

**INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH
THIRUVANANTHAPURAM**

**Construction of Spillway Structure, Extraction well
and Site development works at IISER Campus,
Vithura- Balance works**

TECHNICAL SPECIFICATIONS

CIVIL WORKS

1.0 GENERAL

- 1.1 **The work shall be carried out in accordance with the Architectural Drawings,** Structural Drawings, all services drawings and other approved shop drawings. The Contractor is required to co-ordinate and co- relate all drawings and in case of any differences noticed the contractor shall immediately bring to the notice of the PMC/Engineer-in-Charge and shall obtain his final decision before proceeding with the concerned work.
- 1.2 Unless otherwise specified in the schedule of quantities, the rates for all items of work shall be considered inclusive of pumping out or bailing out water throughout the construction period. This shall include water encountered due to any reason whatsoever.
- 1.3 The work shall be executed and measured in metric units given in the schedule of quantities, drawings, etc., (FPS unit wherever given is for guidance only).
- 1.4 All stone aggregate and stone ballast shall be hard stone variety to be obtained from sources and quarries approved by the Engineer-in-Charge/PMC.
- 1.5 Coarse sand shall be obtained from sources to be got approved by the Engineer-in-Charge. Whenever required, the coarse sand shall be screened and washed to suit the requirement of the specification. Nothing extra shall be payable on this account.

- 1.6 The rates for all items, unless clearly specified otherwise shall include all inputs of materials, labour, T & P, taxes, duties, scaffolding, wastages, profit, overhead, watch & ward, all incidental charges and shall also cover all obligations of the Contract.
- 1.7 Care shall be taken to avoid or reduce to the absolute minimum any cutting and demolishing of masonry work constructed to carry services pipes etc. Where pipes are encased in the hollows of double walls the outer wall shall be constructed after the piping or conduit works are complete in all respects and tested. In case it is found absolutely necessary to cut for taking any services, the same shall be made good during finishing to the satisfaction of the Engineer without any extra payment.
- 1.8 All works shall be carried out as per the specification given in this document. For items/components not covered in this document CPWD specification shall be followed.
- 2.0 **DELIVERY, STORAGE AND HANDLING OF CHEMICALS**
- 2.1 All chemicals (Anti- termite, Epoxy, Polymer, Water Proofing Compound, Plasticizers, etc.) shall be procured in suitable packing in sealed containers and to be stored in a condition as recommended by the manufacturer.
- 2.2 All such material shall be got approved and documents deposited with the PMC/Engineer-in-Charge. However, the material shall be in the custody of the contractor. Day-to-day account of receipt, issue and balance shall be regulated by the Contractor and proper account shall be maintained at the site of works in the prescribed form which shall be submitted to the PMC. The originals of the challan/cash memos of the quantity of various chemicals procured shall be made available on demand and a copy deposited.
- 2.3 Empty container shall not be removed from site till the completion of the project .
- 2.4 Contractor shall follow all safety norms pertaining to handling/storage and application of chemicals. Necessary protective and safety equipment, hand gloves, goggles, etc. shall be provided to all the concerned worker/ staff.

3.0 STONE WORK

The hard rock obtained from excavation shall be properly stacked by the contractor **at site of work**. The hard rock obtained from excavation shall become property of contractor for which he will be charged @ Rs. 391/- per cum by the Employer. The measurement shall be recorded in MB and signed by the PMC, the Engineer and the Contractor. Nothing extra shall be paid for stacking and transport of such material to any destination as felt necessary by the Contractor, making the excavated rock suitable for use in required sizes and cleaning & sorting, if required, for use in any work. If the same is not suitable for use at the site the Contractor shall take it away from site on approval of the Engineer.

4.0 ENVIRONMENT PROTECTION

The following facilities shall be provided and maintained by the contractor at the site. No additional payment shall be made on this account unless otherwise provided for in the BOQ.

- 4.1 Provide sufficient level of sanitation / safety facilities for construction workers to ensure the health and safety of the workers during construction, with effective provision for the basic facilities such as sanitation, drinking water and safety of equipments/ machinery.
- 4.2 Identify roads on-site that would be used for vehicular traffic. Strengthen vehicular roads (if these are unpaved) by increasing the surface strength. This can be achieved by improving particle size, shape and mineral type that make up the surface base. Add surface gravel to reduce source of dust emission. Limit amount of fine particles (smaller than 0.075mm) to 10-20%. Limit vehicular speed on site 10km/h.
- 4.3 Ensure that water spraying is carried out by wetting the surface by spraying water on.
 - i) Any dusty material.

- ii) Areas where demolition work is carried out.
- iii) Any unpaved main road and
- iv) Areas where excavation or earth moving activities are to be carried out.

4.4 **Cover and enclose by**

- i) Providing dust screen, sheeting or netting to scaffold along the perimeter of a building.
- ii) Covering stockpiles of dusty material with impervious sheeting.
- iii) Covering dust emitting load on vehicles by impervious sheeting cover before they leave the site and.
- iv) Transferring, handling/storing dry loose materials like bulk cement and dry pulverized fly ash inside a totally enclosed area/system.

4.5 Adopt measures to prevent air pollution within and in the vicinity of the site due to construction activities. Best approved practices shall be followed (as adopted from international best practice documents and codes).

4.6 The contractor shall ensure that there will be adequate water supply/storage for dust suppression, devise and arrange methods of working and carrying out the work in such a manner so as to minimize the impact of dust on the surrounding environment and deploy suitable trained and experienced personnel to ensure that these methods are implemented. Prior to the commencement of any work, the method of working, plant equipment and air pollution control system to be used on-site shall be made available for inspection and approval of the Engineer-in-Charge to ensure that these are suitable for the project. The following steps shall also be taken:-

All dangerous parts of machinery shall be well guarded and all precautions for working on machinery are taken,

Maintain hoists and lifts, lifting machines, chains, ropes and other lifting tackles in good condition,

Use of durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained,

Ensure that walking surfaces or boards at a height are of sound construction and are provided with safety rails and belts. Provide protective equipment such as helmets.

Provide measure to prevent fire. Fire extinguisher and buckets of sand to be provided in fire-prone area and elsewhere.

Provide sufficient and suitable light for working during night.

Ensure that measures to protect workers from materials of construction, transportation, storage and other dangers and health hazards are taken.

Ensure that all agencies appointed by the Contractor the construction firm / division / company has sound safety policies.

Comply with the safety procedure, norms and guidelines (as applicable) as outlined in NBC 2005 (BIS 2005c).

Adopt additional best practices and prescribed norms as in NBC 2005 (BIS 2005).

Ensure that the vegetation is cleared only from the areas where work will start right away or area to be disturbed due to any sort of construction activity like for vehicular movement, stacking of materials, labour hutments, workshops etc. Vegetate / mulch areas where vehicles do not ply. Apply gravel / landscaping rock to the areas where mulching / paving is impractical.

Employ measures to segregate the waste on-site into 3 categories - inert, chemical or hazardous wastes. Recycle the unused chemical / hazardous wastes such as oil, paint, batteries and asbestos. The inert waste is to be disposed off at approved dump yard and landfill sites.

5.0 **PRESERVATION AND PROTECTION OF LANDSCAPE DURING CONSTRUCTION**

Following provision shall be made at the site by the contractor to preserve and protect landscape. Nothing extra shall be paid on this account unless specifically provided for in the BOQ.

- 5.1 Shall preserve the existing landscape and protect it from degradation during the process of construction to minimize the disturbance such as soil pollution due to spilling of the construction material and it's mixing with rainwater. The plan including soil erosion control management plan shall be prepared accordingly for each month and got approved from the Engineer-in-Charge. The application of erosion control measures includes construction of gravel pits and tire washing bays of approved size and specification for all vehicular site entry/ exists & protection of slopes greater than 10%. Sedimentation Collection System and run-off diversion systems shall be in place before the commencement of construction activity. Preserve and protect the existing vegetation by not-disturbing or damaging specified site areas during construction. The trees that are identified to be retained on site shall be protected during the construction period using the following measures :

- i) The damage to roots is prevented during trenching, placing backfill, driving or parking heavy equipments. The dumping of trash, oil, paint and other material is detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the trees.
- ii) The trees shall not be used for any vertical support and their trunks shall not be damaged by cutting and carving and by nailing posters and advertisements or in any other way.
- iii) The lighting of fires or carrying out heat or gas emitting construction activity within the ground covered by canopy of the trees is not permitted.

- iv) Young trees of saplings identified for preservation within the construction site shall be protected using tree guards of approved specification.
- v) The levels of soil around existing vegetation shall be retained. Lowering or raising the levels shall not be allowed unless specifically directed.
- vi) Maintenance activities shall be performed, as and when needed, to ensure that vegetation remain healthy.

5.2 A construction area shall be divided into two or more sections (staging) to minimize the area of soil that will be exposed at any given time. Staging shall be done to separate undisturbed land from land disturbed by construction activity and material storage. Measures shall be taken for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels and perimeter dike/swale shall be constructed to carry the pollutant laden water directly to the treatment device or facility. The plan shall indicate how the above was accomplished on site well in advance of the commencement of the construction activity.

5.3 Spill prevention and control plans shall clearly state measures to stop the source of the spill. Measures are to be taken to contain the spill and to dispose the contaminated material and hazardous wastes in approved manner. It shall also state the designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners and petroleum products.

5.4 A soil erosion and sedimentation control plan should be prepared by the contractor which shall be applied effectively. Measures for preservation of top soil shall be taken as described below:

Top Soil shall be stripped from the areas proposed for buildings, roads, paved areas and external services. It shall be stockpiled in designated areas and refilled during plantation of the proposed vegetation. The top soil shall be separated from the sub soil debris and stones larger than 50 mm in diameter. The stored top soil may be used for the finished grade for

planting areas post construction or cordoned off undisturbed areas on site. Stockpiled top soil should not be compacted to help process of aeration. It should be stabilized on the top by temporary seeding or plastic sheets to avoid wind and water erosion.

6.0 CEMENT

- 6.1 Unless otherwise specified or called for by the contract, cement shall be Portland Pozzolona Cement (IS : 1849) in 50 kg. bags. The use of bulk cement will be permitted only with the approval of the Engineer-in-Charge. Changing of brands or type of cement within the same structure shall not be permitted unless otherwise necessitated and approved by the Engineer-in-Charge.
- 6.2 Contractor will have to make his own arrangement for storage of adequate quantity of cement. Storage, handling, etc., of cement shall be as specified in CPWD specification.
- 6.3 Conformity of cement to IS specification is to be produced from the manufacturer by the contractor including manufacturer's test certificate. Should anytime, the Engineer-in-Charge has reason to consider that any cement is defective, then irrespective of its origin and or manufacturer's test certificate, such cement shall be tested immediately at a national / approved test laboratory and unless the results of such tests are found to be satisfactory, it shall not be used in the work. In case of such additional tests, the cost of testing shall be born by the contractor.
- 6.4 Cement brought to site and cement remaining unused at the completion of the work shall not be removed from site without the clearance from Engineer-in-Charge.
- 6.5 The record of cement received at the store, issued indicating the source of supply, brand name etc. and consumption shall be regulated and proper accounts maintained as per CPWD. The theoretical consumption of cement shall be worked out as per procedure.

7.0 STEEL

7.1 Contractor shall procure reinforcement bars (Fe 415 / Fe 500 / Fe 550) conforming to CPWD / BIS code. Manufacturer's test certificate as well as independent laboratory testing for samples as per BIS codes shall be provided. In case of non-conformity, the same shall be rejected and shall be removed from the site.

7.2 For checking nominal mass, tensile strength, yield stress, bend test, re-bend test, etc., specimen of sufficient length shall be cut at random at frequency as specified in the relevant IS code.

7.3 In case additional number of tests is required by the Engineer-in-Charge, the same may be ordered by the Engineer-in-Charge. In such case, the charges for the testing shall be born by the contractor / department in the manner indicated below :

- i) By the Contractor, if the results show that the steel does not conform to the specification.
- ii) By the Department, if the results show that the steel conforms to the specification.

7.4 The records of steel received at the store, issued to site of work, and consumption shall be regulated and proper accounts maintained as per CPWD. The theoretical consumption of cement shall be worked out as per procedure followed by CPWD.

8.0 CONCRETE AND RCC WORKS

The work in general shall be carried out as per the CPWD specifications.

8.1 CONCRETE

The concrete shall be procured from a Ready Mix Concrete Suppliers (plants) approved by the Engineer - in - Charge. Site batching plant produced concrete shall also be permitted on approval by the Engineer-in-

Charge. The mix design and other parameters of the RMC including transporting and placing etc. shall be strictly as per the latest **CPWD SPECIFICATIONS FOR CEMENT MORTAR, CEMENT CONCRETE AND RCC WORKS**, unless specified otherwise which shall be informed to the RMC supplier by the Contractor. The Contractor shall be wholly responsible for ensuring the property of concrete, as required at site, irrespective of the fact that the RMC plant/supplier /batching plant shall be approved by the Engineer-in-charge. Engineer-in-charge or his representatives shall be at liberty to inspect the operations, quality of various ingredient materials and take samples, if required, verify quantity of various ingredients being used at the RMC plant /batching plant and take samples of concrete at the RMC plant/batching plant and also at site, as desired. The Contractor shall satisfy himself that the quality of materials including various ingredients is as per the specifications. In case the aggregates tested do not comply with any requirement of specifications, the source for the same shall be rejected. The aggregates shall be stored in such a way as to prevent mixing with foreign material as well as intermixing amongst them. Different sizes of coarse aggregate shall be stored in separate compartment to prevent intermixing at the partition.

8.2 **BATCHING OF CONCRETE**

- i) Various ingredients of the plain cement concrete and Reinforced Cement Concrete shall be mixed by weigh batching only. The measuring equipments shall be maintained in clean and serviceable condition. The calibration certificate shall be made available from RMC supplier approved agency and calibration shall be subject to third party check also, as directed and decided by the Engineer-in-charge and this shall be mandatory and binding on the Contractor and his RMC supplier. The weigh batching shall be done by converting the proportion of ingredients into their masses considering their specific gravity, density, voids, absorption, bulking etc. The decision of Engineer -in- Charge in this regard shall be final and binding. The various grade of concrete to be used shall be as specified in item and as directed by the Engineer-in-charge.

The design mix for reinforced cement concrete shall be for 'MODERATE' exposure condition.

- ii) The Ready mix concrete plant / or site Batching plant should have the computerized weigh batching conforming to IS: 4925 with arrangement for automatic dosing of admixture and adequate production capacity. The minimum cement content in concrete shall be as specified in the relevant IS code.

8.3 CONCRETE TESTING

Samples from fresh concrete shall be taken as per IS: 1199. Random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested. At least one sample shall be taken from each shift of work. Samples of concrete for each batch shall have to be taken by the RMC supplier also tested and results submitted to the department for record. Procedure of testing, its acceptance criteria etc. shall be regulated in accordance with the Specifications.

8.4 TRANSPORTING

- i) The period between mixing of concrete and placing it in final position shall be kept to a minimum and the delivery of concrete shall be coordinated with the rate of placement, to avoid delays in delivery and placement. The concrete shall be supplied / transported through transit mixers and general construction of transit mixer and other requirements shall conform to IS: 5892.
- ii) Concrete shall be handled from the place of mixing to the place of final deposit by methods, which prevent segregation, or loss of any ingredients and contamination.
- iii) Where concrete is conveyed by chutes, the chutes shall be made of metal or fitted with metal lining. The approval of the Engineer-in-Charge shall be obtained for the use of chutes in excess of 3 metres long and in such cases the concrete shall be remixed if so required by the Engineer-in-Charge or closed bottom buckets shall be used.

If concrete is placed by pumping, the conduit shall be primed properly. Once pumping is started, it shall not be interrupted as far as possible. Concrete shall not be dropped in to place from a height more than 1.5m.

8.5 PLACING

- i) Concreting of any portion of the work shall be done in presence of the representative of the PMC/Engineer-in-Charge and shall be done only after approval.
- ii) Concrete can be laid using pumps, buckets, cranes, trolleys etc. as required as per the site conditions. However, nothing extra shall be payable on account of using any particular method of laying concrete.
- iii) Concreting shall be carried out continuously between construction joints shown on the drawings or as agreed by the PMC/ Engineer-in-Charge. The Contractor shall closely follow the sequence of concreting wherever it is specified in the drawings. If concreting is interrupted before reaching the predetermined joint an approved construction joint shall be provided. Construction joints shall be minimized as far as possible. The surface film of the first placed concrete should preferably be removed while the concrete is still green to expose the aggregate and leave a sound irregular surface. However care shall be taken not to disturb the concrete already laid.
- iv) Concrete shall be deposited as nearby as practicable in its position to avoid re-handling and shall not be dumped in large quantities at any point.

8.6 CURING

Moist curing using jute, canvas, hessian or similar materials may be adopted.

8.7 CONSTRUCTION JOINTS

Construction joints in PCC/RCC shall be provided only at places as per approved structural drawings. It shall not in any manner structurally or functionally affect the structure. If, any additional construction joint is required to be provided, it shall be done with approval of the Engineer-in-Charge/PMC.

8.8 MISCELANEOUS

- i) Cover blocks of same mix of concrete shall be used. No other type of cover blocks shall be permitted.
- ii) Cement slurry if added over base surface (or for continuation of concreting) for bond, its cost shall be deemed to have been included in the respective items, unless otherwise, explicitly stated and nothing extra shall be payable nor extra cement considered in the cement consumption on this account.
- iii) Centering and shuttering for concrete and reinforced concrete wherever required shall be in steel and / or plywood to produce a smooth and uniform finish on all exposed surfaces. However, all props, bracings, scaffolding etc., shall be in steel. The entire responsibility of planning, design, erection and safety of formwork shall lie with the Contractor.
- iv) The portion of shuttering in elevation (and not segmental) shall be measured for payment. For shuttering curved in elevation the steel / ply shuttering shall be fabricated to achieve the curved profile as per the architectural drawings.
- v) The crushed stone/ crushed gravel sand meeting relevant IS standards shall be permitted to be used in work subject to the approval by the engineer in charge.

9.0 STRUCTURAL STEEL WORK

9.1 Scope of Work

The work covered by this specification consists of supplying, fabricating and erecting structural steel complete in strict accordance with this specification and the applicable drawings.

9.2 Shop Drawings

The shop drawings of structural steel work based on construction drawings shall be prepared by the contractor and submitted to the Engineer in charge/PMC. Necessary information for fabrication, erection, painting of structure etc. must be furnished in advance

9.3 Painting

Painting shall be strictly according to I.S. 1477 (Part I - Pretreatment) and I.S. 1477 (Part II - Painting).

Painting should be carried out on dry surfaces free from dust, scale etc.

One coat of shop paint (Zinc Chromate) shall be applied on steel except where it is to be encased in concrete or where surfaces are to be field welded.

10.0 STAINLESS STEEL WORKS

10.1 Stainless Steel Frame Work and Hand Rail

Providing, fabricating and fixing in position stainless steel frame/hand rails stainless steel pipes, plates, flats, etc., as shown on drawing, description and as directed by the Engineer-in-Charge. The work shall also include cutting, welding, grinding, bending to required shape and profile, hoisting, buffing and polishing, cutting chase, embedding in masonry / concrete, rigidly fixed etc. all complete at all floors and levels. All railings shall be measured in running meter for a particular type.

10.2 **Testing of Material**

The stainless steel sections shall be tested in an independent laboratory as approved by the Engineer-in-Charge. One sample of each type of stainless section shall be tested for SS grade. This sample shall be selected randomly from site or factory / workshop. If the sample fails the tests, the material shall be rejected and removed from site by the contractor and replace with satisfactory material at his own cost. One sample for each lot shall be tested. The cost of testing and sample shall be borne by the contractor.

10.3 Stainless steel jali for door and window shall be made from SS grade 304.

11.0 **WATERPROOFING WORK**

11.1 **Waterproofing of Basement Raft and Wall**

i) **Raft**

The Sub-base concrete (lean concrete) to be rendered smooth with Cement: Sand Mortar (1 : 3) while it is still green.

Application of two coats of Acrylic polymer Modified Cementitious Slurry coating over the properly rendered surface.

Providing 12mm plaster in the ratio 1 : 4 (Cement : Sand) over the Acrylic polymer Modified Cementitious applied surface, to protect the Acrylic polymer applied surface against probable mechanical damage due to dragging of reinforcement while placing them.

Placing and fixing 12mm N.B.M.S. threaded Nozzles of 75mm length with dummy rod for maintaining the hole upto required depth in an approximate grid pattern at a spacing not exceeding 1.5 M c/c on the entire raft prior to or during concreting. Similar threaded Nozzles along with dummy rod shall also be fixed at a regular interval not exceeding 1.5 M apart along the construction

joints. Similar Nozzles shall also be post fixed at critical points, if required by drilling or making holes with suitable tools.

ii) Slab

Injection of NON- SHRINK POLYMERIC WATERPROOF GROUTING COMPOUND' admixed with Cement Slurry through the Nozzles under pressure by pump. The grout shall flow through all pores and voids thereby sealing them.

Sealing off the Nozzles after the injection operation is over with QUICK SETTING ADMIXTURE' admixed with cement wherever required.

After sealing the nozzles, the concrete surface to be cleaned from all debris, loose material, dust etc.

iii) Retaining Wall

Placing and fixing 12mm N.B.M.S. threaded Nozzles of 75 mm length in an approximate grid pattern in a spacing not exceeding 1.5 M c/c on the entire Retaining Wall after concreting by drilling or making holes with suitable tools upto required depth of the Wall. Similar threaded Nozzles shall also be provided at a regular interval not exceeding 1.5 M apart along the construction joints. Similar Nozzles shall also be post fixed at critical joints, if required by drilling or making holes with suitable tools.

Application of two coats of Acrylic Modified Cementitious Slurry Coating over the properly rendered external face of the Retaining Wall.

Providing 12mm thick plaster in the ratio 1:4 (Cement: Sand) on the external face of the retaining wall if backfilling is not done with Sand or Earth.

Injection of NON-SHRINK POLYMERIC WATERPROOF GROUTING COMPOUND' admixed with Cement Slurry

through the Nozzles already fixed under pressure by pump. The grout shall flow through all pores & voids thereby sealing them.

Sealing off the Nozzles after the grouting operation is over with QUICK SETTING ADMIXTURE' admixed with cement wherever required.

iv) Durability and Performance

The contractor shall furnish proof of durability of the system carried out based on long term performance as basement raft slabs and walls, will be completed in two stages. The adequacy of the system to meet the above requirement shall be established by the above said agency.

v) Precautions

All water proofing shall be adequately protected during the progress of work and shall be kept dry until it is covered up.

vi) Guarantee

The Contractor shall provide performance guarantee of the water-proofing system on non-judicial stamp paper of appropriate value in approved format to the Dept. through the Contractor for a period of ten years after completion of the relevant treatment.

In the event of unsatisfactory performance of waterproofing treatment work, the contractor shall undertake to the Dept., to carry out necessary remedial / rectification work to render the structure free from leakage/seepage of waterproofing including all associated works that may be necessary in the opinion of the Dept. at no extra cost.

The contractor shall also give a bank guarantee for an amount equal to 10% of the gross amount of water proofing item valid for a period of 10 years from the date of final completion. 50% of this

bank guarantee shall be released on satisfactory performance of waterproofing job for a period of 5 years and remaining amount of the bank guarantee shall be released on satisfactory performance for 10 years.