b) Each case shall be carefully studied before finally following a particular sequence of welding.

c) Butt weld in flange plates and/or web plates shall be completed before the flanges and webs are welded together.

d) The beam and column stiffeners shall preferably be welded to the webs before the web and flanges are assembled unless the web and flanges to the beam or column are assembled by automatic welding process.

e) All welds shall be finished full and made with correct number of runs, the weld being kept free from slag and other inclusions, all adhering slag being removed.

f) Current shall be appropriate for the type of electrode used. To ensure complete fusion, the weaving procedure should go proper and rate of arc advancement should not be so rapid as to leave the edges unmelted.

g) Pudding shall be sufficient to enable the gases to escape from the molten metal before it solidifies.

h) Non-uniform heating and cooling should be avoided to ensure that excessive stresses are not locked up resulting ultimately in cracks.

i) The ends of butt welds shall have full throat thickness. This shall be obtained on all main butt welds by the use of run off and run on pieces adequately secured on either side of main plates. The width of these pieces shall not be less than the thickness of the thicker part joined. Additional metal remaining after the removal of extension pieces shall be removed by grinding or by other approval means and the ends and surface of the welds shall be smoothly finished. Where the abutting parts are thinner than 20mm the extension pieces may be omitted but the end be welded to provide the ends with the required reinforcement.

j) The fusion faces shall be carefully aligned. Angle shrinkage shall be controlled by presetting. Correct gap and alignment shall be maintained during the welding operation.

k) All main butt welds shall have complete penetration and back surface of the weld being gouged out clean before first run of the weld is given from the back. However, partial penetration butt weld shall be permitted, when specifically shown in the design drawings.

l) Intermittent welds shall be permitted only when shown in the design drawings.

m) The welding shrinkage shall be minimised by adopting the correct welding procedure and method. In long and slender member extra length should be provided at the time of fabrication for shrinkage.

8.07.01.4 **Testing of Welders**

All the welders to be employed for the job shall have to qualify the appropriate tests laid down in IS: 817 and IS: 1181 and ASME IX/AWS D1.1. All the necessary arrangements required for the testing of welders are to be provided by the Bidder.

8.07.01.5 **Inspection of Welds**

a) **Visual Inspection**

100 percent of the welds shall be inspected visually for external defects. Dimensions of welds shall be checked. The lengths and size of weld shall be as per fabrication drawings. It may be slightly oversized but should not be undersized. The profile of weld is affected by the position of the joint but it should be uniform. The welds should have regular height and width of beads. The height and spacing of

ripples shall be uniform. The joints in the welds run shall as far as possible be smooth and should not show any humps or craters in the weld surface. Welds shall be free from unfilled craters on the surface, under-cuts, stages on the surface and visible cracks.

Such inspection shall be done after cleaning the weld surface with steel wire brushes and chisel to remove the spatter metal, scales, slag, etc., If external defects mentioned above are noticed, there is every possibility of internal defects and further radiographic/ultrasonic examination shall be undertaken.

b) **Production Test Plate**

Test plates shall be incorporated on either side of at least one main butt welds of each flange plate and web plate of every main frame columns and crane girder. The weld shall be continuous over the test plate. The test plate extensions of the main plates and shall be fixed so that metal lies in the same direction as that of the main plate. Test plates shall be prepared and tested in accordance with the accepted Standards, in the presence of the Engineer or his authorised representative. Should any of these tests fail, further radiographic examination of the welds shall be done. These tests for test plates and radiographic examination are additional to those contemplated under inspection and testing.

c) **Non-destructive and special testing**

Radiographic / ultrasonic or other non-destructive examination shall be carried out. All tests of welds shall be carried out by the Bidder at his own cost. The cordoning of radiation zone, while Radiography testing is going on, shall be done.

In case of failure of any of the tests, re-testing of the joints shall also be carried out after rectification is done.

d) **Rectification of defective welding work**

Wherever defects like improper penetration, extensive presence of blow holes, undercuts, cracking, slag inclusion, etc., are noticed by visual inspection/other tests, the welds, in such location shall be removed by gouging process. The joints shall be prepared again by cleaning the burrs and residual matters with wire brushes and grinding, if necessary, and rewelded. The gouging shall as far as possible be done using gouging electrodes.

8.07.01.6 **Inspection and Testing**

a) **Fillet Welds**

Refer clause 11.1.5 of Part B Sub Section E-41 of Technical Specification

b) **Butt Welds**

Refer clause 11.1.5 of Part B Sub Section E-41 of Technical Specification

c) **Dimensional Tolerance and Acceptance Criteria of Welds**

Refer clause 11.1.5 of Part B Sub Section E-41 of Technical Specification

8.07.01.7 **Correction of Defective Welds**

Correction of defective welds shall be carried out without damaging the parent metal. When a crack in the weld is removed magnetic particles inspection or any other equally positive means shall be used to ensure that the whole of the crack and material up to 25mm beyond each end of the crack has been removed.

8.07.02 **Painting**

a) Surface treatment and painting before and after delivery to site shall be in accordance with Clause no. 6.4.0 above. All steel structures shall be designed by following basic design criteria in ISO 12944 Part 3. However, where it is not feasible to follow the design criteria given in ISO 12944 Part 3 where the steel surface are inaccessible for application of protective coating, corrosion allowance in thickness(over the design thickness) of structural steel members shall be kept.

b) For parts to be bolted, the surfaces in contact shall be provided with ethyl Zinc silicate primer as specified in clause 6.4.3 (a) and shall be free of oil, dirt, loose rust, burrs and other defects, which would prevent proper seating of the parts. For design of friction type bolted joints slip factor for surfaces with ethyl zinc silicate primer as given in IS 4000 shall be considered.

c) Surfaces inaccessible after shop assembly shall receive the full-specified protective treatment before assembly. However, interior surfaces of Box-sections, which are effectively sealed from all ends, need not be painted.

8.07.03 **Bolting**

The threaded portion of each bolt shall project through the nut by at least one thread. High strength friction grip bolts, preferably the type with indicated load, shall be used where specified and shall be tightened strictly in accordance with the manufacturer's instructions and the relevant regulations.

When connections are made using high strength friction grip bolts the relevant standards shall be observed.

8.07.04 **Erection of Structures**

All erection work shall be done with the help of cranes, use of derrick is not envisaged.

**Erection Marks**

a) Erection marks in accordance with fabrication drawing shall be clearly painted on the fabricated steelwork. Each piece shall be marked in at least on two places. Each piece shall also have its weight marked thereon.

c) The centre lines of all columns, elevations and girder bearings shall be marked on the sections to ensure proper alignment and assembly of the pieces at site.

**Erection Scheme**

a) The Erection Scheme for the erection of all major structures shall be furnished. The erectability of the structure shall be checked by the Bidder before commencement of fabrication work to avoid future modification. The erection scheme shall indicate the approximate weight of the structural members, position of lifting hook, crane boom length, crane capacity at different boom length and at different boom inclination, etc.,

b) The erection scheme shall also give details of the method of handling, transport, hoisting, including false work/staging, temporary, bracing, guying, temporary strengthening, etc., It will also give the complete details of the number and capacity of the various erection equipment that will be used such as cranes, winches, etc., along with disposition at the time of erection of columns, trusses, etc.

c) The erection of columns, trusses, trestles, portals, etc., shall be carried out in one single piece as far as practicable. No column shall be fabricated and erected in more than 3 pieces. Galleries shall generally be erected as box i.e. the bottom chord and bracings, top chord and bracings, side vertical posts and bracings, end portals and roof-trusses shall be completely welded prior to erection and if required temporary strengthening during erection shall be made. The inside sheeting runners and roof sheeting purlins may be erected individually. When erection joints are provided in

columns, their location shall generally be just above a floor level.

**8.08.00 STEEL HELICAL SPRINGS AND VISCOUS DAMPERS UNITS**

8.08.01 General Requirement

This part of the specification covers the requirement for the manufacturing, testing, supply, transport to site, pre-stressing erection, supervision of erection by the vendor, release of pre-stress, alignment, commissioning, etc. of Steel helical springs and viscous dampers units.

The Steel helical springs and viscous dampers units supplied should be of proven make.

8.08.02 Codes and Standards

Some of the relevant applicable Indian standards and codes, etc, applicable to this section of the specification are listed below:

DIN : 4024 Machine foundations; Flexible supporting structures for machine with rotating masses.

DIN : EN 13906-1 Cylindrical helical springs made from round wire and bar: calculation & design.

DIN : 2096 Helical compression springs out of round wire and rod; quality requirements for hot formed compression springs.

ISO : 10816 /IS:14817 Criteria for assessing mechanical vibrations of machine.

ISO : 1940/IS: 11723 Criteria for assessing the state of balance of rotating rigid bodies.

**8.08.03 Design & Supply of Material**

i) **Supply**

Steel helical springs and viscous dampers and associated auxiliaries shall consist of:

(a) Steel helical springs units (fully pre-stressable) and viscous dampers units along with viscous liquid including associated auxiliaries for installation of the spring units and dampers like steel shims, adhesive pads, etc.

(b) Frames for pre-stressing of spring elements.

(c) Suitable hydraulic jack system including electric pumps, high pressure tubes etc. required for the erection, alignment etc., of the spring units. One set of extra hydraulic jacks, and hand operated pumps shall also be provided.

(d) Any other items which may be required for the pre-stressing, erection, release of pre-stress, alignment, and commissioning of the Steel helical springs and viscous dampers.

ii) **Design**

The spring units should have stiffness in both vertical and horizontal directions with the horizontal stiffness not less than 50% of vertical stiffness. However, for projects in high seismic zones, the minimum stiffness in horizontal direction shall be reviewed based on the design requirement and in no case it shall be less than 15% of vertical stiffness.

The stiffness should be such that the vertical natural frequency of any spring unit at its rated load carrying capacity is between 2 Hz to 4 Hz. The damper units or spring-cum-damper units should be of viscous type offering velocity proportional damping. The damper units should be suitable for temperatures ranging from 0 to 50°C. The damping

resistance of individual damper units should be such that the designed damping can be provided using reasonable number of Units.

The Steel helical spring units and viscous damper units and their housings shall be designed for a minimum operating life of 30 years. Steel helical spring units shall conform to infinite life fatigue load calculations as per DIN EN 13906-1.

**8.08.04 Manufacturing & Testing**

Complete manufacturing and testing of the Steel helical springs and viscous dampers shall be done at the manufacturing shop of the approved sub vendor / supplier. For this purpose the contractor / sub vendor shall submit the detailed quality plan for approval of engineer and take up the manufacturing / testing after approval of such quality plan. The quality plan shall include

(a) Manufacturing schedule and quality check exercised during manufacturing.

(b) Detail of test to be carried out at the manufacturing shop with their schedule.

(c) Special requirements, if any, regarding concreting of top deck.

(d) Complete step-by-step procedure covering the installation and commissioning of the spring system.

(e) Manuals for erection, commissioning, testing and maintenance of the Steel helical springs and viscous dampers.

(f) A checklist for confirming the readiness of the civil fronts for erection of Steel helical springs and viscous dampers.

(g) Checklist for equipment required at each stage of erection.

(h) Bill of materials and data sheet of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply.

(i) Bill of material and data sheet for frames for pre stressing, hydraulic jack including electric pump, high pressure tubes, hand operated pump etc., with their rating and umbers.

(j) Any other details which may be necessary to facilitate design and construction of the foundations / structures.

8.08.05 The springs shall conform to codes DIN EN 13906-1 and DIN 2096. The quality assurance and inspection procedure shall be finalized on the basis of the above codes and the quality plans be drawn accordingly.

**8.08.06 Transportation**

Steel helical springs and viscous dampers shall be suitably protected, coated, covered, boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection.

**8.08.07 Erection and Commissioning**

Complete erection and commissioning of the Steel helical springs and viscous dampers including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc. shall be carried out by a specialist supervisor of vendor.

The contractor shall guarantee the performance of the Steel helical springs and viscous dampers for 24 months from the date of commissioning of each machine which shall be termed as Guarantee Period".

**8.08.08 Supervision**

The supervision of installation of Steel helical springs and viscous dampers including pre-stressing, placing, releasing and alignment of spring units shall be done by a specialist supervisor of sub vendor / supplier, trained for this purpose.

**8.08.09.1 Realignment of Spring System**

If any realignment of the Steel helical springs and viscous dampers is required to be done for aligning the shaft or for any other reasons during the first one year of operation from the date of commissioning of the machine, the same shall be done by the contractor.

**8.08.09.2 Acceptance Criteria**

Stiffness values shall be checked. The permissible deviations shall be as per DIN 2096.

Following acceptance criteria shall be followed:

General workmanship is being good as recommended by the manufacturer and approved by Equipment supplier.

Tolerances are within the specified limit.

Manufacturer's test certificate (MTC) shall be in compliance with the applicable codes / standards.

Bought out material is from the approved manufacturer / vendor.

Bought out material is matching with the approved sample.

**8.09.00** **Information on Geopolymer Concrete-**

**A) Ingredients**: Geo-Polymer Concrete is a special type of concrete where no cement is used unlike conventional cement concrete.

Major ingredients of Geo-polymer concrete are as below:

a) Fly Ash ( to be collected from location within existing operating plant/from existing fly ash silos near plant boundary)
b) Ground Granulated Blast Furnace slag
c) Aggregates ( Coarse and fine)
d) Sodium Silicate
e) Sodium Hydroxide
f) Chemical admixtures like super-plasticiser, retarder, shrink-reducing compound, evaporation reducer etc.

Fly ash produced by coal-based power stations of NTPC, if available, will be issued free of cost for the production of Geo-polymer concrete on 'as is where is' basis.

**B) Batching & Mixing**: Geopolymer concrete of minimum required grades of M10 and M35 shall be prepared for Dry Lean Concrete (DLC) and Pavement Quality Concrete (PQC), respectively. The solid constituents of geo-polymer concrete mix such as coarse aggregate, fine aggregate, fly ash and slag are to be mixed dry for 2-3 minutes, then Geo-activator solution, consisting of sodium silicate and sodium hydroxide pre-mixed in tanks at site, is added to the dry mix in batching plant mixer.The whole mixture is mixed until a homogeneous cohesive mix is obtained. Pumping devices shall be used for transferring activator solution from tank to the mixer. Proportion of different ingredients and mixing process are to be finalized/established during mix design finalization and trial mix at site. However, if any constraint is observed related to initial setting time of the geopolymer concrete and time required for transporting the geopolymer concrete mix from batching plant to the point of application then suitable alternative option such as mixing of geoactivator solution may have to be mixed in transit mixer instead of batching plant.
Bidder shall make available concrete batching plant suitably customized for handling/feeding/dosing/weighing etc of ingredients and capable of production of Geo-Polymer Concrete of suitable grade.

**C) Geo-activator**: This solution shall be prepared using Sodium Hydroxide & Sodium silicate with water in a certain ratio. The ratio of Sodium Silicate and Sodium Hydroxide in activator solution shall be decided during finalization of Design mix. Separate tanks having adequate capacity are to be constructed close to batching plant with fencing and a lockable gate for preparation of Sodium Hydroxide and Sodium Silicate solution. These tanks shall be provided with acid-alkali resistant lining and covered with GI sheet. Each tank shall be fitted with a chemical resistant pump of suitable capacity and dual valve in the discharge line for recirculation (to enable mixing) and also for transferring the Geo-Activator solution to mixer. This connection pipe from Pump discharge to batching plant mixer shall be HDPE of suitable Diameter.

Preparation of Geo-activator solution is a critical process and extra care needs to be taken during the preparation in respect of safety of personnel handling the chemicals. Worker handling the chemicals shall be provided with proper PPE's. A dedicated shower with water tank shall be available close to chemical handling area/tank on permanent basis for washing of affected person, in case of emergency. Bottles filled with distilled water in cupboard / Boxes near work place shall also be kept for emergency eye wash by worker exposed to such hazardous chemicals.

**D) Placing**: Laying /placing of Geopolymer concrete DLC and PQC manually with hand-guided means or by semi-mechanized methods may be permitted provided acceptance criteria as per MORT&H specification is achieved.

**8.10.00 Controlled Low Strength Material (CLSM)**

Bidder to refer Annexure-AC-3

a) Minimum 1000 mm high (from floor/ roof level) hand railing shall be provided around
all floor/roof openings, projections/balconies, walkways, platforms, steel stairs, etc.,
wherever the height of the building is more than 12m, railing height shall be 1.2m. All
handrails and ladder pipes (except at operating floors) shall be 32 mm nominal bore
MS pipes (medium class) conforming to IS: 1161 and **shall finished with suitable paint**. All rungs and ladders shall also be **finished with suitable paint**.
The spacing of vertical posts shall
be maximum 1500mm. Two number of horizontal rails shall be provided including the
top member. In addition, toe guard/ kick plate of min size 100x6th shall be provided
above the floor level.

**D-1-9**

9.01.0 …fer to 5.01.00 in this specification.

**9.02.0**

9.02.0 …oor/ roof level) hand railing shall be provided around …s/balconies, walkways, platforms, steel stairs, etc., …g is more than 12m, railing height shall be 1.2m. All …pt at operating floors) shall be 32 mm nominal bore …ming to IS: 1161 and shall be galvanised as per IS: …aint. All rungs and ladders shall also be galvanised. …all be 610 g/sqm. The spacing of vertical posts shall …ber of horizontal rails shall be provided including the …rd/ kick plate of min size 100x6th shall be provided

b) All stairs shall have a maximum riser height of 150mm and a minimum tread width of 300 mm. Minimum clear width of stair shall be 1500 mm unless specified otherwise. The width of staircase shall meet the National Building Code require-ments.

…s of … …floor …shall …all be …ber …e gu…

…ection VI)

For handrailing at operating floors of Main Power House including RCC stairs (for one
flight above and below operating floor level), passages, around all floor openings shall
be Stainless Steel (SS) pipes shall be used. For SS handrail 32NB/50NB/60NB
(polished) stainless steel **pipe with wall thickness 1.65 mm (minimum)** shall be provided. The spacing of vertical posts shall not
be more than 1500mm. Two number of horizontal rails shall be provided including the
top member. SS Toe guard, and knee guard **( 100 mm wide and 6 mm thick)** shall be provided above the
floor level.

**b) All stairs shall have a maximum riser height of 150mm and a minimum tread width of 300 mm. Minimum clear width of stair shall be 1500 mm unless specified otherwise. The width of staircase shall meet the National Building Code requirements.**

…iser height of 175mm and a minimum tread width of …stair shall be 1200 mm unless specified otherwise.

…ng shall be provided with 1 meter high brick wall at …aving metal cladding shall be provided with a 150 mm …or) at the edge of the floor along the metal cladding. …ailing shall be provided on this RCC kerb, wherever …view.

…le arrangement for draining out water collected from …, floor washings, fire fighting, etc., shall be provided …all be suitably covered with grating or precast RCC

…rovided for main entrance of all RCC construction

…indow and 600mm door heads, 900mm over rolling shutters, architectural facia, projections, etc., shall be provided with drip course in cement sand mortar 1:3.

g) All fire exits shall be painted with fire resistant paint P.O red/signal red colour shade which shall not be used anywhere except to indicate emergency or safety measure. Fire safety norms shall be followed as per National Building Codes and fire safety requirements for providing fire exits, escape stairs and fire fighting equipment. In detailing of all buildings, fire safety requirements conforming to IS: 1641 and IS:1642 shall be followed.

9.03.00 **Water Supply and Sanitation**

9.03.01

Roof water tanks of adequate capacities depending on the number of users and 8 hours requirement sha… e. Polyethylene water storage tanks conformir… be complete with all fittings including lid, floa…

Chlorinated Po… 15778, having thermal stability for hot & cold wa… eaded fittings shall be used for internal piping w… For installation of CPVC pipes guidelins as stip… s shall be followed.

UPVC (conform… s above ground level.

**All Buildings sh… ms.**

**All buildings sh…** … facilities provided in the toilet block shall depe… n facilities to be provided shall be as stipulated… ved for working out the basic requirements fo…

In addition, IS:2… ection VI)

9.03.02

Each Toilet bloc… Unless specified all the fittings shall be of Chro… uar / Hindware/ equivalent) .

a) One nu… ina European water closet and dual flu… aucet (Jaquar / Hindware/ equivale…

b) One nu… basin 450x 550 mm (approx.) mounte… te beveled edge counter fitted with ph… ottle trap as per IS:2556. For commo… er requirement. However, for Pump H… oto voltaic control system for water c…

c) For Mal… tings with photovoltaic control flushing…

d) One nu… ar / Hindware / Asahi) , edge mounte… .2 mm thick plywood backing, one nur… ber liquid soap dispenser per wash ba…

e) One toi… physically challenged persons as per N…

f) Janitor…

g) Electric…

h) The par… pantry sink, as per IS : 13983, of size … oard of at least 450 mm length with cou… one number geyser of 25 liters capacity… over head water storage tank, as per … ty, complete with float valve, overflov… er supply pipe of minimum 12 mm dia… with lead joints) of minimum 75 mm dia…

Steel gr… drainage, with all bends, tees, junction… commissioning and efficient

ection VI)



Each Toilet block shall have the following minimum facilities. Unless specified all the fittings shall be of Chromium plated brass ( decorativetype).(Jaquar / Hindware/ equivalent)
a) One number wall mounted coloured glazed vitreous China European water closet and flushing valve system, water faucet, toilet paper holder as per IS:2556. (Jaquar / Hindware/ equivalent)
b) One number colour glazed ceramic oval shaped wash basin 450x 550 mm ( pprox..) mounted under the counter with18mm thick granite beveled edge counter fitted with photo-voltaic control system for water controls, bottle trap as per IS:2556. For common toilets, number of washbasins shall be as per requirement. However, for Pump Houses the same shall be provided without photo voltaic control system for water control.
c) For Male Toilets Urinal as per requirements, with all fittings with photovoltaic control flushing system as per IS: 2556.
d) One number looking mirror 600 x 900 x 6 mm, edge mounted with teak beading and minimum 12 mm thick plywood backing or mounted with SS Studs, one number stainless towel rail 600 x 20 mm, one number liquid soap dispenser. (Jaquar / Hindware/ Asahi/ Saingobain /equivalent)
**e) One toilet with required facilities shall be provided for physically challenged persons on Ground floor of Main Power House Building.**
f) Janitor Space & space for drinking water cooler.
g) Electric operated hand dryer with photo voltaic control.
**h) The pantry shall consist of one number stainless steel pantry sink, as per IS : 13983, of size 610 x 510 mm, bowl depth 200 mm with drain board of at least 450 mm length withcoupling , CP bottle trap, hot and cold water mixer, one number geyser of 25 liters capacity, with inlet and outlet connections, one number over head water storage tank, as per IS : 12701 and of minimum 500 liters capacity, complete with float valve, overflow drainage pipe arrangement, CPVC concealed water supply pipe of minimum 12 mm diameter, CPVC sanitary pipe (with lead joints) of minimum 75 mm diameter, floor trap with Stainless Steel grating, inlet and outlet connections for supply and drainage, with all bends, tees, junctions, sockets, etc., as are necessary for the commissioning and efficient functioning of the pantry (all sanitary fittings shall be heavy duty chrome plated brass, unless noted otherwise)**

One number of pantry shall be provided on Control Room floor of ESP control room building and One number of pantry shall be provided in Buildings having Control Room ..
i) Laboratory sink shall be of white vitreous china of size 600x400x200 mm conforming to IS: 2556 (Part-5)with single 15 mm C.P. brass pillar taps with elbow operated levers ISI Marked.
j) In addition, adequate number of portable toilet units with adequate plumbing and sanitary arrangement, shall be provided during construction stage for workers.
k) Adequate number of toilet units with adequate plumbing and sanitary arrangement, shall be provided for workers (O&M workers).

functioning of the pantry (all sanitary fittings shall be heavy duty chrome plated brass, unless noted otherwise)

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j) In addition, adequate number of portable toilet units with adequate plumbing and sanitary arrangement, shall be provided during construction stage for workers.

k) Adequate number of toilet units with necessary plumbing and sanitary arrangement, shall be provided for workers (O&M workers).

9.04.00 **Flooring**

Floor finishes of approved shade and colour over under bed of cement mortar / concrete, at all levels and for all kind of works, elevations, on horizontal and vertical surfaces for all types of work (like flooring, skirting, dado, wall lining & facing, tread and risers etc.), including topping, spreading white cement slurry at an average rate of 2.5 kg/Sq. M., (unless noted otherwise), jointing and joint filling with white cement (unless noted otherwise) slurry mixed with colour pigment, to match the shade of the finishing material, laying to plumb and water level in desired pattern, line and flush butt square jointing, curing, rubbing, grinding, polishing, edge moulding, finishing and cleaning, testing, providing opening of required size and shape, casting in panels wherever specified.

9.04.01 The nominal total thickness of floor finish shall be 50/70 mm i.e. underbed and topping. The floor shall be laid on an already laid and matured concrete base. The underbed for floors and similar horizontal surfaces shall consist of cement concrete M20 grade. Stone chips shall be 12.5 mm down well graded & proper filling shall be done with brick bats/cinders. Flooring like Tiles/ Stones shall be laid with 1:4 cement sand mortar and Tile/ Stone Cladding on wall shall be laid with 1:3 cement sand mortar.

9.04.02 All toilets shall have sunken slab to accommodate sanitary pipes and the finish level of floor shall match with general floor finish level. Sunken slabs shall be made watertight by suitable water proofing treatment.

Water proofing treatment in sunken portion of WCs, bathroom, kitchen, pantry etc., shall be done in two (2) coats by applying cement slurry mixed with water proofing cement compound (confirming to IS 2645).

The First layer shall be of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/ sqm. This layer shall be allowed to air cure for 4 hours.

The Second layer shall be of slurry of cement @ 0.242 kg/sqm mixed with water proofing cement compound @ 0.126 kg/sqm. This layer will be allowed to air cure for 4 hours followed with water curing. The water proofing shall be done for the entire sunken area.

Metallic Hardener Topping shall be 12 mm thick. Metallic Hardening Compound shall be of approved quality consisting of uniformly graded iron particles, free from non-ferrous metal particles, oil, grease sand, soluble alkaline compounds. The ratio of Metallic hardener and Cement shall be 1:4. This mix

9.04.03 Metallic hardene ~~k (insitu) or finishing~~ the concrete / m slurry (with ordinary grey cement)

9.04.04 Heavy duty cem using white cement with pigment, wi s for wearing course as per IS:1237.

9.04.05 Digitally glazed glazed ceramic floor and wall tiles sh**ction VI)**

a) Floor - 300x3( Somany/ Johnson or equivalent

shall be mixed with 6mm nominal stone in Ratio of 1mix : 2 stone. The mixture so obtained shall be laid in 12 mm thickness, on cement concrete floor within 2 to 4 hours of its laying. For laying, The top surface pf underbed shall be roughened with brushes while the concrete is still green and the forms/strips shall be kept projecting up 12 mm over the concrete surface, to receive the metallic hardening compound topping. The topping shall be laid true to provide a uniform and even surface. It shall be firmly pressed into the bottom concrete so as to have good bond with it. After the initial set has started, the surface shall be finished smooth and true to slope with steel floats.

b) Walls - 300x omany/ Johnson or equivalent

c) Walls - 300x omany/ Johnson or equivalent

9.04.06 12mm / 20mm / rizontal and vertical surfaces, at all le n primer followed by 12 mm thick biti R. tiles, 6 mm thick under-bed by po nting of joints of tiles with acid/alkali r t-I), up to a depth of 20 mm and bitumastic end sealing.

Battery Room in all buildings shall be provided with acid/ alkali resistant tiles on flooring & dado 1200mm high.

9.04.07 (i) Mirror polished Digitally glazed vitrified & Matt Finish Digitally glazed Vitrified ceramic tiles with 3mm groove joints as per approved pattern pointed neatly with 3x4mm stainless epoxy grout mix of 0.70kg of organic coated filter of desired shade (0.10kg of hardener and 0.20kg of resin per kg) with sizes of the tiles shall be as under:

a) Double charged , Size of tile 600x600/605x605 of Kajaria/ Somany/ Series Johnson / NITCO / JHONSON / RAK or equivalent

b) Double Charged, Size of tile 800x800 of Kajaria/ Somany/ NITCO / Johnson /RAK or equivalent

ii) Anti-Skid Full Body Vitrified Tiles

Antiskid, full body Vitrified Tiles (KAJARIA/ RAK/NITCO / JOHNSON)of size 600X600X20 mm thick as specified below of approved make, shade, colour and pattern, over under bed of cement mortar / PCC shall be provided in TG Hall flooring at operating level. Full body Vitrified Tiles shall be laid on properly laid leveled floor, with joints 3 to5 mm wide & 8 to10 mm deep & shall be filled with approved Epoxy Grout mix of 0.70 kg of organic coated filler of desired shade (0.10 kg of hardner and 0.20 kg of resin per kg).

Full body Vitrified Tiles (KAJARIA/ RAK/NITCO / JOHNSON) shall have water absorption less than 0.5%, Modulus of Rupture more than 38N/mm2, Breaking strength more than 7500 N, Mohs scale more than 6, Abrasion resistance less than 144 mm3 and coefficient of friction more than 0.4. Vitrified Tiles shall generally conform to IS: 15622.

9.04.08 For pathway, chequered and designed concrete tiles minimum 22 mm thick, 200x200 mm size conforming to IS: 13801 of approved shade and colour shall be used. 1000 wide pathways shall be provided for maintenance on rooftops of all buildings.

9.04.09 **Epoxy Flooring**

Epoxy Flooring shall be provided with surface preparation of concrete substrate with Captive Shot Blasting Machine OR Light Grinding to form the required anchor profile on the floor substrate followed by application of epoxy resin based moisture barrier underlay of 2 mm thickness including filling of saw cut joints with epoxy cementitious resin based moisture barrier underlay as per manufacturer specification. Application of self smoothing epoxy floor topping of epoxy based resin of 2 mm thickness over epoxy resin based moisture barrier underlay inclu...r.

It sh...ectively including surfa...ant.

White glazed tile

Above the Over deck insulation, White glazed tile (min. 5mm thick) for roofing over under bed of cement mortar/ concrete, topped with spreading the white ce-ment slurry at an average rate of 2.5 kg/sq m (unless noted otherwise), jointing and joint filling with white cement slurry, laid to plumb and water level in desired pattern, casted in panels, wherever required, shall be provided on the roof of Service Building.

9.04.10

9.04.11 Mirr...m) / Flame finish/ (mal...) - 18 mm thick (min...

9.04.12 Dec...nce concrete tiles of 2...

9.04.13 Skirt...upto false ceiling level from finished floor level. Skirting and Dado shall match with the floor finish.

9.04.14 Interlocking concrete blocks shall be of various sizes and thickness having M35 grade of concrete and pigmented to specified colours, in different pattern (in different textures chequered or other patterns in indentation for guiding band/s for visually impaired persons) including the preparation of sub base with 20mm thick sand and filling of joints with sand.

9.04.15 24 mm x 24 mm x 3.8 mm thick (minimum) glass mosaic tiles in decorative murals and pattern.

Engineered wooden flooring (15mm thick) of Mikasa/ Century/ Pergo / Equivalent shall be provided in VIP area, conference rooms.

9.04.16 **Ru...**

Ru... size of ...nts, res...nce an...tatic gra...

Matt finish (with grooves) Porcelain tiles (for guiding band/s for visually impaired persons in service building ) shall be with 3mm groove joints as per approved pattern pointed neatly with 3x4mm stainless epoxy grout SP- 100 of Laticrete or approved equivalent in approved colour to match colour of tile. **Porcelain tiles shall be provided in Service Building.**

24 mm x 24 mm x 3.8 mm thick (minimum) glass mosaic tiles in decorative murals and pattern.

Engineered wooden flooring (15mm thick) of Mikasa/ Century/ Pergo / Equivalent shall be provided in VIP area, conference rooms of Service Building and MPH building.

9.05.00 **Ep...**

Se...tical su...ved col...

9.06.00 **Ro...**

9.06.01 Ex...ame wo...heet de...aint ha...shall be...d by the...ll be

| CLAUSE NO. | TECHNICAL REQUIREMENTS |
|---|---|
| | provided over the metal decking. Water proofing cum plasticiser compound shall be added to concrete over the metal decking. Bidder shall demonstrate that the roof is leak proof by carrying out the w ter depth of 50mm over the roof surface f as given below for RCC roof slabs shall b |
| 9.06.02 | ~~DELETED~~ |
| 9.06.03 | For efficient dispo l not be less than 1:100 and the roof shall d. Gutter shall be made water tight using s ovided either in structure or subsequently p gregate) and/or cement mortar (1:4). Hov all be provided on top to achieve smooth s |
| 9.06.04 | Unplasticised PV with with joints with seal ring confirming to m the roof. These shall be suitably conce ting work to match with the exterior finish erned by IS 1742 and IS 2527. Roof drain situ RCC roof shall be provided with Rai g minimum thickness of 30 mm with 1:2:4 and finished with 12 mm thick cement sand able fittings and fixtures. |
| 9.06.05 | **Roof Water Proo** |
| | Roof water proofi |
| | a) For roofs having structural slope: |
| | Top surface of sloped R.C.C. slab shall be finished with 15mm thick cement plaster (1:4). Over the finished surface elastomeric membrane shall be laid. The elastomeric shall comprise of high solid content liquid applied urethane laid over reinforcing layer of polyscrim cloth or non woven geo-textile. The top of the elastomeric membrane shall be finished with 20 mm thick cement: sand (1:4) mortar with chicken wire mesh and pressed precast concrete tiles of 20 mm thickness where applicable shall be laid over mortar at green stage. Provision for thermal expansion of roofing tiles shall be kept by providing an expansion gap in both directions filled up with polysulphide joint sealant. The expansion gap shall be provided in the cement sand mortar underbed layer also. |
| | b) For roofs having no structural slope: |

Over-Deck Insulation
Roof insulation with 40 mm thick impervious sprayed, closed cell free Rigid Polyurethane foam over deck insu-lation conforming to IS: 12432 Part-III (density of foam being 40-50 Kg/Cum), over a coat of Polyurethane primer applied @ 6-8 sqm per litre, laid over 400 G Polythene sheet over PUF spray and provided with a wearing course of 40 mm cement screed 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) in chequered rough finish, in panels of 2.5m X2.5m and em-bedded with 24G wire netting and sealing the joints with polymerized mastic, shall be provided on the roof of Ser-vice Building above the waterproofing.

The elastomeric membrane above mentioned for water-proofing shall be of two component, instant setting, 100% solids spray applied hybrid polyurea polyurethane liquid applied elastomeric seamless waterproofing membrane meeting the requirements of LAM as per ASTM C836 and having excellent tensile strength of 15MPa (As per ASTM D412), elongation more than 450% (as per ASTM D 412), tear strength of 60 Kn/m (As per ASTM D1004/ASTM D624), adhesion to concrete of 2MPa (as per ASTM D 4541), abrasion resistance of 60mg loss (1 Kg,CS 10 Wheels,1000 cycles - As per ASTM D4060), Shore A Hard-ness of 85 (As per ASTM D2240), resistance to hydrostatic pressure head of 7 Bar (As per ASTM D 5385/ DIN 16726), puncture resistance of 1000N (As per ASTM E154), water vapour permeability of 25 mg/m2/day (As per ASTM E96), Impact resistance of 17 N.m (As per ASTM D2794), Low temperature crack bridging ability up to 3.2mm (As per ASTM C 1305), dynamic crack bridging ability class B 3.2 (as per EN 1062-7 Method B- B3.2) with no crack observed in the coating after 20000 sinusoidal cycles, resistance to root (As per CEN TS/14416) and fire resistance of class B (As per EN 13501-1).The coating shall be applied with a total consumption of 1.6 Kg/Sqm to achieve a total system DFT of 1.5mm, thereby satisfy the requirements of LAM as per ASTM C898 and shall be applied on the entire horizon-tal surface extending upto 300mm above the FFL on the vertical surface as per the methodology.
The application system includes base preparation of cleaning, brushing and removal of flacky materials, grout-ing the porous area with cementitious grout, proper cov-ing between slab and wall junctions and priming the sur-face with two component solvent free epoxy primer which is applied with a consumption of 200 grams per Sqm, fol-lowed by spray application of hybrid polyurea waterproof-ing coating.
Protective geo textile fabric of minimum 150GSM over the entire membrane with proper overlaps shall be applied.

wall comprising structural steel post, runner and sheeting may be provided for buildings with metal sheet cladding.

9.06.08 Fillets at junction of roof and vertical walls shall be provided with cast-in-situ cement concrete (1:1.5:3) nominal mix followed by 12mm thick 1:4 cement sand plaster.

9.06.09 Pathways for handling of materials and movement of personals shall be provided with 22mm thick chequered cement concrete tiles as per IS:13801 for a width of 1000mm.

9.07.00 **Walls**

9.07.01 All walls shall be non-load bearing infill panel walls.

9.07.02 For initial height up to 1 metre in buildings one brick thick masonry wall shall be provided wherever metal cladding is specified.

9.07.03 All internal walls shall be with one brick thick in cement mortar (1:6). However, internal partition walls for toilets shall be with half brick masonry thick with cement mortar (1:4).

9.07.04 For ESP shall be of Autoclaved Aerated Concrete Block. Autoclav lock masonry shall be with blocks having dimensions of 625 mm from 100 mm to 300 mm conforming to I.S. :2185(part III).The the composition of 1: 6 (Cement: sand) shall be used with sui nd having modulus of fineness 1.1 shall be used. The horizont shall be approximately 10 mm. In case of partition walls (100 mm rcement i.e. 1 number of 6-8 mm diameter bars shall be place be anchored properly with the main structure. All other structura of masonry, joint reinforcement etc. in the AAC masonry work str structions laid down in IS 6041 – 1985, IS - 1905. For control om in MPH Building , walls shall be of factory made compos ted concrete panels,(minimum 2 hours of fire rating) consisti nt sheets (minimum 4 mm thick) on either side of light weight c n co nsity in the ra he th ovide external ll le

3.00 M ction oove jointing to t 1.25 mm thic 0 (minimum) as per IS : 277), fixing U profiled top and bottom c steel members which are placed at the maximum vertical spacing nised steel expansion fasteners, filling the joints

from bo aste and making the same water tight by covering with fibre gla de and minimum 0.5 mm thick) or by any other suitable material construction done with the light weight aerated concrete panels a urfaces are flush for painting, creating opening for doors / windov ans/AC etc. and finishing the opening face with the same U profile hich is used at the top and bottom.

For ESP Control Room Building, wall shall be of Autoclaved Aerated Concrete Block.

Autoclaved Aerated Concrete (AAC) block masonry shall be with blocks having dimensions of

625 mm x 250 mm. thickness ranging from 100 mm to 300 mm conforming to I.S. :2185(part III).The jointing cement sand mortar in the composition of 1: 6 (Cement: sand) shall be used with suitable plasticizer(optional). Sand having modulus of fineness 1.1 shall be used. The horizontal and vertical joint thickness shall be approximately 10 mm. In case of partition walls (100 mm /125 mm thk.) the joint reinforcement i.e. 1 number of 6-8 mm diameter bars shall be placed at every alternate course to be anchored properly with the main structure. All other structural requirements like stiffening of masonry, joint reinforcement etc. in the AAC masonry work strictly be carried out as per instructions laid down in IS 6041 – 1985, IS - 1905. For control room , control equipment room in MPH Building, **where dry wall construction is envisaged,** the walls shall be constructed of factory made composite modular light weight aerated concrete panels,(minimum 2 hours of fire rating) consisting of 2 fiber reinforced cement sheets (minimum 4 mm thick) on either side of light weight concrete core, having minimum compressive strength of 35 Kg / Cm2 and the density in the range of 700-900 Kg. / cu.m. of the thickness and fire rating as specified below, to provide external wall and internal partition at all levels, capable of sustaining wind pressure of 3.00 M height (H) within limiting deflection of span/250, fixed in position in tongue and groove jointing system by screwing the panels to top and bottom U channels, (channels minimum 1.25 mm thick and galvanised to grade 180 (minimum) as per IS : 277), fixing U profiled top and bottom channels to concrete / primary steel members which are placed at the maximum vertical spacing of 4.5m with the help of galvanised steel expansion fasteners, filling the joints from both faces with silicon acrylic paste and making the same water tight by covering with fibre glass tape (minimum 50 mm wide and minimum 0.5 mm thick) or by any other suitable material, so as to ensure that the entire construction done with the light weight aerated concrete panels are weather proof and panel surfaces are flush for painting, creating opening for doors / windows /ventilators / ducts / pipes/fans/AC etc. and finishing the opening face with the same U profiled galvanized steel channel which is used at the top and bottom.

**The Outer wall of control room, control equipment room in MPH Building shall be made of aerated concrete panels over that 50 mm thick mineral wool insulation and metal sheeting on outside.**

For ESP Control Room Building.....U profiled galvanized steel channel which is used at the top and bottom.

**The Outer wall of control room, control equipment room in MPH Building shall be made of aerated concrete panels over that 50 mm thick mineral wool insulation and metal sheeting on outside**

ection VI)

9.07.05 Toilet Block in ESP Control Room Building shall be of Brick Masonry

9.07.06 50 mm thick DPC in Cement concrete (1:1.5:3) with water proofing compound followed by two layers of bitumen coating 85/25 grade as per IS: 702 @ 1.7 kg./sq.m. shall be provided at plinth level before starting the masonry work.

9.07.07 Enclosure of the elevator shall have 2 hours fire rating and it shall be sealed from outside to ensure dust free environment.

9.08.00 **COLOUR COATED AND OTHER SHEETING WORK**

**9.08.01** **Material**

**a) Wall Cladding & Roofing Material**

Troughed permanently colour coated sheet of approved shade and colour shall be

**i)** either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade Y250 as per IS 15961 / grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150

**ii)** or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade Y350 as per IS15961/ grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150.

**iii)** or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade Y550 as per IS 15961/ grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150
Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS: 1254.

Bidder to ensure that same profile is to be used throughout the package for all facilities to maintain uniformity.

**b) Metal Deck Roof Material**

Troughed permanently colour coated metal decking sheets shall be

**i)** either of steel with minimum 0.8mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275.

**ii)** or of minimum 0.6mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275.

**iii)** or of steel of minimum 0.6mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275.

Alternatively aluminium feed material of minimum bare metal thickness of 0.9 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254 can also be used for metal decking.

Thickness tolerance of (+/-) 0.04mm is permissible. However, all design calculations shall be carried out on the basis of lowest value of sheet thickness provided.

Bidder to ensure that same profile is to be used throughout the package for all facilities to maintain uniformity. In addition, the depth of the profile shall be restricted to 60 mm (maximum) to reduce the overall thickness of floor slab and thus minimizing the dead load of the floor slab. If the bidder proposes to use two different metal deck sheets (same profile but different grades or thicknesses), the unexposed (concrete) side of the metal deck sheets shall be painted with clearly distinct colours to facilitate identification.

Bidder to ensure that both cladding sheet and decking sheet supplied at site to be provided with transparent organic film of thickness of 40 microns on each face. Also they should be stored in a covered place on wooden sleepers till erection.

**9.08.02 Colour Coating**

Steel shall be colour coated with total coating thickness of at least 40 microns (nominal) comprising of silicon modified polyester (SMP) paint or Super Polyester paint or SDP paint (Super Durable Polyster with no TGIC Triglycidyl Isocynurate) . The silicon content in the SMP paint to be 30 to 50%. The paint to be , of minimum 20 microns (nominal) dry film thickness (DFT) on external face over primer coat of minimum 5 microns (nominal) and minimum 10 microns (nominal) SMP or super polyester paint over primer coat of minimum 5 microns (nominal) on internal face. SMP and Super polyester paint/SDP systems shall be of industrial finish of product type 4 of AS/NZ2728.

Also the heavy metal content (Lead, Cadmium, Chromium etc) to be within environmental norms so that the sheet is also suitable for rainwater harvesting

**9.08.03 Design Criteria**

For wall cladding insulated / uninsulated and conveyor gallery sides and roof, permanently colour coated sheet of troughed profile shall be used. However alternative profile meeting the strength, deflection and other functional requirements such as section modulus and moment of inertia shall be provided.

Sheet shall be of profile, sectional properties, colour and shade as per specifications.

For profiled metal decking sheets (to be used for RCC floor slab or roof slab) the sectional modulus and moment of inertia of troughed profile per meter width shall be so as to limit the deflection of sheets to span/250 under total super imposed loading (DL +LL) comprising the self-weight of metal deck sheet, dead weight of green concrete and an additional construction load 100kg per sq.m for two span condition. The section modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements.

For metal deck sheets used for roofing (with or without RCC) and side cladding, the sectional modulus and moment of inertia of troughed profile per metre width shall be such that the deflection of sheets is limited to span/250 under design wind pressure for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS 801 for satisfying the deflection and strength requirements. No increase in allowable stress is permissible under wind load condition.

**9.08.04 Fasteners**

Side cladding/roofing/decking sheets shall be fixed to the runner/purlins using self-drilling special coated fasteners confirming to corrosion resistant class 3 of AS3566 and tested for 1000 hours salt spray test. Spacing of Self-drilling fasteners in transverse direction (along runners/purlin) shall be equal to the pitch of trough or 250(+/-100) mm, whichever is lesser and in longitudinal direction at every runner/purlin location.

Shear anchor studs shall also be provided through metal deck, which are to be used as permanent shuttering, at regular interval on all top flange / flange plate of structural beams as specified in Clause no. 8.03.00.

Alternatively, J/U type hooks shall be used in roofing which shall be provided in transverse direction (along runners/purlin) at a spacing equal to the pitch of trough or 250(+/-100) mm, whichever is lesser and in longitudinal direction at every runner/purlin location.

**9.08.05** **Miscellaneous Details**

To minimize the number of joints, the length of the sheet shall preferably be not less than 4.5m, cut pieces shall not be used, unless specifically approved by the Engineer. However, the actual length shall be such so as to suit the purlin / runner spacing.

Lap between the sheets shall be at least 150mm in the longitudinal direction and at least one crest wide in the transverse direction which shall be properly anchored / fixed with fasteners.

Z spacers if required shall be made of at least 2 mm thick galvanised steel sheet of grade 350 as per IS 277

Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non stainless material and be flexible enough not to interface with fit of the sheets

. Filler blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. The filler blocks shall be manufactured from black synthetic rubber or any other material approved by the Engineer.

For insulation of cladding and other areas, mineral wool conforming to IS 8183 shall be used. The density shall be 32 or 48 kg. /cu.m for glass or rock wool respectively. The nominal thickness of insulation shall be 50mm.

All flashings, trim closures, caps etc. required for the metal cladding system shall be made out of plain sheets having same material and any weather/moisture sealants with appropriate material and coating specification as mentioned above for the outer face of the metal cladding. Overlap shall be min. 150 mm or as specified by manufacturer.

The contractor shall prepare working drawings of sheeting system including end and side laps, flashing, fixing details etc. before starting sheeting work at site.

**9.08.06** **Pre-Fabricated Insulated Metal Sandwich Panels**

For buildings where Pre-Fabricated (Factory made) Insulated Metal Sandwich Panels shall be used for Roofing, the sandwich panels shall comprise top sheet as troughed permanently colour coated sheet & bottom sheet as plain permanently colour coated with 50mm thick insulation sandwiched between the two sheets. Each sheet shall be

**i)** either of steel with minimum 0.6mm bare metal thickness (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade Y250 as per IS15961/ grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150

**ii)** or of minimum 0.5mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade Y350 as per IS15961/ grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150

**iii)** or of steel of minimum 0.4mm BMT (i.e. excluding the thickness of galvanizing/aluminium-zinc coating and painting) of grade Y550 as per IS15961/ grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326 with zinc coating to class Z275 / aluminium-zinc alloy coating to class AZ150.

Alternatively aluminium feed material of minimum bare metal thickness of 0.7 mm of aluminium alloy of Series 31000 and above as per IS 737 and IS 1254.

Metal sheets (steel or aluminium) shall be colour coated with total coating thickness of at least 40 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester (SMP with silicon content of 30% to 50%) paint or Polyester paint, of minimum 20 microns (nominal) SMP or polyester paint on one side (exposed face), over minimum 5 micron (nominal) primer coat and minimum 10 micron (nominal) SMP or Polyester paint over minimum 5 micron

| | |
|---|---|
| | (nominal) primer coat on other side. SMP and Super Polyester paint shall conform to product type 4 of AS/NZS 2728. Troughed sheet shall be of approved profile, sectional properties, (suitable for the specified loading / deflection and purlins / runners spacing), colour and shade.<br><br>Special coated fastener conforming to corrosion resistant Class 3 of AS3566 and tested for 1000 hours salt spray test shall be used for fixing Pre-Fabricated Insulated Metal Sandwich Panels with the structural members below.<br><br>The contractor shall prepare working drawings of sheeting system including end and side laps, fixing details etc. before starting sheeting work at site. The insulation shall be of Polyurethane type. The polyurethane shall be Chlorofluorocarbon (CFC) free and self-extinguishing and shall conform to IS 12436: 1988. It shall have Modular Density 40 +/- 2 Kg/m3 and Thermal Conductivity @ 10 Deg.C 0.017 - 0.020 W/M 0k, Water absorption (% by vol) 3.1, Critical Oxygen Index 23 and Compressive Strength 1.2 Kg/sq.cm. |
| **9.08.07** | **Polycarbonate Sheets**<br><br>The polycarbonate sheet to be used for cladding and glazing purpose in conveyor galleries, Transfer points & pump houses shall have toughed profile to match with the metal cladding profile. Minimum 3.0mm thick fire retardant and UV resistant polycarbonate clean sheet of approved make shall be used. The polycarbonate sheet shall be installed along with the metal cladding so as to have a watertight lapping arrangement. Suitable detailing shall be made to cater for the thermal expansion. IS 14434 to be referred for other details. |
| 9.09.00 | **Plastering** |
| 9.09.01 | Outer face (i.e. rough side) of all brick walls shall have 18 mm thick and inner face (i.e. smooth side) of all walls shall have 12 mm thick cement sand plaster 1:6. |
| 9.09.02 | Acrylic wall putty in two coats shall be applied over cement plastered surfaces in interior of building. The finish surface shall be smooth and shall be of 2 mm nominal thickness. |
| 9.09.03 | All R.C.C. walls shall have minimum 12mm thick cement sand plaster 1:6. |
| 9.09.04 | All RCC ceilings (except areas provided with false ceiling, cable vault ceiling and metal decking) shall be provided with 6mm thick cement sand plaster 1:4. |
| 9.09.05 | Groove of uniform size 12 x 12 mm up to 20 x 15 mm in plastered surface as per approved pattern, shall be provided as per approved drawing. |
| 9.09.06 | All plastering work shall conform to IS: 1661. |
| **9.10.00** | **Painting, Aluminium Composite Panel,** |
| 9.10.01 | All painting on masonry or concrete surface shall preferably be applied by roller. If applied by brush then same shall be finished off with roller. |
| 9.10.02 | All paints shall be of approved make including chemical resistant paint. |
| 9.10.03 | Minimum 2 finishing coats of paint shall be applied over a coat of primer. |
| | Stone work for wall lining etc. (Veneer work) over 20 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry @3.3kg/sq.m, including rubbing and polishing in complete. (Black polished granite stone slab, 18 mm thick / polished Sadarhally grey granite slab 18 mm thick / other equivalent approved sahde).<br><br>The final, finished coating shall be fungus resistant, UV resistant, water repellent, alkali resistant, and extremely durable with colour fastness. |
| 9.10.04 | Acrylic emulsion paint shall be as per IS: 15489. Acrylic distemper shall be as per IS: 428. Cement paint shall conform to IS: 5410, white wash/colour wash shall conform to IS: 627. |

9.10.05 All fire exits shall be painted in post office red/signal red colour shade, which shall not be used anywhere else except to indicate emergency or safety measure.

9.10.06 For painting on concrete, masonry and plastered surface IS: 2395 shall be followed. For painting on wood work IS: 2338 shall be followed.

9.10.07 For painting on steel work and ferrous metals, BS: 5493 and IS: 1477 shall be followed. The type of surface preparation, thickness and type of primer, intermediate and finishing paint shall be according to the painting system adopted.

9.10.08 Bitumen primer used in acid/alkali resistant treatment shall conform to IS: 158.

9.10.09 ~~All internal paints shall be of low VOC (Less than 50 g /L) content conforming to GRIHA rating for reduction of VOC content.~~

All internal paints shall be of low VOC (Less than 50 g /L) content.

**9.10.10 Aluminium Composite Panel**

Aluminum Composite Panel cladding with open grooves shall be designed, fabricated, tested installed and fixed for linear as well as curvilinear portions of the building for all heights and levels including:

a) Structural analysis & design and preparation of shop drawings for pressure equalization or rain screen principle as required, proper drainage of water to make it watertight including checking of all the structural and functional design.

b) Aluminium Composite Panel cladding (Alucobond/ Alpolic / Aludecor /Equivalent) in pan shape in metallic/ solid colour of approved shades made out of 4mm thick aluminium composite panel. ACP consisting of 3mm thick Fire Retardant mineral filled Core comprising of around 70% Inorganic compound which is 100% non-combustible mineral and balance 30% is food grade virgin polymer sandwiched between two Aluminium sheets (each 0.5mm thick). The aluminium composite panel top and bottom skin should confirm to Aluminium Alloy 5005 (AlMg 1) marine grade series and H 22/24 temper.

The ACP sheet shall be coil coated with Kynar 500 based (70:30 ratio) PVDF / Lumiflon based fluoropolymer resin coating of approved colour and shade on face # 1 and polymer (Service) coating on face # 2 as specified using stainless steel screws, nuts, bolts, washers, cleats, weather silicone sealant, backer rods etc.

c) The fastening brackets of Aluminium alloy 6005 T5 / MS with Hot Dip Galvanised with serrations and serrated washers to arrest the wind load movement, fasteners, SS 316 Pins and anchor bolts of approved make in SS 316, Nylon separators to prevent bi-metallic contacts all complete required to perform as per specification and drawing.

**9.10.11 DELETED**.

**9.10.11 DELETED**

9.10.13 **Exterior Painting on Wall (Premium Acrylic Smooth Exterior Paint with Silicone Additives)**

~~The paint shall be (premium acrylic smooth exterior paint with silicone additives) of approved brand and manufacture. This paint shall be brought to the site of work by the contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empty containers shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge.~~

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## Exterior Painting on Wall (Premium Acrylic SmoothExterior Paint with Silicone Additives)

The paint shall be (premium acrylic smooth exterior paint with silicone additives) of approved brand and manufacture. This paint shall be brought to the site of work by the contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empty containers shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge.

Preparation of Surface

For new work, the surface shall be thoroughly cleaned off all mortar dropping, dirt dust, algae, fungus or moth, grease and other foreign matter of brushing and washing, pitting in plaster shall make good, surface imperfections such as cracks, holes etc. should be repaired using white cement. The prepared surface shall have received the approval of the Engineer in charge after inspection before painting is commenced.

**Textured base coat**

**Exterior wall Texture-New work (Two or more coats applied @ 6.5kg/10 sqm over and including priming coat of exterior primer applied @ 2.20 kg/10 sqm). High Quality Exterior Acrylic Modified resin and special quality Silica Quartz with Trowel Texture (Asian / Dulux/ Nerolac/ Berger/ Equivalent) as per selection.....**

ection VI)

Application of exterior paint

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its container, when applying also the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. Dilution ratio of paint with potable water can be altered taking into consideration the nature of surface climate and as per recommended dilution given by manufacturer. In all cases, the manufacturer's instructions & directions of the Engineer-incharge shall be followed meticulously.

The lids of paint drums shall be kept tightly closed when not in use as by exposure to atmosphere the paint may thicken and also be kept safe from dust. Paint shall be applied with a brush on the cleaned and smooth surface. Horizontal strokes shall be given, First and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks.

9.11.00 Doors & Windows

9.11.01 Doors, windows and ventilators of air-conditioned areas, entrance lobby of all buildings (where ever provided), and all windows and ventilators of all buildings (unless otherwise mentioned) shall have aluminium framework with glazing. The aluminium section shall have minimum 2 mm thickness. The aluminium frame shall be electro colour dyed (anodised with 15 micron coating thickness) when used on outer side of the building and it shall be powder coated( 50 microns coating thickness) when used in interior of the building. All doors of toilet areas shall be of steel framed solid core flush shutter. For Mill Bunker Building, transfer points, crusher house, conveyor gallery, steel louvered windows shall be provided.

9.11.02 Control Rooms of all buildings shall be provided with Aluminium Glazed door.

9.11.03 Single glazed panels with aluminium framework shall be provided as partition between two airconditioned areas wherever clear view is necessary.

9.11.04 a) The doors frames shall be fabricated from 1.6 mm thick MS sheets and shall meet the general requirements of IS: 4351.

b) All steel doors shall consist of double plate flush door shutters. The door shutter shall be 35 mm (min.) thick with two outer sheets of 1.2 mm rigidly connected with continuous vertical 1.0 mm stiffeners at the rate of 150 mm centre to centre. Side, top and bottom edges of shutters shall be reinforced by continuous pressed steel channel with minimum 1.2 mm. The door shall be sound deadened by filling the inside void with mineral wool. Doors shall be complete with all hardware and fixtures like door closer, tower bolts, handles, stoppers, aldrops, locks etc.

9.11.05 Steel windows and ventilators shall be as per IS: 1361 and IS: 1038.

9.11.06 Wherever functionally required Rolling shutter (fully closed/partly grilled) with suitable operating arrangement (manual/Electric) shall be provided to facilitate smooth operations. Rolling shutters shall conform to IS: 6248. M.S sliding doors with suitable mechanical and electrical operations fixtures as per requirement for bigger openings shall be used.

9.11.07 All windows and ventilators on ground floor of all buildings shall be provided with suitable Aluminium grill.

9.11.08 Fire-Proof doors with panic devices shall be provided at all fire exit points as per requirements. These doors shall generally be as per IS 3614 (Part 2). Fire rating of the doors shall be of minimum 2 hours. These doors shall be double cover plated type with mineral wool insulation.

9.11.09 Hollow extruded section of minimum 2 mm wall thickness as per IS: 1285 (Grade of Alluminum shall be Alloy 63400) shall be used for all aluminium doors, windows and ventilators.

9.11.10 Minimum size of door provided shall be 2.1 m high and 1.2 m wide. However for toilets minimum width shall be 0.75 m and office areas minimum width shall be 1.20m.

9.11.11 Electrically operated, self operable/closing, aluminium framed with tinted glass, sliding doors shall be provided at the entrance of all common control rooms, entrance lobby of facility building. At the entrance of all common control rooms in MPH G.I. framed with fire resistant glass, sliding doors shall be provided.

The other doors in common control rooms in MPH shall be G.I. framed with fire resistant glass as per fire zoning.
Fire Resistant Glazed Door System (Swing / Sliding) shall be of uniform GI profile 50X50 mm with 14mm(Minimum) EI 20 GLASS for Interior Application.
Fire Resistant Glazed Door System shall have 120 minutes of integrity and radiation control (EW 120) with symmetrical (Bi-Directional) fire protection. The frames shall be cold rolled profiles as per EN standard EN 10327/ Indian Standard IS 513 . The door frames are cold rolled from 1.5 mm steel sheet to form a profile of 50 mm x 50 mm on all sides. The door shutter shall have the top rail, side rail and bottom rail dimensions of 50 mm x 50 mm. The overall door opening shall be as per tested evidence and tested as per EN 1634-1/ ISO 834- 1 / ISO 3009 /(Indian Standard ) IS 16947:2018 in an accredited laboratory.

The glass must be minimum 14mm thick , clear (MADE IN INDIA )120 min fire rated for Integrity, Radiation control (EW 120) and partially insulation (EI 20) Non Wired Toughened Interlayered glass with a light transmission of 86% and a sound reduction of 37 dB and manufactured in UL & TUV audited Facility and including UL-EU Certification and compliant to class 1(B)1 category of Impact Resistance as per EN 12600. The glass shall be tested and certified for no formation of bubbles or yellowing after 5000 hours of exposure to UV radiation by TUV Rheinland as per EN 12543-4. The base glass and finished glass shall be made in India.
The shutters shall be fixed to the frame using Weld-on hinges of dimensions 179mm X 20mm. The profiles shall have groves to incorporate Fire Resistant gaskets. The glass shall be held in its place with the help of 1.5 mm cold rolled steel beading and Kerafix 2000 ceramic tape with cross section of 4 x 15 mm as per the test evidence. Beading shall be clipped on using Stainless Steel self-tapping screws fixed at a distance of 70 mm from the edges and 150 mm c/c henceforth. The glass panes are to be supported on non-combustible 6 mm Calcium Silicate setting blocks. The door shall be fitted with offset pull handle and door closer of Dorma (TS 73V, TS 83V, TS93V), Geze (TS 2000NV) or equivalent. The inactive leaf ( in case of double leaf only )shall be fixed to the frame using a tower bolt at meeting edge at top or as per the tested evidence. The doors shall be manufactured in a TUV audited facility. The maximum glazing size shall be as per the test certification. The profile shall be fixed to the supporting construction by means of M10 or bigger steel bolts at every 150 mm from the edges and every 500 mm (approx.) c/c. The doors shall offer C4 level of wind resistance when tested as per EN12211 and shall provide class 4 level of air permeability as per EN 1026. The door shall also be subjected to durability tests as per EN 12400 for C5 classification (200,000 cycles). The doors shall also be tested for class 5 of impact resistance when tested as per EN 13049. The doors & partition shall also be tested for class 4 level of Mechanical strength when tested as per EN13115. The door shall have water tightness level of 8A when tested as per EN 1027.
The sliding door system shall be connected to the surrounding construction by means of interlocking labyrinths lined with intumescent tapes as per the test evidence and connected to the sliding mechanism at the top. The sliding mechanism shall be as mentioned in the tested evidence or Assessment and shall have steel rollers. The glass should be held in its place with the help of 1.5 mm cold rolled steel beading and Kerafix 2000 ceramic tape with cross section of 4 x 15 mm as per the test evidence. Beading shall be clipped on using Stainless Steel self-tapping screws fixed at a distance of 70 mm from the edges and 150 mm c/c henceforth. The glass panes are to be supported on non-combustible 6 mm Calcium Silicate setting blocks.
The sliding mechanism shall be fixed to adequate supporting construction (MS channel / Reinforced concrete) to ensure proper support for the door.

Fire Rated Door (swing / sliding) shall be of Makes- Saint Gobain, Acodor, IGI, Matrix. At the entrance of all common control rooms in MPH G.I. framed with fire resistant glass, sliding doors shall be provided. The other doors in common control rooms in MPH shall be G.I. framed with fire resistant glass as per fire zoning .Fire Resistant Glazed Door System shall be of Uniform Profile 50X50 mm with 14mm EI 20 GLASS For Interior Application.

FIRE RESISTANT GLAZED DOOR SYSTEM shall have 120 minutes of integrity and radiation control (EW 120) with symmetrical (Bi-Directional) fire protection. The frames shall be cold rolled profiles as per EN standard EN 10327/ Indian Standard IS 513 . The door frames are cold rolled from 1.5 mm steel sheet to form a profile of 50 mm x 50 mm on all sides. The door shutter shall

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|---|---|
| | have the top rail, side rail and bottom rail dimensions of 50 mm x 50 mm. The overall door opening shall be as per tested evidence and tested as per EN 1634-1/ ISO 834- 1 / ISO 3009 /(Indian Standard ) IS 16947:2018 in an accredited laboratory.<br><br>The glass must be minimum 14mm clear (MADE IN INDIA )120 min fire rated for Integrity, Radiation control (EW 120) and partially insulation (EI 20) Non Wired Toughened Interlayered glass with a light transmission of 86% and a sound reduction of 38 dB and manufactured in UL & TUV audited Facility and including UL-EU Certification and compliant to class 1(B)1 category of Impact Resistance as per EN 12600. The glass shall be tested and certified for no formation of bubbles or yellowing after 5000 hours of exposure to UV radiation by TUV Rheinland as per EN 12543-4.The base glass and finished glass must made in India .<br><br>The shutters shall be fixed to the frame using Weld-on hinges of dimensions 179mm X 20mm. The profiles shall have groves to incorporate Fire Resistant gaskets. The glass shall be held in its place with the help of 1.5 mm cold rolled steel beading and Kerafix 2000 ceramic tape with cross section of 4 x 15 mm as per the test evidence. Beading shall be clipped on using Stainless Steel self-tapping screws fixed at a distance of 70 mm from the edges and 150 mm c/c henceforth. The glass panes are to be supported on non-combustible 6 mm Calcium Silicate setting blocks. The door shall be fitted with offset pull handle and door closer of Dorma (TS 73V, TS 83V, TS93V), Geze (TS 2000NV) or equivalent. The inactive leaf ( in case of double leaf only )shall be fixed to the frame using a tower bolt at meeting edge at top or as per the tested evidence. The doors shall be manufactured in a TUV audited facility. The maximum glazing size shall be as per the test certification. The profile has to be fixed to the supporting construction by means of M10 or bigger steel bolts at every 150 mm from the edges and every 500 mm (approx.) c/c. The doors shall offer C4 level of wind resistance when tested as per EN12211 and shall provide class 4 level of air permeability as per EN 1026. The door shall also be subjected to durability tests as per EN 12400 for C5 classification (200,000 cycles). The doors shall also be tested for class 5 of impact resistance when tested as per EN 13049.<br>The doors & partition shall also be tested for class 4 level of Mechanical strength when tested as per EN13115. The door shall have water tightness level of 8A when tested as per EN 1027.<br>Fire Rated Door shall be of Makes- Saint Gobain, Acodor , IGI, Matrix. |
| 9.11.12 | Minimum area of windows in building on each floor level shall be 10% of floor area. |
| 9.12.00 | **Glazing** |
| 9.12.01 | All windows and ventilators (not specified elsewhere) shall be provided with minimum 6 mm thick toughened glass conforming to IS: 5437. |
| 9.12.02 | For single glazed aluminium partitions and doors, 8mm thick clear toughened glass shall be used. |
| 9.12.03 | Toughened tinted glass of 6 mm thickness shall be used for all windows and ventilators in toilets. |
| 9.12.04 | All glazing work shall conform to IS: 1083 and IS: 3548. |
| 9.12.05 | For glazings of Air Conditioned Buildings Composite double glazing shall be 24mm thick consisting of 6mm thick clear float glass on inner side and 6mm thick reflective toughened glass on outer side. The two glasses shall be separated by 12mm air-gap and hermetically sealed by beading of anodized aluminium with outer edge sealed with silicon sealant. Outer glass of 6mm thickness shall have following technical characteristics: Solar factor 25% or less, Maximum U-value 3.3 W/ SQMK, VLT min 30%: Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28).<br>The glass to be used should be from the manufacturers of glass like Saint Gobain (India) or Asahi (India) or equivalent. The glass should be free from distortion and thermal stress. |
| 9.12.06 | For internal glazed partition, 8mm thick clear toughened glass shall be provided. Internal Glazed partition in in MPH shall be fully glazed fire rated fixed partition with 120 minutes of integrity and radiation control (EW 120) with symmetrical (Bi-Directional) fire protection. The frames shall be cold rolled profiles As per EN standard EN 10327/Indian Standard (IS 513 ) . The frames are cold rolled from 1.5 mm steel sheet to form a profile of 50 mm x 50 mm on all sides. he system shall be tested as per EN 1364-1/(Indian Standars) IS 16945:2018 in an accredited laboratory. |

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| | The glass shall be 14mm(minimum) ( MADE IN INDIA )clear 120 min fire rated for Integrity, Radiation control (EW 120) and partially insulation (EI 20) Non Wired Toughened Interlayered glass with a light transmission of 86% and a sound reduction of 37 dB and manufactured in UL & TUV audited Facility and including UL-EU Certification and compliant to class 1(B)1 category of Impact Resistance as per EN 12600. The glass shall be tested and certified for no formation of bubbles or yellowing after 5000 hours of exposure to UV radiation by TUV Rheinland as per EN 12543-4 The glass shall provide bi-directional (Symmetrical) fire protection. The base glass and processed glass must be made in INDIA.<br><br>The glass shall be held in its place with the help of 1.5 mm cold rolled steel beading and Kerafix 2000 ceramic tape with cross section of 4 x 15 mm as per the test evidence. Beading shall be clipped on using Stainless Steel self-tapping screws fixed at a distance of 70 mm from the edges and 150 mm c/c henceforth. The glass panes are to be supported on noncombustible 5 mm Calcium Silicate setting blocks. The maximum glazing size shall be as per the test certification. The profile has to be fixed to the supporting construction by means of M10 or bigger steel bolts at every 150 mm from the edges and every 500 mm (approx.) c/c.<br><br>The Partitions shall offer C4 level of wind resistance when tested as per EN12211 and shall provide class 4 level of air permeability as per EN 1026. The Partitions shall also be tested for class 5 of impact resistance when tested as per EN 13049. The Partitions shall also be tested for class 4 level of Mechanical strength when tested as per EN13115. The Partitions shall have water tightness level of 8A when tested as per EN 1027. Partitionr shall be of Makes - Saint Gobain,Acodor , IGI , Matrix ,Tata Pravesh. |
| 9.13.00 | **False ceiling** |
| 9.13.01 | False ceiling of 12.5 mm thick tapered/square edge glass fibre reinforced gypsum board conforming to IS : 2095 having fine texture finish, including providing and fixing of frame work at all levels, for all kind of work, consisting of light weight galvanised steel member (minimum 0.8 mm thick and galvanised as per IS: 277) having maximum grid size of 1200 mm x 600 mm for supporting panels of specified size, suspended from RCC structural steel or catwalkway grid above, with 4 mm (minimum) galvanised wires (rods), with special height adjustment clips, providing angle section of minimum 25 mm width along the perimeter of ceiling, supporting grid system (minimum 0.8 mm thick and galvanised as per IS: 277 ), expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts, return air grills, light fixtures, etc., all complete. (concealed grid and finished flat seamless and curve shape (dome etc.), finished smooth(seamless) along with the galvanised light gauge steel supporting system laid in profile to suit the profile of dome). |
| 9.13.03 | False ceiling of 12 mm thk calcium silicate board of 'HILUX' or equivalent with suspension system as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts, return air grills, light fixtures, etc., all complete. (With concealed grid and finished flat seamless). |
| 9.13.05 | ALUMINIUM FALSE CEILING : Aluminium false ceiling shall be in 600 mm x 600 mm tile or plank type of 0.6 mm thickness (minimum) with perforation of 2.5 mm dia in combination with built in nonwoven tissue for providing good acoustic properties. False ceiling shall have coil coating of thickness 25micron (minimum)and it shall be installed with T-Grid (of profile 24 mm) in same or contrasting colours or with 6 mm recess joints. The whole system shall be level adjusting arrangement and shall be suspended as per manufacturer guidelines. |
| 9.13.08 | Additional hangers and height adjustment clips shall be provided for return air grills, light fixtures, A.C. ducts etc. |
| 9.13.09 | Suitable M.S. channel (Minimum MC75 with maximum spacing of 1.2 m C/C both ways) grid shall be provided above the false ceiling level for movement of personnel and to facilitate maintenance of lighting fixtures, AC ducts etc. |
| 9.13.10 | Underdeck insulation shall be provided on the ceiling (underside of roof slab) and underside of floor slab of air-conditioned area depending upon the functional requirements. This underdeck insulation |

shall consist of 50mm thick mineral wool insulation with 0.05 mm thick aluminium foil & 0.6 mm x 25mm mesh wire netting and shall be fixed to the ceiling with 2 mm wire ties.

9.13.11 ~~Suitable cut-outs shall be provided in false ceiling to facilitate fixing of lighting fixtures, AC grills, smoke detectors, etc.~~

9.14.00 **Elevator Machine Room**

Suitable cut-outs shall be provided in false ceiling to facilitate fixing of lighting fixtures, AC grills, smoke detectors, etc. Batten ceiling: Batten ceiling made up of extruded aluminum / metal of minimum 0.6mm thickness with powder coated finish (min. 40 microns) / wooden finish (minimum 0.11mm). The ceiling must have superior acoustics and must ad-here to the highest health and safety standards. The bat-tens shall have possibility of curvilinear arrangement. The batten ceiling shall be Greenguard, tested/certified from UL/ Intertek. The product shall meet technical re-quirements of ASTM E84. Batten ceiling of 1”x1” made up of extruded aluminum with “click-on system”. Subli-mation/Heat transfer method should not be used for bet-ter scratch resistance. Die-casted click on joinery shall not be used. Designer membrane ceiling: The ceiling shall be have demountable translucent stretch ceiling membrane with harpoon, corners ready to install. It shall not get discolored & sag. All joints shall be provided with appropriate interface trims to be able to demount the ceiling to access the lights. The ceiling shall be installed using ceiling aluminum suspension system, complete as per manufacturer’s installation guidelines and as per approved shop drawings in line with the design intent and approval by Engineer In-charge. LED strips shall be installed using custom alumi-num extrusions to ensure longevity of the installation. The ceiling shall have following features and properties: - Durable: The systems shall resist shocks and shall not crack with movement or under stretch conditions. Safe: The membranes and profiles shall have passed the stringent fire and safety tests. The membrane shall have been classified as non-toxic upon burning. The Flexible membrane shall be b-s1-d0 / ASTM E-84 class A tested/certified. Green: Membranes shall be 100% recyclable. There shall not be any welding defect on Membranes.

equirements in either way.

ll be of RCC and wall shall be of one brick thick
e door and other requirements as per NBC and

with profiled metal decking sheet. Trough shall be
rock wool) and thereafter finished with Minimum
7 mm thick hardwood planks, finished with 11mm
o’ or equivalent) with plank size 193x1195mm
9), over 2 mm expanded polystyrene foam and

shall be provided with Prefabricated Insulated

Insulated Metal Sandwich Panels shall be as
of Technical Specification.

te Steel flush doors of thickness 45 mm with steel
s. Space between two sheets shall be filled with
shall be pressed steel sheets of 16 gauge. All
ded by the Bidder. Rubber sealing, for making the

truded anodised Aluminium Sections of minimum
aled double glazing consisting of two 6 mm thick

ulated metal sandwich panels/decking sheets

ecification.

9.1

all be conceived with the intention of projecting a

o inside working environment. It shall take into
activities involving power plant technology, and
control hierarchy and man machine interface. All
eiling, furniture, colour scheme equipment design
s and ergonomics requirements shall be detailed
etic spatial appearance.

r design process shall be control room complex
room, conference rooms and office areas in the
reviewed and evaluated for design. Furniture to
n complex and other control rooms shall be as

interface and suitable ergonomic practices.

ecture and interior design.

agnetic interference levels, taking into account the

air conditioning, fire fighting, fire escapes, etc.

e) Microprocessors based control system to control the functional requirements.

The above design philosophy put into practice shall be detailed out through presentation drawings, perspective views, scale models, detail drawings, etc.

9.16.00 **Stainless Steel Hand railing**

Providing and fixing knockdown railing system comprising of SS 304 Grade Stainless Railing of 50mm diameter handrail fixed on 50 mm SS round baluster placed at maximum 1000 c/c along with five numbers 19 mm diameter midrail connected at side of baluster by special brackets, both the end of mid rail should be bush inserted for jointing and to give extra strength (joints should not be welded and invisible). The balustrade should be fixed onto floor with casted plate of minimum 6mm thickness. Base plate shall be concealed with suitable SS 304 cover cap so that the mounting height fasteners are not visible after installation. Only high strength anchor fasteners would be used for fixing of baluster, as giving extra strength, rust proof and more durable. Onsite welding is strictly not allowed. Wherever welding is required, it should be Tig welding process with same grade 304/316 at factory only so that floor stone and other things would not be damaged and for safety purpose also. Baluster and handrail connector should be screwed tightened and not to be welded on site. Wall thickness of all pipes shall be taken as 2 mm. Along with all visible components developed in high grade SS and whenever required, joints to be filled with bushings for extra strength. Railing Height to be taken @ 1000/ 1200 mm from floor level.

9.17.00 **Finishing Schedule**

~~Interior and Exterior Finishes shall be as given in Tables-A & B respectively attached at the end of these specification.~~

Revised Table A B attached as annexure sl no AC-2 'D-1-9 - Table A and Table B'

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| 1. | Main power house Building. | | | |
| | a) Unloading Bay | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area) |
| | b) Cable vault | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area) |
| | c) Balance area including passage | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area) |
| | d) SWAS Room | Matt Finished Vitrified ceramic tiles. | Aluminium composite panel cladding on walls and columns upto false ceiling level | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | e) Equipment Area, ESP SWGR/ ACP Room/ UAF Room | Cement concrete with Metallic hardener topping | Acrylic distemper. | Acrylic distemper (except metal deck area |
| | f) UPS Battery charger room | Matt finished Vitrified ceramic tiles. | Aluminium composite panel cladding on walls and columns upto false ceiling level | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | g) Deaerator floor | Cement concrete with Metallic hardener topping. | | - |
| | h) Operating Floor | 20 mm thick heavy duty anti skid full body vitrified tile in TG Hall. Rubber flooring at TG deck. | Colour coated Metal cladding on A-Row& Gable end, up to crane girder level. | Metal deck roofing (bottom of sheeting with RAL 9002 finish) |
| | i) General circulation and movement areas | 20 mm thick heavy duty anti skid full body vitrified tile | | Acrylic distemper (except metal deck area). |
| | j) Switchgear room | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area ) |
| | k) MCC Room | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area ) |
| | l) Control room area including control room | Matt Finish Vitrified ceramic tiles flooring of size 1000 x1000 mm | Partition in fire rated glass with fire rated frames with 2 hr fire rating & Metal Batten panel cladding for columns and walls | Metal Batten panel ceiling in combination with demountable translucent stretch ceiling membrane or as per approved design |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | m) control equipment room, | Matt finish Vitrified ceramic tiles. | Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls | Allluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | n) Conference room, senior executive room., Computer Room | Matt finish Vitrified ceramic tiles | Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | o) Record room | ceramic tiles | Acrylic distemper. | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | p) Locker room | Ceramic Tiles | Acrylic Emulsion Paint | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | q)Toilet area | ceramic tiles | Digitally glazed ceramic wall tiles up to False Ceiling Height | Alluminium False ceiling in size 600x 600 |
| | r) Office Room, Staff Room | Matt Finished Vitrified ceramic tiles. | Partition in fire rated glass with fire rated frames with 2 hr fire rating & Aluminium composite panel cladding for columns and walls | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | s)Laboratory area | Vitrified Ceramic / Acid/alkali resistant tiles. | Designer ceramic wall tiles up to False Ceiling Height/ Aluminium composite panel cladding for columns and walls in case of A.C Panel | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | t) RCC Stair case | 18mm thick Granite (Polished and honed Finished) stone | Polished Granite Stone up to 1.2m. ht. & Acrylic Distemper Paint over wall putty finish for balance height. | Acrylic Distemper |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | u) Lift and Staircase Lobby | 18mm thick polished granite stone as pattern. | 18mm thick polished granite & glass mosaic tile cladding up to False Ceiling Height | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | v) Passages and general circulation areas. | Deleted | Deleted | Deleted |
| | w) Battery Room | Acid and alkali resistant tile. | Acid and alkali resistant tile up to 1.2m height and chemical resistant paint for balance height | Chemical Resistant paint except in locations where Metal deck has been provided |
| | x) Oil canal, oil room, oil purification Tank and other areas where oil spillage is likely to occur. | Oil resistant paint (epoxy based) 150 micron over primer. | As above except oil canal<br>Oil resistant Paint | As above except oil canal. |
| | y)Pathways including roof area. | 22mm thick concrete chequered tiles. | - | - |
| | | | | |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| 2. | DELETED | | | |
| 3 | ESP control building/Air compressor house/ Safety Control Room | | | |
| | a) Operating/Maintenance areas | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area) |
| | b) Office Room, Staff Room | Digitally glazed Vitrified ceramic tiles. | Aluminium composite panel cladding on walls and columns | Mineral fiber Board False Ceiling |
| | c) Control Room | Digitally glazed Vitrified ceramic tiles. | Aluminium composite panel cladding on walls and columns in ESP Control Room Building | Alluminium false ceiling in combination with GRG plaster board border in column depth or as per approved design |
| | d) MCC Room | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area) |
| | e) RCC Stair case | Cement concrete with Metallic hardener topping | Polished Granite stone up to 1.2m.ht. & Acrylic Distemper | Acrylic Distemper (except metal deck area) |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | f) Battery Room | Acid, Alkali resistant tile | Acid, Alkali resistant tile 1.2m height / chemical resistant paint above dado | Chemical resistant paint (except metal deck area) |
| | g) AHU/ AC Plant room/ Cable vault | Cement concrete with Metallic hardener topping | Acrylic Distemper | Acrylic Distemper (except metal deck area) |
| | h) Toilets | ceramic tiles. | Designer ceramic wall tiles dado up to false ceiling level. | Calcium silicate false ceiling. |
| | | | | |
| 4. | Mill & Bunker building/ T.P.s / Conveyor Galleries | Cement concrete with Metallic hardener topping | Acrylic distemper on masonry walls/ color coated Metal panel cladding | color coated Metal panel cladding |
| 5. | Fire water booster water pump house/ CW PH/RWPH/ Switchgear Building | | | |
| | a) Maintenance /Pump floor/PLC | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area) |
| | b) Control room /PLC. | Matt Finished Vitrified Ceramic Tiles | Acrylic emulsion paint. | Mineral fiber board false ceiling. |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | Toilet area | ceramic tiles. | Digitally glazed ceramic wall tiles dado up to false ceiling level. | Acrylic distemper |
| 6. | Ash slurry pump house/ Ash water pump house / Silo Area Utility Building / Transport air compressor house/ Fuel Oil pressurizing Pump House with switchgear building& control room / Miscellaneous Switchgear room CW Pump house, Switchgear room, control room/ RW Switchgear room, control room/Any other Building.. | | | |
| | a) Operating/Maintenance areas/ MCC room | Cement concrete with Metallic hardener topping | Acrylic distemper | Acrylic distemper (except metal deck area) |
| | b) Office Room, / Control Room | Matt Finished Vitrified ceramic tiles. | Acrylic emulsion paint. | Mineral Fibre Board False Ceiling in A.C area |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | c) Toilet area | ceramic tiles. | Digitally glazed ceramic wall tiles dado up to false ceiling level. | Acrylic distemper |
| 7. | DELETED | | | |
| 8. | Rest Room for O&M Workers | | | |
| | Rest room | Cement concrete with Metallic hardener topping. | Acrylic distemper | Metal roof |
| | Toilets | ceramic tiles. | Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above | Metal roof |
| 9. | First Aid Centre with Creche Facilities. | | | |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | Waiting Lobby cum Reception/ Doctor's Chamber / First Aid Room/ Driver's Room | Matt Finished Vitrified ceramic tiles. | Acrylic emulsion paint. | Acrylic Emulsion Paint. / Mineral Fibre Board False Ceiling in A.C area |
| | Toilets/ Bath room | ceramic tiles. | Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above | Metal roof/ Acrylic Distemper |
| | Crèche Facilities | 5 mm thick vinyl flooring | Glass mosaic tiles in murals & patterns and Acrylic Emulsion Paint | Acrylic Emulsion paint |
| | Porch | | Acrylic distemper | Acrylic distemper |
| | Covered Parking | Concrete Blocks | Acrylic distemper | Acrylic distemper |
| 10. | Vehicle parking sheds | | | |
| | | Concrete Blocks | | |

**TABLE –A**

**INTERIOR FINISHING SCHEDULE**

| S.NO. | DESCRIPTION OF AREA | FLOOR FINISH | WALL FINISH | CEILING FINISH |
|---|---|---|---|---|
| | | | | |
| 9. | FQA Building | | | |
| | RT Film Processing and Viewing Room, DGM Room, Staff room , Passage | Matt Finished Vitrified ceramic tiles. | Acrylic emulsion paint. | Acrylic Emulsion Paint. / Mineral Fibre Board False Ceiling in A.C area |
| | Toilets/ Pantry / Bath room | ceramic tiles. | Digitally glazed ceramic wall tiles dado up to 2100 high, Acrylic Distemper paint above | Metal roof/ Acrylic Distemper |
| | Store, Civil Equipment room, Concrete mixture and Cube casting area , Cement Testing Room, Mechanical Equipment room, Record Room. | Cement concrete with Metallic hardener topping. | Acrylic distemper | Acrylic distemper |
| | Porch | | Acrylic distemper | Acrylic distemper |
| | Covered Parking | Concrete Blocks | Acrylic distemper | Acrylic distemper |

Note :

1. All wall above false ceiling shall be plastered.
2. The colour and pattern of finish shall be as per approved details.
3. All materials shall be of reputed and established brand approved by Engineer-in-charge.
4. Wherever alternative materials are specified, the final selection rests with Engineer-in-charge.
5. This finishing schedule shall also be applicable to similar functional areas for all other buildings and facilities.
6. All the finishing materials shall be applied/provided as per manufacturer specification and guidelines under the supervision & guidelines of manufacturer.
7. Requirement given above are suggestive and minimum. Bidder is welcome to suggest alternative scheme conforming to design functional requirement subject to approval of the Engineer-in-charge.

**TABLE –B**

**EXTERIOR FINISHES SCHEDULE**

**TABLE –B**

**EXTERIOR FINISHES SCHEDULE**

| Sl.No. | DESCRIPTION OF AREA | WALL AND PROJECTIONS | SOFFIT OF PROJECTIONS |
|---|---|---|---|
| 1. | Auxiliary building in steel framed structure. | Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface/ Aluminium Composite Panel<br>Approved colour/ colour combination of colour coated metal cladding | Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface<br>Approved colour/ colour combination of colour coated metal cladding |
| 2. | Building with concrete frame work, etc. | Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface | Premium Acrylic Smooth exterior paint with silicon additives over suitable primer of Water Proof Cement Paint over plastered surface |
| 3. | Steel Structure, trestles, etc. | High performance Paint of approved specification and shade. | |
| 4. | DELETED | | |

NOTE : 1. The colour and pattern of finish shall be as finalized by Engineer.

2. All materials shall be of reputed and established brand approved by Engineer.

D-1-10 **MATERIAL SPECIFICATION**

10.01.00 **Cement**

Fly ash based portland pozzolana cement conforming to IS: 1489 (Part-1) shall be used for all areas other than for the critical structures identified below. Other properties shall be as per IS code.

Ordinary Portland Cement (OPC) shall necessarily be used for the following structures.

a) Ordinary Portland Cement (OPC) shall necessarily be used for RCC for Chimney shell.
b) TG foundation top deck/ Substructure
c) Spring supported decks of all machine foundations such as TDBFP/MDBFP

The grade of cement shall be Grade 43 for OPC conforming to IS: 269.

In place of fly ash based portland pozzolana cement, OPC mixed with Fly Ash can be used. Batching plant shall have facility for mixing fly ash. Fly ash shall conform to IS: 3812(Part I). Percentage of fly ash to be mixed in concrete shall be based on trial mix. Mix design shall be done with varying percentage of fly ash mix with cement

10.02.00 **Aggregates**

a) **Coarse Aggregate**

Coarse aggregate for concrete shall be crushed stones chemically inert, hard, strong, durable against weathering of limited porosity and free from deleterious materials. It shall be properly graded. It shall meet the requirements of IS: 383.

However, use of aggregate manufactured from other than natural sources (Listed in Annexure-A of IS 383) and Bottom Ash from Thermal Power Plants shall be permitted only in Lean Concrete of Grade M7.5 and M10 (for % of utilization refer Table-1 of IS 383).

b) **Fine Aggregate**

Fine aggregate shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Fine aggregate in concrete shall conform to IS: 383. Bidder can use either natural sand or crushed sand, confirming to IS:383, based on availability.

For plaster, it shall conform to IS: 1542 and for masonry work to IS: 2116.

However, use of aggregate manufactured from other than natural sources (as Listed in Annexure-A of IS 383) and Bottom Ash from Thermal Power Plants conforming to IS:383 shall be permitted only in Lean Concrete of Grade M7.5 and M10 (for % of utilization refer Table-1 of IS 383).

c) Petrographic examination of aggregate shall be carried out by the contractor at National Council for Cement and Building Materials (NCB), Ballabgarh, or any other approved laboratory to ascertain the structure and rock type including presence of strained quartz and other reactive minerals for machine foundations, etc. In case, the coarse aggregate sample is of composite nature, the proportions (by weight) of different rock types in the composite sample and petrographic evaluation of each rock should also be ascertained. While determining the rock type, special emphasis should be given on identification of known reactive rocks like chalcedony, opal etc. The procedure laid down in IS 2430 for sampling of aggregates may be followed.

The laboratory shall determine potential reactivity of the aggregate, which may lead to reaction of silica in aggregate with the alkalis of cement and / or potential of some aggregates like limestone to cause residual expansion due to repeated temperature cycle. If the same is established, the contractor shall further carry out alkali aggregates

reactivity test as per IS 2386 (Pt.VII) and / or repeated temperature cycle test to establish the suitability of the aggregates for the concrete work. The test results, with the final recommendations of the laboratory, as to a suitability of the aggregate, for use in the concrete work for various structures and suggested measures, in case of results are not satisfactory, shall be submitted to the Engineer for his review, in a report form.

In case in the report, it is established, that the aggregates contain reactive silica, which would react with alkalis of the cement, the contractor shall change the source of supply of the aggregate or use low alkali cement as per recommendation or take measures as recommended in the report as instructed by Engineer. In case aggregates indicate residual expansion, under repeated temperature cycle test (from 10 degree Celsius to 65 degree Celsius and for 60 temperature cycles) the material shall not be used for concreting of TGs', BFPs' and other equipment foundations which are likely to be subjected to repeated temperature cycle. The contractor shall use aggregates free from residual expansion under repeated temperatures cycle test.

10.03.00 **Reinforcement Steel**

Reinforcement steel shall be of high strength deformed TMT steel bars of grade Fe-415/Fe-500/Fe 500D/Fe550D and shall conform to IS 1786 and IS 13920. However, minimum elongation shall be 14.5%.

Relevant clause of IS 13920 are quoted below for clarity:

**Quote**

**5.3.1** Steel reinforcement shall comply with all of the following:
a) Elongation shall be at least 14.5 percent,
b) Ratio of ultimate stress to 0.2 percent proof stress shall not exceed 1.25,
c) Ratio of ultimate stress to 0.2 percent proof stress shall be at least 1.15, and
d) Steel shall be only of strength grades with minimum 0.2 percent proof stress of 415 MPa, 500 MPa or 550 MPa, in addition to other requirements of IS 1786.'

**5.3.2** The actual 0.2 percent proof stress of steel bars based on tensile test must not exceed their characteristic 0.2 percent proof stress by more than 20 percent

**Unquote**

Mild steel and medium tensile steel bars shall conform to Grade A of IS:432-Part 1 and hard drawn steel wire shall confirm to IS:432-Part II. Welded wire fabric shall conform to IS 1566.

10.04.00 **Structural Steel**

Structural Steel (including embedded Steel) shall be straight, sound, free from twists, cracks, flaw, laminations and all other defects. Structural steel shall comprise of mild steel, medium strength steel and high tensile steel as specified below.

10.04.01 **Mild Steel**

a) Rolled sections shall be of grade designation E250, Quality A/BR, Semi-killed/ killed conforming to IS 2062. All steel plates shall be of Grade designation E250, Quality BR (fully killed), conforming to IS 2062 and shall be tested for impact resistance at room temperature. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.

b) Pipes shall conform to IS: 1161.

c) Hollow (square and rectangular) steel sections shall be hot formed conforming to IS: 4923 and shall be of minimum Grade Yst 240 and minimum thickness shall be 4 mm..

d) Chequered plate shall conform to IS 3502 and shall be minimum 6 mm thick excluding projection. Steel for chequered plate shall conform to grade E250A semi killed of IS: 2062 or equivalent grade conforming to ASTM & BS standards only.

10.04.02 **Medium and High Tensile Steel**

Rolled Sections and plates shall be of grade designation E350 or higher, Quality B0 (Fully killed), conforming to IS: 2062. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.

10.05.00 **Bricks**

Only fly ash bricks shall be used in all construction, except for elevator shafts, which can be either of burnt clay bricks or RCC construction as per functional / codal provisions. Bricks shall be table moulded/ machine made of uniform size, shape and sharp edges and shall have minimum compressive strength of 75kg/cm2. Burnt clay fly ash bricks and fly ash lime bricks shall conform to IS: 13757 and IS: 12894 respectively. Minimum fly ash content in fly ash based bricks shall be 25%.

10.06.00 **Foundation Bolts**

Material and details of foundation bolts shall conform to IS: 5624. Mild steel bars used for the fabrication of bolt assembly shall conform to grade 1of IS: 432 and/ or grade A of IS: 2062. Hexagonal nuts and lock nuts shall conform to IS: 1363 & IS: 1364 upto M36 diameter and IS: 5624 for M42 to M150 diameter.

10.07.00 **Stainless steel**

The material specification for stainless steel plates are mentioned in the design concept area of Mill Bunker building.

10.08.00 **Water**

Water used for cement concrete, mortar, plaster, grout, curing, washing of coarse aggregate, soaking of bricks, etc. shall be clean and free from oil, acids, alkalis, organic matters or other harmful substances in such amounts that may impair the strength or durability of the structure. Potable water shall generally be considered satisfactory for all masonry and concrete works, including curing. When water from the proposed source is used for making the concrete, the maximum permissible impurities, development of strength and initial setting time of concrete shall meet the requirements of IS: 456.

All materials brought for incorporation in works shall be of best quality as per IS unless specified otherwise.

**10.09.00 PTFE (Poly Tetra Fluoroethylene) Bearing**

The bearing shall be of reputed make and manufacturer as approved by the Engineer, for required vertical load and end displacement/rotation. PTFE bearing shall be sliding against highly polished stainless steel and the coefficient of friction between them shall be less than 0.06 at 55 kg/sq.cm. In order to prevent cold flow in PTFE surface it shall be rigidly bonded by a special high temperature resistance adhesive to the stainless steel substrata. The stainless steel surface that slides against the PTFE is mirror polished. The stainless steel shall be bonded to the top plate by special high strength adhesive. The thickness of stainless steel plate shall be between 1.0 mm to 1.5 mm.

10.10.00 **Statutory Requirements**

Bidder shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules at Tariff Advisory Committee. Water Act for pollution control, Explosives Act, etc.

Provisions of safety, health and welfare according to Factories Act shall be complied with. These shall include provision of continuous walkways along the crane - girder level on both

sides of building, comfortable approach to EOT crane cabin, railing, fire escape, locker room for workmen, pantry, toilets, rest room etc.

Provisions for fire proof doors, number of staircases, fire separation wall, lath plastering/encasing the structural members (in fire prone areas), type of glazing etc. shall be made according to the recommendations of Tarrif Advisory Committee.

Statutory clearances and norms of State Pollution Control Board shall be followed.

Bidder shall obtain approval of Civil/Architectural drawings from concerned authorities before taking up the construction work.

10.11.00 **Autoclave Aerated Concrete (AAC) Block**

Providing and laying of **Autoclave Aerated Concrete (AAC) block masonry** using blocks having dimensions of 625mm x 250mm. thickness ranging from 100 mm to 300 mm conforming to IS:2185 (Part-III), for dimension and tolerance, with minimum compressive strength of 30 kg/ sq.cm. The jointing cement sand mortar in the composition of 1:6 (Cement: Sand) shall be used with suitable plasticizer (optional). Sand having modulus of fineness 1.1 shall be used. The horizontal and vertical joint thickness shall be approximately 10 mm. In case of partition walls (1000 mm/ 125 mm thk.) the jointing reinforcement i.e 1 number of 8 mm diameter bars shall be placed at every alternate course to be anchored properly with the main structure. All other structural requirements like stiffening of masonry, joint reinforcement etc. in the AAC masonry work strictly be carried out as per instruction laid down in IS:6041-1985, IS-1905) ( Reinforcement bars shall be measured & paid separately under relevant items).

AAC blocks shall have the following physical properties:

Density (oven dry) - 550-650kg/ cum.
Compressive Strength - Min. 30 kg/ sq. cm.
Thermal Conductivity - 0.162W/mk (avg)
Resistant to fire - 2-6 hrs depending upon thickness
Dry shrinkage - 0.02% (avg)
Design gross density - 800 kg/cum (approx)

D-1-11 **Inspection, Testing and Quality Control**

11.01.00 Sampling and testing of major items of civil works viz. earthwork, concreting, structural steel work (including welding, sheeting, etc. shall be carried out in accordance with the requirements of this specification. Wherever nothing is specified relevant Indian Standards shall be followed. In absence of Indian Standard equivalent International Standards may be used.

The Bidder shall submit and finalise a detailed field Quality Assurance Programme before starting of the construction work according to the requirement of this specification. This shall include frequency of sampling and testing, nature/type of test, method of test, setting of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of format for record, Field Quality Plan, etc. Tests shall be done in the field and/or at a laboratory approved by the Engineer. The Bidder shall furnish the test certificate from the manufacturer's of various materials to be used in the construction.

11.02.00 Workmanship and dimensional tolerances shall be checked as stipulated else where in the specification.

D-1-12 **ANNEXURES**

D-1-12(A) **ANNEXURE (A)**

**(a) List of Codes and Standards**

All applicable standards, references, specifications, codes of practice, etc., shall be the latest edition including all applicable official amendments and revisions. A complete set of all these documents shall be available at site with Bidder. List of some of the applicable Standards, in original Codes and references is as following:

Where provisions are not covered in Indian Standards, reference shall be made to ACI, AISC, EN, CICIND and other International Standards.

**LIST OF CODES AND STANDARDS**

**Excavation and Filling**

| | |
|---|---|
| IS :2720 | Methods of test for soils(relevant parts) |
| IS:4701 | Code of practice for earth work on canals. |
| IS:9759 | Guide lines for dewatering during construction. |
| IS:10379 | Code of practice for field control of moisture and compaction of soils for embankment and sub-grade. |

**Properties, Storage and Handling of Common Building Materials**

| | |
|---|---|
| IS:269 | 33 grade for ordinary Portland cement. |
| IS:383 | Coarse and fine aggregates from natural sources for concrete. |
| IS:432 | Specification for mild steel and medium tensile steel bars and |
| (Part 1&2) | hard drawn steel wires for concrete reinforcement. |
| IS:455 | Portland slag cement. |
| IS:702 | Industrial bitumen. |
| IS:712 | Specification for building limes. |
| IS:1077 | Common burnt clay building bricks. |
| IS:1161 | Steel tubes for structural purposes. |
| IS:1239 | Mild steel tubes, tubulars and other wrought steel fitting - MS tubes. |
| IS:1363 | Hexagon head bolts, screws and nuts of productions |
| (Part 1-3) | grade - C. |
| IS:1364 | Hexagon head bolts, screws and nuts of productions |
| (Part 1-5) | grade-A & B. |
| IS:1367 (Part 1-18) | Technical supply condition for threaded fasteners. |
| IS:1489 (Part-I) | Portland-pozzolana cement. Fly ash based |
| IS:1542 | Sand for Plaster. |

| | |
|---|---|
| IS:1566 | Hard drawn steel wire fabric for concrete reinforcement. |
| IS:1786 | High strength deformed steel bars & wires for concrete reinforcement. |
| IS:2062 | Hot Rolled Low, Medium and High Tensile Structural Steel |
| IS:2116 | Sand for masonry mortars. |
| IS : 2185 (Part 1)<br>(Part 2) | Hollow & solid concrete blocks.<br>Hollow & solid light weight concrete blocks. |
| IS:2386 (Part I-VIII) | Testing of aggregates for concrete. |
| IS:3812 | Specification for fly ash for use as pozzolona and admixture. |
| IS:4082 | Recommendation on stacking and storage of construction materiel and components at site |
| IS:8112 | 43 grade ordinary portland cement. |
| IS:8500 | Structural steel-Microalloyed (Medium and high strength qualities). |
| IS:12269 | 53 grade ordinary portland cement. |
| IS:12894 | Specification for fly ash lime bricks. |
| IS:13757 | Burnt clay fly ash building bricks. |

**Cast in-situ Concrete and Allied Works**

| | |
|---|---|
| IS:280 | Mild steel wire for general engineering purpose. |
| IS:456 | Code of practice for plain and reinforcement concrete. |
| IS:457 | Code of practice for general construction of plain and reinforced concrete for dams and other massive structures. |
| IS:516<br>IS:1199 | Method of test for strength of concrete.<br>Methods of sampling and analysis of concrete. |
| IS:1791 | General requirement for batch type concrete mixers. |
| IS:1834<br>IS:1838 | Hot applied sealing compound for joints in concrete.<br>Preformed fillers for expansion joints in concrete pavement and structures. |
| IS:2438 | Specification for roller pan mixers. |
| IS:2502 | Code of practice for bending and fixing of bars for concrete reinforcement. |
| IS:2505 | Concrete vibrators - immersion type. |

| | | |
|---|---|---|
| | IS:2506 | General requirements for screed board concrete vibrators. |
| | IS:2722 | Specification for Portable Swing weigh batchers for concrete (single and double bucket type). |
| | IS:2750 | Steel scaffoldings |
| | IS:2751 | Recommended practice for welding of mild steel plain and deformed bars for reinforced construction. |
| | IS:3150 | Hexagonal wire netting for general purposes. |
| | IS:3366 | Specification for pan vibrators. |
| | IS:3370 (Part 1-4) | Code of practice for concrete structures for the storage of liquids. |
| | IS:3558 | Code of practice for use of immersion vibrators for consolidating concrete. |
| | IS:4014 (Part-1&2) | Code of practice for steel tubular scaffolding. |
| | IS:4326 | Code of practice for earth quake resistant design and construction of buildings. |
| | IS:4656 | Form vibrators for concrete. |
| | IS:4925 | Concrete batching and mixing plant. |
| | IS:4990 | Plywood for concrete shuttering work. |
| | IS:4995 | Criteria for design of reinforced concrete bins for storage of granular and powdery materials |
| | IS:5256 | Code of practice for sealing expansion joints in concrete lining on canals. |
| | IS:5525 | Recommendations for detailing of reinforcement in reinforced concrete works. |
| | IS:6461 | Glossary of terms relating to cement concrete. |
| | IS:6494 | Code of practice for water proofing of underground reservoir and swimming pools. |
| | IS:6509 | Code of practice for installation of joints in concrete pavements. |
| | IS:7861 (Part -1&2) | Code of practice for extreme weather concreting. |
| | IS:9012 | Recommended practice for shotcreting. |
| | IS:9103 | Admixtures for concrete. |
| | IS:9417 | Recommendations for welding cold worked bars for reinforced concrete construction. |
| | IS:10262 | Recommended guidelines for concrete mix design. |
| | IS:11384 | Code of practice for composite construction in structural steel and concrete. |

| | |
|---|---|
| IS:12118 | Two parts polysulphide based sealants. |
| IS:12200 | Code of practice for provision of water stops at transverse construction joints in masonry and concrete dams. |
| IS:13311 | Non destructive testing of concrete - methods of test. |
| (Part 1) | Ultrasonic pulse velocity. |
| (Part 2) | Rebound hammer. |
| IS:17452 | Use of Alkali Activated Concrete for Precast Products-Guidelines |
| SP-16 | Design codes for reinforced concrete to IS:456-1978. |
| SP-23 | Hand book of concrete mixes. |
| SP-24 | Explanatory handbook on Indian standards code for plain and reinforced concrete. (IS : 456) |
| SP-34 | Hand book on concrete reinforcement and detailing. |
| ACI-318 | American Concrete Institute code for structural concrete. |

**Precast Concrete Works**

| | |
|---|---|
| SP:7<br>(Part 6/Sec.7) | National Building Code - Structural Design<br>Prefabrication and system building and mixed / composite construction. |
| IS:10297 | Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units. |
| IS:10505 | Code of practice for construction of floors and roofs using pre-cast reinforced concrete waffle units. |
| IS:15658 | Pre-cast concrete block for paving. |
| IS 15916 | Building Design and Erection using Pre fabricated concrete |

**Masonry & Allied Works**

| | |
|---|---|
| IS:1905 | Code of practice for structural use of unreinforced masonry. |
| IS: 2185 | Part-1 Concrete Masonry Units - Specification Part 1 Hollow and Solid Concrete Blocks<br>Part-3 Specification for concrete masonry units: Part 2 Hollow and solid light weight concrete blocks |
| IS:2212 | Code of practice for brick work. |
| IS:2250 | Code of practice for preparation and use of masonry mortars. |
| IS:2572 | Code of practice for construction of hollow concrete block masonry. |
| SP:20 | Hand book on masonry design and construction. |

**Sheeting Works**

| | |
|---|---|
| IS:277 | Galvanised steel sheets (Plan & corrugated). |
| IS:513 | Cold-rolled low carbon steel sheets & strips. |
| IS:730 | Hook bolts for corrugated sheet roofing. |
| IS:801 | Code of practice for use of cold formed light gauge steel structural members in general building construction. |
| IS:2527 | Code of practice for fixing rain water gutters and down pipe for roof drainage. |
| IS:7178 | Technical supply condition for tapping screw. |
| IS:8183 | Bonded mineral wool. |
| IS:8869 | Washers for corrugated sheet roofing. |
| IS:12093 | Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets. |
| IS:12436 | Preformed rigid Polyurethane (PUR) and isocyanurate (PIR) foams for thermal insulation. |
| IS:12866 | Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced). |
| IS:14246 | Continuously pre-painted galvanised steel sheets and coils. |
| BS:5950 | Code of practice for design of light gauge profiled |
| (Part-6) | steel sheeting |

**Fabrication and Erection of Structural Steel Works**

| | |
|---|---|
| IS:800 | Code of practice for General Construction of steel. |
| IS:813 | Scheme for symbols for welding. |
| IS:814 | Covered electrodes for manual metal arc welding of carbon & carbon manganese steel. |
| IS:816 | Code of practice for use of metal arc welding for general construction in mild steel. |
| IS:817 | Code of practice for training and testing of metal arc welders. |
| IS:1024 | Welding in bridges and substructured subject to dynamic. |
| IS:1181 | Qualifying tests for Metal Arc welders (engaged in welding structures other than pipes). |
| IS:1182 | Recommended practice for Radiographic examination of fusion welded butt joints in steel plates |

| | |
|---|---|
| IS:1608 | Mechanical testing of metals - tensile testing |
| IS:1852 | Rolling and Cutting Tolerances for Hot rolled steel products. |
| IS:2016 | Specification for Plain washers. |
| IS:2595 | Code of practice for Radiographic testing |
| IS:2629 | Hot dip galvanising of iron and steel |
| IS:3502 | Steel chequred plate. |
| IS:3613 | Acceptance tests for wire flux combination for submerged arc welding. |
| IS:3658 | Code of practice for liquid penetrant flaw detection. |
| IS:3664 | Code of practice for ultra sonic pulse echo testing contact and immersion method |
| IS:3757 | High strength structural bolts. |
| IS:4000 | High strength bolts in steel structure - code of practice. |
| IS:4353 | Sub merged arc welding of mild steel and low alloy steel Recommendation |
| IS:4759 | Hot dip zinc coating on structural steel and other allied products. |
| IS:5334 | Code of practice for magnetic particle flaw detection of welds. |
| IS:5369 | General requirements for plain washers and lock washer |
| IS : 6623 | High strength structural nuts. |
| IS:6649 | Hardened and tampered washers for high strength structural bolts & nuts. |
| IS:6911 | Stainless steel plate, sheet and strip. |
| IS:7205 | Safety code for erection of structural steel. |
| IS:7215 | Tolerances for fabrication of structural steel. |
| IS:7307 | Approved test for welding procedures |
| (Part - I) | Fusion welding of steel. |
| IS:7310 (Part-I) | Approval test for welders working to approval welding procedure. Fusion welding of steel |
| IS:9178 (Part-1to 3) | Criteria for design of steel bins for storage of bulk material. |
| IS:9595 | Recommendations for metal arc welding of carbon & carbon manganese steel. |

| | |
|---|---|
| IS:12843 | Tolerances for erection of steel structures. |
| SP:6 (Part 1 to 7) | ISI Hand book for structural Engineers. |

**Plastering and Allied Works**

| | |
|---|---|
| IS:1661 | Code of practice for application of cement and cement lime plaster finishes. |
| IS:2402 | Code of practice for external rendered finishes. |
| IS:2547 (Parts 1&2) | Gypsum building plaster. |

**Acid and Alkali Resistant Lining**

| | |
|---|---|
| IS:158 | Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting. |
| IS:412 | Expanded metal steel sheets for general purpose. |
| IS:4441 | Code of practice for use of silica type chemical resistant mortars. |
| IS:4443 | Code of practice for use of resin type chemical resistant mortars. |
| IS:4456 (Part I & II) | Method of Test for chemical resistant tiles. |
| IS:4457 | Ceramic unglazed vitreous acid resisting tiles. |
| IS:4832 | Specification for chemical resistant mortars. |
| (Part - 1) | Silicate type |
| (Part - 2) | Resin type |
| (Part - 3) | Sulfur type |
| IS:4860 | Acid resistant bricks. |
| IS:9510 | Bitumastic acid resisting grade. |

**Water Supply, Drainage and Sanitation**

| | |
|---|---|
| IS:458 | Precast concrete pipes (with & without reinforcement). |
| IS:554 | Pipe threads where pressure tight joints are made on the threads – dimensions, tolerances and designation. |
| IS:651 | Salt glazed stoneware pipes and fittings. |
| IS:774 | Flushing cisterns for water closets and urinals. |
| IS:775 | Cast iron brackets and supports for wash basins and sinks. |

| | |
|---|---|
| IS:778 | Copper alloy gate, globe and check valves for water works purposes. |
| IS:781 | Cast copper alloy screw down bib taps & stop valves for water services. |
| IS:782 | Caulking lead. |
| IS:783 | Code of practice for laying of concrete pipes. |
| IS:1172 | Code of basic requirements of water supply, drainage and sanitation. |
| IS:1230 | Cast iron rain water pipes and fittings. |
| IS:1239 (Part 1&2) | Mild Steel tubes, tubulars and other wrought steel fittings |
| IS:1536 | Centrifugally cast (Spun) iron pressure pipes for water. |
| IS:1537 | Vertically cast iron pressure pipes for water, gas and sewage. |
| IS:1538 | Cast iron fittings for pressure pipe for water, gas and sewage. |
| IS:1703 | Copper alloy float valve for water supply fitting. |
| IS:1726 | Cast iron manhole covers and frames. |
| IS:1729 | Cast iron / Ductile iron drainage pipes and pipe/fittings for over ground non pressure pipeline socket and spigot series. |
| IS:1742 | Code of practice for building drainage. |
| IS:2064 | Selection, installation and maintenance of sanitary appliances. |
| IS:2065 | Code of practice for water supply in buildings. |
| IS:2326 | Automatic flushing cisterns for urinals. |
| IS:2548 | Plastic seats and covers for water closets. |
| IS:2556 | Vitreous sanitary appliances (vitreous china). |
| IS:3114 | Code of practice for laying of cast iron pipes. |
| IS:3311 | Waste plug and its accessories for sinks and wash basins. |
| IS:3438 | Silvered glass mirrors for general purposes. |
| IS:3486 | Cast iron spigot and socket drain pipes. |
| IS:3589 | steel pipe for water and sewage (168.3 to 2540mm outside diameter) |
| IS:3989 | Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories. |
| IS:4111 (Part 1 to 5) | Code of practice for ancillary structure in sewerage system. |

| | | |
|---|---|---|
| | IS:4127 | Code of practice for laying of glazed stone ware pipes. |
| | IS : 4733 | Methods of sampling and testing sewage effluents. |
| | IS:4764 | Tolerance limits for sewage effluents discharged into inland surface waters. |
| | IS:1068 | Electroplated coating of nickel plus chromium and copper plus nickel plus chromium. |
| | IS:5329 | Code of practice for sanitary pipe work above ground for buildings. |
| | IS:5382 | Rubber sealing rings for gas mains, water mains and sewers. |
| | IS:5822 | Code of practice for laying of electrically welded steel pipes for water supply. |
| | IS:5961 | Specification for cast iron grating for drainage purpose. |
| | IS:7740 | Code of practice for construction and maintenance of road gullies. |
| | IS:8931 | Copper alloy fancy single taps combination tap assembly and stop valves for water services. |
| | IS:9762 | Polyethylene floats for float valves. |
| | IS:10592 | Industrial emergency showers, eye and face fountains and combination units. |
| | IS:12592 | Specification for precast concrete manhole covers and frames. |
| | IS:12701 | Rotational moulded polyethylene water storage tanks. |
| | IS:13983 | Stainless steel sinks for domestic purposes. |
| | SP:35 | Hand book on water supply and drainage with special emphasis on plumbing. |
| | CPH&EEO | Manual on sewage and sewage treatment |
| | Publication | - as updated. |
| | **Doors Windows and Allied Works** | |
| | IS:204 | Tower Bolts. |
| | (Part 1) | Ferrous metals |
| | (Part 2) | Non - ferrous metals |
| | IS:208 | Door Handles. |
| | IS:281 | Mild steel sliding door bolts for use with padlocks. |
| | IS:362 | Parliament Hinges. |
| | IS:419 | Putty, for use on window frames. |
| | IS:451 | Technical supply conditions for wood screws |

| | |
|---|---|
| IS:733 | Wrought aluminium and aluminium alloy bars, rods and sections for general engineering purposes. |
| IS:1003 (Part I) | Timber panelled and glazed shutters (doors shutters). |
| IS:1003 | Timber panelled and glazed shutters |
| (Part-1) | door shutters. |
| IS:1038 | Steel doors, windows and ventilators. |
| IS:1081 | Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators. |
| IS:1285 | Wrought aluminium and aluminium alloy extruded round tube & hollow section (for general engineering purposes). |
| IS:1341 | Steel butt hinges. |
| IS:1361 | Steel windows for Industrial buildings. |
| IS:1823 | Floor door stoppers. |
| IS:1868 | Anodic coatings on Aluminium and its alloys. |
| IS:2202 | Wooden flush door shutters (solid core type) particle |
| (Part-2) | board face panels and hard board face panels. |
| IS:2209 | Mortice locks (vertical type) |
| IS:2553 | Safety glass. |
| (Part-1) | General purposes |
| IS:2835 | Flat transparent sheet glass. |
| IS:3548 | Code of practice for glazing in buildings. |
| IS:3564 | Door closers (Hydraulically regulated) |
| IS:3614 | Specification for fire check doors : |
| (Part-1) | plate, metal covered and rolling type. |
| (Part-2) | Resistance test and performance criteria. |
| IS:4351 | Specification for steel door frames. |
| IS:5187 | Flush bolts. |
| IS:5437 | Figured, rolled and wired glass. |
| IS:6248 | Specification for metal rolling shutters and rolling grills. |

| | |
|---|---|
| IS:6315 | Specification for floor springs (Hydraulically regulated) for heavy doors. |
| IS:7196 | Hold fast. |
| IS:7452 | Hot rolled steel sections for doors, windows and ventilators. |
| IS:10019 | Mild steel stays and fasteners. |
| IS:10451 | Steel sliding shutters (top hung type) |
| IS:12823 | Prelaminated particle boards. |

**Roof Water Proofing and Allied Works**

| | |
|---|---|
| IS:3067 | code of practice for general design details and preparatory work for damp proofing and water proofing of buildings. |
| ASTM | Standard specification for high solid content cold |
| C836-89a | liquid applied elastomeric water proofing membrane for use with separate wearing course. |
| ASTM | Standard guide for high solid content cold |
| C898-89 | liquid applied elastomeric water proofing membrane for use with separate wearing course. |

**Floor Finishes and Allied Works**

| | |
|---|---|
| IS:5318 | Code of practice for laying of flexible PVC sheet and tile flooring. |
| IS:8042 | White portland cement. |
| IS:13755 | Dust pressed ceramic tiles with water absorption of 3%, E 6% (Group B11a). |
| IS:13801 | Chequered cement concrete tiles. |

**Painting and Allied Works**

| | |
|---|---|
| IS:162 | Ready mixed paint, brushing fire resisting, silicate type for use on wood, colour as required. |
| IS:428 | Distemper, oil, emulsion, colour as required. |
| IS:1477 | Code of practice for painting of terrous metals in buildings. |
| (Part -1)<br>(Part -2) | Pretreatment.<br>Painting. |
| IS:1650 | Specification for colours for building and decorative materials. |
| IS:2074 | Ready mixed paint, air drying, red oxide-zinc chrome, priming. |

| | | |
|---|---|---|
| | IS:2338 | Code of practice for finishing of wood and wood based materials. |
| | (Part -1) | Operations and Workmanship. |
| | (Part -2) | Schedule. |
| | IS:2395 | Code of pratice for painting concrete, masonry and plaster surfaces. |
| | (Part-1) | Operations and Workmanship. |
| | (Part -2) | Schedule. |
| | IS:2524 | Code of practice for painting of nonferrous metals in buildings. |
| | (Part -1) | Pretreatment |
| | (Part -2) | Painting. |
| | IS:2932 | Enamel, synthetic, exterior, (a) under coating and (b) finishing. |
| | IS:2933 | Enamel exterior, (a) under coating, (b) finishing. |
| | IS:4759 | Hot dip zinc coatings on structural steel and other allied products. |
| | IS:5410 | Specification for cement paint. |
| | IS:15489 | Plastic emulsion paint. |
| | IS:6278 | Code of practice for white washing and Colour washing. |
| | IS:10403 | Glossary of term related to building finish. |
| | IS:12027 | Silicone based water repellent |
| | IS:13238 | Epoxy based zinc phosphate primer (2 pack) |
| | IS:13239 | Epoxy surfacer (2 pack) |
| | IS:13467 | Chlorinated rubber for paints |
| | IS:14209 | Epoxy enamel, two component glossy. |
| | BS:5493 | Code of practice for protective coating of iron and steel structures against corrosion. |
| | **Piling and Foundation** | |
| | IS:1080 | Code of practice for design and construction of shallow foundations on soils. |
| | IS:1904 | Code of practice for design and construction of foundation in Soils : General Requirements. |
| | IS:2314 | Steel sheet piling sections. |
| | IS:2911 | Code of practice for design and construction of pile foundations. |

| | |
|---|---|
| | (Relevant Parts) |
| IS:2950 | Code of practice for designs and construction of Raft foundation. |
| (Part-1) | Design |
| IS:2974 (Part-1 to 5) | Code of practice for design and construction of machine foundation. |
| IS:4091 | Code of practice for design and construction foundations for transmission line towers and poles. |
| IS:6403 | Code of practice for determination of Bearing capacity of Shallow foundations. |
| IS:8009 | Code of practice for calculation of settlement of foundation. |
| (Part -1) | Shallow foundations. |
| (Part -2) | Deep foundations. |
| IS:12070 | Code of practice for design and construction of shallow foundations on rocks. |
| ISO 10816 | Criteria for assessing mechanical vibrations of machines. |
| ISO 1940 | Criteria for assessing the st of balance of rotating rigid bodies. |
| DIN : EN 13906-1 | Helical compression spring made of round wire and rod : calculation and design of compression . |
| DIN:2096 | Helical compression spring out of round wire and rod : Quality requirements for hot formed compression spring. |
| DIN:4024 | Flexible supporting structures for machine with rotating machines. |
| **Roads** | |
| IRC:5 (Section-1) | Standard specifications and Code of practice for road bridges, General Features of Design. |
| IRC:14 | Recommended practice for 2cm thick bitumen and tar carpets. |
| IRC:15 | Standard specifications and code of practice for construction of concrete roads. |
| IRC:16 | Specification for priming of base course with bituminous primers. |
| IRC:19 | Standard specifications and Code of practice for water bound macadam. |
| IRC:21 (Section-III) | Standard specifications and Code of practice for road bridges. Cement concrete (plain and reinforced). |
| IRC:34 | Recommendations for road construction in water logged areas. |

| | | |
|---|---|---|
| | IRC:36 | Recommended practice for the construction of earth embankments for road works. |
| | IRC:37 | Guidelines for the Design of flexible pavements. |
| | IRC:56 | Recommended practice for treatment of embankment slopes for erosion control. |
| | IRC:58 | Guidelines for the design of rigid pavements for highways. |
| | IRC:73 | Geometric Design standards for rural (non-urban) highways. |
| | IRC : 86 | Geometric Design standards for urban roads in plains. |
| | IRC:SP:13 | Guidelines for the design of small bridges & culverts. |
| | IRC - Publication | Ministry of Surface Transport (Road wing), specifications for road and bridge works. |
| | IS:73 | Paving bitumen. |
| | **Loading** | |
| | IS:875 | Code of practice for design loads (other than earthquake) for (Relevant parts) buildings and structures. |
| | IS:1893 | Criteria for earthquake resistant design of structures. |
| | IS:4091 | Code of practice for design and construction of foundation for transmission line towers and poles. |
| | IRC:6 (Section-II) | Standard specifications & Code of practice for road bridges. loads and stresses |
| | **Safety** | |
| | IS:1641 | Code of practice for fire safety of buildings - General principles of fire grading and classification. |
| | IS:1642 | Code of practice for fire safety of buildings - Details of construction. |
| | IS:3696 (Part-1&2) | Safety code for scaffolds and ladders. |
| | IS:3764 | Excavation work - code of safety. |
| | IS:4081<br>IS:4130 | Safety code for blasting and related drilling operations.<br>Demolition of buildings - code of safety. |
| | IS:5121 | Safety code for piling and other deep foundations. |
| | IS:5916 | Safety code for construction involving use of hot bituminous materials. |
| | IS:7205 | Safety code for erection of structural steel work. |

IS:7293 Safety code for working with construction machinery.

IS:7969 Safety code for handling and storage of building materials.
Indian Explosives Act 1940) (As updated)

**Architectural Design of Buildings**

SP:7 National Building Code of India

SP:41 Hand book on functional requirements of buildings (other than industrial buildings)

ECBC Energy Conservation Building Code

GRIHA Green Rating For Integrated Habitat Assessment.

**Tall Structures, Chimneys**

IS:4998 Criteria for design of reinforced chimneys
IS:6533 Code of practice for design and construction of steel chimneys

ICAO International Civil Aviation Organisation (ICAO)

DGCA Instruction of Director General of Civil Aviation , India

ACI:307 Specification for the design and construction of reinforced concrete chimneys

BS:4076 Specification for steel chimneys

CICIND Model Code for concrete chimneys
Model code for steel chimneys

ASCE Code Design and construction of steel chimney liners prepared by Task committee on steel chimney liners. Fossil power committee, Power division published by ASCE - 1975.

IS:1554 PVC insulated (heavy duty) electric cables

IS:2606 Alloy lead anodes for chromium plating

IS:3043 Code of Practice for Earthing

IS:9537 Conduits for electrical installations.
The Indian Electricity Rules
The Indian Electricity Act
The Indian Electricity (Supply) Act
The Indian Factories Act

IS:2309 Practice for protection of buildings and allied structures against lightning

**Miscellaneous**

| | |
|---|---|
| IS:802 (Relevant parts) | Code of practice for use of structural steel in overhead transmission line towers. |
| IS:803 | Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks. |
| IS:10430 | Criteria for design of lined canals and guidance for selection of type of lining. |
| IS:11592 | Code of practice for selection and design of belt conveyors. |
| IS:12867 | PVC handrails covers. |
| IS 11504 | Criteria for structural design of reinforced concrete natural draught cooling towers |
| BS:4485 (IV) | British Standard : Code of design for water cooling towers |
| CIRIA Publication | Design and construction of buried thin-wall pipes. |
| IS 4671 | Expanded polystyrene for thermal insulation purposes. |

D-1-12(B)

**ANNEXURE (B)**

**CONSTRUCTION METHODOLOGY**

Construction and erection activities shall be fully mechanized from the start of the work.

All excavation and backfilling work shall be done using excavators, loaders, dumpers, dozers, poclains, excavator mounted rock breakers, rollers, sprinklers, water tankers, etc. Manual excavation can be done only on isolated places with specific approval of engineer.

For controlled rock blasting specialized agency, equipped with sensors to assess the impact of the blast on the adjoining existing structures, shall be employed.

Dewatering shall be done using the combination of electrical and standby diesel pumps.

Pile installation equipment suitable for flushing with air lift technique shall be used for construction of bored piles.

For concreting, weigh batching plants, transit mixers, concrete pumps, hoists, etc. shall be used.

All fabrication and erection activities of structural steel shall be carried out using automatic submerged arc welding machines, cutting machines, gantry cranes, crawler mounted heavy cranes and other equipment like heavy plate bending machines, shearing machines, lathe, milling machines, etc. Use of derricks shall not be permitted. Special enclosures, for blast cleaning of steel structure surface preparation, shall be used.

All handling of materials shall be with cranes. Heavy trailers shall be used for transportation.

Mechanized modular units of scaffolding and shuttering shall be used.

Grouting shall be carried out using hydraulically controlled grouting equipment.

Roadwork shall be done using pavers, rollers and premix plant.

All finishing items shall be installed using appropriate modern mechanical tools. Manual punching etc. shall not be permitted.

Heavy duty hoists for lifting of construction materials shall be deployed. Compressors for cleaning of foundations and other surfaces shall be used.

Field laboratory shall be provided with all modern equipment for survey, testing of soil, aggregates, concrete, welding, etc. For testing of steel works, ultrasonic testing machines, radiographic testing machines, dye penetration test equipment, destruction testing equipment, etc. shall be deployed.

All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/ erection activity. Moreover, only the persons who are trained in the respective trade shall be employed for executing that particular work.

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 07/08/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.1

Co-ordinates E=(-)600.000 N=870.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 31/07/2018
Completion Date : 02/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.160 M.
Water Struck At :
Standing Water Level : 3.10 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. | | | | |
| Filled up soil consists of brownish grey, silty clay / clayey silt with decomposed rock. | | Refusal | DS-1 | 0.50 |
| | | 100 5.0 cm Pentn. | *SPT-1 | 1.00-1.05 |
| 1.40m. | | 100 Refusal 4.0 cm Pentn. | *SPT-2 | 1.40-1.44 |
| Highly wearthered, reddish brown, fine grained, highly fractured shale. | | NX. drilling from 1.40m to 20.00m | R1 | CR=24% RQD=NIL |
| | | | R2 | CR=25% RQD=NIL |
| 2.75m. | | | R3 | CR=28% RQD=NIL |
| | | | R4 | CR=30% RQD=NIL |
| | | | R5 | CR=32% RQD=16% |
| | | | R6 | CR=36% RQD=13% |
| | | | R7 | CR=40% RQD=20% |
| Highly wearthered, reddish brown, fine grained, highly fractured shale. | | | R8 | CR=40% RQD=24% |
| | | | R9 | CR=36% RQD=16% |
| | | | R10 | CR=26% RQD=20% |
| | | | R11 | CR=38% RQD=20% |
| | | | R12 | CR=38% RQD=NIL |
| 10.50m. | | | | |

1.40 → 2.00 → 2.75 → 3.50 → 4.25 → 5.00 → 5.75 → 6.50 → 7.25 → 8.00 → 8.75 → 9.50 → 10.25

BH-1/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 07/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.1

Co-ordinates E=(-)600.000 N=870.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 31/07/2018
Completion Date : 02/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.160 M.
Water Struck At :
Standing Water Level : 3.10 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m<br>Highly wearthered, reddish brown, fine grained, fractured shale. | | | R13 | CR=35% RQD=24% 11.00 |
| 11.00m | | | R14 | CR=44% RQD=26% 11.75 |
| | | | R15 | CR=45% RQD=30% 12.50 |
| | | | R16 | CR=45% RQD=32% 13.25 |
| Moderately weathered, reddish brown, fine grained, highly to modeartely fractured shale. | | | R17 | CR=50% RQD=40% 14.00 |
| | | | R18 | CR=54% RQD=26% 14.75 |
| | | | R19 | CR=44% RQD=29% 15.50 |
| | | | R20 | CR=48% RQD=13% 16.25 |
| 16.25m | | | R21 | CR=52% RQD=26% 17.00 |
| | | | R22 | CR=55% RQD=30% 17.75 |
| Moderately weathered, reddish brown, fine grained, highly to modeartely fractured shale. | | | R23 | CR=40% RQD=16% 18.50 |
| | | | R24 | CR=58% RQD=42% 19.25 |
| | | | R25 | CR=55% RQD=36% 20.00 |
| 20.00m | | | | |

N.B. – '*' means sample could not be recovered.

BH-1/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 13/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.2

Co-ordinates E=(-)585.000 N=920.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 01/08/2018
Completion Date : 03/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.230 M.
Water Struck At :
Standing Water Level : 3.50 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. | | | | |
| Filled up soil consist of brownish grey, clayey silt / silty clay with decomposed rock. | | | DS-1 | 0.50 |
| | | Refusal 100 5.0 cm Pentn. | *SPT-1 | 1.00-1.05 |
| 1.50m. | | Refusal 100 4.0 cm Pentn. | *SPT-2 | 1.50-1.54 |
| | | NX. drilling from 1.50m to 20.00m | R1 | CR=30% RQD=26% |
| | | | R2 | CR=30% RQD=20% |
| | | | R3 | CR=29% RQD=NIL |
| | | | R4 | CR=32% RQD=NIL |
| | | | R5 | CR=34% RQD=NIL |
| Highly to moderately weathered, reddish brown, fine grained, highly to moderately fractured shale. | | | R6 | CR=38% RQD=NIL |
| | | | R7 | CR=40% RQD=NIL |
| | | | R8 | CR=38% RQD=NIL |
| | | | R9 | CR=36% RQD=NIL |
| | | | R10 | CR=40% RQD=24% |
| | | | R11 | CR=42% RQD=16% |
| | | | R12 | CR=40% RQD=20% |
| 10.50m. | | | | |

1.50 2.25 3.00 3.75 4.50 5.25 6.00 6.75 7.50 8.25 9.00 9.75 10.50

BH-2/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 13/08/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.2

Co-ordinates E=(-)585.000 N=920.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 01/08/2018
Completion Date : 03/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.230 M.
Water Struck At :
Standing Water Level : 3.50 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m. | | | | |
| | | | R13 | CR=38% RQD=26% 11.25 |
| | | | R14 | CR=36% RQD=NIL 12.00 |
| | | | R15 | CR=38% RQD=NIL 12.75 |
| | | | R16 | CR=40% RQD=20% 13.50 |
| | | | R17 | CR=41% RQD=30% 14.25 |
| | | | R18 | CR=46% RQD=30% 15.00 |
| Highly to moderately weathered, reddish brown, fine grained, highly to moderately fractured shale. | | | R19 | CR=44% RQD=30% 15.75 |
| | | | R20 | CR=43% RQD=32% 16.50 |
| | | | R21 | CR=48% RQD=24% 17.25 |
| | | | R22 | CR=49% RQD=30% 18.00 |
| | | | R23 | CR=46% RQD=20% 18.75 |
| 18.75m. | | | | |
| | | | R24 | CR=58% RQD=40% 19.50 |
| Moderately weathered, reddish brown, fine grained, highly to moderately fractured shale. | | | R25 | CR=60% RQD=20% 20.00 |
| 20.00m. | | | | |

N.B. – '*' means sample could not be recovered.

BH-2/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.3

Co-ordinates E=(-)700.000 N=900.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 10/06/2018
Completion Date : 11/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.620 M.
Water Struck At :
Standing Water Level : 4.08 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up soil consists of brown, clayey silt with decomposed rock fragments.<br>0.30m | | Refusal<br>100<br>2.0 cm Pentr. | DS-1<br>*SPT-1 | 0.20<br>0.30-0.32 |
| Moderately weathered, reddish brown, fine grained, highly fractured shale.<br>1.05m | | NX. drilling from 0.30m to 15.00m | R1 | CR=41%<br>RQD=NIL |
| | | | R2 | CR=58%<br>RQD=NIL |
| | | | R3 | CR=61%<br>RQD=NIL |
| | | | R4 | CR=60%<br>RQD=NIL |
| | | | R5 | CR=61%<br>RQD=NIL |
| Moderately to slightly weathered, reddish brown, fine grained, highly to moderately fractured shale. | | | R6 | CR=57%<br>RQD=NIL |
| | | | R7 | CR=68%<br>RQD=NIL |
| | | | R8 | CR=57%<br>RQD=NIL |
| | | | R9 | CR=65%<br>RQD=NIL |
| | | | R10 | CR=64%<br>RQD=20% |
| 7.80m<br>Moderately weathered, reddish brown, fine grained, highly fractured shale.<br>8.50m | | | R11 | CR=48%<br>RQD=NIL |

0.30 1.05 1.80 2.55 3.30 4.05 4.80 5.55 6.30 7.05 7.80 8.55

BH-3/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.3

Co-ordinates E=(-)700.000 N=900.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 10/06/2018
Completion Date : 11/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.620 M.
Water Struck At :
Standing Water Level : 4.08 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m<br>Moderately weathered, reddish brown, fine grained, highly fractured shale. | | | R12 | CR=45%<br>RQD=NIL |
| 9.30m | | | | 9.30 |
| Moderately to slightly weathered, reddish brown to light grey, fine grained, highly to modeartely fractured shale. | | | R13 | CR=56%<br>RQD=NIL |
| | | | | 10.05 |
| | | | R14 | CR=62%<br>RQD=37% |
| 10.80m | | | | 10.80 |
| Moderately to slightly weathered, light grey, fine grained, moderately fractured shale. | | | R15 | CR=41%<br>RQD=NIL |
| | | | | 11.55 |
| | | | R16 | CR=44%<br>RQD=NIL |
| | | | | 12.30 |
| | | | R17 | CR=54%<br>RQD=NIL |
| | | | | 13.05 |
| | | | R18 | CR=53%<br>RQD=NIL |
| | | | | 13.80 |
| | | | R19 | CR=49%<br>RQD=NIL |
| | | | | 14.50 |
| | | | R20 | CR=46%<br>RQD=NIL |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-3/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.4

Co-ordinates E=(-)775.000 N=920.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 13/06/2018
Completion Date : 15/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 283.010 M.
Water Struck At :
Standing Water Level : 4.80 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | Depth (m) |
|---|---|---|---|---|
| 0.00m | | | | |
| Filled up soil consists of reddish brown, clayey silt with decomposed rock. | | | DS-1 | 0.50 |
| 1.00m | | Refusal 100 3.0 cm Pentn. NX. drilling from 1.00m to 15.00m | *SPT-1 | 1.00-1.03 |
| Moderately weathered, reddish brown, fine grained, highly fractured shale. | | | R1 | CR=56% RQD=NIL |
| | | | R2 | CR=60% RQD=NIL |
| | | | R3 | CR=50% RQD=NIL |
| | | | R4 | CR=53% RQD=NIL |
| | | | R5 | CR=58% RQD=NIL |
| 4.75m | | | R6 | CR=48% RQD=NIL |
| Highly weathered, reddish brown, fine grained, highly fractured shale. | | | R7 | CR=49% RQD=NIL |
| | | | R8 | CR=36% RQD=NIL |
| 7.00m | | | R9 | CR=41% RQD=NIL |
| Moderately weathered, light grey to brownish grey, fine grained, highly fractured shale. | | | R10 | CR=49% RQD=NIL |
| 8.50m | | | | |

1.00 1.75 2.50 3.25 4.00 4.75 5.50 6.25 7.00 7.75 8.50

BH-4/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.4

Co-ordinates E=(-)775.000 N=920.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 13/06/2018
Completion Date : 15/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 283.010 M.
Water Struck At :
Standing Water Level : 4.80 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m | | | | |
| Slightly weathered, light grey to brownish grey, fine grained, highly fractured shale. | | | R11 | CR=65% RQD=NIL |
| 9.25m | | | | 9.25 |
| | | | R12 | CR=35% RQD=NIL |
| | | | | 10.00 |
| | | | R13 | CR=40% RQD=NIL |
| | | | | 10.75 |
| | | | R14 | CR=44% RQD=NIL |
| | | | | 11.50 |
| | | | R15 | CR=31% RQD=NIL |
| | | | | 12.25 |
| Highly weathered, light grey to brownish grey, fine grained, highly fractured shale. | | | R16 | CR=39% RQD=NIL |
| | | | | 13.00 |
| | | | R17 | CR=26% RQD=NIL |
| | | | | 13.75 |
| | | | R18 | CR=26% RQD=NIL |
| | | | | 14.50 |
| | | | R19 | CR=24% RQD=NIL |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-4/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.5

Co-ordinates E=(-)780.000 N=875.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 25/06/2018
Completion Date : 26/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.950 M.
Water Struck At :
Standing Water Level : 3.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up soil consists of reddish brown, clayey silt to silty clay with decomposed rock fragments. | | | DS-1 | 0.50 |
| 0.60m | | Refusal<br>100<br>2.0 cm Pentn. | *SPT-1 | 0.60-0.62 |
| | | NX. drilling from 0.60m to 15.00m | R1 | CR=29%<br>RQD=NIL |
| | | | R2 | CR=34%<br>RQD=NIL |
| | | | R3 | CR=38%<br>RQD=NIL |
| | | | R4 | CR=37%<br>RQD=NIL |
| Highly to moderately weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=39%<br>RQD=10% |
| | | | R6 | CR=40%<br>RQD=NIL |
| | | | R7 | CR=50%<br>RQD=NIL |
| | | | R8 | CR=42%<br>RQD=40% |
| | | | R9 | CR=44%<br>RQD=NIL |
| 7.25m<br>Highly to moderately weathered, reddish brown to light grey, fine grained, fractured shale. | | | R10 | CR=53%<br>RQD=NIL |
| 8.50m | | | R11 | CR=56%<br>RQD=NIL |

0.60 1.25 2.00 2.75 3.50 4.25 5.00 5.75 6.50 7.25 8.00

BH-5/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.5

Co-ordinates E=(-)780.000 N=875.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 25/06/2018
Completion Date : 26/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.950 M.
Water Struck At :
Standing Water Level : 3.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m<br>Highly to moderately weathered, reddish brown to light grey, fine grained, fractured shale. | | | | 8.75 |
| | | | R12 | CR=54%<br>RQD=NIL |
| 9.50m | | | | 9.50 |
| | | | R13 | CR=49%<br>RQD=17% |
| | | | | 10.25 |
| | | | R14 | CR=51%<br>RQD=NIL |
| | | | | 11.00 |
| | | | R15 | CR=44%<br>RQD=NIL |
| Highly weathered, light grey, fine grained, fractured shale. | | | | 11.75 |
| | | | R16 | CR=32%<br>RQD=NIL |
| | | | | 12.50 |
| | | | R17 | CR=39%<br>RQD=NIL |
| | | | | 13.25 |
| | | | R18 | CR=37%<br>RQD=NIL |
| | | | | 14.00 |
| | | | R19 | CR=38%<br>RQD=NIL |
| | | | | 14.50 |
| | | | R20 | CR=36%<br>RQD=NIL |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-5/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.6

Co-ordinates E=(-)660.520 N=899.260

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 19/06/2018
Completion Date : 20/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.880 M.
Water Struck At :
Standing Water Level : 3.02 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m | | | DS-1 | 0.30 |
| Filled up with reddish brown, clayey silt with decomposed rock fragments. 0.40m | | Refusal 100 | *SPT-1 | 0.40-0.42 |
| Highly weathered, reddish brown, fine grained, fractured shale. 1.15m | | 2.0 cm Pentn. NX. drilling from 0.40m to 20.00m | R1 | CR=40% RQD=14% 1.15 |
| | | | R2 | CR=65% RQD=26% 1.90 |
| | | | R3 | CR=76% RQD=NIL 2.65 |
| | | | R4 | CR=66% RQD=16% 3.40 |
| Moderately / slightly weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=69% RQD=NIL 4.15 |
| | | | R6 | CR=74% RQD=NIL 4.90 |
| | | | R7 | CR=56% RQD=NIL 5.65 |
| | | | R8 | CR=56% RQD=NIL 6.40 |
| 6.90m | | | R9 | CR=68% RQD=NIL 7.15 |
| | | | R10 | CR=69% RQD=NIL 7.90 |
| | | | R11 | CR=66% RQD=36% 8.65 |
| Moderately / slightly weathered, reddish brown / light grey to dark grey, fine grained, fractured shale. | | | R12 | CR=69% RQD=24% 9.40 |
| | | | R13 | CR=72% RQD=20% 10.15 |
| 10.50m | | | R14 | CR=70% RQD=NIL |

BH-6/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.6

Co-ordinates E=(-)660.520 N=899.260

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 19/06/2018
Completion Date : 20/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.880 M.
Water Struck At :
Standing Water Level : 3.02 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m | | | | 10.90 |
| Moderately / slightly weathered, reddish brown / light grey to dark grey, fine grained, fractured shale. | | | R15 | CR=53% RQD=NIL |
| | | | | 11.65 |
| | | | R16 | CR=61% RQD=NIL |
| 12.40m | | | | 12.40 |
| Highly to moderately weathered, light grey to dark grey, fine grained, fractured shale. | | | R17 | CR=37% RQD=21% |
| | | | | 13.15 |
| | | | R18 | CR=48% RQD=40% |
| 13.90m | | | | 13.90 |
| Moderately weathered, light grey to dark grey, fine grained, fractured shale. | | | R19 | CR=60% RQD=18% |
| | | | | 14.65 |
| | | | R20 | CR=56% RQD=13% |
| | | | | 15.40 |
| | | | R21 | CR=56% RQD=29% |
| | | | | 16.15 |
| | | | R22 | CR=57% RQD=NIL |
| 16.90m | | | | 16.90 |
| Highly weathered, light grey to dark grey, fine grained, fractured shale. | | | R23 | CR=37% RQD=NIL |
| | | | | 17.65 |
| | | | R24 | CR=40% RQD=NIL |
| 18.40m | | | | 18.40 |
| Moderately / slightly weathered, light grey to dark grey, fine grained fractured shale. | | | R25 | CR=63% RQD=33% |
| | | | | 19.15 |
| | | | R26 | CR=52% RQD=NIL |
| | | | | 19.60 |
| | | | R27 | CR=72% RQD=NIL |
| 20.00m | | | | 20.00 |

N.B. – '*' means sample could not be recovered.

BH-6/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.7

Co-ordinates E=(-)676.000 N=846.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 1 |

Commencement Date : 12/06/2018
Completion Date : 14/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.840 M.
Water Struck At :
Standing Water Level : 3.27 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. Filled up soil with reddish brown, clayey silt with decomposed rock fragment. 0.40m. | | Refusal 100 2.0 cm Pentr. NX. drilling from 0.40m to 20.00m | DS-1 | 0.20 |
| | | | *SPT-1 | 0.40-0.42 |
| | | | R1 | CR=32% RQD=NIL |
| Highly weathered, reddish brown, fine grained, highly fractured shale. | | | R2 | CR=36% RQD=NIL |
| | | | R3 | CR=37% RQD=NIL |
| | | | R4 | CR=33% RQD=NIL |
| 03.40m. | | | WS-1 | 3.27 |
| | | | R5 | CR=61% RQD=NIL |
| | | | R6 | CR=58% RQD=NIL |
| | | | R7 | CR=65% RQD=NIL |
| | | | R8 | CR=62% RQD=29% |
| Moderately / slightly weathered, reddish brown, fine grained, highly to moderately fractured shale. | | | R9 | CR=63% RQD=NIL |
| | | | R10 | CR=66% RQD=NIL |
| | | | R11 | CR=60% RQD=NIL |
| | | | R12 | CR=62% RQD=NIL |
| | | | R13 | CR=54% RQD=NIL |
| 10.50m. | | | R14 | CR=60% RQD=NIL |

0.40 1.15 1.90 2.65 3.40 4.15 4.90 5.65 6.40 7.15 7.90 8.65 9.40 10.15

BH-7/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.7

Co-ordinates E=(-)676.000 N=846.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 1 |

Commencement Date : 12/06/2018
Completion Date : 14/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.840 M.
Water Struck At :
Standing Water Level : 3.27 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| | | | | 10.90 |
| Moderately / slightly weathered, reddish brown, fine grained, highly to moderately fractured shale. | | | R15 | CR=53% RQD=NIL |
| | | | | 11.65 |
| | | | R16 | CR=56% RQD=NIL |
| 10.50m. | | | | 12.40 |
| | | | R17 | CR=48% RQD=17% |
| | | | | 13.15 |
| Moderately weathered, reddish brown, fine grained, moderately fractured shale. | | | R18 | CR=46% RQD=22% |
| | | | | 13.90 |
| | | | R19 | CR=48% RQD=NIL |
| 12.40m. | | | | 14.65 |
| | | | R20 | CR=53% RQD=13% |
| | | | | 15.40 |
| | | | R21 | CR=56% RQD=NIL |
| | | | | 16.15 |
| | | | R22 | CR=61% RQD=16% |
| | | | | 16.90 |
| Moderately to slightly weathered, light grey to brownish grey, fine grained, moderately fractured shale. | | | R23 | CR=64% RQD=49% |
| | | | | 17.65 |
| | | | R24 | CR=58% RQD=NIL |
| | | | | 18.40 |
| | | | R25 | CR=65% RQD=36% |
| | | | | 19.15 |
| | | | R26 | CR=62% RQD=NIL |
| | | | | 19.65 |
| | | | R27 | CR=80% RQD=NIL |
| 14.65m. | | | | 20.00 |
| 20.00m. | | | | |

N.B. – '*' means sample could not be recovered.

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.8

Co-ordinates E=(-)649.000 N=849.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 17/06/2018
Completion Date : 18/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.060 M.
Water Struck At :
Standing Water Level : 4.14 m.

| DESCRIPTION | SYMBOL | N-VALUE (EACH DIVN=15CM) | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up with reddish brown, clayey silt with decomposed rock fragments. | | | DS-1 | 0.50 |
| 0.80m | | Refusal<br>100<br>3.0 cm Pentn. | *SPT-1 | 0.80-0.83 |
| Highly to moderately weathered, reddish brown, fine grained, fractured shale. | | NX. drilling from 0.80m to 20.00m | R1 | CR=33%<br>RQD=NIL<br>1.25 |
| | | | R2 | CR=28%<br>RQD=NIL<br>2.00 |
| | | | R3 | CR=38%<br>RQD=NIL<br>2.75 |
| | | | R4 | CR=44%<br>RQD=NIL<br>3.50 |
| 3.50m<br>Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=56%<br>RQD=NIL<br>4.25 |
| | | | R6 | CR=65%<br>RQD=20%<br>5.00 |
| | | | R7 | CR=66%<br>RQD=17%<br>5.75 |
| | | | R8 | CR=66%<br>RQD=NIL<br>6.50 |
| | | | R9 | CR=65%<br>RQD=NIL<br>7.25 |
| | | | R10 | CR=65%<br>RQD=NIL<br>8.00 |
| | | | R11 | CR=64%<br>RQD=13%<br>8.75 |
| | | | R12 | CR=62%<br>RQD=NIL<br>9.50 |
| | | | R13 | CR=66%<br>RQD=NIL<br>10.25 |
| 10.50m | | | | |

BH-8/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.8

Co-ordinates E=(-)649.000 N=849.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 17/06/2018
Completion Date : 18/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.060 M.
Water Struck At :
Standing Water Level : 4.14 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m<br>Moderately to slightly weathered, reddish brown, fine grained, fractured shale.<br>11.00m | | | R14 | CR=61%<br>RQD=NIL<br>11.00 |
| | | | R15 | CR=57%<br>RQD=NIL<br>11.75 |
| | | | R16 | CR=54%<br>RQD=NIL<br>12.50 |
| | | | R17 | CR=62%<br>RQD=24%<br>13.25 |
| | | | R18 | CR=60%<br>RQD=46%<br>14.00 |
| Moderately / slightly weathered, light grey to dark grey, fractured shale. | | | R19 | CR=66%<br>RQD=46%<br>14.75 |
| | | | R20 | CR=65%<br>RQD=38%<br>15.50 |
| | | | R21 | CR=61%<br>RQD=17%<br>16.25 |
| | | | R22 | CR=57%<br>RQD=NIL<br>17.00 |
| 17.00m<br>Moderately / slightly weathered, light grey to dark grey, fractured shale. | | | R23 | CR=65%<br>RQD=NIL<br>17.75 |
| | | | R24 | CR=54%<br>RQD=NIL<br>18.50 |
| | | | R25 | CR=53%<br>RQD=NIL<br>19.25 |
| | | | R26 | CR=66%<br>RQD=NIL<br>20.00 |
| 20.00m | | | | |

N.B. – '*' means sample could not be recovered.

BH-8/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.9

Co-ordinates E=(-)665.000 N=820.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/06/2018
Completion Date : 16/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.092 M.
Water Struck At :
Standing Water Level : 4.34 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up with reddish brown clayey silt with decomposed rock fragments | | | DS-1 | 0.40 |
| 0.50m | | Refusal<br>100<br>2.0 cm Pentn. | *SPT-1 | 0.50-0.52 |
| | | NX. drilling from 0.50m to 20.00m | R1 | CR=44%<br>RQD=NIL |
| | | | R2 | CR=45%<br>RQD=NIL |
| | | | R3 | CR=46%<br>RQD=NIL |
| | | | R4 | CR=41%<br>RQD=NIL |
| Highly to moderately weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=36%<br>RQD=NIL |
| | | | R6 | CR=37%<br>RQD=NIL |
| | | | R7 | CR=56%<br>RQD=NIL |
| | | | R8 | CR=44%<br>RQD=NIL |
| 6.50m | | | R9 | CR=74%<br>RQD=14% |
| | | | R10 | CR=65%<br>RQD=16% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R11 | CR=49%<br>RQD=NIL |
| | | | R12 | CR=57%<br>RQD=36% |
| | | | R13 | CR=57%<br>RQD=NIL |
| 10.50m | | | R14 | CR=64%<br>RQD=NIL |

0.50 1.25 2.00 2.75 3.50 4.25 5.00 5.75 6.50 7.25 8.00 8.75 9.50 10.25

BH-9/Sheet-1

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO.9

Co-ordinates E=(-)665.000 N=820.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/06/2018
Completion Date : 16/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.092 M.
Water Struck At :
Standing Water Level : 4.34 m.

| DESCRIPTION | SYMBOL | N-VALUE (EACH DIVN=15CM) | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m<br>Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | | 11.00 |
| 11.00m | | | R15 | CR=34%<br>RQD=NIL |
| | | | | 11.75 |
| Highly to moderately weathered, reddish brown, fine grained, fractured shale. | | | R16 | CR=45%<br>RQD=NIL |
| | | | | 12.50 |
| | | | R17 | CR=50%<br>RQD=NIL |
| 13.25m | | | | 13.25 |
| | | | R18 | CR=62%<br>RQD=37% |
| | | | | 14.00 |
| | | | R19 | CR=57%<br>RQD=NIL |
| | | | | 14.75 |
| | | | R20 | CR=49%<br>RQD=NIL |
| | | | | 15.50 |
| Moderately to slightly weathered, light grey to dark grey, fine grained fractured shale. | | | R21 | CR=69%<br>RQD=18% |
| | | | | 16.25 |
| | | | R22 | CR=62%<br>RQD=NIL |
| | | | | 17.00 |
| | | | R23 | CR=60%<br>RQD=NIL |
| | | | | 17.75 |
| | | | R24 | CR=64%<br>RQD=NIL |
| | | | | 18.50 |
| | | | R25 | CR=56%<br>RQD=NIL |
| | | | | 19.25 |
| | | | R26 | CR=64%<br>RQD=NIL |
| 20.00m | | | | 20.00 |

N.B. – '*' means sample could not be recovered.

BH-9/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.10

Co-ordinates E=(-)769.000 N=1318.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 3 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 3 |
| Vane (V) | | Disturbed (DS) | 5 |
| | | Water Sample (WS) | 0 |

Commencement Date : 17/07/2018
Completion Date : 19/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.712 M.
Water Struck At :
Standing Water Level : 4.90 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. | | | | |
| | | | DS-1 | 0.50 |
| | | | DS-2 | 1.00 |
| Filled up with ash, coal, brick bats, concrete etc. | | | DS-3 | 2.00 |
| | | | DS-4 | 3.00 |
| | | 7 19 21 40 | SPT-1 | 3.20-3.65 |
| | | | DS-5 | 4.00 |
| 4.00m. | | 100 Refusal 2.0 cm Pentr. | *SPT-2 | 4.10-4.12 |
| Hard, brownish grey, silty clay with decomposed rock fragments. 4.20m. | | 100 Refusal 2.0 cm Pentr. | *SPT-3 | 4.20-4.22 |
| | | NX. drilling from 4.20m to 15.00m | R1 | CR=30% RQD=NIL 4.20 |
| | | | R2 | CR=25% RQD=NIL 4.75 |
| | | | R3 | CR=28% RQD=NIL 5.50 |
| | | | R4 | CR=29% RQD=NIL 6.25 |
| Highly to modeartely weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=29% RQD=NIL 7.00 |
| | | | R6 | CR=31% RQD=NIL 7.75 |
| 8.50m. | | | | 8.50 |

BH-10/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.10

Co-ordinates E=(-)769.000 N=1318.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 3 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 3 |
| Vane (V) | | Disturbed (DS) | 5 |
| | | Water Sample (WS) | 0 |

Commencement Date : 17/07/2018
Completion Date : 19/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.712 M.
Water Struck At :
Standing Water Level : 4.90 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m | | | | |
| Highly to modeartely weathered, reddish brown, fine grained, fractured shale. | | | R7 | CR=46% RQD=13% |
| | | | | 9.25 |
| | | | R8 | CR=34% RQD=NIL |
| 10.00m | | | | 10.00 |
| | | | R9 | CR=66% RQD=62% |
| | | | | 10.75 |
| | | | R10 | CR=68% RQD=64% |
| | | | | 11.50 |
| Slightly weathered, reddish brown, fine grained, fractured shale. | | | R11 | CR=67% RQD=53% |
| | | | | 12.25 |
| | | | R12 | CR=65% RQD=62% |
| | | | | 13.00 |
| | | | R13 | CR=69% RQD=64% |
| | | | | 13.75 |
| | | | R14 | CR=62% RQD=60% |
| | | | | 14.50 |
| | | | R15 | CR=62% RQD=58% |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-10/Sheet-2

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO.11

Co-ordinates E=(-)670.000 N=1371.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 30/06/2018
Completion Date : 05/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.590 M.
Water Struck At :
Standing Water Level : 2.90 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m | | | | |
| Filled up with road materials, brick bats, decomposed rock fragments. | | | DS-1 | 0.50 |
| | | Refusal | | |
| 1.00m | | 100 | *SPT-1 | 1.00-1.03 |
| Highly weathered, reddish brown, fine grained, fractured shale. | | 3.0 cm Pentn. NX. drilling from 1.00m to 17.25m | R1 | CR=28% RQD=NIL |
| 1.75m | | | | 1.00 / 1.75 |
| | | | R2 | CR=60% RQD=45% |
| | | | | 2.50 |
| | | | R3 | CR=59% RQD=49% |
| | | | | 3.25 |
| | | | R4 | CR=53% RQD=47% |
| | | | | 4.00 |
| | | | R5 | CR=51% RQD=47% |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | | 4.75 |
| | | | R6 | CR=54% RQD=28% |
| | | | | 5.50 |
| | | | R7 | CR=60% RQD=47% |
| | | | | 6.25 |
| | | | R8 | CR=50% RQD=45% |
| | | | | 7.00 |
| | | | R9 | CR=55% RQD=39% |
| | | | | 7.75 |
| | | | R10 | CR=60% RQD=32% |
| 8.50m | | | | 8.50 |
| | | | R11 | CR=41% RQD=28% |
| | | | | 9.25 |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | R12 | CR=43% RQD=14% |
| | | | | 10.00 |
| | | | R13 | CR=43% RQD=NIL |
| 10.50m | | | | |

BH-11/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.11

Co-ordinates E=(-)670.000 N=1371.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 30/06/2018
Completion Date : 05/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.590 M.
Water Struck At :
Standing Water Level : 2.90 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m | | | | |
| 10.75m | | | | 10.75 |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | R14 | CR=53% RQD=29% |
| | | | | 11.50 |
| | | | R15 | CR=52% RQD=45% |
| 12.25m | | | | 12.25 |
| | | | R16 | CR=69% RQD=65% |
| | | | | 13.00 |
| | | | R17 | CR=78% RQD=66% |
| | | | | 13.75 |
| | | | R18 | CR=80% RQD=76% |
| | | | | 14.50 |
| Slightly weathered to fresh, reddish brown, fine grained, fractured shale. | | | R19 | CR=89% RQD=82% |
| | | | | 15.25 |
| | | | R20 | CR=82% RQD=77% |
| | | | | 16.00 |
| | | | R21 | CR=90% RQD=82% |
| | | | | 16.75 |
| | | | R22 | CR=86% RQD=80% |
| 17.25m | | | | 17.25 |

N.B. – '*' means sample could not be recovered.

BH-11/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.12

Co-ordinates E=(-)611.000 N=1334.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 25/07/2018
Completion Date : 27/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 283.330 M.
Water Struck At :
Standing Water Level : 3.00 m.

| DESCRIPTION | SYMBOL | N-VALUE (EACH DIVN=15CM) | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m | | | | |
| Hard(N>50), reddish brown, clayey silt with decomposed rock fragments.(Cl) | | Refusal 100 3.0 cm Pentn. | DS-1 | 0.50 |
| | | | *SPT-1 | 1.00-1.03 |
| 1.50m | | Refusal 100 2.0 cm Pentn. | *SPT-2 | 1.50-1.52 |
| | | NX. drilling from 1.50m to 20.00m | R1 | CR=51% RQD=NIL |
| | | | | 2.25 |
| | | | R2 | CR=51% RQD=NIL |
| | | | | 3.00 |
| | | | R3 | CR=49% RQD=NIL |
| | | | | 3.75 |
| | | | R4 | CR=58% RQD=NIL |
| | | | | 4.50 |
| | | | R5 | CR=56% RQD=NIL |
| | | | | 5.25 |
| Moderately / slightly weathered, reddish brown, fine grained, fractured shale. | | | R6 | CR=44% RQD=NIL |
| | | | | 6.00 |
| | | | R7 | CR=53% RQD=NIL |
| | | | | 6.75 |
| | | | R8 | CR=49% RQD=NIL |
| | | | | 7.50 |
| | | | R9 | CR=62% RQD=54% |
| | | | | 8.25 |
| | | | R10 | CR=60% RQD=40% |
| | | | | 9.00 |
| | | | R11 | CR=60% RQD=20% |
| | | | | 9.75 |
| | | | R12 | CR=60% RQD=15% |
| 10.50m | | | | 10.50 |

BH-12/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.12

Co-ordinates E=(-)611.000 N=1334.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 25/07/2018
Completion Date : 27/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 283.330 M.
Water Struck At :
Standing Water Level : 3.00 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m | | | | |
| | | | R13 | CR=60% RQD=NIL |
| | | | | 11.25 |
| | | | R14 | CR=66% RQD=23% |
| | | | | 12.00 |
| | | | R15 | CR=63% RQD=13% |
| | | | | 12.75 |
| | | | R16 | CR=60% RQD=NIL |
| | | | | 13.50 |
| | | | R17 | CR=62% RQD=13% |
| | | | | 14.25 |
| | | | R18 | CR=62% RQD=45% |
| | | | | 15.00 |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R19 | CR=61% RQD=24% |
| | | | | 15.75 |
| | | | R20 | CR=60% RQD=NIL |
| | | | | 16.50 |
| | | | R21 | CR=64% RQD=32% |
| | | | | 17.25 |
| | | | R22 | CR=61% RQD=NIL |
| | | | | 18.00 |
| | | | R23 | CR=60% RQD=21% |
| | | | | 18.75 |
| | | | R24 | CR=64% RQD=21% |
| | | | | 19.50 |
| | | | R25 | CR=50% RQD=NIL |
| 20.00m | | | | 20.00 |

N.B. – '*' means sample could not be recovered.

BH-12/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.13

Co-ordinates E=(-)711.000 N=1261.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 05/07/2018
Completion Date : 07/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.160 M.
Water Struck At :
Standing Water Level : 1.70 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. Filled up soil consist of reddish brown, silty clay to clayey silt with rock fragments. | | Refusal | DS-1 | 0.40 |
| 0.50m. Highly weathered, reddish brown, fine grained, fractured rock. | | 100 2.0 cm Pentrn. NX. drilling from 0.50m to 18.25m | *SPT-1 | 0.50-0.52 |
| 1.25m. Slightly weathered to fresh, reddish brown, fine grained, fractured shale. | | | R1 | CR=27% RQD=21% |
| | | | R2 | CR=70% RQD=50% |
| | | | R3 | CR=61% RQD=NIL |
| | | | R4 | CR=74% RQD=21% |
| | | | R5 | CR=65% RQD=62% |
| | | | R6 | CR=61% RQD=36% |
| | | | R7 | CR=69% RQD=52% |
| | | | R8 | CR=62% RQD=57% |
| | | | R9 | CR=66% RQD=46% |
| | | | R10 | CR=65% RQD=20% |
| | | | R11 | CR=69% RQD=66% |
| | | | R12 | CR=67% RQD=61% |
| | | | R13 | CR=72% RQD=13% |
| 10.50m. | | | | |

0.50 1.25 2.00 2.75 3.50 4.25 5.00 5.75 6.50 7.25 8.00 8.75 9.50 10.25

BH-13/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.13

Co-ordinates E=(-)711.000 N=1261.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 05/07/2018
Completion Date : 07/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.160 M.
Water Struck At :
Standing Water Level : 1.70 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m | | | R14 | CR=67% RQD=42% 11.00 |
| | | | R15 | CR=66% RQD=34% 11.75 |
| | | | R16 | CR=61% RQD=NIL 12.50 |
| | | | R17 | CR=62% RQD=NIL 13.25 |
| | | | R18 | CR=69% RQD=65% 14.00 |
| Slightly weathered to fresh, reddish brown, fine grained, fractured shale. | | | R19 | CR=78% RQD=66% 14.75 |
| | | | R20 | CR=80% RQD=76% 15.50 |
| | | | R21 | CR=89% RQD=82% 16.25 |
| | | | R22 | CR=82% RQD=77% 17.00 |
| | | | R23 | CR=90% RQD=82% 17.75 |
| | | | R24 | CR=86% RQD=80% 18.25 |
| 18.25m | | | | |

N.B. – '*' means sample could not be recovered.

BH-13/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 20/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.14

Co-ordinates E=(-)668.000 N=1283.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/07/2018
Completion Date : 16/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.380 M.
Water Struck At :
Standing Water Level : 3.00 m.

| DESCRIPTION | SYMBOL | N-VALUE (EACH DIVN=15CM) | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up with reddish brown, clayey silt to silty clay with road material. | | | DS-1 | 0.40 |
| 0.50m | | Refusal<br>100<br>2.0 cm Pentr. | *SPT-1 | 0.50-0.52 |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | NX. drilling from 0.50m to 16.00m | R1 | CR=44%<br>RQD=19% |
| | | | R2 | CR=45%<br>RQD=24% |
| | | | R3 | CR=40%<br>RQD=36% |
| 2.75m | | | R4 | CR=61%<br>RQD=55% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=71%<br>RQD=41% |
| | | | R6 | CR=75%<br>RQD=69% |
| 5.00m | | | R7 | CR=50%<br>RQD=40% |
| | | | R8 | CR=56%<br>RQD=52% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R9 | CR=41%<br>RQD=NIL |
| | | | R10 | CR=56%<br>RQD=33% |
| 8.50m | | | R11 | CR=49%<br>RQD=NIL |

0.50 1.25 2.00 2.75 3.50 4.25 5.00 5.75 6.50 7.25 8.00

BH-14/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 20/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.14

Co-ordinates E=(-)668.000 N=1283.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/07/2018
Completion Date : 16/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.380 M.
Water Struck At :
Standing Water Level : 3.00 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m | | | | 8.75 |
| | | | R12 | CR=54% RQD=50% |
| | | | | 9.50 |
| | | | R13 | CR=52% RQD=48% |
| | | | | 10.25 |
| | | | R14 | CR=49% RQD=46% |
| | | | | 11.00 |
| | | | R15 | CR=61% RQD=58% |
| | | | | 11.75 |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R16 | CR=61% RQD=52% |
| | | | | 12.50 |
| | | | R17 | CR=68% RQD=64% |
| | | | | 13.25 |
| | | | R18 | CR=73% RQD=69% |
| | | | | 14.00 |
| | | | R19 | CR=61% RQD=53% |
| | | | | 14.75 |
| | | | R20 | CR=66% RQD=64% |
| | | | | 15.50 |
| | | | R21 | CR=68% RQD=64% |
| 16.00m | | | | 16.00 |

N.B. – '*' means sample could not be recovered.

BH-14/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.15

Co-ordinates E=(-)627.000 N=1259.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/07/2018
Completion Date : 15/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.720 M.
Water Struck At :
Standing Water Level : 1.26 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up with reddish brown, clayey silt with decomposed rock fragments.<br>0.50m | | Refusal<br>100<br>2.0 cm Pentr. | DS-1<br>*SPT-1 | 0.30<br>0.50-0.52 |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | NX. drilling from 0.50m to 20.00m | R1<br>R2<br>R3 | CR=51% RQD=24%<br>CR=67% RQD=NIL<br>CR=60% RQD=NIL |
| 2.75m<br>Highly weathered, reddish brown to greyish brown, fine grained, fractured shale. | | | R4<br>R5 | CR=24% RQD=NIL<br>CR=40% RQD=NIL |
| 4.25m<br>Moderately / slighly weathered, reddish brown to greyish brown, fine grained, fractured shale. | | | R6<br>R7<br>R8<br>R9<br>R10<br>R11<br>R12<br>R13 | CR=67% RQD=47%<br>CR=72% RQD=65%<br>CR=69% RQD=17%<br>CR=76% RQD=18%<br>CR=68% RQD=NIL<br>CR=64% RQD=NIL<br>CR=72% RQD=56%<br>CR=69% RQD=61% |
| 10.50m | | | | 0.50<br>1.25<br>2.00<br>2.75<br>3.50<br>4.25<br>5.00<br>5.75<br>6.50<br>7.25<br>8.00<br>8.75<br>9.50<br>10.25 |

BH-15/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.15

Co-ordinates E=(-)627.000 N=1259.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/07/2018
Completion Date : 15/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.720 M.
Water Struck At :
Standing Water Level : 1.26 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m | | | R14 | CR=78% RQD=NIL |
| | | | | 11.00 |
| | | | R15 | CR=76% RQD=29% |
| | | | | 11.75 |
| | | | R16 | CR=69% RQD=NIL |
| | | | | 12.50 |
| | | | R17 | CR=66% RQD=NIL |
| | | | | 13.25 |
| | | | R18 | CR=69% RQD=31% |
| | | | | 14.00 |
| | | | R19 | CR=66% RQD=NIL |
| | | | | 14.75 |
| Moderately / slightly weathered, reddish brown to greyish brown, fine grained, fractured shale. | | | R20 | CR=74% RQD=23% |
| | | | | 15.50 |
| | | | R21 | CR=72% RQD=69% |
| | | | | 16.25 |
| | | | R22 | CR=72% RQD=65% |
| | | | | 17.00 |
| | | | R23 | CR=76% RQD=66% |
| | | | | 17.75 |
| | | | R24 | CR=67% RQD=42% |
| | | | | 18.50 |
| | | | R25 | CR=71% RQD=60% |
| | | | | 19.25 |
| | | | R26 | CR=55% RQD=NIL |
| 20.00m | | | | 20.00 |

N.B. – '*' means sample could not be recovered.

BH-15/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.16

Co-ordinates E=(-)588.000 N=1281.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 27/06/2018
Completion Date : 28/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.980 M.
Water Struck At :
Standing Water Level : 1.62 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. Filled up with reddish brown, clayey silt with decomposed rock fragments. | | | DS-1 | 0.40 |
| 0.50m. | | Refusal 100 3.0 cm Pentr. | *SPT-1 | 0.50-0.53 |
| Highly weathered, reddish brown, fine grained, fractured shale. | | NX. drilling from 0.50m to 15.25m | R1 | CR=21% RQD=17% |
| 1.25m. Highly weathered, reddish brown, fine grained, fractured shale. | | | R2 | CR=38% RQD=NIL |
| 2.00m. | | | R3 | CR=53% RQD=38% |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | R4 | CR=54% RQD=40% |
| | | | R5 | CR=57% RQD=46% |
| 4.25m. | | | R6 | CR=64% RQD=46% |
| | | | R7 | CR=56% RQD=NIL |
| | | | R8 | CR=64% RQD=31% |
| Moderately / slightly weathered, reddish brown, fine grained, fractured shale. | | | R9 | CR=60% RQD=28% |
| | | | R10 | CR=72% RQD=32% |
| 8.50m. | | | R11 | CR=65% RQD=NIL |

0.50 1.25 2.00 2.75 3.50 4.25 5.00 5.75 6.50 7.25 8.00

BH-16/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.16

Co-ordinates E=(-)588.000 N=1281.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 27/06/2018
Completion Date : 28/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 281.980 M.
Water Struck At :
Standing Water Level : 1.62 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m | | | | 8.75 |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R12 | CR=64% RQD=24% |
| 9.50m | | | | 9.50 |
| | | | R13 | CR=54% RQD=NIL |
| | | | | 10.25 |
| | | | R14 | CR=73% RQD=64% |
| Moderately to slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | | 11.00 |
| | | | R15 | CR=82% RQD=66% |
| | | | | 11.75 |
| | | | R16 | CR=81% RQD=57% |
| 12.50m | | | | 12.50 |
| | | | R17 | CR=77% RQD=61% |
| | | | | 13.25 |
| | | | R18 | CR=85% RQD=73% |
| Slightly weathered to fresh, reddish brown, fine grained, fractured shale. | | | | 14.00 |
| | | | R19 | CR=85% RQD=74% |
| | | | | 14.75 |
| | | | R20 | CR=82% RQD=64% |
| 15.25m | | | | 15.25 |

N.B. – '*' means sample could not be recovered.

BH-16/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.17

Co-ordinates E=(-)559.000 N=1253.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 29/06/2018
Completion Date : 30/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.380 M.
Water Struck At :
Standing Water Level : 2.02 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. Filled up with reddish brown, clayey silt with decomposed rock fragments. | | | DS-1 | 0.50 |
| 0.60m. | | Refusal 100 / 2.0 cm Pentr. | *SPT-1 | 0.60-0.62 |
| | | NX. drilling from 0.60m to 15.00m | R1 | CR=63% RQD=55% |
| Slightly weathered / fresh, yellowish to reddish brown, fine grained, fractured shale. | | | R2 | CR=88% RQD=56% |
| | | | R3 | CR=63% RQD=NIL |
| 2.85m. | | | R4 | CR=93% RQD=53% |
| | | | R5 | CR=94% RQD=81% |
| | | | R6 | CR=77% RQD=64% |
| | | | R7 | CR=77% RQD=27% |
| Slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | R8 | CR=89% RQD=85% |
| | | | R9 | CR=80% RQD=68% |
| | | | R10 | CR=85% RQD=78% |
| 8.50m. | | | R11 | CR=88% RQD=73% |

0.60 / 1.35 / 2.10 / 2.85 / 3.60 / 4.35 / 5.10 / 5.85 / 6.60 / 7.35 / 8.10

BH-17/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.17

Co-ordinates E=(-)559.000 N=1253.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 29/06/2018
Completion Date : 30/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.380 M.
Water Struck At :
Standing Water Level : 2.02 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| | | | | 8.85 |
| 8.50m<br>Slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | R12 | CR=91%<br>RQD=64% |
| | | | | 9.60 |
| 9.60m | | | R13 | CR=73%<br>RQD=NIL |
| | | | | 10.35 |
| | | | R14 | CR=92%<br>RQD=41% |
| | | | | 11.10 |
| | | | R15 | CR=76%<br>RQD=NIL |
| | | | | 11.85 |
| Slightly weathered to fresh, reddish brown, fine grained, fractured shale. | | | R16 | CR=89%<br>RQD=37% |
| | | | | 12.60 |
| | | | R17 | CR=77%<br>RQD=40% |
| | | | | 13.35 |
| | | | R18 | CR=76%<br>RQD=41% |
| | | | | 14.10 |
| | | | R19 | CR=84%<br>RQD=66% |
| | | | | 14.60 |
| | | | R20 | CR=95%<br>RQD=92% |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-17/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.18

Co-ordinates E=(-)706.000 N=1233.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 04/07/2018
Completion Date : 05/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.430 M.
Water Struck At :
Standing Water Level : 1.58 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up soil consist of reddish brown, clayey silt / silty clay with decomposed rock fragments.<br>0.40m | | Refusal<br>100<br>2.0 cm Pentr. | DS-1<br>*SPT-1 | 0.30<br>0.40-0.42 |
| Moderately weathered, reddish brown, fine grained, fractured shale.<br>1.15m | | NX. drilling from 0.40m to 15.00m | R1 | CR=44%<br>RQD=13% |
| | | | R2 | CR=60%<br>RQD=57% |
| | | | R3 | CR=66%<br>RQD=56% |
| | | | R4 | CR=67%<br>RQD=53% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=68%<br>RQD=54% |
| | | | R6 | CR=65%<br>RQD=46% |
| | | | R7 | CR=73%<br>RQD=66% |
| | | | R8 | CR=69%<br>RQD=53% |
| | | | R9 | CR=65%<br>RQD=61% |
| | | | R10 | CR=64%<br>RQD=44% |
| 8.00m | | | | |

0.40
1.15
1.90
2.65
3.40
4.15
4.90
5.65
6.40
7.15
7.90

BH-18/Sheet-1

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO.18

Co-ordinates E=(-)706.000 N=1233.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 04/07/2018
Completion Date : 05/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.430 M.
Water Struck At :
Standing Water Level : 1.58 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.00m | | | R11 | CR=66% RQD=54% |
| | | | | 8.65 |
| | | | R12 | CR=69% RQD=58% |
| | | | | 9.40 |
| | | | R13 | CR=72% RQD=69% |
| | | | | 10.15 |
| | | | R14 | CR=73% RQD=71% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | | 10.90 |
| | | | R15 | CR=73% RQD=36% |
| | | | | 11.65 |
| | | | R16 | CR=74% RQD=72% |
| | | | | 12.40 |
| | | | R17 | CR=72% RQD=60% |
| | | | | 13.15 |
| | | | R18 | CR=66% RQD=34% |
| | | | | 13.90 |
| | | | R19 | CR=75% RQD=68% |
| | | | | 14.50 |
| | | | R20 | CR=62% RQD=40% |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-18/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.19

Co-ordinates E=(-)641.000 N=1222.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 16/07/2018
Completion Date : 17/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.990 M.
Water Struck At :
Standing Water Level : 0.82 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Hard(N>50), reddish brown, clayey silt with decomposed rock fragments.(Cl) | | Refusal | DS-1 | 0.50 |
| 0.70m | | 100 | *SPT-1 | 0.70-0.73 |
| | | 3.0 cm Pentr. | | 0.70 |
| | | NX. drilling from 0.70m to 15.00m | R1 | CR=54%<br>RQD=13% |
| | | | | 1.45 |
| | | | R2 | CR=36%<br>RQD=NIL |
| | | | | 2.20 |
| | | | R3 | CR=40%<br>RQD=NIL |
| Highly / moderatey weathered, reddish brown, fine grained, fractured shale. | | | | 2.95 |
| | | | R4 | CR=47%<br>RQD=NIL |
| | | | | 3.70 |
| | | | R5 | CR=43%<br>RQD=NIL |
| | | | | 4.45 |
| | | | R6 | CR=48%<br>RQD=NIL |
| 5.20m | | | | 5.20 |
| | | | R7 | CR=60%<br>RQD=23% |
| | | | | 5.95 |
| | | | R8 | CR=67%<br>RQD=45% |
| Slightly weathered, reddish brown, fine grained, fractured shale. | | | | 6.70 |
| | | | R9 | CR=76%<br>RQD=39% |
| | | | | 7.45 |
| | | | R10 | CR=76%<br>RQD=NIL |
| 8.00m | | | | |

BH-19/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.19

Co-ordinates E=(-)641.000 N=1222.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 16/07/2018
Completion Date : 17/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.990 M.
Water Struck At :
Standing Water Level : 0.82 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.00m | | | | 8.20 |
| | | | R11 | CR=80% RQD=19% |
| | | | | 8.95 |
| | | | R12 | CR=76% RQD=51% |
| | | | | 9.70 |
| | | | R13 | CR=75% RQD=NIL |
| | | | | 10.45 |
| | | | R14 | CR=76% RQD=13% |
| | | | | 11.20 |
| Slightly weathered, reddish brown, fine grained, fractured shale. | | | R15 | CR=78% RQD=44% |
| | | | | 11.95 |
| | | | R16 | CR=67% RQD=24% |
| | | | | 12.70 |
| | | | R17 | CR=73% RQD=20% |
| | | | | 13.45 |
| | | | R18 | CR=78% RQD=24% |
| | | | | 14.20 |
| | | | R19 | CR=75% RQD=NIL |
| | | | | 14.60 |
| | | | R20 | CR=70% RQD=NIL |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-19/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.20

Co-ordinates E=(-)679.310 N=1181.384

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 25/06/2018
Completion Date : 25/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.299 M.
Water Struck At :
Standing Water Level : 2.80 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. Filled up soil consist of reddish brown, clayey silt with decomposed rock fragments. | | Refusal | DS-1 | 0.30 |
| 0.40m. Moderately weathered, reddish brown, fine grained, fractured shale. | | 100 2.0 cm Pentn. NX. drilling from 0.40m to 15.00m | *SPT-1 | 0.40-0.42 |
| | | | R1 | CR=44% RQD=NIL |
| 1.15m. | | | R2 | CR=61% RQD=13% |
| | | | R3 | CR=64% RQD=17% |
| | | | R4 | CR=62% RQD=NIL |
| | | | R5 | CR=66% RQD=30% |
| | | | R6 | CR=73% RQD=NIL |
| Slightly weathered, reddish brown, fine grained, fractured shale. | | | R7 | CR=73% RQD=26% |
| | | | R8 | CR=70% RQD=17% |
| | | | R9 | CR=74% RQD=24% |
| | | | R10 | CR=73% RQD=NIL |
| | | | R11 | CR=72% RQD=17% |
| 8.50m. | | | | |

0.40 1.15 1.90 2.65 3.40 4.15 4.90 5.65 6.40 7.15 7.90

BH-20/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.20

Co-ordinates E=(-)679.310 N=1181.384

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 25/06/2018
Completion Date : 25/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.299 M.
Water Struck At :
Standing Water Level : 2.80 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| | | | | 8.65 |
| Slightly weathered, reddish brown, fine grained, fractured shale. | | | R12 | CR=74% RQD=28% |
| 8.50m | | | | 9.40 |
| 9.40m | | | R13 | CR=84% RQD=54% |
| | | | | 10.15 |
| | | | R14 | CR=80% RQD=21% |
| Slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | | 10.90 |
| | | | R15 | CR=70% RQD=13% |
| | | | | 11.65 |
| | | | R16 | CR=82% RQD=20% |
| 12.40m | | | | 12.40 |
| | | | R17 | CR=74% RQD=25% |
| | | | | 13.15 |
| Slightly weathered to fresh, reddish brown, fine grained, fracture shale. | | | R18 | CR=77% RQD=58% |
| | | | | 13.90 |
| | | | R19 | CR=80% RQD=68% |
| | | | | 14.60 |
| | | | R20 | CR=87% RQD=32% |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-20/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.21

Co-ordinates E=(-)584.000 N=1229.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 1 |

Commencement Date : 01/07/2018
Completion Date : 02/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.420 M.
Water Struck At :
Standing Water Level : 1.25 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. Hard (N>50), reddish brown, clayey silt with decomposed rock fragments.(Cl) | | Refusal | DS-1 | 0.40 |
| 0.50m. | | 100 | *SPT-1 | 0.50-0.53 |
| | | 3.0 cm Pentn. | | 0.50 |
| | | NX. drilling from 0.50m to 20.00m | R1 | CR=69% RQD=15% |
| | | | WS-1 | 1.25 |
| | | | | 1.25 |
| | | | R2 | CR=76% RQD=NIL |
| | | | | 2.00 |
| | | | R3 | CR=75% RQD=27% |
| | | | | 2.75 |
| | | | R4 | CR=76% RQD=57% |
| | | | | 3.50 |
| | | | R5 | CR=83% RQD=57% |
| Slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | | 4.25 |
| | | | R6 | CR=76% RQD=54% |
| | | | | 5.00 |
| | | | R7 | CR=76% RQD=19% |
| | | | | 5.75 |
| | | | R8 | CR=77% RQD=57% |
| | | | | 6.50 |
| | | | R9 | CR=77% RQD=31% |
| | | | | 7.25 |
| | | | R10 | CR=75% RQD=27% |
| 8.00m. | | | | 8.00 |
| | | | R11 | CR=84% RQD=56% |
| | | | | 8.75 |
| Fresh, reddish brown, fine grained, fractured shale. | | | R12 | CR=84% RQD=61% |
| | | | | 9.50 |
| | | | R13 | CR=91% RQD=37% |
| | | | | 10.25 |
| 10.50m. | | | | |

BH-21/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.21

Co-ordinates E=(-)584.000 N=1229.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 1 |

Commencement Date : 01/07/2018
Completion Date : 02/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.420 M.
Water Struck At :
Standing Water Level : 1.25 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m. | | | R14 | CR=83% RQD=43% 11.00 |
| | | | R15 | CR=87% RQD=53% 11.75 |
| | | | R16 | CR=88% RQD=51% 12.50 |
| | | | R17 | CR=83% RQD=56% 13.25 |
| | | | R18 | CR=88% RQD=77% 14.00 |
| | | | R19 | CR=84% RQD=72% 14.75 |
| Fresh, reddish brown, fine grained, fractured shale. | | | R20 | CR=93% RQD=33% 15.50 |
| | | | R21 | CR=95% RQD=61% 16.25 |
| | | | R22 | CR=89% RQD=80% 17.00 |
| | | | R23 | CR=91% RQD=68% 17.75 |
| | | | R24 | CR=91% RQD=69% 18.50 |
| | | | R25 | CR=78% RQD=73% 19.25 |
| | | | R26 | CR=84% RQD=67% 20.00 |
| 20.00m. | | | | |

N.B. – '*' means sample could not be recovered.

BH-21/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.22

Co-ordinates E=(-)763.000 N=1162.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 01/07/2018
Completion Date : 02/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.400 M.
Water Struck At :
Standing Water Level : 1.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | Depth (m) |
|---|---|---|---|---|
| 0.00m. Filled up soil consist of reddish brown, clayey silt to silty clay with decomposed rock. | | | DS-1 | 0.50 |
| 0.60m. | | Refusal 100 2.0 cm Pentr. | *SPT-1 | 0.60-0.62 |
| | | NX. drilling from 0.60m to 15.00m | R1 | CR=26% RQD=NIL |
| | | | R2 | CR=32% RQD=NIL |
| | | | R3 | CR=36% RQD=NIL |
| | | | R4 | CR=29% RQD=NIL |
| Highly to modeartely weathered, reddish brown, fine grained, fractured shale. | | | R5 | CR=40% RQD=NIL |
| | | | R6 | CR=34% RQD=NIL |
| | | | R7 | CR=50% RQD=NIL |
| | | | R8 | CR=45% RQD=NIL |
| | | | R9 | CR=44% RQD=NIL |
| | | | R10 | CR=41% RQD=NIL |
| 8.50m. | | | R11 | CR=50% RQD=NIL |

0.60 1.25 2.00 2.75 3.50 4.25 5.00 5.75 6.50 7.25 8.00

BH-22/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.22

Co-ordinates E=(-)763.000 N=1162.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 01/07/2018
Completion Date : 02/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.400 M.
Water Struck At :
Standing Water Level : 1.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m<br>Highly to modeartely weathered, reddish brown, fine grained, fractured shale.<br>8.75m | | | | 8.75 |
| | | | R12 | CR=53%<br>RQD=16% |
| | | | | 9.50 |
| Modeartely weathered, reddish brown, fine grained, fractured shale. | | | R13 | CR=52%<br>RQD=15% |
| | | | | 10.25 |
| | | | R14 | CR=54%<br>RQD=19% |
| 11.00m | | | | 11.00 |
| | | | R15 | CR=48%<br>RQD=20% |
| | | | | 11.75 |
| Modeartely weathered, reddish brown, fine grained, fractured shale. | | | R16 | CR=40%<br>RQD=15% |
| | | | | 12.50 |
| | | | R17 | CR=45%<br>RQD=16% |
| | | | | 13.25 |
| | | | R18 | CR=47%<br>RQD=21% |
| 14.00m | | | | 14.00 |
| | | | R19 | CR=54%<br>RQD=NIL |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | | 14.50 |
| | | | R20 | CR=56%<br>RQD=52% |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-22/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |
|---|---|---|---|

# BORE LOG DATA SHEET

## BORE HOLE NO.23

Co-ordinates E=(-)678.000 N=1136.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 23/06/2018
Completion Date : 24/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.340 M.
Water Struck At :
Standing Water Level : 2.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Hard (N>50), reddish brown, clayey silt with decomposed rock fragments.(Cl)<br>0.40m | | Refusal<br>100<br>3.0 cm Pentn. | DS-1<br>*SPT-1 | 0.30<br>0.40-0.43 |
| | | NX, drilling from 0.40m to 20.00m | R1 | CR=52%<br>RQD=16% |
| | | | R2 | CR=61%<br>RQD=16% |
| | | | R3 | CR=60%<br>RQD=25% |
| | | | R4 | CR=64%<br>RQD=45% |
| | | | R5 | CR=73%<br>RQD=NIL |
| | | | R6 | CR=76%<br>RQD=44% |
| | | | R7 | CR=73%<br>RQD=52% |
| Moderately to slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | R8 | CR=72%<br>RQD=48% |
| | | | R9 | CR=73%<br>RQD=28% |
| | | | R10 | CR=76%<br>RQD=60% |
| | | | R11 | CR=74%<br>RQD=28% |
| | | | R12 | CR=72%<br>RQD=46% |
| | | | R13 | CR=74%<br>RQD=41% |
| 10.50m | | | R14 | CR=82%<br>RQD=70% |

0.40 1.15 1.90 2.65 3.40 4.15 4.90 5.65 6.40 7.15 7.90 8.65 9.40 10.15

BH-23/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.23

Co-ordinates E=(-)678.000 N=1136.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 23/06/2018
Completion Date : 24/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.340 M.
Water Struck At :
Standing Water Level : 2.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| | | | | 10.90 |
| Moderately to slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | R15 | CR=78% RQD=14% |
| | | | | 11.65 |
| Slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | R16 | CR=82% RQD=NIL |
| | | | | 12.40 |
| | | | R17 | CR=76% RQD=NIL |
| 13.15m | | | | 13.15 |
| | | | R18 | CR=88% RQD=84% |
| | | | | 13.90 |
| | | | R19 | CR=81% RQD=73% |
| | | | | 14.65 |
| Slightly weathered / fresh, reddish brown, fine grained, fractured shale. | | | R20 | CR=81% RQD=62% |
| | | | | 15.40 |
| | | | R21 | CR=84% RQD=24% |
| | | | | 16.15 |
| | | | R22 | CR=78% RQD=53% |
| 16.90m | | | | 16.90 |
| | | | R23 | CR=53% RQD=16% |
| | | | | 17.65 |
| | | | R24 | CR=50% RQD=NIL |
| Moderately weathered, light grey, fine grained, fractured shale. | | | | 18.40 |
| | | | R25 | CR=52% RQD=NIL |
| | | | | 19.15 |
| | | | R26 | CR=40% RQD=NIL |
| | | | | 19.60 |
| | | | R27 | CR=60% RQD=27% |
| 20.00m | | | | 20.00 |

N.B. – '*' means sample could not be recovered.

BH-23/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.24

Co-ordinates E=(-)616.000 N=1139.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 18/07/2018
Completion Date : 19/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.210 M.
Water Struck At :
Standing Water Level : 2.80 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. Filled up soil consist of brownish grey, concrete material. | | | DS-1 | 0.30 |
| 0.40m. | | Refusal 100 3.0 cm Pentn. | *SPT-1 | 0.40-0.43 |
| | | NX. drilling from 0.40m to 15.00m | R1 | CR=68% RQD=NIL |
| | | | R2 | CR=73% RQD=NIL |
| | | | R3 | CR=69% RQD=40% |
| | | | R4 | CR=75% RQD=32% |
| Slightly weathered to fresh, reddish brown, fine grained, fractured shale. | | | R5 | CR=78% RQD=35% |
| | | | R6 | CR=80% RQD=25% |
| | | | R7 | CR=88% RQD=60% |
| | | | R8 | CR=89% RQD=81% |
| | | | R9 | CR=80% RQD=38% |
| | | | R10 | CR=80% RQD=28% |
| | | | R11 | CR=83% RQD=42% |
| 8.50m. | | | | |

0.40 1.15 1.90 2.65 3.40 4.15 4.90 5.65 6.40 7.15 7.90

BH-24/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.24

Co-ordinates E=(-)616.000 N=1139.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 18/07/2018
Completion Date : 19/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.210 M.
Water Struck At :
Standing Water Level : 2.80 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m | | | | 8.65 |
| | | | R12 | CR=81% RQD=33% |
| | | | | 9.40 |
| | | | R13 | CR=81% RQD=NIL |
| | | | | 10.15 |
| | | | R14 | CR=80% RQD=24% |
| | | | | 10.90 |
| | | | R15 | CR=84% RQD=72% |
| Slightly weathered to fresh, reddish brown, fine grained, fractured shale. | | | | 11.65 |
| | | | R16 | CR=83% RQD=39% |
| | | | | 12.40 |
| | | | R17 | CR=84% RQD=49% |
| | | | | 13.15 |
| | | | R18 | CR=86% RQD=57% |
| | | | | 13.90 |
| | | | R19 | CR=89% RQD=51% |
| | | | | 14.65 |
| | | | R20 | CR=85% RQD=49% |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-24/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.25

Co-ordinates E=(-)710.000 N=1112.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 03/07/2018
Completion Date : 04/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.030 M.
Water Struck At :
Standing Water Level : 2.50 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up soil consist of reddish brown, clayey silt to silty clay with decomposed rock fragments. | | | DS-1 | 0.40 |
| 0.50m | | Refusal<br>100<br>2.0 cm Pentr. | *SPT-1 | 0.50-0.52 |
| | | NX. drilling from 0.50m to 15.00m | R1 | CR=34%<br>RQD=NIL |
| | | | R2 | CR=40%<br>RQD=NIL |
| | | | R3 | CR=60%<br>RQD=NIL |
| Highly to moderately weathered, reddish brown, fine grained, fractured shale. | | | R4 | CR=41%<br>RQD=NIL |
| | | | R5 | CR=48%<br>RQD=NIL |
| | | | R6 | CR=47%<br>RQD=NIL |
| | | | R7 | CR=44%<br>RQD=NIL |
| | | | R8 | CR=48%<br>RQD=29% |
| 6.50m | | | R9 | CR=53%<br>RQD=30% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R10 | CR=68%<br>RQD=64% |
| 8.50m | | | R11 | CR=61%<br>RQD=18% |

0.50 1.25 2.00 2.75 3.50 4.25 5.00 5.75 6.50 7.25 8.00

BH-25/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.25

Co-ordinates E=(-)710.000 N=1112.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 03/07/2018
Completion Date : 04/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.030 M.
Water Struck At :
Standing Water Level : 2.50 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| | | | | 8.75 |
| | | | R12 | CR=64% RQD=44% |
| | | | | 9.50 |
| | | | R13 | CR=62% RQD=35% |
| | | | | 10.25 |
| | | | R14 | CR=61% RQD=50% |
| | | | | 11.00 |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R15 | CR=62% RQD=53% |
| | | | | 11.75 |
| | | | R16 | CR=63% RQD=52% |
| | | | | 12.50 |
| | | | R17 | CR=64% RQD=48% |
| | | | | 13.25 |
| | | | R18 | CR=62% RQD=57% |
| 14.00m | | | | 14.00 |
| Highly weathered, reddish brown, fine grained, fractured shale. | | | R19 | CR=36% RQD=26% |
| | | | | 14.50 |
| | | | R20 | CR=38% RQD=36% |
| 15.00m | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-25/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.26

Co-ordinates E=(-)563.000 N=1151.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 19/07/2018
Completion Date : 20/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.440 M.
Water Struck At :
Standing Water Level : 3.20 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up with brownish grey, concrete material. | | | | |
| | | Refusal | DS-1 | 0.50 |
| 0.70m | | 100 | *SPT-1 | 0.70-0.72 |
| | | 2.0 cm Pentm. | | 0.70 |
| | | NX. drilling from 0.70m to 15.00m | R1 | CR=65% RQD=NIL |
| | | | | 1.45 |
| | | | R2 | CR=69% RQD=36% |
| | | | | 2.20 |
| | | | R3 | CR=66% RQD=NIL |
| | | | | 2.95 |
| | | | R4 | CR=78% RQD=32% |
| | | | | 3.70 |
| | | | R5 | CR=82% RQD=17% |
| Moderately / slightly weathered, reddish brown, fine grained, fractured shale. | | | | 4.45 |
| | | | R6 | CR=86% RQD=30% |
| | | | | 5.20 |
| | | | R7 | CR=75% RQD=56% |
| | | | | 5.95 |
| | | | R8 | CR=78% RQD=20% |
| | | | | 6.70 |
| | | | R9 | CR=80% RQD=NIL |
| | | | | 7.45 |
| | | | R10 | CR=76% RQD=NIL |
| | | | | 8.20 |
| 8.50m | | | | |

BH-26/Sheet-1

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO.26

Co-ordinates E=(-)563.000 N=1151.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 19/07/2018
Completion Date : 20/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.440 M.
Water Struck At :
Standing Water Level : 3.20 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m | | | R11 | CR=77% RQD=22% 8.95 |
| | | | R12 | CR=80% RQD=64% 9.70 |
| | | | R13 | CR=80% RQD=NIL 10.45 |
| | | | R14 | CR=62% RQD=21% 11.20 |
| Moderately / slightly weathered, reddish brown, fine grained, fractured shale. | | | R15 | CR=57% RQD=NIL 11.95 |
| | | | R16 | CR=52% RQD=NIL 12.70 |
| | | | R17 | CR=73% RQD=NIL 13.45 |
| | | | R18 | CR=76% RQD=13% 14.20 |
| | | | R19 | CR=77% RQD=NIL 14.60 |
| | | | R20 | CR=80% RQD=NIL 15.00 |
| 15.00m | | | | |

N.B. – '*' means sample could not be recovered.

BH-26/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.27

Co-ordinates E=(-)815.000 N=1104.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 29/06/2018
Completion Date : 30/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.440 M.
Water Struck At :
Standing Water Level : 2.30 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Filled up soil consist of reddish brown, fine grained, clayey silt to silty clay with decomposed rock fragments. | | | DS-1 | 0.50 |
| 0.90m | | Refusal<br>100 | *SPT-1 | 0.90-0.92 |
| Highly weathered, reddish brown, fine grained, fractured shale. | | 2.0 cm Pentn.<br>NX. drilling from 0.90m to 20.00m | R1 | CR=21%<br>RQD=NIL |
| | | | R2 | CR=23%<br>RQD=NIL |
| 2.25m | | | R3 | CR=41%<br>RQD=NIL |
| Modeartely weathered, reddish brown, fine grained, fractured shale. | | | R4 | CR=45%<br>RQD=NIL |
| | | | R5 | CR=48%<br>RQD=NIL |
| | | | R6 | CR=41%<br>RQD=NIL |
| | | | R7 | CR=47%<br>RQD=NIL |
| 6.00m | | | R8 | CR=53%<br>RQD=NIL |
| | | | R9 | CR=58%<br>RQD=NIL |
| Moderately / slightly weathered, reddish brown, fine grained fractured shale. | | | R10 | CR=60%<br>RQD=NIL |
| | | | R11 | CR=61%<br>RQD=16% |
| | | | R12 | CR=62%<br>RQD=NIL |
| | | | R13 | CR=61%<br>RQD=37% |
| 10.50m | | | | |

0.90 1.50 2.25 3.00 3.75 4.50 5.25 6.00 6.75 7.50 8.25 9.00 9.75 10.50

BH-27/Sheet-1

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO.27

Co-ordinates E=(-)815.000 N=1104.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 29/06/2018
Completion Date : 30/06/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.440 M.
Water Struck At :
Standing Water Level : 2.30 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| | 10.50m | | R14 | CR=65% RQD=53% 11.25 |
| | | | R15 | CR=58% RQD=54% 12.00 |
| | | | R16 | CR=60% RQD=49% 12.75 |
| Moderately / slightly weathered, reddish brown, fine grained fractured shale. | | | R17 | CR=65% RQD=54% 13.50 |
| | | | R18 | CR=53% RQD=NIL 14.25 |
| | | | R19 | CR=52% RQD=37% 15.00 |
| | | | R20 | CR=48% RQD=42% 15.75 |
| | 15.75m | | R21 | CR=61% RQD=30% 16.50 |
| | | | R22 | CR=56% RQD=53% 17.25 |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | R23 | CR=60% RQD=40% 18.00 |
| | | | R24 | CR=57% RQD=38% 18.75 |
| | | | R25 | CR=60% RQD=33% 19.50 |
| | 19.50m | | R26 | CR=42% RQD=NIL 20.00 |
| Moderately weathered, reddish brown, fine grained, fractured shale. | 20.00m | | | |

N.B. – '*' means sample could not be recovered.

BH-27/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 13/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.28

Co-ordinates E=(-)879.000 N=1167.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 06/08/2018
Completion Date : 06/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.482 M.
Water Struck At :
Standing Water Level : 2.20 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m | | | | |
| Filled up soil consists of reddish brown, clayey silt to silty clay with decomposed rock fragments. | | | DS-1 | 0.50 |
| | | | DS-2 | 1.00 |
| | | Refusal 100 4.0 cm Pentm. | *SPT-1 | 1.50-1.54 |
| 1.70m | | Refusal 100 2.0 cm Pentm. | *SPT-2 | 1.70-1.72 |
| Highly weathered, reddish brown, fine grained, fractured shale. | | NX. drilling from 1.70m to 14.20m | R1 | CR=23% RQD=NIL 1.70 - 2.45 |
| | | | R2 | CR=21% RQD=NIL 2.45 - 3.20 |
| | | | R3 | CR=23% RQD=NIL 3.20 - 3.95 |
| | | | R4 | CR=25% RQD=NIL 3.95 - 4.70 |
| | | | R5 | CR=26% RQD=NIL 4.70 - 5.45 |
| | | | R6 | CR=24% RQD=NIL 5.45 - 6.20 |
| 6.20m | | | | |
| Highly weathered, reddish brown, fine grained, fractured shale. | | | R7 | CR=28% RQD=NIL 6.20 - 6.95 |
| | | | R8 | CR=35% RQD=NIL 6.95 - 7.70 |
| 8.00m | | | | |

BH-28/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 13/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.28

Co-ordinates E=(-)879.000 N=1167.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 2 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 2 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 06/08/2018
Completion Date : 06/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.482 M.
Water Struck At :
Standing Water Level : 2.20 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.00m | | | R9 | CR=25% RQD=NIL |
| | | | | 8.45 |
| Highly weathered, reddish brown, fine grained, fractured shale. | | | R10 | CR=38% RQD=NIL |
| 9.20m | | | | 9.20 |
| | | | R11 | CR=65% RQD=61% |
| | | | | 9.95 |
| | | | R12 | CR=62% RQD=58% |
| | | | | 10.70 |
| | | | R13 | CR=58% RQD=56% |
| Moderately / slightly weathered, reddish brown, fine grained, fractured shale. | | | | 11.45 |
| | | | R14 | CR=56% RQD=51% |
| | | | | 12.20 |
| | | | R15 | CR=56% RQD=53% |
| | | | | 12.95 |
| | | | R16 | CR=67% RQD=64% |
| | | | | 13.70 |
| | | | R17 | CR=64% RQD=54% |
| 14.20m | | | | 14.20 |

N.B. – '*' means sample could not be recovered.

BH-28/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.29

Co-ordinates E=(-)495.000 N=1141.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 0 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 0 |
| Vane (V) | | Disturbed (DS) | 0 |
| | | Water Sample (WS) | 0 |

Commencement Date : 18/07/2018
Completion Date : 19/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.244 M.
Water Struck At :
Standing Water Level : 3.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. | | NX. drilling from 0.00m to 20.00m | | 0.00 |
| | | | R1 CR=38% RQD=NIL | 0.75 |
| | | | R2 CR=40% RQD=NIL | 1.50 |
| | | | R3 CR=42% RQD=NIL | 2.25 |
| | | | R4 CR=45% RQD=NIL | 3.00 |
| Highly / moderately weathered, reddish brown, fine grained, highly fractured shale. | | | R5 CR=40% RQD=NIL | 3.75 |
| | | | R6 CR=39% RQD=NIL | 4.50 |
| | | | R7 CR=40% RQD=20% | 5.25 |
| | | | R8 CR=38% RQD=20% | 6.00 |
| 6.00m. | | | R9 CR=42% RQD=14% | 6.75 |
| | | | R10 CR=40% RQD=NIL | 7.50 |
| | | | R11 CR=44% RQD=NIL | 8.25 |
| Highly / moderately weathered, reddish brown, fine grained, moderately fractured shale. | | | R12 CR=42% RQD=NIL | 9.00 |
| | | | R13 CR=40% RQD=NIL | 9.75 |
| | | | R14 CR=36% RQD=NIL | 10.50 |
| 10.50m. | | | | |

BH-29/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.29

Co-ordinates E=(-)495.000 N=1141.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 0 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 0 |
| Vane (V) | | Disturbed (DS) | 0 |
| | | Water Sample (WS) | 0 |

Commencement Date : 18/07/2018
Completion Date : 19/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.244 M.
Water Struck At :
Standing Water Level : 3.40 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 10.50m | | | | |
| | | | R15 | CR=35% RQD=NIL |
| | | | | 11.25 |
| | | | R16 | CR=40% RQD=13% |
| | | | | 12.00 |
| | | | R17 | CR=40% RQD=30% |
| | | | | 12.75 |
| | | | R18 | CR=38% RQD=13% |
| | | | | 13.50 |
| | | | R19 | CR=42% RQD=20% |
| Highly / moderately weathered, reddish brown, fine grained, moderately fractured shale. | | | | 14.25 |
| | | | R20 | CR=40% RQD=24% |
| | | | | 15.00 |
| | | | R21 | CR=42% RQD=28% |
| | | | | 15.75 |
| | | | R22 | CR=39% RQD=36% |
| | | | | 16.50 |
| | | | R23 | CR=40% RQD=38% |
| | | | | 17.25 |
| | | | R24 | CR=44% RQD=18% |
| 18.00m | | | | 18.00 |
| | | | R25 | CR=56% RQD=52% |
| | | | | 18.75 |
| Moderately weathered, reddish brown, fine grained, moderately fractured shale. | | | R26 | CR=60% RQD=54% |
| | | | | 19.50 |
| | | | R27 | CR=60% RQD=58% |
| 20.00m | | | | 20.00 |

BH-29/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.30

Co-ordinates E=(-)501.000 N=1322.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 24/07/2018
Completion Date : 25/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.050 M.
Water Struck At :
Standing Water Level : 2.65 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m<br>Hard(N>50), redish brown, clayey silt with disintegrated rock fragments.(Cl)<br>0.60m | | Refusal<br>100<br>3.0 cm Pentr. | DS-1<br>*SPT-1 | 0.50<br>0.60-0.63 |
| | | NX. drilling from 0.60m to 15.00m | R1 | CR=51%<br>RQD=26% |
| | | | R2 | CR=64%<br>RQD=25% |
| | | | R3 | CR=62%<br>RQD=33% |
| Moderately to slightly weathered / fresh, reddish to greyish brown, fine grained, fractured shale. | | | R4 | CR=81%<br>RQD=77% |
| | | | R5 | CR=93%<br>RQD=76% |
| | | | R6 | CR=88%<br>RQD=48% |
| | | | R7 | CR=84%<br>RQD=64% |
| | | | R8 | CR=80%<br>RQD=77% |
| | | | R9 | CR=81%<br>RQD=24% |
| | | | R10 | CR=80%<br>RQD=NIL |
| 8.00m | | | | |

0.60 1.35 2.10 2.85 3.60 4.35 5.10 5.85 6.60 7.35

BH-30/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 01/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.30

Co-ordinates E=(-)501.000 N=1322.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 1 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 1 |
| Vane (V) | | Disturbed (DS) | 1 |
| | | Water Sample (WS) | 0 |

Commencement Date : 24/07/2018
Completion Date : 25/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 284.050 M.
Water Struck At :
Standing Water Level : 2.65 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| | | | | 8.10 |
| Moderately to slightly weathered / fresh, reddish to greyish brown, fine grained, fractured shale. | 8.00m / 8.10m | | R11 | CR=80% RQD=48% |
| | | | | 8.85 |
| | | | R12 | CR=72% RQD=61% |
| | | | | 9.60 |
| | | | R13 | CR=65% RQD=37% |
| | | | | 10.35 |
| | | | R14 | CR=76% RQD=37% |
| | | | | 11.10 |
| | | | R15 | CR=80% RQD=69% |
| Slightly weathered, reddish brown, fine grained, fractured shale. | | | | 11.85 |
| | | | R16 | CR=70% RQD=49% |
| | | | | 12.60 |
| | | | R17 | CR=78% RQD=20% |
| | | | | 13.35 |
| | | | R18 | CR=73% RQD=42% |
| | | | | 14.10 |
| | | | R19 | CR=70% RQD=60% |
| | | | | 14.60 |
| | | | R20 | CR=65% RQD=42% |
| | 15.00m | | | 15.00 |

N.B. – '*' means sample could not be recovered.

BH-30/Sheet-2

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.31

Co-ordinates E=(-)864.000 N=1342.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 4 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 4 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 10/07/2018
Completion Date : 12/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.474 M.
Water Struck At :
Standing Water Level : 3.10 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. | | | | |
| Filled up soil consists of reddish brown, silty clay to clayey silt with decomposed rock fragments. | | 9 13 14 (27) | DS-1 | 0.50 |
| | | | SPT-1 | 1.00-1.45 |
| 1.50m. | | | DS-2 | 2.00 |
| Hard(N>50), reddish brown, silty clay to clayey silt with disintegrated rock fragments.(Cl) | | 28 72 (>100) 8 cm Pentn. | SPT-2 | 2.50-2.73 |
| | | 100 Refusal 3.0 cm Pentn. | *SPT-3 | 3.00-3.03 |
| 3.10m. | | 100 Refusal 2.0 cm Pentn. | *SPT-4 | 3.10-3.12 |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | NX. drilling from 3.10m to 15.00m | R1 | CR=41% RQD=NIL |
| 3.75m. | | | R2 | CR=58% RQD=38% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | R3 | CR=64% RQD=49% |
| | | | R4 | CR=70% RQD=53% |
| | | | R5 | CR=65% RQD=46% |
| | | | R6 | CR=66% RQD=50% |
| | | | R7 | CR=73% RQD=32% |
| 8.50m. | | | | |

3.10
3.75
4.50
5.25
6.00
6.75
7.50
8.25

BH-31/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.31

Co-ordinates E=(-)864.000 N=1342.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 4 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 4 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 10/07/2018
Completion Date : 12/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.474 M.
Water Struck At :
Standing Water Level : 3.10 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m. | | | R8 | CR=68% RQD=62% |
| | | | | 9.00 |
| | | | R9 | CR=65% RQD=49% |
| Moderately to slightly weathered, reddish brown, fine grained, fractured shale. | | | | 9.75 |
| | | | R10 | CR=75% RQD=62% |
| | | | | 10.50 |
| | | | R11 | CR=61% RQD=40% |
| 11.25m. | | | | 11.25 |
| | | | R12 | CR=45% RQD=14% |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | | 12.00 |
| | | | R13 | CR=42% RQD=NIL |
| 12.75m. | | | | 12.75 |
| | | | R14 | CR=66% RQD=64% |
| Slightly weathered, reddish brown, fine grained, fractured shale. | | | | 13.50 |
| | | | R15 | CR=70% RQD=39% |
| 14.25m. | | | | 14.25 |
| | | | R16 | CR=48% RQD=46% |
| Moderately weathered, reddish brown, fine grained, fractured shale. | | | | |
| 15.00m. | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO.32

Co-ordinates E=(-)1030.000 N=1287.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 5 | Undisturbed (UDS) | 1 |
| Cone (Pc) | | Penetrometer (SPT) | 5 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/07/2018
Completion Date : 15/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.300 M.
Water Struck At :
Standing Water Level : 3.00 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. | | | | |
| | | | DS-1 | 0.50 |
| Filled up soil consists of reddish brown, clayey silt to silty clay with road material. | | 10 16 21 (37) | SPT-1 | 1.00-1.45 |
| | | | *UDS-1 | 2.00-2.45 |
| 2.50m. | | | | |
| | | | DS-2 | 3.00 |
| Hard, reddish brown, silty clay / clayey silt with decomposed rock fragments.(CI) | | 8 19 25 (44) | SPT-2 | 3.00-3.45 |
| | | | | |
| 4.05m. | | 13 31 56 (81) | SPT-3 | 4.05-4.45 |
| Hard(N>50), reddish brown, silty clay/clayey silt with decomposed rock fragments.(CI) | | 10 cm Pentn. 100 Refusal 3.0 cm Pentn. | *SPT-4 | 4.60-4.63 |
| 4.70m. | | 100 Refusal 2.0 cm Pentn. | *SPT-5 | 4.70-4.72 |
| | | NX. drilling from 4.70m to 15.00m | R1 | CR=28% RQD=19% 4.70 |
| | | | | 5.25 |
| | | | R2 | CR=51% RQD=NIL |
| | | | | 6.00 |
| | | | R3 | CR=44% RQD=NIL |
| Highly to moderatrely weathered, reddish brown, fine grained, fractured shale. | | | | 6.75 |
| | | | R4 | CR=57% RQD=26% |
| | | | | 7.50 |
| | | | R5 | CR=50% RQD=46% |
| | | | | 8.25 |
| 8.50m. | | | | |

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 24/07/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO. 32

Co-ordinates E=(-)1030.000 N=1287.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 5 | Undisturbed (UDS) | 1 |
| Cone (Pc) | | Penetrometer (SPT) | 5 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 14/07/2018
Completion Date : 15/07/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.300 M.
Water Struck At :
Standing Water Level : 3.00 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m. | | | | |
| Highly to moderatrely weathered, reddish brown, fine grained, fractured shale. | | | R6 | CR=54% RQD=45% |
| | | | | 9.00 |
| | | | R7 | CR=48% RQD=36% |
| 9.75m. | | | | 9.75 |
| | | | R8 | CR=60% RQD=26% |
| | | | | 10.50 |
| | | | R9 | CR=57% RQD=52% |
| | | | | 11.25 |
| Moderatrely weathered, reddish brown, fine grained, fractured shale. | | | R10 | CR=57% RQD=14% |
| | | | | 12.00 |
| | | | R11 | CR=60% RQD=26% |
| | | | | 12.75 |
| | | | R12 | CR=59% RQD=34% |
| | | | | 13.50 |
| | | | R13 | CR=59% RQD=49% |
| | | | | 14.25 |
| | | | R14 | CR=53% RQD=46% |
| 15.00m. | | | | 15.00 |

N.B. – '*' means sample could not be recovered.

| Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. | | | CETEST |
|---|---|---|---|
| Job No : 4157 | Created by : T.SAHA | Created on : 13/08/2018 | Sheet No: |

# BORE LOG DATA SHEET

## BORE HOLE NO.33

Co-ordinates E=(-)1106.000 N=1164.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 3 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 3 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 03/08/2018
Completion Date : 04/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.300 M.
Water Struck At :
Standing Water Level : 2.70 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 0.00m. | | | | |
| Very dense, reddish brown, silty sand with decomposed rock fragments.(SM) | | | DS-1 | 0.50 |
| | | | DS-2 | 1.00 |
| | | 12 20 32 52 | SPT-1 | 1.50-1.95 |
| | | 100 Refusal 4.0 cm Pentn. | *SPT-2 | 2.20-2.24 |
| 2.50m. | | 100 Refusal 2.0 cm Pentn. | *SPT-3 | 2.50-2.52 |
| Highly weathered, reddish brown, fine grained, fractured shale. | | NX. drilling from 2.50m to 15.00m | R1 | CR=24% RQD=NIL |
| 3.25m. | | | | 3.25 |
| | | | R2 | CR=28% RQD=NIL |
| | | | | 4.00 |
| | | | R3 | CR=28% RQD=NIL |
| | | | | 4.75 |
| | | | R4 | CR=26% RQD=NIL |
| Highly weathered, reddish brown, fine grained, fractured shale. | | | | 5.50 |
| | | | R5 | CR=30% RQD=NIL |
| | | | | 6.25 |
| | | | R6 | CR=36% RQD=NIL |
| | | | | 7.00 |
| | | | R7 | CR=32% RQD=NIL |
| | | | | 7.75 |
| | | | R8 | CR=35% RQD=NIL |
| 8.50m. | | | | 8.50 |

BH-33/Sheet-1

Project : Geotechnical Inv. Work for 1x800MW Sipat STPP at Sipat, Chhattisgarh. CETEST

Job No : 4157 | Created by : T.SAHA | Created on : 13/08/2018 | Sheet No:

# BORE LOG DATA SHEET

## BORE HOLE NO.33

Co-ordinates E=(-)1106.000 N=1164.000

| Field Test | Nos | Samples | Nos |
|---|---|---|---|
| Penetrometer (SPT) | 3 | Undisturbed (UDS) | 0 |
| Cone (Pc) | | Penetrometer (SPT) | 3 |
| Vane (V) | | Disturbed (DS) | 2 |
| | | Water Sample (WS) | 0 |

Commencement Date : 03/08/2018
Completion Date : 04/08/2018
Bore Hole Diameter : 150 mm./ N.X
Level Of Ground : 282.300 M.
Water Struck At :
Standing Water Level : 2.70 m.

| DESCRIPTION | SYMBOL | N-VALUE EACH DIVN=15CM | SAMPLES Ref. No | SAMPLES Depth (m) |
|---|---|---|---|---|
| 8.50m. | | | | |
| | | | R9 | CR=40% RQD=NIL |
| | | | | 9.25 |
| | | | R10 | CR=32% RQD=NIL |
| Highly weathered, reddish brown, fine grained, fractured shale. | | | | 10.00 |
| | | | R11 | CR=36% RQD=NIL |
| | | | | 10.75 |
| | | | R12 | CR=29% RQD=NIL |
| 11.50m. | | | | 11.50 |
| | | | R13 | CR=36% RQD=NIL |
| | | | | 12.25 |
| | | | R14 | CR=38% RQD=NIL |
| | | | | 13.00 |
| Highly weathered, light grey, fine grained, fractured shale. | | | R15 | CR=40% RQD=NIL |
| | | | | 13.75 |
| | | | R16 | CR=40% RQD=13% |
| | | | | 14.50 |
| | | | R17 | CR=40% RQD=26% |
| 15.00m. | | | | 15.00 |

N.B. – '*' means sample could not be recovered.