

# TECHNICAL SPECIFICATION

## SECTION – CIVIL WORKS

### **VOLUME-II** SECTION – 8

## **TECHNICAL SPECIFICATION FOR CIVIL WORKS**

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## **VOLUME-II**

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#### **TECHNICAL SPECIFICATION FOR CIVIL WORKS**

##### **I. General Conditions and Guide Lines:**

**The bidder shall go through the following guidelines and conditions thoroughly before quoting the rates for individual items of work.**

- 1) Design, engineering and construction of all civil works at sub-station shall satisfy the general technical requirements specified in other sections of the specification and as detailed below. They shall be designed to the required service conditions/loads as specified elsewhere in this specification or implied as per National/International Standards.
- 2) All civil works shall be carried out as per applicable Indian Laws, standards and codes. All materials shall be of best quality conforming to relevant Indian standards and codes.
- 3) The contractor shall furnish all design (unless otherwise specified), drawings, 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 approved drawings, specifications and direction of owner.
- 4) **The work shall be carried out according to the design/drawings to be developed by the contractor and approved by the owner or supplied to the contractor by the owner.** For all buildings, structures, foundations etc., necessary layout and details shall be developed by the contractor keeping in view of the functional requirement of the equipments and facilities for providing enough space & access for operation, use and maintenance in due course by the owner. Certain minimum requirements are indicated in this specification for guidance purposes only. However, the bidder shall quote according to the complete requirements.
- 5) The site will be handed over as “As it is where it is” condition. The layout and levels of all structure etc shall be marked by the contractor at his own cost from the general grid layout drawing and as per the benchmarks given by the Engineer-in-charge for checking of the layout and levels.
- 6) **Earth work excavation:** This includes excavation in all types of soil strata including hard rock and disposing of excavated surplus stuff after back

filling to the places, shown by the Engineer-in-charge within the station premises or outside the premises of sub-station, to any notified disposal point of local bodies.

- 7) **Back filling and consolidation:** Back filling shall be done in layers of 250 mms thick for yard leveling & 150 mms thick for trenches backfilling duly watering and compacting to the required density. If the excavated earth is not suitable for back filling, then the approved new earth shall be brought from outside, mixed with 3% cement (only for casing below foundations / trenches backfilling) and shall be used for back filling. Back filled earth & the sub-grade for the roads and embankment shall be compacted to minimum 96% of the standard Proctor's Density at OMC.
- 8) **Cement concrete mixing and laying:** The cement concrete shall conform to the requirement mentioned in IS-456 and all the test shall be conducted as per relevant Indian standard codes. The concrete shall be machine mixed and laid in layers of 150 mms thick and compacted using suitable vibrators to required shape. The bidder shall arrange for testing of concrete cubes at different stages of work as desired by the owner at his own cost.
- 9) **Cement:** The cement used shall be ordinary port land cement (OPC) of 43/53 grade and shall conform to relevant IS. The bidder shall produce test certificates for each lot of cement procured.
- 10) **Reinforcement steel:** Reinforcement shall be TMT bars conforming to IS-1786-2008(Fe 500 grade) and in specific areas, mild steel (Grade-I) conforming to IS: 432 can also be used. Bidders shall produce test certificate for each lot of reinforcement procured at site. Clear cover as per IS provision shall be left to the reinforcement from the external concrete surface.
- 11) **Jelly:** The jelly used shall be of hard broken granite/basalt/trap metal free from dust and organic material and shall be well graded. For bed concrete/leveling course (PCC 1:4:8) 40 mm and down size jelly shall be used and for coping, basement, cills, screed concrete, structural concrete, Design Mix etc (PCC/RCC 1:2:4, 1:3:6 & concrete M20 Grade) 20 mm and down size jelly shall be used.
- 12) **Sand:** white river sand free from clay and any other organic materials very well grained and cleanly sieved shall be used.
- 13) **Bricks:** Standard size table molded, well-burnt Bricks having minimum compressive strength of 45 Kgs per Sq Cms with neat edges shall be used. But in places where laterite stones are available the same may be used in place of bricks.

- 14) **Centering, formwork:** Only steel/plywood/plank centering shall be used for construction work. The centering material shall be discarded as soon as it loses its shape. Centering works shall be done to line and plumb with sufficient support to bear the dead weight of concrete and live loads during execution of work. The centering shall be water tight to avoid wheezing out of cement slurry during vibrating.
- 15) **Curing:** Curing shall be done for a minimum period of 10 days & maximum period of 28 days until the structures develops the required strength. The bidder shall construct a water storage tank for storing water and install 1 HP pump with distribution line for usage of water for construction & curing, as per the direction of Engineer-in-charge. The exposed faces of concrete shall be covered with gunny bags to keep the surface damp. The Max & Min period of curing may be decided with the Engineer in charge of the work depending upon the importance and type of the structure & surface to be kept damp.
- 16) **VOID**
- 17) 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.
- 18) Foundation system adopted shall ensure that relative settlement shall be as per provision of IS-1904 and other Indian standards.
- 19) **Interaction:** The proper co-ordination and execution of all interfacing civil works activities like fixing of conduits in roofs/wall floors, fixing of foundation bolts, fixing of lighting fixtures, fixing of supports/embedment, provision of cutouts 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.
- 20) **VOID.**
- 21) The excess quantity of earth obtained from site leveling and from foundations and other works shall be filled in low laying areas of the station premises or transported to any notified areas of local body outside the station without any extra cost.
- 22) Bidder shall visit the site and shall obtain all required information regarding the availability of labour, materials, machineries etc., before submitting their offer. Any other additional information and details can be obtained from the concerned transmission offices of KPTCL. Any plea/request for the revision of rates owing to non-availability of the materials or insufficient

quantity of materials will not be considered/entertained under any circumstances, which may please be noted.

## **II. SITE LEVELING:**

SCOPE: - The scope of Site leveling work includes the following with out any additional cost.

- 1) The bidder shall take the block levels of entire station area at an interval of 5 mtrs and plot the same marking contours at regular intervals. The block level drawing shall be submitted for approval along with calculations of cutting and filling quantities duly proposing the economical FGL of the yard.
- 2) Based on the above block levels,
- 3) the owner will decide the FGL to suit the requirement of station yard.
- 4) Clearing the site area free of bushes, trees including removal of roots, any unsuitable materials, demolition of any temporary building/structure and removal of debris/unserviceable materials, stacking within the premises or any disposal point away from the station area as per the decisions of the Engineer in charge of the work and stacking of useful/serviceable materials outside the yard within the station premises in the manner directed.
- 5) Leveling the station area to the required RL. The work includes cutting/excavating the areas above FGL in all types of soil and rock including soft rock, hard rock, hard laterite by blasting or chiseling, transporting the excavated earth to the areas lower than FGL, removal of roots, vegetation and other organic materials, breaking of clods, filling the areas lower than FGL in layers of 250mm loose thickness and consolidating the same using PRR to Proctors density of 96% to the required line, grade and cross section.
- 6) The shortage of earth if any shall be made good with the surplus earth from the foundation and other works. However if the earth is found shortage for leveling even after usage of all surplus available earth from all excavations, then such excess quantity of new earth brought from outside and used for site leveling only, will be paid at such rates provided in the price schedule for associated civil Engineering works or payment will be regulated as per the terms and conditions stipulated in the contract.
- 7) The excess/surplus earth & excavated rock shall be disposed off to the places within the station premises/stocked at the desired places or outside the premises to any notified disposal point of the local bodies as per the decisions & directions of the Engineer in charge of the work.

- 8) In the areas where the movement of roller is not possible, compaction shall be done using surface vibrators duly adding water to get the required density. Due care shall be exercised so as not to damage any foundation, structure, equipments etc during compaction.
- 9) If the type of soil encountered is black cotton soil/expansive soil or unsuitable for acceptance, then new approved earth/murram brought from outside shall be spread to the entire switchyard area to a depth of 300mm (compacted thickness) excluding plinths of the structures, roads, drainage, buildings, cable ducts etc and consolidated/compacted to proctors density of 96% to the line, grade and cross section after completion of casting of foundations and other works before Jelly spreading. Payment for the use of new earth for site leveling will be regulated as stated under Sl.NO. (6) above.
- 10) Bidder shall quote rate per CMTR to carryout:
  - (i) Site leveling – Cutting in all types of soil and rock and filling with available earth including compaction, disposal of surplus earth etc
  - (ii) Filling the yard with new / borrowed earth including compaction etc.

### **III. FOUNDATION TO STATION TOWERS, EQUIPMENTS AND OTHER SUCH WORKS**

#### **a) General:**

- 1) Hard copy of the soil investigation report if available may be obtained from the concerned transmission office of KPTCL and if the same is not available the contractor has to carryout the soil investigation and the designs shall be based on the test report.
- 2) Work covered under this clause of the specification comprises the design, supply and installation of foundation and other RCC/PCC constructions for switchyard structures, equipment supports, trenches, drains, jacking pad, pulling block, fencing, control cubicles, bus supports, transformers, marshalling kiosks, auxiliary equipment and 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. **The circuit breakers/Reactor/transformer shall rest on block foundations only.**
- 3) **Concrete shall conform to the requirements mentioned in IS: 456 and all the tests shall be conducted as per relevant Indian Standard Codes. M20 grade(Min) concrete shall be used for construction.**

- 4) If the site is slopy, the foundation height will be adjusted to maintain the exact level at the top of foundation of the structures to compensate such slopes.
- 5) **The switchyard foundations' plinths and building plinths shall be minimum 300mm and 750mm above finished ground level respectively.**
- 6) **Minimum 75mm thick lean cement concrete 1:4:8 shall be provided below all underground structures, foundations trenches etc to provide a base for construction unless otherwise specified..**
- 7) Concrete works done with Portland slag cement shall be carefully cured and special importance shall be given during the placing of concrete and removal of shuttering.
- 8) 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.
- 9) If pile foundations are adopted, the same shall be cast-in-situ driven/bored or pre-cast or undreamed type as per relevant IS Code. Only RCC piles shall be provided. Suitability of the pile foundations adopted shall be justified by way of full design calculations. Detailed design calculations shall be submitted by the bidder showing complete details of piles/pile groups proposed to be used. Necessary initial load test shall also be carried out by the bidder at their cost to establish the piles design capacity. Only after the design capacities of piles have been established, the contractor shall take up the job of execution of pile foundation. All the work (design & testing) shall be planned in such a way that these shall not cause any delay in project completion.

**b) Design:**

- 1) **Foundation shall be of RCC type only. The design and construction of cement concrete structures shall be carried out as per IS: 456 and minimum grade of concrete shall be M-20.** Higher grade of concrete than specified above may be used at the discretion of bidder, which has to be stated at the time of bidding. If the reinforcement is required the same shall have to be provided by the bidder with out additional cost.
- 2) Limit state method of design shall be adopted unless specified otherwise in the specification. For design and construction of steel concrete composite beam IS: 11384 shall be followed.



- 3) For detailing of reinforcement IS: 2502 and SP: 34 shall be followed. TMT bars conforming to IS-1786-2008(Fe 500 grade) shall be used as reinforcement. However, in specific areas, mild steel (Grade-I) conforming to IS: 432 can also be used. Two layers of reinforcement (one inner and outer face) shall be provided for wall & slab sections having thickness of 150 mm and above. Clear cover to reinforcement towards the earth face shall be 40mm In case of sidewalls of cable ducts and for tower foundations & equipment foundation, clear cover shall be 50mm.
- 4) RCC water retaining structures like storage tanks, cooling water basin etc. shall be designed as uncracked section in accordance with IS: 3370 (part I to IV) by working stress method. However, water channels shall be designed as cracked section with limited steel stresses as per IS: 3370 (part I to IV) by working stress method.
- 5) The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and/ or super structure and other conditions, which produces the maximum stresses in the foundation or the foundation component, and as per the relevant IS Codes of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details of piles / pile groups proposed to be used.
- 6) All foundations shall rest below virgin ground level and the minimum depth of foundation below the virgin ground level shall be at least 500mm for equipment foundations and 1000 mm for towers, transformers and reactors.
- 7) Design shall consider any sub-soil water pressure that may be encountered following relevant standard strictly.
- 8) Necessary protection to the foundation work if required shall be provided to take care of any special requirements for aggressive alkaline soil, black cotton soil or any other type of soil, which is detrimental / harmful to the concrete foundations.
- 9) RCC columns shall be provided with rigid connection at the base.
- 10) All sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combinations of loads. Factors of safety for these cases shall be taken as mentioned in relevant IS codes or as stipulated elsewhere in the specifications. For checking against over turning, weight of soil vertically above footing shall be taken and inverted frustum of pyramid of earth on the foundation should not be considered.

- 11) Earth pressure for all underground structures shall be calculated using coefficient of earth pressure at rest, coefficient of active or possible earth pressure (whichever is applicable). However, for the design of substructures of any underground enclosures, earth pressure at rest shall be considered.
- 12) In addition to earth pressure and ground water pressure etc., a surcharge load of  $2T/Sq.m$  shall also be considered for the design of all underground structures including channels, sumps, tanks, trenches, substructure of any underground hollow enclosure etc., for the vehicular traffic in the vicinity of the structure.
- 13) Following conditions shall be considered for the design of water tank in pump house, channels, sumps, trenches and other underground structures.
  - a) Full water pressure from inside and no earth pressure and ground water pressure & surcharge pressure from outside (application only to structures, which are liable to be filled up with water or any other liquid).
  - b) Full earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.
  - c) Design shall also be checked against buoyancy due to the ground water during construction and maintenance stages. Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the superimposed loading.
- 14) Base slab of the any underground enclosure shall also be designed for empty condition during construction and maintenance stages with maximum ground water table (GWT). Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the superimposed loadings.
- 15) Base slab of any underground enclosure like water storage tank shall also be designed for the condition of different combination of pump sumps being empty during maintenance stages with maximum GWT. Intermediate dividing piers of such enclosures shall be designed considering water in one pump sump only and the other pump sump being empty for maintenance.
- 16) The foundations shall be proportioned so that the estimated total and differential movements of the foundations are not greater than the movements that the structure or equipment is designed to accommodate.
- 17) **Machine foundations:**

- a) All machine foundations shall be designed in accordance with the provisions of the relevant parts of latest revisions of Indian standards IS: 2974, IS: 456, IS: 2911. The provisions of DIN 4024 (latest) shall also be followed.
- b) All block foundations resting on soil or piles shall be designed using the elastic half space theory. The mass of the RCC block shall not be less than three times the mass of the machine. Dynamic analysis shall be carried out to calculate natural frequencies in all the modes including coupled modes and to calculate vibration amplitudes. Frequencies and amplitude criteria as lay down by the relevant IS codes and/or machine manufacturers, shall be satisfied. Minimum reinforcement shall be governed by IS: 2974 and IS: 456. & M 20 concrete shall be used for construction.
- c) For the foundations supporting minor equipments weighing less than one tone or if the mass of the rotating parts is less than one-hundredth of the mass of the foundation, no dynamic analysis is necessary. However, if such minor equipments is to be supported on building structure, floors etc., suitable vibration isolation shall be provided by means of springs, neoprene pads etc. and such vibration isolation system shall be designed suitably.

#### **18) Other foundations:**

All foundations shall be designed in accordance with the provisions of the relevant parts of latest revisions of Indian Standards IS: 2911 and IS: 456. & M20 concrete **(Min)** shall be used for construction.

- i) Type of foundation system i.e., isolated or combined footing or raft or piling shall be decided based on the load intensity and soil-strata.
- ii) Minimum three piles shall be provided in any pile group, if required. The tower and equipment foundations shall be designed for a factor of safety of 2.2 for normal/broken wire condition and 1.65 for short circuit conditions.

#### **19) Admixtures & Additives:**

- 1) 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 labeled containers to enable identification.

- 2) Admixtures in concrete shall conform to IS: 9103. The waterproofing cement additives shall conform to IS: 2645. Concrete admixtures / Additives shall be approved by Owner.
- 3) The contractor shall use an approved neutralized vinsol resin air-entraining agent in all concrete. The air-entraining agent shall be supplied and batched as a solution with solids content not exceeding 15 percentages by weight with suitable, stable & consistent pH. Air –entraining requirements shall be in accordance with CP 100 part I.
- 4) The contractor may propose and the Owner may approve the use of 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, operating and shall only be approved as an aid overcoming unusual circumstances and placing conditions.
- 5) The water-reducing set-retarding admixture shall be an approved brand of ignosulphonate type admixture
- 6) The waterproofing cement additives shall be used as required / advised by the owner.

## **20) Hot Weather Requirement:**

- 1) As per relevant code, during hot weather, precautions shall be taken to avoid premature stiffening of the fresh mix and to reduce water absorption and evaporation losses and when the temperature of the surrounding air is higher than 30 degree C; the following shall apply unless otherwise approved by the owner.
  - a) The formwork shall be continuously sprayed with cold water in advance of concreting and excess water shall be removed from inside the forms immediately prior to placement of concrete.
  - b) The reinforcement and the formwork (if metal forms are used) shall be protected from the effect of hot winds and direct sunlight.
  - c) Suitable barriers shall be provided to protect the freshly placed concrete from wind until the concrete is sufficiently hard.
  - d) The concrete when placed shall be maintained at a temperature of less than 30 degree C by the use of chilled water or by spraying the aggregate with cold water.

- e) The concrete shall be mixed, transported, placed and consolidated, as rapidly as possible and shall then be covered with an impervious membrane or wet Hessian until moist curing begins.
- f) Curing compounds shall not be used as an alternative to the requirements of (clause 8.10.3) curing.
- g) During hot weather (atmospheric temperature above 40° C) or cold weather (atmospheric temperature at & below 5° C) the concreting shall be done as per the procedure set out in IS: 7861 (part I & II).

#### **IV(a). R.C.C. CABLE DUCTS**

- 1) Cable ducts shall be constructed by RCC of grade M 20 as per typical drawings furnished by the owner. RCC pre-cast cover slabs shall be provided for covering the top portion. At junction and where pre-cast slabs cannot be provided cast-in situ slabs may be provided.
- 2) The trench bed shall have a slope of 1 in 500 along the run and 1 in 250 perpendiculars to the run.
- 3) Trench wall shall not foul with the foundation. Suitable clear gap shall be provided.
- 4) Water flow diagram to drain the storm water collected in the drain shall be prepared and got it approved. If the topography of the area permits the gravity flow, water collected in the drain shall be effectively discharged to the convenient point outside the station by providing 300mm dia RCC Hume pipe NP2 class. If the site does not permit the gravity flow, then necessary RCC sumps shall be constructed and suitable pumps installed to drain the water effectively through RCC Hume pipes & GI pipes as required. Cable trenches shall not be used as storm water drains. **No separate rate or extra rate will be paid for providing RCC Hume pipes or for construction of Sump, providing pump and pipe lines for draining of water from the cable ducts.**
- 5) All metal parts inside the trench shall be connected to the earthing system.
- 6) All the construction joints of cable trench i.e., between base slab to base slab & the junction of vertical wall to base slab as well as from vertical wall to wall and all the expansion joints shall be provided with approved quality PVC water stops of approx 230X5mm size for those sections where the ground water table is expected to rise above the junction of base slab and vertical wall of cable ducts.

- 7) Cable ducts shall be blocked at the ends if required with brick masonry in cement sand mortar 1:6 and plastered with 12mm thick 1:6 cement sand mortar.
- 8) Rate per Rmtr of duct shall be quoted. Rate shall include excavation in all types of soil and rock, backfilling with available earth or new earth, disposal of surplus soil/rock to the places directed, concrete= PCC 1:4:8 & M20 concrete, structural steel work- insert plate, cable support angles, cable trays, lugs etc., pre-cast or cast in situ RCC slabs, reinforcement, brick works, RCC hume pipe, GI pipe, Sump tank and other items of works not mentioned herein but required for the completion of work.
- 9) **In case of black cotton soil/expansive soil, well compacted murrum casing with 3% cement shall be provided below PCC 1:4:8,**
- 10) All mild steel parts shall be fabricated and neatly placed in position to plumbs and levels and welded as per drawing and painted with two coats of approved synthetic enamel paint over one coat of shop primer.

#### **IV(b). R.C.C. CABLE DUCTS AT ROAD CROSSING:- (M 20 concrete)**

The bidder shall quote rate per No. of duct crossing. Rate shall include cost of excavation, back filling, and disposal of surplus earth R.C.C. M20 grade for side walls, raft and top slab, PCC 1:4:8, reinforcement, tray supports, cable trays and allied works including cost of all materials as per technical specification and enclosed drawing in all respects.

- 1) **The length of the crossing shall be to the full width of the road and section shall be kept as that of the duct for which the crossing is required.**
- 2) The scope of work applicable to RCC duct specified under 4(a) is also applicable to cable duct crossing.

#### **IV(c). RCC HUME PIPE SUB DUCTS**

Bidder shall quote Rate per Rmtr of cable duct. Rate shall include cost of excavation in all types of soil and rock, backfilling and disposal of surplus earth/rock, supplying, providing and jointing RCC hume pipes of 150mm dia NP2 class/of required dia with collars, GI/PVC pipes for taking cables from equipments to ducts/chambers, etc as per detailed specification and directions of the Engineer in charge of work.

#### **IV (d). INSPECTION CHAMBERS:**

Inspection chambers of size 650x450mm / 450X450mm as required shall be provided wherever required as per layout and directions of Engineer-In-Charge of work. Rate per number shall be quoted. Work includes

excavation, back filling and disposal of surplus earth / rock, bed concreting, brick masonry / laterite masonry walls, CI frame and cover, plastering etc., required for the completion of work as per specifications and directions of the Engineer-In-Charge of the work.

## **V. VOID**

## **VI. JELLY SPREADING:**

Bidder shall quote rate per Smtr of area for Jelly spreading. After the soil sterilization, material is applied and surface prepared/compacted to the required slope/grade, 100 mm thick layer of granite/basalt/trap jelly of **20/25mm** size shall be spread over the area marked in drawing for jelly spreading as per drawing and directions of Engineer in charge of work.

The material required for jelly spreading shall be free from all types of organic materials, flakes and shall be of standard approved quality and as directed by the owner.

The **20/25mm** nominal size shall pass through IS sieve designation 40mm and nothing through 16mm IS sieve.

The area marked in the drawing (excluding buildings, pathways, roads, drains, cable ducts, equipment/structure plinths etc) shall be covered with jelly.

The work shall be taken up after completion of all construction activities.

## **VII . TRANSFORMER FOUNDATION, RAIL TRACK/ROAD CUM RAIL TRACK:**

The Contractor shall provide a permanent transfer track system integrated with the transformer foundation to enable installation and the replacement of any failed unit by the spare unit located at the site. The transformer track system shall be suitable to permit the movement of any failed unit fully assembled (including OLTC, bushings) with integral radiators and oil, without the deenergization of any other equipment in the station. This system shall enable the removal of any failed unit from its foundation to a repair area and the installation of the spare unit. This system, preferably, shall not interfere with the normal internal road and trench system. If trench/drain crossings are required, then suitable RCC culverts shall be provided in accordance with IRC Code/relevant IS. Rail tracks shall be of RCC, minimum M20 grade. The space between the tracks shall be suitably filled with local sand and 75 mm thick PCC of grade 1:4:8 placed over sand filling. The top of PCC shall be up to the formation level. Suitable drainage system between the tracks shall be provided.

The rails shall be first quality 52 Kg/m medium manganese steel as per Indian Railway specification T-12-64 and its subsequent revision, joined together by fish plates as per Indian Railway specification T-1/57 and their drawing no.090 M and 27mm diameter fish bolts.

The Contractor shall provide a pylon support system for supporting the fire fighting system. **For Transformer / Reactor foundation, rails shall be provided in both the directions.**

### **VIII. ROAD WORK:**

The approach road and road within the sub-station provided for access to equipments & building are in the scope of the bidder. The layout of the roads shall be based on general details and arrangement drawing for the Sub-station. Parking areas shall be provided for site personnel and visitors at convenient locations. Adequate turning space for vehicles shall be provided and bend radii shall be set accordingly. Road to the transformer / reactors shall be as short and straight as possible. All Sub-station and approach roads be constructed so as to permit transportation of all heavy equipments.

**NOTE: When the length of the Road is more than 250 Mtr, Asphalt/Bitumen Road shall be provided and When the length of the Road is less than 250 Mtr, RCC road shall be provided.**

- \_1) The double lane road shall have minimum 5M black topping/RCC with 1.6M wide shoulders on either side of the road. The other service roads shall be with 3.75M black topping/RCC and 1.3M wide shoulder on either side of the road. **The finished top (crest) of roads shall be 200mm (min) above the surrounding grade level (formation level).** Road construction shall be as per IRC standards. Adequate provision shall be made for road drainage.
- 2) Approach road from the nearest P.W.D. main road up to the proposed Substation is also in the scope of the contract..
- 3) All the culverts and its allied structure (required for road/rail, drain trench crossings etc.) shall be designed for class AA loading and checked for Class A loading as per IRC standard.
- 4) All roads shall be designed for class 'E' of traffic as per IRC Standards.
- 8) Excavation shall be done in all types of soil & rock to the required cross section, line and grade. Longitudinal gradient and cross slope/camber shall be provided to dispose off the rain water to the nearby drains.
- 9) The excess/surplus earth shall be disposed off to the places directed as per the directions of the owner.



**i. Asphalt/Bitumen Road**

- 1) The bidder shall quote rate per Rmtr of road including cost of forming the approach, laying 3 layers of graded metal, spreading of murrum, watering, consolidation using road roller and forming the shoulders on either side, providing and fixing RCC kerb stones and walk ways if the space is available, providing chip carpet with seal coat including cost of all materials, labours etc., complete as per technical specification and enclosed drawing
- 2) The macadam road shall consist of sub-base (with 90mm size jelly of consolidated thickness of 200mm including 25 mm thick murrum layer) and base course in two stages each of consolidated thickness of 75mm with murrum packing (1st stage with 63 – 40 mm size jelly and 2nd stage with 40-25 mm jelly).
- 3) Block top shall consist of 50mm thick B.U.S.G. (Built up spray grout) and 25mm thick pre-mixed chip carpet. The work shall be carried out as per MOST specification incorporated in the KPWD Schedule of Rates..
- 4) For road in expansive/ BC soil, a consolidated/compacted thickness of murrum/new earth 450mm thickness below sub-grade and 250 mm for shoulders shall be provided. RCC Kerb stones (M20 Grade) shall be provided on either side of the road and fixed as per the drawing. The exposed faces of the kerb stone shall be painted with two coats of approved synthetic enamel paint (Black & Yellow stripes as per IRC standards shall be provided).

**ii. RCC ROAD**

RCC Road (M20 Grade) shall be provided as per the drawing furnished.

- 1) The bidder shall quote rate per Rmtr of road including cost of forming the approach, providing a consolidated/compacted thickness of murrum/new earth 300mm thick with 3 %cement (for expansive soil / black cotton soil ) providing walk ways/shoulders using available approved earth or approved new earth (in expansive/BC soil), providing PCC 1:4:8 100mm thck, providing RCC M20 Grade 150mm thick, providing required reinforcement as per drawing, providing RCC Kerbs on both sides, providing two coats of synthetic enamel paint to the exposed faces of the Kerb (Black and yellow stripes ) etc to complete the work in all respects
- 2) The RCC road shall consist of 100mm thick PCC 1:4:8 plain concrete using 40mm and down size jelly , 150mm thick RCC (M20 Grade) with required reinforcement as indicated in the drawing.

- 3) For road in expansive/ BC soil, a consolidated/compacted thickness of murrum/new earth 300mm thickness with 3% cement below PCC 1:4::8 and 250 mm for shoulders shall be provided. RCC Kerb stones (M20 Grade) shall be provided on either side of the road and fixed as per the drawing. The exposed faces of the kerb stone shall be painted with two coats of approved synthetic enamel paint (Black & Yellow stripes as per IRC standards shall be provided).

## **IX. CULVERT: ACROSS APPROACH ROAD**

The bidder shall quote rate per culvert as a whole including cost of excavation in all kinds of soil and rock, bed concrete, RCC Hume pipes, RCC wing walls, back filling etc., complete as per enclosed drawing and technical specification. The culvert shall be provided either inside the substation or outside the substation as directed by the Engineer-in-charge of work.

- 1) Earth work excavation shall be done to the required depth in all types of soil and strata including Hard Rock.
- 2) **The length of culvert shall be as per site requirements –Hume pipes may be single or double row as per requirements.**
- 3) The RCC Hume pipes shall be of NP-3 class of 45/60/90 cms dia as per requirements with suitable collars laid to required slope to suit site condition and jointed with cement and hemp.
- 4) Side wall (Wing walls) shall be of RCC M 20 grade as per drawing and constructed over 1:4:8 bed concrete.
- 5) The exposed faces of RCC side wall shall be plastered with cement mortar (1:4) 12 mm thick.
- 6) Back filling to the foundation and basement shall be done including watering & consolidation.
- 7) Extra excavated earth shall be disposed off to the place shown by the engineer-in-charge of work after back filling.

### **RCC Deck slab/Box culverts:**

**Rate per No. of culverts shall be quoted. Scope includes design, Engineering and construction of culvert as per approved drawing, specifications and directions of the Engineer in charge of the work. The concrete Grade shall be minimum M20 Grade. The vents shall be one or more depending on the site requirements. Other details are as applicable to the RCC Hume pipe culverts.**

## **X. BAFFLE WALL BETWEEN TRANSFORMER**

**GENERAL:** Fire protection wall shall be provided in accordance with Tariff Advisory Committee (TAC) recommendations.

**APPLICATION CRITERIA:** A fire wall shall be erected between the transformers / reactors if the free distance between the various pieces of equipment is less than 10m. to protect each one from the effects of fire on another.

**FIRE RESISTANCE:** The fire wall shall have a minimum fire resistance of 3 hours. The partitions which are made to reduce the noise level of the transformer / reactor shall have the same fire resistance where the partitions are also used as fire walls. The walls of the building, which are used as fire walls, shall also have a minimum fire resistance of 3 hours.

The fire wall shall be designed in order to protect against the effect of radiant heat and flying debris from an adjacent fire.

**MECHANICAL RESISTANCE:** The fire wall shall have the mechanical resistance to withstand local atmospheric conditions. If this wall shall serve as a support for equipment such as insulators etc., its mechanical rigidity must be increased.

Connecting the walls by steel or other structures, which may produce a reversing torque, if overheated, shall be avoided.

**DIMENSIONS:** The fire wall shall extend at least 1m on each side of the power transformer / reactors and at least 1 m above the conservator tank or safety vent.

These dimensions might be reduced in special cases, and if TAC permits so, where there is lack of space. A minimum of 2 meter clearance shall be provided between the equipments i.e., transformer / reactors and fire walls.

The building walls, which act as fire walls, shall extend at least 1 m above the roof in order to protect it.

**MATERIALS:** The fire wall may be made of reinforced concrete framed structure (M-20 grade) and infilling with table moulded brick masonry with foundation to suit soil condition, Materials used must conform to the standards of the National Fire Prevention Association and TAC norms.

The exposed surface shall be painted with two coats of waterproof cement painting over one coat of primer.

**The bidder shall quote rate per No.**

## **XI (A). CHAIN LINK MESH SECURITY FENCING:**

The bidders shall quote rate per "Rmtr" of securing fencing including supply and erection / fixing of RCC fencing poles (vertical / bent up and struts), chain link mesh, barbed wire, GI flat, bolts and nuts, including cost of all materials labour etc., complete as per technical specification and enclosed drawings.

- 1) The security fencing shall be provided as per the layout drawing and to the areas as per the directions of the Engineer in charge of the work.
- 2) The security fencing poles shall be of RCC (1:1.5:3 prop) and of size 0.15 mtrs x 0.15 mtrs and length as per drawing cast at site using 12 mm and down size jelly and approved clean sieved sand. The reinforcement shall be 4 numbers of 12mm dia TOR steel vertical bars at corners and 8 mm dia TOR stirrups at 20 cm C/C including cost of making holes wherever required as per design.
- 3) **Poles shall be erected at a spacing of 2.5 mtrs C/C with strut poles at all corners in both directions. Two transverse stay poles shall be provided at every 25 mtrs intervals and at every change in levels.**
- 4) The chain link mesh shall be of galvanized iron in accordance to specification covered under IS 2721.
  - a) Size of mesh : Inter links of 50 mm x 50mm
  - b) Size of coated wire : 8 gauge (4.06 mm thick)
  - c) Width of chain link mesh : 2500 mm
  - d) Class of zinc coating : As per IS standards
- 5) Above chain link mesh, 3 rows of galvanized barbed wire with loops as shown in drawing shall be provided.
- 6) The barbed wire shall consist of two splices per reel. The barbed wire shall be formed by twisting two line wires, one containing the barbs. The barbed wire shall be of 12 SWG galvanized steel with its weight 155-136 gm/m length of the wire. Distance between two barbs shall be 75 mm. The barbs shall carry four points and shall be formed by twisting two point wires each two turn tightly round one line wire, making altogether over complete turn. The barbs shall be furnished in such a way that the four points are set and locked at right angles to each other. The barbs shall have a length of not less than 13mm and not more than 18mm. The points shall be sharp and well pointed. The barbed wire shall have tensile properties as below;  
Breaking load of line wire: Minimum 216 Kg / Maximum 302 Kg.  
Minimum breaking load of:  
Complete barbed wire: 444 Kg.

On the results of these additional tests, the whole or portion of the barbed wire shall be accepted or discarded by the owner, as the case may be.

- 7) Fence fabric shall not be installed until concrete is cured for a minimum period of 7 days.
- 8) The chain link mesh shall be stretched tightly to line and plumb all along the fencing and fixed to the security fencing poles using 50x6mm thick galvanized flat and galvanized bolts and nuts of size 16mm dia 230mm long.
- 9) The fencing poles shall be painted with 2 coats of waterproof cement paint of approved color over 1 coat of cement primer.

**XI (B): TOE WALL:** Size stone masonry toe wall shall be provided for the security fencing as per the drawing enclosed. Work includes excavation, back filling and disposal in all types of soil / rock, PCC 1:4:8 bed concreting, providing new earth mixed with 3% cement for back filling and casing below foundations in expansive / BC soil, size stone masonry in cement mortar 1:6 for foundation and basement, PCC 1:3:6 for copping and embedding the RCC fencing poles, pointing to the exposed faces of stone masonry etc., complete as per drawing and directions of Engineer-In-Charge of the work.

**XI (C) SECURITY COMPOUND WALL:**

Security compound wall shall be provided as per the drawing enclosed/furnished to the areas indicated in the layout drawing **OR** to the areas shown by the Engineer in charge of the work.

- 1) Earth work excavation for foundation shall be done in all types of soil and rock, backfilling with available approved earth /approved new earth, disposal of the surplus soil/rock to the places directed within the station premises or outside to any notified areas of the local bodies.
- 2) Providing PCC 1:4:8 plain cement concrete 100mm thick below masonry foundation.
- 3) Providing and constructing granite or trap or basalt size Stone Masonry, stones hammer dressed in courses not less than 20cms high with bond stones 2m apart in each course including curing etc., complete as per specifications, in cement mortar 1:6 for foundation.
- 4) Providing and constructing granite or trap or basalt size Stone Masonry, in courses not less than 15cms high with bond stones 2m apart in each course, edges of stones chisel dressed and all quoins 2 line dressed 5cmtr wide on each face including curing etc., complete as per specifications, in cement mortar 1:6 for Basement.

- 5) Providing Cement Concrete 1:3:6 for basement, coping & for fixing Security fencing angle iron supports using 20mm and down size jelly, curing etc., complete.
- 6) Providing Solid cement concrete block masonry wall and pillar using solid concrete blocks with compressive strength of not less than 35Kg/Sqcms.
- 7) Providing plastering to the exposed faces of concrete block masonry wall and pillar and the concrete surface with 20 thick cement mortar 1:6.
- 8) Providing pointing in 1:3 cement mortar to the exposed faces of the size stone masonry.
- 9) Providing two coats of water proof cement painting to the exposed faces of the masonry and concrete over one coat of primer.
- 10) Providing structural steel supports made out of 2 equal angles of 65X65X6mm welded together and fixed in the concrete as indicated in the drawing. The top portion for a depth of 400mm shall be made Y shape with single angle and holes shall be provided for drawing barbed wire as indicated in the drawing. Frames made out of ISA 45X45X5mm all-round shall be welded to the vertical supports at the ends and fixed to the concrete at the bottom as indicated in the drawing. The structural steel work shall be painted with anticorrosive steel paint with primer.
- 11) Providing GI chain link mesh 50X50mm size of 8 guage fixed to the structural steel frames using GI bolts, nuts and washers and MS flat 40X6mm all-round as indicated in the drawing.
- 12) Providing GI barbed wire 12X12 guage 6 rows at the bent up portion of the vertical supports and loops as shown in the drawing.

#### **XI (D) PERIPHERY COMPOUND WALL:**

Periphery compound wall shall be provided as per the drawing enclosed/furnished to the areas indicated in the layout drawing **OR** to the areas shown by the Engineer in charge of the work.

- 1) Earth work excavation for foundation shall be done in all types of soil and rock, backfilling with available approved earth /approved new earth, disposal of the surplus soil/rock to the places directed within the station premises or outside to any notified areas of the local bodies.
- 2) Providing PCC 1:4:8 plain cement concrete 100mm thick below masonry foundation.

- 3) Providing and constructing granite or trap or basalt size Stone Masonry, stones hammer dressed in courses not less than 20cms high with bond stones 2m apart in each course including curing etc., complete as per specifications, in cement mortar 1:6 for foundation.
- 4) Providing and constructing granite or trap or basalt size Stone Masonry, in courses not less than 15cms high with bond stones 2m apart in each course, edges of stones chisel dressed and all quoins 2 line dressed 5cmtr wide on each face including curing etc., complete as per specifications, in cement mortar 1:6 for Basement.
- 5) Providing Cement Concrete 1:3:6 for basement, coping & for fixing Security fencing angle iron supports using 20mm and down size jelly, curing etc., complete.
- 6) Providing Solid cement concrete block masonry wall and pillar using solid concrete blocks with compressive strength of not less than 35Kg/Sqcms.
- 7) Providing plastering to the exposed faces of concrete block masonry wall and pillar and the concrete surface with 20 thick cement mortar 1:6.
- 8) Providing pointing in 1:3 cement mortar to the exposed faces of the size stone masonry.
- 9) Providing two coats of water proof cement painting to the exposed faces of the masonry and concrete over one coat of primer.

## **XII. MAIN GATE, WICKET GATE & GATE PILLARS:**

- 1) The Gate frame shall be made of medium duty MS pipe conforming to relevant IS with welded joints.
- 2) The gates shall be fabricated with welded joints to achieve rigid connections. The gate shall be painted with one coat of approved steel primer and two coats of synthetic enamel paint.
- 3) Gates shall be fitted with approved quality iron hinges, latch and latch catch. Latch and latch catch shall be suitable for attachment and operation of pad lock from either side of gates. Hinges shall permit gates to swing through 180 degree back against fence.
- 4) Gates shall be fitted with galvanized chain hook or gate hold back to hold gates open. Double gates shall be fitted with center rest and drop bolt to secure gates in closed position.
- 5) Work shall be carried out as per the drawing and directions of the Engineer-In-Charge of the work.
- 6) The bidder shall quote rate for carrying out the entire job.

### **XIII. CONTROL ROOM BUILDING:**

- 1) The scope includes Design, Engineering (Unless otherwise stated) & construction of RCC framed control room building as per detailed technical specification and enclosed drawing including providing necessary treatment to sub-soil depending on the soil conditions, internal water supply, internal & external sanitary arrangements including construction of septic tank & soak pit **connecting with the UGO system of the local authorities**, electrification / Illumination (concealed type) and internal RCC & Hume pipe cable ducts **& providing hanging trays etc.** including cost of all materials, labour etc., complete.

The rate shall be quoted for the entire job as a whole considering the following aspects and technical specifications. The payment will be made at different stages of building i.e., 10% at plinth level, 25% at lintel level, 50% at roof level and 100% after completing the entire job.

### **2) DESIGN AND GENERAL CONDITIONS:**

The buildings shall be designed:

1. To the requirements of the National Building Code of India, and the standards quoted therein.
2. For the specified climatic & loading conditions.
3. To adequately suit the requirements of the equipment and apparatus contained in the buildings and in all respects to be compatible with the intended use and occupancy.
4. With a functional and economical space arrangement.
5. For a life expectancy of structure, systems and components not less than that of the equipment, which is contained in the building, provided regular maintenance is carried out.
6. To be aesthetically pleasing. Different buildings shall show a uniformity and consistency in architectural design.
7. To allow for easy access to equipment and maintenance of the equipment.
8. With, wherever required, fire retarding materials for walls, ceilings and doors, which would prevent supporting or spreading of fire.
9. With materials preventing dust accumulation.
10. a) Individual members of the buildings frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion etc.  
b) Permissible stresses for different load combinations shall be taken as per relevant IS Codes.  
c) The building lighting shall be designed in accordance with the requirements of relevant section.

### **3) DESIGN LOADS**



Building structures shall be designed for the most critical combinations of dead loads, super- imposed loads, equipment loads, crane load, wind loads, seismic loads, and temperature loads. In additions, loads and forces developed due to differential settlement shall also be considered.

Dead loads shall include the weight of structures complete with finishes, fixtures and partitions and should be taken as per IS: 1911 (latest revision).

Super-imposed loads in different areas shall include live loads, minor equipment loads, cable trays, small pipe racks/hangers and erection, operation and maintenance loads. Equipments loads shall constitute, if applicable, all load of equipments to be supported on the building frame.

The wind loads shall be computed as per IS 875, Seismic Coefficient method shall be used for the seismic analysis as per IS: 893 (latest revision).

For temperature loading, the total temperature variation shall be considered as  $2/3$  of the average maximum annual variation in temperature. The average maximum annual variation in temperature for the purpose shall be taken as the difference between the mean of the daily minimum temperature during the coldest month of the year and mean of daily maximum temperature during the hottest month of the year. The structure shall be designed to withstand stresses due to 50% of the total temperature variation.

Wind and Seismic forces shall not be considered to act simultaneously.

For consideration of loads on structures, IS: 875, "Code of practice for structural safety of building" shall be followed. The following minimum superimposed live loads shall, however, be considered for the design.

- |    |            |   |  |
|----|------------|---|--|
| a. | Roof slab  | 1.5 kN/m <sup>2</sup><br>0.75 kg/m <sup>2</sup> | for accessible roofs<br>for non-accessible roofs   |
| b. | Floor slab | 5 kN/m <sup>2</sup>                             | for offices and minimum<br>10 kN/m <sup>2</sup> for<br>equipment floors or<br>actual requirement, if<br>higher than 10kN/m <sup>2</sup> .<br>based on equipment<br>component weight and<br>layout plans. |

c.	Stairs & Balconies	5KN/m2
d.	Toilet Rooms	2KN/m2
e.	Chequered- plate floor	4KN/m2
f.	Walkways	3KN/m2

#### 4) **Submission**

The following information shall be submitted for review and approval to the Owner:

1. Design criteria shall comprise the codes and standards used, applicable climatic data including wind loads, earthquake factors maximum and minimum temperatures applicable to the building locations, assumptions of dead and live loads, including equipment loads impact factors, safety factors and other relevant information.
2. Structural design calculations and drawing (including construction / fabrication) for all reinforced concrete and structural steel structures.
3. Fully, dimensioned floor plans, cross sections, longitudinal sections and elevations of each building. These drawings shall be drawn at a scale not smaller than 1:50 and shall identify the major building components.
4. Fully dimensioned drawings showing details and sections drawn to scales of sufficient size to clearly show sizes and configuration of the building components and the relationship between them.
5. Product information of building components and materials, including walls, partitions, flooring, ceiling, roofing, door and windows and building finishes.
6. A detailed schedule of building finishes including color schemes.
7. A door & window schedule showing door types and locations, door locksets and latch sets and other door hardware.
8. Water supply, internal and external drainage works, internal cable ducts.
9. Approval of the above information shall be obtained before ordering materials or starting fabrication or construction as applicable.

- (5) a)** The building shall be RCC framed structure. The top of the Grade Beams shall be kept 150mm above ground/FGL. New earth mixed with 3% cement shall be used for back filling and below foundations for foundation in BC/expansive. All walls shall be non-load bearing walls in table mould bricks/laterite stone. Min. thickness of external walls and main walls shall be 230 mm in 1:6 cement sand mortar and partition walls shall be 115mm thickness in table mould brick masonry/laterite

stone in CM 1:4. 50mm thick DPC in CC 1:2:4 shall be provided at plinth level before starting masonry work. PCC 1:2:4 Cills shall be provided for window & Ventilator opening. Through & all-round lintels shall be provided. RCC racks & Loft with/without brick masonry support shall be provided in T&P room and wherever required as per the requirements and directions of the Engineer in charge of the work. The inside face of the Brick masonry wall between FGL & plinth shall be plastered in cement mortar 1:4, 20mm thick using waterproof compound before earth back filling and taking up the flooring work.

**b) Earth work excavation: -**

This includes excavation for foundation in all types of soil and rock including hard rock, soft rock and hard laterite. The excavated earth shall be used for back filling the foundation and basement if the same is suitable for backfilling. In case of black cotton soil/expansive soil, back filling to the foundation and basement and for casing (soil stabilization) below the foundation shall be with approved borrowed / new earth mixed with 3% cement without additional cost.

**c) Internal finish :**

All internal walls shall have minimum 20mm thick 1:6 cement plasters with lime rendering. The ceiling shall have 12mm thick 1:4 cement sand plaster with lime rendering.

All internal walls and ceiling (except battery room) shall have plastic emulsion paint two coats over one coat of primer.

Walls and ceiling of battery room shall have acid proof resistant paint two coats over one coat of primer.

Metal and wood surfaces shall be given two coats of synthetic enamel paint of approved colour and shade over one coat of primer. Colour scheme shall be prepared and got it approved.

**d) External Finish**

All external walls shall have 20mm thick plaster in 1:6 cement mortars.

External walls shall have two coats of Apex or ACE or similar other type of fungus resistant paint over one coat of primer. Colour and finish scheme shall be got approved.

**e) Roof**

Roof of the building shall consist of cast-in-situ R.C.C. slabs.

Waterproofing treatment of roof /floor slab.

Over the pre-cast RCC floor/roof slab, screed concrete of proportion 1:2:4 75mm thickness average using 12mm and down size jelly shall be laid to provide a gradient of 1 in 120 to drain the storm water effectively. Over this, pressed clay tiles shall be laid over a CM bed of 25mm thickness average of proportion 1:6 and joints shall be pointed with red oxide.

Terrace plan showing ridge points, gradient, direction of water flow, position of rain water pipes, sizes of rain water pipes etc., shall be prepared and got it approved by the owner.

Dowel rods of column for future extension shall be encased in lean concrete mix and plastered in CM: 1:10.

**f) Glazing**

Minimum thickness of glazing shall be 6 mm.

**g) Diesel Engine Generator House:**

The diesel engine generators may be installed in DG room inside control room, engine generators shall be vibration free, suitable foundation shall be provided for the same. Door openings shall be dimensioned to allow removal of diesel engine generators. Suitable ventilation exhaust shall be provided.

**h) BUILDING STORM WATER DRAINAGE.**

The building design shall provide for the collection of storm water from the roofs and effective disposal of it to the boundary/roadside drain. This water shall be collected in junction boxes and these boxes shall drain to the main drainage system of the station.

PVC/HDPE rain water pipes of 150mm dia of 6KSC pressure as per relevant IS of approved make with bends shoes etc., be provided to drain off the rain water from the roof. These shall be suitably fixed to the masonry walls with suitable clamps. The number and size of down comers shall be governed by IS: 1742 and IS: 2547. All drains inside the buildings shall have minimum 10mm thick grating covers and in areas where heavy equipment loads would be coming pre-cast RCC covers shall be provided in place of steel grating.

For all buildings, suitable arrangement for draining out water collected from equipment blow down, leakages, floor washings fire fighting etc. shall be provided for each floor.

**i) DOORS & WINDOWS:**

The type & size of doors, windows and ventilators shall be as per layout / drawing supplied

## **Aluminum doors, Windows & Ventilators:**

### **Doors:**

The aluminum sections shall conform to IS standards, anodized to 12 to 15 microns & shall be glossy/mat finish.

Door Frame Sections:

Outer frame, Plain section – 101.60mmx44.45mmx3.18mm

Door shutter:

Vertical section – 47.62mmx44.45mmx3.18mm.

Top section – 47.62mmx44.45mmx3.04mm.

Centre section – 25.00mmx44.45mmx3.00mm.

Bottom section – 114.3mmx44.45mmx3.18mm.

All the door sections should be anodized to 12 to 15 microns and cut to length, joints, mitered and corners grinded. The bottom rail hinged or pivoted opening arrangements with heavy duty aluminum alloy automatic door closers, including providing and fixing standard approved accessories such as aluminum handles, tower bolts, lock, PVC/rubber gasket with 12 mm thick pre-laminated sheet (Novo pan – exterior grade) of approved color for bottom panel of max height 0.90m and 6 mm thick plain or pin headed glass for top panel.

### **Windows and Ventilators:**

Double track frame of size – 61.85mmx31.75mmx1.50mm.

Shutter Section – 40mmx18mmx1.25mm

Inter lock section – 40mmx26.70mmx1.10mm

The shutter should be mounted on nylon rollers for easy sliding with approved quality fixtures such as aluminum handle, tower bolt etc. The shutter should be provided with 6mm thick plain or pinheaded glass with rubber beading.

All the aluminum sections used for door and windows should be treated for removal of any rust and prevention of further rust formation and coated with greasy materials for non-adherence of mortar or any other sticky materials. The assembled frame should be stiffened with corner angles strips and fixed with screws, rawl plugs and teak wood guttas to RCC column or masonry on sides, beams and mosaic flooring at bottom, including cutting, chiseling and making good with cement mortar to match the surface. All the frames should be thoroughly cleaned free of rust, scale or dirt. Work should be carried out as per the approved drawings and directions of the Engineer in charge of the work.

**Ventilators:** Ventilators shall be provided as per the drawing supplied.

### **Wooden Door : -**

#### **i) Mathi / Nandi wood frames:**

Providing and fixing mathi or Nandi wood frames of 65x125mm with or without ventilators with glass 6mm thick and 2 M.S.Rods of 16mmdia as per design and drawing fixed in masonry with 40x5mm flat iron hold fasts 40cm long embedded in CC 1:3:6 with granite metal of size 20mm and down, 15cm thick.

**ii) Honne wood fully paneled shutters:**

Honne wood fully paneled shutters with styles and rails of 40mm thick and with 25mm thick panels with required door fittings as per drawing & filed requirement (Aluminum handle, Aluminum Aldrop, hinges, tower bolts, doorstoppers etc) shall be provided for each door.

**iii) Composite polymer laminated sal wood door shutter :**

Providing and fixing factory made splendoor of solid core single leaf rigid composite polymer laminated sal wood, door shutter of 30mm thick, manufactured out of solid core confirming to IS 2202 (Part-1) 1991, laminated with 0.8mm thick polymer, termite, water resistant and fire retardant with superior gluing based on vacume lamination technology and with various pre-moulded design on both faces confirming to IS 6307 – 1985, using adhesive confirming to IS 4835 – 1979 and door shutter tested in confirmation to IS 4020-1994. The finish of shutters will be TEAK / OAK / CEDAR / ROSE WOOD / WAL NUT, plain colours WHITE / IVORY / BEIGE / LIGHT GREY including providing all fixtures.

**j) Flooring & Skirting :**

The entire building (except battery room, lavatory, T&P room & D.G. Room) shall be provided with granite flooring using 19mm thick pre polished water cut / gang saw grey granite slabs laid in cement mortar 1:4, 20mm thick (average) over cement concrete bed (PCC 1:4:8, 100mm thick) / floor slab and pointed with white / grey pigment etc.

Skirting 125mm high shall be provided using 19mm thick pre polished water cut / gang saw grey granite slabs laid in cement mortar 1:4, 20mm thick after chipping the walls etc., complete.

The battery and lavatory rooms shall have first class ceramic tiles flooring, tiles of approved make (Spartek/ Johnson/ Naveen) and size 20cms x 20 cms. Dadoing for battery room walls shall be done up to lintel level (2400mm) using ceramic tiles of 20cms x 20cms size. The lavatory room walls shall be provided with ceramic tiles dadoing upto 120cms height and in areas of urinals and washbasin as per requirements. (Note: All flooring tiles shall be laid on 100 mm thick CC 1: 4:8 in ground floor & over cement mortar bed over floor slab).

T&P Room and D.G. Room shall be provided with Ironies flooring over 100mm thick PCC 1:4:8. And skirting 125mm high in cement mortar 1:3 and 15mm projection shall be provided.

**k) Flagging concrete and Path ways. :**

Flagging concrete & pathways in PCC 1:4:8, 100mm thick and 50mm thick PCC 1:2:4. and top finished with 12mm thick 1:4 cement mortar shall be provided for a width of 900mm all-round the building and 1500mm wide from the main road to control room building entrance.

**l) Internal Water Supply:**

Internal water supply shall be done using 20/15mm CPVC pipes confirming to IS 15778 embedded in brick masonry with necessary specials like valves, taps etc., as per drawing and directions of the Engineer in charge of the work.

**m) Sanitary arrangement:**

Necessary sanitary arrangements shall be made as per requirement. This includes providing and fixing approved quality closets in both gents and ladies toilets, wash basin, Mirror, Toilet paper holder, etc & laying PVC sanitary pipe line with inspection chambers. For 66 KV Control Room building, a soak pit of 2.50m x 2.00 mtr internal dimension and required depth constructed with size stone masonry/Laterite with suitable weep holes to soak sewage water/liquid waste, RCC cover slab of 15cm thick with suitable inspection cover etc shall be provided as per the directions of the owner. For 220 KV Control Room building, Septic tank and soak pit as per the drawing supplied shall be provided.

- n) RCC & Hume pipe cable duct inside CR Building:** Necessary RCC (M20 Grade) & Hume pipe cable ducts shall be constructed inside the control room building including providing cable supports, cable trays, M.S. angles, M.S. flats, Chequered plates etc., as per enclosed drawing and directions of the owner. The open spaces left after the erection of panels shall be covered with 6mm thick chequered plates with suitable lifting arrangements. Scope also includes providing hanging trays as detailed in other sections.

**o) Collapsible gates/doors:**

Collapsible gates/doors shall be double leaf made of 20mmX20mmX2mm channels and braced with flat iron diagonals 20mmX5mm size with top & bottom rails of section 40mmX6mm fitted with 38mm dia steel rollers (pulleys), brass handles on both sides, locking device from both sides, two coats of paint over one coat of primer etc complete.

**p) Electrification:**

The building lighting shall be designed and provided in accordance with the requirements of relevant section.

**q) Providing air conditioning system for C&R panel Room of 220kV control room building. The scope includes design, Engineering and providing air conditioning system in accordance with the requirements of relevant sections.**

**r) False ceiling for C&R panel of 220kV control room building.**

The scope includes providing false ceiling as per design / requirement and providing 15mm thick densified regular edged eco friendly light weight calcium silicate false ceiling as per the specifications of KPWD SR.

220KV and 66kV GIS Building : Refer Section – 1 PROJECT for details

**XIV. DRILLING BORE WELL & ARRANGING WATER SUPPLY:**

- a) The bidder shall be overall responsible for supply of water within the switchyard for drinking purpose, fire fighting, earthing and other miscellaneous purpose.
- b) A scheme shall be prepared by the bidder indicating the layout and details of water supply and shall get it approved by the owner before commencement of work.
- c) One good yielding bore-well for 66&110kV stations / two bore wells for 220kV stations shall be drilled. The bore well shall yield sufficient water to meet the required demand. If the drilled bore well fails or yield is not sufficient to meet the demand before handing over of sub-station, additional bore well shall be drilled by the bidder without extra cost.
- d) Suitable pump set of sufficient capacity shall be installed and serviced with all accessories like control panel board, UG cable, earthing arrangements etc.
- e) Main supply line from borewells to the water tank on the control room building and distribution line for water supply to buildings shall be with required dia CPVC pipes with necessary fittings.
- f) 2000 ltrs synthetic water storage tank shall be provided over the raised platform over the roof slab of control room building in case of 66kV & 110kV sub-stations and in case of 220kV sub-station, the tank may be placed over the first floor roof slab with necessary arrangements, with suitable electrical water level controller as per the directions of the Engineer in charge of the work.



- g) The distribution system for watering earth pits & for drinking water shall be with required dia CPVC pipes with necessary fittings, as per directions of the Engineer in charge of the work and scheme to be approved by the owner.

## **XV. CONSTRUCTION OF OIL STORAGE SUMP TANK**

The bidder shall quote rate per No. Work includes, cost of earth work excavation for foundation in all types of soil and strata including hard rock, bed concrete, construction of size stone masonry wall, pointing to the exposed faces of wall, plastering to the inside faces of the wall with cement mortar using water proof compound, R.C.C cover slab and connection from transformer to sump tank using suitable size G.I. pipes with necessary G.I. specials and valves. Work shall be carried out according to detailed specifications. The rate includes cost and conveyance of all materials, labour etc., complete.

- 1) Earth work excavation shall be done to the required depth as per design in all strata.
- 2) Bed concrete shall be of 1:4:8 proportions
- 3) Size stone masonry shall be with granite/trap/basalt size stone built in cement mortar 1:6 proportion.
- 4) The coping concrete shall be of 1:2:4 proportions.
- 5) The flooring shall be with PCC 1:2:4 and finished with 20mm thick 1:4 cement mortar using water proof compound.
- 6) The walls and the bottom of the slab shall be finished with cement mortar 1:4 proportion 20 mm thick with waterproof compound.
- 7) The roof slab shall be of R.C.C (M.20) with necessary reinforcement as per the drawing and one inspection chamber with frame and cover & locking arrangement as per directions shall be provided.
- 8) The pipe connections between transformer and the sump tank shall be provided with required diameter G.I. pipes with necessary G.I. specials as per directions of the Engineer in charge of the work.
- 9) Heavy duty Gate valve shall be provided at suitable location and for easy accessibility & operation during emergency & kept in the manhole chamber with locking arrangements.
- 10) GI ladder shall be provided for usage during maintenance as per directions of the Engineer-In-Charge of the work.

## **XVI. YARD PROTECTION WORKS AND STORM WATER DRAINAGE**

Scope of the work includes for Design, Engineering and Construction of size stone masonry or RCC retaining wall, Size stone masonry or RCC drain and Size stone masonry or dry pitching with size stone masonry toe wall.

Items of the work involved in the job and quantities are furnished in the schedule. Bidders shall develop the designs and drawings to suit the site requirements in consultation with the owner and shall start commencement of work after approval of the designs and drawings by the owner.

Retaining wall or Pitching as required shall be constructed along the boundaries and in between the levels to retain earth filling/cutting as per requirements and directions of the owner.

Size stone masonry or RCC drain as required shall be constructed all along the boundaries and along the approach road. Necessary gradient shall be provided to ensure that silting is minimized and water flows freely. Final discharge point shall be located in consultation with the Engineer in charge of the work.

**XVII. FOUNDATION & A.C SHEET SHELTER FOR METAL CLAD 11KV, VCB SWITCH GEARS:-**

The bidder shall quote rate per No. which includes the cost of earth work excavation for foundation in all types of soil and in all types of rocks and strata, bed concrete, construction of size stone masonry, plastering to the exposed faces of walls, flooring, structural steel which includes I beams, channels, angles for shelter work and cable duct, A.C. sheets, electrification to shelter etc. complete as per drawing & directions of the engineer-in-charge- of work.

1. Earthwork excavation shall be done to the required depth & width as per design in all strata & as per drawing.
2. Bed concrete shall be of 1:4:8 proportion
3. Size stone masonry shall be granite/trap/basalt built in cement mortar 1:6 proportion. Necessary pouches shall be left in the masonry walls to embed I-beam sections.
4. Working plat form shall be provided with size stone masonry in CM 1:6, bed concrete in CC 1:4:8, 1:2:4 basement concrete. & Flooring using CC 1:4:8 and CC 1:2:4, top of the concrete finished with CM 1:3. The flooring of the trench shall be with CC 1:2:4 & plastered with cement mortar 1:3.
5. 6mm thick chequered plates shall be covered to the open portion of ducts after erecting switchgears. Necessary handles to lift plates shall be provided including two coats of enamel painting over one coat of primer.

6. Structural steel work, which includes ISMC, ISMB, and ISA, of, required sizes as per enclosed drawing should be provided for vertical supports, rafters, purlins, cable duct tray supports, cable trays etc.
7. A.C. sheet roofing 6mm thick including 10mm dia G.I. 'J'. Hooks & bitumen Zinc washers with an end lap of 15 cm shall be provided, including A.C. ridges & hips sheets. Vertical drop of 1.00m shall be provided all-round the shelter using A.C. sheet.
8. All structural steel members shall be painted with two coats of synthetic enamel paint over one coat of primer.
9. The vertical supports shall be embedded in CC 1:2:4 to the required size and depth. Necessary lugs shall be provided to the vertical supports at bottom.
10. RCC Hume pipe/PVC pipe of required dia shall be provided to lead off the water collected in duct to the nearest drain or upto the natural gradient to lead off the water. This includes cost of excavation, providing pipes, etc. Also required dia RCC Hume pipe/PVC pipe shall be provided for entry and exit of cables.
11. Electrification to the shelter shall be done by providing necessary switch points, U.G. cables, service connection and providing 6 numbers of industrial type fluorescent fittings with 2 numbers of 4ftX40 watts tubes.

#### **XVIII :-RCC BAY KIOSK:**

The scope includes design, engineering and construction of RCC framed (M20) building. Architectural drawings shall conform to the detailed technical specification and owner's requirements. After approval of the architectural drawing, structural drawings shall be developed. Scope also includes providing necessary treatment to sub-soil depending on the soil conditions, electrification/illumination, air conditioning, fire detection system, internal RCC cable ducts, building earthing using chicken wire mesh as per design requirements. Typical drawing is enclosed for guidance purpose.

#### **XIX. RCC PLATORM:**

The scope includes design, engineering and construction of RCC raised platform of dimension indicated in the layout drawing. The design, drawing shall be developed by the bidder for approval of the owner.

#### **XX. RAIN WATER HARVESTING SYSTEM**

**Providing Roof Top Rain water Harvesting System to the Control room building.**

### **For 220kV S/s.**

The scope of the work includes the following.

- a) Construction of RCC water storage sump tank of suitable size with storage capacity of **50,000 Litres** (adjacent to control room building) with its allied works, with GI ladder and inspection / manhole cover for maintainance complete as per requirements and approved drawing.
- b) Providing Rainy dual capacity self-cleaning roof top rain water harvesting filter or equivalent filter of **FL500** specification suitable for a catchment area of about **500 Sqm** including interconnecting of down water pipes from control room building roof top leading to the water storage sump.
- c) Supplying, Erecting and Commissioning of suitable mono-sub pumpset of 1.5 HP capacity /pumpset of approved make & capacity along with necessary raising main of 32 mm GI pipe leading to overhead Synthetic tank, including necessary cable, control panels, electrification etc., complete and any other items not mentioned herein but required for completion of work as per technical specification, approved drawings and directions of the Engineer-in-charge of work. Scheme to cover the above works shall be prepared in consultation with KPTCL field staff & approved by the competent authority.

### **For 110kV & 66kV S/s.**

The scope of the work includes the following.

- a) Construction of RCC water storage sump tank of suitable size with storage capacity of **20,000 Litres** (adjacent to control room building) with its allied works, with GI ladder and inspection / manhole cover for maintainance complete as per requirements and approved drawing.
- b) Providing Rainy dual capacity self-cleaning roof top rain water harvesting filter or equivalent filter of **FL200** specification suitable for a catchment area of about **225 Sqm** including interconnecting of down water pipes from control room building roof top leading to the water storage sump.
- c) Supplying, Erecting and Commissioning of suitable mono-sub pumpset of 1.5 HP capacity /pumpset of approved make & capacity along with necessary raising main of 32 mm GI pipe leading to overhead Synthetic tank, including necessary cable, control panels, electrification etc., complete and any other items not mentioned herein but required for completion of work as per technical specification, approved drawings and directions of the Engineer-in-charge of work. Scheme to cover the above works shall be prepared in consultation with KPTCL field staff & approved by the competent authority.

