नॉर्थ ईस्टर्न इलेक्ट्रिक पावर कॉर्पोरेशन लिमिटेड
NORTH EASTERN ELECTRIC POWER CORPORATION LIMITED

भारत सरकार का उद्यम A Govt. of India Enterprise
मिनीरत्न : श्रेणी-I Miniratna : Category-I
एनटीपीसी लिमिटेड की पूर्ण स्वामित्व वाली सहायक कंपनी A wholly owned subsidiary of NTPC Ltd

ISO:9001, 14001 & 45001

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आज़ादी का अमृत महोत्सव

Corrigendum No.1 dated 03-10-2024

To

NIB No.452 dated 27-09-2024

Name of Work: Construction of approach road to Barrage site of Heo HEP from Tato-Menchukha road (Ch.0.00 KM to CH. 890.00 M), Shi Yomi District, Arunachal Pradesh".

Following corrigendum to the bid document is hereby issued:

Appendix-V: Model Quality Assurance Plan, mentioned in clause 46 of Part-4: Conditions of Contract of Bid document is attached herewith and included as a part of the Bid Document.

All other terms and conditions contained in the Bid Document shall remain unchanged.

3.10.24

Executive Director
Contracts & Procurement

NORTH EASTERN ELECTRIC POWER CORPORATION LTD

(A GOVT. OF INDIA ENTERPRISE)

ISO : 9001- 2015
ISO : 14001-2015
ISO : 27001-2013
ISO : 45001-2018

Construction of approach road to Barrage site of Heo HEP from Tato-Menchukha road (CH. 0.00 Km to Ch. 890.00 m), Shi Yomi District, Arunachal Pradesh.

APPENDIX- V : MODEL QAP

CONTENTS

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1.0 GENERAL :

The actions to be taken by an intending contractor to provide and document assurance in respect of quality of works that are proposed to be executed shall be in accordance with the contract documents and standards of good practice of construction works. The Quality Assurance Plan (QAP) of the contractor is therefore a documental assurance by the contractor based on the tender document namely the **Model QAP**. The documental assurance i.e. QAP of the contractor/ bidder prepared as per the requirement of model QAP of the tender documents shall be submitted by him along with his bid document.

The QAP of the contractor for the instant proposed contract shall therefore be to ensure that the execution of the work "**Construction of approach road to Barrage site of Heo HEP from Tato-Menchukha road (CH. 0.00 Km to Ch. 890.00 m), Shi Yomi District, Arunachal Pradesh."** under the scope of the Contract to be performed by the Contractor or his Sub-Contractor are in accordance with the national or international standards & specification of works. Cement, aggregate materials (CA & FA), HYSD bar reinforcement, Reinforced Cement Concrete Pipe NP2/ prestressed concrete pipe and water etc to be used for making mortar/concrete and all other construction materials shall be checked by the contractor for assessing the suitability of the materials prior to usage in construction works as per latest editions of BIS codes of practice.

Any material/s procured from vendor/s shall have its manufacturer's test certificate and shall be used only as per manufacturer's specification and approved methodology. Suitability of materials for a particular type of damage shall be ensured as this may lead to high cost and failure of repair, if the materials used are unsuitable. Care shall be taken during batching, mixing,proportioning, handling and placement of materials to ensure good quality control.

For such quality assurance, the Contractor shall adopt suitable Quality Assurance Programme / Plan (QAP) to control his activities at all points of execution process as necessary. Such plan / programme shall be outlined by the Contractor and shall finally be accepted and approved by the Corporation before finalization of the Contract.

The QAP of the Contractor shall generally cover the following:

a) Set-up at field execution site for the management and implementation of his proposed QAP dully approved by the Corporation.

b) Documentation of control system and process for records relating to requirements of quality system reviewed and approved for adequacy before use.

c) The procedure for purchase & procurement of all construction materials like cement, HYSD bar reinforcement, wire mesh, Reinforced Cement Concrete Pipe NP2/ prestressed concrete pipe etc.

d) Field Quality controls including execution process control supported by a FQAP (Field Quality Assurance Plan) to be accepted and approved by the Corporation.

e) The FQAP of the contractor shall therefore include the following:

- Checks on receipt of construction materials like cement, FA/CA, HYSD bar reinforcement, materials for WMM works, wire mesh, Reinforced Cement Concrete Pipe NP2/ prestressed concrete pipe etc as per actual requirement for completion of the works as per approved technical specification of works under the scope of the contract.
- Planning & checks for storage / buffer storage of construction materials.
- Testing & checks during execution of works.
- Detailed process for controlling non-conforming products / executed works and system for corrective works.

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2.0 Contractor's QA/QC duties:

The contractor's QA/QC duties are summarized in the table below. Apart from these, other duties shall be performed as per the contract documents or as directed by the Engineer-In-Charge for completion of the works as per technical specification of works. It is therefore essential to keep certain documents at site for making a permanent record of each and every items of the works related to the work. Such items may include test certificates, instructions issued to contractor, record of drawings issued to the contractor, inventory of the material at site. All such site documents as mentioned plays an important role in assuring the quality of the work. All these documents shall have a definite identification number.

Sl.No.	Activity / Item	Contractor's QA/QC Duties
1	Drawings for the Contract	• To use only approved drawings for constructionworks.
2	Material receipts & materials testing.	• To enter receipts in material register. • To use only approved mix proportions of concrete/Mortar. • To take test samples in presence of NEEPCO's representative when requested. • To perform material tests when requested. • To submit test reports to the EIC. • To maintain test log.
3	Rejected materials	• Entries to be made in material register at site. • To tag and record all rejected materials. • To intimate EIC in writing the proposed date of removal of such rejected materials from site and confirm after removal.
4	Material consumption	• To enter daily consumption of materials in material register and indicate balance quantity.
5	Rejected work items	• To intimate EIC in writing the proposed date of removal from site and confirm after removal. • To rectify defective work and invite EIC for re-inspection.
6	Daily Work Progress	• To maintain in daily log records.
7	Instruction from EIC or his	• To enter change orders, site instructions, letter and minutes

	representative	of meetings issued by the EIC in the Instruction Log.
8	Inspection of EIC or his representative	• To take instructions in Site Order Book. • To intimate EIC of compliance.
9	Work progress scheduling and control	• To prepare and maintain work schedules and undertake work in accordance with approved schedule.
10	Records	To maintain the following records on Site: • Site Order Book. • Material Register. • Daily Progress Report. • Test Records if any. • Drawing Records. • Non-conformity items record. • Others as per requirement of the contract.
11	Reporting	To prepare and submit Monthly Progress Reports and other reports as per contractual requirements.
12	Workmanship	All the work executed against the contract shall be of good workmanship.\
13	Disposal of debris	All the debris should be disposed of properly after completion of the work.

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3.0 Contractor's QA Compliance on approved QAP:

With his tender, the contractor shall submit his details for achieving quality in respect of all works included in the scope of work under this tender.

The contractor's proposal for FQAP shall be specific enough to assure that all works are executed in a professional manner. Within 7 days of award of works, the contractor shall prepare and submit **detailed QAP** along with his Field Quality Assurance Plan (FQAP) for obtaining approval of the Engineer-In-Charge. All works shall be executed based on approved QAP.

Quality and durability of the civil work depend on the workmanship during execution process. The aim of work is to provide strength and durability to the structure. For this, the workmen involved in execution shall have sufficient knowledge, skills and experience to perform the work. Work carried out shall be done in a manner such that the durability requirement is met. All these processes involved shall therefore be carefully supervised by experienced personnel. Well trained, competent workmen are particularly essential when specialized items are involved.

Selection of right procedures is essential to ensure that the qualitycontrol for which appropriate techniques are carefully performed. Wrong procedure and workmanship may lead to non-achievement of the desired objective.

One of the common problems that leads to premature failure of any civil work is improper curing, especially cementitious materials which cause early cracking.

The objective of quality control shall be clearly understood by the workmen in letter and spirit so as to achieve desired quality in executed works and to achieve high order of quality as laid down in specifications by controlling various factors responsible for deterioration in quality, investigating reasons there and suggesting ways and means for improvement.

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4.0 Types of inspection & QC tests & checks to be carried out:

GENERAL: All materials/fittings used in the work shall conform to the latest revision of the relevant Indian Standard Specifications to the extent practicable. Where no such specifications exist, they shall conform to relevant British Standard and /or shall be of the best quality available in the market. Wherever ISI certified materials and products are available these alone shall be used.

There are different types of civil works involved under the scope of the contract like, Excavation in Hill Area in Soil by Mechanical Means, Excavation in Hard Rock (controlled blasting), Plain/Reinforced cement concrete works, Gabian Structure/ Stone masonry work, Laying Reinforced Cement Concrete Pipe NP2/ prestressed concrete pipes, Wet Mix Macadam road works etc.

Following broad based general inspection & QC checks shall be carried out by the contractor during execution of the civil work under the scope of the contract in accordance with the approved technical specification & methodology of works as per contract documents of the civil work.

4.1 Clearing and Grubbing Road Land:

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

During clearing and grubbing, the Contractor shall take all adequate precautions against soil erosion, water pollution, etc., and where required, undertake additional works to that effect. Before start of operations, the Contractor shall submit to the Engineer-in-charge for approval, his work plan including the procedure to be followed for disposal of waste materials, etc., and the schedules for carrying out temporary and permanent erosion control works as stipulated. Only such methods, tools and equipment as are approved by the Engineer-in-charge and which will not affect any property to be preserved shall be adopted for the Work.

4.2 Excavation in Hill Area in Soil by Mechanical Means:

All excavations shall be carried out in conformity with the directions laid here-in-under and in a manner approved by the Engineer-in-charge. The work shall be so done that the suitable materials available from excavation are satisfactorily utilized as deemed fit or as approved by the Engineer-in-charge.

While planning or executing excavations, the Contractor shall take all adequate precautions against soil erosion, water pollution etc. as per Clause 306, and take appropriate drainage measures to keep the site free of water.

The excavations shall conform to the lines, grades, side slopes and levels shown on the drawings or as directed by the Engineer-in-charge. The Contractor shall not excavate outside the limits of excavation. Subject to the per mitted tolerances, any excess depth/width excavated beyond the specified levels/dimensions on the drawings shall be made good at the cost of the Contractor with suitable material of characteristics similar to that removed and compacted to the requirements.

All debris and loose material on the slopes of cuttings shall be removed. No backfilling shall be allowed to obtain required slopes excepting that when boulders or soft materials are encountered in cut slopes, these shall be excavated to approved depth on instructions of the Engineer and the resulting cavities filled with suitable material and thoroughly compacted in an appropriate manner.

After excavation, the sides of excavated area shall be trimmed and the area contoured to minimize erosion and ponding, allowing for natural drainage to take place.

Only such methods, tools and equipment as approved by the Engineer shall be adopted/ used in the work. If so desired by the Engineer-in-charge, the Contractor shall demonstrate the efficacy of the type of equipment to be used before the commencement of work.

4.3 Steel for Reinforcement:

All steel shall be procured from 'Original producers' who manufacture billets directly from iron ores and roll the billets to produce steel conforming to IS:1786. No re-rolled steel shall be incorporated in the works. However, in case the original producers give certificate that they are unable to supply the steel within the required time period or that they are not producing bars of the required diameter, the Engineer-in-charge may allow the procurement of steel from other suppliers, provided that the reinforcement is manufactured from billets procured from the original producers. In such cases, the manufacturer's certificate alone shall not be considered as sufficient and the steel shall be got tested by the Engineer-in-charge in the NABL accredited laboratories only, as a third party check. It shall be ensured that all the test results conform to IS:1786 requirements.

Only new steel shall be delivered to the site. Every bar shall be inspected before assembling on the work and defective, brittle or burnt bars shall be discarded. Bars with cracked ends shall be discarded.

For the steel procured from original producers also, the Engineer-in-charge / Employer may carry out occasional checks on materials through third party as mentioned above, for confirming the test results shown in the certificates, in case of any doubt regarding the quality of steel supplied.

Uncoated reinforcing steel shall be protected from rusting or chloride contamination. Reinforcements shall be free from rust, mortar, loose mill scale, grease, oil or paints. This may be ensured either by using reinforcement fresh from the factory or by thoroughly cleaning it using any suitable method such as sand blasting, mechanical wire brushing etc., as directed by the Engineer-in-Charge. Reinforcements shall be stored above the ground in a clean and dry condition, on blocks, racks or platforms and shall be suitably marked to facilitate inspection and identification.

Portions of uncoated reinforcing steel and dowels projecting from concrete, shall be protected within one week after initial placing of concrete, with a brush coat of neat cement mixed with water to a consistency of thick paint. This coating shall be removed by lightly tapping with a hammer or other tool not more than one week before placing of the adjacent pour of concrete. Coated reinforcing steel shall be protected against damage to the coating. If the coating on the bars is damaged during transportation or handling and cannot be repaired, the same shall be rejected.

BENDING OF REINFORCEMENT

Bar bending schedule shall be furnished by the Contractor and got approved by the Engineer before start of work. Reinforcing steel shall conform to the dimensions and shapes given in the approved Bar Bending Schedules. Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer-in-charge using a proper bar bender, operated by hand or power to obtain the correct shape and radii of bends. Bars shall not be bent or straightened in a manner that will damage the parent material or the coating. Bars bent

during transport or handling shall be straightened before being used on work. They shall not be heated to facilitate straightening.

PLACING OF REINFORCEMENT

a) The reinforcement cage should generally be fabricated in the yard at ground level and then shifted and placed in position. The reinforcement shall be placed strictly in accordance with the drawings and shall be assembled in position only when the structure is otherwise ready for placing of concrete. Prolonged time gap between assembling of reinforcement and casting of concrete, which may result in rust formation on the surface of the bars, shall not be permitted.

b) Reinforcement bars shall be placed accurately in position as shown on the drawings. The bars, crossing one another shall be tied together at every intersection with binding wire (annealed), conforming to IS:280 to make the skeleton of the reinforcement rigid such that the reinforcement does not get displaced during placing of concrete, or any other operation. The diameter of binding wire shall not be less than 1 mm.

c) Bars shall be kept in position usually by the following methods:

i) In case of beam and slab construction, industrially produced polymer cover blocks of thickness equal to the specified cover, shall be placed between the bars and formwork, subject to satisfactory evidence that the polymer composition is not harmful to concrete and reinforcement. Cover blocks made of concrete may be permitted by the Engineer-in-charge, provided they have the same strength and specification as those of the member.

ii) In case of dowels for columns and walls, the vertical reinforcement shall be kept in position by means of timber templates with slots cut in them accurately, or with cover blocks tied to the reinforcement. Timber templates shall be removed after the concreting has progressed up to a level just below their location.

iii) Layers of reinforcements shall be separated by spacer bars at approximately one metre intervals. The minimum diameter of spacer bars shall be 12 mm or equal to maximum size of main reinforcement or maximum size of coarse aggregate, whichever is greater. Horizontal reinforcement shall not be allowed to sag between supports.

iv) Necessary stays, blocks, metal chairs, spacers, metal hangers, supporting wires etc. or other subsidiary reinforcement shall be provided to fix the reinforcement firmly in its correct position.

v) Use of pebbles, broken stone, metal pipe, brick, mortar or wooden blocks etc., as devices for positioning reinforcement shall not be permitted.

d) Bars coated with epoxy shall be placed on supports that do not damage the coating. Supports shall be installed in a manner such that planes of weakness are not created in hardened concrete. The coated reinforcing steel shall be held in place by use of plastic or plastic coated binding wires especially manufactured for the purpose.

e) Placing and fixing of reinforcement shall be inspected and approved by the Engineer-in-charge before concreting is commenced.

BAR SPLICES

All reinforcement shall be furnished in full lengths as indicated on the drawing. No splicing of bars, except where shown on the drawing, shall be permitted without approval of the Engineer-in-charge. The lengths of the

splice shall be as indicated on drawing or as approved by the Engineer-in-charge. Where practicable, overlapping bars shall
not touch each other, and shall be kept apart by 25 mm or 1.25 times the maximum size of coarse aggregate, whichever is greater. If this is not feasible, overlapping bars shall be bound with annealed steel binding wire not less than 1 mm diameter and twisted tight in such a manner as to maintain minimum clear cover to the reinforcement from the concrete surface. Lapped splices shall be staggered or located at points along the span where stresses are low.

Welding

Splicing by welding of reinforcement will be permitted only if detailed on the drawing or approved by the Engineer-in-charge. Weld shall develop an ultimate strength equal to or greater than that of the bars connected. While welding may be permitted for mild steel reinforcing bars conforming to IS:432, welding of deformed bars conforming to IS:1786 shall in general be prohibited. Welding may be permitted in case of bars of other than Fe 240 grade including specials.

4.4 Plain/Reinforced cement concrete:

In cast-in-situ concrete works:

- Material Testing and approval.
- Approval of methodology for mixing in concrete preparation.
- Shuttering /Form work quality.
- Alignment & leveling of shuttering / Form work.
- Checking the foundation levels & co-ordinates prior to concreting.
- Methodology of placement of concrete mix.
- Proper compaction during concreting work.
- Proper & appropriate curing and de-shuttering during post-concreting period.
- Stripping & identifying defects in concreting if any.
- Workmanship in Concrete Repairs.
- Concrete Repair Procedures as approved by the EIC for concrete repairing works.

MATERIALS AND WORK SPECIFICATIONS:

1. Cement:

The cement used shall be any of the following with the prior approval of EIC.

i) Ordinary or Low heat Portland cement conforming to IS-269-1976.
ii) High strength ordinary Portland cement conforming to IS-8112-1976

The weight of Ordinary Portland cement shall be taken as 1440 kg. Per cum. Cement shall be measured by weight and in whole bags and each undisturbed and sealed 50 kg bag being considered equivalent to 35 ltrs in volume.

Cement shall be stored in weatherproof shade with raised wooden plank flooring to prevent deterioration by dampness or intrusion of foreign matter. It shall be stored in such a way as to allow the removal and use of

cement in chronological order of receipt, i.e. first received being first used. Cement deteriorated and or clotted shall not be used on work but shall be removed at once from the site.

2. **Fine Aggregate:**

Sand shall conform to relevant portion of IS 515. It shall pass through an IS sieve 4.75 (3/16 BS) test sieve, leaving a residue not more than 5%. It shall be from natural source or crushed stone screening, if allowed. Chemically inert, clean, sharp, hard, durable, well graded and free from dust, clay, shale, large pebbles, salt, organic matter, loam mica, or other deleterious matter. The sum of percentage of all such deleterious materials in sand shall not exceed 5% by weight. It shall be washed if directed to reduce the percentage of deleterious substances to acceptable limits. Sand shall not contain any trace of salt and it shall be tested and sand containing any trace of salt shall be rejected.

The fine aggregate for concrete shall be graded within limits as specified in IS 383 and the Fineness Modulus may range between 2.60 to 3.20.

The fine aggregate shall be stacked carefully on a clean, hard, dry surface so that it will not get mixed with deleterious foreign materials. If such a surface is not available a platform of planks or corrugated iron sheets or brick floor or a thin layer of lean concrete shall be prepared.

3. **Coarse Aggregate:**

Shall consist of crushed or broken stone 95% of which shall be retained on 5.75mm IS test sieve. It shall be obtained from crushing Granite, Quartzite, Trap Basalt or similar approved stones from approved quarry and shall conform to IS-383 and IS-515. Coarse aggregate shall be chemically inert when mixed with cement and shall be fairly cubical in shape and free from soft, feeble, thin, porous, laminated or flaky pieces. It shall be free from dust and any other foreign matter.

4. **Water:**

Water for mixing cement mortar or concrete shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil, acid, injurious alkali, salts, organic matter and other deleterious materials which will either weaken the mortar or concrete or causes efflorescence or attack the steel in reinforced cement concrete. Water shall be obtained from sources approved by the Engineer-in-charge. Potable water is generally considered satisfactory for mixing and curing concrete mortar masonry etc. Where water other than from main source is used this shall be tested in an approved testing laboratory to establish its suitability. All charges connected there with shall be borne by the contractors.

If hand mixing is allowed it shall be done on pucca water proof platform. The gauged materials shall be put on the platform and mixed dry, water will then be added and the whole mixed again until it is homogeneous and of uniform colour. Not more than one bag of cement shall be mixed at one time and which can be consumed within half an hour of its mixing.

i) **General:**

It shall be to ensure that all concrete placed at various locations of the job should be durable and strong enough to carry the design loads, it should wear well and practically be impervious to water. It should be free from such defect as shrinkage cracking and honey combing.

ii) **Proportioning the Mix:**

In ordinary concrete, excluding controlled concrete proportions of cement to fine and coarse aggregate shall be as specified in the respective items and shall be accurately measured. These proportions are based on assumption that the aggregates are dry. If aggregates are moist allowance shall be made for bulking in accordance with IS 2386 (Part-III).

iii) **Mixing:**

Concrete of 1:1.5:3 shall be mixed in an approved mechanical mixer. The mixer and mixing platform shall be suitably protected from wind and rain. Aggregates shall be measured accurately and mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency and the mixing time may be ½ to 2 minutes.

iv) **Placing of Concrete:**

Concreting shall be commenced only after Engineer-in-Charge has inspected the centering and shuttering as placed and passed the same. Shuttering shall be clean and free from all shavings, saw dust, pieces of wood, or other foreign material. It is necessary that the time between mixing and placing of concrete shall not exceed 30 minutes so that the initial setting process is not interfered with.

v) **Compaction:**

Concrete shall be compacted into dense mass immediately after placing by means of mechanical vibrators designed for continuous operations complying with IS 2505, IS 2506, IS 2514 and IS 4656 or hand compaction at the discretion of the Engineer-in-Charge for certain items depending on the thickness of the members and feasibility of vibrating. Hand compaction shall be done with the help of tamping rods so that concrete is thoroughly compacted and completely worked around the reinforcement, embedded fixtures, and into corners of the form. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed. The vibrators shall maintain the whole of concrete under treatment in an adequate state of agitation; such that de-aeration and effective compaction is attained at a rate commensurate with the supply of concrete from the mixers. The vibration shall continue during the whole period occupied by placing of concrete, the vibrators being adjusted so that the centre of vibrations approximates to the centre of the mass being compacted at the time of placing. Concrete shall be judged to be properly compacted, when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. When this condition has been attained, the vibrator shall be stopped.

vi) **Curing:**

Concrete shall be carefully protected during first stage of hardening from harmful effects or excessive heat, drying winds, rain or running water and shock. It shall be covered with a layer of sacking, sand, canvas, hessian or similar absorbent materials and kept constantly wet for ten days from the date of placing of concrete. Alternatively, the concrete being thoroughly wetted and covered by layer of approved waterproof material which should be kept in contact with it for seven days.

vii) **Form work:**

The form work shall be designed and constructed to the shape, lines and dimensions of member as shown in the drawings and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete and shall be sufficiently tight to prevent loss of liquid from the concrete.

All rubbish particularly chippings, shavings and saw dust, shall be removed from the interior of the forms before the concrete is placed and the form work in contact with the concrete shall be cleaned and thoroughly wetted or treated with an approved composition.

4.5 Gabian Structure for Retaining Earth:

Materials:

i) Gabions (or wire crates) shall have a volume varying between 1 and 4 m^3 depending on local requirement. They shall be rectangular in shape and constructed of double twisted galvanized mild steel wire formed into a hexagonally shaped mesh, of mesh area between 5,000 and 8,000 mm^2. Corners shall be reinforced with larger diameter galvanized wire.
ii)Gabions shall be either prefabricated or assembled at the required place of installation, and then filled with cobbles or rock fragments.
iii)The iron wire for gabion construction shall be hard drawn conforming to IS: 432 (Part II). The galvanized coating on the wire shall conform to IS: 4826. The wires shall have the following minimum diameter:

Net and tension rods:	3 mm
Wires for corner reinforcement:	5 mm
Seam wires:	2 mm

iv)Fill material shall comprise cobbles or rock fragments that are dense, sound and resistant to abrasion. Cobbles and rocks shall be free of cracks, seams and other defects, which could increase their susceptibility to destruction by erosive action. Individual cobbles or rock fragments shall be rounded and well graded in size between 120- and 200-mm. Flat rock fragments shall not be used.

4.6 Stone masonry work:

Dressing:

The stone shall be hammer dressed on the face, the sides and beds to enable it to come in proximity with the neighbouring stone. The bushing on the exposed face shall not be more than 40 mm.

Insertion of Chips:

Chips and spalls of stone may be used wherever necessary to avoid thick mortar beds or joints and it shall be ensured that no hollow spaces are left anywhere in the masonry. The chips shall not be used below hearting stones to bring these upto the level of face stones. Use of chips shall be restricted to filling of interstices between the adjacent stones in hearting and they shall not exceed 20 percent of the quantity of stone masonry.

Hearting Stones:

The hearting or interior filling of the wall face shall consist of rubble stones not less than 150 mm long in any direction, carefully laid, hammered down with a wooden mallet into position and solidly bedded in mortar. The hearting should be laid nearly level with facing and backing.

4.7 weep holes in Brick masonry/Plain/Reinforced concrete abutment, wing wall/return wall:

Weep holes shall be provided on all plain concrete, reinforced concrete, brick masonry and stone masonry structures such as, abutment, wing wall and return walls as shown on the drawings or as directed by the Engineer to permit water to flow out without building up pressure in the back fill. Weep holes shall be provided with 100 mm diameter AC/PVC/HDPE pipe for structures in plain/reinforced concrete or brick masonry. In case of stone masonry, weep holes shall be of rectangular shape 80 mm wide, 150 mm high or circular with 150 mm diameter. Weep holes shall extend through the full width of concrete/masonry with slope of about 1 vertical: 20 horizontals towards the draining face. The spacing of weep holes shall be 1 m in either direction or as shown in

the drawings with the lowest at 150 mm above the low water level or ground level whichever is higher or as dire cted by the Engineer.

4.8 Plum Concrete:

Description:
The work shall be in conformity with the lines, grades and dimensions, as shown on the drawings or as directed by the Engineer-in-Charge.
Laying of Plum Concrete shall be carried out with 60% Boulders (maximum size limited to 1/3rd of sectional width or 450mm whichever is less) and remaining 40% Cement Concrete (1:2:4 Nominal mix with 20mm down aggregates).

Materials:
All materials shall conform to Section 1000 of MoRTH Specifications.

Grades of Concrete:
- The grades of concrete shall be 1:2:4 Nominal Mix with 20mm down aggregate.

Mixing of Concrete
All concrete shall be machine mixed. Mixing shall be continued till materials are uniformly distributed, a uniform colour of the entire mass is obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case mixing shall be done for less than 2 minutes. It shall be ensured that the mixers are not loaded above their rated capacities and are operated at a speed recommended by the manufacturer.

Transporting Concrete:
Mixed concrete shall be transported from the place of mixing to the place of final deposit as rapidly as possible by methods which will prevent the segregation or loss of the ingredients. The method of transporting or placing of concrete shall be approved by the Engineer-in-Charge. Concrete shall be transported and placed as near as practicable to its final position so that no contamination, segregation or loss of its constituent materials take place.

Placing of Plum Concrete:
All formwork shall be cleaned and made free from standing water, dust, snow or ice immediately before placing of concrete.
Entire placement of Plum Concrete shall be carried out in 2 (Two) phases viz. Step-I: 60% of the total volume shall be filled up by placing boulders having maximum size limited to 1/3rd of sectional width or 450mm whichever is less. The balance 40% volume shall be filled up with cement concrete (1:2:4 nominal mix with 20mm down aggregate).

4.9 Reinforced Cement Concrete Pipe NP2/ prestressed concrete pipe:

This work shall consist of furnishing and installing reinforced cement concrete pipes, of the type, diameter and length as per design and details and at locations shown on the drawings or as ordered by the Engineer-in-charge and in accordance with the requirements of these Specifications.

MATERIALS

All materials used in the construction of pipe culverts shall conform to the requirements of cl no.2 of this document.

Each consignment of cement concrete pipes shall be inspected, tested, if necessary, and approved by the Engineer-in-charge either at the place of manufacture or at the site before their incorporation in the works.

EXCAVATION FOR PIPE

The foundation bed for pipe culverts shall be excavated true to the lines and grades shown on the drawings or as directed by the Engineer-in-charge. The pipes shall be placed in shallow excavation of the natural ground or in open trenches cut in existing embankments, taken down to levels as shown on the drawings. In case of high embankments where the height of fill is more than three times the external diameter of the pipe, the embankment shall first be built to an elevation above the top of the pipe equal to the external diameter of the pipe, and to width on each side of the pipe of not less than five times the diameter of pipe, after which a trench shall be excavated and the pipe shall be laid.

Where trenching is involved, its width on either side of the pipe shall be a minimum of 150 mm or one-fourth of the diameter of the pipe whichever is more and shall not be more than one-third the diameter of the pipe. The sides of the trench shall be as nearly vertical as possible.

The pipe shall be placed where the ground for the foundation is reasonably firm. Installation of pipes under existing bridges or culverts shall be avoided as far as possible. When during excavation the material encountered is soft, spongy or other unstable soil, and unless other special construction methods are called for on the drawings or in special provisions, such unsuitable material shall be removed to such depth, width and length as directed by the Engineer. The excavation shall then be backfilled with approved granular material which shall be properly shaped and thorough compacted up to the specified level.

Where bed-rock or boulder strata are encountered, excavation shall be taken down to at least 200 mm below the bottom level of the pipe with prior permission of the Engineer-in-charge and all rock/ boulders in this area be removed and the space filled with approved earth, free from stone or fragmented material, shaped to the requirements and thoroughly compacted to provide adequate support for the pipe.

Trenches shall be kept free from water until the pipes are installed and the joints have hardened.

BEDDING FOR PIPE

The bedding surface shall provide a firm foundation of uniform density throughout the length of the culvert, shall conform to the specified levels and grade, and shall be of first class bedding as specified on the drawings.

LAYING OF PIPE

No pipe shall be laid in position until the foundation has been approved by the Engineer-in-charge. Where two or more pipes are to be laid adjacent to each other, they shall be separated by a distance equal to at least half the diameter of the pipe subject to a minimum of 450 mm.

The arrangement for lifting, loading and unloading concrete pipes from factory/yard and at site shall be such that the pipes do not suffer any undue structural strain, any damage due to fall or impact. The arrangement may be got approved by the Engineer-in-charge.

Similarly, the arrangement for lowering the pipe in the bed shall be got approved by the Engineer-in-charge. It may be with tripod-pulley arrangement or simply by manual labour in a manner that the pipe is placed in the proper position without damage.

The laying of pipes on the prepared foundation shall start from the outlet and proceed towards the inlet and be completed to the specified lines and grades. In case of use of pipes with bell-mouth, the belled end shall face upstream. The pipes shall be fitted and matched so that when laid in work, they form a culvert with a smooth uniform invert.

Any pipe found defective or damaged during laying shall be removed at the cost of the Contractor.

JOINTING

The pipes shall be jointed either by collar joint or by flush joint. In the former case, the collars shall be of RCC 150 to 200 mm wide and having the same strength as the pipes to be jointed. Caulking space shall be between 13 and 20 mm according to the diameter of the pipe. Caulking material shall be slightly wet mix of cement and sand in the ratio of 1:2 rammed with caulking irons. Before caulking, the collar shall be so placed that its center coincides with the joint and an even annular space is left between the collar and the pipe.

Flush joint may be internal flush joint or external flush joint. In either case, the ends of the pipes shall be specially shaped to form a self centering joint with a jointing space 13 mm wide. The jointing space shall be filled with cement mortar, 1 cement to 2 sand, mixed sufficiently dry to remain in position when forced with a trowel or rammer. Care shall be taken to fill all voids and excess mortar shall be removed.

For jointing pipe lines under light hydraulic pressure, the recess at the end of the pipe shall be filled with jute braiding dipped in hot bitumen or other suitable approved compound. Pipes shall be so jointed that the bitumen ring of one pipe shall set into the recess of the next pipe. The ring shall be thoroughly compressed by jacking or by any other suitable method.

All joints shall be made with care so that their interior surface is smooth and consistent with the interior surface of the pipes. After finishing, the joint shall be kept covered and damp for at least four days.

BACKFILLING

Trenches shall be backfilled immediately after the pipes have been laid and the jointing material has hardened. The backfill soil shall be clean, free from boulders, large roots, excessive amounts of sods or other vegetable matter, and lumps and shall be approved by the Engineer. Backfilling up to 300 mm above the top of the pipe shall be carefully done and the soil thoroughly rammed, tamped or vibrated in layers not exceeding 150 mm, particular care being taken to thoroughly consolidate the materials under the haunches of the pipe. Approved pneumatic or light mechanical tamping equipment can be used.

Filling of the trench shall be carried out simultaneously on both sides of the pipe in such a manner that unequal pressures do not occur.
In case of high embankment, after filling the trench up to the top of the pipe in the above said manner, a loose fill of a depth equal to external diameter of the pipe shall be placed over the pipe before further layers are added and compacted.

4.10 Plastering with cement mortar (1:3) on brick work:

Plastering shall be done where shown on the drawing.

Plastering shall be started from top and worked down. All holes shall be properly filled in advance of the plastering, while the scaffolding is being taken down. Wooden screeds 75 mm wide and of the thickness of the

plaster shall be fixed vertically 2.5 m to 4 m apart, to act as gauges and guides in applying the plaster. The mortar shall be laid on the wall between the screeds using the plasterer'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 to 75 mm at a time. Finally, the surface shall be finished off with a plasterer's wooden float. Metal floats shall not be used.

When re-commencing 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.

No portion of the surface shall be left unfinished for patching up at a later period.

The plaster shall be finished true to plumb surface and to the proper degree of smoothness as directed by the Engineer-in-charge.

The average thickness of plaster shall not be less than that specified. The minimum thickness over any portion of the surface shall not be less than the specified thickness by more than 3 mm.

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 in rectangular shape and re-done as directed by the Engineer-in-charge.

4.11 Construction of Subgrade and Earthen Shoulders:

Materials and General Requirements:

1 Physicai Requirements:

The materials used in embankments, subgrades, earthen shoulders and miscellaneous backfills shall be soil, moorum, gravel, reclaimed material from pavement, fly ash, pond ash, a mixture of these or any other material as approved by the Engineer-in-charge. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the embankment.

4.12 Preparation and Surface Treatment of Formation:

Preparation and surface treatment of the formation, shall be carried out only after completion of any specified sub -grade drainage and unless otherwise agreed by the Engineer, immediately prior to laying the sub-base or the road base where no sub-base is required. The sequence of operations shall be as follows:
a) Full formation, after reinstatement of any soft areas to the required Specifications shall be well cleaned and freed of all mud and slurry.
b) The surface shall be compacted to the required density by a smooth wheeled roller of 80 to 100 kN weight after spraying requisite amount of water, if required.
c) the formation shall be finished as per MoRTH specification at Clause 305.3.9.

4.13 Granular Sub-base with well graded material:

The Percentage passing by Weight shall be as per the following table, -

IS Sieve Designation	Percent by Weight Passing the IS Sieve
	Grading 1

75.0 mm	100
53.0mm	80-100
26.5mm	55-90
9.5mm	35-65
4.75mm	25-55
2.36mm	20-40
0.85mm	-
0.425mm	10-15
0.075mm	<5

4.14 Wet Mix Macadam:

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared sub-grade/sub- base/ base or existing pavement as the case may be in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer-in-charge.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be up to 200 mm with the approval of the Engineer-in-charge.

Physical Requirements

Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than Sub-Bases, Bases (Non-Bituminous) and Shoulders 90 percent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table 400 -12 of MoRTH specification.

If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS:2386 (Part-5).

Physical Requirements of Coarse Aggregates for Wet Mix Macadam for Sub-base/Base Courses

Sl. No. of Test	Test Method	Requirements
1	Los Angeles Abrasion value or Aggregate Impact value IS:2386 (Part-4) IS:2386 (Part-4) or IS:5640	 40 percent (Max.) 30 percent (Max.)
2	Combined Flakiness and Elongation indices (Total) IS:2386 (Part-1)	35 percent (Max.)*

*To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The values of flakiness index and elongation index so found are added up.

Grading Requirements:

The aggregates shall conform to the grading given in Table 400-13 of MoRTH specification.

Grading Requirements of Aggregates for Wet Mix Macadam:

IS Sieve Designation	Percent by weight passing the IS Sieve
53.00 mm	100
45.00 mm	95-100
26.50 mm	-
22.40 mm	60-80
11.20 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600.00 micron	8-22
75.00 micron	0-5

The areas listed above and the QC aspects are not limited and are broadly mentioned to describe the general inspection and checks to be carried out. As the primary responsibility for quality control for execution of works lies with the executing contractor, the QC In-Charge of the Contractor shall identify the areas / activities specific for any other particular item of works for overall completion of the works as per the approved technical specification of works.

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5.0. **Control of non-conformities**:

Non-conforming products and executed works shall require following types of disposition action:

a) Acceptance for repair or rework:

In case of acceptance with repair or modification or rework, approval of repair/modification or rework process shall be obtained from the EIC. Inspection for acceptance after repair / modification or rework shall also be ensured.

b) Rejection:

It shall be ensured that rejected material / works do not find way back for acceptance. It shall be suitably segregated and disposed of.

c) Preventive action:

In course of reviewing non-conforming product / work, the cause of incident and situation leading to it are usually revealed. Corrective action which is necessary to eliminate to avoid recurrence shall be taken.

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6.0 Format for Contractor's Field Quality Assurance Plan (FQAP) :

Contractor's Logo		Contractor's name& address	Field Quality Assurance Plan (FQAP) Item of works :					**Project name**: CONSTRUCTION OF EXISTING COLONY ROAD WITH NEW CEMENT CONCRETE PAVER BLOCK FROM GATE NO.2 TO CHURCH JUNCTION, CHURCH JUNCTION TO W.T.P. AND PERMANENT COLONY, DHPS	
Sl.No.	Activities	Characteristics	Class of check	Type of check	Quantum of check	Reference Document	Acceptance norms	Format of records	Remarks
1	2	3	4	5	6	7	8	9	10

Guidelines :

1. **Column 1** : Serial number.
2. **Column 2** : Item of work / material in detail including exact area and stage of processing, testing, etc.
3. **Column 3** : Characteristics of checks like , physical, visual, dimensional, hydraulic, chemical, mechanical, performance, ultrasonic etc.
4. **Column 4** : Class shall be classified as critical (A), major(B) and minor(C). [**Critical class (A)** : Checks for defects those are deemed to be hazardous or totally unsafe. **Major class (B)** : Checks for defects those are likely to create failure of the component / structural unit for its intended purpose. **Minor class (C)** : Checks for defects those are discrepancies from the acceptable standards but are not likely to affect the usability of the component / structural unit.]

Classification of checks	**Checking Authority**	**Accepting Authority**
Critical (A)	NEEPCO & Contractor + FQA	Project Authority / EIC
Major (B)	NEEPCO & Contractor	NEEPCO-Project Authority.
Minor (C)	Contractor	NEEPCO- Engineer-In-Charge.

5. **Column 5 :** Type of check shall indicate nature of check i.e. visual, measurement, physical, chemical analysis, Non Destructive Test etc.
6. **Column 6 :** Quantum of check shall be 100% for all characteristics preferably unless otherwise mentioned in reference documents. In case of non-conformity,accepting authority shall ensure & approve disposition before accepting and the disposition shall have to be reflected in Log-sheets / protocols.
7. **Column 7 :** Reference standard / drawing / technical specification etc. as per which checks / tests to be carried out shall be indicated.
8. **Column 8 :** Acceptance norms like plant standard, design data, standard/s etc shall be indicated.
9. **Column 9 :** Appropriate format/s or certificate on which test/ inspection results to be recorded shall be indicated.
10. **Column 10:** Any specific remark/s shall be written here in this column.

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7.0 SAMPLE FORMATS OF TEST REPORTS AND PROTOCOLS (INDICATIVE):

Sl No.	Details of Formats
1.	SAMPLE COLLECTION – CEMENT
2.	SAMPLE COLLECTION – AGGREGATE
3.	ANALYSIS OF CEMENT
4.	SIEVE ANALYSIS OF FINE AGGREGATE
5.	SIEVE ANALYSIS OF COARSE AGGREGATE
6.	COMPRESSIVE STRENGTH RESULT SHEET – CUBE
7.	TEST REPORT OF CONSTRUCTION WATER

1) FIELD QUALITY CONTROL (FQC) ORGANISATION

SAMPLE COLLECTION – CEMENT

1. REFERENCE LETTER NO.:……
2. DATE OF COLLECTION:……
3. LOCATION/ COLLECTED FROM :……...
4. **MATERIAL : CEMENT**
5. BATCH NO. OF CEMENT ;……...
6. GRADE OF CEMENT :……
7. APPROXIMATE QUANTITY :……
8. SAMPLE NO .:…….
9. APPROXIMATE QUANTITY OF SAMPLE : ……..
10. REMARKS: ……

Signature: …….
Name: …….
(REP. OF CONTRACTOR)

Signature: ……. Signature:
……
Name: ……. Name:
……..
Designation: …….. Designation:
……

(FQA, NEEPCO) **(Construction Unit, NEEPCO)**

DETAILS OF RESULT OF ABOVE SAMPLE:

1. DATE OF RECEIVING:
   ……
2. REFERENCE LETTER NO.:
   …….
3. SATISFACTORY OR
   NOT:……
   ……...
4. REMARKS: .....

2) SAMPLE COLLECTION – AGGREGATE

1. REFERENCE LETTER NO.:……
2. DATE OF COLLECTION: ……...
3. LOCATION/ COLLECTED FROM ……
4. **MATERIAL : FINE AGGREGATE (FA)/ COARSE AGGREGATE (CA)**
5. SAMPLE NO.:……
6. APPROXIMATE QUANTITY OF SAMPLE:……
7. REMARKS: ……

Signature: …….
Name: …….
(REP. OF CONTRACTOR)

Signature: …….	Signature:
……	
Name: …….	Name:
……	
Designation: ……..	Designation
……	
(FQA, NEEPCO)	**(Construction Unit, NEEPCO)**

DETAILS OF RESULT OF ABOVE SAMPLE

1. DATE OF RECEIVING:
   ……
2. REFERENCE LETTER NO.:
   …….
3. SATISFACTORY OR NOT:……
   ……...
4. REMARKS: ……

3) TEST REPORT FOR CEMENT

ROOM TEMPERATURE DURING ANALYSIS OF CEMENT (OPC):

BATCH NO: THE TIME OF TESTING:

MAKE OF CEMENT: SITE: DATE OF SAMPLING: GRADE:

Sl. No.	**NAME OF TEST**	**RESULT**	**SPECIFICATION AS PER IS / BIS CODE NO---------- FOR OPC**
1	Normal consistency (in percentage) – By Vicat Apparatus		
2.	Setting Time (By vicat apparatus)		
	A) Initial setting time		
	B) Final setting time		
3.	Compressive Strength		
	A) 3 days in Kg./cm^2		
	B) 7 days in Kg./cm^2		
	C) 28 days in Kg./cm^2		
4.	Fineness by dry sieving		
5.	Soundness by		
	a) Le-Chatelier method (Expansion in mm)		
	b) By Auto clave method		
6.	Specific surface of cement (By Bllaines variable flow Permeability app.)		
7.	CHEMICAL TEST		
	1) Loss in ignites %		
	2) Silica (SiO_2) %		
	3) Insoluble residue %		
	4) Aluminium Oxide %		
	5) Iron Oxide %		
	6) Calcium Oxide %		
	7) Magnesium Oxide %		
	8) Sulphuric An Hydrits		
	9) Al2 O3 / Fe2O3		
	10) CaO 0.7 SO3 2.8 SiO2 + 1.2 Al2O3 + 0.65Fe2O3		
8.	Remarks		

REMARKS: With respect to above tests, OPC (Grade_____) is in conformation / Non-conformation.

LAB –ASTT. **QC In-Charge**

4. SIEVE ANALYSIS OF FINE AGGREGATE (FA)

LOCATION: …….

DATE OF TESTING:……

NATURE OF MATERIAL:……...

WEIGHT OF SAMPLE TAKEN FOR SIEVING:……

Sieve Size	Wt. retained on sieve (in ---)	% wt. retained	Cum % wt. retained	% finer	Silt content	F.M.	Remark
10mm							
4.75mm							
2.36mm							
1.18mm							
600 micron							
300 micron							
150 micron							
75 micron							
Pan							

LAB –ASTT. **QC In-Charge**

5. SIEVE ANALYSIS OF COARSE AGGREGATE (CA)

NAME OF PROJECT LOCATION / SITE:…….

DATE OF TESTING:……

WEIGHT OF SAMPLE TAKEN FOR SIEVING:……

Nature of Material	Sieve size	Wt. retained on Sieve (in-----)	% wt. retained	Cum % wt. retained	% Finer	Remark
150-80 mm. crushed aggregate	150mm 80mm Pan					
80-20 mm crushed aggregate	80mm 40mm Pan					
40-20 mm crushed aggregate	40mm 31.5mm 25.0mm 20.0mm 10.0mm Pan					
20-10 mm. crushed aggregate	20mm 16mm 12.5mm 10.0mm 4.47mm Pan					
5-10 mm. crushed aggregate	10mm 6.3mm 4.75mm 2.36mm Pan					

LAB –ASTT. **QC In-Charge**

6. CONCRETE COMPRESSIVE STRENGTH RESULT SHEET – CUBE

Site:- Agreement No.:-

Agency:-Concrete Grade:

Sl. No.	Date of casting	Identification Mark	Slump in cm.	Mix Design	Curing time in days	Size of cube in cm 15x15x15	Area over which load is applied 225cm^2	Dateof test	Load applie din ton	Comp. strength Kg./ cm^2	Average Comp. strength Kg/cm^2
REMARKS:-											

LAB –ASTT. **QC In-Charge**

7. TEST REPORT OF CONSTRUCTION WATER

Location /Site…….. Date of Testing:……

Agency:…….. Agreement No…….

TEST RESULTS (As per IS 456: 2000)

Sl. No.	TESTS	RESULTS	IS: LIMIT	CONFORMITY	REMARKS
1	Volume of 0.02N H_2SO_4 required to neutralize 100ml sample using mixed indicator (ml.)		25.00 Max	Yes / No	
2.	Volume of 0.02N NaOH required to neutralize 100ml. sample using phenolphthalein (ml.)		5 Max	Yes / No	
3.	Tests (mlg/l):-				
	a) Organic solids		200 Max	Yes / No	
	b) Inorganic solids		3000 Max	Yes / No	
	c) Sulphates as SO_3		400 Max	Yes / No	
	d) Chlorides as Cl.		2000 Max for concrete containing embedded steel & 500 for RCC works	Yes / No	
	e) Suspended matter		2000 Max	Yes / No	
	f) pH value		Not less than 6	Yes / No	

REMARKS: With respect to above tests water is Conformation / Non conformation with IS: 456-2000 for construction purpose.

LAB –ASTT. **QC In-Charge**