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SECTION - 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & QUANTITIES

SECTION - 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & QUANTITIES

1.1.0 SCOPE

1.1.1 The scope of work under this specification covers Civil Works of 765kV Sub-Station Extension at Ajmer, Rajasthan, being executed by BHEL on turnkey basis. The Employer/Customer is POWERGRID Corporation of India Limited.

1.1.2 The Civil works shall generally include, *but not limited to*, following:

- (i) Tower and equipment foundations.
- (ii) Cable trenches, crossings and sump pit(s).
- (iii) Anti weed treatment and Stone spreading.
- (iv) Any other work felt necessary for completion of project.

1.1.3 The works to be performed in the above constructions include preparation of bar bending schedules, based on the drawings released for construction and getting the same approved by the Engineer-in-charge plus the execution of the work including providing of all labour, supervision, materials, scaffolding, power, fuel, construction equipments, tools and plants, supplies, transportation, all incidental items necessary for successful completion of the work including contractor's supervision and in strict accordance with the drawings and specifications and with inspection and testing standards. The nature of work shall generally involve excavation in all type of soil/rock including dewatering, shoring, strutting, backfilling with available excavated earth around completed structures, disposal of surplus soil, concreting including reinforcement and formwork, providing necessary steel embedments and other inserts, fixing of foundation bolts, brickwork, etc., all complete as per detailed specification, drawings and directions of Engineer-in-charge.

1.2.0 SPECIFIC TECHNICAL REQUIREMENTS

1.2.1 All technical requirements for the execution of civil works shall be as per POWERGRID Technical Specification (Refer SECTION 3)/ CPWD Specification/IS. In case of any conflict between these, POWERGRID Technical Specification shall prevail.

1.2.2 The quality requirements shall be as per POWERGRID Field Quality Plan (Refer SECTION-3).

1.3.0 BILL OF QUANTITIES CUM PRICE SCHEDULE

- 1.3.1 The Bill of Quantities cum price schedule shall be as per pages 1.3 to 1.9.
- 1.3.2 The quantities indicated in the 'Bill of Quantities cum price schedule' are indicative and can vary to any extent. Contractor shall not be entitled for any claim for any such variation in the quantities.
- 1.3.3 The provision of Bill of Quantities, specifications and drawings shall be read in conjunction with each other and in case of conflict amongst them, the clarification shall be obtained from the Engineer-in-Charge whose decision shall be final and binding.
- 1.3.4 Method of measurement:
 - 1.3.4.1 Excavation shall be measured in cubic meters. The lateral dimensions to be considered for working out excavation quantity shall be the PCC dimension below the footing as per approved drawing. Nothing extra shall be paid for slope cutting, etc. Backfilling & disposal qty's shall be worked out based on the above dimensions only.
 - 1.3.4.2 For other items, unless otherwise described the method of measurement as described in 'Method of Measurement of Building and Civil Engineering Works'-IS 1200(Part I to XXV) latest edition of BIS shall be followed.

SECTION - 2

STANDARD TECHNICAL SPECIFICATION
(N.A.)

SECTION - 3

ENCLOSURES TO THE SPECIFICATION

- (a) POWERGRID Technical Specification**
- (b) POWERGRID Field Quality Plan**

POWERGRID Technical Specification for Civil Works
(Page 1, 7 to 16, 20,42, 49,50 OF 50)

SECTION: CIVIL

1.0 GENERAL

The intent of this technical specification covers the following:

All civil works shall be carried out as per design/drawings provided by the Employer / Contractor and as per these specification provided by the Employer. In case any item is not covered under specification then the same shall be carried out as per CPWD specification and applicable Standards and Codes. Any item for which specification is not provided herein and is not covered under CPWD specification shall be executed as per manufacturer guidelines. All materials shall be of best quality conforming to relevant Indian Standards and Codes. In case of any conflict between Standards/ Code and Technical Specification, the provisions of Technical Specification shall prevail.

The Contractor shall furnish all labour, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with drawings, specifications and direction of Employer.

All materials including cement, reinforcement steel and structural steel etc. shall be arranged by the Contractor. All testing required shall be arranged by the Contractor at his own cost. The Contractor shall execute the work as per the Field Quality Plan (FQP) attached with this document.

The bidder shall fully apprise himself of the prevailing conditions at the proposed site. Climatic conditions including monsoon patterns, local conditions and site specific parameters, soil parameters, availability of construction material and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications.

Employer has standardized its technical specification for various items/ works. Specification for items which are covered in the scope and as defined in Section project & BPS need only be referred.

2.0 GEOTECHNICAL INVESTIGATION **NOT APPLICABLE**

- 2.1 The Contractor shall perform a detailed soil investigation to arrive at sufficiently accurate conclusion regarding general as well as specific information about the soil profile and the necessary soil parameters of the site, in order to design and construct the foundation of the various structures safely and rationally.

settlement, bearing capacity, pile capacity shall be enclosed.

- c) The report should contain specific recommendations for the type of foundation for the various structures envisaged at site. The Contractor shall acquaint himself about the type of structures and their functions from the Employer. The observations and recommendations shall include but not limited to the following:
- i) Geological formation of the area, past observations or historical data, if available, for the area and for the structures in the nearby area, fluctuations of water table etc.
 - ii) Recommended type of foundations for various structures.
If piles are recommended the type, size and capacity of pile and groups of piles shall be given after comparing different types and sizes of piles and pile groups.
 - iii) Allowable bearing pressure on the soil at various depths for different sizes of the foundations based on shear strength and settlement characteristics of soil with supporting calculations. Minimum factor of safety for calculating net safe bearing capacity shall be taken as 2.5. Recommendation of liquefaction characteristics of soil and possible remedies shall be provided.
 - iv) Recommendations regarding slope of excavations and dewatering schemes, if required.
 - v) Comments on the Chemical nature of soil and ground water with due regard to deleterious effects of the same on concrete and steel and recommendations for protective measures.
 - vi) If expansive soil is met with, recommendations on removal or detainment of the same under the structure, road, drains, etc. shall be given. In the latter case detailed specification of any special treatment required including specification or materials to be used, construction method, equipments to be deployed etc. shall be furnished. Illustrative diagram of a symbolic foundation showing details shall be furnished.
 - vii) Recommendations for additional investigations beyond the scope of the present work, if considered such investigation as necessary.
 - viii) In case of foundation in rocky strata, type of foundation and recommendation regarding rock anchoring etc. should also be given based on RMR value.

3

DRAWINGS

Standard drawings have been developed for roads, road culverts, drains, cable trenches, cable trench crossing roads, sump, switchyard fence, fencing gates, rain water harvesting, fire fighting pump house (Super structure), control room building (Super structure) and fire water tank by

the Employer, as mentioned below, and are enclosed with the tender documents. These drawings are good for construction and are also available on POWERGRID website. Additional prints if required can be downloaded from the website.

All foundation drawings including foundations for buildings, towers, equipments etc shall be released to the Contractor after award and after receiving the geotechnical investigation report.

Drawings that have been mentioned to be issued by the Employer to the Contractor during detailed Engineering shall be made available to the Contractor as per the agreed work schedule finalised after award.

3.1 Control room building and Switchyard Panel Room

Standard Architectural drawings are enclosed with the tender documents. These drawings are good for construction. The construction drawings for foundation shall be released, in a phased manner, to the successful bidder after award of work.

3.2 FIRE FIGHTING PUMP HOUSE BUILDING & FIRE WATER TANK

Architectural/Construction drawings of superstructure are enclosed with the tender documents. These drawings are good for construction. However, foundation drawing matching with site requirement shall be released in a phased manner to the successful bidder after award of work.

3.3 TOWER & EQUIPMENT FOUNDATIONS

Construction drawings for towers and equipments foundations, which are enclosed with the tender documents, have been standardised and are available on the POWERGRID website. However the Contractor shall confirm to use these drawings before execution as the type and dimensions depends on the soil parameters.

Drawings for any non-standard tower or equipment foundation, if required, shall be designed by the Employer and made available to the Contractor during detailed Engineering. Foundations for any miscellaneous requirements like electric poles, marshalling box, control cubicles, etc. shall be engineered by the Contractor and the design and drawings shall be submitted for Employer's approval.

Drawings for transformer, reactor foundations and fire wall are not enclosed and shall be made available to the Contractor by the Employer during detailed engineering. Firewall shall be finished with waterproofing cement paint of required shade.

In case the site conditions warrant any special type of foundations to be used, the same shall be designed and issued by the Employer to the Contractor during detailed engineering.

3.4 Transit Camp

The Architectural and Construction drawings of transit camp and covered parking are enclosed with the tender documents.

3.4.1 Septic tank and soak pit

The construction drawings of septic tank and soak pit for control room building and transit camp are enclosed with the tender document.

3.5 Roads, road culverts and rail cum Road

The construction drawings showing section detail for road, culverts as well as rail cum road are enclosed with the tender documents. The layout of roads shall be as per approved general arrangement drawing. The type of culverts i.e. the number and diameter of Hume pipes shall be as decided during detailed engineering.

3.6 Drains

The construction drawing for the section of drain is enclosed with the tender documents. The Contractor shall develop an overall drainage layout for the new sub-station/ extension of substation during detailed engineering. The type of drains used shall be of the sections standardized and indicated in the drawings enclosed with the tender documents.

3.7 Chain link fencing and Switchyard gate

The construction drawings are enclosed with the tender documents.

3.8 Rain water harvesting

The construction drawings are enclosed with the tender documents.

3.9 External water supply from bore-well to fire water tank/Control building and Transit Camp

(i) The drawing for the water supply from bore-well to fire water tank shall be developed by the Contractor. Water supply will be made available to the Contractor from a bore-well by the Employer at any one location within the sub-station. 80 mm dia GI pipe shall be provided by the Contractor from the bore-well to the fire water tank. From this a 25 mm dia tap off shall be connected by the Contractor to the roof water tank provided for

the control room building & transit camp.

(ii) The Contractor shall carry out all the external plumbing/erection works required for supply of water to the control room building, firewater tank and transit camp beyond the single point as at (i).

(iv) A scheme shall be prepared by the Contractor indicating the layout and details of water supply which shall be got approved from the Employer before actual start of work including all other incidental items not shown or specified but as may be required for complete performance of the works.

(v) Bore well is not in the scope of Contractor.

3.10 Stone spreading and antiweed treatment

The layout of the area, where anti-weed treatment and stone spreading is to be done, shall be developed by the Contractor during detailed engineering and the same shall be submitted to the employer for approval.

3.11 Cable Trenches

The construction drawings of cable trenches, cable trench crossing road and sump are enclosed with tender documents. The Contractor shall develop an over all cable trench layout for the substation during detailed engineering. The layout should show type of cable trench, longitudinal slope and invert level calculated considering future extensions also. The types of cable trench shall be of the section indicated in the drawings enclosed with the tender documents and are also available on POWERGRID website.

4.0 EARTH WORK:

Unless mentioned otherwise in section – Project, fairly levelled site with single level/terraces with different levels/ gradual slope shall be handed over to the Contractor, in the phased manner. The finished ground level (FGL) with a tolerance of (+/-) 100mm shall be the finished formation level furnished by the Employer. The layout and levels of all structure etc shall be made by the Contractor at his own cost from the general grids of the plot and benchmarks set by the Contractor and approved by the Employer. The Contractor shall provide all assistance in instruments, materials and personnel to the Employer for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels.

4.1 EXCAVATION AND BACKFILL

a) Excavation for foundations shall be in accordance with CPWD Specification/ the relevant code. Excavation shall include removal

of all materials of whatever nature at all depth and whether wet or dry necessary for the construction of foundations. The bottom of excavation shall be levelled both longitudinally and transversely unless otherwise mentioned in the drawings or as directed by Engineer-in-charge.

If required the sides of excavations should be supported in such a way as is necessary to secure these from falling in, and the shoring, if required, shall be provided and maintained in position as long as necessary. No extra payment shall be made for shoring.

- b) Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, The excavation shall be kept free from water:-
 - i) When concrete and/or masonry works are in progress and till they come above the natural water level
 - ii) Till the Employer considers that the concrete/ mortar is sufficiently set.
- c). Material unsuitable for foundations shall be removed and replaced by suitable fill material and to be approved by the Employer.
- d). Backfill material around foundations or other works shall be suitable for the purpose for which it is used and compacted. Excavated material not suitable or not required for backfill shall be disposed off in areas as directed by Employer up to a maximum lead of 2 km.
- e). Requirements regarding density / tests of backfilled earth shall be as specified in Field Quality Plan. The subgrade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor's density at OMC (optimum moisture content). Cohesion less material subgrade shall be compacted to 70% relative density (minimum).

4.2 REQUIREMENT FOR FILL MATERIAL UNDER FOUNDATION

The thickness of fill material under the foundations shall be such that the maximum pressure from the footing, transferred through the fill material and distributed onto the original undisturbed soil will not exceed the allowable soil bearing pressure of the original undisturbed soil. The filling shall be done in accordance with clause 4.10 of IS: 1080. For expansive soils the fill materials and other protections etc. to be used under the foundation is to be got approved by the Employer. Cohesive Non Swelling (CNS) soil, if required, for filling under / around the foundations, cable trenches, drains, roads etc shall confirm to IS: 9451: 1994 reaffirmed 2004.

5.0 ANTIWEED TREATMENT & STONE SPREADING

5.1 Scope of work

The Contractor shall furnish all labour, equipment and materials required for complete performance of the work in accordance with the drawings, specification and direction of the Employer.

Stone spreading over cement concrete layer shall be done in the areas of the switchyard under present scope of work. The cement concrete layer shall also be provided in future areas within the fenced area. However the stone spreading in future areas shall be provided in case step potential without stone layer is not well within safe limits.

5.2 General requirement

The material required for site surfacing/stone filling shall be free from all types of organic materials and shall be of standard quality, and as approved by the Employer.

5.2.1 The material to be used for stone filling/site surfacing shall be stone aggregate of 40mm nominal size (ungraded single size) conforming to Table 2 of IS:383 – 1970. Hardness, flakiness shall be as required for wearing courses are given below:

- (a) Sieve Analysis limits (Gradation)
(IS : 383 – Table – 2)

Sieve Size	% passing by weight
63mm	100
40mm	85-100
20mm	0-20
10mm	0-5

“One Test” shall be conducted for every 500 cu.m.

- (b) Hardness

Abrasion value (IS:2386 Part-IV) – not more than 40%

Impact value (IS: 2386 Part-IV) – not more than 30% and frequency shall be one test per 500 cu.m. with a minimum of one test per source.

(c) Flakiness Index

One test shall be conducted for every 500 cu.m. of aggregate as per IS: 2386 Part – I and maximum value is 25%.

- 5.2.2 After all the structures/equipments are erected, antiweed treatment shall be applied in the switchyard where ever cement concrete is to be done and the area shall be thoroughly de-weeded including removal of roots. The recommendation of local agriculture or horticulture department may be sought where ever feasible while choosing the type of chemical to be used. The antiweed chemical shall be procured from reputed manufacturers. The doses and application of chemical shall be strictly done as per manufacturer's recommendation. Nevertheless the effectiveness of the chemical shall be demonstrated by the Contractor in a test area of 10MX10M (appx) and shall be sprinkled with water at least once in the afternoon everyday after forty eight hours of application of chemical. The treated area shall be monitored over a period of two to three weeks for any growth of weeds by the Engineer – in- charge. The final approval shall be given by Engineer – in –charge based on the results.
- 5.2.3 Engineer-in-charge shall decide final formation level so as to ensure that the site appears uniform devoid of undulations. The final formation level shall however be very close to the formation level indicated in the approved drawing.
- 5.2.4 After antiweed treatment is complete, the surface of the switchyard area shall be maintained, rolled/compacted to the lines and grades as decided by Engineer-in-charge. The sub grade shall be consolidated by using half ton roller/surface vibrator with suitable water sprinkling arrangement to form a smooth and compact surface. The roller shall run over the sub grade till the soil is evenly and densely consolidated and behaves as an elastic mass.
- 5.2.5 In areas that are considered by the Engineer-in-Charge to be too congested with foundations and structures for proper rolling of the site surfacing material by normal rolling equipments, the material shall be compacted by hand rammer, if necessary. Due care shall be exercised so as not to damage any foundation structures or equipment during rolling / compaction.
- 5.2.6 The sub grade shall be in moist condition at the time the cement concrete is placed. If necessary, it should be saturated with water for not less than 6 hours but not exceeding 20 hours before placing of cement concrete. If it becomes dry prior to the actual placing of cement concrete, it shall be sprinkled with water and it shall be ensured that no pools of water or soft patches are formed on the surface.
- 5.2.7 Over the prepared sub grade, 75mm thick base layer of cement concrete in 1:5:10 (1 cement: 5 fine/coarse sand: 10 burnt brick aggregate 40mm nominal size) shall be provided in the area excluding roads, drains, cable trenches as per detailed engineering drawing. The Contractor shall have option to use graded

stone aggregate 40mm nominal size in place of brick aggregate without any extra cost to employer. For easy drainage of water, the slope of 1:1000 is to be provided from the ridge to the nearest drain. The ridge shall be suitably located at the centre of the area between the nearest drains. The above slope shall be provided at the top of base layer of cement concrete in 1:5:10. A layer of cement slurry of mix 1:6 (1cement: 6 fine sand) shall be laid uniformly over cement concrete layer. The cement consumption for cement slurry shall not be less than 150 kg for every 100 sq.m.

- 5.2.8 A final layer of 100mm thickness of stone aggregate of 40mm nominal size (conforming to clause 5.2.1) shall be spread uniformly over cement concrete layer after curing is complete.

6.0 RAINWATER HARVESTING: **NOT APPLICABLE**

- 6.1 In addition to drainage of rainwater, the Contractor shall make arrangement for rainwater harvesting also.
- 6.2 Rainwater harvesting shall be done by providing recharge structures with bore wells. The recharge structures shall be suitably located within the sub-station. Branch drains from the main drain carrying rainwater from entire switchyard shall be connected to the recharge structures.

A drawing showing details of recharge structure for rainwater harvesting is enclosed with tender document and is also available on POWERGRID website.

7.0 ROADS AND CULVERTS **NOT APPLICABLE**

- 7.1 All the roads in the scope of contract shall be of concrete road.
- 7.2 There would be two types of Roads. The wider road shall be 5.5m wide and the other road shall be 3.75m wide.

The road outside the switchyard fenced area and road leading to control room building shall be provided with kerb stone and interlocking tiles on shoulder. Width of shoulder shall be 1.75m in case of 5.5m wide road and 1.3m in case of 3.75m wide road.

In case of switchyard road the shoulder would be 600mm wide on the sides of both types of road. Well compacted 75mm thick PCC 1:4:8 (1Cement: 4 coarse sand: 8 graded stone aggregate 40mm nominal size) shall be provided in shoulder area. The top surface of PCC shall be finished smooth.

RCC Hume pipe (NP-3) of 100mm diameter shall be provided across the road at every 100M interval along the road.

- 7.3 Layout of the roads shall be as shown in the approved General Arrangement drawing for the substation. Adequate turning space for vehicles shall be provided

and bend radii shall be set accordingly. Road to the Autotransformer/Reactor shall be as short and straight as possible. Roads which are to be used for carrying transformers / reactors shall be provided with turning radius preferably 19.5M or more but not less than 16.5M. Turning radius of other roads may be decided at site depending on layout constraints.

- 7.4 All roads shall be rigid pavement type RCC road. Thickness of RCC, PCC and WBM shall be as per section details provided in the drawing. The concrete shall be laid and finished with screed board, vibration, vacuum dewatering process etc.
- 7.5 The details of roads and culverts are furnished in the drawing enclosed with tender document.
- 7.6 The shoulder of the road in case of substation extension shall match with the shoulder of the existing road.
- 7.7 The location of culverts, diameter of RCC Hume pipes shall be decided by the Contractor during detailed engineering while finalising drainage layout. The invert level of Hume pipes of culverts shall match with the invert level of drain meeting the culvert.

8.0 FOUNDATION / RCC CONSTRUCTION

8.1 General

- a). Work covered under this Clause of the Specification comprises the construction of foundations and other RCC constructions for switchyard structures, equipment supports, trenches, drains, jacking pad, pulling block, control cubicles, bus supports, Autotransformer/Reactors, marshalling kiosks, auxiliary equipments & systems buildings, tanks or for any other equipment or service and any other foundation required to complete the work. This clause is as well applicable to the other RCC constructions.
- b). Reinforced cement concrete shall be of grade M-25 conforming to IS: 456 or volumetric mix 1:1.5:3 (1 cement: 1.5 coarse sand: 3 well graded stone aggregate 20mm nominal size) conforming to CPWD specification as per BPS. Volumetric mix 1:1.5:3 shall be considered equivalent to M-20. All the tests shall be conducted as per relevant Indian Standard Codes as mentioned in Standard field quality plan appended with the specification. Type and grade of cement shall confirm to CPWD specification and reinforcement steel shall be thermo mechanically treated reinforcement bars of grade Fe 500 conforming to IS: 1786.
- c). If the site is sloping, the foundation height will be adjusted to maintain the exact level of the top of structures to compensate such slopes.

The switchyard foundation's plinths and building plinths shall be minimum 300mm and 600mm above finished ground level respectively.

- d). Minimum 75mm thick lean concrete (1:4:8) shall be provided below all underground structures, foundations, trenches etc. to provide a base for construction.
- e). Concrete made with OPC grade 53 and PPC shall be carefully cured and special importance shall be given during the placing of concrete and removal of shuttering.
- f). The design and detailing of foundations shall be done based on the approved soil data and sub-soil conditions as well as for all possible critical loads and the combinations thereof. The Spread footings foundation or pile foundation as may be required based on soil/sub-soil conditions and superimposed loads shall be provided.
- g). If pile foundations are adopted, the same shall be cast-in-situ bored or pre-cast or under reamed type as per relevant parts of IS: 2911. Only RCC piles shall be provided. Necessary initial load test shall be carried out by the Contractor at their cost to establish the pile design capacity. Only after the design capacity of pile has been established, the Contractor shall take up the job of piling. Routine tests for the pile shall also be conducted as per IS-2911. All the testing work shall be planned in such a way that these shall not cause any delay in project completion. RCC for pile works shall be Design Mix of minimum grade M-25 and also minimum cement content shall be 400Kg/ cu.m as per IS-2911 (Latest revision)

8.2 DESIGN

The following clauses shall be applicable only for the foundation / structure which the Contractor may have to design

- a. All foundation shall be of reinforced cement concrete. The design and construction of RCC structures shall be carried out as per IS: 456. Grade of concrete can be volumetric mix 1:1.5:3 (1cement: 1.5 coarse sand: 3stone aggregate 20mm nominal size) equivalent to M-20 or designed concrete mix of grade M-25 or higher as specified in BPS or section- Project of Technical Specification.
- b. Limit state method of design shall be adopted unless specified otherwise in the specification.
- c. Thermo mechanically treated reinforcement bars of grade Fe 500 conforming to IS: 1786 shall be used as reinforcement. Detailing of reinforcement shall be done in accordance with IS: 2502 and SP: 34. Ductile Detailing shall conform to IS: 13920. Two layers of reinforcement (on inner and outer face) shall be provided for wall & slab sections having thickness of 150 mm and more. Clear cover to reinforcement shall be as per IS: 456 (latest).

~~The firewall will be made of reinforced cement concrete and shall be finished with water proofing cement paint of grey colour.~~

8.3 ADMIXTURES & ADDITIVES

- a). Only approved admixtures shall be used in the concrete for the Works. When more than one admixture is to be used, each admixture shall be batched in its own batch and added to the mixing water separately before discharging into the mixer. Admixtures shall be delivered in suitably labelled containers to enable identification.
- b). Admixtures in concrete shall conform to IS: 9103. The water proofing cement additives shall conform to IS: 2645. Concrete Admixtures/ Additives shall be approved by Employer (Engineer in charge).
- c). The Contractor may propose and the Employer may approve the use of a water-reducing set-retarding admixture in some of the concrete. The use of such an admixture will not be approved to overcome problems associated with inadequate concrete plant capacity or improperly planned placing operations and shall only be approved as an aid to overcoming unusual circumstances and placing conditions.
- d). The water-reducing set-retarding admixture shall be an approved brand of Ligno-sulphonate type admixture.
- e). The water proofing cement additives shall be used as required / advised by the Employer.

9.0 Chain link Fencing and Switchyard Gate: NOT APPLICABLE

Fencing and Gate shall be provided at the locations shown in approved general arrangement drawing. Separate gate shall be provided for men and equipment. Fence shall also be provided for the various equipments (if) mounted on ground or a height lower than 2.5m. Necessary gates shall be provided for each area so surrounded. Fencing and Gate shall be constructed as per drawing attached with tender documents and are also available on POWERGRID website.

Chain link galvanised fence fabric with 3.15mm dia wire and 75mm mesh size conforming to IS: 2721 shall be used. MS tube used shall be of grade YST22 and conform to IS: 1161. All other structural steel shall conform to IS: 2062. In case the substation is located within 30km from sea coast, the zinc coating shall be 900gm/ sq.m.

The whole assembly of tubular post and frame of panels shall be hot dip galvanized. The zinc coating shall be minimum 610 gram per sq. meter. The purity of zinc shall be 99.95% as per IS: 209.

required shade. All doors of Transit Camp shall have tubular type Hydraulic Door closer conforming to IS-3564.

47. All doors except toilet and kitchen shall have 100mm 6 liver mortice lock and a pair of lever handles with necessary screws complete etc.
48. Cement Jali of (1:2:4) (1 Cement: 2 fine aggregate : 4 coarse aggregate) 50mm thick, shall be reinforced with 1.6mm dia with Mild steel wire including centring and shuttering cleaning fixing and furnishing with cement mortar 1:3).
49. Providing and fixing 15mm thick densified tegular edged eco friendly light weight calcium silicate false ceiling tiles of approved texture spintone/cosmos/ Hexa or equivalent of size 595x595 mm in true horizontal level, suspended on inter locking metal grid of hot dipped galvanised steel sections (galvanising @ 120 grams per sqm. Including both side) consisting of main 'T' runner suitably spaced at joints to get required length and of size 24x38 mm made from 0.33 mm thick (minimum) sheet, spaced 1200 mm centre to centre, and cross 'T' of size 24x28 mm made out of 0,33 mm (minimum) sheet, 1200 mm long spaced between main 'T' at 600 mm centre to centre to form a grid of 1200x600 mm and secondary cross 'T' of length 600 mm and size of 24x28 mm made of 0.33 mm thick (minimum) sheet to be interlocked at middle of the 1200x600 mm panel to form grid of size 600x600 mm, resting on periphery walls/partitions on a perimeter wall angle precoated steel of size (24x24x300 mm made of 0.40 mm thick (minimum) sheet with the help of rawl plugs at 450 mm centre to centre with 25 mm long drywall screws @230 mm interval and laying 15 mm thick densified edges calcium silicate ceiling tiles of approved texture (Spintone/ Cosmos/ hexa) in the grid, including, cutting/making openings for services like diffusers, grills, light fittings, fixtures, smoke detectors etc., Wherever required. Main 'T' runners to be suspended from, ceiling using G.I. slotted cleats of size 25x35x1.6 mm fixed to ceiling with 12.5 mm dia and 50 mm long dash fasteners, 4 mm G.I. adjustable rods with galvanised steel level clips of size 85x30x0.8 mm, spaced at 1200 mm centre to centre along main 'T', bottom exposed with 24 mm of all T-section shall be pre-painted with polyester baked paint, for all heights, as per specifications, drawings and as directed by engineer- in-charge.

~~12.0 MODE OF MEASUREMENT~~

~~12.1 Earthwork~~

~~This shall include excavation in all kinds of soil including rock, all leads~~

~~paid under civil works.~~

13.0 MISCELLANEOUS GENERAL REQUIREMENTS

- 13.1** Reinforced cement concrete with controlled water cement ratio as per IS-code shall be used for all underground concrete structures such as pump-house, tanks, and water retaining structures for achieving water-tightness.
- 13.2** All joints including construction and expansion joints for the water retaining structures (RCC tank for Fire Fighting and underground water tank) shall be made water tight by using PVC ribbed water stops with central bulb. The minimum thickness of PVC water stops shall be 5 mm and minimum width shall be 230 mm.
- 13.3** All mild steel parts used in the fire fighting water tank and under ground water tank shall be hot-double dip galvanised. The minimum coating of the zinc shall be 750 gm/sq. m. for galvanised structures and shall comply with IS:2629 and IS:2633. Galvanizing shall be checked and tested in accordance with IS: 2633. The galvanizing shall be followed by the application of an etching primer and dipping in black bitumen in accordance with BS: 3416.
- 13.4** FPS Bricks of clay having minimum 75 kg/cm² compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 75 kg/cm² compressive strength before submitting his offer. However, Contractor can propose to use of fly ash based bricks/ hollow concrete blocks or solid concrete blocks of compressive strength not less than 75kg/cm². for which no extra payment shall be made.
- 13.5** Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round cut outs/openings in floor slab.
- 13.6** Anti termite chemical treatment shall be given to column pits, wall trenches, foundations of buildings, filling below the floors etc. as per IS: 6313 and other relevant Indian Standards.
- 13.7** The material specification, workmanship and acceptance criteria shall be as per approved standard Field Quality Plan attached with this document. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification.
- 13.8** Ready mix concrete pertaining to M25 grade of reputed manufacturer such as Lafarge, ACC, Ultra Tech, RMC Readymix India etc. or manufacturer of similar repute shall also be accepted for use in construction activity. Materials specification shall conform to IS: 456 and acceptance criteria of readymix concrete shall be as per IS: 4926-2003.

13.9 Items/ components of buildings not explicitly covered in the specification but required for completion of the project shall be deemed to be included in the scope.

14.0 INTERFACING

The proper coordination & execution of all interfacing civil works activities like fixing of conduits in roofs/walls/floors, fixing of foundation bolts, fixing of lighting fixtures, fixing of supports/embedment, provision of cut outs etc. shall be the sole responsibility of the Contractor. He shall plan all such activities in advance and execute in such a manner that interfacing activities do not become bottlenecks and dismantling, breakage etc. is reduced to minimum.

15.0 STATUTORY RULES

15.1 Contractor shall comply with all the applicable statutory rules pertaining to factories act (as applicable for the State), Fire Safety Rules of Tariff Advisory Committee, Water Act for pollution control etc.

15.2 Statutory clearance and norms of State Pollution Control Board shall be followed as per Water Act for effluent quality from plant.

15.3 Requirement of sulphate resistant cement (SRC) for sub structural works shall be decided in accordance with the Indian Standards based on the findings of the detailed soil investigation.

15.4 All building/construction materials shall conform to the best quality specified in CPWD specifications if not otherwise mentioned in this specification.

15.5 All tests as required in the standard field quality plans have to be carried out.

PGCIL Field Quality Plan

(Pages 1 to 20)

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**STANDARD FIELD QUALITY PLAN
FOR SWITCHYARD CIVIL WORKS**

Section : FOUNDATION MATERIALS

Sl. No.	Component/Operation & Description of Test	Sampling Plan with basis	Ref. Document & acceptance norm	Testing Agency	Remarks	Check
1.	CHECKING OF FOUNDATION MATERIALS					
A)	CEMENT					
i)	Fineness	One sample per lot of 100 MT or part thereof from each source for MTCs and one sample per lot of 200 MT or part thereof from each source for site testing	IS:456, IS:269	Manufacturer/ POWERGRID approved lab	Review of manufacturers test certificates (MTCs) and laboratory test results by POWERGRID	B
ii)	Compressive Strength		IS:8112, IS:12269			
iii)	Initial & final setting time		IS:1489 & POWERGRID specification			
iv)	Soundness					
v)	Heat of Hydration for low heat cement (Not applicable for OPC & PPC)					
vi)	Chemical Composition of Cement	One sample per lot of 100 MT or part thereof from each source for MTCs	IS:456, IS:269 IS:8112, IS:12269 IS:1489 & POWERGRID specification	Manufacturer	Review of manufacturers test certificates by POWERGRID	B
B)	COARSE AGGREGATES					
i)	Determination of Partical size (Sieve Analysis)	One sample per lot of 100 cubic meter or part thereof from each source for each size	IS:383, IS:2386 and POWERGRID specification	POWERGRID approved lab. However, Moisture content test for design mix concrete shall be done on all days of concreting at site.	Each source to be approved by POWERGRID Review and acceptance of test result by POWERGRID.	B
ii)	Flakiness Index					
iii)	Crushing Value					
iv)	Specific Gravity*					
v)	Bulk Density*					
vi)	Absorption Value*					
vii)	Moisture Content*					
viii)	Soundness of Aggregate**					
ix)	Presence of deleterious materials					
	* Applicable Design concretes only	** Applicable to concrete work subject to frost action				

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C)	FINE AGGREGATE					
i)	Gradation/Determination of Particle size (Sieve Analysis)	One sample per lot of 100 cubic meter or part thereof from each source	IS:383,IS:2386,IS:456 and POWERGRID specification	POWERGRID approved lab. However Moisture content test for design mix concrete shall be done on all days of concreting at site.	Each source to be approved by POWERGRID Review and acceptance of test result by POWERGRID.	B
ii)	Specific Gravity and density					
iii)	Moisture content					
iv)	Absorption Value					
v)	Bulking					
vi)	Silt Content Test					
vii)	Presence of deleterious materials					
D)	BRICKS					
i)	Dimensional tolerance	As per enclosed Annexure-II	CPWD & POWERGRID specification	POWERGRID approved Lab.	Approved by POWERGRID	B
ii)	Compressible Strength					
iii)	Water Absorption					
iv)	Efflorescence					
E)	WATER					
i)	Cleanliness (Visual Check)	Random	IS:456, IS:3025 and POWERGRID specification. The water used for mixing concrete shall be fresh, clean and free from oil, acids and alkalies, organic materials, or other deleterious materials	Contractor	Each source to be approved by POWERGRID	B
ii)	Chemical and physical properties of water for checking its suitability for construction purposes	One sample per source	IS:456, IS:3025 and POWERGRID specification	Contractor/ POWERGRID Approved Lab	Approved by POWERGRID	B
	*Applicable to design mix concretes only					

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Sl. No.	Component/Operation & Description of Test	Sampling Plan with basis	Ref. Document & acceptance norm	Testing Agency	Remarks	Check
1.	REINFORCEMENT STEEL					
i)	Identification & size	Random	IS:432, IS:1139, IS:1786 & POWER GRID specification	Contractor	Approved by POWERGRID	B
ii)	Chemical Analysis Test	One sample per heat	IS:432, IS:1139, IS:1786 POWERGRID specification	Manufacturer	Review of manufacturers test certificates by POWERGRID	B
iii) iv) v)	Tensile Test Yield stress/proof stress Percentage Elongation	One sample per lot of 40 MT or part thereof for each size of steel conforming to IS: 1139 and 5 MT or part thereof for HDS wire for each size of steel as per IS: 432. For steel as per IS:1786 under 10mm 1 sample for each 25 MT or part thereof. 20 mm-16 mm 1 sample for each 35 MT or part thereof. Over 16mm 1 sample for each 45 MT or part thereof	IS:432, IS:1139, IS:1786 POWER GRID specification	Manufacturers/ POWERGRID approved lab	Review of manufacturers test certificates as well as lab test results by POWERGRID	B
vi)	Bend/Rebend Test	One sample per lot of 20 MT or part thereof for each size of steel as per IS:432, IS:1139. For steel as per IS:1786 under 10mm-16mm 1 sample for each 25MT or part thereof 10 mm-16mm 1 sample for each 45 MT or part thereof.	IS:432, IS:1139, IS:1786 POWER GRID specification	Manufacturers/ POWERGRID	Review of manufacturers test certificates as well as lab test results by POWERGRID	B
vii)	Reverse Bend Test for HDS wire	One sample per lot of 5 MT or part thereof for each size	IS:432 POWER GRID specification	Manufacturer/ POWERGRID approved lab	Review of manufacturers test certificates as well as lab test result by POWERGRID	B

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Section : FOUNDATION

Sl. No.	Component/Operation & Description of Test	Sampling Plan with basis	Ref. Document & acceptance norm	Testing Agency	Remarks	Check
C.	STRUCTURAL STEEL USED IN CABLE TRENCHES & FOUNDATIONS					
i)	Dimensional Check	Random	POWERGRID Specification & approved drawing	Contractor	Checklist to be prepared and signed jointly	B
ii)	Visual Check for damages, rusting, Pitting etc.	100%	POWERGRID Specification & approved drawing	Contractor	Checklist to be prepared and signed jointly	C
iii)	Visual Check for welding, defects, primer, coating and painting/galvanizing as applicable	Random	POWERGRID specification & approved drawings	Contractor	Checklist to be prepared and signed jointly	C
iv)	Physical properties of structural steel	1 sample per lot of 40 MT or part thereof for tensile tests and 1 sample per lot of 20 MT or part thereof for bend test for each size.	IS:2062, POWERGRID specification & approved drawings	Manufacturer/ POWER GRID Approved lab	Review of Mfgs. Test certificates as well as lab test results by POWERGRID	B

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Sl. No.	Component/Operation & Description of Test	Sampling Plan with basis	Ref. Document & acceptance norm	Testing Agency	Remarks	Check
2.	GANTRY/EQUIPMENT FOUNDATION/ CABLE TRENCH					
A.	BEFORE EXCAVATION					
i)	Checking of pegs condition as per line and alignment	100% on each location	IS:4091, IS:3764 & POWERGRID approved drawings/specification	Contractor	Approval by POWERGRID	C
ii)	Checking of pit making as per drawing & RL	100% on each location	IS:4091, IS:3764 & POWERGRID approved drawings/specification	Contractor	Approval by POWERGRID	C
B.	EXCAVATION					
i)	Dimensional conformity	Each location	IS:4091, IS:3764 & POWERGRID approved drawings/specification	Contractor	Approval by POWERGRID (JMC/MB)	B
ii)	Verticality/slopes & Squareness of each pit	Each location	IS:4091, IS:3764 & POWERGRID approved drawings/specification	Contractor	Checklist to be prepared and signed jointly	B
iii)	Verification of classification of foundation wherever applicable	Each location	IS:4091, IS:3764 & POWERGRID approved drawings/specification	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	B
C.	FOUNDATION BOLTS/MATALLIC INSERTS					
i)	Check for proper	100%	POWERGRID	Contractor	Checklist to be	C

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	identification foundation bolts w.r.t type of foundation		specification & approved drgs.		prepared and signed jointly	
ii)	Visual check for mechanical damage and galvanising/ painting if applicable for metallic insert	100%	POWERGRID specification & approved drgs.	Contractor	Checklist to be prepared and signed jointly	C
iii)	Alignment & Level	100%	POWERGRID specification & approved drgs.	Contractor	Checklist to be prepared and signed jointly	B
iv)	Grouting/Underpinning of foundation base plate	100%	POWERGRID specification & approved drgs.	Contractor	Checklist to be prepared and signed jointly	C
D.	P.C.C. Padding	For all locations	IS:456 and POWERGRID approved foundation drawings & specification	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	B
E.	SHUTTERING(Form work)					
i)	Check for materials, breakage or damage	100%	IS:456, POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	C
ii)	Check for plumb, alignment parallelism, squareness and equidistance from stub	100% casting	IS:456, POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	B
iii)	Dimensional check	100% before casting	IS:456, POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	B
iv)	Check for level & height	100% before casting	POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	B
v)	Check for rigidity of	100%	POWERGRID	Joint	Approval by	B

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	frame/tightness		specification/ approved drawings	inspection by POWER GRID and contractor	POWERGRID	
vi)	Cleaning and oiling	100%	POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	B
vii)	Diagonal bracing if required as per drawings/site conditions	100%	POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	C
viii)	Checking of joints to avoid undue loss of cement slurry	100%	POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	C
E.	PLACEMENT OF REINFORCEMENT STEEL					
i)	Check the steel bars for rust, cracks, surface flaws, laminate etc. (Visual check)	100%	IS:456 and POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	C
ii)	Check as per the bar bending schedule before placement of concrete	For all locations	IS:456,IS:2502 and POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID (Pour Card)	B
iii)	Check cutting tolerance for bars as per check list/drawings. Check whether all the bent bars and lap lengths are as per approved bar bending schedule	For all locations	IS:456,IS:2502 and POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID (Pour Card)	B
iv)	Check whether all joints & crossing of bars are tied properly	100%	IS:456 and POWERGRID specification/	Joint inspection by POWER	Approval by POWERGRID	C

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	with right guage & annealed wire as per specification		approved drawings	GRID and contractor		
v)	Check for proper cover distance spacing of bars, spacers, & chairs after the reinforcement cage has been put inside the formwork	100%	IS:456 and POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	C
vi)	Check whether lapping of bars are tied properly with right gauge and annealed wire as per specification	100%	IS:456 and POWERGRID specification/ approved drawings	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	B
G.	PILE FOUNDATION (Additional Tests)					
i)	Check of centre line of pile group	Each pile group	IS:2911 & POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Checklist to be prepared and signed jointly	B
ii)	Check pile location	Each pile	IS:2911 & POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Checklist to be prepared and signed jointly	B
iii)	Temporary casing tube & permanent liner also check thickness of liner material (if applicable)	Each pile	IS:2911 & POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Verticality of the tube to be checked	B
iv)	Bentonite slurry (if applicable)	Each pile	IS:2911 & POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Records to be kept by POWERGRID for specific gravity of slurry	B
v)	Pile depth, level, size	Each pile	IS:2911 &	Joint	Approved by	B

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	and alignment		POWERGRID approved pile foundation drawings/specification	inspection by POWER GRID and contractor	POWERGRID	
vi)	Chipping of pile head	Each pile	IS:2911 & POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Before concreting pile cap, pile head to be chipped off for concreting	B
vii)	Standard Penetrator Test	As per Powergrid BOQ/Specification	IS:2911 & POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Records to be kept by POWERGRID	B
viii)	Pile load testing	As per Powergrid BOQ/Specification IS:2911	IS:2911 & POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Records to be kept by POWERGRID Approval by POWERGRID	B
ix)	Anchor bolts if applicable					
a)	Level, centre to centre distance of bolts	100% on each location	POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Checklist to be prepared and signed jointly	B
b)	Visual check for galvanising	100% on each location	POWERGRID approved pile foundation drawings/specification	Joint inspection by POWER GRID and contractor	Checklist to be prepared and signed jointly	B
3.	CONCRETING					
A)	APPROVAL OF MIX DESIGN	Each Mix.	IS:456 & POWERGRID approved drawings and specifications	POWER GRID Approved by lab	Approval by POWERGRID	A
B)	BATCHING, MIX-	100%	IS:456 &	Joint	Approval by	B

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	ING & PLACING OF CONCRETE AND COMPACTING		POWERGRID approved drawings and specifications	inspection by POWER GRID and contractor	POWERGRID	
C)	FIXING OF CHIMNEY COLUMN Check for Width/length squareness, parallelism & equidistance from stub	100%	IS:456 & POWERGRID approved drawings and specifications	Joint inspection by POWER GRID and contractor	Approval by POWERGRID	C
D)	PLACING CONCRETE, AND COMPACTING	100%	IS:456 & POWERGRID approved drawings and specifications	Joint inspection by POWER GRID and contractor	Min. gap between boxes and reinforcement bars should be maintained Approval by POWERGRID	B
E)	CONCRETE TESTING					
i)	Slump test	One sample per foundation	IS:456,IS:516, IS:1199 and POWERGRID Specification	Contractor	Approval by POWERGRID	B
ii)	Check for quantities for cement, fine aggregate, coarse aggregate and water while batching	100% on all locations	IS:456,IS:516, IS:1199 and POWERGRID Specification	Contractor	Checklist to be prepared and signed jointly	B

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Sl. No.	Component/Operation & Description of Test	Sampling Plan with basis	Ref. Document & acceptance norm	Testing Agency	Remarks	Check
F)	CONCRETE CUBE TESTING					
i)	Compressive Strength	One sample for every 20 Cum of concreting or part thereof for each days concreting (one sample consists of min. 3 test cubes for 28 days strength).	IS:1199,IS:456, IS:516 and POWERGRID Specification	POWERGRID Approved lab	Approval by POWERGRID Cubes must be tested within a week after 28 days curing period and test results should be approved.	A
G)	CHECK FINISING, DIMENSIONAL CONFORMITY AND WORKMANSHIP BEFORE & AFTER BOX REMOVAL	100%	IS:456,IS:516, IS:1199 and POWERGRID Specification	Contractor	Approval by POWERGRID	B
4.	BACKFILLING					
i)	Check for thickness of Layer & watering	100%	POWERGRID Specification and approved drawings	Contractor	Approval by POWERGRID	C
ii)	Visual check for correction/ramming	100%	POWERGRID Specification and approved drawings	Contractor	Approval by POWERGRID	C
iii)	Compaction test (Percentage of max. dry density)	Gantry Foundation-2 samples for each pit. Equipment	POWERGRID specification	POWERGRID approved lab	Review of lab test results by POWERGRID Elevation for testing to be	B

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		and other foundation- 20% at random			decided by POWERGRID	
5.	BRICK-WORK					
i)	Mortar mix/proportion	Random	IS:2250, POWERGRID Specification & CPWD Specification	Contractor	Approval by POWERGRID	B
ii)	Plumb & Alignment	Random	POWERGRID Specification & CPWD Specification	Contractor	Approval by POWERGRID	B
iii)	Joints	Random	POWERGRID Specification & CPWD Specification	Contractor	Approval by POWERGRID	B
6.	PLASTERING					
i)	Plastering thickness and evenness	Random	POWERGRID Specification & CPWD Specification	Contractor	Approval by POWERGRID	B
ii)	Mortar mix proportion	Random	POWERGRID Specification & CPWD Specification	Contractor	Approval by POWERGRID	B
7.	CURING FOR CONCRETE, MASONRY, PLASTERING ETC.	100% on all location	IS:5613 & POWERGRID Specification	Contractor	Approval by POWERGRID	C
8.	SWITCH YARD EARTHING					
i)	Check for dimension of earth mat rod	Random	POWERGRID Specification & drawings	Contractor	Approval by POWERGRID	B
ii)	Depth of excavation	Random	POWERGRID Specification & drawings	Contractor	Approval by POWERGRID	C
iii)	Check for weld joints and anti corrosive treatment	Random	POWERGRID Specification & drawings	Contractor	Approval by POWERGRID	B
iv)	Backfilling	100%	POWERGRID Specification & drawings	Contractor	Approval by POWERGRID	C
9.	SITE SURFACING					
i)	Levelling	100%	POWERGRID Specification and approved drawings	Contractor	Checklist to be prepared and signed jointly	C

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ii) a)	Soil Sterilisation Spraying of chemicals	100%	POWERGRID Specification and Manufacturers recommendations	Con tractor	Checklist to be prepared and signed jointly	B
iii)	Grading of 20/40mm Stone	1 sample per lot of 500 Cubic Metre or part thereof from each source for each size	IS: 383, IS: 2386 and POWERGRID Specification. The grading shall be as per single sized nominal size	Contractor/ POWERGRID Approved lab	Each source to be approved by POWERGRID Review and acceptance of test results by POWERGRID	B
iv)	Compacted thickness of 20/40 mm stone layers as applicable	Random	POWERGRID Specification and specification drawings	Contractor	Checklist to be prepared and signed jointly	B

Section: GENERAL GUIDELINES FOR IMPLEMENTATION

1. Details of categories of check codes A,B & C including accepting and deviation dispositioning authorities are indicated at Annexure-I.
2. POWERGRID specification shall mean POWERGRID technical specification, approved drawings data sheets and LOA provisions applicable for the specific contract.
3. Acceptance criteria and permissible limits for certain tests are indicated at Annexure-II. For balance tests, site to verify the same with respect to POWERGRID specification, relevant Indian Standards and/or prevalent code of practice.
4. It is clarified that the tests indicated at column 2 of this FQP i.e. against column “Component operation & Description of Test”, are only generally required to be conducted. However, POWERGRID reserves the right to carry-out any additional tests at any stage if the situation so warrants.
5. POWERGRID site representative shall witness all the tests conducted by the contractor as mentioned in the FQP. However, in case of tests conducted in the POWERGRID approved lab, it is preferred to witness the tests in the lab itself, if possible.
6. Head of GHQ shall approve testing laboratory before accepting the test results from the lab.
7. Head of GHQ shall approve the sources for cement , coarse aggregate, fine aggregate & water before actual utilization.
8. All the testing & measuring equipments used by the contractor for testing are required to be calibrated. A copy of valid calibration report shall be retained by POWERGRID as records.
9. Classification of foundations shall be approved by POWERGRID based on the Joint Inspection Report & soil investigation reports.
10. Curing of concrete work should be continued for minimum period of 10 days.

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11. ZONE-IV FINE AGGREGATE

11.1 Zone-IV fine aggregate shall be used for nominal mix. Reinforced cement concreting work.

11.2 Zone-IV fine aggregate shall be avoided for design mix reinforced cement concreting work unless tests have been done to ascertain the suitability of proposed with the prior approval POWERGRID site.

12. Bricks should be free from cracks, flaws and modules of free lime. They should have smooth rectangular faces with sharp corners and should be uniform in colour.

13. CEMENT

13.1 In case of cement is in the scope of the contractor, the same shall be procured from sources approved by POWERGRID site and got tested on sample basis for specified acceptance tests as specified in the FQP at a reputed Third Party Lab approved by POWERGRID site.

13.2 The samples of cement for site testing shall be taken within three weeks of the delivery and all the tests shall be commenced within one week of sampling. If the cement remains in store for a period of more than six months. All the site tests are required to be repeated before usage.

14. REINFORCEMENT STEEL & STRUCTURAL STEEL USED IN CABLE TRENCHES & FOUNDATIONS

14.1 In case supply of steel is in the scope of the contractor, the same shall be procured from the main producers i.e. SAIL, TISCO, IISCO or Rashtriya Ispat Nigam or the rerollers approved by main producers. The steel shall be got tested at site on sample basis for specified acceptance tests as specified in this FQP at a reputed Third Party Lab approved by POWERGRID site.

14.2 The results of the testing of cement and reinforcement steel referred in 13.1 and 14.1 above shall be got approved from POWERGRID site before cement and reinforcement steel are put to use. However, in exceptional cases due to exigencies of work. POWERGRID site may authorize the contractor to use Cement and Reinforcement Steel even before the test results are received. However, in all such cases, if the test results subsequently received are found to be not complying with the specified acceptance criteria, the contractor shall have to dismantle and recast all such foundations cast with such non-conforming materials at his own cost. Confirmation to this effect shall be obtained from the contractor by the Project authorities beforehand in all such cases.

15. The contractor shall submit welding procedure specification (WPS) including the type of electrode used for approval of POWERGRID site before starting the welding work.

16. Approval/acceptance of individual test results by POWERGRID in the course of execution of contract will not relieve the contractor of his contractual obligations and responsibilities, nor does it limit the Owner's right under the contract.

17. In case, requirement of special items like Super Sulphated Cement, Corrosive Resistant Reinforcement Steel (CRRS) etc. arise due to site conditions, the specific approval of POWERGRID may be obtained before using the same and all the tests as per relevant standards shall be carried out.

18. All the materials shall be stored by the contractor in a manner affording convenient access for identifications and inspection at all times. Storage of material shall be in accordance with IS: 4032 (Latest Edition).

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ANNEXURE-I

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**ACCEPTING AND DEVIATION DISPOSITIONG AUTHORITIES FOR DIFFERENT
CATEGORIES OF CHECKS AS ENVISAGED IN FIELD QUALITY PLANT**

CATE GORY	TYPE OF CHECK	100% CHECKING/WITNESSING BY	COUNTER CHECK/SURVEI LLANCE CHECK BY	ACCEPTING AUTHORITY, IF TEST RESULTS ARE WITHIN PERMISSIBLE LIMITS	DEVIATION DISPOSITIONING AUTHORITY
'A'	CRITI- CAL	EXECUTING DEPTT. PLUS FQA REPRESENTATIVE GHQ	FQA REPRESENTATIVE AND RHQ/DHQ REPRESENTATIVE	HEAD OF DHQ	HEAD OF RHQ IN CONSULTATION WITH CQA, IF REQUIRED.
'B'	MAJOR	EXECUTING DEPTT.	DHQ- REPRESENTATIVE	HEAD OF GHQ	HEAD OF DHQ
'C'	MINOR	CONTRACTORS REPRESENTATIVE	EXECUTING DEPTT.	MINIMUM E4 LEVEL EXECUTING OF SUB- STATION/TL	HEAD OF GHQ

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ANNEXURE-2
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**ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR
FOUNDATION MATERIALS AND CONCRETE**

A) CEMENT

S. No.	Description of the tests	33 Grade OPC as per IS:269	43 Grade cement as per IS:8112	PPC as per IS:1489	Low Heat cement
1.	Fineness (min.)	225 m ² /kg	225 m ² /kg	300 m ² /kg	225 m ² /kg
2.	Compressive strength (min.) 72 ± 1 hours 168 ± 2 hours 672 ± 4 hours	160 kgf/cm ² 220 kgf/cm ² -	23 MPa 33 MPa 43 MPa	16 MPa 22 MPa 33 MPa	100 Kgf/cm ² 160 Kgf/cm ² 350 Kgf/cm ²
3.	Initial setting time (min.)	30 minutes	30 minutes.	30 minutes	30 minutes
4.	Final setting time (max.)	600 minutes	600 minutes	600 minutes.	600 minutes.
5.	Soundness (Le Chatelier Method)	Maximum 10 mm expansion	Maximum 10 mm expansion	Maximum 10 mm expansion	Maximum 10 mm expansion
6.	Heat of Hydration (max.)	-	-	-	Max. 65 cal/gm for 7 days & max. 75 cal./gm for 28 days
7.	Chemical composition	As per IS	As per IS	As per IS	As per IS

B) COARSE AGGREGATE :

(i) Sieve Analysis

IS SIEVE DESIGNATION	PERCENTAGE PASSING FOR GRADED AGGREGATE OF NOMINAL SIZE		PERCENTAGE PASSING FOR SINGLE SIZED AGGREGATE OF NOMINAL SIZE	
	40 mm	20 mm	40 mm	20 mm
63 mm	-	-	100	-
40 mm	95 to 100	100	85 – 100	100
20 mm	30 to 70	95 to 100	0 – 20	85 - 100
10 mm	10 to 35	25 to 55	0 – 5	0 - 20
4.75 mm	0 to 5	0 to 10	-	0 - 5

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- (ii) Flakiness Index Not to exceed 25%
 - (iii) Crushing value Not to exceed 45%
 - (iv) Soundness of aggregate applicable for concrete works subject to frost action Loss of weight after 5 cycle not to exceed 12% when tested with Sodium sulphate and 18% when tested with magnesium sulphate
 - (v) Deleterious material Not to exceed 5% of the weight of aggregate when tested as per IS:2386 Part – II (1963)
- (C) FINE AGGREGATE
- (i) Sieve Analysis Shall confirm to Zone-I, Zone-II or Zone-III

IS Sieve designation	Grading Zone-I	Percentage Grading Zone-II	Passing for Grading Zone-III	Grading Zone-IV
10 mm	100	100	100	100
4.75 mm	90 - 100	90 - 100	90 - 100	90 - 100
2.36 mm	60 - 95	75 - 100	85 - 100	95 - 100
1.18 mm	30 - 70	55 - 90	75 - 100	90 - 100
600 Micron	15 - 34	35 - 59	60 - 79	80 - 100
300 Micron	15 - 20	8 - 30	12 - 40	15 - 50
150 Micron	0 - 10	0 - 10	0 - 10	0 - 15

- (ii) For guidance of adjusting sand in mix of concrete, the following table may be used.

Moisture Content %	building % by volume
2	15
3	20
4	25
5	30

- (iii) Silt Content Test: Shall not exceed 8% when tested as per test procedure specified in appendix-D of chapter 3 of 1991-92 CPWD Specification.
- (iv) Deleterious Materials: Total deleterious material shall not be more than 5% by weight.

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(D) REINFORCEMENT STEEL: As per relevant Indian Standards.

(E) CONCRETE CUBE TEST

For nominal (volumetric) concrete mixes, compressive strength for 1:1½:3 (cement : sand : coarse aggregate) concrete shall be 265 kg/cm² for 28 days and for 1:2:4 nominal mix, it shall be 210Kg/cm².

(F) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTH FOR NOMINAL MIX CONCRETE

- (a) The average of the strength of three specimen be accepted as the compressive strength of the concrete, provided the strength of any individual cube shall neither be less than 70% nor higher than 130% of the specified strength.
- (b) If the actual average strength of accepted sample exceeds specified strength by more than 30%, the Engineer-in-charge, if he so desires, may further investigate the matter. However, if the strength of any individual cube exceeds more than 30% of specified strength, it will be restricted to 30% only for computation of strength.
- (c) If the actual average strength of accepted sample is equal to or higher than specified strength upto 30%, then strength of the concrete shall be considered in order and the concrete shall be accepted at full rates.
- (d) If the actual average strength of accepted sample is less than specified strength but not less than 70% of the specified strength, the concrete may be accepted at reduced rate at the discretion of Engineer-in-Charge.
- (e) If the actual average strength of accepted sample is less than 70% of specified strength, the Engineer-in-Charge shall reject the defective portion of work represented by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at the risk and cost of contract. If, however, the Engineer-in-Charge so desires, he may order additional tests to be carried out to ascertain if the structure can be retained. All the charges in connection with these additional tests shall be borne by the contractor.

(G) ACCEPTANCE CRITERIA FOR DESIGN MIX CONCRETE SHALL BE AS PER IS:456.

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(H) SAMPLING PLAN FOR BRICK WORK

- i) Scale of sampling and permissible number of defectives for visual and dimensional characteristics.

No. of bricks in the lot	For characteristics specified for individual bricks		For dimensional characteristics for group of 20 bricks-No. of bricks to be selected
	No. of bricks to be selected	Permissible no. of defective in the sample	
(1)	(2)	(3)	(4)
2001-10000	20	1	40
10001-35000	32	2	60
35001-50000	50	3	80

Note : In case the lot contains 2000 or less bricks the sampling shall be as per decision of the Engineer-in-Charge.

- ii) Scale of sampling for physical characteristics

Lot size	Sampling size for compressive strength water absorption and efflorescence	Permissible no of defectives for efflorescence
(1)	(2)	(3)
2001-10000	5	0
10001-35000	10	0
35001-50000	15	1

Note: In case the lot contains 2000 or less bricks, the sampling shall be as per decision of Engineer-in-Charge.

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(I) ACCEPTANCE CRITERIA FOR BRICK-WORK

- (i) Dimensional tolerances: The dimensions of modular bricks when tested shall be within the following limits per 20 bricks.

Length 372 to 388 cm (380 ± 8 cm)

Width 176 to 184 cm ($180 \pm$ cm)

Height 176 to 184 cm (180 ± 4 cm) for 90 mm high bricks

- (ii) In case of non-modular bricks, %age tolerance will be +/- 2% for group of 20 numbers of class 10 bricks and +/- 4% for other class of bricks.
- (iii) Compressive strength: The bricks, shall have a minimum average compressive strength as specified in POWERGRID specification. The compressive strength of any individual brick tested shall not fall below the min. average compressive strength specified for the corresponding class of brick by more than 20%. In case compressive strength of any individual brick tested exceeds the upper limit specified for the corresponding class of bricks, the same shall be limited to upper limit of the class as specified for the purpose of calculating the average compressive strength.
- (iv) Water absorption: The average water absorption of bricks shall not be more than 20% by weight.
- (v) Efflorescence: The rating of efflorescence of bricks shall not be more than moderate.