved by the engineer in sealed tins, shall be used. Before application of the cement paint the shade shall be approved the Engineer. It shall be procured either in 50 kg. Container or 25 kg. Container. All such container shall have unbroken seal with manufacturer's name and trade marks as well as a description of contents all clearly marked. Such paint shall be mixed and applied strictly in accordance with the manufacturer's instructions and with the approval of site In-charge. All materials shall be stored in dry place.</p> <p>Preparation of Paint</p> <p>Only fresh cement paint shall be used, hard or set paint shall not be used. The container shall be made loose by rolling and shaking the container before opening. Cement paint shall be mixed with water in two stages.</p> <p>First a paste shall be prepared by mixing 2 parts of cement paint powder with one part of water by volume and immediately this shall be thinned by adding another part of water to have uniform solution of consistency of paints. Care shall be taken to add the cement paint gradually to the water and not vice versa.</p> <p>The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer's instructions shall be followed meticulously.</p> <p>Cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken affecting flow and finish. The lids of cement paint shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities.</p> <p>Preparation of Surface</p> <p>Before application of paint all dust and foreign materials shall be</p>

		<p>removed from the surface by use of wire brush. All holes, cracks and abrasion shall be fill with plaster of Paris, properly prepared and applied and smoothed off to match adjoining surfaces. Any loose or uneven areas or any major cracks or defects in the concrete or plaster back ground shall be cut out and made good and the repairs allowed to dry thoroughly. Any efflorescence shall be removed by dry brushing The surface shall be allowed to run off.</p> <p>Application The fresh mixed paint shall be frequently stirred during application and no mixture (paint) shall be used after an hour of mixing. A vertical stroke with another horizontal stroke shall be termed one coat. Paint solution shall be applied to the surface with hair brushed/roller in a number of coats to get uniform finish. After the first coat of the paint has hardened, it shall be cured with water at least for 24 hours before the second coat is applied. Similarly required number of coats shall be given to get an even and uniform shade. It shall be kept damp at least for seven days. Sample of workmanship shall be approved by the Engineer prior to commencement of work.</p> <p>The final painted surface shall exhibit uniform and good finished appearance. Measurement shall being square meter of actual covered area. No extra shall be allowed for scaffolding, curing and painting corners, plaster strips etc.</p> <p>Measurement / Payment Measurement shall be in square meters of the actual covered area of the paint. Nothing extra shall be allowed for painting any rough surface e.g. external sand - faced plaster or work in short width or surface in any shape. The rate shall include for two or more coats inclusive of materials, labour, scaffolding all complete.</p>
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11. M. Metal, Fence and railing Works

		<p>Tubes shall be designated by their nominal bore. These shall be light, medium or heavy as specified depending upon the wall thickness. Tubes shall be clean finished and reasonably free from scale. They shall be free from cracks, surface flaws, laminations and other defects. The ends shall be cut clean and square with axis of tube, unless otherwise specified.</p> <p>Wall thickness of tubes used for construction exposed to weather shall be not less than 4 mm and for construction not exposed to weather it shall be not less than 3.2 mm where structures are not readily accessible for maintenance, the minimum thickness shall be 5 mm.</p> <p>Fabrication The component parts of the structure shall be assembled in such a manner that they are neither twisted nor otherwise damaged and be so prepared that the specified cambers, if any, are, maintained. The tubular steel work shall be painted with one coat of approved steel primer after fabrication. All fabrication and welding is to be done in an approved workshop.</p> <p>Straightening:- All material before being assembled shall be straightened, if necessary, unless required to be of curvilinear form</p>
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M11	Black Pipe Tubular Truss	<p>and shall be free from twist.</p> <p>Bolting: Washers shall be specially shaped where necessary, or other means, used to give the nuts and the heads of bolts a satisfactory bearing. In all cases, where the full area of the bolts is to be developed, the threaded portion of the bolt shall not be within the thickness of the parts bolted together and washers of appropriate thickness shall be provided to allow the nuts to be completely tightened.</p> <p>Welding: Where welding is adopted, it shall be as specified.</p> <p>Caps and Bases for Columns: The ends of all the tubes, for columns transmitting loads through the ends, should be true and square to the axis of the tubes and should be provided with a cap or base accurately fitted to the end of the tube and screwed, welded or shrunk on. The cap or base plate should be true and square to the axis of the column.</p> <p>Sealing of Tubes: When the end of a tube is not automatically sealed by virtue of its connection by welding to another member the end shall be properly and completely sealed. Before sealing, the inside of the tubes should be dry and free from loose scale.</p> <p>Flattened Ends: In tubular construction the ends of tubes may be flattened or otherwise formed to provide for welded. Riveted or bolted connections provide that the methods adopted for such flattening do not injure the material. The change of sections shall be gradual.</p> <p>Hoisting and Erection Tubular trusses shall be hoisted and erected in position carefully, without damage to themselves, other structure, equipment and injury to workman. The method of hoisting and erection proposed to be adopted shall be got approved from the Engineer-in-charge. The contractor shall however be fully responsible, for the work being carried out in a safe and proper manner without unduly stressing the various members. Proper equipment such as derricks, lifting tackles, winches, ropes etc. shall be used.</p> <p>Measurements The work as fixed in place shall be measured in running metres correct to a centimeter on their weights calculated on the basis of standard tables correct to the nearest kilogram unless otherwise specified. Weight of cleats, brackets, packing pieces bolts nuts, washers distance pieces separators diaphragm gussets, fish plates, etc. shall not be measured separately. No deduction shall be made for skew cuts.</p> <p>Rate The rate shall include the cost of labour and materials involved in all the operations described above including application of one coat of approved steel primer, i.e. red oxide zinc chrome primer.</p>
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