BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT INDUSTRY SECTOR, NOIDA (U.P.).

DOCUMENT No.	**TB-427-607-003-PKG-1**	**Rev-0**	Prepared	Checked	Approved
TYPE OF DOC.	**BILL OF QUANTITY**	NAME	**PNK**	**PNK**	**PLK**
TITLE **CIVIL WORKS FOR PRE -CAST RCC BOUNDARY WALL, LABOUR HUT, SECURITY HUT & SWITCHYARD PANEL ROOMS (SPR) AT VATAMAN IN GUJARAT**		SIGN			
		DATE			
		GROUP	**TBEM**	**W.O. No.**	
CUSTOMER	POWERGEID CORPORATION OF INDIA LTD.				
PROJECT	765/400/220 kV SUBSTATION AT VATAMAN (NEW) IN GUJARAT				

CONTENTS

Rev No.	Date	Altered	Checked	Approved	
02	05.06.25	PNK	PNK	PLK	**Revised in line with approved estimate (rev-02) dt 02.06.25**

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SECTION - 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & QUANTITIES

1.1.0 SCOPE

1.1.1 The scope of work under this specification is Civil Works of 765kV Yard of 765/400/220kV Vataman (New) Sub-station at Vataman in Gujarat being executed by BHEL on turnkey basis. The Customer is Powergrid Corporation of India Limited.

1.1.2 The Civil Works of 765kV Yard shall generally include construction of the , *but not limited to*, followings:

(i) Pre Fab RCC Boundary wall.
(ii) Labour Hut
(iii) Security Hut
(iv) Main Entrance gate
(v) Switchyard Panel rooms
(vi) Any other works required for the project

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

1.1.3 The Contractor shall execute the work as per the Latest Field quality Plan (FQP) which is available on POWERGRID website. Sample copy of Powergrid Field Quality Plan is attached as a part of tender. However, Latest Field Quality Plan (FQP) is to be followed during construction. All testing requirements as per FQP shall be arranged by contractor at his Own Cost.

1.1.4 The bidder shall fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon patterns, local conditions and site-specific parameters, soil parameters, availability of

construction water & material and shall include for all such conditions and contingent measures in the bid, including those which may not have specifically brought out in the specifications.

1.1.5 The material specification, workmanship and acceptance criteria shall be as per approved Standard Field quality Plan. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification/ relevant BIS.

1.1.6 All tender drawings shall be read in conjunction with this customer technical specification. Discrepancy if any shall be brought to the notice of BHEL prior to quote.

1.1.7 All foundation drawings including foundations for pre-cast boundary wall, switchyard panel room, security hut, Labour hut, Main entrance gate etc. shall be released to the sucesfulful bidder after award of the work.

1.2.0 SPECIFIC TECHNICAL REQUIREMENT

1.2.1 The specific technical requirements for the execution of civil works shall be as per Customer's technical specification / I.S. Codes/ CPWD Specification. In case of any conflict between these Customer's technical specification shall prevail.

1.3.0 BILL OF QUANTITIES

1.3.1 The Bill of Quantity shall be as per page 1.6 to page 1.8.

1.3.2 The quantities indicated in the 'Bill of Quantity' are indicative and can vary to any extent. Contractor shall not be entitled for any claim for any such variation in the quantities.

1.3.3 The provision of Bill of Quantity, specifications and drawings shall be read in conjunction with each other and in case of conflict amongst them, the clarification shall be obtained from the Engineer-in-charge whose decision shall be final and binding.

1.4.0 METHOD OF MEASURMENT:

1.4.1 EARTHWORK

Excavation shall be measured in cubic meters. The lateral dimensions to be considered for working out excavation quantity shall be the PCC dimension below the footing as per approved drawing. Nothing extra shall be paid for slope cutting, etc. Backfilling & disposal quantities shall be worked out based on the above dimensions only. However the contractor shall maintain the required slope and working space as per the safety /statutory requirement and its cost is deemed to be included in the quoted rate.

Where rock and soil are mixed, the measurement of the excavation shall be made as per PCC dimensions. The rock shall be stacked and measured in stack. The net quantity of the rock shall be arrived at by applying deduction of 50% to allow for voids in stacks.

Where soil, soft rock (ordinary rock), & hard rock are mixed, the measurement of the excavation shall be made as per PCC dimensions. Excavated materials comprising of the soft rock (ordinary rock) and hard rock shall be stacked separately, measured in stacks, and each reduced by 50% to allow for voids to arrive at the quantity payable under soft rock (ordinary rock) and hard rock .

In no case, the sum of net quantities shall exceed the total quantity of the excavated materials.

Clause No. 2.1.0 of CPWD Specification Volume-I shall be followed for classification of soils

1.4.2 **SECURITY HUT**:

The drawing pertaining to Security including septic tank & soak pit is attached as a part of tender drawings. The scope includes all civil works with all materials, labour required to complete the building in all respect as per drawing/customer specification. For security room the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection, door, windows etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rate. Mode of measurement of this item is in SQM of plinth area as per BOQ.However the items such as earthwork (Excavation, backfilling & disposal), shuttering, PCC, RCC, reinforcement and Structural steel shall be paid separately as per respective BOQ items.

1.4.3 **LABOUR HUT**:

The scope includes supply, fabrication & erection of all structural works, civil works with all materials, labour required to complete the building in all respect.

a) Drawings pertaining to Labour hut are attached as a part of tender drawings.

b) Cement concrete flooring 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate) finished with a floating coat of neat cement, including cement slurry shall be done over 100 MM thk. PCC (1:4:8).

c) Exterior wall: Pre-Engineered galvanized iron 0.5mm thick both side sandwich panels with 75mm thick thermocole /glass wool insulation of density 12 Kg/m3, shall be painted with weatherproof texture paint from outside and inside oil bond distemper.

d)Internal wall partition: Light gauge steel structure using 50mm galvanized sections both vertically and horizontally at a gap of 600mm. 8 mm cement fibre board both sides and 50mm glass wool insulation and joints concealed with polymer based putty and exterior side weatherproof plastic emulsion paint.

e) Roofing: 0.50mm Thk GI Trapezoidal profile sheet with 8mm polynum insulation (64 cum /Kg)

f) False ceiling: 8mm thick PVC profile section with interlocking arrangement held on MS pipe framework with grid of 1200 x 1200mm.

g) Door: 32 mm thick Waterproof wooden flush door with SS Hinges and locking arrangements and painted with synthetic enamel paint.

h) Window: MS tubular frame with clear float glass with locking arrangements.

i) 02 nos septic tank & soak-pit of sizes 10'x 8' x 8 ft and 8'x8'x8'ft respectively and suitable numbers of inspection chamber 600mm x600mm.

j) PVC Water tank of 2x 5000 Ltr (for every approx. 420 Sqm of Hut) on MS stand of suitable height to give sufficient water head & PVC pipeline.

k) Indian type WC pan & wash basin @ 1 set of bath & toilet per 10 labour. The toilet and bath shall be separate.

l) All plumbing fixtures such as tapes, showers etc shall be CP as per CPWD Specification.

m) Labour Hut is to be kept cleaned and well maintained (including repair work) till completion of the work at site under the contract without any additional financial implication to BHEL.

Mode of measurement of this item is in SQM of plinth area as per BOQ.However the items such as earthwork (Excavation, backfilling & disposal), shuttering, PCC, RCC & reinforcement steel shall be paid separately as per respective BOQ items.

1.4.4 SWITCHYARD RELAY PANEL ROOM (SPR):

The drawings pertaining to Switchyard Panel Room (SPR) are attached as a part of tender drawings. The scope includes all civil works with all materials, labour required to complete the building in all respect as per drawing/customer specification .For SPRs, the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection, door, windows etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rate. Mode of measurement of this item is in SQM of plinth area as per BOQ.However the items such as earthwork (Excavation, backfilling & disposal), Shuttering, PCC, RCC, reinforcement and Structural steel shall be paid separately as per respective BOQ items.

1.4.5 **PRE CAST BOUNDARY WALL**:

The drawings pertaining to pre-cast boundary wall is attached as a part of tender drawings. The scope includes all civil works with all materials, labour required to complete the boundary wall in all respect as per drawing/customer specification. The items such as earthwork (Excavation, backfilling & disposal), PCC, RCC, Reinforcement, Misc. Structural steel, concertina coil and all other civil works required as per technical specification and drawings for successful completion of the works are payable as per respective BOQ items.

1.4.6 **MAIN ENTRANCE GATE**:

The drawings pertaining to main entrance gate is attached as a part of tender drawings. The scope includes all civil works with all materials, labour required to complete the main entrance gate in all respect as per drawing/customer specification. The items such as earthwork (Excavation, backfilling & disposal), PCC, RCC, Reinforcement, Misc. Structural steel and all other civil works required as per technical specification and drawings for successful completion of the works are payable as per respective BOQ items.

1.4.7 For other items, unless otherwise described the method of measurement as described in 'Method of Measurement of Building and Civil Engineering Works'-IS 1200(Part I to XXV) latest edition of BIS shall be followed.

1.4.8 Customer technical specification Clause No. 20.1 TO 20.27 under head 20.0 "MODE OF MEASURMENT" for mode of measurement of civil works shall not be applicable in this contract."

BOQ CUM PRICE SCHEDULE

/ Sub-Station Vataman(New) Gujarat

Name of Work:Civil Works for Pre -cast RCC Boundary wall,Labour Hut,Security Hut & Switchyard panel rooms (SPR) at Vataman in Gujarat.

S. No.	Description of Item	Quantity	Unit	Unit Rate (Rs) Ecluding GST	Amount (Rs) Excluding GST
1	Earthwork in excavation by Mechanical Means (Hydraulic Excavator)/Manul Means including dewatering as necessary of rain water/subsoil seepage water and disposal of excavated earth upto 100m and lift upto 3.5m, disposed earth to be levelled and neatly dressed:All kinds of soil.	800	CUM	125.95	100760.00
2	Boring of 600mm Dia and required length for fixing of Pre-Fab RCC Column in line, level and verticality as per approved drawing & direction of Engineer-In-Charge etc all complete, including removal of excavated earth with all its leads & lifts, disposal with in switchyard boundary & level the disposed earth to nearly Existing Ground Level.	3000	RM	520.00	1560000.00
3	Filling available excavated earth in trenches, plinth, sides of foundations, etc., in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead upto 100m and lift upto 3.5m.	700	CUM	125.75	88025.00
4	Carriage & disposal of surplus excavated earth beyond initial lead by mechanical means not necessarily all the times on pucca roads, including loading, unloading, dressing of excavated material, etc., complete as per specifications -.Lead upto 1 km.	200	CUM	98.34	19668.00
5	Carriage & disposal of surplus excavated earth/rock beyond initial lead by mechanical means not necessarily all the times on pucca roads, including loading, unloading, dressing of excavated material, etc., complete as per specifications -.Lead upto 2 km.	50	CUM	111.50	5575.00
6	Supplying, filling and compacting stone boulders mixed with sand at the site under floors, foundations, roads, cable trenches, drains, etc. in layers not exceeding 250mm thickness including royalty, carriage,ramming,watering ,compacting etc. all complete, for all leads and lift with all labour, material, tools, tackles, equipments, safeguards & incidentals as necessary as per specification and direction - of - Engineer -in- charge.	50	CUM	1336.50	66825.00
7	Supplying, filling and compacting CNS material as per specification underfloors, foundations, roads, cable trenches, drains etc inlayers not exceeding 200 mm thickness.	500	CUM	1074.90	537450.00
8	Supply of earth (excluding rock & boulders) at site including royalty, carriage and filling in specified areas in layers notexceeding 200mm in depth, compacting under optimum moisture condition to achieve 95% of Proctor density, finishing etc. allcomplete, for all leads & lifts, with all labour, material, tools, tackles, equipments, safeguards & incidentals as necessary as perdrawings, specification and direction of the Engineer- in- Charge.	1000	CUM	374.20	374200.00
9	Centering and shuttering including strutting, propping etc. and removal of form for : Foundations, footings, bases of columns.	200	SQM	184.42	36884.00
10	Centering and shuttering including strutting, propping etc. and removal of form for : Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	200	SQM	369.24	73848.00
11	Centering and shuttering including strutting, propping etc. and removal of form for all height : Suspended floors, roofs, landings, balconies and access platform.	250	SQM	413.62	103405.00
12	Centering and shuttering including strutting, propping etc. and removal of form for all height : Lintels, beams, plinth beams, girders, bressumers,chajjas and cantilevers.	350	SQM	333.23	116630.50
13	Centering and shuttering including strutting, propping etc. and removal of form for all height :Columns, Pillars, Piers, Abutments, Posts and Struts at all levels.	320	SQM	454.41	145411.20
14	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering:1:4:8 (1 cement : 4 Fine sand : 8 graded stone aggregate 40 mm nominal size)	100	CUM	3920.00	392000.00
15	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering: 1:3:6 (1 cement : 3 Fine sand : 6 graded stone aggregate 20 mm nominal size)	650	CUM	4294.00	2791100.00
16	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering 1:2:4 (1 cement : 2 fine sand : 4 graded stone aggregate 20 mm nominal size)	20	CUM	4728.00	94560.00

BOQ CUM PRICE SCHEDULE

/ Sub-Station Vataman(New) Gujarat

Name of Work:Civil Works for Pre -cast RCC Boundary wall,Labour Hut,Security Hut & Switchyard panel rooms (SPR) at Vataman in Gujarat.

S. No.	Description of Item	Quantity	Unit	Unit Rate (Rs) Ecluding GST	Amount (Rs) Excluding GST
17	Providing & installation in Position Pre-fabricated RCC boundary wall of Precast cement concrete grade M30 at various elevations in all kind of works including moulding, formwork, mixing, laying out, compacting and curing, platform for construction & storing, transportation, erection without damage, setting in position with cement and sand mortar, filling the gap with 1:3 cement mortar, grouting,chamfering edge, grooves in RCC panel etc all as per technical specifications, drawings and directions of Engr-in-Charge but excluding the cost of reinforcement, inserts, edge angles, Coping etc. (Note:- Cement content considered in M-25 is @340 kg/cum. Excess/less cement used as per design mix is payable/ recoverable separately).	1200	CUM	8494.00	10192800.00
18	Providing and laying in position machine batched, machine mixed and machine vibrated design mix cement concrete of specified grade for RCC work including pumping of cocrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement including admixtures in recommended proportions (as per IS 9103) to accelerate, retrard setting of concrete, improve workability without impairing strength and durability. - M30 grade. (Note:- Cement content considered in M-30 is @340 kg/cum). All works up to plinth level. Excess/less cement used as per design mix is payable/ recoverable separately	150	CUM	5942.69	891403.50
19	Providing and laying in position machine batched, machine mixed and machine vibrated design mix cement concrete of specified grade for RCC work including pumping of cocrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement including admixtures in recommended proportions (as per IS 9103) to accelerate, retrard setting of concrete, improve workability without impairing strength and durability. - M30 grade. (Note:- Cement content considered in M-30 is @340 kg/cum). All works above plinth level to floor V level. Excess/less cement used as per design mix is payable/ recoverable separately	120	CUM	6746.26	809551.20
20	Add for using extra cement in the items of design mix over and above the specified cement content therein.	1000	QUINTAL	533.82	533820.00
21	Steel reinforcement (Corrosion resistant) of grade Fe-500/500D/550/550D TMT bars: Including supply (To be procured from SAIL/TISCO/RINL/IISCO or Powergrid approved source) and straightening, cutting,bending, binding, (i/c cost of binding wire), placing in position, chairs & laps etc. all labour & material complete at all level and heights.	8000	KG	72.30	578400.00
22	Steel reinforcement (Corrosion resistant) of grade Fe-500/500D/550/550D TMT bars: Excluding supply but including straightening, cutting,bending, binding, (i/c cost of binding wire), placing in position, chairs & laps etc. all labour & material complete at all level and heights. (Note: Rates also includes Unloading, storage, watch and ward etc for BHEL supplied Reinforcement).	147000	KG	11.00	1617000.00
23	Structural steel work welded in built up sections like edge protection angles, MS pipe sleeves , insert plates with lugs & framed work including providing, cutting, hoisting, fixing in position/ embedding in concrete and applying a priming coat of approved steel primer all complete.	12650	KG	71.40	903210.00
24	Steelwork welded in built up sections/framed work including providing, cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc., as required. In covering of floors/trenches of control room building with chequered plates, stringers, treads, landings, etc., of staircases involving use of chequered plates, wherever required, all complete.	3000	KG	76.00	228000.00
25	Steelwork welded in built up sections/framed work including providing, cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc., as required.In gratings, frames, ladders, stair railings, gates (including pipes), rails, ISMB, ISMC and similar works.	10000	KG	104.50	1045000.00
26	Finishing walls with water proofing cement paint of required shade : New work (Two or more coats applied @ 3.84 kg/10 sqm).	13400	SQM	56.21	753214.00
27	Painting with black anti-corrosive bitumastic paint of approved brand and manufacture to give an even shade:Two or more coats on new work	450	SQM	63.50	28575.00
28	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade: Two or more coats on new work over a priming coat of steel primer of approved brand and manufacture	550	SQM	107.66	59213.00

BOQ CUM PRICE SCHEDULE

/ Sub-Station Vataman(New) Gujarat

Name of Work:Civil Works for Pre -cast RCC Boundary wall,Labour Hut,Security Hut & Switchyard panel rooms (SPR) at Vataman in Gujarat.

S. No.	Description of Item	Quantity	Unit	Unit Rate (Rs) Ecluding GST	Amount (Rs) Excluding GST
29	Providing and fixing concertina coil fencing with punched tape concertina coil 600 mm dia 10 metre openable length (total length 90 m), having 50 nos rounds per 6 metre length, upto 3 m height of wall with existing angle iron 'Y' shaped placed upto 3.0 m apart and with 9 horizontal R.B.T. reinforced barbed wire, stud tied with G.I. staples and G.I. clips to retain horizontal, including necessary bolts or G.I. barbed wire tied to angle iron, all complete as per direction of Engineer-in-charge, with reinforced barbed tape(R.B.T.) / Spring core (2.5mm thick) wire of high tensile strength of 165 kg/ sq.mm with tape (0.52 mm thick) and weight 43.478 gm/ metre (cost of M.S. angle, C.C. blocks shall be paid separately)	3500	RM	221.33	774655.00
30	All civil works for Switchyard Panel Room as per drawing and specifications complete, including - brickwork, finishing(external and internal), door,windows etc. However, earthwork (Excavation,bakfilling & disposal) , Shuttering, PCC, RCC , reinforcement and Structural steel shall be paid separately as per respective BOQ items. (Plinth area shall be measured forpayment purpose).	135	SQM	10534.00	1422090.00
31	All civil works for Security Hut along with septic tank & soak pit as per drawing and specifications complete, including - brickwork,finishing (external and internal),door,windows etc.However, earthwork (Excavation,bakfilling & disposal),shuttering , PCC,RCC ,reinforcement and Structural steel shall be paid separately as per respective BOQ items. (Plinth area shall be measured for payment purpose).	18	SQM	22468.90	404440.20
32	Supply & erection of Pre-fabricated steel structure labour Hut including all civil works, materials ,labours etc. required to complete in all respect as per the technical specification and direction of Engineer-in Charge. However (Excavation,bakfilling & disposal),shuttering, PCC,RCC and reinforcement steel shall be paid separately as per respective BOQ items (Plinth area shall be measured for payment purpose)	410	SQM	11153.40	4572894.00
			TOTAL AMOUNT		**31320608**

SECTION - 2

STANDARD TECHNICAL SPECIFICATION
(N.A.)

STANDARD
TECHNICAL SPECIFICATION
FOR
SUBSTATION- CIVIL WORKS

SUB-STATION CIVIL WORKS – REV 11A

पावर ग्रिड कारपोरेशन ऑफ़ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

Document Code no.:
TECHNICAL SPECIFICATION: CIVIL WORKS
C/ENGG/SPEC/CIVIL/REV -11A/JUN'18

पावर ग्रिड कारपोरेशन आफ इण्डिया लिमिटेड

(केन्द्रीय अभियांत्रिकी विभाग)

Ref: TS-REV11A/Cor.Slip-1 **Date: 07.01.2021**

Sub: TS –REV 11A- Specification of Civilworks- minor modification regarding.

S. No	Section/ Clause. no.	Existing Provision	Proposed for modification
1	11.2.1	Purlins, girts, necessary clips and other cold rolled structural members shall conform to the physical specification of **ASTM A570 (Grade 50) or equivalent IS Standards** having a minimum yield strength of 340 MPa and shall be of Pre galvanised having a total coating thickness of 275 gm/sqm. inclusive of both sides)	Purlins, girts, necessary clips and other cold rolled structural members shall conform to the physical specification of **ASTM A570 (Grade 50) or IS 277 Standards** having a minimum yield strength of 340 MPa and shall be of Pre galvanised having a total coating thickness of 275 gm/sqm. inclusive of both sides)
2	11.3.1	The material of sheets shall confirm to **ASTM 792 M** with minimum yield strength of 340 Mpa	The material of sheets shall confirm to **ASTM 792 M (or) it shall confirm to BIS standards. (i.e - Base material IS 513 + Substrate- IS 15961+Color coating- IS 15965)** with minimum yield strength of 340 Mpa

This is issued with the approval of competent authority vide approved NS No: CC-EGCV-25-/0018 /2020/Engg-Civil Grp3

07.01.21

Chief Manager,

CC-Engg-CVL

<u>पावर ग्रिड कारपोरेशन आफ इण्डिया लिमिटेड</u>

<u>(केन्द्रीय अभियांत्रिकी विभाग)</u>

Ref: TS-REV11A/Cor.Slip-2 **Date: 11.04.2022**

Sub: TS –REV 11A- Specification of Civil works- minor modification regarding.

S. No	Section/ Clause. no.	Existing Provision	Proposed for modification
1	11.6	**<u>Closures:</u>** …Total mass of zinc aluminium alloy coating shall be **minimum 200gm/Sq.m.** inclusive of both sides…	**<u>Closures:</u>** …Total mass of zinc aluminium alloy coating shall be **minimum 150gm/Sq.m.** inclusive of both sides…
2	11.7	**<u>Flashing and Trim:</u>** …Total mass of zinc aluminium alloy coating shall be **minimum 200gm/Sq.m.** inclusive of both sides…	**<u>Flashing and Trim:</u>** …Total mass of zinc aluminium alloy coating shall be **minimum 150gm/Sq.m.** inclusive of both sides…
3	11.10	**<u>Gutters and Down Spouts:</u>** …Total mass of zinc aluminium alloy coating shall be **minimum 200gm/Sq.m.** inclusive of both sides…	**<u>Gutters and Down Spouts:</u>** …Total mass of zinc aluminium alloy coating shall be **minimum 150gm/Sq.m.** inclusive of both sides…

This is issued with the approval of competent authority vide approved NS No: CC-EGCV-25-/0006 /2022/Engg-Civil Grp2 (Computer No. 465306).

CC-Engg-CVL

पावर ग्रिड कारपोरेशन आफ इण्डिया लिमिटेड

(केन्द्रीय अभियांत्रिकी विभाग)

Ref: TS-REV11A/Cor.Slip-3 **Date: 01.12.2022**

Sub: Correction Slip-3 for Technical Specification for Civil Works–REV 11A-for use of grade Fe500 / Fe 500D / Fe550/ Fe 550D and CRS (Corrosion Resistant Steel) in Civil Works

S. No	Section/ Clause. no.	Existing Provision	Amended Provision
1	9.0	**Reinforcement Steel** Reinforcement steel shall be thermo mechanically treated (TMT) or HYSD reinforcement bars of grade Fe 500D conforming to IS: 1786. Reinforcement shall be arranged by Contractor.	**Reinforcement Steel** Reinforcement steel shall be thermo mechanically treated (TMT) or HYSD reinforcement bars of grade Fe 500 / Fe 500 D / Fe 550 / Fe 550D conforming to IS: 1786. Corrosion resistant steel (CRS) of grade Fe 500 / Fe 500D / Fe 550 / Fe 550D conforming to IS 1786 shall be used in coastal region or site with aggressive soil and water. If design of RCC structures shall be done using properties of Fe 550 or Fe 550D, use of Fe 500 / Fe 500D /Fe 500S shall not be permitted. Reinforcement shall be arranged by contractor.

This is issued with the approval of competent authority vide approved NS No: CC-EGCV-21-/0001/2022/Engg-Civil Grp2 (Computer No. 555412)

CC-Engg-CVL

CONTENTS: TECHNICAL SPECIFICATION CIVIL WORK – 11A

P R E F A C E

Salient changes made over previous TS -11

S No.	Ref Clause of Rev. 11A	Brief Description
1	1.1	Mention of "Approval of Employer for design/drawings" Insertion of order of precedence for Technical Specification, BIS code & CPWD specification
2	2.9.2.5	Signing and stamping of soil report by qualified Geotechnical engineer/ consultant
3	3.2.2, 3.4.2, 3.5.1	Layouts to be proposed by the contractor and approved by POWERGRID before execution
4	3.6	Weep holes/ gratings in boundary walls
5	3.6.3.7	"Cage" to be replaced with "design and drawing"
6	5.6 (a)	Supervision and safety of existing structures during dismantling works
7	8.0	Mentioning of IS 456-200 (latest) for RCC works.
8	8.1 & 8.2	Description of minor works for volumetric concreting. Clarity regarding Design mix added.
9	10.2	"Contractor" word added with vendor
10	10.2.6	RCC pedestal to finish at floor level
11	10.2.12	Clarity w.r.t floor finish of GIS hall
12	10.3.18	"working stress method" replaced by "limit state method" for PEB design
13	10.3.16	All design and detailing (including ductile) as per latest BIS standards
14	20.0	Reference of IS 1200 in case of ambiguity.

P R E F A C E

Salient changes made over previous TS -10

S No.	Ref Clause of Rev. 11	Brief Description
1	2.9.2.4 (iv)	Liquefaction related in soil report
2	3.5.1	Provision of pre-cast cable trench
3	3.6	Specification of RCC frame brick masonry wall & stone masonry wall
4	3.6.4	structural steel angle supporting barbed wire/concertina coil over boundary wall shall be painted with epoxy paint
5	4.1, 4.2	"Sand" replaced with "fine aggregate"
6	5.0 &20.1	Excavation in hard rock as separate item
7	5.6	Dismantling and demolishing works
8	8.2.1	Restriction of volumetric mix concrete
9	9.0	Reinforcement steel grade revised to Fe 500D
10	10.1.1	CRB shall be RCC structure at both AIS and GIS substations.
11	10.2.1	Partition sheet for extension works in GIS hall
12	10.2.2	Reference of BIS standard
13	10.3.9	Plinth level raised to 750 mm above FGL.
14	10.3.24	Air pressure maintaining measures.
15	10.7.1	Provision of pre-cast firewall
16	10.9	Aluminium door windows replaced with uPVC sections
17	10.9.1	PU coating over total area of GIS hall
18	10.11.2	Roof treatment through graded concrete.
19	10.12.7	Provision of "triple layered" polyethylene water storage tank
20	11.3.2	Min. value of Zn-Al coating in roof and wall sheeting changed to 150 gm/sqm
21	13.22	Provision of Seamless galvalume rolling shutter
22	20.12.2 & 20.12.3	Payment of miscellaneous structural steel for GIS equipment in GIS hall

SECTION: CIVIL WORKS

1.0 GENERAL

1.1 All civil works shall be carried out as per design/drawings provided by the Employer/ Contractor and as per these specification provided by the Employer. *In case design/drawings are prepared by the contractor then these shall be approved by the employer before execution.* In case any item is not covered under specification then the same shall be carried out as per CPWD specification /applicable BIS Standards and Codes. Any item for which specification is not provided herein and is not covered under CPWD specification/ BIS Standards, the same shall be executed as per manufacturer guidelines with the approval of employer. All materials shall be of best quality conforming to relevant Indian Standards and Codes. In case of any conflict between Standards/ Code and Technical Specification, *the order of precedence shall be as under:*

1.1.1 Technical specification,

1.1.2 BIS codes

1.1.3 CPWD specification.

The decision of engineer in charge in this regard shall be final and binding.

1.2 Wherever reference to CPWD/BIS Codes is made, it shall be to the latest edition/revision of the same, issued up to 7 days prior to the date of opening of this tender.

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

1.4 All materials including cement, reinforcement steel, structural steel etc. shall be arranged by the Contractor.

1.5 The Contractor shall execute the work as per the Field Quality Plan (FQP) which is available on POWERGRID website. All testing required shall be arranged by the Contractor at his own cost.

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

1.7 Unless leveling is in the scope of the bidder, fairly leveled site with single level/terraces with different levels/ gradual slope shall be handed over to the Contractor, in a phased

manner. The finished ground level (FGL) with a tolerance of (+/-) 100mm shall be decided by the Employer. The layout and levels of all structure etc shall be made by the Contractor at his own cost from the general grids of the plot and benchmarks set by the Contractor and approved by the Employer. The Contractor shall provide all assistance in instruments, materials and personnel to the Employer for checking the detailed layout and shall be solely responsible for the correctness of the layout and levels.

In case leveling is in the scope of bidder, FGL shall be decided by the employer.

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

1.9 The material specification, workmanship and acceptance criteria shall be as per approved standard Field Quality Plan. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification/ relevant BIS.

2.0 GEOTECHNICAL INVESTIGATION:

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

A report to the effect shall be submitted by the Contractor for Employer's specific approval giving details regarding data proposed to be utilized for the design.

2.1 SCOPE:

This specification covers all the work required for detailed soil investigation and preparation of a detailed report. The work shall include mobilization of necessary equipment, providing necessary engineering supervision and technical personnel, skilled and unskilled labour etc. as required to carry out field investigation as well as, laboratory investigation, analysis and interpretation of data and results, preparation of detailed Geo-technical report including specific recommendations for the type of foundations and the allowable safe bearing capacity for different sizes of foundations at different founding strata starting from 0.5M from existing ground level for the various structures of the substation. The Contractor shall make his own arrangement for locating the co-ordinates and various test positions in field as per the information supplied to him and also for determining the reduced level of these locations with respect to the benchmark indicated by the Employer.

2.2 BORE HOLES:

- Bore holes of 150 mm diameter in accordance with the provisions of IS: 1892 at the rate of minimum one number bore hole per hectare up to 15meter depth into virgin soil or to refusal whichever occurs earlier shall be drilled. Total area of substation plot (including of Switchyard, Township and Future area) shall be considered for arriving at number of bore holes to be drilled. In any case number of boreholes shall not be less than five and shall not exceed twenty. By refusal it shall mean that a standard penetration blow count (N) of 100 is recorded for 30 cm penetration. In case rock is encountered within five meter from existing ground level, coring in all the boreholes shall be carried out up to 3 meter in rock.
- The Contractor shall carry out Standard Penetration Tests at approximately 1.5 m interval in the borehole starting from 0.5 m below ground level onwards and at every change of stratum. The disturbed samples from the standard penetrometer shall also be collected for necessary tests.
- The Contractor shall collect undisturbed samples of 100/75 mm diameter 450 mm long from the bore holes at intervals of 2.5 m and every change of stratum starting from 0.5 m below ground level onwards in clayey strata.
- The depth of Water Table, if encountered, shall be recorded in each borehole. In case the soil investigation is carried out in winter/summer, the water table for rainy season shall be collected from reliable sources and recorded in the report.
- All samples, both disturbed and undisturbed, shall be identified properly with the borehole number and depth from which they have been taken.
- The sample shall be sealed at both ends of the sampling tubes with wax immediately after the sampling and shall be packed properly and transported to the laboratory without any damage or loss.
- The logging of the boreholes shall be compiled immediately after the boring is completed and a copy of the bore log shall be handed over to the Engineer-in-charge.

2.3 TRIAL PITS:

Trial pits shall be carried out at minimum one location per hectare as directed by the Employer. In case hard rock is encountered in trial pit, test need not be carried out. Total area of substation plot (including of Switchyard, Township and Future area) shall be considered for arriving at number of Trial Pit to be excavated. Minimum number of trial pits shall be five and maximum number shall be ten. The trial pits shall be 2 m x 2 m in size extending to 4 m depths, or as specified by the Employer. Undisturbed samples shall be taken from the trial pits as per the direction of the Employer.

2.4 ELECTRICAL RESISTIVITY TEST :

The resistivity of earth varies over a wide range depending on its moisture content, temperature, salt content and compactness. Therefore earth resistivity test shall be conducted preferably during the dry season in order to get conservative results.

2.4.1 TEST LOCATION

In the evaluation of earth resistivity for the substations, at least eight test directions shall be chosen from the centre of the substation to cover the entire area including the future area. The number of test points shall be as per approved drawing.

2.4.2 PRINCIPLE OF TEST

Wenner's four electrode method shall be used. In this method, four small electrodes shall be buried in four small holes in the earth along a straight line at equal intervals. A test current (I) by earth resistivity tester shall be passed between two outer electrodes and the voltage difference (V) between the two inner electrodes shall be measured. The test current (I) thus flowing into the earth, produces an electric field proportional to its density and to the resistivity of the soil. The voltage (V) measured between the inner electrodes is proportional to the field. Consequently, the resistivity will be proportional to the ratio of the voltage to current. Thus the resistivity shall be calculated from the following equation.

$$\rho_a = \frac{4\pi aR}{1+\frac{2a}{\sqrt{(a^2+4b^2)}}-\frac{a}{\sqrt{(a^2+b^2)}}}$$

Where,

ρ_a is the apparent resistivity of the soil in Ω-m

R is the measured resistance in Ω

a is the distance between adjacent electrodes in metres

b is the depth of the electrodes in m

2.4.3 TEST PROCEDURE

In the selected test point and chosen direction, four electrodes with insulated connecting wires shall be driven into the earth along a straight line of equal intervals (a). The depth of the electrodes in the earth shall be of the order of 15 cm to 20 cm. The megger shall be placed on a steady and approximately level base, the link between terminals P1 and C1 shall be opened and the four electrodes connected to the instrument terminals. An appropriate range on the instrument shall be selected to obtain clear readings avoiding the two ends of the scale as far as possible.

Resistivity shall be calculated by substituting the value of R in the above equation. The test shall be repeated in a chosen direction with a number of different electrode spacing, increasing from 2m to 50m preferably in the steps of 2, 5, 10, 15, 25 and 50m. When the spacing is increased gradually from low values, at a stage, it may be found that the resistivity reading is more or less constant irrespective of the increase in the electrode spacing. The resistivity for this spacing is noted and taken as the resistivity for that direction. In a similar manner, resistivity for at least eight equally spaced directions from the centre of the test points shall be measured. These measurements shall be repeated for all test points.

NOTES:-

i. Soil resistivity points shall preferably be one number in each 100mx100m grid and number of test points shall be such that the entire substation including the future area is covered.
ii. Average resistivity value of all eight directions shall be considered for design of earthing system.
iii. Soil resistivity measurement may be done in dry season. Small amount of water may be applied at electrodes for making proper contact between the electrodes and soil.

2.5 PLATE LOAD TEST

Plate load test shall be conducted to determine the bearing capacity, modulus of sub grade reaction and load/settlement characteristics of soil at shallow depths by loading a plane and level steel plate kept at the desired depth and measuring the settlement under different loads, until a desired settlement takes place or failure occurs. The specification for the equipment and accessories required for conducting the test, the test procedure, field observations and reporting of results shall conform to IS: 1888. Modulus of sub grade reaction shall be conducted as per IS: 9214. Plate load test shall be conducted at two locations to be decided during detailed engineering at the proposed foundation depth below finished ground level for determining the bearing capacity.

Undisturbed tube samples shall be collected at 0.5 m and 2.5m depths from natural ground level for carrying out laboratory tests

The size of the pit in plate load test shall not be less than five times the plate size and shall be taken up to the specified depth. All provisions regarding excavation and visual examination of pit shall apply here.

Unless otherwise specified the reaction method of loading shall be adopted. Settlement shall be recorded from dial gauges placed at four diametrically opposite ends of the test plate.

The load shall be increased in stages. Under each loading stage, record of Time v/s Settlement shall be kept as specified in IS: 1888.

Backfilling of the pit shall be carried out as per the directions of the Employer. Unless otherwise specified the excavated soil shall be used for this purpose. In cases of gravel-boulder or rocky strata, respective relevant codes shall be followed for tests.

2.6 WATER SAMPLE

Representative samples of ground water shall be taken when ground water is first encountered before the addition of water to aid drilling of boreholes. The samples shall be of sufficient quantity for chemical analysis to be carried out and shall be stored in air- tight containers.

2.7 BACK FILLING OF BORE HOLES

On completion of each hole, the Contractor shall backfill all bore holes as directed by the Employer. The backfill material can be the excavated material.

2.8 LABORATORY TEST

2.8.1. The laboratory tests shall be carried out progressively during the field work after sufficient number of samples has reached the laboratory in order that the test results of the initial bore holes can be made use of in planning the later stages of the field investigation and quantum of laboratory tests.

2.8.2. All samples brought from field, whether disturbed or undisturbed shall be extracted/prepared and examined by competent technical personnel, and the test shall be carried out as per the procedures laid down in the relevant I.S. Codes.

The following laboratory tests shall be carried out

i) Visual and Engineering Classification
ii) Liquid limit, plastic limit and shrinkage limit for C-Ø soils.
iii) Natural moisture content, bulk density and specific gravity.
iv) Grain size distribution.
v) Swell pressure and free swell index determination.
vi) California bearing ratio.
vii) Consolidated drained test with pore pressure measurement.
viii) Chemical tests on soil and water to determine the carbonates, sulphates, nitrates, chlorides, Ph value, and organic matter and any other chemical harmful to the concrete foundation.
ix) In case of rock samples following tests shall also be conducted:
    - Rock quality designation (RQD), RMR.
    - UCC test.
    - Point load index test.

2.9 TEST RESULTS AND REPORTS

2.9.1 The Contractor shall submit the detailed report in four (4) copies wherein information regarding the geological detail of the site, summarised observations and test data, bore logs, and conclusions and recommendations on the type of foundations with supporting calculations for the recommendations. Initially the Contractor shall submit

draft report and after the draft report is approved, the final report in four (4) copies shall be submitted. The site test data shall bear the signatures of the Investigation Agency, Vendor and also site representative of Employer.

2.9.2 The report shall include, but not limited to the following:-

2.9.2.1 A plan showing the locations of the exploration work i.e. bore holes, trial pits, Plate load test etc.

2.9.2.2 Bore Logs: Bore logs of each bore holes clearly identifying the stratification and the type of soil stratum with depth. The values of Standard Penetration Test (SPT) at the depths where the tests were conducted on the samples collected at various depths shall be clearly shown against that particular stratum.

2.9.2.3 Test results of field and laboratory tests shall be summarized strata wise as well a s in combined tabular form. All relevant graphs, charts tables, diagrams and photographs, if any, shall be submitted along with report. Sample illustrative reference calculations for settlement, bearing capacity, pile capacity shall be enclosed.

2.9.2.4 The report should contain specific recommendations for the type of foundation for the various structures envisaged at site. The Contractor shall acquaint himself about the type of structures and their functions from the Employer. The observations and recommendations shall include but not limited to the following:

i) Geological formation of the area, past observations or historical data, if available, for the area and for the structures in the nearby area, fluctuations of water table etc.
ii) Recommended type of foundations for various structures. If piles are recommended the type, size and capacity of pile and groups of piles shall be given after comparing different types and sizes of piles and pile groups.
iii) Allowable bearing pressure on the soil at various depths for different sizes of the foundations based on shear strength and settlement characteristics of soil with supporting calculations. Minimum factor of safety for calculating net safe bearing capacity shall be taken as 2.5.
iv) Recommendation regarding liquefaction potential/characteristics of soil during ground shaking and possible remedies shall be provided.
v) Recommendations regarding slope of excavations and dewatering schemes, if required.
vi) Comments on the Chemical nature of soil and ground water with due regard to deleterious effects of the same on concrete and steel and recommendations for protective measures.
vii) If expansive soil is met with, recommendations on removal or detainment of the

same under the structure, road, drains, etc. shall be given. In the latter case detailed specification of any special treatment required including specification or materials to be used, construction method, equipments to be deployed etc. shall be furnished. Illustrative diagram of a symbolic foundation showing details shall be furnished.

viii) Recommendations for additional investigations beyond the scope of the present work, if considered such investigation as necessary.

ix) In case of foundation in rocky strata, type of foundation and recommendation regarding rock anchoring etc. should also be given based on RMR value

2.9.2.5 All Geotechnical investigation reports must be signed and stamped by qualified Geotechnical engineer/ consultant even if they have been prepared by NABL accredited test labs.

3.0 STANDARD DRAWINGS:

i) Standard drawings have been developed for Control Room Building, Switchyard Panel Room, Fire Fighting Pump House & Water Tank, Towers & Equipments Foundations, Transit Camp, Septic Tank & Soak Pit, Roads, Road Culverts & Rail Cum Road, Drains, Chain Link Fence & Switchyard Gate, Rain Water Harvesting by the Employer and are enclosed with the tender documents.

ii) These drawings are good for construction and are also available on POWERGRID website. Additional prints if any required, can be downloaded from the website.

iii) All tender drawings shall be read in conjunction with this specification. Discrepancy if any shall be brought to the notice of Employer prior to quote.

iv) All foundation drawings including foundations for buildings, towers, equipments etc shall be released to the Contractor after award in a phased manner, after receiving the geotechnical investigation report.

v) Drawings for transformer, reactor foundations and fire walls are not enclosed and shall be made available to the successful bidders by the Employer during detailed engineering.

vi) In case the site conditions warrant any special type of foundations to be used, the same shall be designed and issued by the Employer to the Contractor during detailed engineering unless otherwise mentioned in section project.

vii) Drawings for any non-standard tower or equipment and their foundation, if required, shall be designed by the Employer and made available to the Contractor during detailed Engineering unless otherwise mentioned in section project.

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

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

3.1 ROADS, ROAD CULVERTS AND RAIL CUM ROAD:

3.1.1 The construction drawings showing section detail for road, culverts as well as rail cum road are enclosed with the tender documents. The layout of roads shall be as per approved general arrangement drawing. Types of the roads in the scope of contract shall be either of RCC or bituminous road as indicated in the GA drawing or in Bid Price Schedule.

3.1.2 The width of the road shall be either 5.5m wide or 3.75m as indicated in the GA drawing. Type of pavement either rigid pavement (RCC Road) or flexible pavement(Bituminous Road) shall be as per tender documents.

3.1.3 The type & location of culverts i.e. the number and diameter of Hume pipes shall be as decided during detailed engineering. The invert level of Hume pipes of culverts shall match with the invert level of drain meeting the culvert.

3.1.4 100mm diameter RCC Hume pipe (NP-3) shall be provided across the road at every 100M interval along the road. In case NP3 pipe is not available, vendor may provide 100 dia UPVC pipe encased with 75 mm thk. concrete 1:2:4 alround without any financial implication to POWERGRID.

3.1.5 Road within the switchyard area should have shoulder of 600mm wide on either sides of road. Shoulder shall be smooth finished with well compacted 75mm thick PCC 1:4:8. The road leading to control room building and the roads outside switchyard fence area shall be provided with kerb stone and interlocking tiles on shoulder. Width of shoulder shall be 1.75m in case of 5.5m wide road and 1.3m in case of 3.75m wide road.

3.1.6 The shoulder of the road in case of substation extension shall match with the shoulder of the existing road in all respect.

3.1.7 Road leading towards the area of Autotransformer/Reactor shall be as short as possible. Road layouts shall be prepared with adequate turning radius, so that easy movement of vehicles is possible. Roads which are to be used for carrying transformers / reactors shall be provided with turning radius preferably 19.5M or more but not less than 16.5M. Turning radius of other roads may be decided at site depending on layout constraints

3.1.8 Contractor may use WMM instead of WBM with prior approval of employer without any additional financial implication to POWERGRID. Guidelines of IRC: 109-1997 shall be followed for Wet Mix Macadam (WMM) only. However, measurement of road shall be done as specified elsewhere in this specification.

3.1.9 In case of rigid pavements, RCC shall be laid and finished with screed board, vibration, vacuum dewatering process etc.

3.2 DRAINS:

3.2.1 The construction drawing for the section of drain is enclosed with the tender documents.

3.2.2 The Contractor shall *propose* an overall drainage layout for the new sub-station or extension of substation during detailed engineering considering the site conditions *which is to be approved by POWERGRID before execution*. The type of drains used shall be of the sections standardized and indicated in the drawings enclosed with the tender documents.

3.3 CHAIN LINK FENCING AND SWITCHYARD GATE:

3.3.1 Fencing and Gate shall be constructed as per drawing attached with tender documents and are also available on POWERGRID website.

3.3.2 Fencing and Gate shall be provided at the locations shown in approved general arrangement drawing. Separate gate shall be provided for men and equipment. Fence shall also be provided for the various equipments (if) mounted on ground or a height lower than 2.5m. Necessary gates shall be provided for each area so surrounded.

3.3.3 Chain link of galvanized fence fabric with 3.15mm dia wire and 75mm mesh size conforming to IS: 2721 shall be used. MS tube used shall be of grade YST210 and conform to IS: 1161. All other structural steel shall conform to IS: 2062.

3.3.4 The whole assembly of tubular post and frame of panels shall be hot dip galvanized. The zinc coating shall be minimum 610 gram per square meter. In case the substation is located within 30km from sea coast, the zinc coating shall be 900gm per square meter. The purity of zinc shall be 99.95% as per IS: 209.

3.3.5 The gate shall be made of medium duty M.S. pipe of grade YST210 and conform to IS: 1161 with welded joints. The main frame (outer frame) of the gate shall be made of 40mm nominal bore pipe and vertical pipes of 15mm nominal bore @ 125mm spacing (maximum) shall be welded with the main frame. Gate shall be painted with one coat of approved steel primmer and two or more coats of synthetic enamel paint to give an even shade.

3.4 RAIN WATER HARVESTING:

3.4.1 In addition to drainage of rainwater, the Contractor shall make arrangement for rainwater harvesting also. A drawing showing details of recharge structure for rainwater harvesting is enclosed with tender document and is also available on POWERGRID website.

3.4.2 Rainwater harvesting shall be done by providing recharge structures with bore wells. The *contractor shall propose location of* recharge structures within the sub-station considering the site conditions *which is to be approved by POWERGRID before execution*. Branch drains from the main drain carrying rainwater from entire switchyard shall be connected to the recharge structures.

3.5 CABLE TRENCHES:

3.5.1 The construction drawings of cable trenches, cable trench crossing road and sump are enclosed with tender documents. The construction of cable trenches shall be cast in situ type or pre cast RCC as per drawings and meeting the technical specification. The Contractor shall *propose* an overall cable trench layout for the substation during detailed engineering *which is to be approved by POWERGRID before execution.*

3.5.2 The layout should show type of cable trench, longitudinal slope and invert level calculated considering future extensions also. The types of cable trench shall be of the section indicated in the drawings enclosed with the tender documents and are also available on POWERGRID website.

3.6 BOUNDARY WALL

Boundary wall shall be brick masonry wall with RCC frame or Stone masonry wall or Pre cast RCC wall. The construction drawing of the boundary wall applicable is enclosed with tender document. *All walls shall have adequate weep holes/ gratings as per drawing/ as per site conditions for the drainage of water*. The layout shall be as per approved layout drawing during detail engineering.

3.6.1 Brick masonry wall with RCC frame:

Boundary wall shall consist of frame of RCC column and foundation at regular intervals connected through plinth beam and supporting 230 thick brick masonry. Details such as height, column spacing, structural details, fencing/grating works, plastering/ painting, etc. shall be as per tender/construction drawing.

3.6.2 Stone masonry wall:

Boundary wall shall be Random Rubble masonry wall and coursed rubble masonry (for front portion). The wall thickness shall be 350 thk and foundation, height, fencing shall be as per tender/construction drawing.

3.6.3 Pre cast boundary wall:

3.6.3.1 Pre-cast reinforced concrete units such as columns, posts, wall panels etc. shall be of grade M-25 Design Mix. Mix design concrete should be well proportioned, mixed, placed and thoroughly compacted by mechanical/platform/form vibrators to give a dense concrete free from voids and honey combing. Fly ash conforming to grade-I of IS: 3812 (Part-1) may be used as part replacement of OPC as per IS: 456. Uniform blending with cement to be

ensured in accordance with clauses 5.2 and 5.2.1 of IS: 456 -2000. Admixtures may be used with the approval of the engineer-in-charge. However use of any admixture containing chlorides in any form is prohibited. No admixtures shall be accepted for use in concrete unless these are tested in accordance with IS: 9103 and the test results are approved by the Engineer-in-Charge.

3.6.3.2 The forms/ moulds shall be of fiber glass or of steel sections for better finish. Provision shall be made in the forms and moulds to accommodate fixing devices such as angle for concertina coils, hooks and forming of notches and holes.

3.6.3.3 The contractor may pre-cast the units on cement or steel platform which shall be adequately oiled provided the surface finish is of the same standard as obtained in form. Each unit shall be cast in one operation.

3.6.3.4 Pre-cast articles shall have a dense surface finish showing no coarse aggregate and shall not have cracks or crevices likely to assist in disintegration of concrete or rusting of steel or other defects that would interfere with the proper placing of the units. All angles of the pre-cast units with the exception of the angles resulting from the splayed or chamfered faces shall be true right angles. Arises shall be clean and sharp except those specified or shown to be rounded. Gaps if any noticed during installation shall be finished with 1:3cement Mortar. The wearing surface shall be true to the lines. On being fractured, the interior of the units should present a clean homogeneous appearance.

3.6.3.5 The pre-cast articles shall be matured for 28 days before erection or being built in so that the concrete shall have sufficient strength to prevent damage to units when first handled. Date of casting shall be marked on the surface which should not be visible after installation.

3.6.3.6 The exposed surfaces of walls & columns shall be painted with water proofing cement paint of approved shade to give an even shade as per BOQ item.

3.6.3.7 Reinforcement *as per approved design drawing* shall be placed inside the mould in such a way as to fulfill the minimum cover requirement or as per the drawing. Concrete shall then be poured in middle and the sides and compacted with a plate vibrator (platform/table/surface vibrator).

3.6.3.8 Each Pre-cast unit shall have marking like; date of manufacturing and identification number. Units without marking shall not be accepted.

3.6.3.9 The mould sizes shall satisfy the following dimensional tolerances:

S.No.	DIMENSION	TOLERANCE
1	Length	±4 mm
2	Width	±2 mm

3	Depth	±2 mm

3.6.3.10 Contractor shall make his own arrangement for curing by making suitable size pond for curing as directed by Engineer-in-charge. After having been cast in the mould or form the concrete shall be adequately protected during setting in the first stages of hardening from shocks and from harmful effects of frost, sunshine, drying winds and cold. The concrete shall be cured at least for 7 days from the date of placing of concrete in case of OPC and at least 10 days where mineral admixtures or blended cements are used. In hot & arid regions, the minimum curing period shall be 14 days.

OR

Pre-cast units shall be stacked against a vertical support in nearly vertical position and cured for at least two weeks by sprinkling water. If necessary, low pressure steam curing may be employed. It shall further be air cured for another two weeks before it can be used for construction. During initial stages of hardening, the Pre-cast units shall be adequately protected from shocks as well as harmful effects of frost, sunshine, drying winds and cold.

3.6.3.11 SAMPLING

- All Pre-cast units (viz. planks and columns) of the same size, manufactured from similar materials and under similar conditions of production shall be grouped together to constitute a lot.
- Five units shall be selected at random out of a lot consisting of 300 units or less. For lots bigger than 300 units, 5 units shall be selected for every additional 300 units or part thereof.
- The units shall be selected from the lot at random. In order to ensure randomness of selection, procedure given in IS: 4905-1968 may be followed. The sampling procedure may be modified, if the Engineer-In-Charge desires so.

3.6.3.13 DIMENSIONAL TOLERANCES

Pre-cast units manufactured in accordance with the drawings/specifications shall be required to satisfy following dimensional tolerances:

S.No.	DIMENSION	TOLERANCE
1	Length	±5 mm
2	Width	±3 mm
3	Thickness	±2 mm
4	Bow (Deviation from intended line or plane)	±2 mm

5	Twist (Distance of any corner from the plane containing other three corners)	1 mm

If four out of the five samples satisfy the shape (as per the drawing) and dimensional requirements as tabulated above, the lot represented by the sample shall be deemed to have passed the dimensional requirements.

3.6.3.14 HANDLING, STORAGE AND DELIVERY

- Pre-cast units shall be stored, transported and placed in position in such as manner that they will not be overstressed or damaged.
- Pre-cast units shall be transported to the site by suitable means as approved by the Engineer-In-Charge. Care shall be taken to ensure that no damage occurs during transportation.
- In case the units are to be transported in trolleys, the overhang of the units from the trolley shall not be more than one-fifth of length of the Pre-cast unit.
- For lifting/handling the units, rope slings shall be used at locations where lifting hooks have been provided. The units shall be lifted manually or with the help of chain pulley blocks or mechanically with a hoist or a crane. The Pre-cast units shall be handled and transported in nearly vertical position as far as possible and these should be supported only near the edges.
- Any defect/breakage arising during transportation, due to mishandling or due to faulty storage practice shall be the sole responsibility of the Manufacturer/Supplier/Agency.

3.6.3.15 ERECTION

- Precast concrete columns and wall panel shall be placed in truly vertical position with the aid of a compatible light crane/manually/by suitable means.
- For erection, panels are handled by means of lifting devices/manually to set into columns wedge. Panels may be carefully placed in successive horizontal position by means of temporary wooden wedges placed at the junction of the two adjacent panels during construction and which shall be removed after proper placement of panels.
- After placement of wall panels, gaps if any between the wall panels shall be filled with 1:3 cement mortar and shall b finished before taking up of painting. No extra payment shall be made for filling of joints with cement mortar.
- Pre-cast units shall be erected in such a manner that no part is overstressed or damaged due to faulty erection.
- Any defect/breakage occurred during erection shall be the sole responsibility of the Agency/Manufacturer/Supplier and such units shall not be accepted for use in construction.

3.6.3.16 MISCELLANEOUS

The work to be performed under this specification shall include providing all labour, supervision, materials, storages, inventories, all enabling works like scaffolding, watch and ward for the works, power, fuel, construction equipment, water, tools and plants, transportation, all taxes and duties, all labour welfare and safety measures, complete and

all other incidental items not shown or specified, but reasonably implied or necessary for successful completion of the work including Contractor's supervision and in strict accordance with the drawings and specifications, inspection and testing standards and field quality control and testing as given in the tender documents and the complete execution of the works.

Any technical clarifications required regarding the drawings/specifications during the progress of works shall be obtained from the Engineer-in-Charge.

Employer reserves the right to inspect all the material before dispatch.

3.6.4 All structural steel angle for supporting barbed wire/concertina coil shall be painted with epoxy paint of approved brand and colour shade.

4.0 STONE SPREADING AND ANTI-WEED TREATMENT

4.1 The layout of the area, where anti-weed treatment and stone spreading is to be done, shall be developed by the Contractor during detailed engineering and the same shall be submitted to the employer for approval. The Contractor shall arrange all labour, equipment and materials required for complete performance of the work in accordance with the drawings, specification and direction of the Employer.

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

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

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

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

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

ii) Hardness : Abrasion value (IS:2386 Part-IV) – not more than 40% Impact value (IS: 2386 Part-IV) – not more than 30%.

iii) Flakiness Index : As per IS: 2386 Part – I maximum value is 25%.

iv) Frequency of test shall be conducted for sieve analysis, Hardness & Flakiness index as per latest SFQP available on POWERGRID website.

4.5 After all the structures/equipments are erected, antiweed treatment shall be applied in the switchyard where ever cement concrete is to be done and the area shall be thoroughly de-weeded including removal of roots. The recommendation of local agriculture or horticulture department may be sought where ever feasible while choosing the type of chemical to be used.

4.6 The antiweed chemical shall be procured from reputed manufacturers. The doses and application of chemical shall be strictly done as per manufacturer's recommendation. Nevertheless the effectiveness of the chemical shall be demonstrated by the Contractor in a test area of 10MX10M (appx) and shall be sprinkled with water at least once in the afternoon every day after forty eight hours of application of chemical. The treated area shall be monitored over a period of two to three weeks for any growth of weeds by the Engineer – in- charge. The final approval shall be given by Engineer – in –charge based on the results.

4.7 Engineer-in-charge shall decide final formation level so as to ensure that the site appears uniform devoid of undulations. The final formation level shall however be very close to the formation level indicated in the approved drawing.

4.8 After antiweed treatment is complete, the surface of the switchyard area shall be maintained, rolled/compacted to the lines and grades as decided by Engineer-in-charge. The sub grade shall be consolidated by using half ton roller/surface vibrator with suitable water sprinkling arrangement to form a smooth and compact surface. The roller shall run over the sub grade till the soil is evenly and densely consolidated and behaves as an elastic mass.

4.9 In areas that are considered by the Engineer-in-Charge to be too congested with foundations and structures for proper rolling of the site surfacing material by normal rolling equipments, the material shall be compacted by hand rammer, if necessary. Due care shall be exercised so as not to damage any foundation structures or equipment during rolling / compaction.

4.10 The sub grade shall be in moist condition at the time the cement concrete is placed. If necessary, it should be saturated with water for not less than 6 hours but not exceeding 20 hours before placing of cement concrete. If it becomes dry prior to the actual placing of cement concrete, it shall be sprinkled with water and it shall be ensured that no pools of water or soft patches are formed on the surface.

4.11 Over the prepared sub grade, 75mm thick base layer of cement concrete in 1:5:10 (1 cement: 5 fine aggregate: 10 burnt brick aggregate 40mm nominal size) shall be provided

in the area excluding roads, drains, cable trenches as per detailed engineering drawing. The Contractor shall have option to use graded stone aggregate 40mm nominal size in place of brick aggregate without any extra cost to employer. For easy drainage of water, the slope of 1:1000 is to be provided from the ridge to the nearest drain.

4.12 The ridge shall be suitably located at the centre of the area between the nearest drains. The above slope shall be provided at the top of base layer of cement concrete in 1:5:10. A layer of cement slurry of mix 1:6 (1cement: 6 fine aggregate) shall be laid uniformly over cement concrete layer. The cement consumption for cement slurry shall not be less than 150 kg for every 100 sq.m.

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

5.0 EXCAVATION AND BACKFILL OF FOUNDATIONS:

Excavation for foundations shall be in accordance with CPWD Specification/ the relevant BIS code. Excavation shall include removal of all materials of whatever nature at all depth and whether wet or dry necessary for the construction of foundations. The bottom of excavation shall be leveled both longitudinally and transversely unless otherwise mentioned in the drawings or as directed by Engineer-in-charge. Excavation shall be measured as classified under:-

a) Excavation in all kind of soil including soft/ disintegrated rock, PCC, WBM, Brickwork/ stone masonry etc (excluding hard rock).

b) Excavation in hard rock (required blasting)

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

5.2 Whenever water table is met during the excavation, it shall be dewatered and water table shall be maintained below the bottom of the excavation level during excavation, The excavation shall be kept free from water:-

- When concrete and/or masonry works are in progress and till they come above the natural water level
- Till the Employer considers that the concrete/ mortar is sufficiently set.

No extra payment shall be made for dewatering.

5.3 Material unsuitable for foundations shall be removed and replaced by suitable fill material as per specification and to be approved by the Employer.

5.4 Backfill material around foundations or other works shall be suitable for the purpose for which it is used and compacted. Requirements regarding density / tests of backfilled earth shall be as specified in Field Quality Plan. The sub-grade for the roads and embankment filling shall be compacted to minimum 95% of the Standard Proctor's density at OMC (optimum moisture content). Cohesion less material sub-grade shall be compacted to 70% relative density (minimum).

5.5 If, excavated material is not suitable or not required for backfill, it shall be disposed off in areas as directed by Employer up to a maximum lead of 2 km from the substation boundary.

5.6 DISMANTLING & DEMOLISHING WORKS

a. The scope of work includes dismantling of existing R.C.C. works at all levels (in foundations or super structures) either manually or by mechanical means including disposal of steel bars and unserviceable material as per direction of Engineer – in-charge. The work of dismantling of RCC works shall be measured in cu. m. *Dismantling work must be carried out very carefully under strict close supervision to ensure structural stability of the remaining and/or adjoining/ abutting structure.*

b. The scope of work includes Demolishing/dismantling of existing chain link fencing either manually or by mechanical means including disposal of unserviceable material as per direction of Engineer – in-charge. The work of dismantling/demolishing of existing chain link fencing shall be measured in running meter.

5.7 REQUIREMENT FOR FILL MATERIAL UNDER FOUNDATION:

5.7.1 The thickness of fill material under the foundations shall be such that the maximum pressure from the footing, transferred through the fill material and distributed onto the original undisturbed soil will not exceed the allowable soil bearing pressure of the original undisturbed soil.

5.7.2 The filling shall be done in accordance with clause 4.10 of IS: 1080. For expansive soils the fill materials and other protections etc. to be used under the foundation is to be got approved by the Employer.

5.7.3 Cohesive Non Swelling (CNS) soil, if required, for filling under / around the foundations, cable trenches, drains, roads etc shall confirm to IS: 9451: 1994 reaffirmed 2004

6.0 CEMENT:

6.1 The type of cements which can be used are Portland Pozzolana cement (conforming to IS:1489), Ordinary Portland cement (conforming to IS:269 or IS:8112 or IS:12269), and Portland Slag cement. (Conforming to IS: 455). Cement shall be arranged by contractor.

6.2 Generally PPC type shall be used for concrete work. However depending on availability, OPC may also be used without any additional financial implication to POWERGRID.

6.3 Extra care for curing shall be taken for concrete made with OPC 53 grade & PPC.

6.4 Extra care for removing form work shall be taken, when PPC is used.

6.5 Portland Slag Cement has low heat of hydration and is relatively better resistant to soils and water containing excessive amount of sulphates of alkali metals, alumina and iron, as well as to acidic waters. Hence it can be specifically allowed for above conditions with prior approval of EIC.

7.0 CHEMICAL ADMIXTURES & ADDITIVES

7.1 Use of chemical admixtures shall be permitted in accordance, with the provisions of IS 456 and IS 9103.

7.2 It shall be the responsibility of the producer to establish compatibility and suitability of any admixture with the other ingredients of the mix and to determine the dosage required to give the desired effect. The amount of admixture added to mix shall be recorded in the production record by the producer.

7.3 Admixtures should be stored in a manner that prevents degradation of the product and consumed within the time period indicated by the admixture supplier. Any vessel containing an admixture in the plant or taken to site by the producer shall be clearly marked as to its content.

7.4 When offering or delivering a mix to a purchaser it should be indicated if such a mix contains an admixture or combination of admixtures or not. The admixtures may be identified generically and should be declared on the delivery ticket.

8.0 REINFORCED CONCRETE CEMENT (RCC):

All RCC work including material properties, proportioning, batching, mixing, transporting, pouring, compacting, finishing, curing, sampling, testing, acceptance criterion etc. shall be as per IS : 456-2000 (or latest)

8.1 DESIGN MIX CONCRETE

8.1.1 For new substations and extensions *except minor works*, Reinforced cement concrete shall be M-25 design mix conforming to IS: 456. IS: 10262 shall be followed for mix

proportioning. *The minor work may be defined as any work involving less than 3.0 cum of concrete in a single day of concreting at one particular construction site .*

8.1.2 Design mix concrete may be *procured* from *approved* RMC plant as per latest IS: 4926 or *may be prepared* by using a portable/mini/compact *weigh* batch plant conforming to latest IS: 4925

8.1.3 As per provisions of IS: 456, fly ash conforming to grade I of IS: 3812 (part-1) may be used as part replacement of cement, when OPC cement is used for concrete works. Uniform blending with cement is to be ensured.

8.2 VOLUMETRIC MIX CONCRETE

8.2.1 Use of volumetric mix concrete shall be restricted to minor works only *(as per clause 8.1.1) with approval of engineer incharge. In such cases* reinforced cement concrete shall be of volumetric mix 1:1.5:3 (1 cement: 1.5 coarse sand: 3 well graded stone aggregate 20mm nominal size) conforming to CPWD specifications. Volumetric mix 1:1.5:3 shall be considered equivalent to M-20.

8.2.2 In case of volumetric mixes, Standard measuring boxes of 35cmX40cmX25cm (35 liters capacity as per CPWD) shall be used for measuring fine and coarse aggregates.

8.2.3 However, full 50 kg of OPC/PPC/Slag cement shall be directly unloaded into the mixer hopper to ensure that cement consumption is 400kg per cum of 1:1.5:3 concrete irrespective of different types of cements with different densities.

8.2.4 The cement consumption shall be as per DSR (CPWD) for other grades of concretes provided as volumetric concrete in the BPS.

8.2.5 For volumetric mix concretes, the cement used may be generally PPC type, however concrete may be prepared with OPC also, without any financial implication to POWERGRID.

9.0 REINFORCEMENT STEEL:

Reinforcement steel shall be thermo mechanically treated (TMT) or HYSD reinforcement bars of grade Fe 500D conforming to IS: 1786. Reinforcement shall be arranged by contractor.

10.0 DRAWINGS AND DESIGN TO BE DEVOLOPED BY CONTRACTOR / EMPLOYER DURING DETAILED ENGINEERING:

The following clauses are applicable for the design and drawings which are to be developed during detailed engineering either by *contractor*/ vendor or by employer as per section project.

10.1 CONTROL ROOM BUILDING:

10.1.1 For AIS Substations: Control room building shall be of RCC framed structure & brickwork (Conventional).
For GIS Substations: Control room building shall be of RCC framed structure with brickwork; however its alignment shall be in line with GIS hall & may/may not be attached to GIS hall as per detail engineering.

10.1.2 In case of extension of Control room building, the same shall be matched with existing building, whether it is PEB or Conventional.

10.1.3 All walls shall be of non-load bearing Minimum wall thickness of full brick with 1:6 cement sand mortar. Partition walls in toilets and pantry can be half brick walls with 1:4 cement sand mortar and two nos. 6mm dia MS bars at every third course. CPWD specifications shall be followed for brick masonry work.

10.1.4 Partitions, if any required shall be made of powder coated aluminium frame (minimum thickness of powder coating is 50 micron) provided with minimum 5.5mm thick clear glass or pre-laminated board depending upon the location of partition.

10.1.5 The details of doors and windows of the control room building shall be as per finish schedule Table-1.

10.1.6 IS approved or ISI Marked PVC electrical conduits of shall be provided as per the requirement of electrical installations including its accessories, junction boxes/surfaces boxes, fan boxes etc. Areas where false ceiling is provided electrical conduit may be laid on exposed surfaces of walls or ceiling, above false ceiling area. In rest areas conduits & junction boxes, fan boxes etc. shall be concealed.

10.1.7 Contractor shall develop conduit layout drawing based on electrical illumination & Electrical installation drawings approved by POWERGRID. For control Room conference Hall/Admin Hall conduits are also to be provided below floor tiles for extending power supply/internet cables to Conference table users/ Admin Cubicles.

10.1.8 The plinth area of Control Room Building either PEB or conventional shall be as per respective items of BPS. The calculation of plinth area shall be as per IS:3861-2002. It shall comprise of following, to meet the functional requirement:

- Control room, ACDB & DCDB room, Battery room, Electrical lab, Telecom Room, In-Charge Room with attached toilet, Administrative area, Pantry, Lobby, Passage, toilet, shafts etc.
- Portico in case of RCC Building / 3m wide canopy in case of PEB
- One toilet should be disabled friendly.

10.1.9 The area for above provisions shall be suitably decided by bidder during detailed engineering stage in consultation with employer.

10.1.10 Control room building shall be so designed that most of the area of switchyard is visible from control room.

10.1.11 Open cable trenches in the building shall be covered with minimum 6mm thick steel chequered plate with suitable stiffeners. Chequered plate shall be painted with two or more coats of epoxy paint as per item 13.52 of DSR' 2014 over a coat of steel primer.

10.1.12 The isometric view of the CRB with local aesthetic and best industry practices shall be submitted by vendors for approval of POWERGRID. Three alternatives of colored isometric views with different color shades shall be submitted for approval.

10.1.13 All flooring area other than foundations shall be designed as industrial floor with minimum 100 mm thick RCC floor slab, laid over well compacted stone soiling of minimum 200 mm thick using stone of size 150 mm & below with interstices filled with sand over well compacted earth.

10.2 <u>GIS BUILDING / GIS HALL:</u>

10.2.1 The New GIS building shall be of pre-engineered steel structure. GIS building consist of GIS hall, Room for control, protection & communication panels and AHU room. Provision for service bay and future extension of the building shall be made. During extension works in GIS hall, to keep the existing part of the building dust free, a temporary partition sheet of suitable material and strength shall be provided without any additional cost to POWERGRID. The same shall be removed after completion of work and taken back by contractor. Suitable space shall be provided to facilitate maintenance of GIS equipments. Panels shall be kept in an air-conditioned enclosure. The building shall be designed for future expansion also. Building shall be designed in such a manner that the same crane shall be extended in future expansion. Loads, structural design, fabrication & erection, material etc. of PEB structure shall be as per BIS standards

10.2.2 In case of extension of GIS building, the same shall be matched with existing type either PEB or conventional.

10.2.3 Size of the building shall be as per requirement of GIS modules, panel, O&M needs and housekeeping considerations. Any clearance required as per Electricity Act or any other Standard shall also be kept. Separate fire escape doors shall also be provided in the GIS Building

10.2.4 A Glazed partition made of aluminum extruded sections powder coated frame (min. 50 micron powder coating) and 5.5 mm (min) thick glass shall be provided between GIS hall and panel room. The total height of glazed partition shall 3000 mm above FFL include sill level of 900mm. Up to sill level full brick masonry wall to be provided and finished with Non-VOC acrylic emulsion paint to give an even shade on plastered surface over 2mm POP putty.

10.2.5 Over all Width of crane walk way shall not be less than 1.0m and shall be provided at gantry girder level on the two longer side of GIS hall along with climbing arrangement to facilitate maintenance of crane. Suitable arrangement shall be made on top of the crane, to facilitate maintenance of lighting fixtures. Structural steel of walkway shall be finished with priming coat of standard steel primmer followed by one coat of epoxy paint and final coating of PU (Minimum 100 Micron). The minimum clear height of the building shall be kept 1800 mm from the top of walk way or 600 mm above the top most point of crane, whichever is higher.

10.2.6 The base plate of steel columns shall be mounted on the RCC foundation by means of hot dip galvanized foundation bolts (The zinc coating shall be minimum 610 gram per square meter. In case the substation is located within 30km from sea coast, the zinc coating shall be 900gm per square meter. The purity of zinc shall be 99.95% as per IS: 209). *The RCC pedestal shall not protrude above floor level to avoid obstruction in the movement.*

10.2.7 PVC electrical conduits of ISI marked or IS approved shall be provided as per the requirement of electrical installations its accessories, junction boxes/surfaces boxes, fan boxes etc. Areas where false ceiling is provided and on puff panels, electrical conduit may be laid on exposed surfaces of walls or ceiling, above false ceiling area. In rest area conduit & junction boxes, fan boxes etc. shall be concealed wherever brick wall/RCC is provided.

10.2.8 The walls of GIS building and the attached relay room shall be of full brick and up to a height of 150mm above false ceiling level of relay room. Rest portion shall be provided with puff sandwiched panels as mentioned elsewhere in TS.

10.2.9 Open cable trenches in the GIS hall shall be covered with minimum 6mm thick steel chequered plate with suitable stiffeners. Chequered plate shall be painted with two or more coats of epoxy paint as per item 13.52 of DSR' 2014 over a coat of steel primer.

10.2.10 Colour Scheme matching with local aesthetic and best industry practices shall be submitted by vendors for approval of POWERGRID. Three alternatives of coloured isometric views with colour codes shall be submitted for approval. The monotony of external colour of sheet shall be avoided by providing vertical bands of different coloured sheet. The colour of roof sheet shall be light coloured to minimize heat absorption. External and internal masonry walls shall be painted with suitable approved colour in consultation with Employer.

10.2.11 All external openings for duct entries shall be provided with all round sunshade/chajjas to ensure that no rain water shall directly splashes on the sealant.

10.2.12 All flooring area other than foundations shall be designed as industrial floor with minimum 100 mm thick RCC floor slab, laid over well compacted stone soiling of minimum 200 mm thick using stone of size 150 mm & below with interstices filled with sand over well compacted earth *and with floor finish as per table - 1.*

10.3 BUILDING DESIGN CONSIDERARIONS:

THE CONTROL ROOM BUILDING & GIS BUILDING SHALL BE DESIGNED:

10.3.1 To the requirements of the National Building Code of India, and the standards quoted therein.

10.3.2 For the specified climatic & loading conditions.

10.3.3 To adequately suit the requirements of the equipment and apparatus contained in the buildings and in all respects to be compatible with the intended use and occupancy.

10.3.4 With a functional and economical space arrangement.

10.3.5 To be aesthetically pleasing. Different buildings shall show a uniformity and consistency in architectural design.

10.3.6 To allow for easy access to equipment and maintenance of the equipment.

10.3.7 With wherever required, fire retarding materials for walls, ceilings and doors, which would prevent supporting or spreading of fire.

10.3.8 With materials preventing dust accumulation.

10.3.9 With the FFL of building shall be minimum 750 mm above finished ground level or as indicated in the tender drawings. In case of extension of existing buildings, FFL should match with the existing buildings.

10.3.10 With anti-termite treatment, plinth protection, DPC, peripheral drain, sanitary, water supply, electrification etc.

10.3.11 With the building lighting, in accordance with the requirements of relevant section.

10.3.12 With the building auxiliary services like air conditioning and ventilation systems, fire protection and detection systems and all other miscellaneous services, in accordance with the requirements specified in relevant section or elsewhere in this Specification.

10.3.13 Most critical combinations of dead loads, super- imposed loads, equipment loads, crane load, wind loads, Snow load, seismic loads, any other load etc whichever is applicable shall be considered.

10.3.14 The individual members of the buildings frame shall be designed for the worst combination of forces such as bending moment, axial force, shear force, torsion deflection etc.

10.3.15 The permissible stresses for different load combinations shall be taken as per relevant BIS Codes.

10.3.16 All structures and its components must be designed and detailed as per latest BIS standards incorporating ductile detailing. List of reference codes e.g IS 456-2000 (latest), IS 875 all parts, IS 1893 all parts, IS 4326, IS 13920,SP34 etc.

10.3.17 RCC columns shall be provided with rigid connection at the base.

10.3.18 The design of steel structures for the Pre-engineered buildings shall be done in accordance with IS: 800-2007 with limit state method or elsewhere mentioned in section project.

10.3.19 Limit state method of Concrete design shall be adopted unless specified otherwise in the specification.

10.3.20 Clear cover to reinforcement shall be as per IS: 456 (latest).

10.3.21 Expansion joints wherever necessary with provision of twin columns shall be as per the provisions of relevant IS or National building codes.

10.3.22 Any sub-soil water encountered at founding level, same shall be considered in the

design.

10.3.24 For maintaining adequate air pressure inside GIS Halls following measures need to be adopted:

1. Elastomeric sealants to be provided at doors/windows junction with walls, duct entry points, roof joint, etc. to check any air leakages.
2. Cable sealing system shall be provided at the cable entry points.
3. Mats to be provided on cable trenches to reduce air leakage.
4. External doors shall be inward opening.
5. Providing of an air lock lobby for separating the inside area of GIS hall.

10.4 DESIGN LOADS:

The following loads shall be considered in design, in addition to the equipment manufacturer's requirements if any. However, all the loads, which are required for design, are subjected to employer's approval.

10.4.1 DEAD LOADS

i) Dead loads shall include the self-weight of all structures complete with finishes, fixtures and partitions.
ii) In addition, RCC beams shall be designed for any incidental point loads to be applied at any point along the beams if applicable.

10.4.2 IMPOSED LOADS

i) Super-imposed loads in different areas shall include live loads, minor equipment loads, cable trays, small pipe racks/hangers and erection, operation and maintenance loads wherever these loads are expected. Equipment loads shall constitute, if applicable, all load of equipments to be supported on the building frame.
ii) Floors/slabs shall be designed to carry loads imposed by equipment, cables and other loads associated with building. Cable load shall also be considered additionally for floors where these loads are expected.
iii) The floor loads shall be subject to Employer's approval. Floors shall be designed for live loads as per relevant IS 875 part 2 (latest), however, for Buildings, the following loads may be considered.

Roof	1.5 kN/m2 for accessible roofs and 0.75 kN/m2 for in-accessible roofs
RCC-Floor	i) 5 kN/m2 for offices ii) 10 kN/m2 (min.) for equipment floors or actual requirement, if higher than 10kN/m2 on

	equipment component and layout plans
Stairs & balconies	5 kN/m2
Toilets	2 kN/m2
Chequered plate floor	4 kN/m2
Walkways	3 kN/m2

iv) For crane loads an impact factor of 30% and lateral crane surge of 10% (lifted weight + trolley) shall be considered in the analysis of frame according to provisions of IS:875. The horizontal surge shall be 5% of the static wheel load. Crane load shall be applied as per the requirement of building.

10.4.3 WIND LOAD

i) The wind loads shall be computed as per IS 875 part 3 (latest), the class of structure for design, k1 factor, shall be considered under the category as 'important buildings and structures like hospitals, communication buildings/towers, power plant structures' for Control Room building, GIS hall, Towers, Gantries, equipment structure. For other buildings/structures wind loads shall be computed as per IS 875 part 3 (latest).
ii) Wind and Seismic forces shall not be considered to act simultaneously.

10.4.4 SEISMIC LOAD

i) Seismic Coefficient method/Response Spectrum method shall be used for the seismic analysis as per IS: 1893: Part 1 with importance factor 1.5.
ii) Wind and Seismic forces shall not be considered to act simultaneously.

10.4.5 SNOW LOAD

i) Snow load shall be computed as per IS:875 part 4 (latest).
ii) When snow load is present in roofs, replace imposed load by snow load in respective load combinations.

10.4.6 LOAD COMBINATIONS

i) The critical load combinations for design of RCC structures shall be computed or generated by using IS: 875 Part-5 (latest), IS: 456 (latest), IS: 1893- part 1 (latest).
ii) The critical load combinations for design of Steel structures shall be computed or generated by using IS: 875 Part-5 (latest), IS: 800, IS: 1893- part 1 (latest).

10.5 DESIGN OF FOUNDATIONS FOR BUILDINGS & OTHER SWITCH YARD STRUCTURES:

10.5.1 All foundation shall be of reinforced cement concrete. The design and construction of RCC structures shall be carried out as per IS: 456. Minimum 75mm thick lean concrete (1:4:8) shall be provided below all underground structures, foundations, trenches etc. to provide a base for construction

10.5.2 The switchyard foundation's plinths shall be minimum 300mm and buildings plinth shall be minimum 600 mm above finished ground level respectively. If the site is sloping, the foundation height will be adjusted to maintain the exact level of the top of structures to compensate such slopes.

10.5.3 The tower and equipment foundations shall be checked for a partial factor of safety of 2.2 for normal condition and 1.65 for short circuit condition.

10.5.4 The design and detailing of foundations shall be done based on the approved soil data and sub-soil conditions as well as for all possible critical loads and the combinations thereof. The Isolated/ Combined/ Strip footings / Raft or pile foundation as may be required based on soil/sub-soil conditions and superimposed loads shall be provided

10.5.5 The procedure used for the design of the foundations shall be the most critical loading combination of the steel structure and or equipment and/or superstructure and other conditions which produces the maximum stresses in the foundation or the foundation component and as per the relevant BIS Codes of foundation design. Detailed design calculations shall be submitted by the bidder showing complete details.

10.5.6 Necessary protection to the foundation work, if required shall be provided to take care of any special requirements for aggressive alkaline soil, black cotton soil or any other type of soil which is detrimental/harmful to the concrete foundations.

10.5.7 If pile foundations are adopted, the same shall be cast-in-situ bored or pre-cast or under reamed type as per relevant parts of IS: 2911. Only RCC piles shall be provided. Necessary initial load test shall be carried out by the Contractor to establish the pile design capacity. Only after the design capacity of pile has been established, the Contractor shall take up the job of piling. Routine tests for the pile shall also be conducted as per IS: 2911/IS :10262. All the testing work shall be planned in such a way that these shall not cause any delay in project completion. RCC for pile works shall be Design Mix of minimum grade M-25 and also minimum cement content shall be 400Kg/ cu.m as per IS:2911 (Latest revision). In case extra cement is required to meet the provisions of IS: 2911, it will be paid extra.

10.5.8 The foundations shall be proportioned so that the estimated total and differential movements of the foundations are not greater than the movements that the structure or equipment is designed to accommodate.

10.6 DESIGN OF TRANSFORMER AND REACTOR FOUNDATION:

10.6.1 The foundations of Transformer & Reactor shall be of block type foundation. Minimum reinforcement shall be governed by IS: 2974 and IS: 456. In case of Reactor Plan dimension of block should not be less than size of base of reactor.

10.6.2 The Contractor shall provide a RCC Rail cum road system integrated with the Autotransformer / Reactor foundation to enable installation and the replacement of any failed unit. The transfer track system shall be suitable to permit the movement of any failed unit fully assembled (including OLTC, bushings) with oil.

10.6.3 This system shall enable the removal of any failed unit from its foundation to the nearest road. If trench/drain crossings are required then suitable R.C.C. culverts shall be provided in accordance with I.R.C. standard / relevant IS.

10.6.4 The Contractor shall provide a pylon support system for supporting the firefighting system.

10.6.5 Each Autotransformer/Reactor including oil conservator tank and cooler banks etc. shall be placed in a self-sufficient pit surrounded by retaining walls (Pit walls). The clear distance of the retaining wall of the pit from the Autotransformer/Reactor shall be 20% of the Autotransformer/Reactor/ cooler bank height or 0.8m whichever is higher. The oil collection pit thus formed shall have a void volume equal to 200% volume of total oil in the Autotransformer/Reactor. In case of transformers of 132kV and below, where hydrant system for firefighting is not provided, volume of pit may be reduced to 130% of total oil volume. However, in case common oil pit is envisaged during detailed engineering, the individual oil collection pit thus formed shall have a void volume equal to 33% volume of total oil in the Autotransformer/Reactor. The common oil collection pit shall have a void volume equal to 200% volume of maximum total oil of either Autotransformer or Reactor.

10.6.6 The minimum height of the retaining walls of pit shall be 20 cm above the finished level of the ground to avoid outside water pouring inside the pit. The bottom of the pit shall have a uniform slope towards the sump pit. While designing the oil collection pit, the movement of the autotransformer / reactor must be taken into account.

10.6.7 The grating shall be made of MS flat of size 30mm x 5mm placed at 30mm centre to centre and 6mm dia MS bar at spacing of 150mm at right angle to each other.

Maximum length of grating shall be 2000mm and width shall not be more than 500mm. The gratings, supported on ISMB 150 mm, shall be placed at the formation level and will be covered with 100mm thick layer of stone aggregate having size 40mm to 60mm. All steel work used for grating and supports shall be painted with epoxy based zinc phosphate primer (two packs) confirming to IS: 13238- 1991, thereafter with two or more coat of bituminous paint of approved quality shall be applied. Contractor shall have option to provide factory made electro forged MS grating made of specified size MS flat and round bars without any extra cost to employer.

10.6.8 Each oil collection pit shall be drained towards a sump pit of size 1000X750mm and 500mm deep below the floor level within the collection pit whose role is to drain water and oil due to leakage within the collection pit so that collection pit remains dry.

10.7 DESIGN OF FIRE PROTECTION WALLS:

10.7.1 The construction of fire walls shall be cast in situ type or pre cast RCC as per drawings and meeting the technical specification.

10.7.2 The firewall shall have a minimum fire resistance of 4 hours. The walls of the building, which are to be used as firewalls, shall have also a minimum fire resistance of 4 hours. The firewall shall be designed to protect against the effect of radiant heat and flying debris from an adjacent fire.

10.7.3 The firewall shall extend 600 mm on each side of the Autotransformer or Reactors and 600 mm above the conservator tank or safety vent. A minimum of 2.0 meter clearance shall be provided between the equipment's e.g. Autotransformer or Reactors and firewalls. In case of space constraints, these dimensions can be reduced as per the approval of Employer.

10.7.4 The building walls, which act as firewalls, shall extend at least 1 m above the roof or 600 mm above the conservator tank or safety vent, whichever is maximum, in order to protect it.

10.7.5 The firewall will be made of reinforced cement concrete with smooth surfaces devoid of honey comb, undulations etc. and shall be finished with water proofing cement paint of approved colour.

10.8 DESIGN OF WATER TANKS, CHANNELS, SUMPS, TRENCHES AND OTHER UNDER-GROUND STRUCTURES:

10.8.1 RCC water retaining structures like storage tanks, etc. shall be designed as un-cracked section in accordance with IS: 3370 (Part I to IV) by working stress method. In case of

water channels, shall be designed as cracked section with limited steel stresses as per IS: 3370 (Part I to IV) by working stress method.

10.8.2 All sub-structures shall be checked for sliding and overturning stability during both construction and operating conditions for various combinations of loads. Factors of safety for these cases shall be taken as mentioned in relevant BIS Codes or as stipulated elsewhere in the Specifications. For checking against overturning, weight of soil vertically above footing shall be taken and inverted frustum of pyramid of earth on the foundation should not be considered.

10.8.3 Earth pressure for all underground RCC structures like cable trenches, underground water tanks, Oil collection pits, Septic tanks, basements etc. shall be calculated using co-efficient of earth pressure at rest, co-efficient of active or passive earth pressure (whichever is applicable). However, for the design of substructures of any underground enclosures, earth pressure at rest shall be considered.

10.8.4 In addition to earth pressure and ground water pressure etc., a surcharge load of 2T/Sq.m shall also be considered for the design of all underground structures for the vehicular traffic in the vicinity of the structure.

10.8.5 Underground tanks shall be checked for full water pressure from inside and no earth pressure & ground water pressure & surcharge pressure from outside (application only to structures which are liable to be filled up with water or any other liquid). They shall also be checked for full earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.

10.8.6 Design shall also be checked against buoyancy due to the ground water during construction and maintenance stages. Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the superimposed loadings. Base slab of any underground enclosure shall also be designed for empty condition during construction and maintenance stages with maximum ground water table (GWT). Minimum factor of safety of 1.5 against buoyancy shall be ensured ignoring the super-imposed loadings.

10.8.7 Base slab of any underground enclosure like water storage tank shall also be designed for the condition of different combination of pump sumps being empty during maintenance stages with maximum GWT. Intermediate dividing piers of such enclosures shall be designed considering water in one pump sump only and the other pumps sump being empty for maintenance.

10.9 INTERNAL FINISH SCHEDULE FOR BUILDING & GIS HALL EITHER RCC/ PEB:

10.9.1 Internal finishing Schedule for control room building and GIS hall is given in Table - 1 below: The Locations, which are not specified in finish schedule, shall be provided with

vitrified tile flooring and premium acrylic emulsion paint over two mm thick POP putty. The below mentioned finishing schedule is also applicable for extension of Control room or GIS hall unless otherwise mentioned else-where in the Tender. Areas where false ceiling is provided, electrical conduit may be laid on exposed surfaces of walls or ceiling, above false ceiling area.

Table-1

Sr. No.	LOCATION	FLOORING & SKIRTING 150MM HIGH	WALL (INTERNAL)	CEILING	DOOR, WINDOWS & VENTILATOR
1	Control Room	Vitrified tiles size 600 x 600mm (DSR Item 11.46)	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat	False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	Windows shall be of min. 10mm thick laminated float safety glass conforms to IS: 2553 (Part-I) by using suitable powder coated aluminum extruded sections peripheral frame. The glazed window shall be provided between column to column horizontally and vertically from sill level of 0.75 m to bottom false ceiling. In a window 2 to 3 vertical pieces may be provided depending upon the availability of glass and the vertical joint shall be sealed with silicon sealant. All doors shall be glazed powder coated aluminium doors with minimum 5.5 mm thk. glass
2	Confer-ence Room	Vitrified tiles size 600 x 600mm (DSR Item 11.46)	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling	False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.

			over approved primer coat		
3	(S/S In-charge Room)	Vitrified tiles size 600 x 600mm (DSR Item 11.46)	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat	False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
4	Other Office Rooms	Vitrified tiles size 600 x 600mm (DSR Item 11.46)	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat.	False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
5	Electronics Test Lab.	Vitrified tiles size 600 x 600mm (DSR Item 11.46)	Non VOC acrylic emulsion paint over 2mm POP putty false ceiling over approved primer coat	False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
6	ACDB& DCDB Room	62mm thick cement concrete flooring with hardener	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat	Non VOC acrylic emulsion paint over approved primer coat for RCC Building / False ceiling shall be provided in-case of PEB building.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
7	Battery room	Vitrified tiles size 600 x 600mm (DSR Item	Non VOC acrylic emulsion paint over 2mm POP putty upto	False ceiling painted with Non VOC acrylic emulsion paint to give an even	All doors Windows/ventilator shall be glazed uPVC doors with minimum 5.5.mm thk. Glazing.

		11.46)	false ceiling over approved primer coat	shade.	
8	Lobby	18mm thick granite flooring (DSR Item 8.12)	Non VOC acrylic emulsion paint ove r2mm POP putty upto false ceiling over approved primer coat	False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
9	Corridor	Vitrified tiles size 600 x 600mm (DSR Item 11.46)	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat	False ceiling painted with Non VOC acrylic emulsion paint to give an even shade.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
10	Portico for RCC Building	18mm thick granite flooring(DSR Item 8.12)	Granite cladding	Non VOC acrylic emulsion paint over approved primer coat	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
11	Toilet	Ceramic tiles (DSR item 11.38)	DADO glazed tile 2100mm high, above that non VOC acrylic emulsion paint over 2 mm thick POP putty along with primer coat.	Non VOC acrylic emulsion paint over approved primer coat for RCC building / False ceiling shall be provided in-case of PEB building.	All windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing. All doors shall be flush door shutters made of pre-laminated particle board (DSR 9.131 & 9.132) with powder coated aluminum frame.
12	Janitor room	Ceramic tiles (DSR item 11.38)	DADO glazed tile 2100mm high, above that non VOC acrylic emulsion paint	Non VOC acrylic emulsion paint over approved primer coat for RCC building / False ceiling	All windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing. All doors shall be flush door shutters made of

			over 2mm thk. POP putty along with primer coat.	shall be provided in-case of PEB building.	pre-laminated particle board (DSR 9.131 & 9.132) with powder coated aluminium frame.
13	GIS Hall	62mm thick cement concrete flooring with hardener. Two coats of PU coating over the floor shall be provided. over the total area (Present + Future). The final coat of PU shall be applied after Installation of equipments. Total thickness of PU coats shall be minimum 300 microns.	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat over plastered surface	In case of RCC roof, ceiling shall be finished with Non VOC acrylic emulsion paint over approved primer coat.	All doors, windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing.
14	Panel/ Relay Room/	Vitrified tiles 8mm thick size	Non VOC acrylic emulsion paint	False ceiling painted with Non VOC acrylic	All doors, windows, ventilators shall be of uPVC with minimum

	Communication Room	600 x 600mm	over 2mm POP putty upto false ceiling over approved primer coat primer coat over plastered surface	emulsion paint to give an even shade.	5.5.mm thk. Glazing.
15	AHU Room	62mm thick cement concrete flooring with hardener	Non VOC acrylic emulsion paint over 2mm POP putty upto false ceiling over approved primer coat primer coat over plastered surface	RCC ceiling finished with non-VOC acrylic emulsion paint over approved primer coat.	All windows, ventilators shall be of uPVC with minimum 5.5.mm thk. Glazing. All doors shall be flush door shutters (35mm thk. block board with commercial veneer on both side with lipping) with powder coated aluminium frame.

uPVC doors, windows, ventilators shall be sliding or openable or partially openable/partially fixed or fixed type of factory made uPVC doors, windows (casement/sliding), ventilators, fixed glazing and partitions as per DSR '16 item no. 9.147A to 9.147F.

10.10 FALSE CEILING DETAILS:

10.10.1 For the locations of false ceiling refer table -1 above, unless otherwise specified elsewhere in tender documents.

10.10.2 15mm thick densified tegular edged eco friendly light weight calcium silicate false ceiling tiles of approved texture spintone/cosmos/ Hexa or equivalent of size 595x595 mm in true horizontal level, suspended on inter locking metal grid of hot dipped galvanised steel sections (galvanising @ 120 grams per sqm. Including both side).

Consisting of main 'T' runner suitably spaced at joints to get required length and of size 24x38 mm made from 0.33 mm thick (minimum) sheet, spaced 1200 mm centre to centre, and cross 'T' of size 24x28 mm made out of 0,33 mm (minimum) sheet, 1200 mm long spaced between main 'T' at 600 mm centre to centre to form a grid of 1200x600 mm and secondary cross 'T' of length 600 mm and size of 24x28 mm made of 0.33 mm thick (minimum) sheet to be interlocked at middle of the 1200x600 mm panel to form grid of size 600x600 mm, resting on periphery walls/partitions on a perimeter wall angle precoated steel of size (24x24x300 mm made of 0.40 mm thick (minimum) sheet with

the help of rawl plugs at 450 mm centre to centre with 25 mm long drywall screws @230 mm interval and laying 15 mm thick densified edges calcium silicate ceiling tiles of approved texture (Spintone/ Cosmos/ hexa) in the grid, including, cutting/making openings for services like diffusers, grills, light fittings, fixtures, smoke detectors etc., Wherever required.

Main 'T' runners to be suspended from, ceiling using G.I. slotted cleats of size 25x35x1.6 mm fixed to ceiling with 12.5 mm dia and 50 mm long dash fasteners, 4 mm G.I. adjustable rods with galvanised steel level clips of size 85x30x0.8 mm, spaced at 1200 mm centre to centre along main 'T', bottom exposed with 24 mm of all T-section shall be pre-painted with polyester baked paint, for all heights, as per specifications, drawings and as directed by engineer- in-charge.

10.11 WATER PROOFING TREATMENT

10.11.1 Integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc consisting of following operations:

a) Applying a slurry coat of neat cement using 2.75 kg/sqm. of cement admixed with water proofing compound conforming to IS. 2645 and approved by Engineer-in-charge over the RCC slab including adjoining walls upto 300mm height including cleaning the surface before treatment.
b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 (1 cement : 5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge over 20 mm thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls upto 300 mm height including rounding of junctions of walls and slabs
c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sqm of cement admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge.

d) Finishing the surface with 20 mm thick joint less cement mortar of mix 1:4 (1 cement :4 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep.

e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Engineer-in-Charge

f) With average thickness of 120mm and minimum thickness at khurra as 65 mm.

10.11.2 Alternatively in case of non- availability of good quality of brick bats, the water proofing treatment can also be done in the following manner:

The water proofing membrane shall be laid on the RCC slab without any break. The grading concrete (1:2:4) of average thickness of 50 mm with water proofing compound as per manufacturer's specification shall be laid over the membrane. Cement concrete flooring of 40mm thick with (1cement: 2 fine aggregate: 4 stone aggregate 20mm graded stone aggregate) finished with a floating coat of neat cement including cement slurry complete shall be laid over grading concrete and checkered pattern in the grid of 300mm x 300mm shall be made .

10.11.3 SUNKEN WATER PROOFING (RCC):

- Water proofing treatment shall be done in sunken portion of WCs, bathroom etc. by applying cement slurry mixed with water proofing cement compound consisting of:

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

b) Second layer 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 for 48 hours.

- Treatment and sealing of joints, corners, junction of pipes and masonary with polymer mixed slurry shall be carried out as per CPWD specifications.

10.12 SPECIFICATION FOR PLUMBING, SANITATION & WATER SUPPLY ETC:

10.12.1 All plumbing and sanitation shall be executed to comply with the requirements of the appropriate bye-laws, rules and regulations of the Local Authority having jurisdiction over such matters. The Contractor shall arrange for all necessary formalities to be met in regard to inspection, testing, obtaining approval and giving notices etc.

10.12.2 Provision for water cooler shall be provided at suitable location.

10.12.3 Each toilet shall be provided with Water Closet, Wash hand basin, health faucet, Mirror, Towel Rail, Paper Holder, Liquid soap dispenser, twin coat holder.

10.12.4 In addition to general requirements of each toilets, 2 nos. Sensor based urinals shall be provided for common Gents toilet.

10.12.5 Pantry shall be provided with stainless steel kitchen sink.

10.12.6 The platform of kitchen sink and wash hand basin shall be provided with 18 mm thk. Mirror polished approved granite stone.

10.12.7 The specification of different items, which are to be used for plumbing, sanitation & water supply etc. in are given below, the same shall be used during detailed engineering, unless otherwise mentioned else-where in the tender.

S.No.	Items	Description
1	Wall hung Water Closet	Coloured vitreous china extended wall mounting water closet of approved size and shape including providing & fixing white vitreous china cistern with dual flush fitting, of flushing capacity 3 litre/6 litre (adjustable to 4 litre/8 litres), including seat cover, and cistern fittings, nuts, bolts and gasket etc complete.
2	Squatting Pan	(Indian type W.C. pan) (white vitreous china Orissa pattern W.C. pan of size 580x440mm with integral type foot rests) shall be with 100mm sand cast iron P or S trap. 10 litre low level white P.V.C flushing cistern with manually controlled device (handle lever) conforming to IS:7231, with all fittings and fixtures complete including cutting and making good the walls and floors wherever required.
3	Wash Basin	Providing and fixing coloured wash basin counter type of (approximate size 630x450mm size under counter or over counter type), in case flat bash hand is required the approximate size shall be 550x400mm and shall be provided with C.P. close basin mixer (ISI approved) with CI. Brackets taps with battery based infrared sensor, 32mm C.P. brass waste and bottle trap of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever required. Other details shall be as per the drawings.
4	Urinal	White vitreous china battery based infrared sensor operated urinal of approx. size 610 x 390 x 370 mm having pre & post flushing with water (250 ml & 500 ml consumption), having water inlet from back side, including fixing to wall with suitable brackets all as per manufacturers specification and direction of Engineer-in-charge.
5	Urinal partition	10mm thk toughened glass partition with frosted film to be fixed in position for urinals on appropriate stainless steel patch fittings of desired shape and size
6	Kitchen sink	Stainless steel AISI 304 (18/8) Kitchen sink of 510x1040 mm bowl with depth of 178mm with drain board shall be provided and fixed as per IS 13983 with C.I brackets, and stainless steel plug 40mm with provision of 2 nos. CP brass long body bib cock conforming to IS Standard and weighing not less than 650 gm for CP bottle trap etc.

		including painting of fittings and brackets, cutting and making good the wall.
7	Bib cock	C.P. brass short body and long body bib cock 15mm nominal bore shall be of approved quality conforming to IS: 8931.
8	Angle valve	C.P. brass angle valve of 15mm nominal bore provided and fixed in position for basin and cistern points of approved quality conforming IS :8931.
9	Towel rail	C.P. brass towel rail of approved make of 600mm length, 25mm dia with a pair of brackets or flanges provided and fixed to wall beside each wash basin/set of wash basin with necessary screws, plugs, etc.
10	Mirror	6mm thick beveled edge mirror approximate size 1000x600mm made of superior glass of approved make complete with a backing of 6 mm thick water proof hard board fixed to wooden cleats with 25mm dia SS studs, washers etc complete for each wash basin.
11	Hooks	Double type coat & hat hooks with flanges, fixed to wall / shutter, etc. with necessary screws, washers & plugs.
12	Liquid soap holder	C.P. brass liquid soap holder of approved make fixed with each wash basin to the wall with necessary CP brackets, CP screws, washers, plugs etc.
13	C.P. Brass or S.S. cockroach trap	Approved C.P. Brass cockroach trap shall be provided in the Kitchen, Toilets and pantry
14	Floor traps	PVC floor traps of self cleansing design shall be provided & fixed in position with 100 mm dia. inlet and 75mm dia. outlet of approved make, including making connection with PVC soil/waste pipes using rubber gaskets, embedding the trap in 150 mm thick PCC 1:2:4.
15	Internal Soil, waste and vent pipe	Unplasticised rigid PVC pipes of 75mm for waste & 110mm dia for soil shall be provided conforming to IS:13592 type B and all its fittings like bends, sockets, door bend, Y-tee etc. as per requirement with seal ring conforming to IS: 5382 including jointing with cement solvent conforms to IS:14182. All underground or under floor pipes shall be encased with 1:3:6 concrete. Minimum concrete cover shall be 75 mm thk.

16	Rain Water Pipe and fittings	a) Unplasticised rigid PVC rain water pipes of required dia shall be provided and fixed on the wall face conforming to IS: 13592 type A as per requirement including jointing with seal ring conforming to IS: 5382 leaving 10mm gap for thermal expansion single socketed pipes including all fittings like bends, bat clamps gratings etc. b) Unplasticised PVC Moulded fittings/accessories including suitable dia. bend & shoes shall be provided and fixed for unplasticised rigid PVC rain water pipes conforming to IS:13592 type A including jointing with seal ring conforming to IS: 5382 leaving 10mm gap for thermal expansion. c) Clips of approved design shall be provided and fixed to unplasticised PVC rain water pipes by means of 50x50x50mm hard wood plugs, screwed with MS screws of required length including cutting brick work and fixing in cement mortar1:4 (1 cement : 4 coarse sand) and making good the wall etc
17	Internal & External water supply	a) All CPVC pies and fittings shall conform to IS:15778 b) All internal CPVC pipe shall be concealed including cutting of chases and making good the wall. c) Wherever CPVC pipes are buried the same shall be provided and laid in position including trenching, sand cushion and refilling, etc. For trenching, sand cushion and refilling refer CPWD specification applicable for external piping work. d) All internal CPVC pipe shall be concealed including cutting of chases and making good the wall. e) ISI approved CPVC ball valve, non-return valves shall be provided and fixed in position as per requirement and direction of Engineer-in-charge.
18	Water storage tanks	Triple layered Polyethylene water storage tanks shall be provided of approved brand and manufacture with cover and suitable locking arrangement, float valve and making necessary holes for inlet, outlet and overflow pipes. Capacity of water tank shall be 2x1500 litres for control room, 2X2000 litres for Transit Camp.
19	Sluice valve chamber	Masonry chamber for sluice valve shall be 600x600mm size in plan and depth 750mm, or matching with the site condition inside with 50 class designation brick work in cement mortar 1:5 (1 cement : 5 fine sand) with CI surface box 100 mm. Top diameter, 160 mm bottom dia and 180 mm deep (inside) with chained lid and RCC top slab 1:2:4 mix (1cement : 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement : 5 fine aggregate : 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1

		cement : 3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design with FPS bricks of class 75.
20	External Sewerage	Glazed stoneware pipes of 100 & 150mm diameter grade 'A' shall be provided, laid and jointed with stiff mixture of cement mortar in the proportion of 1:1 (1cement :1 fine sand) including testing of joints etc. complete. SW pipes shall be encased with Cement concrete 1:5:10 (1 cement: 5 coarse sand: 10 graded stone aggregate 40 mm nominal size) including bed concrete as per CPWD standard design and CPWD specifications. In case of non-availability of SW Pipe, contractor may use UPVC Pipe of similar dia with the prior approval of EIC without any financial implication to POWERGRID.
21	Gully trap	100x100 mm or 150x100 mm size P type Square-mouth S.W. gully trap class SP-1 complete with C.I. grating brick masonry chamber and water tight C.I. cover frame o f 300 x300 mm size (inside), the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design. FPS Bricks class designation 75 shall be provided for brick masonry chamber.
22	Manholes	FPS brick masonry manhole shall be constructed in cement mortar 1:4 (1 cement :4 coarse sand) RCC top slab with 1:2:4 mix (1 cement : 2 fine aggregate : 4 graded stone aggregate 20 mm nominal size) foundation concrete 1:4:8 mix (1cement : 4 coarse sand :8 graded stone aggregate 40 mm nominal size) inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement: 2 coarse sand :4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement complete as per standard design. The size and depth of manhole shall be suitably decided based on requirement of layout in line with CPWD specification. a) Inside size shall be 90 x 80 cm and 60 cm deep including CI cover with frame (light duty) 455 x 610 mm internal dimensions total weight of cover and frame shall not be less than 38 kg (weight of cover 23 kg and weight of frame 15 kg) and shall be constructed with F.P.S. bricks with class designation 75. b) Inside size shall be 120 x 90 cm and 90 cm or more deep including CI cover with frame (medium duty) 500mm internal diameter total weight of cover and frame to be not less than 116 kg (weight of cover 58 kg and weight of frame 58 kg) with FPS Bricks class designation 75.

23	Foot Rest	Orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS : 10910, on 12 mm dia steel bar conforming to IS: 1786, having minimum cross section as 23 mmx25 mm and over all minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm as per standard drawing and suitable to with stand the bend test and chemical resistance test as per specifications and having manufacture's permanent identification mark to be visible even after fixing, fixing in manholes with 30x20x15 cm cement concrete block 1:3:6 (1 cement : 3 fine aggregate : 6 graded stone aggregate 20 mm nominal size) complete.
24	Road Gully Chamber	Brick Masonry road gully chamber of 50x45x60cm shall be provided with FPS brick with cement mortar 1:4 including 500x450mm pre cast RCC Horizontal/vertical grating with frame complete.

11.0 MATERIAL SPECIFICATION FOR ALL PRE-ENGINEERED BUILDINGS:

11.1 STRUCTURAL STEEL MEMBERS:

11.1.1 Primary structural framing shall include the transverse rigid frames, columns, corner columns, end wall wind columns and crane gantry girders and Frames at Door openings.

11.1.2 Primary members are fabricated from plates and sections with minimum yield strength of 340 Mpa to suit design by continuous double side welding.

11.1.3 All miscellaneous structural members, rod bracings, angle bracings, pipe bracings, wind bracings, sag rods, etc. shall conform to the physical specification of IS: 2062 with a minimum 245Mpa Yield Strength.

11.1.4 All welded structural steel members shall be provided with suitable treatment of shot blasting before application of steel primer.

11.1.5 All structural steel members including walk way structural steel members shall be painted with a steel priming coat followed by one coat of epoxy paint and final coating of PU (Minimum 100 Micron).

11.1.6 The structural steel members of cage ladder shall be galvanized with 610 gm/sqm.

11.2 PURLINS AND GIRTS MEMBERS:

11.2.1 Purlins, girts, necessary clips and other cold rolled structural members shall conform to the physical specification of ASTM A570 (Grade 50) or equivalent IS Standards having a minimum yield strength of 340 MPa and shall be of Pre galvanised having a total coating thickness of 275 gm/sqm. inclusive of both sides.

11.2.2 The minimum thickness of secondary members shall be 2.5mm.

11.3 ROOF & WALL SHEETING:

11.3.1 Factory assembled 50mm thick puff (overall average density 40kg/cu.m. +/- 2 Kg/cu m as per IS: 11239 Part-2) sandwiched panels shall be provided. These panels shall be made of puff insulation sandwiched between two high tensile steel sheets each of 0.5 mm thickness. The material of sheets shall confirm to ASTM 792 M with minimum yield strength of 340 Mpa. However, higher grades of steel sheet may be supplied without any further cost implication.

11.3.2 The steel sheets shall be provided with hot dip coating of Zinc aluminium alloy (approximately 55% Al, 43.5% Zn and 1.5 % silicon).Total mass of zinc aluminium alloy coating shall be minimum 150 gm/Sq. m inclusive of both sides. The tolerance of base metal thickness (BMT) of steel sheet shall be as per IS 16163. After hot dip coating of Zinc aluminium alloy, the sheet shall be provided with steel primer and silicon modified polyester (SMP) paint. The total thickness of primer and paint shall be 40 microns inclusive of both sides (TCT) comprising of 20 microns of SMP paint on top surface and 10 microns of backer coat (polyester coat) on back surface over 5 microns thick primer each on both surfaces with inorganic pigments coated free from heavy metals. Painting shall conform to IS: 15965. In case SMP paint is not available, Super Durable Polyester paint (SDP) can also be used by the bidder without cost implication to POWERGRID.

11.4 SHEETING FASTENERS:

Standard fasteners shall be self tapping zinc plated metal screws with EPDM bonded zinc plated washers. All screws shall be colour coated to match roof and wall sheeting.

11.5 SEALER:

This is to be applied at all side laps and end laps of roof panels and around self flashing windows. Sealer shall be pressure sensitive elastomeric Butyl tapes. The sealer shall be non-asphaltic, non-shrinking and non toxic and shall be superior adhesive metals, plastics and painted at temperatures from 51°C to +104°C.

11.6 CLOSURES:

Solid or closed cell closures matching the profiles of the panel shall be installed along the eaves, rake and other locations. It should be specifically specified on drawings. The steel sheets shall be provided with hot dip coating of Zinc aluminium alloy (approximately 55% Al, 43.5% Zn and 1.5 % silicon).Total mass of zinc aluminium alloy coating shall be minimum 200 gm/Sq. m inclusive of both sides. The tolerance of base metal thickness (BMT) of steel sheet shall be as per IS 16163. After hot dip coating of Zinc aluminium alloy, the sheet shall be provided with steel primer and silicon modified polyester (SMP) paint. The total thickness of primer and paint shall be 40 microns inclusive of both sides (TCT) comprising of 20 microns of SMP paint on top surface and 10 microns of backer coat (polyester coat) on back surface over 5 microns thick primer each on both surfaces with inorganic pigments coated free from heavy metals. Painting shall conform to IS: 15965. In case SMP paint is not available, Super Durable Polyester paint (SDP) can also be used by the bidder without cost implication to POWERGRID.

11.7 FLASHING AND TRIM:

Flashing and / or trim shall be furnished at the rake, corners, eaves, and framed openings and wherever necessary to provide weather tightness and finished appearance. Colour shall be matching with the colour of wall. The steel sheets shall be provided with hot dip coating of Zinc aluminium alloy (approximately 55% Al, 43.5% Zn and 1.5 % silicon).Total mass of zinc aluminium alloy coating shall be minimum 200 gm/Sq. m inclusive of both sides. The tolerance of base metal thickness (BMT) of steel sheet shall be as per IS 16163. After hot dip coating of Zinc aluminium alloy, the sheet shall be provided with steel primer and silicon modified polyester (SMP) paint. The total thickness of primer and paint shall be 40 microns inclusive of both sides (TCT) comprising of 20 microns of SMP paint on top surface and 10 microns of backer coat (polyester coat) on back surface over 5 microns thick primer each on both surfaces with inorganic pigments coated free from heavy metals. Painting shall conform to IS: 15965. In case SMP paint is not available, Super Durable Polyester paint (SDP) can also be used by the bidder without cost implication to POWERGRID.

11.8 WALL LIGHTS:

For day lighting purpose of GIS hall, minimum 2 mm thick approved translucent polycarbonate sheet shall be provided for wall lighting in addition to windows for at least 10% of wall area on upper portion of both long walls. The polycarbonate sheet shall be fixed with necessary EPDM/rubber gasket, Silicon Sealant, cold forged fastener, aluminum profile etc. including MS supporting structural steel (conforming to IS:1161/4923) frame to ensure water tight arrangement.

11.9 CONNECTIONS:

11.9.1 SITE CONNECTIONS

i) All primary bolted connections shall be provided with galvanized high strength bolts, washers, nuts conforming to specifications of grade 8.8 of IS 1367/IS:3357

ii) All secondary bolted connections shall be furnished with bolts, nuts, washers conforming to the specifications of grade 4.6 of IS 1367 or ASTM-A307.

11.9.2 SHOP CONNECTIONS

All shop connections shall be welded with appropriate arc welding process and welding shall be in accordance with IS: 816, IS -818 ,IS1024, IS:1261, IS1323, IS-9595, AWSD 1.1. as appropriate. The Webs should be welded on to the flanges at both the faces at top and bottom for columns, beams and crane girders. Weld material should have strength more than the parent metal.

11.10 GUTTERS AND DOWN SPOUTS:

Gutters and downspouts shall be adequately designed to ensure proper roof drainage system. The steel sheets shall be provided with hot dip coating of Zinc aluminium alloy (approximately 55% Al, 43.5% Zn and 1.5 % silicon).Total mass of zinc aluminium alloy coating shall be minimum 200 gm/Sq. m inclusive of both sides. The tolerance of base metal thickness (BMT) of steel sheet shall be as per IS 16163. After hot dip coating of Zinc aluminium alloy, the sheet shall be provided with steel primer and silicon modified polyester (SMP) paint. The total thickness of primer and paint shall be 40 microns inclusive of both sides (TCT) comprising of 20 microns of SMP paint on top surface and 10 microns of backer coat (polyester coat) on back surface over 5 microns thick primer each on both surfaces with inorganic pigments coated free from heavy metals. Painting shall conform to IS: 15965. In case SMP paint is not available, Super Durable Polyester paint (SDP) can also be used by the bidder without cost implication to POWERGRID.

12.0 VENDORS & MQP FOR PEB BUILDINGS

12.1 All the material required for Pre-engineered (steel) building shall be procured from approved vendors as per list of compendium of vendors available on POWERGRID web site or any other reputed manufacturer for which prior approval shall be obtained from POWERGRID.

12.2 Manufacturing of various parts of the building shall start only after approval of "Manufacturing Quality Plan". Design and structural drawings shall be approved by POWERGRID.

12.3 Shop/fabrication showing each and every detail along with bill of material for all members of structures, joints, nuts & Bolts, welding shall be prepared and approved by venders as per standard practice of fabrication based on POWERGRID approved design and structural drawings.

12.4 Complete material shall be offered for inspection by CC (Corporate Centre) QA&I department before dispatch. Inspection of Material by POWERGRID CC QA &I deptt. shall be carried out based on Shop/fabrication drawing and BOM as approved by Vendors. Approval of BOM and shop/fabrication drawings from Employer is not required.

13.0 GENERAL SPECIFICATION FOR BUILDINGS:

These clauses are applicable for Buildings, which are to be constructed as per drawings provided by employer such as CRB, transit camp, residential buildings, switch yard panel room and fire water pump house with fire water tank. Architectural drawings of buildings covered in the scope are enclosed with the tender documents and are also available on website. These drawings are good for construction except for foundation drawings of the buildings which will be issued to the successful bidder after award of work and after receipt of soil investigation report depending upon soil parameters.

This shall also be applicable for vendor designed buildings wherever applicable.

In case of CRB and GIS halls, most of the finishing items are explained in previous clauses, if any of items are missed or may be required for completion of the same, the below mentioned clauses may also be referred.

13.1 The material specification, workmanship and acceptance criteria shall be as per approved standard Field Quality Plan attached with this document which is available on POWERGRID web site. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification.

13.2 Post constructional Anti termite treatment shall be carried out for all buildings as per DSR item no. 2.34 & 2.35. Anti termite chemical treatment shall be given to column pits, wall trenches, foundations of buildings, filling below the floors etc. as per IS: 6313 and other relevant Indian Standards.

13.3 Reinforced cement concrete with controlled water cement ratio as per IS-code shall be used for all underground concrete structures such as pump-house, tanks, and water retaining structures for achieving water-tightness.

13.4 FPS or Modular clay/fly ash based Bricks having minimum 75 kg/cm2 compressive strength can only be used for masonry work. Contractor shall ascertain himself at site regarding the availability of bricks of minimum 75 kg/cm2 compressive strength before submitting his offer. However, Contractor can propose to use aerated concrete block or solid concrete blocks of compressive strength not less than 75kg/cm2 without any cost implication to POWERGRID.

13.5 Full brickwork shall be provided with cement mortar 1:6 (1cement: 6 coarse sand). Half brick work masonry shall be provided with cement mortar 1:4 (1cement: 4coarse sand) and two no 6mm dia ms bar at every third course.

13.6 12mm cement plaster of mix 1:6 (1cement: 6 fine sand) shall be provided on the smooth side of internal walls. However rough side of walls shall be provided with 15mm cement plaster of mix 1:6 (1cement: 6 fine sand).

13.7 External plaster in two coats - 18mm Cement plaster in two coats under layer 12mm thick cement plaster 1:5 (1 cement: 5coarse sand) finished with a top layer 6mm thick cement plaster (1cement : 6 fine sand). External plastered surface shall be finished with white cement based putty of average thickness 1 mm, of approved brand and manufacturer to prepare the surface even and smooth. After putty the walls shall be finished with Premium Acrylic Smooth exterior paint of approved brand and manufacturer with Silicone additives of required shade (Two or more coats applied @ 1.43 ltr/ 10 sqm. over and including priming coat of exterior primer applied @ 2.20 kg/ 10 sqm).

13.8 6 mm thk. Cement plaster of mix 1:3 (1 cement: 3 fine sand) to RCC ceiling shall be done except areas where false ceiling are provided.

13.9 Internal walls shall be finished with Plaster of Paris putty of average thickness 2 mm, of approved brand and manufacture, over the plaster surface to prepare the surface even and smooth complete. In case plastered surface of buildings are covered under wall paneling, dado work, skirting etc. no putty and painting are required.

13.10 Internal walls shall be painted with minimum two coats of premium acrylic emulsion paint having VOC (volatile organic compound) content less than 50gm per litre of approved brand and manufacture including applying additional coats wherever required, to achieve even shade and colour over priming coat as per manufacturer specification/ recommendation.

13.11 Non - VOC premium acrylic emulsion paint having volatile organic compound content less than 50gm per litre of approved brand and manufacture shall be used wherever specified.

13.12 Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade shall be provided on the steel doors, flush doors and rolling shutters in various buildings or as specified in the drawings. Two or more coats over an under coat of suitable shade with primer paint of approved brand and manufacture.

13.13 Two or more coats of French spirit polishing with a coat of wood filler shall be provided on the wooden doors and frames.

13.14 Polished vitrified tiles in 60x60 cm size (thickness to be specified by the manufacturer) in flooring and skirting, with water absorption's less than 0.08% and conforming to IS: 15622 of approved make in all colours and shades, laid on cement mortar 20mm thick min. for flooring & 12mm thick for skirting 1:4 (1 cement: 4coarse sand) including grouting the joints with white cement and matching pigments etc., complete.

13.15 Glazed Ceramic floor tiles 300x300mm (thickness to be specified by the manufacturer) of 1st quality conforming to IS:15622 of approved make in colours as approved by Engineer-in-charge in toilet and pantries area on 20mm thick min. cement mortar 1:4 (1 cement : 4coarsesand) including grouting the joints with white cement and matching pigments etc., complete.

13.16 62 mm thick cement concrete flooring with concrete hardener topping, under layer 50 mm thick cement concrete 1:2:4 (1 cement: 2 fine aggregate : 4 graded stone aggregate 20mm nominal size) and top layer 12mm thick cement hardener consisting of mix 1:2 (1 cement hardener mix: 2 graded stone aggregate, 6mm nominal size) by volume, hardening compound mixed @ 2 litre per 50 kg of cement or as per manufacturer's specifications.

13.17 Cement plaster skirting (up to 15 cm height) with cement mortar 1:3 (1 cement: 3 coarse sand) mixed with metallic concrete hardener in same ratio as for floor finished with a floating coat of neat cement. 21 mm thick in ACDB/DCDB room.

13.18 Granite stone of 18mm thick gang saw cut mirror polished pre-molded and pre-polished, machine cut for of required size of approved shade, colour and texture laid over 20mm thick base cement mortar 1:4 (1 Cement: 4 coarse sand) with joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing molding and polishing to edge to give high gloss finish etc. complete for staircase.

13.19 Granite stone of flooring with 18mm thick gang saw cut mirror polished premoulded and prepolished, machine cut for of required size of approved shade, colour and texture laid over 20mm thick cement mortar 1:4. The joints are filled with jointing compound matching

to the granite. Wherever granite is specified for the floor, 100mm granite skirting shall be provided with the walls. The granite outer surface shall be flushed to the plaster finish of the wall by molding / beveling of granite at top edge.

13.20 Granite counter of approved shade shall be provided and fixed with 18mm thick gang saw cut, mirror polished, premoulded and pre-polished, machine cut for pantry & kitchen platform facias and similar locations of required size, approved shade, colour & texture laid over 20mm thick base cement mortar 1:4 (1cement : 4 Coarse sand) joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing moulding and polishing to edges to give high gloss finish etc complete at all levels.

13.21 Ceramic glazed wall tiles of 1st quality conforming to IS: 15622 (thickness to be specified by the manufacture) of approved make in all colours, shades as approved by Engineer-in-Charge in dados over 12mm thick bed of cement Mortar 1:3 (1 Cement: 3 Coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm including pointing in white cement mixed with pigment of matching shade complete. Height of dado shall be 2.1m high in toilets, kitchen and pantry or elsewhere specified in the drawings or TS.

13.22 Rolling shutters shall be seamless galvalume motorized rolling shutters, with inclusion of features as under:

Slat material (Shutter curtain):	min. 1.0 mm steel slate (Galvalume)
Slat profiles	min. 100mm wide
Side guide	GI side guides min. 75mm Especially design guides with wind locks for high wind velocity exposed shutters. Nylofelt seals fitted on the shutter skin for frictionless movement within the guides.
Bottom profile	Aluminium bottom rail is provided with additional rubber seal for tight closing for prevention of dust entry.
Roller shaft	Roller shaft shall be heavy duty mild steel strong suspension tubular shaft without springs.
Side brackets	M.S. plate 3 mm to 10 mm as per the opening dimension.

Surface Finish & Painting	Primer and Duco paint (Matt finish)
Operations	Electrically operated with motor of suitable capacity along with manual operation by hand chain or hand crank for emergency

13.22 Circular/hexagonal M.S. sheet ceiling fan box shall be provided in the ceiling with clamp of internal dia. 140 mm, 73 mm height, 3 mm thick rim, top and bottom lid of 1.5 mm M.S. Sheet. Lids shall be screwed in to M. S. box by means of 3 mm round headed screws, clamps shall be made of 12 mm dia. M. S. bar bent to shape as per standard drawing with overall length as 80 cm.

13.23 Powder Coated (minimum thickness 50 micron) aluminium work for doors, windows, ventilators and partitions shall be provided and fixed in building with extruded built up standard tubular and other sections of approved make conforming to IS:733 and IS : 1285, fixed with rawl plugs and screws or with fixing clips, or with expansion hold fasteners including necessary filling up of gaps at junctions at top, bottom and sides with required PVC/neoprene felt etc and joined mechanically wherever required including cleat angle, Aluminium snap beading for glazing / panelling, C.P. brass/ stainless steel screws including glazing and fittings as specified.

13.24 All doors except for toilet shall have 100mm 6 lever CP Brass mortice lock . Anodized aluminum handles of ISI marked and approved size shall be provided for all doors and windows as per requirement and instruction of E.I.C.

13.25 Cylindrical keyless lock of 25 mm diameter and 50mm diameter knob on both sides (ISI marked) shall be provided for toilets.

13.26 Kitchen door shall have 250x16mm C.P. brass sliding door bolt.

13.27 Door shall be provided with anodized aluminum tower bolt (barrel type) 250x10mm wherever door closers are not provided.

13.28 All windows shall have aluminum tower bolt (barrel type) 150x10mm as per requirement.

13.29 Double action hydraulic floor spring of approved brand and manufacture confirming to IS: 6315 having brand logo embossed on the body/plate with double spring mechanism and door weight upto 125 kg, for doors shall be provided and fixed at the following door including cost of cutting floors as required, embedding in floors and cover plates with brass pivot and single piece MS sheet outer box with slide plate etc. as per the direction of Engineer-in-charge. With stainless steel cover plate minimum 1.25 mm thickness.

a. Main Entrance to Control Room Building / Transit Camp
b. Control Room

13.30 Aluminium extruded section body tubular type universal hydraulic door closer (having brand logo with ISI, IS : 3564, embossed on the body) with double speed adjustment with necessary accessories and screws etc. complete

b. Substation In charge room.
c. Conference Room
d. bedroom and toilet doors of transit camp
e. Pantry and Kitchen

13.31 Plinth protection 50 mm thick of cement concrete 1:2:4 (1 cement : 2 fine aggregate : 4 graded stone) aggregate 20 mm nominal size) shall be laid over 75 mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and shall be grouted with fine sand including finishing the top smooth. Minimum width of plinth protection shall be 1000 mm.

13.32 G.S. corrugated sheets of 0.80 mm thick with zinc coating not less than 275 gm/m² roofing shall be provided and fixed with G, I, J or L hooks, bolts and nuts 8mm diameter G, I plain and bitumen washers complete excluding the cost of purlins, rafters and trusses for water tank.

13.33 Cement Jali of (1:2:4) (1 Cement: 2 fine aggregate : 4 coarse aggregate) 50mm thick, shall be reinforced with 1.6mm dia with Mild steel wire including centering and shuttering cleaning fixing and furnishing with cement mortar 1:3).

13.34 Ward Robes of required height and about 600 mm deep shall be made out of 18 mm. thk anti termite treated commercial board ISI marked at end verticals, top and bottom, shutters, partition etc complete. The rear side of the unit shall be made with 6mm thk commercial ply ISI marked, which shall have French spirit polish on the exterior face. Inner surface of the storage cabinet shall be finished with 0.8mm thk approved laminate. The horizontal partition shall be of removable type fixed with necessary SS fittings and hardware. All external surfaces shall be finished with 4.0 mm thk approved veneer with melamine including making necessary grooves, teak wood moulding as per approved drawings. Each shutter shall have piano type stainless steel hinges and C.P. Brass or SS 125mm long handle. The unit shall have necessary fittings such as tower bolts, 4 lever CB locks etc complete.

13.35 Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round cut outs/openings in floor slab.

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

14.0 EXTERNAL WATER SUPPLY FROM BORE-WELL TO FIRE WATER TANK/CONTROL BUILDING AND / OR TRANSIT CAMP:

14.1 The drawing for the water supply from bore-well to fire water tank shall be developed by the Contractor. Water supply will be made available to the Contractor from a bore-well by the Employer at any one location within the sub-station. 80 mm dia CPVC pipe shall be provided by the Contractor from the bore-well to the fire water tank. The underground pipe line shall be laid as per CPWD Specification. The ball valve, NRV etc. shall be provided as per requirement. From this pipe line a 25 mm dia tap off shall be connected by the Contractor to the roof water tank provided for the control room building & transit camp.

14.2 The Contractor shall carry out all the external plumbing/erection works required for supply of water to the control room building, firewater tank and/ or transit camp beyond the single point as given at 14.1.

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

14.4 Bore well is not in the scope of Contractor.

15.0 SUBMISSION:

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

15.1 Editable Soft as well as hard copies of structural design calculations and structural drawings (including construction/fabrication) for all reinforced concrete and structural steel structures.

15.2 Fully, dimensioned concept plan including floor plans, cross sections, longitudinal sections, elevations and perspective view of each building. These drawings shall identify the major building components. Auto cad drawings shall also be submitted.

15.3 Fully dimensioned drawings showing details and sections drawn to scales of sufficient size to clearly show sizes and configuration of the building components and the relationship

between them.

15.4 Product information of building components and materials, including walls partition flooring ceiling, roofing, door and windows and building finishes to be submitted to EIC.

15.5 A door & window schedule showing door types and locations, door lock sets and latch sets and other door hardware. Approval of the above information shall be obtained before ordering materials or starting fabrication or construction as applicable.

16.0 MISCELLANEOUS REQUIREMENTS:

16.1 All joints including construction and expansion joints for the water retaining structures (RCC tank for Fire Fighting and underground water tank) shall be made water tight by using PVC ribbed water stops with central bulb. The minimum thickness of PVC water stops shall be 5 mm and minimum width shall be 230 mm.

16.2 All mild steel parts used in the firefighting water tank and underground water tank shall be hot-double dip galvanised. The minimum coating of the zinc shall be 750 gm/sq. m. for galvanised structures and shall comply with IS:2628 and IS:2633. Galvanizing shall be checked and tested in accordance with IS: 2633. The galvanizing shall be followed by the application of an etching primer and dipping in black bitumen in accordance with BS: 3416. The structural steel provided for roofing shall have enamel paint of approved shade two or more coat to give even shade over steel primer.

16.3 Angles 50x50x6 mm (minimum) with lugs shall be provided for edge protection all round cut outs/openings in floor slab.

16.4 For sump pit of switch yard Horizontal type submersible type pump as per BOQ rating having level switch shall be provided.

16.5 The material specification, workmanship and acceptance criteria shall be as per approved standard Field Quality Plan attached with this document which is available on POWERGRID web site. In case certain item is not covered in FQP, it shall be constructed as per CPWD specification.

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

16.7 CABLE TRANSIT SYSTEM

Modular multi-diameter cable sealing system consisting of frames, blocks and accessories shall be installed where the underground and over ground cables enter or leave concrete bay kiosks/switchyard panel room & control rooms in the substations. Cable transit system

shall consist of multi-diameter type peel-able/adjustable blocks of different sizes to suit the various cables. It should be simple, easy and quick to assemble & re-assemble the cable sealing system. Solid blocks shall not be used on frame. Frames & stay-plate material shall be of galvanized steel and for compression single piece wedge with galvanized steel bolts shall be used. 30% spare blocks of all sizes on the frame shall be provided for expansion in future. Cable sealing system should have been tested for fire/water/smoke tightness.

16.8 For communication Room GI Pipe of 40 mm dia shall be laid below floor to extend communication cable coming from switchyard via ACDB/DCDB Room.

17.0 INTERFACING:

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

18.0 STATUTORY RULES:

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

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

18.3 Requirement of sulphate resistant cement (SRC) for sub structural works shall be decided in accordance with the Indian Standards based on the findings of the detailed soil investigation. In case sulphate resistant cement is used as per requirement, differential cost between sulphate resistant cement and PPC cement shall be payable as an extra item.

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

18.5 All tests as required in the standard field quality plans have to be carried out without any financial implication to employer.

19.0 SPECIFICATION FOR SITE LEVELLING WORK

19.1 SCOPE OF WORK AND GENERAL CONDITION

This specification shall apply to site levelling works as are required to be executed under the Contract or otherwise directed by the Engineer-in-Charge. All testing shall be carried out as per standard field quality plan of POWERGRID**.**

Site levelling work shall consist of clearance of site, excavation in all kinds of soils, soft/disintegrated rock, hard rock, dewatering, transporting of excavated earth, filling, consolidation of earth, levelling benching, giving slopes and making formations, levelling operations, removal and satisfactory disposal of unsuitable materials necessary for achieving desired formation level, if required, in accordance with the requirements of the specifications and the lines, grades and cross-sections shown in the drawings or indicated by the Engineer-in-Charge. The work shall include the hauling and stacking of or the hauling to levelling site, of suitable materials as required, as also the disposal of unsuitable materials in specified manner; and the trimming and finishing of works.

This work also includes cutting of diversion channel to prevent the area from flooding and construction of kuchcha surface drains for drainage of the area.

The quality of work and materials shall comply with the requirements set forth in the succeeding sections. Where the drawings and Specifications describe a portion of the work only in general terms, and not in complete details, it shall be understood that only the best general practice is to prevail, materials and workmanship of the best quality are to be employed and the instructions of the Engineer-in-Charge are to be fully complied with.
The work to be performed under this specifications consists of providing all labour, supervision, materials, planking and strutting, power, fuel, construction equipments, tools and plants, supplies, transportation, blasting materials if required, storage, insurance, royalty and all incidental items not shown or specified by reasonably implied or necessary for successful completion of work including contractor's supervision and in strict accordance with drawing and specifications.

The scope may however vary based on the specific requirement of various works/site, which shall be specified by the Owner.

The work shall be executed according to "Released for Construction", drawings with additions, alterations and modifications made from time to time as required or approved by the Engineer-in-Charge and also according to any other drawings that would be supplied to the Contractor progressively during the execution of the Contract.

Construction traffic shall not use the levelled area without prior permission of the Engineer-in-Charge. Any damage arising out of such use shall be made good by the Contractor at his own expense.

The words like Contract, Contractor, Engineer-in-Charge, Drawings, Owner, works, site used in this Specifications shall be considered to have the meaning as understood from the definition of these terms included in the General Conditions of Contract.

19.2 PRESERVATION OF PROPERTY/AMENITY**:**

The Contractor shall undertake all reasonable precautions for the protection and preservation of Trees, shrubs, any other plants, pole lines, fences, signs, monuments, buildings, pipelines, sewers or other subsurface drains, pipes, conduits and any other structures under or above ground, which may be affected by construction operations and which in the opinion of the Engineer-in-Charge shall be continued in use without any change.

The Contractor shall provide and install at his own expenses, suitable safeguards approved by the Engineer-in-Charge for this purpose. However, if any of these objects is damaged by reason of the Contractor's negligence, it shall be replaced or restored to the original condition without any financial implication to POWERGRID.

19.3 DISPOSAL OF MATERIALS**:**

All materials arising from jungle clearing, grubbing operation, all type of excavation etc. shall be the property of Power Grid and shall be disposed of by the Contractor as hereinafter provided or directed by the Engineer-in-Charge within a lead of 2000 m beyond the periphery of substation area. Also boulders, stones and other materials usable shall be neatly stacked.

All products of clearing and grubbing which in the opinion of the Engineer-in-Charge cannot be used or auctioned shall be cleared away to waste areas and burnt, if so desired, at locations away to a lead mentioned above in a manner as directed. Care shall be taken to see that unsuitable waste materials are disposed of in such a manner that there is no likelihood of these getting mixed up with the materials meant for filling.

Where the excavated material is directed to be used in the filling area, it shall be directly deposited at the required location complying with the total requirements. All disposed material other than hard material shall be spread in layers at the places within specified leads.

All hard materials, such as hard moorum, rubble, etc., not intended for use in the filling, shall be stacked neatly on POWERGRID land as directed by the Engineer-in-Charge, for future use.

Unsuitable and surplus materials not intended for use in any part of the works shall be disposed off.

19.4 SITE CLEARANCE

The work shall consist of numbering of trees, removing and disposing of all materials such as trees, bushes, woods, shrubs, grass, stumps, rubbish, rank vegetation, roots, foreign materials, etc., which in the opinion of the Engineer-in-Charge are unsuitable for incorporation in the works, from within the limits and areas as may be specified by the Engineer-in-Charge.

All trees up to a girth (perimeter) of 30 cm measured at one metre above the ground level shall also be cut and useful portion of the trees so cut shall be stacked at a suitable place as directed by the Engineer-in-Charge and shall be considered incidental to clearing and grubbing operations.

The roots of trees shall be dug up to 60 cm below the ground level or 15 cm below formation level whichever is deeper and after removal of all vegetable and organic matter from the holes so formed by removal of the roots, holes and hollows shall be filled with good earth in layer of 20 cm, well rammed, consolidated and levelled.

The serviceable and unserviceable materials obtained from the site clearance shall be removed from the area and disposed of to a place as per the directions of the Engineer-in-Charge. All unserviceable and serviceable materials obtained from the site clearance shall be the property of POWERGRID.

Clearing and grubbing item is not payable and the same shall be deemed to be included in the earth work in excavation and filling.

Trees having girth above 30 cm are not in the scope of Contractor.

19.5 CLASSIFICATION OF EXCAVATED MATERIALS**:**

All materials involved in excavation shall be classified in the following groups:

19.5.1 ALL KIND OF SOILS AND SOFT/DISINTEGRATED ROCK

The material which can be quarried/excavated with pick, shovels, jumpers, scarifiers, crowbars etc. and other mechanical implements. All materials involved under this classification are as below:

All kind of soils includes various types of soils, plain concrete, shingle and river or nallah bed boulders, soling of road, paths and hard core, macadam surface of any description, stone masonry below the ground level, soft conglomerate and laterite stone which can be detached from the matrix with picks and shovel.

Soft/disintegrated Rock (Not requiring blasting): Rock and boulders which may be quarried and split with crow bars and other mechanical implements etc. It includes lime stone, sand stone, hard conglomerate.

19.5.2 HARD ROCK:

All kind of rocks which can be excavated by machines and requires blasting chiselling in edging or in another agreed method. This can be classified under the following categories:

a) Hard Rock (Requiring Blasting)-This shall comprise:

i) Any rock for the excavation of which the use of mechanical plant or blasting is required;
ii) Reinforced cement concrete (reinforcement cut through but not separated from the concrete) below ground; and
iii) Boulder requiring blasting.

b) Hard Rock (Blasting Prohibited)

Hard rock requiring blasting as described under (a) above but where blasting is prohibited for any reason and excavation has to be carried out by chiselling, wedging or any other agreed method.

19.5.3 AUTHORITY FOR CLASSIFICATION EXCAVATION:

The classification of excavation shall be decided by the Engineer-in-Charge and his decision shall be final and binding on the Contractor. Merely the use of explosives in excavation will not be considered as a reason for higher classification unless blasting is clearly necessary in the opinion of the Engineer-in-Charge. All the excavated material shall be the property of the POWERGRID.

19.6 SITE LEVELLING OPERATIONS:

19.6.1 SETTING OUT AND MARKING PROFILES**.**

After the site has been cleared, the limits of site levelling shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the

Engineer-in-Charge. The Contractor shall provide all labour, survey instruments and materials such as strings, pegs, nails, bamboos, stones, lime, mortar, concrete, etc., required in connection with the setting out of works and establishment of bench marks. A grid system of co-ordinates shall be established by the Contractor at the site. The Contractor shall be responsible for the maintenance of permanent reference pillars, bench marks and other marks and stakes as long as in the opinion of the Engineer-in-Charge they are required for the work. All such marks/pillars shall be removed by the Contractor at his own cost as soon as the purpose is over.

Masonry pillars shall be erected at suitable places in the area to serve as bench marks for the execution of the work. These bench marks shall be connected with G.T.S. of any other permanent bench mark approved by the Engineer-in-Charge. Necessary profiles with pegs, bamboos and strings or "*Burgeis*" shall be made to show the correct formation levels before the work is started and the same shall be approved by the Engineer-in-Charge. The contractor shall supply all labour, tools, equipment, materials, safeguards and incidentals necessary for setting out and making profiles and burgeis & pillars for the work at his own cost. The profiles and burgeis shall be maintained during the execution of the work.

Marks/pillars shall invariably be diagonal unless otherwise directed, and should be such that their average height is representative of average depths. Payments will be made on the basis of volume measurement after with-holding the amount corresponding to 5% of the volume of earth work on account of non-removal of marks/pillars.

The Contractor shall have to remove the marks/pillars and utilise the earth spoils as per the directions of the Engineer-in-Charge. The withheld amount as stated in the above paragraph may be paid after certification of the Engineer-in-Charge; regarding his full satisfaction and to the effect that the mark/pillars, etc. have been removed and soils/earth thereof has been utilised as directed by him.
If the contractor fails to remove, partly or fully the marks/pillars in the manner and within the period as aforesaid double the amount spent by the owner for removal of marks/pillars will be recovered from dues payable to the contractor.

19.6.2 EXCAVATION AND FILLING

All excavations shall be carried out in conformity with the directions laid herein under and in a manner approved by the Engineer-in-Charge. The work shall be so done that the suitable materials available from excavation are satisfactorily utilised as decided upon before disposal.

While planning or executing excavation, the Contractor shall take all adequate precautions against soil erosion, water pollution, air pollution etc.

The excavations shall conform to the lines, grades, side slopes and levels shown on the drawings or directed with a negative tolerance of 100mm. The Contractor shall not excavate outside the slopes or below the established grade or loosen any material outside the limits of excavation. Subject to the permitted tolerances, any excess depth excavated below the specified levels shall be made good at the cost of the Contractor with suitable material of similar characteristics and compacted to the required density and to the satisfaction of the Engineer-in-Charge.

All debris and loose material on the slopes of cuttings shall be removed.

Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be allowed. Final surface shall be neatly dressed. The earth from cutting shall be directly used for filling and no extra claim for double handling of earth shall be admissible to the contractor.

If cutting be taken deeper, it shall be brought to the required level as per the instructions, by filling it with the earth and duly consolidating at the Contractor's cost.

Filling shall be done in regular horizontal layers not exceeding 20 cm. in depth. The earth shall be free from all roots, grass, rubbish and humps and clods exceeding 80mm in any direction shall be broken. Each layer shall be consolidated by breaking clods and Compacting each layer with wooden /steel rammer or movement of dozers, trucks or 8/10 tonne power road rollers, sheep foot roller and vibratory compactors etc. so that compaction of 95% of the maximum dry density is achieved at optimum moisture content. The surface finished shall be neatly dressed to the required formation levels with tolerance of (±) 100 mm.

Tests for Compaction are to be performed as per the procedures laid down in the relevant I.S. Codes of practice and Standard Field Quality Plan of POWERGRID. In cases of compaction below the stipulated percentage, the contractor shall adopt proper techniques as directed by the Engineer in-Charge and to his satisfaction to ensure the specified degree of compaction. The cost of tests to be performed shall be borne by the Contractor.

During the execution of work, natural drainage of the area shall be maintained by the contractor.

19.6.3 HARD ROCK EXCAVATION

Hard Rock, when encountered during excavation, shall be removed up to the finished ground level or as indicated on the drawings. In all cases, the excavation operations shall be so carried out that at no point on cut formation the rock protrudes above the specified levels, provided, however, that a negative tolerance of 150 mm shall be permissible.

Slopes in rock cutting shall be finished to uniform lines corresponding to slope lines shown on the drawings or as directed by the Engineer-in-Charge. Notwithstanding the foregoing, all loose pieces of rock on excavated slope surface which move when prised by a crowbar shall be removed.

Blasting shall be carried out as per relevant clause mentioned elsewhere in this specification and all precautions indicated therein to be observed.

19.6.4 DEWATERING

If water is met with in the excavation due to stream flows, springs, seepage, rain or other causes, it shall be removed by suitable diversions, pumping or bailing out and other excavation kept dry whenever so required or directed by the Engineer-in-Charge, Care shall be taken to so discharge the drained water as not to cause damage to the works, crops or any other property. No extra payment shall be admissible to the contractor on this account.

19.6.5 FINISHING OPERATIONS

Finishing operations shall include the work of properly shaping and dressing all excavated surfaces. When completed, no point on the slopes shall vary from the designated slopes by more than 150 mm measured at right angles to the slope, except where excavation is in rock where no point shall vary more than 600 mm from the designated slope. In no case shall any portion of the slope encroach on the road way.

19.7 EARTH FILL MATERIAL:

19.7.1 SUITABLE MATERIAL

The borrowed earth used in filling shall be free from all roots, grass, shrubs, rank vegetation, brush wood, tree sapling and rubbish.

19.7.2 UNSUITABLE MATERIAL

Unsuitable material shall mean materials unsuitable for placing as fill in the works and shall comprise:

a) Material from swamps, marshes and bogs;
b) Peat, logs, stumps and perishable materials;
c) Material susceptible to spontaneous combustion;
d) Any natural material or industrial and domestic produce which will adversely affect other materials in the work;
e) Clay with liquid limit exceeding 80% and/or plasticity index exceeding 55%.

19.7.3 SPREADING AND COMPACTION OF FILLING

For the earth works contractor shall satisfy the Engineer-in-Charge that the entire specified requirement regarding compaction can be achieved. Testing shall be carried out as per standard field quality plan of POWERGRID.

The Final formation shall be correct in level and profile after compaction.

In the case of earth work consolidated under optimum moisture conditions, each layer of earth shall be carefully moistened to give field moisture content of about + 1% to - 2% of the optimum moisture content (OMC). The OMC shall be determined according to IS: 2720 (Pt.VII &VIII) Methods of Tests for Soils.

Each layer shall then be compacted by rolling with wooden/ steel rammer or movement of dozers, trucks, 8/10 tonnes power road roller, sheep foot roller and vibratory compactors/roller. The required amount of water shall be added during consolidation to keep the moisture content of the soil at the optimum as per test. The density to be achieved for each layer of the material shall not be less than 95% of the density obtained in the laboratory (Proctor Method).

Control on compaction in the field shall be exercised through frequent moisture content and density determinations. A systematic record of these shall be maintained. At all times during construction the top of the embankment shall be maintained at such cross fall as will shed water and prevent pounding.

19.8 BLASTING OPERATIONS**.**

19.8.1 GENERAL

Blasting shall be carried out only with the written permission of the Engineer-in-Charge. All the statutory laws, regulations, rules, Indian Standards, etc., pertaining to the acquisition, transport, storage, handling and use of explosives shall be strictly followed.

The Contractor may adopt any method or methods of blasting consistent with the safety and job requirements, after approval from the Engineer-in-Charge and shall muffle the blasting adequately to the satisfaction of the Engineer-in-Charge. Blasting should be carried out as far as possible with the help of Ammonium Nitrate mixed with proper proportions of fuel oil which is a safer method. However, in the event of its non-availability the convenient practice of using gelatine with detonators can be resorted to.

The magazine for the storage of explosives shall be built to the designs and specifications of the Explosives Department concerned and located at the approved site. No unauthorised person shall be admitted into the magazine which when not in use shall be kept securely locked. No matches or inflammable material shall be allowed in the

magazine. The magazine shall have an effective lightning conductor. The following shall be hung in the lobby of the magazine.

a) A copy of the relevant rules regarding safe storage both in English and in the language with which the workers concerned are familiar,
b) A statement of up to date stock in the magazine,
c) A certificate showing the last date of testing of the lightning conductor,
d) A notice that smoking is strictly prohibited.

In addition to these, the Contractor shall also observe the instructions in following clauses and any further additional instructions which may be given by the Engineer-in-Charge and shall be responsible for damage to property and any accident which may occur to workmen or the public or the materials on account of any operations and blasting. The Engineer-in-Charge shall frequently check the Contractor's compliance with these precautions.

19.8.2 MATERIALS, TOOLS AND EQUIPMENT.

All the materials, tools and equipment used for blasting operations shall be of approved type and shall be arranged by the contractor from any authorised dealer of such approved material. Necessary assistance in the form of approval for procurement of the material shall be given by the Corporation. The contractor shall be fully responsible for entering into the agreement with any authorised magazine contractor in respect of rates, regularity of supply, etc. the Engineer-in-Charge may specify the type of explosives to be allowed in special cases. The fuse to be used in wet locations shall be sufficiently water-resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and definitely known to permit such a safe length being cut as will permit sufficient time to the firer to reach safety before explosion takes place. Detonators shall be capable of giving effective blasting of the explosives. The blasting powder, explosives, detonators fuses, etc., shall be fresh and not damaged due to damp, moisture or any other cause. They shall be inspected before use and damaged articles shall be discarded totally and removed immediately.

19.8.3 PERSONNEL

The blasting operation shall remain in the charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the details of handling explosives and blasting operations.

19.8.4 BLASTING OPERATIONS.

The blasting shall be carried out during fixed hours of the day preferably during the mid-day lunch hour or at the close of the work as ordered in writing by the Engineer-in-Charge. The hours shall be made known to the people in the vicinity. All the charges shall be

prepared by the man in charge only. Proper precautions for safety of persons and property shall be taken.

Red danger flags shall be displayed prominently in all directions during the blasting operations. People, except those who actually light the fuse shall be prohibited from entering this area. The flags shall be planted 200 metres from the blasting site in all directions and all persons including workmen shall be excluded from the flagged area at least 10 minutes before the firing, a warning whistle being sounded for the purpose.
The charge holes shall be drilled to required depths and in suitable places. Blasting should be as light as possible consistent with thorough breakage of the material necessary for economic loading and hauling. Any method of blasting which leads to overshooting shall be discontinued.

When blasting is done with powder, the fuse cut to the required length shall be inserted into the hole and the powder dropped in. The powder shall be gently tamped with copper rods with rounded ends. The explosive powder shall then be covered with tamping material which shall be tamped lightly but firmly.

At a time, not more than 10 such charges will be prepared and fired. The man in charge shall blow a whistle in a recognised manner for cautioning the people. All the people shall then be required to move to safe distances. The charges shall be lighted by the man in charge only. The man in charge shall count the number of explosions. He shall satisfy himself that all the charges have been exploded before allowing the workmen to go back to the work site.
When blasting is to be carried out in the proximity of other existing structures, sand/earth bags, etc. shall be used on the top of the blast holes to prevent the rock fragment from causing damage to the structures.

However, when blasting is prohibited for any reasons the excavation shall be carried out by chiselling, wedging or any other agreed method.

19.8.5 MISFIRE

In case of misfire, the following procedure shall be observed:

i) Sufficient time shall be allowed to account for the delayed blast. The man in charge shall inspect all the charges and determine the missed charges.
ii) If it is the blasting powder charge it shall be completely flooded with water. A new hole shall be drilled at about 45 cm. from the old hole and fired. This should blast the old charge. Should it not blast the old, the procedure shall be repeated till the old charge is blasted.
iii) If a misfire has been found to be due to defective detonator, the whole quantity in the box from which defective article was taken must be sent to the authority directed by the Engineer-in-Charge for inspection to ascertain whether all the remaining materials

in the box are also defective.

19.8.6 ACCOUNT.

A careful and day to day account of the explosives shall be maintained by the Contractor in an approved register and manner which shall be open to inspection by the Engineer-in-Charge at all times.

19.9 RECORDING OF MEASUREMENTS

The ground levels shall be taken at every 5 metres distance and at closer distances where pits, undulations, etc. are met with. The ground level shall be recorded in field book, plotted on plans and shall be signed by contractor and the Engineer-in-Charge before the earth work is started.

The levels of the area after excavation shall be recorded in the field book duly signed by the Engineer-in-Charge and contractor. The labour, materials, tools, equipment, safeguards and incidentals required for taking levels shall be supplied by the contractor at his own cost.

All measurements shall be made in the metric system. Different items of work shall be measured in accordance with the procedures set forth in the relevant sections.

All measurements and computations, unless otherwise indicated, shall be carried nearest to the following limits:

a) Length and breadth -- 10 mm
b) Height, depth or thickness of work -- 5 mm
c) Area -- two places of decimal
d) Cubical qty. -- two places of decimal

20.0 MODE OF MEASUREMENT

Mode of measurement for different items is given below, however, in case of any ambiguity relevant part of IS: 1200 (latest) shall be referred.

20.1 EARTHWORK

This shall include excavation in all kinds of soil including rock, all leads and lifts including back filling, compacting, dewatering (if required) and disposal of surplus earth/ rock to a suitable location within a lead up to two km. Excavation or dismantling of lean concrete shall be measured under this item. The quantity of excavation for foundations of towers, equipment structures, all transformers, firewall, cable trenches, water tank, reactors, buildings, marshalling kiosks, underground water tanks and covered car parking shall only be measured. The quantity of excavation for roads, rail cum road, drains, culverts, rainwater harvesting, septic tank, soak pit, external water supply system, site surfacing,

chain link fencing (including gate) shall not be measured separately and shall be deemed to be included in the composite rates quoted by the bidder for the respective works. All other excavation required for the completion of the work including fixing of lamp posts/ electric poles, plinth protection, flooring, sewerage system, manholes, pipes, earth mat, pipe support etc. shall also not be paid for. The measurement of excavation for all concrete works shall be made considering dimension of the pit keeping 150mm gap around the base pad (lean concrete) or actually excavated pit, whichever is less. For hard rock excavation, the volume of hard rock shall be computed on the basis of stacks of excavated rubble after making 50% deduction for voids. The unit of measurement shall be in cubic meter. The unit rate shall include stacking, disposal of excavated material for leads up to 2000 meters beyond the levelling boundary.

The quantity shall be measured in cubic meters as per following details:

a) Excavation in all kind of soil including soft/ disintegrated rock, PCC, WBM, Brickwork/ stone masonry etc (excluding hard rock).

b) Excavation in hard rock (required blasting)

20.2 PLAIN CEMENT CONCRETE (PCC)

Providing and laying Plain Cement Concrete of all types and at all locations including all leads and lifts. The quantity shall be measured in cubic meters as per lines and levels indicated in the drawings.

20.2.1 PCC 1:2:4 (1 cement : 2 fine aggregate : 4 coarse aggregate 20 mm nominal size) shall be measured in flooring of buildings, plinth protection, fencing, transformer foundation, reactor foundation, rail track, drain, culverts, septic tank, chain link fencing, gate etc. as indicated in the drawings.

20.2.2 PCC 1:3:6 (1 cement : 3 fine aggregate : 6 stone aggregate, 40mm nominal size) shall be measured below all foundations including buildings, underground water tanks, covered car parking cable trench, roads, under flooring, rail-cum-road, transformer foundation, reactor foundation, drain, water tank, culverts, gate, tower/equipment etc. as indicated in the drawings.

20.2.3 PCC 1:4:8 (1 cement : 4 fine aggregate : 8 stone aggregate, 40mm nominal size) shall be measured below all foundations including buildings, underground water tanks, covered car parking cable trench, roads, under flooring, rail-cum-road, transformer foundation, reactor foundation, drain, water tank, culverts, gate, tower/equipment etc. as indicated in the drawings.

20.2.4 PCC 1:5:10 (1 cement: 5 fine aggregate: 10 brick aggregate/ stone aggregate 40mm nominal size) shall be provided for site surfacing in switchyard. This shall include providing and laying cement slurry in case of site surfacing in switchyard.

All other PCC required for the completion of the work including hold fasts of doors/windows/rolling shutters, fixing of plumbing pipes, bedding concrete for sewer lines, embedment of electrical conduits, water proofing of roof etc. shall not be measured and deemed to be included in the composite rates quoted by the bidder for respective works. Water proofing compound wherever specified shall be added without any extra cost.

20.3 RCC

Measurement of reinforced cement concrete at all locations shall be made and shall include all leads, lifts, formwork, grouting of pockets and underpinning. This shall also include pre-cast RCC work and addition of water proofing compound & admixtures wherever required for which no additional payment shall be made. The quantity shall be measured in cubic meters as per lines and levels indicated in the drawings. No deduction shall be made for volume occupied by reinforcement/inserts/sleeves and for openings having cross-sectional area up to 0.1 sq.m.

20.4 REINFORCEMENT STEEL

Reinforcement shall be measured in length (actual or theoretical as per drawing whichever is less) including hooks, if any, separately for different diameters as actually used in work, excluding overlaps. From the length so measured, the weight of reinforcement shall be calculated in tons on the basis of sectional weights as adopted by Indian Standards. Wastage, overlaps, couplings, welded joints, spacer bars, chairs, stays, hangers and annealed steel wire or other methods for binding and placing shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

20.5 STONE FILLING

Measurement of stone (40-60mm size) for transformer/ reactor foundations shall be made as per theoretical volume of the space to be filled in the transformer foundation as per drawings. This shall be measured in cu.m. no voids shall be deducted.

20.6 MISCELLANEOUS STRUCTURAL STEEL

Measurement for Supply, fabrication, transportation and erection of all miscellaneous structural steel work for mono rails (RS joists), rails for transformers/ reactors, trusses, frame work, purlins, gratings including factory made electro forged gratings, steel tubes, built up sections along with all other steel fittings and fixtures, inserts and embedment in concrete shall be made as per drawings. The unit rate for this item shall be inclusive of cutting, grinding, drilling, bolting, welding, pre- heating of the welded joints, applying a priming coat of steel primer / anti corrosive bitumastic paint/ synthetic enamel paint etc. wherever specified (For gratings and its supports epoxy zinc phosphate primmer shall be used) setting of all types of embedment in concrete, etc. Steel required for foundation

bolts & fasteners (other than towers and equipment support structures), doors, windows, ventilators, louvers, rolling shutters, chain link fencing, gratings in drains, soil pipes, plumbing pipes, floor traps, embedment's required for rainwater harvesting, septic tank, soak pit, roof truss and purlins required for fire water tank, steel structures of PEB buildings, etc. shall not be considered for payment and measurements. Quantity shall be measured in MT.

20.7 ROADS

20.7.1 The measurement for the concrete road shall be made on the basis of area in square meter (M^2) of top concrete completed surface of the road and shall be deemed to include all items such as earth work (excavation, disposal etc.), compaction, rolling, watering, WBM, Kerb stone, grating, shoulder, 100mm dia RCC Hume pipe to be provided at every 100M etc where ever indicated complete as per drawing. Concreting all type and reinforcement shall be measured and paid separately under relevant items mentioned else where in this specification. Usage of WMM in place of WBM shall be done with approval of employer without any additional financial implication.

20.7.2 The measurement of bituminous road shall be made on the basis of area in square meter (M^2), of the top bituminous completed surface of the road and shall include all items such as earth work (excavation, disposal etc.), compaction, rolling, watering, WBM, Kerb stone, grating, shoulder, 100mm dia RCC Hume pipe to be provided at every 100M etc where ever indicated complete as per drawing including premix carpet etc complete .Usage of WMM in place of WBM shall be done with approval of employer without any additional financial implication.

20.7.3 Interlocking concrete tiles required to be provided on the shoulders of the road shall be measured in square meter (M^2) and paid separately under relevant item.

20.8 ANTIWEED TREATMENT

The measurement shall be done for the actual area in square metres of antiweed treatment which will include supplying required chemicals and doing the treatment complete in all respect as per the specification for the specified area.

20.9 STONE SPREADING IN SWITCHYARD

The measurement shall be done for the actual area in square meters of stone spreading in the switchyard which will include supplying and laying of 100mm thickness of stone aggregate as per specification for the specified area.

20.10 CHAIN LINK FENCING AND GATE

The measurement shall be made in running metres of the fence provided as per drawing. The rate shall be inclusive of post, wire mesh, MS Flat etc. complete. All concrete shall be measured and paid under relevant item. The gate shall be measured in numbers.

20.11 CABLE TRENCH CROSSING AND ROAD CULVERTS THROUGH HUME PIPES

Cable trench crossings and road culverts shall be measured by length (in running meters) of individual Hume pipe which will be laid as per the drawings. The item shall be inclusive of earth work (excavation, backfilling, disposal etc.), laying, back filling, jointing, brickwork, plastering etc complete in all respect but excluding concrete (all type)which will be measured and paid separately under respective items.

20.12 BUILDINGS:

20.12.1 RCC FRAMED STRUCTURE BUILDINGS:

Payment for item shall be made on plinth area basis. However, the quantity of earth work (excavation, backfilling, disposal etc.), concrete (all type), reinforcement steel shall be measured and paid as per relevant clauses as described above. The rest of the entire work (including internal & external finishing), stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit & junction boxes, fan boxes, cable transit system etc. required to complete the building in all respect as per the drawings furnished by the Employer shall be deemed to be included in the plinth area rate. Plinth area shall be calculated based on IS 3861-2002.

20.12.2 PRE-ENGINEERED STEEL BUILDINGS:

a) GIS HALL
b) AHU & RELAY ROOM

The quantity of earth work (excavation, backfilling, disposal etc.), concrete (all type), reinforcement steel shall be measured & paid separately as per relevant clauses as described above. Plinth area shall be calculated based on IS 3861-2002. However, payment for remaining finishing items a), b) & c) shall be made on plinth area basis for each building including internal foundations, cable trenches, internal & external finishes, stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit & junction boxes, fan boxes, cable transit system, miscellaneous structural steel required for seating of GIS equipments, cable supports in cable trenches, chequered plates etc inside GIS building. complete in all respect.

20.12.3 EXTENSION OF RCC /PEB BUILDINGS:

a) CONTROL ROOM BUILDING

b) GIS HALL
c) AHU & RELAY ROOM

The quantity of earth work (excavation, backfilling, disposal etc.), concrete (all type), reinforcement shall be measured and paid as per relevant clauses as described above. Plinth area shall be calculated based on IS 3861-2002. However, payment for above items a), b) & c) shall be made on plinth area basis for each building including internal foundations, cable trenches, internal & external finishes, stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit & junction boxes, fan boxes, cable transit system wall dismantling works, miscellaneous structural steel required for seating of GIS equipments, cable supports in cable trenches, chequered plates etc inside GIS building complete in all respect.

20.12.4 INTERNAL ELECTRIFICATION AND FIRE FIGHTING:

Payment for internal electrification as well as internal firefighting works is not included in items covered in clauses above and shall be paid as per relevant clauses and BPS. However, conduit, junction boxes, surface boxes for electrification, cable transit system is deemed to be included in the building items.

20.13 RAIN WATER HARVESTING

This is a lump sum item. The Contractor shall be required to complete the work in all respect as per drawings furnished by the Employer. All the items including earth work (excavation, backfilling, disposal etc.), miscellaneous steel, brick work, fillings of boulders, gravel, sand, pipes etc. shall be deemed to be included in this lump sum rate. However, the concrete (all types) and the reinforcement shall be measured and paid under the relevant clauses as mentioned above.

20.14 RAIL CUM ROAD

The measurement for the rail cum road shall be made in square metres of top concrete completed surface of the rail cum road and shall include all items such as earth work (excavation, backfilling, disposal etc.), compaction, rolling, watering, WBM etc. complete as per drawing but excluding concrete (all type), reinforcement, structural steel and rails. Usage of WMM in place of WBM shall be done with approval of employer without any additional financial implication.

20.15 SEPTIC TANK AND SOAK PIT

This is a lump sum item. The Contractor shall be required to complete the work in all respect as per drawings furnished by the Employer. All the clause including earth work

(excavation, backfilling, disposal etc.), masonry work, all types of fillings, all types of pipes including plumbing and vent pipes, all type of fittings etc. shall be deemed to be included in this lump sum rate. However, the concrete (all types) and the reinforcement shall be measured and paid under the relevant clauses mentioned above.

20.16 FIRE WATER TANK

This is a lump sum item. The Contractor shall be required to complete the work in all respect as per drawings furnished by the Employer. All the items including, compaction, brick work, roof truss, purlins, roofing, all types of miscellaneous steel, internal and external plastering, painting etc. shall be deemed to be included in this lump sum cost. However, concrete (all types) and reinforcement shall be measured and paid under the relevant clauses as mentioned above.

20.17 EXTERNAL WATER SUPPLY FROM BORE-WELL TO FIRE WATER TANK, CONTROL ROOM BUILDING AND TRANSIT CAMP:

The external water supply from Bore-well shall be measured in running meters of pipe of various diameters. It shall include all the items such as earth work (excavation, backfilling, disposal etc.), piping, pipe fittings, painting, brickwork, sand filling, concrete, valves, chambers cutting chases in walls, openings in RCC and repairs, etc. required to complete the job.

20.18 EXTERNAL SEWERAGE :

Sewage System of the shall be measured diameter wise in running meters. It shall include all the items such as earth work (excavation, backfilling, disposal etc.), piping, pipe fittings, manholes, gully trap, gully chamber, encasing in concrete and repairs etc required to complete the job. Any modification in the existing sewage system, if required, shall be done by the Contractor without any financial implication to Employer.

20.19 CABLE TRENCHES:

Various items like earth work (excavation, backfilling, disposal etc.), concrete (all type), reinforcement steel and miscellaneous steel required for construction of cable trenches shall be measured and paid under respective clauses mentioned above.

20.20 DRAINS:

The item Concrete (all type) & Reinforcement for drains shall be measured under relevant clauses as mentioned above. All other items required for completion of drains

shall be deemed to be included in the rate of items quoted for the drain. The quantity for each type of drain section shall be measured in meters along the centre line of drain.

20.21 SOIL TREATMENT :

CNS or sand filling or boulder packing with interstices filled with sand under or sides of the foundations, roads, cable trenches, drains etc shall be measured in cubic meters.

20.22 PILE FOUNDATION:

20.22.1 For payment purpose pile of different diameter shall be measured separately in length (running meter) from bottom of pile cap to the lowest point of pile. The rate shall include boring, providing and installation including temporary casing as applicable etc. complete in all respect except for concrete and reinforcement steel which will be paid separately under relevant items of BPS. Initial and routine test for vertical load and lateral load shall be payable under respective items of BPS.

20.22.2 In case pile foundation is not envisaged originally in the LOA then concrete and reinforcement steel shall be measured and paid as per items mentioned under relevant clauses as mentioned above. Boring installation including temporary casing, bentonite treatment, initial and routine tests etc of pile will be paid as an extra item. In case extra quantity of cement is required to meet the provisions of IS: 2911, it will be paid as an extra item.

20.23 CONTRACTOR DESIGNED FOUNDATIONS: Contractor designed foundations shall be measured {quantity of earth work (excavation, backfilling, disposal etc.), PCC, RCC, reinforcement} and paid as per relevant clauses as mentioned above, unless otherwise specified.

20.24 Billing break up of Lump sum items for payment purpose shall be decided at site by Engineer in charge for the work.

20.25 Civil works for Pipe supports and deluge valve housing for firefighting shall be deemed to be included in the items for firefighting and shall not be paid under civil works.

20.26 BOUNDARY WALL:

The measurements of boundary wall shall be in running meter of finished work. The rate shall be inclusive of earth work (excavation, backfilling, disposal etc.), concrete (all type), Reinforcement, MS steel, brick masonry, plastering barbed wire/ concertina coil, painting etc. complete required for completion of boundary wall. Nothing extra shall be payable on this account.

20.27 SITE LEVELLING:

20.27.1 EARTH WORK IN EXCAVATION AND FILLING

The quantity of excavation in all types of soil and soft/disintegrated rock shall be worked out by using initial and final levels. No void deduction shall be made to calculate net quantity of earth work. Only Excavation/cutting will be measured for payment purpose. The unit of measurement shall be in cubic metre.

In case hard rock is encountered during excavation, the level of rock surface before start and completion of rock excavation shall be recorded for calculating the quantity of excavation of hard rock. The volume of hard rock shall be computed on the basis of stacks of excavated rubble after making 50 % deduction for voids. The item of excavation in hard rock shall be payable separately.

The quantity of earth work in excavation in all kinds of soil & soft/disintegrated rock shall be arrived by reducing quantity of hard rock from the gross excavated quantity.

The unit rate shall include all lifts and all leads within levelling boundary. It also includes disposal of surplus earth and stacking of unusable material up the lead of2000 meters beyond the levelling boundary. Rate of item shall include all operations specified in the respective clause of technical specification.

20.27.2 EARTH WORKS IN EXCAVATION IN ALL TYPES OF SOILS AND SOFT /DISINTEGRATED ROCKS, HARD ROCKS AND DISPOSAL.

Quantity of excavation in all type of soils and soft/disintegrated rocks shall be worked out based on initial level before start of excavation and final levels after excavation. No void deduction shall be made to calculate net quantity of earth work in excavation. The excavated soil and soft/disintegrated rock shall be used for filling in lower areas of the substation. The unit rate shall include disposal of excavated material for leads up to 1000 meters beyond the levelling boundary.

For hard rock excavation, the volume of hard rock shall be computed on the basis of stacks of excavated rubble after making 50% deduction for voids. The unit of measurement shall be in cubic meter. The unit rate shall include stacking, disposal of excavated material for leads up to 2000 meters beyond the levelling boundary.

Where soil, soft/disintegrated rock and hard rock are mixed, the quantity of earth work in excavation in all kinds of soil & soft/disintegrated rock shall be arrived by reducing quantity of hard rock from the gross excavated quantity. Rate of item shall include all operations specified in the respective clause of technical specification.

20.27.3 FILLING USING EARTH BORROWED FROM OUTSIDE THE SUBSTATION LAND

For borrowed earth, the measurement shall be based on levels of area under filling only. The quantity of earth shall be worked out based on initial and final levels of levelling area. No void deduction shall be made to calculate net quantity of earth work. The unit of measurement shall be in cubic meter. The rate shall include arrangement of borrow area, payment of royalty, transportation, laying compaction, all leads and lifts etc. Rate of item shall include all operations specified in the respective clause of technical specification.

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1.	**Detailed Soil Investigation**	**a) Bore log**	1. Depth of bore log 2. SPT Test 3. Collection of samples	As per POWERGRID Specification	Contractor (Soil testing agency approved by POWERGRID)	100% at Field	To witness 20% at Field by site engineer	Site in charge
		b) Tests on samples	As per tech. Specs.	As per POWERGRID Specification	**Contractor (Testing in Laboratory of soil testing agency approved by POWERGRID**	100% by testing lab (Reports to be signed by Testing person & Checking person)	Review of lab test results (All soil reports to have signature of POWERGRID executive reviewing the report)	Site In-charge based on the guide line issued by CC Engg. as Annexure-9
2.	**Earth Work (site leveling)**							
		1. Mandatory testing for filling						
			1. Proctor compaction test for maximum dry density	IS:2720 (Part-7) & POWERGRID Specification	Contractor from *POWERGRID* approved Lab.	One sample per 25000 Cum. or part thereof for each type & source of filling material.	100% review of lab test results	Site In charge
			2. Optimum Moisture Content	do	Contractor from *POWERGRID* approved Lab.	do	do	do

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		2. Field Compaction Test	1. Field dry density & Moisture content test for each layer of compaction	IS:2720 (Part-29), & POWERGRID Specification	Contractor Field lab./ *POWERGRID* approved Lab.	One sample for every 2500 Sqm. or part there of for compacted soil for each compacted layer.	100% review of lab test results	Site In charge
3.	**Checking of foundation Material**							
	A. Materials	1. Cement	1. Brand approval	Cement of approved brands according to the COV in POWERGRID web Site may be procured.	Contractor	As proposed by Contractor	Any new brand cement proposed by Contractor shall be assessed by RHQ-FQA and approved by Regional Head After approval, details shall be forwarded to CC-QA&I/*FQA for* uploading in COV.	FQA-RHQ
			2. Physical tests	As per document at Annexure-I of this FQP	**Contractor** Samples to be taken jointly with POWERGRID and tested at POWERGRID *approved Lab.*	**Review of 100% MTC's and one sample for every week of Manufacturer.**	100% review of lab test results and MTC. **Test results shall be sent by the Lab by E-mail directly to POWERGRID. Further, hard Copy of Test Certificate shall also be sent by the Lab directly to POWERGRID by Postal Address.**	Site in charge
			3. Chemical Tests Chemical composition of Cement	-do-	Contractor to submit MTC	**Review of all MTC's**	**100% review of MTC results**	Site In charge
		2. a) Reinforcement Steel	1. Source approval	May be procured either from producers directly or through the authorized dealers who can produce MTC from producers with traceability.	Contractor	**As proposed by contractor.**	Material shall be supplied from producers / authorized dealers.	Site In charge

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				Refer COV in POWERGRID web site for list of producers of reinforcement steel Also refer approved list of Cut & Bend suppliers				
			2. Physical and Chemical analysis test	As per Annexure-2 of this FQP	Contractor to submit MTC	100% MTC's One sample* / 300 MT / Manufacturer shall be jointly sealed by POWERGRID and tested at POWERGRID approved Lab. *Note: All sizes of 10mm and above shall be taken for testing in every 300MT.	100% review of MTC and embossing. 1) Review of lab test results. Test results shall be sent by the Lab, by E-mail directly to POWERGRID; further, hard Copy of Test Certificate shall also be sent by the Lab directly to POWERGRID by Postal Address. 2) Unit weight of three samples to be witnessed. # #	Site In charge Site Engineer
	# # Three samples of each size of Reinforcement steel (all sizes of 10mm & above) out of 100MT steel Lot need to be physically weight at site in presence of POWERGRID to ascertain their acceptance as per technical specification. The weighted samples at site may be kept under custody for three months for further examination by any auditing authority (if required).							
		2. b) Miscellaneous structural steel excluding cable trench, transformer & reactor foundation.	**Source to be proposed by contractor.**	**Source with material meeting POWERGRID Specification**	**contractor**	**As proposed by contractor**	**To verify documents.**	Site In charge
			1. Dimensional check **2. Visual check for**	POWERGRID specification and approved drawing.	Contractor	100%	random	Site Engineer

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			Damages, rusting, pitting etc.					
		2. c) Structural steel used in cable trench, transformer & reactor foundation.	**Source to be proposed by contractor.**	**POWERGRID Specification**	**Contractor**	**As proposed by contractor**	**To verify documents.**	Site in charge
			1. Dimensional check	POWERGRID specification and approved drawing	Contractor	100%	random	Site Engineer
			2. Visual check for damages, rusting, pitting etc.	POWERGRID specification and approved drawing	Contractor	100%	random	Site Engineer
			3.Visual check for welding defects primer coating and painting/ galvanizing as applicable	POWERGRID specification and approved drawing	Contractor	100%	Random	Site Engineer
			4. Physical properties of Structural steel	IS 2062: 2011, reaffirmed 2016 POWERGRID specification and approved drawing	Contractor	1 sample per lot of 40MT or part thereof for tensile tests and 1 sample per lot of 20MT or part thereof for bend test of each size.	Review of lab test results by POWERGRID.	Site in charge

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		3. Coarse Aggregates	1. Source approval	Source meeting POWERGRID Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry & based on the test results of Joint samples tested in POWERGRID *approved lab.*	To review the proposal based on the documents	Site In-charge. Once approved, the particular source shall be used for all the running contracts under various Packages.
			2. Physical tests	As per document at Annexure-3 of this FQP	Samples to be taken jointly and tested in POWERGRID *approved lab.*	**One sample per 500 cum or part thereof per source, Samples to be tested by Contractor in POWERGRID *approved lab.***	100% review of lab test results.	Site In charge
		4. Fine aggregate	1. Source approval	**Source meeting POWERGRID Specification**	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the results of Joint samples tested in POWERGRID approved lab.	To review the proposal based on the documents.	Site In-charge. Once approved, the particular source shall be used for all the running contracts under various Packages.
			2. Physical test	**As per Annexure-4 of this FQP**	Samples to be taken jointly and tested in POWERGRID *approved lab*	**One sample per 500cum or part thereof per source, Samples to be tested by Contractor in POWERGRID *approved lab.***	100% review of lab test results.	Site In charge

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		5. Water	1. Cleanliness	POWERGRID Specification (Water shall be fresh and clean)	Contractor	100% visual check at Field	Verification at random	Site Engineer
			2. PH Value	- do -	Contractor	One sample per source	100% review of the test results Ph value not less than 6	Site Engineer
			3. Chloride Content	IS 456:2000	Samples to be take jointly and tested in POWERGRID approved lab	One sample per source	100% review of the test results	Site Engineer
			4. Sulphate Content	IS 456:2000	Samples to be take jointly and tested in POWERGRID approved lab	One sample per source	100% review of the test results	Site Engineer
		6.Finishing materials of building	Physical verification of Different items as per specification	As per Specification.	Contractor	100%	MTC/Manufacturer catalogue To be reviewed by POWERGRID.	Site In charge.
	B. Concrete Works a)Before concreting							
		1. Dimensions of excavation	**Dimension & Depth of foundation**	Approved Drawing.	Contractor	100% at Field	100% check by POWERGRID	Site Engineer

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		2. Setting of Foundation Bolts, Embedments etc.	1) Centre Line	Approved Drawing.	Contractor	100% at Field	100% check by POWERGRID	Site Engineer
			2) Diagonals	-do-	-do-	-do-	-do-	-do-
			3) Level of foundation bolts	-do-	-do-	-do-	-do-	-do-
		3. Reinforcement steel	Placement	Bar bending schedule	-do-	-do-	-do-	Site Engineer At least 5% locations shall be cross verified by immediate officer/ Site In charge, at Random with respect to foundation bolt and reinforcement steel placement
		4. Concrete mix proportion (Applicable for Design Mix)	Ratio of mix proportion	Approval of Design Mix submitted by contractor based on inputs furnished by POWERGRID as per Annexure- 10 of this FQP.	-do-	-do-	-do-	Site In charge in consultation with Regional engineering department

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	b) During concreting	1. Workability	Slump test	Range 25 mm to 75 mm refer document at Annexure-5 of this FQP	Contractor	Minimum Two per day, preferably one at the start of concreting	20% check at random	Site Engineer

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		2. Concrete Strength	Cubes Compressive Strength	As per POWERGRID Specifications & Annexure-5 of this FQP	Contractor Casting of cubes at site. Cubes to be tested for 28 days strength at POWERGRID In-house Lab/At site (if testing machine installed by contractor is duly calibrated by NABL Lab.)/ POWERGRID approved Lab Cubes at 100% location are to be taken in presence of POWERGRID officials.	**Nominal Mix** One sample of 3 cubes for every 20 cum or part thereof for each day of concreting and 28 dayscompressive strength shall be tested. **Design Mix** Sampling for concrete strength should be one set of 3 nos. of cubes for every 20 cum or part thereof for each day of concreting and 28 days compressive strength shall be tested. However, In case of concrete supplied by RMC, one set of 3 nos. of cubes for every 50 cum or part thereof for each day of concreting and 28 days compressive strength shall be tested. ***NOTE: Apart from cube testing, the CORE testing on casted foundations shall be carried out on 5% of***	Normally testing shall be carried out at the POWERGRID in-house cube testing facility. Alternatively, samples shall be tested at cube testing facility installed by contractor at POWERGRID premises, in the witness of POWERGRID. Lastly, POWERGRID approved Labs, in this case, test results shall be sent by the Lab. by E-mail directly to POWERGRID; further, hard copy of Test Certificate shall also be sent by the Lab directly to POWERGRID by Postal Address. **NOTE: The efforts shall be made to carry out 100% cube testing in the in-house cube testing facility.**	Site Engineer. All cubes shall be tested at In-house testing facilities. However, in case of breakdown of CTM or other force majeure conditions, cubes may be tested at approved TPL. Out of testing on 10% samples to be witnessed at TPL by POWERGRID Site Engineer and at least 5% samples at random, shall be witnessed by Site In-charge. In-case of Site/ POWERGRID

						total locations on sampling basis. The sampling should be planned in such a way that the locations are tested within 45 days after casting .Regional FQA has to decide the sample locations to be tested. ***The 5% samples shall be taken from Tower, Equipment, Transformer, Reactor, Building foundations.***		Lab, 100% witness by POWERGRID Representative.

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	c)After Concreting	Back filling	a) Watering & Ramming for compaction	POWERGRID Specification	Contractor	100%	Random	Site Engr.
			b) Compaction Test	POWERGRID Specification	Contractor At Site/ Power grid Accepted Lab	a) One Sample of three specimen for 50% of tower location b) One Sample of three specimen for 20% of Equipment Foundation location c) 3 Samples (three specimen for one sample) for every Building (The depth of sampling and the locations shall be decided by Site Engineer)	Physically at Random & 100% review of Test results	Site In charge
		NDT/Core Tests	**UPV and Rebound Hammer /Core test**	**Refer POWERGRID's Standard procedure for Testing/Assessment of compressive strength of casted Concrete**				**Regional Head**
4.	**Pile foundations**	**REFER SFQP OF SWITCHYARD PILE WORK**						

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5.	1) Brick Masonry							
		a) Clay Bricks	1.Dimensional tolerance	POWERGRID Specification/enclosed Annexure 6	Contractor (samples to be taken jointly and tested in POWERGRID accepted lab)	Enclosed Annexure 6	Review 100% of test results	Site Engineer
			2.Compressive strength	POWERGRID Specification/enclosed Annexure 6	-Do-	-Do-	-do-	Site Engineer
			3.Water Absorption	POWERGRID Specification/enclosed Annexure 6	-Do-	-Do-	-do-	Site Engineer
			4.Efflorescence	POWERGRID Specification/enclosed Annexure 6	-Do-	-Do-	-do-	Site Engineer
		b)Fly Ash Bricks	1.Dimensional tolerance	POWERGRID Specification/enclosed Annexure 6	Contractor (samples to be taken jointly and tested in POWERGRID accepted lab)	Enclosed Annexure 6	Review 100% of test results	Site Engineer
			2.Compressive strength	POWERGRID Specification/enclosed Annexure 6	-Do-	-Do-	-do-	Site Engineer
			3.Water Absorption	POWERGRID Specification/enclosed Annexure 6	-Do-	-Do-	-do-	Site Engineer

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			4.Efflorescence	POWERGRID Specification/enclosed Annexure 6	-Do-	-Do-	-do-	Site Engineer
		c) Concrete Blocks d) Mortar Mix for brick/concrete works	Tests as per IS:2185 Cement Sand Proportion	Tests as per IS:2185 As per POWERGRID Specification	Contractor Contractor	Sampling as per IS:2185 100%	Random Random	Site Engineer Site Engineer
	2) Stone Masonry	1.Compressive Strength	IS: 1121 (Part-I) & CPWD Specification clause 7.1 Stone with round surface shall not be used	Contractor (samples to be taken jointly and tested in POWERGRID accepted lab)	One sample pre source	100%	Random	Site Engineer
		2. Water Absorption	IS: 1124-1974 & CPWD Specification clause 7.1 Stone with round surface shall not be used	Contractor (samples to be taken jointly and tested in POWERGRID accepted lab)	One sample pre source	100%	Random	Site Engineer
6.	P.C.C	Grade , thickness, plan dimension	Completeness	IS 456: 2000, reaffirmed 2016 and POWERGRID approved foundation drawings & specification	Joint Inspection by POWERGRID and CONTRACTOR	For all locations	Joint Inspection by POWERGRID and CONTRACTOR	Site Engineer
7.	PLASTERING							
		1.Plastering	thickness and evenness	As per POWERGRID Spec.	Contractor	100%	Random	Site Engineer

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		2. ingredients	Mortar Mix/Proportion	As per POWERGRID Spec.	Contractor	100%	Random	Site Engineer
8.	Switchyard earthing							
		1. Check for dimension of earth mat	Physical check	POWERGRID spec & approved drawings	contractor	100%	Random	Site Engineer
		2. Depth of excavation and Electrode	Physical check	POWERGRID spec & approved drawings	Contractor	100%	Random	Site Engineer
		3. Check for weld joints and anti corrosion treatment	Physical check	POWERGRID spec & approved drawings	Contractor	100%	Random	Site Engineer
9.	Site surfacing							
		1.Leveling,Level & Height & evenness	Physical Check	POWERGRID spec & approved drawings	Contractor	100%	Random	Site Engineer
		2. Soil sterilization : spraying of chemicals	Physical Check	POWERGRID spec & manufacturers recommendations	Contractor	100%	random	Site Engineer
		3. P.C.C (Grade, thickness & Size) a) PCC 1:5:10 (1 cement:5	Completeness	POWERGRID specifications	Joint Inspection by POWERGRID and Contractor	100%	Random	Site Engineer

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		coarse/fine sand:10 coarse aggregate /burnt brick aggregates) b)Burnt brick aggregate of nominal size 40 mm	Grading	As per Annexure-8	Samples to be taken jointly & tested in POWERGRID accepted lab.	1 sample per 500 cu.mtr	100% review of lab test results	Site In-charge
		4. 40mm stone aggregate	Grading	IS 383: 2016, *IS: 2386: Part 1, reaff. 2016* and POWERGRID Specification. The grading shall be as per single sized nominal size	Contractor (POWERGRID accepted lab)	1 sample per lot of 500 Cubic Meter or part thereof from each source for each size.	100% review of test report	Site Engineer
		5. Resistivity of 40mm stone aggregate	Electrical Check	POWERGRID Technical Specification. (resistivity of the stone for spreading over the ground shall be minimum 3000 ohm-m under wet condition)	Contractor	1 sample of stone from each source (in case stones are supplied from more than one source)	100% review of test report.	Site Engineer
		6. Compacted thickness of 40mm stone layers as applicable	Physical	POWERGRID specification & approved drawings	Contractor	100%	Random	Site Engineer
10	**Road (WBM/WMM layers)**							
		1. Alignment & Level	Physical check	POWERGRID specification & approved drawings	Contractor	100%	100%	Site In charge

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	Material	A. Coarse Aggregates	1. Source approval	Source with materials meeting POWERGRID Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested in POWERGRID approved lab.	To review the proposal based on the documents	Site In charge
			2. Physical tests	As per document at Annexure-7 of this FQP	Samples to be taken jointly and tested in POWERGRID approved lab	One sample per lot of **500** cum or part thereof per source	100% review of lab test results	Site In charge
		B)Stone Screening						
			1. Source approval	Source with materials meeting POWERGRID Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested in POWERGRID accepted lab	To review the proposal based on the documents	Site In charge
			2. Grading	As per document at Annexure-7 of this FQP	Samples to be taken jointly and tested in POWERGRID approved lab	One sample per lot of **200** cum or part thereof	100% review of lab test results	Site In charge
		C)Binding Material	Plasticity index	As per document at Annexure-7 of this FQP	Contractor	One sample per lot of **100** cum or part thereof	100% review of lab test results	Site In charge
		D) Laying of sub base Course	Physical check	As per CPWD spec clause 17.7.2	Contractor	100%	Random	Site Engineer

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		E) Laying of base Course	Physical check	As per CPWD spec clause 17.8.1	Contractor	100%	Random	Site Engineer
11	**Drain**	Alignment and invert level	Dimension	POWERGRID spec and approved drawing	Contractor	100%	Random	Site Engineer
12	**Cable trench**	Alignment and Section	Dimension	POWERGRID spec and approved drawing	Contractor	100%	Random	Site Engineer
13	Storage of materials	1)Storage of Tower parts, Conductor drums, Insulators, Hardware fittings, Bolts/Nuts, RF Steel 2) Cement Storage 3) Indoor/Outdoor Equipment	Visual & Physical check	POWERGRID specifications	Contractor	100%	Random check	Site Engineer

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CEMENT

ORDINARY PORTLAND CEMENT					
S. No.	**Name of the test**	**Ordinary Portland Cement 33 grade as per IS *269: 2015***	**Ordinary Portland Cement 43 grade *as per IS 269: 2015***	**Ordinary Portland Cement 53 grade as *per IS 269: 2015***	**Remarks**
a)	**Physical tests**				To be conducted in Appd. Lab
(i)	Fineness	Specific surface area shall not be less than 225 sq.m. per kg. or 2250 cm2 per gm.	Specific surface area shall not be less than 225 sq.m. per kg or 2250 cm2 per gm.	Specific surface area shall not be less than 225 sq.m. per kg or 2250 cm2 per gm.	Blaine's air permeability method as per IS 4031 (Part-2):1999, Reaffirmed 2013
(ii)	Compressive strength	72 ± 1 hour : Not less than 16 Mpa (16 N/mm2) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm2) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm2), *Not more than 48Mpa (48 N/mm2)*	72 ± 1 hour : Not less than 23 Mpa (23 N/mm^2) 168 ± 2 hour : Not less than 33Mpa (33 N/mm^2) 672 ± 4 hour : Not less than 43 Mpa (43 N/mm^2), *Not more than 58Mpa (58N/mm2)*	72 ± 1 hour : Not less than 27Mpa (27 N/mm^2) 168 ± 1 hour : Not less than 37Mpa (37 N/mm^2) 672 ± 1 hour : Not less than 53 Mpa (53 N/mm^2)	As per IS 4031 (Part-6): 1988, Reaffirmed 2014
(iii)	Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	As per IS 4031 (Part-5): 1988, Reaffirmed 2014. -do-
(iv)	Soundness	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Le Chatlier and Autoclave test as per IS 4031 (Part-3): 1988, Reaffirmed 2014.

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Annexure-1

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S. No.	Name of the test	Ordinary Portland Cement 33 grade as per IS 269: 2015	Ordinary Portland Cement 43 grade as per IS *269: 2015*	Ordinary Portland Cement 53 grade as per IS *269: 2015*	Remarks
b)	**Chemical composition tests**				Review of MTC only
		a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02%	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02%	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.80 to 1.02%	
		b) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	
		c) Insoluble residue, percentage by mass, Max. *5.00%*	c) Insoluble residue, percentage by mass, Max. *5.00%*	c) Insoluble residue, percentage by mass Max. *5.00%*	
		d) Magnesia percentage by mass Max. 6%	d) Magnesia percentage by mass Max. 6%	d) Magnesia percentage by mass Max. 6%	
		e) Total sulphur content calculated as sulphuric anhydride (SO_3), percentage by mass not more than 3.5%.	e) Total sulphur content calculated as sulphuric anhydride (SO_3), percentage by mass not more than 3.5%.	e) Total sulphur content calculated as sulphuric anhydride (SO_3), percentage by mass not more than 3.5%.	
		f) Total loss on ignition shall not be more than 5 percent	f) Total loss on ignition shall not be more than 5 percent	f) Total loss on ignition shall not be more than 4 percent	
		g) Chloride content, percent by mass, max 0.1%	*g) Chloride content, percent by mass, max 0.1%*	*g) Chloride content, percent by mass, max 0.1%*	

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Annexure-1

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S. No.	Name of the test			Remarks
2.	**POZZOLANA PORTLAND CEMENT AS PER IS 1489 (Part 1): 2015**			
a)	**Physical tests**			To be conducted in POWERGRID approved Lab
		i) Fineness	Specific surface area shall not be less than 300m^2/Kg. or 3000 cm^2/gm.	IS 4031 (Part-II)
		ii) Compressive strength	a) 72 ± 1 hour : Not less than 16 Mpa (16 N/mm^2) b) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm^2) c) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm^2)	IS 4031 (Part-VI)
		iii) Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	IS 4031 (part-V)
		iv) Soundness	Unaerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier test and 0.8% by Autoclave test as per IS 4031 (Part-3)	
b)	**Chemical composition tests**			
		a) Magnesia percentage by mass Max. 6%		Review of MTC only
		b) *Insoluble residue, percent by mass, (a) Maximum {x + 4 (100-x)/100} (b) Minimum 0.6x, where x is the declared % of fly ash in the given Portland pozzolana cement.*		-do-
		c) Total sulphur content calculated as sulpuric anhydride (SO_3), percentage by mass not more than 3.5		-do-
		d) Total loss on ignition shall not be more than 5 percent		
		e) *Chloride content, percent by mass, max 0.1%*		

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Annexure-2

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR REINFORCEMENT STEEL AS PER IS 1786-2008 (Reaffirmed 2013), Amendment No. - 1

S. No.	Name of the test	Fe 415	Fe 500	*Fe 500D*
i)	**Chemical analysis test**			
	Carbon	**0.30 Percent Maximum**	**0.30 Percent Maximum**	***0.25 Percent Maximum***
	Sulphur	**0.060 Percent Maximum**	**0.055 Percent Maximum**	***0.040 Percent Maximum***
	Phosphorus	**0.060 Percent Maximum**	**0.055 Percent Maximum**	***0.040 Percent Maximum***
	Sulphur & Phosphorus	**0.110 Percent Maximum**	**0.105 Percent Maximum**	***0.075 Percent Maximum***
	Carbon Equivalent	**0.42 percent Maximum**	**0.42 percent Maximum**	**0.42 percent Maximum**
ii)	**Physical tests**			
	a) Tensile Strength/Yield stress ratio,	*≥1.10, but tensile strength not less than 485.0 N/mm^2*	*≥1.08, but tensile strength not less than 545.0 N/mm^2*	*≥1.10, but tensile strength not less than 565.0 N/mm^2*
	b) 0.2% of proof stress/Yield stress Minimum, N/mm ^{2}	415	500	*500*
	c) Elongation percent , Minimum	14.5	12	*16*
	d) *Total elongation at maximum force, percent, Minimum*	--	--	*5*
	e) Unit weight, Kg/m on sample sent for third party lab	As per IS 1786	As per IS 1786	As per IS 1786
iii)	**Bend & Rebend tests**	Pass	Pass	*Pass*

Annexure-3

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR COARSE AGGREGATES AS PER IS 383: 2016

3.	**Coarse Aggregates**										
i)	Physical Tests										
	a) Determination of particles size	a. IS Sieve Designation	**%age passing for Single-Sized Aggregate of nominal size**					**Percentage Passing for grades Aggregate of nominal size**			
			40 mm	**20 mm**	**16 mm**	**12.5 mm**	**10 mm**	**40 mm**	**20 mm**	**16 mm**	**12.5 mm**
		63 mm	100	-	-	-	-	-	-	-	-
		40 mm	85 to 100	100	-	-	-	90 to 100	100	-	-
		20 mm	0 to 20	85 to 100	100	-	-	30 to 70	90 to 100	100	100
		16 mm	-	-	85 to 100	100	-	-	-	90-100	-
		12.5 mm	-	-	-	85 to 100	100	-	-	-	90 to 100
		10 mm	0 to 5	0 to 20	0 to 30	0 to 45	85 to 100	10 to 35	25 to 55	30 to 70	40 to 85
		4.75 mm	-	0 to 5	0 to 5	0 to 10	0 to 20	0 to 5	0 to 10	0 to 10	0 to 10
		2.36 mm	-	-	-	-	0 to 5	-	-	-	-
	b. *Combined Flakiness and Elongation index*		*Not to exceed 40%*								
	c. *Crushing Value*		*Not to exceed 30%*								
	d. *Presence of deletrious material*		*Total presence of deleterious materials not to exceed 5% for uncrushed, 2% for crushed and manufactured coarse aggregates as per Annexure- 3A.*								
	e *Hardness*		*Abrasion value not more than 50%, Impact value not more than 45%*								
	f. Soundness test (for concrete work subject to frost action)		12% when tested with sodium sulphate and 18% when tested with magnesium sulphate								

Deleterious Substance	***Percentage by Mass, Max***		
	Uncrushed	*Crushed*	*Manufactured*
a) Coal and lignite	*1.0*	*1.0*	*1.0*
b) Clay lumps	*1.0*	*1.0*	*1.0*
c) Materials finer than 75 micron	*1.0*	*1.0*	*1.0*
d) Soft fragments	*3.0*	*--*	*3.0*
e) Shale	*--*	*--*	*--*
f) Total of percentages of all deleterious materials (except mica) including S. No. a) to e) for uncrushed and crushed aggregates	*5.0*	*2.0*	*2.0*

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR FINE AGGREGATES AS PER IS 383: 2016

4.	**Fine aggregates**				
i)	Physical Tests	**IS Sieve Designation**	**Percentage passing for graded aggregate of nominal size**		
	a) Determination of particle size		**F.A. Zone I**	**F.A. Zone II**	**F.A. Zone III**
		10 mm	100	100	100
		4.75 mm	90-100	90-100	90-100
		2.36 mm	60-95	75-100	85-100
		1.18 mm	30-70	55-90	75-100
		600 microns	15-34	35-59	60-79
		300 microns	5 to 20	8 to 30	12 to 40
		150 microns*	0-10	0-10	**0-10**
	b) Presence of deleterious material	*Total presence of deleterious materials not to exceed 5% for uncrushed, 2% for crushed/Mixed and manufactured fine aggregates as per Annexure- 4A.*			
	c) *Soundness Applicable to concrete work subject to frost action*	*10% when tested with sodium sulphate and 15% when tested with magnesium sulphate*			

*For crushed stone sand the permissible limit on 150 microns IS Sieve is increased to 20 %.

Deleterious Substance	***Percentage by Mass, Max***		
	Uncrushed	*Crushed/Mixed*	*Manufactured*
a) Coal and lignite	*1.0*	*1.0*	*1.0*
b) Clay lumps	*1.0*	*1.0*	*1.0*
c) Materials finer than 75 micron	*3.0*	*15.0 (for crushed sand)* *12.0 (for mixed sand)*	*10.0*
d) Soft fragments	--	--	--
e) Shale	*1.0*	--	*1.0*
f) Total of percentages of all deleterious materials (except mica) including S. No. a) to e) for uncrushed aggregates and a) & b) for crushed/mixed and manufactured aggregates	*5.0*	*2.0*	*2.0*

Annexure-5

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CONCRETE WORK

1)	**Concrete**	a) Workability	Slump shall be recorded by slump cone method and it shall between 25-75 mm, depending upon workability requirement as per IS 456: 2000, reaffirmed 2016.
		b) Compressive strength	**For Design mix as per IS:456 for Grade M15 or above** **For nominal (volumetric) concrete mixes compressive strength for 1:1.5:3 (Cement : Fine aggregates : Coarse aggregates) concrete 28 days strength shall be min 265Kg/cm^2 (26N/mm^2) and for 1:2:4(Cement: Fine Aggregate: Coarse aggregate) nominal mix concrete 28 days strength shall be min 210Kg/cm^2 (20.60N/mm^2).**

Notes :

1) ***ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR NOMINAL MIX CONCRETE: As per clause 5.4.10.4 of CPWD Specifications, Volume 1***

(a) The average of the strength of three specimen be accepted as the compressive strength of the concrete provided the strength of any individual cube shall neither be less than 70% nor higher than 130% of the specified strength.

(b) If the strength of any individual cube exceeds more than 30% of specified strength, it will be restricted to 130% only for computation of strength.

(c) If the actual average strength of accepted sample is equal to or higher than specified strength upto 30% then strength of the concrete shall be considered in order and the concrete shall be accepted at full rates.

(d) If the actual average strength of accepted sample is less than specified strength but not less than 70% of the specified strength, the concrete may be accepted at reduced rate after reconfirmation by NDT/Core test on the location portion represented by the cube samples in line with approved Standard testing procedure of POWERGRID.

(e) If the actual average strength of accepted sample is less than 70% of specified strength, the Engineer-in-Charge shall reject the defective portion of work represented by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure

shall be taken at the risk and cost of contractor. If, however the Engineer-in-Charge so desires, he may order additional tests to be carried out to ascertain if the structure can be retained. All the charges in connection with these additional tests shall be borne by the contractor.

2) 53 Grade cement shall be used after obtaining specific approval of the Engineer in charge.

3) Portland slag cement conforming to IS 455:2015 may be used as per Technical Specification.

4) All Design Mix concrete shall be as per IS 456: 2000, reaffirmed 2016

5) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR DESIGN MIX CONCRETE: As per Table-11, Amendment No. 4 of IS 456: 2000 as given below: Note sheet reference no. CC/FQA/CLA/MIX dated 08/12/16 approved by Competent Authority.

Specified Grade	***Case No.***	***Sampling***	***Acceptance Criteria for Mix Design as per Is 456:2000***	***Remarks***
M15 and above	*A 1.*	*Mean of Group of 4 non-overlapping consecutive test results.*	*Shall greater than or equal to fck+0.825 x established standard deviation (rounded off to nearest 0.5 N/sq. mm)** *Or* *fck + 3 N/sq. mm, whichever is greater*	
	A 2.	*Individual test result out of A 1.*	*Greater than or equal (fck-3) N/ sq.mm*	*Out of four non- overlapping consecutive test results, one individual test result only.*
	B 1.	*Group of non-overlapping consecutive if test results are less than 4*	*fck + 4, N/sq.mm, minimum*	
	B 2.	*Individual test result out of B 1.*	*fck - 2, N/sq.mm, minimum*	*Out of less than four non-overlapping consecutive test results, one individual test result only.*
	C 1	*When number of sample is only one.*	*fck + 4, N/sq.mm, minimum*	

** Established value of standard deviation shall be determined based on Note of Table-11 of IS 456*

6) *The test results of the sample shall be the average of the strength of the three specimens. The individual variation shall not be more than ± 15% of the average.*

Annexure- 6

(Sheet 01 0f 02)

SAMPLING PLAN FOR BRICK-WORK

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

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

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

Scale of sampling for physical characteristics

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

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(Sheet 02 0f 02)

ACCEPTABLE CRITERIA FOR BRICK WORK

1) Dimensional Tolerances: The dimensions of modular/ Non modular bricks when tested shall be within the following limits per 20 bricks.

S. No	DESCRIPTION	MODULAR BRICKS	NON-MODULAR BRICKS
1	LENGTH	372 to 388 cm (380± 8 cm)	*452 to 468 cm (460 ± 8 cm)*
2	WIDTH	*176 to 184 cm (180± 4 cm)*	*216 to 224 cm (220 ± 4 cm)*
3	HEIGHT	176 to 184 cm (180± 4 cm)	*136 to 144 cm (140 ± 4 cm)*

2) Compressive strength: the bricks shall have a minimum average compressive strength as specified in POWERGRID specification. The compressive strength of any individual brick tested shall not fall below the min. average compressive strength specified for the corresponding class of brick by more than 20%. in case compressive strength of any individual brick tested exceeds the upper limit specified for the corresponding class of bricks, the same shall be limited to upper limit of the class as specified for the purpose of calculating the average compressive strength.

3) Water Absorption: The average water absorption of bricks shall not be more than 20% by weight.

4) Efflorescence: The rating of efflorescence of bricks shall not be more than moderate.

PHYSICAL, REQUIREMENT OF COARSE AGGREGATE

S.No.	Type of Constn.	Type of W.B.M	Test Method	Requirements
1.	Sub-base	Los Angeles Abrasion Value or Aggregate Impact value	IS 2386 (Part-IV) IS 2386 (Part-IV) IS 5640***	60% max. * 50% max
2.	Base	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness Index	IS 2386 (Part-IV) IS 2386 (Part-IV) IS 5640*** IS 2386 (Part-I)	50% max. * 40% max **15% max
3.	Surface Course	a) Los Angeles Abrasion Value or Aggregate Impact value b) Flakiness Index	IS 2386(Part-IV) IS 2386 (Part-IV) IS 2386 (Part-I)	40% max. 30% max **15% max
4	Binding Material	Plasticity index	IS 2720 (Part-V)	Less than 6

* Aggregates may satisfy requirements of either of the two tests

** The requirements of flakiness index shall be enforced only in case of crushed/broken stone and crushed slag.

*** Aggregates like brick metal, kankar and laterite which get softened in presence of water, shall be tested for impact value under wet conditions in accordance with IS 5640.

GRADING REQUIREMENTS OF COARSE AGGREGATE FOR W.B.M

Grading No.	Size Range	Sieve designation	% by weight passing the sieve
1	90mm to 45mm (Suitable for sub base courses of compacted layer of not less than 90mm thickness).	125mm 90mm 63mm 45mm 22.4mm	100 90-100 25-60 0-15 0-5
2.	63mm to 45mm	90mm 63mm 53mm 45mm 22.4mm	100 90-100 25-75 0-15 0-5
3.	53mm to 22.4mm	63mm 53mm 45mm 22.4mm 11.2mm	100 95-100 65-90 0-10 0-5
4	Screening		
	A) 13.2 mm	13.2 mm 11.2 mm 5.6 mm 180 micron	100 95-100 15-35 0-10
	B) 11.2 mm	11.2 mm 5.6 mm 180 micron	100 90-100 15-35

Annexure-8

Requirement of grading of broken Burnt Brick Coarse aggregate

IS Sieve Designation	Percent Passing
75 mm	100
37.5 mm	95-100
19.0 mm	45-75
4.75 mm	0-5

General Notes:

1) This standard Field Quality Plan is not to limit the supervisory checks which are otherwise required to be carried out during execution of work as per drawings/Technical specifications etc.
2) All materials under supply contract should have Cat-A CIP before they are erected.
3) Contractor shall be responsible for implementing/documenting the SFQP. Documents shall be handed over by the contractor to POWERGRID after the completion of the work.
4) Project incharge means over all incharge of work. Site Incharge means incharge of the Site. Site Engineer means in charge of the section. Site Engineer's responsibility may be allocated to Site JE, with the approval of Regional Head, only in such cases where, Site Engineer is not in position.
5) In case of deviation the approving authority will be one step above the officer designated for acceptance in this quality plan subject to minimum level of Site incharge.
6) Acceptance criteria and permissible limits for tests are indicated in the Annexures. However for further details/tests POWERGRID specification and latest relevant Indian standards shall be referred.
7) Tests as mentioned in this FQP shall generally be followed. However E.I.C. reserves the right to order additional tests wherever required necessary at the cost of the agency.
8) All counter checks/tests by POWERGRID shall be carried out by POWERGRID's officials' at least at the level of Site Engineer.
9) The authorized dealer of reinforcement steel means the dealer whose names are listed in the steel producer's web site or certified by the producers.
10) Accepting Authority for testing Laboratory shall be Regional Head.

11) **READYMIX CONCRETE (RMC) IS ACCEPTABLE FOR USE. HOWEVER, SITE INCHARGE SHALL APPROVE THE SOURCE OF MATERIALS TO BE USED FOR RMC .The documentation to be maintained shall be as per IS 4926:2003, Reaffirmed 2012 i.e.**

i) Information to be supplied by the purchaser (clause 7)

ii) Information to be supplied by the producer (clause 8)

iii) Sampling for concrete strength should be one set of 3 nos. of cubes for every 50 cum or part thereof for each day of concreting and 28 days compressive strength shall be tested in line with IS 456: 2000, Reaffirmed 2016.

12) The preference shall be given to batching/RMC plants approved by Quality Council of India.

13) Epoxy coating on reinforcement steel wherever required shall be done as per IS 13620: 1993, Reaffirmed 2015.

14) Cement is to be used in the order; it is delivered (i.e. First in First Out). In case the cement remains in storage for more than 3 months, the cement shall be retested before use and shall be rejected, if it fails to conform to any of the requirements given in the relevant Indian Standard. Cement shall be packed in bags and stored in accordance with the provisions in IS 4082:1996, Reaffirmed 2003.

15) Three samples of each size of steel (all sizes of 10mm & above) out of 100MT steel Lot need to be physically weighted to ascertain their acceptance as per technical specification. The weighted samples at site may be kept under custody for three months.

16) If e-mail facility is not available in POWERGRID approved Lab, report may be collected directly by POWERGRID /Speed Post / Register Post / UPC.

17) In case any Laboratory refuses to allow POWERGRID representative for witnessing the test, same shall be taken in writing and approved by Regional Head.

18) *Latest IS codes shall be followed.*

19) *Standard marking of ISI mark along with license number (Seven digit no.. represented as CM/L-----) should be verified for construction materials.*

20) *The mix design shall be approved in line with standard format for mix design concrete and final approval of mix design shall be done in consultation with Regional engineering department.*

21) *Tolerance of cement weight shall be governed by clause no. 10.1.1 of IS 269:2015 for OPC and by clause no. 10.1.1 of IS 1489 (Part 1):2015 for PPC.*

22) *Digital Photographs during major construction activities shall be taken and kept in record.*

23) *All the charges in connection with NDT/ Core tests shall be borne by the contractor.*

24) *The cube testing in in-house Cube testing machine shall be carried out by POWERGRID employee not directly associated with construction activities. The employees associated with O&M works should be preferred for carried out cube test.*

ENGINEERING GUIDE LINE FOR CHECKING / ACCEPTING SOIL INVESTIGATION REPORT:

Following are the guide line for checking and accepting the soil investigation report:

The soil investigation shall be carried out in line with the Technical Specification. The detailed soil Investigation Report should be signed by the soil investigating agency, Line Contractor and POWERGRID's Site Engineer/RHQ Engineer and following points should be checked in the soil investigation report:

a) Soil investigation report should contain the bore Log sheet indicating the variation of different soil strata.

b) The Bearing capacity, Bulk density (γ) , Submerged Density(γ_{Sub}) , angle of repose (δ) in dry as well as wet condition and Angle of internal friction (ϕ) for different soil layers including at 3m depth shall be indicated in the Soil investigation report.

c) Present water table and history of variation of water table at the tower location shall be indicated in the soil investigation report.

d) Classification of foundation should be indicated based on the water table , Bearing capacity, Swelling Index, Soil type and the value of angle of repose (δ) in line with parameters indicated in the standard foundation drawings.

CONCRETE MIX PROPORTIONING-MIX DESIGN

S. No.	Design Stipulations	Specified Criteria for Mix Proportion
A 1.	CONCRETE DETAILS: Grade of Concrete (M 20 to M 60- 28 days compressive Strength of 150mm cubes)	M20 ☐ M25 ☐ M30 ☐ M35 ☐ M40 ☐
2.	Type of Concrete- Structural Classification	PCC ☐ RCC ☐ PSC ☐ Others ☐
3.	Placing Conditions of Concrete (Structural Elements)	Building ☐ TL Pile ☐ S/S Pile ☐ S/S Structure ☐ Road ☐
B 4.	MIX DESIGN LIMITS: Max. Water-Cement Ratio (W/C)- Optional	0.30 ☐ 0.35 ☐ 0.40 ☐ 0.45 ☐ 0.50 ☐ Others ☐
5.	Min Cement Content- Optional- Kg/m3	300 ☐ 320 ☐ 340 ☐ 360 ☐ 380 ☐ Others ☐
C 6.	EXPOSURE CONDITIONS:@ Type of Environmental Exposure	Mild ☐ Mod. ☐ Severe ☐ V. Severe ☐ Extreme ☐
7.	Whether Exposed to Sulphate attack from Soil, Water & Containment.	Yes ☐ No ☐ Not Known ☐
8.	Whether Exposed to Chloride attack from Soil, Water & Containment.	Yes ☐ No ☐ Not Known ☐

D 9.	CONCRETE INGREDIENTS: Source of Water for Construction	Ground ☐ River ☐ Pond ☐ Others ☐
10.	Type of Cement & Strength Grade.	OPC Gr.33 ☐ OPC Gr.43 ☐ OPC Gr.53 ☐ PPC BFS ☐ PPC FAB ☐ PSC
11.	Brand, Batch No./Week/Year of Cement(Test Certificate to be sent to Lab)	☐ ☐
12.	Cementitous Materials Proposed for Improvement of Density & Permeability.	Microsilica/ Silica Fume ☐ Slag ☐ Fly Ash ☐ Other Pozzolona ☐
13.	FRESH CONCRETE Properties: Desired Slump of Concrete (mm)#	25-55 ☐ 25-75 ☐ 100-150 ☐ Others ☐
14.	QUALITY CONTROL AT SITE: Degree of Quality Control at Project Site (For Standard Deviation)	V.Good ☐ Good ☐ Fair ☐ Std.Lab. ☐
15.	Max. Size of Coarse Aggregate (MSA)-mm	63 ☐ 40 ☐ 20 ☐ 12.5 ☐ 4.75 ☐ Other ☐
16.	Source of Coarse Aggregate	Name of Quarry Location
17.	Type of Fine Aggregate	River Sand ☐ Crushed Sand ☐ Others Specify ☐
18.	Source of Fine Aggregate (Sand)	Name of Quarry Location

19.	Admixture proposed to be Used (Batch MTC to be Submitted to Lab)	Brand Name: Batch No.:
20.	Type of Compaction Equipment	Plate Vibrator ☐ Needle Vibrator ☐ Vibro Hyd. Pressure ☐ Piling Concrete ☐
21.	Type of Concrete Placement Facility at Project	Manual Lift ☐ Hudraulic Bucket ☐ Concrete Pump ☐
22	Maximum/Minimum temp. envisaged during placing of concrete	

Slump Value as per SFQP;

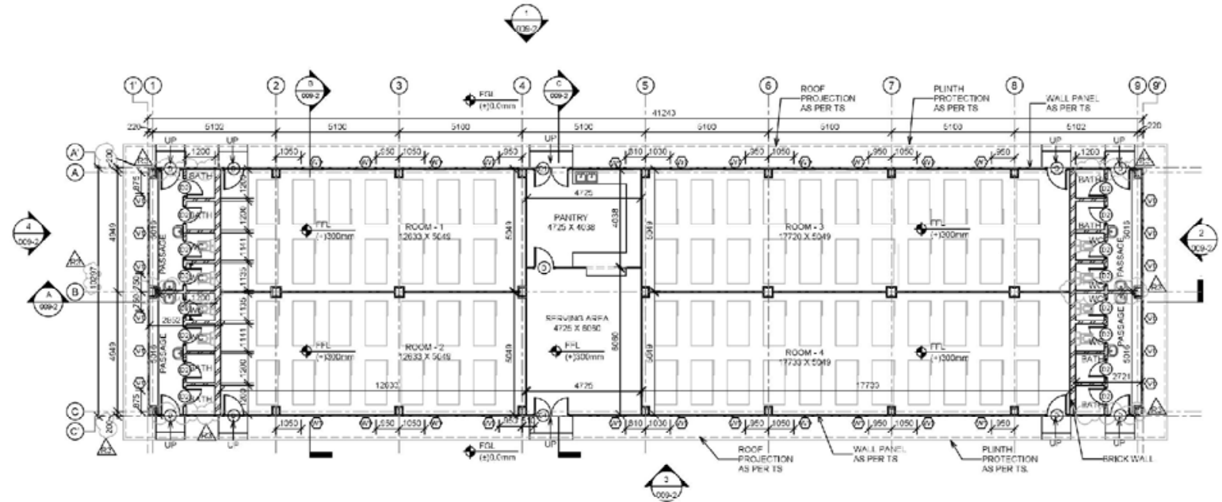
i. For Switchyard civil works – 25 to 75mm
ii. For Switchyard pile foundations- 150-180mm
iii. For Transmission line open cast foundations- 25 to 75mm
iv. For Transmission line pile foundations- 150-180mm

@EXPOSURE CONDITIONS

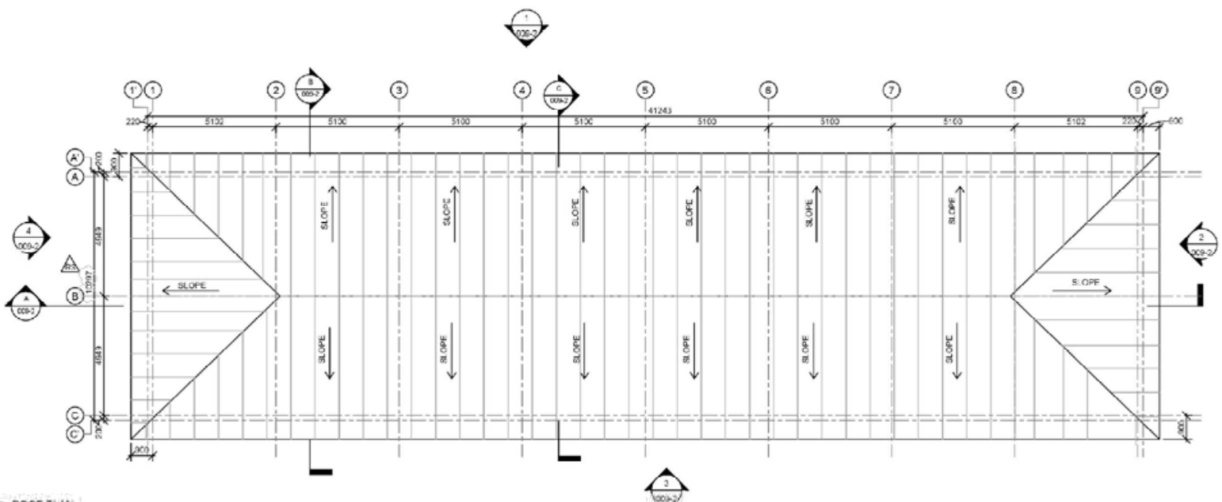
ENVIRONMENT	EXPOSURE CONDITIONS
MILD	• Concrete surfaces protected against weather or aggressive
MODERATE	• Concrete exposed to condensation and rain • Concrete continuously under water • Concrete surfaces sheltered from rain or freezing whilst wet • Concrete in contact or buried under non-aggressive soil/ground water
SEVERE	• Concrete surfaces exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation • Concrete completely immersed in sea water • Concrete exposed to coastal environment
VERY SEVERE	• Concrete surfaces exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet. • Concrete in contact with or buried under aggressive subsoil/ ground water
EXTREME	• Surface of members in tidal zone, Members in direct contact with liquid/solid aggressive chemicals

ANNEXURE - A

List of drawings			
Sl. No.	**Drawing Description**	**Drawing Number**	**Sheet**
1	ARCHITECTURAL FLOOR PLANS FOR LABOUR HUT	C/ENGG/LABOUR HUT/01	Total 08 Sheets
2	DETAILS OF MAIN ENTRANCE GATE	C/ENGG/MAIN GATE/01, REV-0	01 SHEET
3	DETAILS OF PRE-FABRICATED RCC BOUNDRY WALL	C/ENGG/TBCB/PRE-FAB/01, REV-0	01 SHEET
4	ARCHITECTURAL DETAILS OF SECURITY ROOM	TB202318-1002026-SS3500-I- SECURITY HUT-ARC	01 SHEET
5	ARCHITECTURAL DETAILS OF SECURITY ROOM (SOAK PIT & SEPTIC TANK)	TB202318-1002026-SS3500-I-SECURITY HUT - SEP TANK	01 SHEET
6	STANDARD SWITCHYARD PANEL ROOM GA DETAIL OF PANEL ROOM	C/ENGG/STD/PR/2017	SHEET 1 TO 3



① GROUND FLOOR PLAN
1 : 100



② ROOF PLAN
1 : 100

NOTES:-

1. ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METERS, UNLESS STATED OTHERWISE.
2. ONLY WRITTEN DIMENSION SHALL BE FOLLOWED. DO NOT SCALE THE DRAWING.
3. FGL(±) 0.0 CORRESPONDS TO FINISHED GROUND LEVEL(F.G.L.)
4. ANY DISCREPANCIES SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECT PRIOR TO EXECUTION OF JOB/PROCURING MATERIALS AT SITE.
5. SIZE OF COLUMNS & BEAMS ARE JUST INDICATIVE.
6. DRAWING TO BE READ ON CONJUNCTION WITH TECHNICAL SPECIFICATION.
7. ALL FINISHES SHALL BE AS PER LABOUR HUT TS.

STRUCTURAL DETAILS:-

1. PRIMARY MEMBERS FABRICATED FROM PLATES AND SECTIONS WITH MINIMUM YIELD STRENGTH OF 340 MPA OR TO SUIT DESIGN BY CONTINUOUS DOUBLE SIDE WELDING.
2. SECONDARY MEMBERS FOR PURLINS AND GRITS SHALL CONFORM TO THE PHYSICAL SPECIFICATION OF ASTM A570 (GRADE 50) OR EQUIVALENT IS STANDARDS HAVING A MINIMUM YIELD STRENGTH OF 340 MPA AND SHALL BE OF PRE GALVANIZED HAVING A TOTAL COATING THICKNESS OF 275 GM/SQM INCLUSIVE OF BOTH SIDE. THE MINIMUM THICKNESS OF SECONDARY MEMBERS SHALL BE 2.5MM.
3. ROD ANGLE BRACING SHALL CONFORM TO THE PHYSICAL SPECIFICATION IS 2062 OF MINIMUM 245MPA YIELD STRENGTH.
4. ALL HOT ROLLED SECTIONS SHALL CONFORM TO THE PHYSICAL SPECIFICATIONS IS 2062. ALL OTHER MISCELLANEOUS SECONDARY MEMBERS SHALL HAVE MINIMUM YIELD STRENGTH OF 250 MPA.
5. THE CLADDING TO BE EQUALLY DIVIDED BETWEEN GRIDS TO MINIMIZE ODD SIZE PANELS BETWEEN COLUMNS.

LEGENDS -

FFL-FINISHED FLOOR LEVEL
F.G.L. - FINISHED GROUND LEVEL
W - WINDOW
D- DOOR
V-VENTILATOR

- RCC

- BRICK WALL

EXTERIOR WALL: PRE ENGINEERED GALVANIZED IRON 0.5MM THICK BOTH SIDE SANDWICH PANELS WITH 75MM THICK THERMOCOLE /GLASS WOOL INSULATION OF DENSITY 12 KG/M3, SHALL BE PAINTED WITH WEATHER PROOF TEXTURE PAINT FROM OUTSIDE AND INSIDE OIL BOND DISTEMPER.

INTERNAL WALL PARTITION: LIGHT GAUGE STEEL STRUCTURE USING 50MM GALVANISED SECTIONS BOTH VERTICALLY AND HORIZONTALLY AT A GAP OF 600MM. 8 MM CEMENT FIBRE BOARD CEMENT FIBRE BOARD BOTH SIDES AND 50MM GLASS WOOL INSULATION AND JOINTS CONCEALED WITH POLYMER BASED PUTTY AND EXTERIOR SIDE WEATHER PROOF PLASTIC PAINT EMULSION PAINT.

- ROOF PANEL
0.50MM THK GI TRAPEZOIDAL PROFILE SHEET WITH 8MM POLYNUM INSULATION (64 CUM /KG) SUPPORTED BY MS TRUSS.

FINISHES SCHEDULE FOR LABOUR HUT

SR.NO	LOCATION	WALL(INTERNAL)	CEILING	ROOFING
1	LABOUR HUT	OIL BOND DISTEMPER	8MM THICK PVC PROFILE SECTION WITH INTERLOCKING ARRANGEMENT HELD ON MS PIPE FRAMEWORK WITH GRID OF 1200 X 1200MM.	0.50MM THK GI TRAPEZOIDAL ROFILE SHEET WITH 8MM POLYNUM INSULATION (64 CUM /KG) SUPPORTED BY MS TRUSS.
2	BATH & WC	TILE DADO UPTO 2.1M HEIGHT ABOVE IT OIL BOUND DISTEMPER	8MM THICK PVC PROFILE SECTION WITH INTERLOCKING ARRANGEMENT HELD ON MS PIPE FRAMEWORK WITH GRID OF 1200 X 1200MM.	0.50MM THK GI TRAPEZOIDAL PROFILE SHEET WITH 8MM POLYNUM INSULATION (64 CUM /KG) SUPPORTED BY MS TRUSS.
3	PANTRY & SERVING AREA	OIL BOND DISTEMPER	8MM THICK PVC PROFILE SECTION WITH INTERLOCKING ARRANGEMENT HELD ON MS PIPE FRAMEWORK WITH GRID OF 1200 X 1200MM.	0.50MM THK GI TRAPEZOIDAL PROFILE SHEET WITH 8MM POLYNUM INSULATION (64 CUM /KG) SUPPORTED BY MS TRUSS.
4	CORRIDOR	OIL BOND DISTEMPER	8MM THICK PVC PROFILE SECTION WITH INTERLOCKING ARRANGEMENT HELD ON MS PIPE FRAMEWORK WITH GRID OF 1200 X 1200MM.	0.50MM THK GI TRAPEZOIDAL PROFILE SHEET WITH 8MM POLYNUM INSULATION (64 CUM /KG) SUPPORTED BY MS TRUSS.

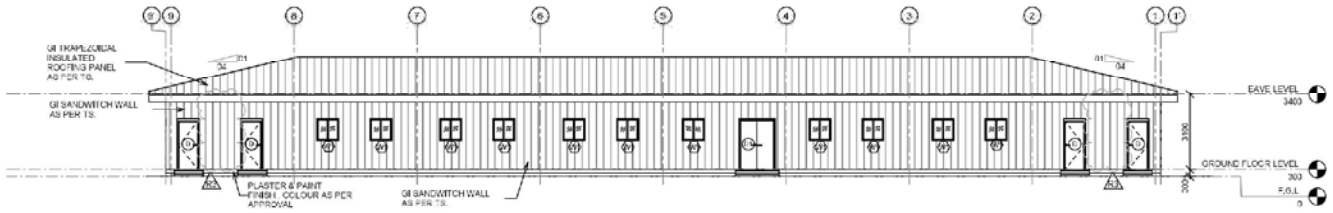
DOOR WINDOW SCHEDULE

TYPE	SIZE	SILL LVL.	LINTEL LVL.	DESCRIPTION	NOS.
D	900X2100	--	+2100MM FROM F.F.L	SINGLE SHUTTER WOODEN FLUSH DOOR	09
D1	1500X2100	--	+2100MM FROM F.F.L	DOUBLE SHUTTER WOODEN FLUSH DOOR	02
D2	750X2100	--	+2100MM FROM F.F.L	SINGLE SHUTTER WOODEN FLUSH DOOR	16
W1	900X900	+1200MM FROM F.F.L	+2100MM FROM F.F.L	MS TUBULAR FRAME WINDOW WITH CLEAR FLOAT GLASS	22
V	600X300	+1800MM FROM F.F.L	+2100MM FROM F.F.L	MS TUBULAR FRAME VENTILATOR WITH CLEAR FLOAT GLASS	12

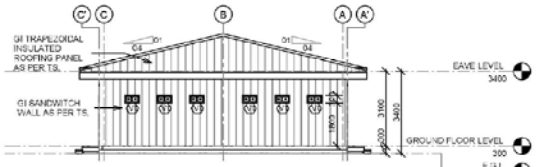
REV.	DESCRIPTION	PREP.	CHCKD.	APPD.	DATE
		SIGN.			

OWNER: POWER GRID CORPORATION OF INDIA LTD

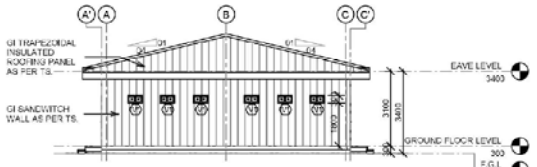
PROJECT	LABOUR HUT
SUBSTATION	
DRG. TITLE	ARCHITECTURAL FLOOR PLANS FOR LABOUR HUT
DRG. NO.	C/ENGG/LABOUR HUT/01
SCALE	1:100 · SHEET: 01 OF 02 · A1



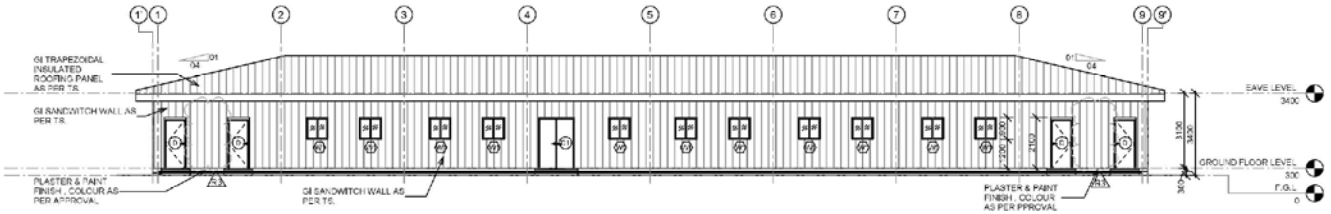
① ELEVATION-1
1 : 100



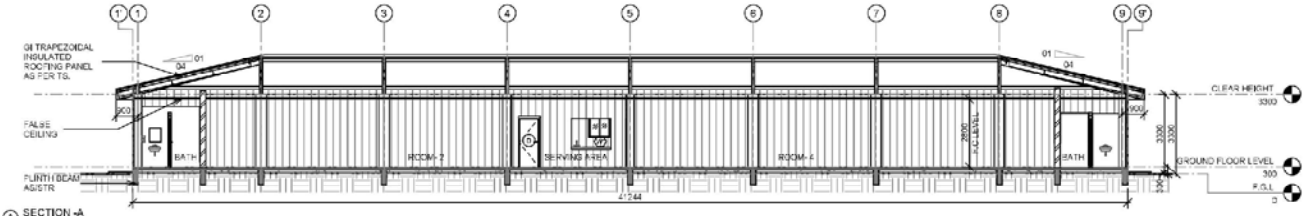
② ELEVATION-2
1 : 100



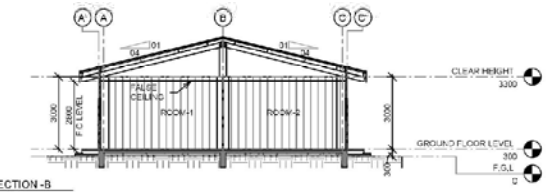
④ ELEVATION-4
1 : 100



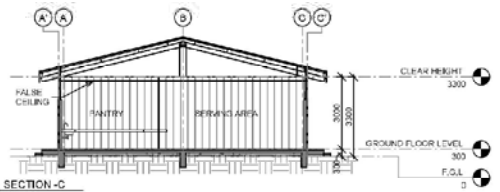
③ ELEVATION-3
1 : 100



Ⓐ SECTION -A
1 : 100



Ⓑ SECTION -B
1 : 100



Ⓒ SECTION -C
1 : 100

NOTES -

STRUCTURAL DETAILS -

LEGENDS -

FFL-FINISHED FLOOR LEVEL
F.G.L - FINISHED GROUND LEVEL
W - WINDOW
D- DOOR
V-VENTILATOR

- RCC
- BRICK WALL

EXTERIOR WALL: PRE ENGINEERED GALVANIZED IRON 0.5MM THICK BOTH SIDE SANDWICH PANELS WITH 175MM THICK THERMOCOLE GLASS WOOL INSULATION OF DENSITY 12 KG/M3. SHALL BE PAINTED WITH WEATHER PROOF TEXTURE PAINT FROM OUTSIDE AND INSIDE OIL BOND DISTEMPER.

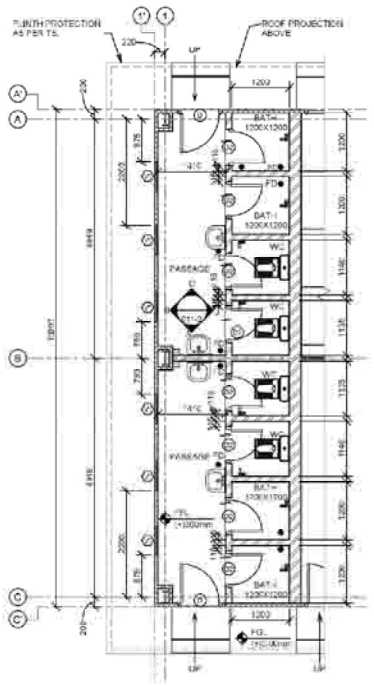
INTERNAL WALL: PARTITION LIGHT GAUGE STEEL STRUCTURE USING 50MM GA. VANISED SECTIONS BOTH VERTICALLY AND HORIZONTALLY AT A GAP OF 600M.M. 9 MM CEMENT FIBRE BOARD CEMENT FIBRE BOARD BOTH SIDES AND 50MM GLASS WOOL INSULATION AND JOINTS CONCEALED WITH POLYMER BASED PUTTY AND EXTERIOR SIDE WEATHER PROOF PLASTIC PAINT EMULSION PAINT.

- ROOF PANEL
0.5MM THK GI TRAPEZOIDAL PROFILE SHEET WITH 8MM POLYNUM INSULATION (64 GUM /KG) SUPPORTED BY M.S TRUSS.

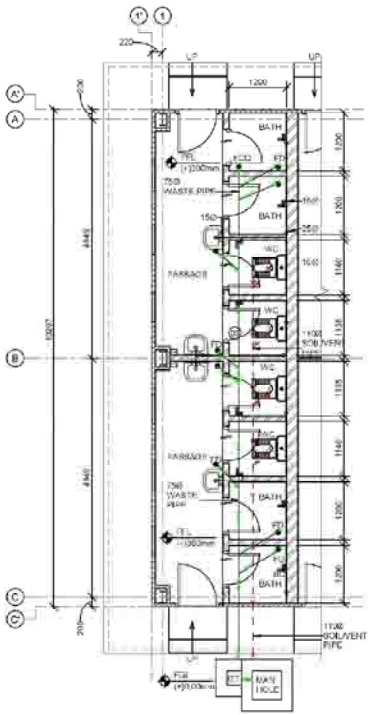
REV.	DESCRIPTION	PREP.	CHKD.	APPD.	DATE
		SIGN.			

OWNER : POWER GRID CORPERATION OF INDIA LTD

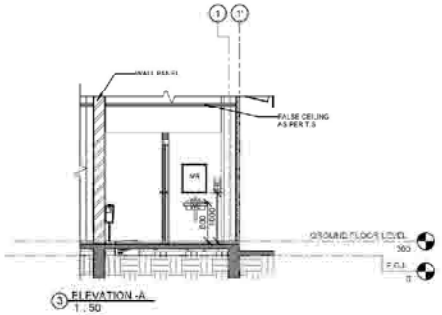
PROJECT	LABOUR HUT
SUBSTATION	
DRG. TITLE	ARCHITECTURAL ELEVATIONS AND SECTIONS FOR LABOUR HUT
DRG. NO.	C/ENGG/LABOUR HUT/01
SCALE	1:100
SHEET	02 OF 02
	A1



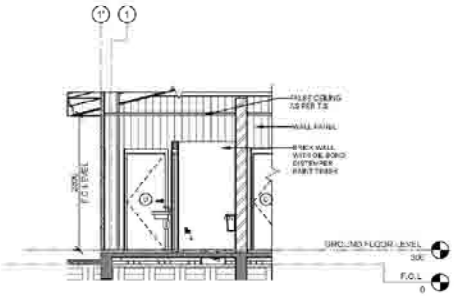
1 GROUND FLOOR TOILET - FIXTURE LAYOUT
1 : 50



2 GROUND FLOOR TOILET - PLUMBING LAYOUT
1 : 50



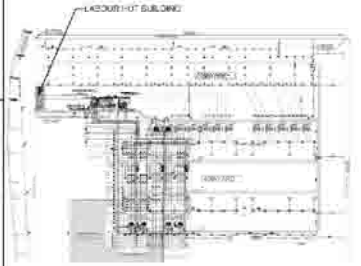
3 ELEVATION -A
1 : 50



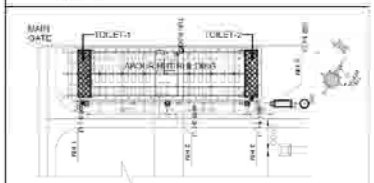
4 ELEVATION-C
1 : 50

GENERAL NOTES:-

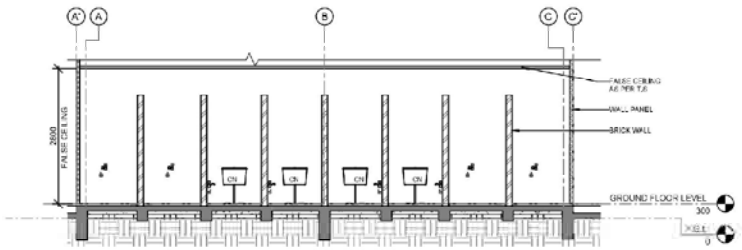
1. ALL DIMENSIONS & LEVEL ARE [illegible]
2. FGL ±0.00 SHALL CORRESPOND TO LEVEL [illegible] WHEREVER INDICATED.
3. SIZES OF COLUMNS ARE JUST INDICATIVE, SIZES SHALL BE AS PER STRUCTURAL DETAIL.
4. ALL LEVELS ARE TO BE VERIFIED BEFORE THE START OF CONSTRUCTION.
5. ALL ARCHITECTURAL FINISHES SHALL BE AS PER TS.
6. LOCATION/ORIENTATION/CO-ORDINATES OF THE BUILDING SHALL BE CROSS-CHECKED WITH STRUCTURAL/ CIVIL DRAWINGS. IN CASE OF ANY MIS-MATCH THE SAME SHALL BE RESOLVED BEFORE CONSTRUCTION.
7. REFERENCE SHALL BE MADE TO RELEVANT DRAWINGS BEFORE STARTING FLOORING.
   WORKS, TRENCH/SLOT CUTS IN FLOOR SHALL BE PROVIDED IN ACCORDANCE WITH RELEVANT ELECTRICAL/STRUCTURAL/PLUMBING DRAWINGS.
8. ALL TOILET AND PLUMBING FIXTURES SHALL BE AS PER TS. & BOQ.



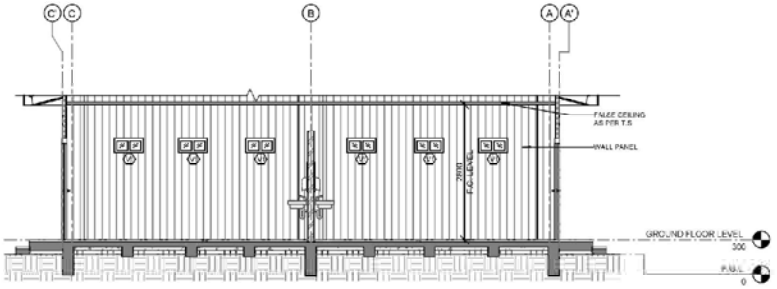
RE* PLAN - OVERALL
SCALE - NTS



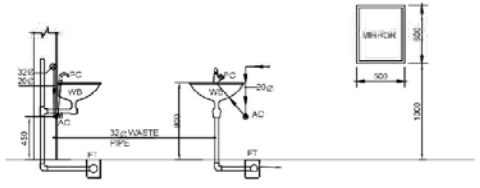
KEY PLAN- SEWRAGE LAYOUT
SCALE - NTS



5 ELEVATION- B
1 : 50



6 ELEVATION-D
1 : 50



FIXTURE LAYOUT
1 : 25

PIPE LEGENDS	
	75Ø WASTE PIPE
	110Ø SOIL PIPE
	WATER SUPPLY PIPE

* PVC PIPE FOR HOT & COLD WATER SUPPLY

PLUMBING LEGEND	
DIA METER OF WATER SUPPLY	
NOMINAL DIAMETER (in mm)	NOMINAL DIAMETER (in Inches)
15	1/2"
20	1"
40	1.5"

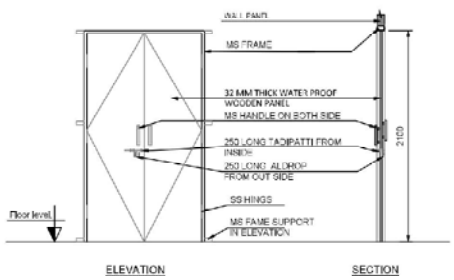
LEGENDS:-	
FFL = FINISHED FLOOR LEVEL	AC = ANGLE COCK
TOC = TOP OF CONCRETE	BC = BIB COCK
D = DOOR	HT = HEALTH FAUCET
V = VENTILATOR	PH = PAPER HOLDER
WC = WATER CLOSET	TC = TRUSH COCK
WB = WASH BASIN	PC = PILLAR COCK
FD = FLOOR DRAIN	SC = STOP COCK
FT = FLOOR TRAP	LS = LIQUID SOAP HOLDER
MR = MIRROR	B.T. = BOTTLE TRAP
FLOOR TILE DROP	C.N. = CISTERN

NOTE :-
* SPECIFICATIONS OF TOILET FIXTURES AND OTHER DETAILS SHALL BE AS PER TS. & BOQ.

REV.	DESCRIPTION	PREP.	CHKD.	APPD.	DATE
R0	ISSUED FOR APPROVAL				

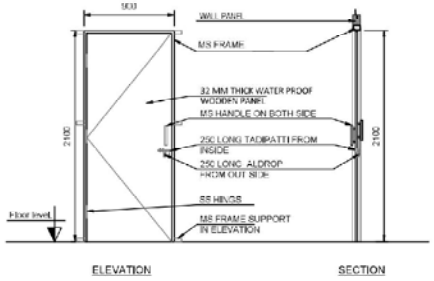
OWNER : POWER GRID CORPERATION OF INDIA LTD

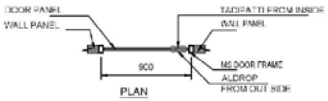
PROJECT	LABOUR HUT
SUBSTATION	
DRG. TITLE	ARCHITECTURAL TYPICAL TOILET DETAIL FOR LABOUR HUT BIKANER
DRG. NO.:	C/7/NGG/LABOUR HUT/01
SCALE	1 : 50
SHEET:	02 OF 02
	A1



PLAN

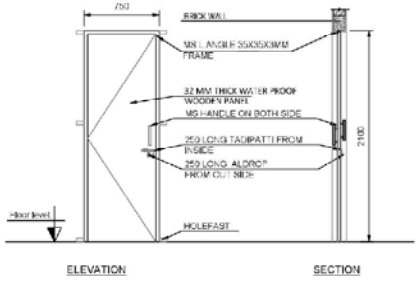
D1 : 1500x2100
MS TUBULAR FRAME WATER PROOF DOUBLE SHUTTER DOOR
G.F. - 02 NOS - 6.30 SQ MT

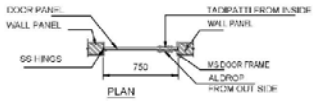




PLAN

D : 900X2100
LOCATION : TOILET , ROOMS & PANTRY
(MS TUBULER FRAME WATER PROOF SINGLE SHUTTER FLUSH DOOR)
G.F. - 09 NOS. - 17.01 SQ MT





PLAN

D2 : 750X2100
LOCATION: BATH, TOILET
MS L ANGLE FRAME SINGLE SHUTTER FLUSH DOOR)
G.F. - 12 NOS. - 19.9 SQ MT

NOTES

1. All dimensions & levels are in m m unless
2. All dimensions to be read, not scaled.
3. uPVC Doors,window ventilators shall
   openable / partially fixed or fixed type
   (casement / sliding), ventilators, fixed
   pre-fab structure, door, etc.
4. The
5. For location of doors, windows etc. refer
6. The sections of frame is indicative, site to modify the
   sizes of the frame as per site requirement.

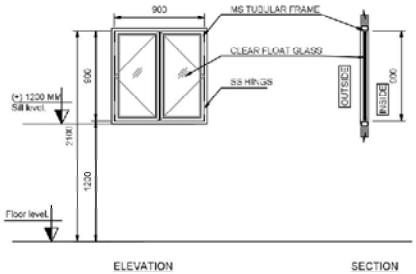
LEGEND

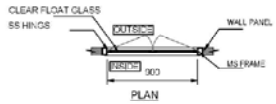
FGL - FINISH GROUND LEVEL.
FFL - FINISH FLOOR LEVEL.
D - DOOR
W - WINDOW
V- VENTILATOR

230mm THK BRICK WALL
R.C.C.
WALL PANEL

BUILDING SPECIFICATIONS

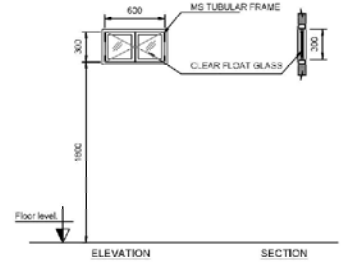
BUILDING SPECIFICATIONS SHALL BE AS PER I.S
PRE-FAB STRUCTURE LABOUR HUT

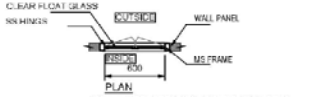




PLAN

W1 : 900x900 LOCATION : ROOMS
(MS TUBULAR FRAME OPENABLE WINDOW WITH CLEAR FLOAT GLASS.)
G.F.- 22 NOS - 17.82 SQ MT





PLAN

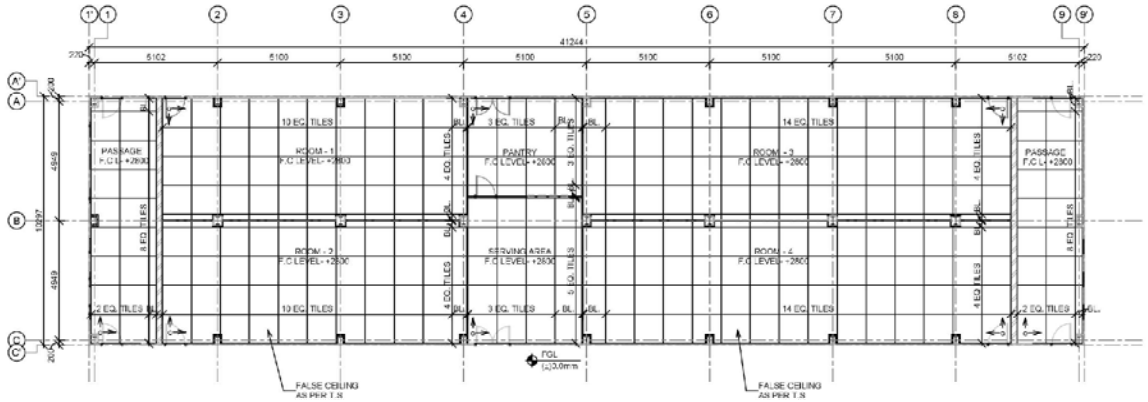
V1 : 600x300 LOCATION : TOILET, BATH AREA
MS TUBULAR FRAME VENTILATOR WITH 5.5mm THICK GLAZING.
G.F. - 12 NOS. - 2.16 SQ MT

DOOR WINDOW SCHEDULE

TYPE	SIZES	SILL LVL.	LINTEL LVL.	DESCRIPTION	NOS.
D	900 X 2100	-	2100	MS TUBULAR FRAME 32 MM THICK WATER PROOF WOODEN SINGLE SHUTTER FLUSH DOOR WITH SS HINGS	09
D1	1500 X 2100	-	2100	MS TUBULAR FRAME 32 MM THICK WATER PROOF WOODEN DOUBLE SHUTTER FLUSH DOOR WITH SS HINGS	02
D2	750 X 2100	-	2100	MS L ANGLE FRAME 32 MM THICK WATER PROOF WOODEN SINGLE SHUTTER FLUSH DOOR WITH SS HINGS	19
W1	900 X 900	1200	2100	MS TUBULAR FRAME WINDOW WITH CLEAR FLOAT GLASS	22
V1	600 X 600	1800	2100	MS TUBULAR FRAME VENTILATOR WITH CLEAR FLOAT GLASS	12

REV.	DESCRIPTION	PREP.	CHEKD.	APPD.	DATE
			CIGN.		

OWNER	POWER GRID CORPERATION OF INDIA LTD
PROJECT	LABOUR HUT
SUBSTATION	
DRG. TITLE	DOOR WINDOW DETAILS FOR LABOUR HUT
DRG. NO.	C/ENGG/LABOUR HUT/01
SCALE:	1 : 25
SHEET:	01 OF 01
	A1

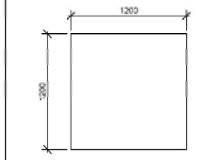


1 FALSE CEILING PLAN
1 : 100

GENERAL NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN MM UNLESS
2. DO NOT SCALE THE DRAWING, ONLY WRITTEN DIMENSIONS SHALL BE
3. ALL MEASUREMENTS MUST BE CHECKED IN SITE BY CONTRACTOR
BEFORE EXECUTION
4. REFER LIGHTING LAYOUT AND AS SUCH LAYOUT FOR LIGHTING FIXTURES RELEVANT DETAILS.
5. CEILING STRIPS SHALL BE CUT ACCORDINGLY FOR FIXING THE FIXTURES / FITTINGS.
6. REFER TENDER TECHNICAL SPECIFICATION FOR FALSE CEILING.
7. SUPPLY AIR DIFFUSER SIZE SHALL BE AS PER HVAC LAYOUT.
8. IN CASE OF ANY CONFLICT WITH TENDER PACKAGE, THE SAME SHALL BE GOT RESOLVED BEFORE PROCUREMENT AND EXECUTION.
9. ALL THE CONSTRUCTIONAL WORKS SHALL BE SUBJECT TO APPROVAL OF THE OWNER.
10. AS CONSIDERING CONVENIENT WORK FLOW FALSE CEILING WORK SHOULD BE DONE AFTER COMPLETION OF ELECTRICAL WORK.
11. F.C.L LEVELS FOR RESPECTIVE FLOORS SHALL BE MEASURED FROM THE F.F.L OF THE RESPECTIVE FLOOR

LEGENDS
E.Q. = EQUAL
F.F.L = FINISHED FLOOR LEVEL
F.C.L = FALSE CEILING LEVEL
B.L. = BALANCE



TILE SHEET- 1200mm X 1200mm

AREAS /ROOMS PROVIDED WITH FALSE CEILING SHOWN THUS
START POINT

FALSE CEILING SCHEDULE

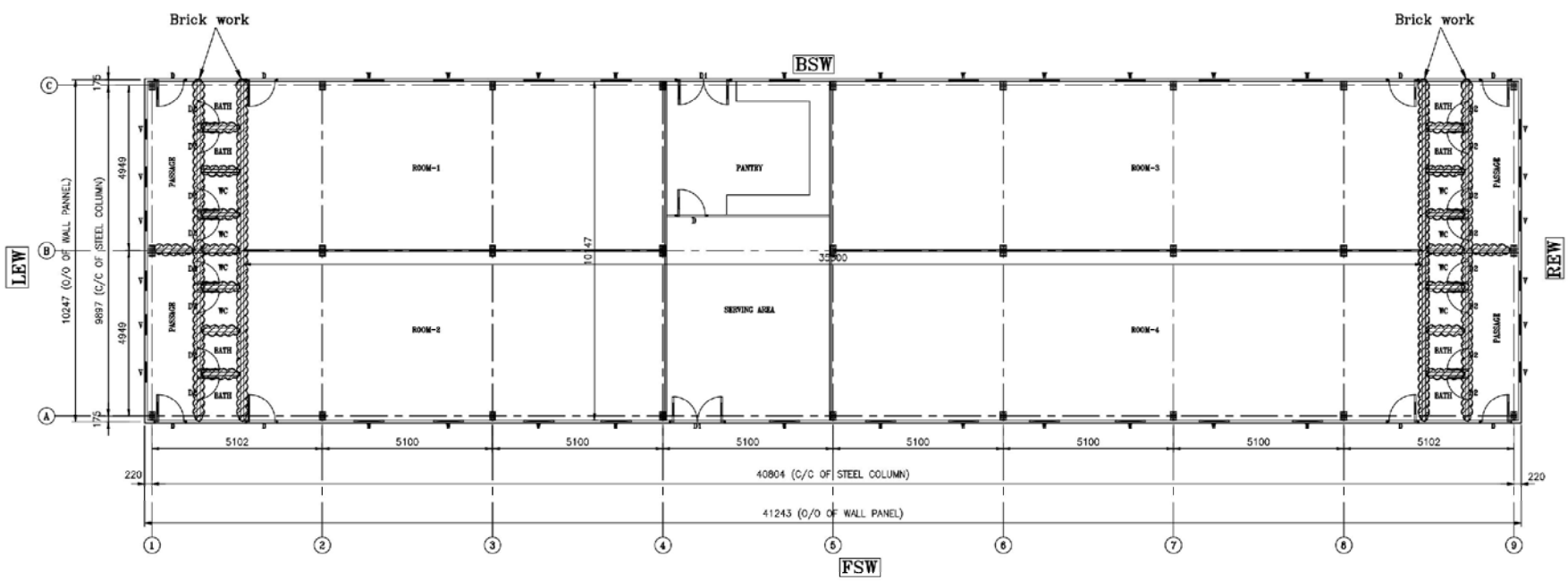
S.NO.	LOCATION	FALSE CEILING LEVEL	FALSE CEILING MATERIAL
	GROUND FLOOR		
1.	LABOUR HUT	2800	8MM THICK PVC PROFILE SECTION WITH INTERLOCKING ARRANGEMENT HELD ON MS PIPE FRAMEWORK WITH GRID OF 1200 X 1200MM.
2.	PANTRY	2800	
3.	SERVING AREA	2800	
4.	CORRIDOR	2800	
5.	BATH AND WC	2800	

REV.	DESCRIPTION	PREP.	CHKD.	APPD.	DATE
R0	ISSUED FOR APPROVAL	TS	SM	SM	14-09-2022
		SIGN.			

OWNER : POWERGRID CORPORATION OF INDIA LTD

PROJECT	LABOUR HUT
SUBSTATION	
DRG. TITLE	ARCHITECTURAL FALSE CEILING PLAN FOR LABOUR HUT
DRG. NO.:	C/ENGG/LABOUR HUT/01
SCALE	1:100
SHEET:	01 OF 01
	A1

REV-00



LAYOUT PLAN

NOTE:- ALL TOILET PARTITION WALL IN BRICK WORK AND OTHER PARTITION WALL 50mm LGSF SECTION 8mm thk cement board fixed on both sides of wall infill 50mm glasswool insulation

DOOR-D	900X2100	9 NOS.
DOOR-D1	1500X2100	2 NOS.
DOOR-D2	7500X2100	16 NOS.
WINDOW-W1	900X900	22 NOS.
VENTILATOR-V	600X300	12 NOS.

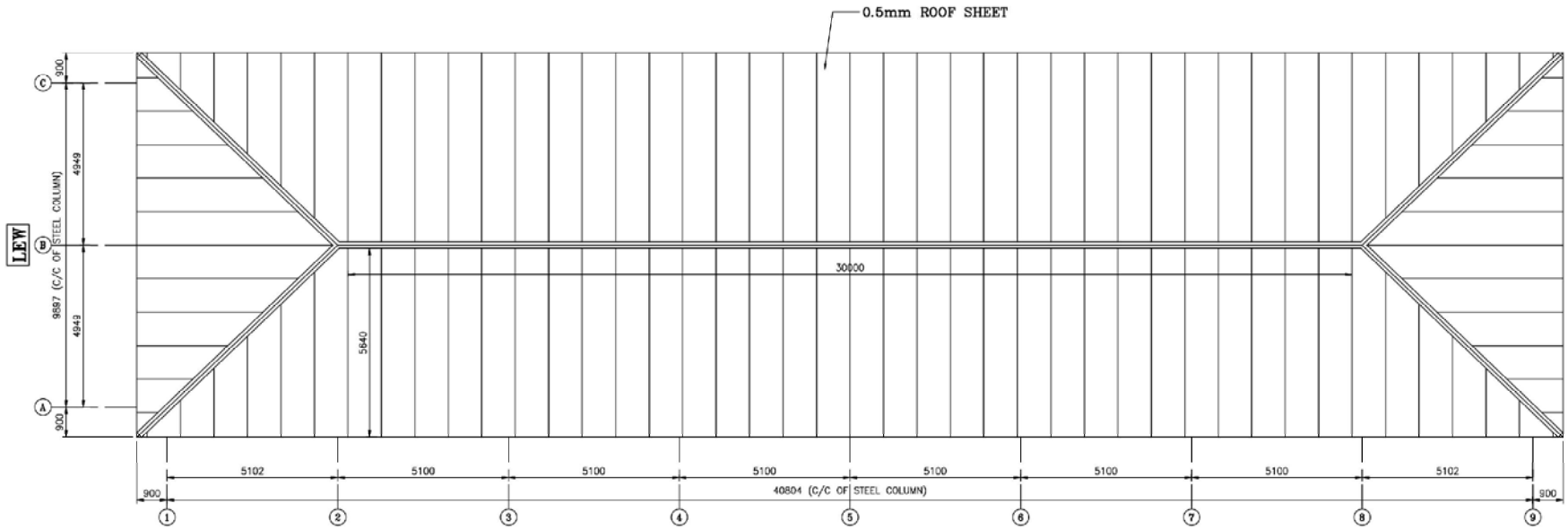
NOTE:-
ALL MATERIALS AND FINISHING SHALL BE AS PER TS

NOTES FOR STRUCTURAL STEEL WORK:-

1 DESIGN, FABRICATION & ERECTION OF STEEL STRUCTURES SHALL CONFORM TO IS 800 & ROLLED SECTION SHALL BE CONFORMING IS 808.
2 ALL WELDING SHALL BE CONFORMING TO IS 816.
3 TOLERANCE FOR VARIOUS STRUCTURAL STEEL FABRICATION SHALL BE AS PER IS 7215.
4 ALL WELDING SHALL BE DONE WITH ELECTRODES CONFORMING TO IS 814.
5 R.H.S SECTION SHALL CONFORM TO IS:4923-1997 & HOLLOW STEEL TUBE SHALE CONFORM TO IS:1161-1998.
6 GRADE OF STEEL SHALL BE 250 MPa FOR HOLLOW SECTION AND HOTROLLED SECTIONS
7 GRADE OF COLDFORMED STEEL SECTONS SHALL BE 250 MPa.
8 CONNECTION BOLTS SHALL BE HOT DIPPED GALVANIZED,HIGH STRENGTH 8.8 GRADE BOLTS CONFIRMING TO IS 4000-1992.

OWNER	Power Grid Corporation of india limited
PROJECT NAME	Prefab shelter for Labour Hut
DRAWING TITLE	LAYOUT PLAN
MT-20-07-900-001	
DRAWN :	CHECKED : SCALE : AS SHOWN
APPROVED :	REVIEWED :- DATE :
DRAWING NO. C/ENGG/LABOUR HUT/01	SHEET 02 OF 08 REV. 01

REV-00



FSW

ROOF PLAN

NOTE:- 0.5mm thk GI Trapezoidal profile sheet with 8 mm polynum insulation(64kg/cum)

NOTE:-
ALL MATERIALS AND FINISHING SHALL BE AS PER TS

NOTES FOR STRUCTURAL STEEL WORK:-

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2 ALL WELDING SHALL BE CONFORMING TO IS 816.
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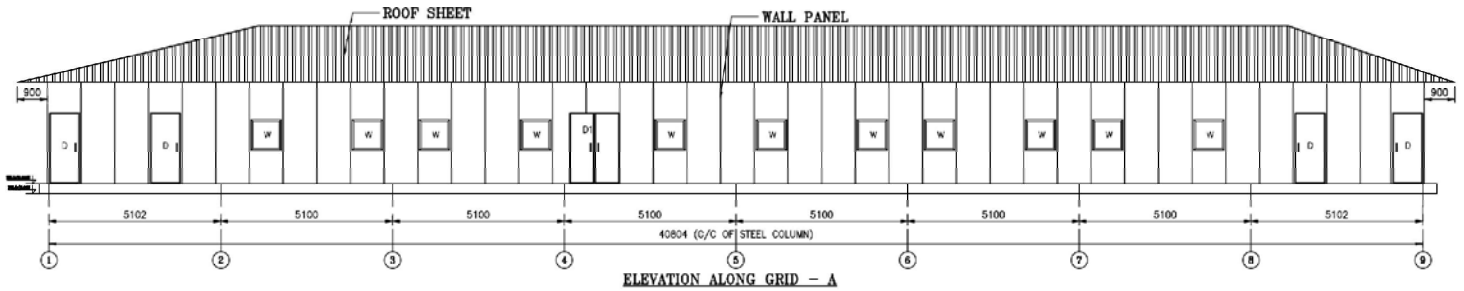
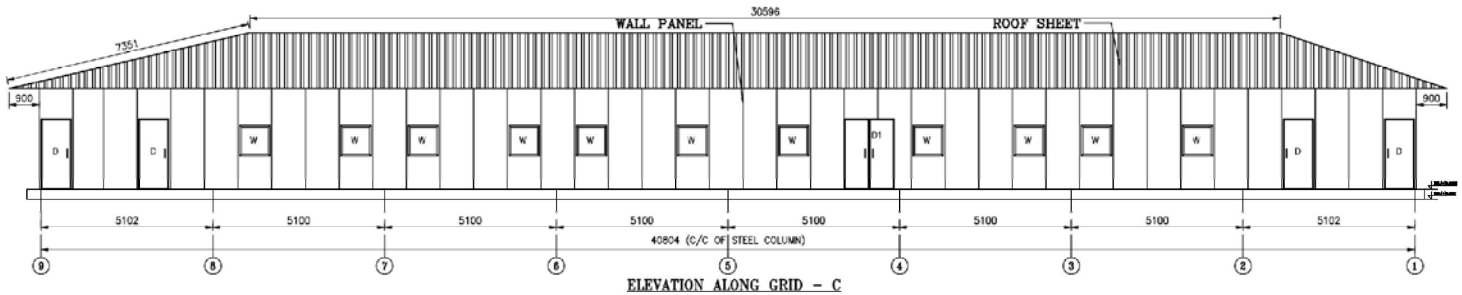
OWNER	Power Grid Corporation of india limited
PROJECT NAME	Prefab shelter for Labour Hut at Bikaner for 400ks SS New Substation
DRAWING TITLE	ROOF PLAN
NT-20-07-900-001	
DRAWN :	CHECKED :. SCALE : AS SHOWN
APPROVED :	REVIEWED :- DATE :
DRAWING NO. C/ENGG/LABOUR HUT/01	SHEET 05 OF 08 REV. 01

METHOD OF PROJECTION

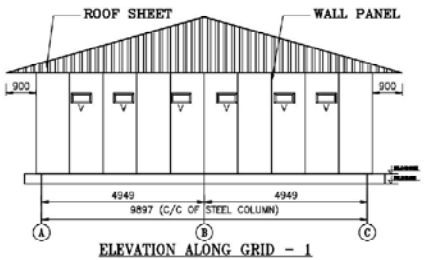
REV-00



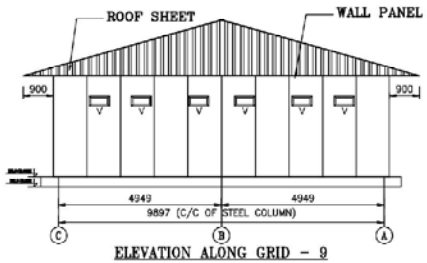
ELEVATION ALONG GRID – A



ELEVATION ALONG GRID – C



ELEVATION ALONG GRID – 1



ELEVATION ALONG GRID – 9

NOTES FOR STRUCTURAL STEEL WORK:–

1 DESIGN, FABRICATION & ERECTION OF STEEL STRUCTURES SHALL CONFORM TO IS 800 & ROLLED SECTION SHALL BE CONFORMING IS 808.
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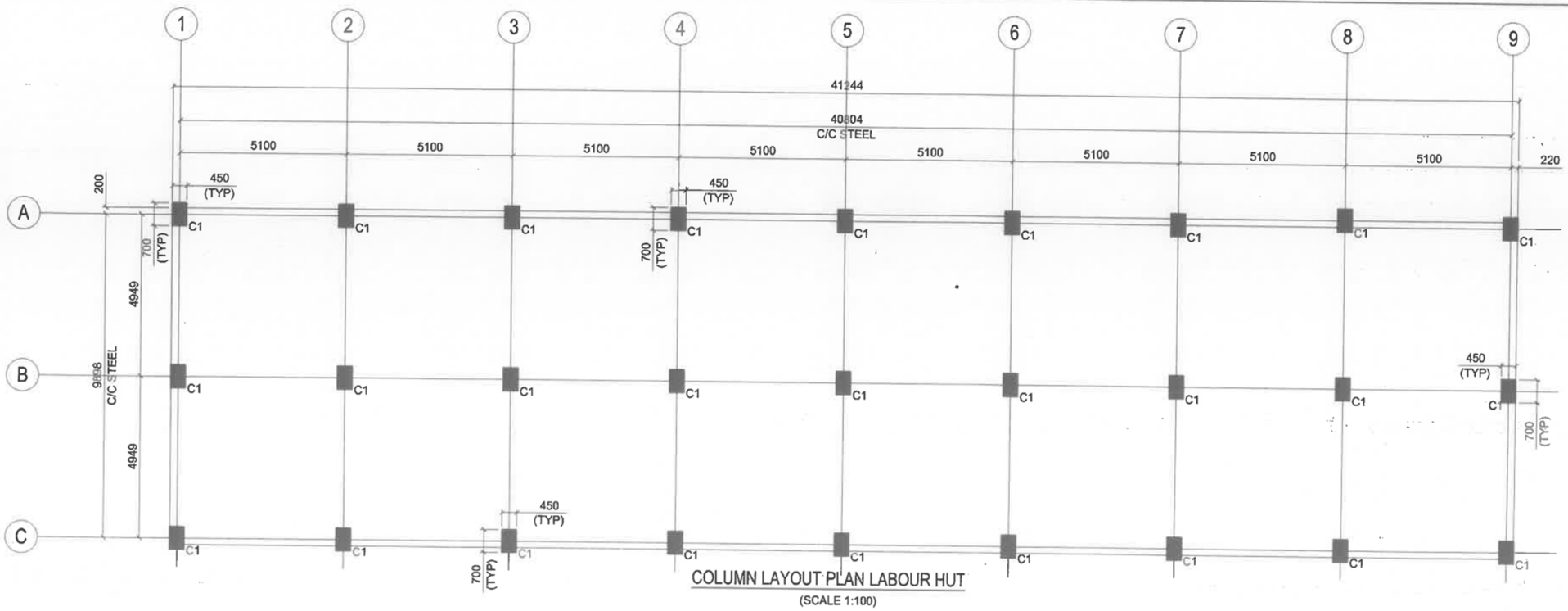
7 GRADE OF COLDFORMED STEEL SECTONS SHALL BE 250 MPa.
8 CONNECTION BOLTS SHALL BE HOT DIPPED GALVANIZED/HIGH STRENGTH 8.8 GRADE BOLTS CONFIRMING TO IS 4000–1992.

NOTE:–
ALL MATERIALS AND FINISHING SHALL BE AS PER TS

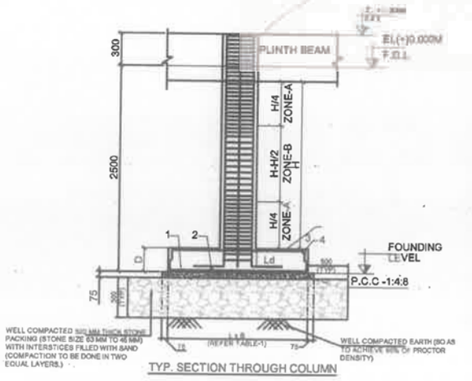
NOTE:– 0.5mm G.I sheet panel with 75mm Thk thermocole /Glasswool insulation 12kg/m3 shall be painted with weather proof texture paint outside and oil bond distemper inside

OWNER	Power Grid Corporation of india limited		
PROJECT NAME	Prefab shelter for Labour Hut at Bikaner for 400ks SS New Substation		
DRAWING TITLE	ELEVATIONS		
DRAWN :	CHECKED :	SCALE : AS SHOWN	METHOD OF PROJECTION
APPROVED :	REVIEWED :–	DATE :	
DRAWING NO. C/ENGG/LABOUR HUT/01		SHEET 08 OF 08	REV. 01

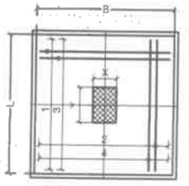


COLUMN LAYOUT PLAN LABOUR HUT

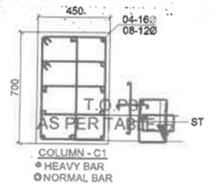
(SCALE 1:100)



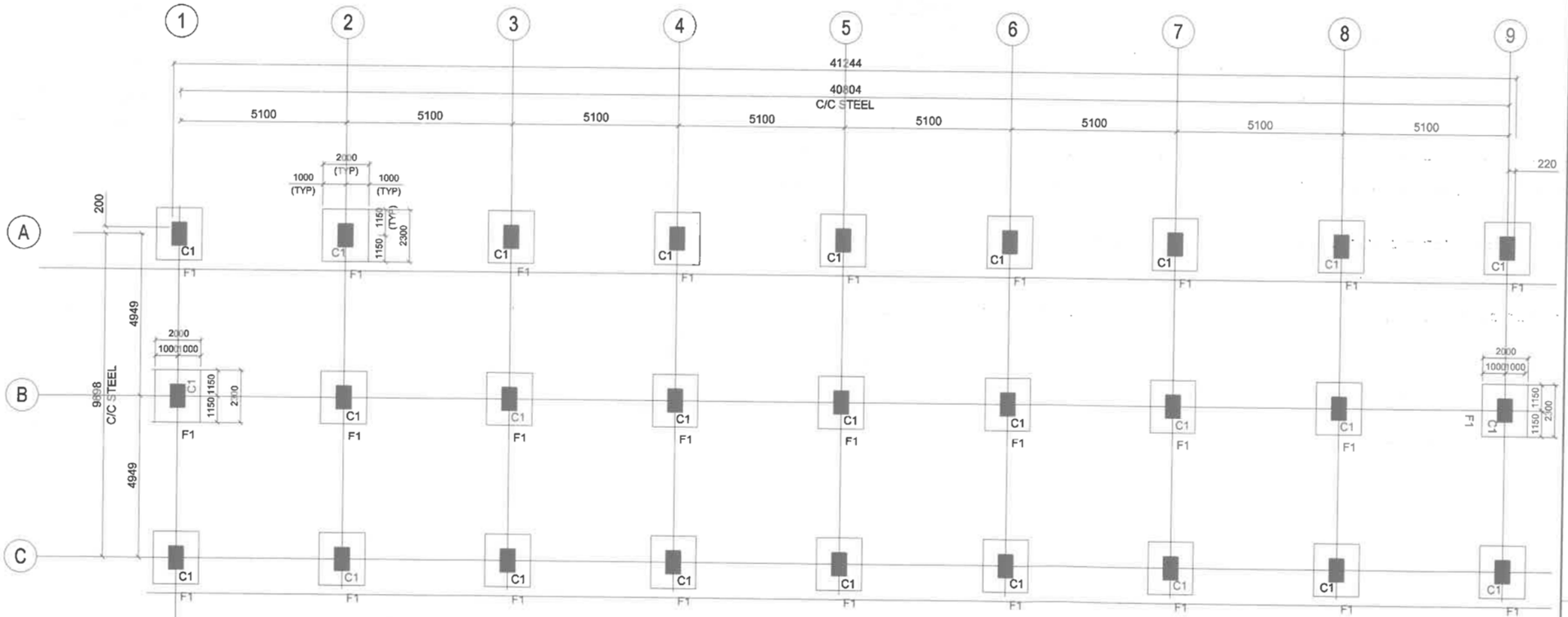
TYP. SECTION THROUGH COLUMN



TYPICAL FOUNDATION PLAN FOR F1,



COLUMN - C1
* HEAVY BAR
O NORMAL BAR



FOUNDATION LAYOUT PLAN LABOUR HUT

(SCALE 1:100)

NOTES:-

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METRES.
2. FIGURED DIMENSIONS ONLY SHALL BE FOLLOWED.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION THE RELEVANT ARCH. DRG.
4. ALL R.C.C. SHALL BE OF GRADE M30
5. ALL REINF. BARS SHALL BE CRS BARS OF MIN. Fe 500(AS PER BPS) CONFORMING TO IS:1786 AND TECHNICAL SPECIFICATIONS..
6. CLEAR COVER TO REINF. INCLUDING LINKS FOR R.C.C. MEMBERS SHALL BE AS UNDER:- COLUMN=40mm, FOOTING=50mm, BEAM=25mm, SLAB=20mm
7. STANDARD 'L' HOOKS SHALL BE PROVIDED AT THE ENDS OF ALL BARS.
8. PROVIDED LAP LENTH/DEVELOPMENT LENGTH 'Ld' FOR BOTHCOMPRESSION AND TENSION MAIN R/F BAR SHALL BE=50XDIA OF BAR.
9. LAPS SHALL BE STAGGERED AND AVOIDED AT THE SECTIONS OF MAX. BENDING MOMENT
10. 02 (TWO) COAT OF BITUMINOUS PAINTING OF 0.55KG/SQMPER COAT, TOTAL PAINTING OF 1.10 KG/SQM,SHALL BE APPLIED ON THE FACESOF THE FOUNDATIONS (i.e. COLUMN BASE & FOOTING)
11. FOUNDATION MUST REST MINIMUM 500MM BELOW NGL

TABLE 01-SCHEDULE OF COLUMN & REINFORCEMENT:-

SI.NO.	PED. TYPE.	NO. OF COL.	COLUMN TERMINATION LEVEL	COLUMN SIZE X	COLUMN SIZE Y	LONGITUDINAL REINFORCEMENT DETAILS	SPECIAL CONFINING STIRRUPS - ST (ZONE-A)	NORMAL CONFINING STIRRUPS - ST (ZONE-B)
1	C1	27	EL.(+) 0.300M	700	450	04 - 16 Ø 08 - 12 Ø	8 Ø @ 100	8 Ø @ 150

TABLE 02-SCHEDULE OF FOUNDATION & REINFORCEMENT:-

SI.NO	FOOTING MARKED	NO. OF FOOTING	SIZE L	SIZE B	SIZE D	BOTTOM REINFORCEMENT 1	BOTTOM REINFORCEMENT 2	TOP REINFORCEMENT 3	TOP REINFORCEMENT 4
1	F1	27	2300	2000	350	Ø12@150C/C	Ø12@150C/C	Ø12@150C/C	Ø10@150C/C

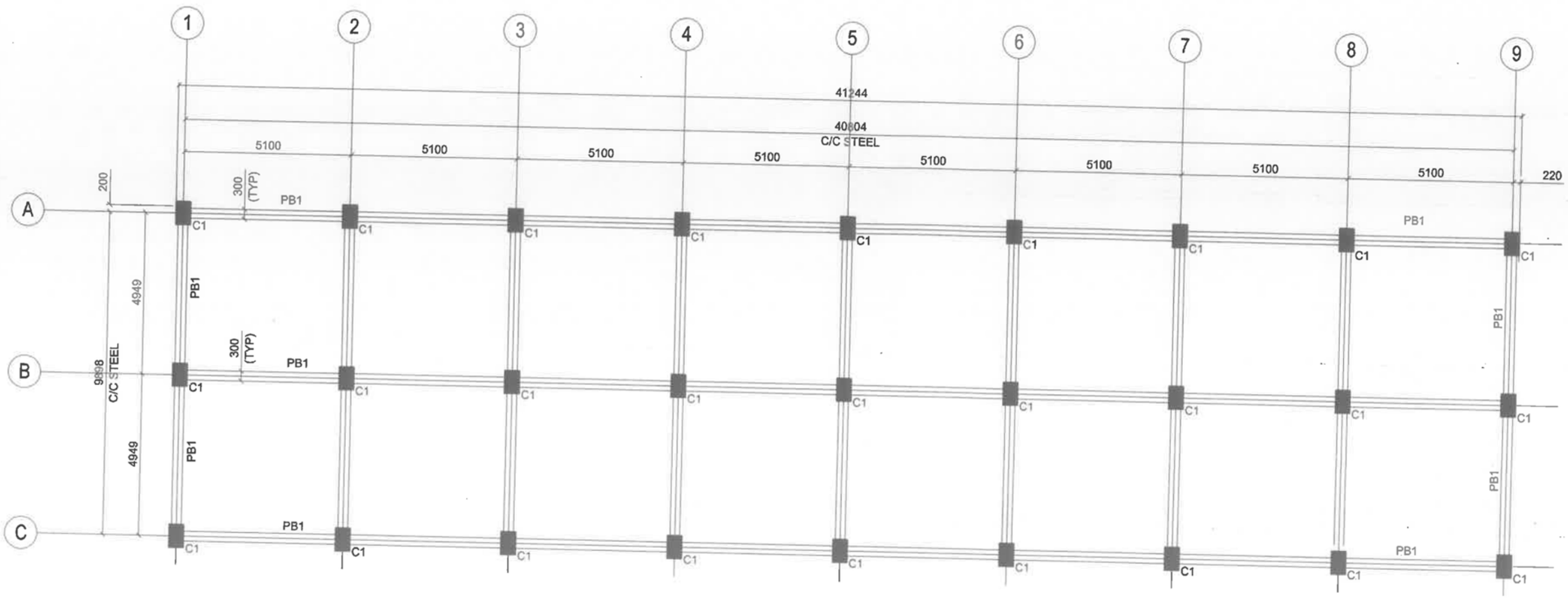
REVD	REVD	APVD	DATE
			16.05.2025

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

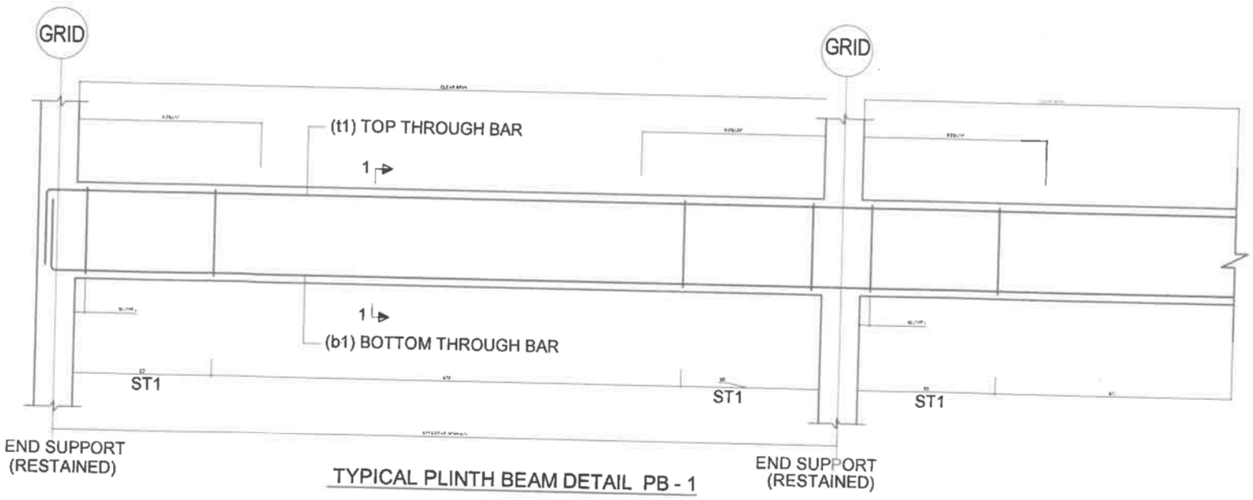
PROJECT : SUB-STATION PACKAGE SS15T, 765 KV VATAMAN SUB-STATION NEW

TITLE : COLUMN & FOUNDATION DETAILS OF LABOUR HUT BUILDING FOR 765KV VATAMAN(NEW) SUB-STATION

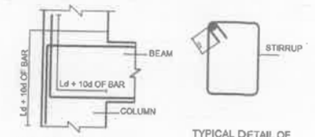
DRAWING NO.		SCALE	REV
	LABOUR HUT-FDN-DRG-VATAMAN (SH. 1 OF 2)	NTS	0



PLINTH BEAM LAYOUT PLAN
SCALE 1:100



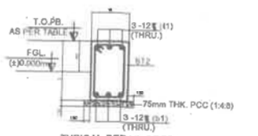
TYPICAL PLINTH BEAM DETAIL PB - 1



ANCHORAGE OF BEAM BARS AT THE END COLUMNS

TYPICAL DETAIL OF BEAM STIRRUP BENDING (d = DIA OF BAR)

TYPICAL DETAIL OF STIRRUP WITH 135° HOOK



TYPICAL DETAIL OF PB1 SECTION 1-1

SCHEDULE OF PLINTH BEAM

BEAM MARKED	SIZE		REINFORCEMENT (ϕ)		STIRRUPS (ϕ) 2 LEGGED			LEVEL (T.O.PB.)	SIDE FACE REIN. ON EACH SIDE
	W	D	BOTTOM R/F. (b1) THRU.	TOP R/F (t1) THRU.		ST1	ST2		
PB1	300	450	3-12ϕ	3-12ϕ	2L	8ϕ @ 100 C/C	8ϕ @ 150 C/C	(+) 0.300M	–

NOTES:-

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METRES.
2. FIGURED DIMENSIONS ONLY SHALL BE FOLLOWED.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION THE RELEVANT ARCH. DRG.
4. ALL R.C.C. SHALL BE OF GRADE M30
5. ALL REINF. BARS SHALL BE CRS BARS OF MIN. fe 500(AS PER BPS) CONFORMING TO IS:1786 AND TECHNICAL SPECIFICATIONS..
6. CLEAR COVER TO REINF. INCLUDING LINKS FOR R.C.C MEMBERS SHALL BE AS UNDER:- COLUMN=40mm, FOOTING=50mm, BEAM=25mm, SLAB=20mm
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9. LAPS SHALL BE STAGGERED AND AVOIDED AT THE SECTIONS OF MAX. BENDING MOMENT
10. 02 (TWO) COAT OF BITUMINOUS PAINTING OF 0.55KG/SQMPER COAT, TOTAL PAINTING OF 1.10 KG/SQM,SHALL BE APPLIED ON THE FACESOF THE FOUNDATIONS (i.e. COLUMN BASE & FOOTING)
11. FOUNDATION MUST REST MINIMUM 500MM BELOW NGL

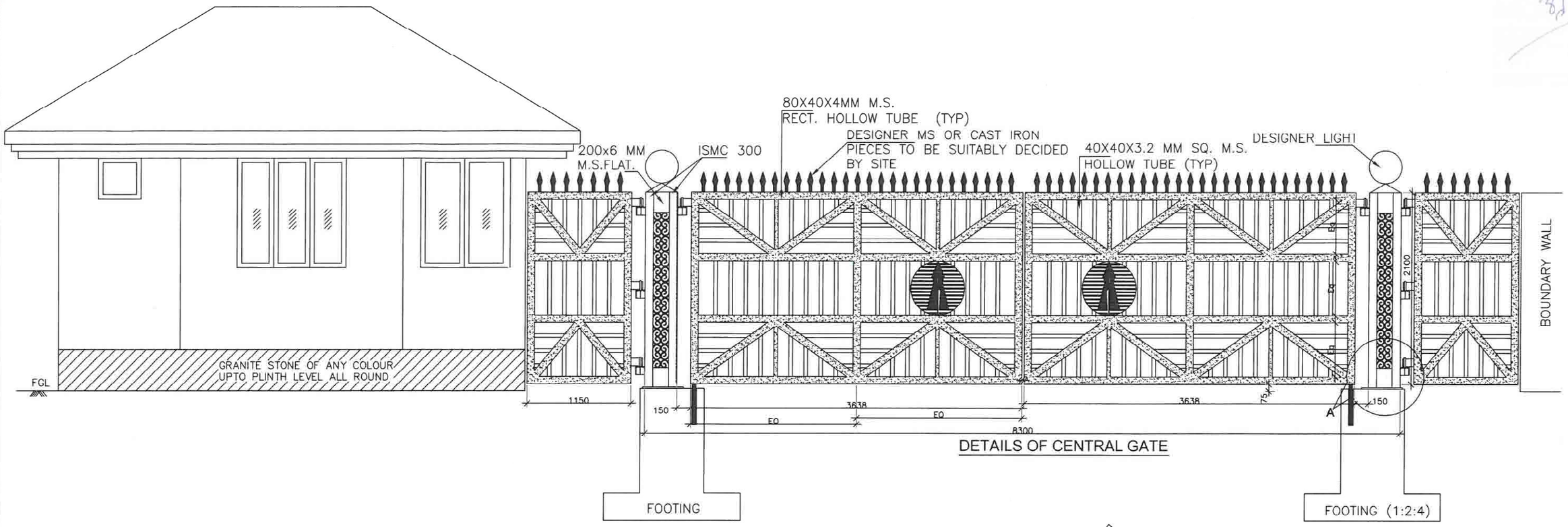
			16.05.2025
REVD	REVD	APVD	DATE

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

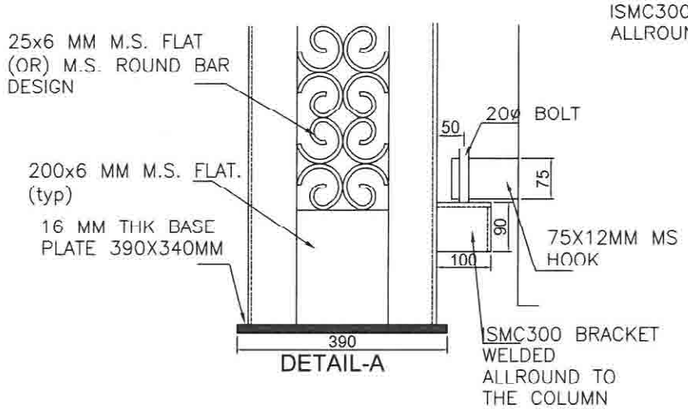
PROJECT : SUB-STATION PACKAGE SS15T, 765 KV VATAMAN SUB-STATION NEW

TITLE : PLINTH BEAM DETAILS OF LANOUR HUT BUILDING FOR 765KV VATAMAN(NEW) SUB-STATION

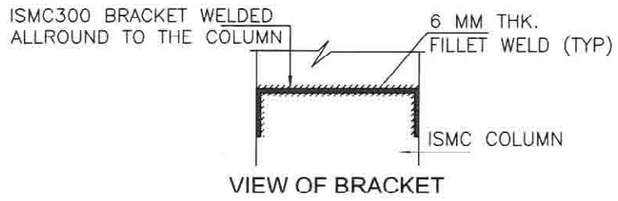
DRAWING NO. LABOUR HUT-P.BEAM-DRW-VATAMAN SCALE REV



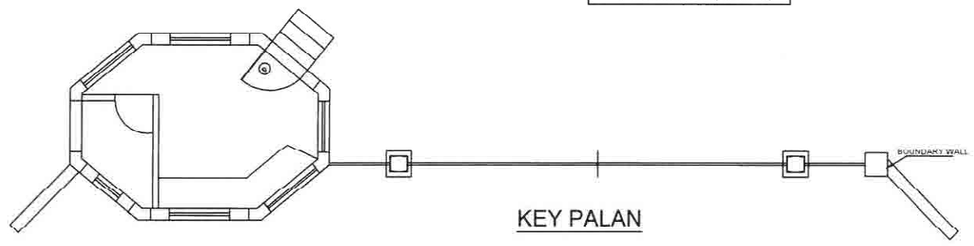
DETAILS OF CENTRAL GATE



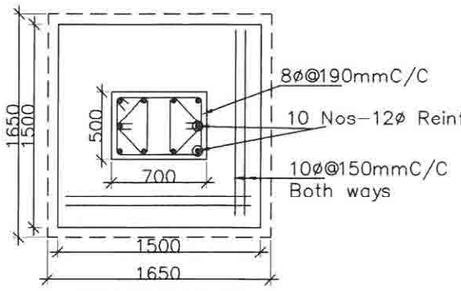
DETAIL-A



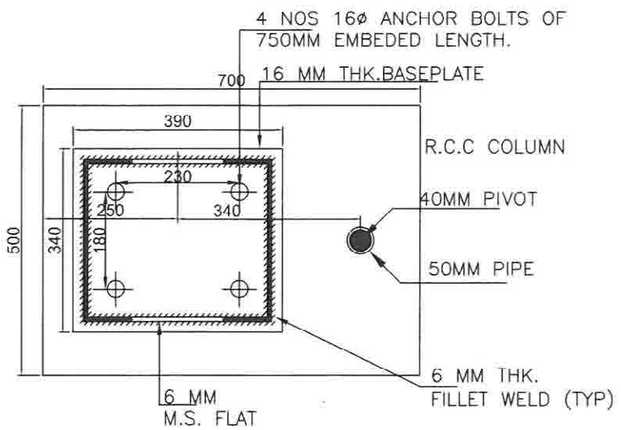
VIEW OF BRACKET



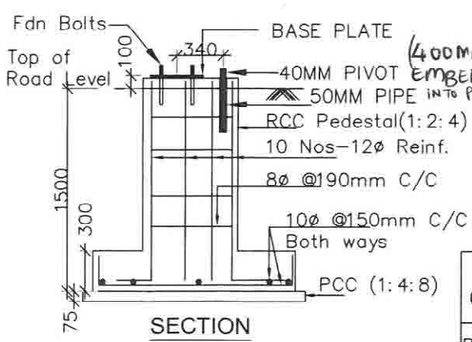
KEY PALAN



FOOTING PLAN



BASE PLATE & FDN BOLT DETAILS



SECTION

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS ONLY.
3. THE DRAWING SHALL BE READ TOGETHER IN CONJUNCTION WTIH OTHER RELEVANT STRUCTURAL, ARCHITECURAL, SERVICE DRAWINGS AND SPECIFICATIONS.
4. ANY DISCREPANCY IN DRAWING TO BE BROUGHT TO THE NOTICE SITE INCHARGE/STRUCTURAL CONSULTANT PRIOR TO EXECUTION
5. ALL WELDS ARE 6 MM CONTINUOUS FILLET WELDS UNLESS NOTED OTHER WISE.
6. WELDING SHALL CONFORM TO IS 816 -1969.
7. ALL ELECTRODES SHALL CONFORM TO IS 814 (PART -1)-1974. ALL ELECTRODES SHALL CONFORM TO IS 814 (PART -1)-1974.
8. ALL FABRICATION, HANDLING AND ERECTION TO BE STRICTLY AS PER IS 800-1984.
9. ALL STRUCTURAL STEEL AND PLATES SHALL CONFORM TO INDIAN STANDARDS
10. ALL STRUCTRAL MEMBERS, AFTER FABRICATION SHALL BE PAINTED WITH STEEL PRIMING COAT AS PER CPWD SPECIFICATIONS.
11. CONCRETE GRADE SHALL BE 1:2:4 UNLESS NOTED OTHERWISE
12. ALL REINFORCEMENT SHALL BE OF GRADE Fe-500 CONFIRMS TO IS:1786 OR TMT BARS OF EQUIVALENT GRADE
13. MINIMUM CLEAR COVER TO THE REINFORCEMENT SHALL BE AS PER LATEST IS:456.
14. ALL STRUCTURAL MEMBERS SHALL BE PAINTED WITH ENAMEL PAINT.

RELEASED FOR TENDER/CONSTRUCTION

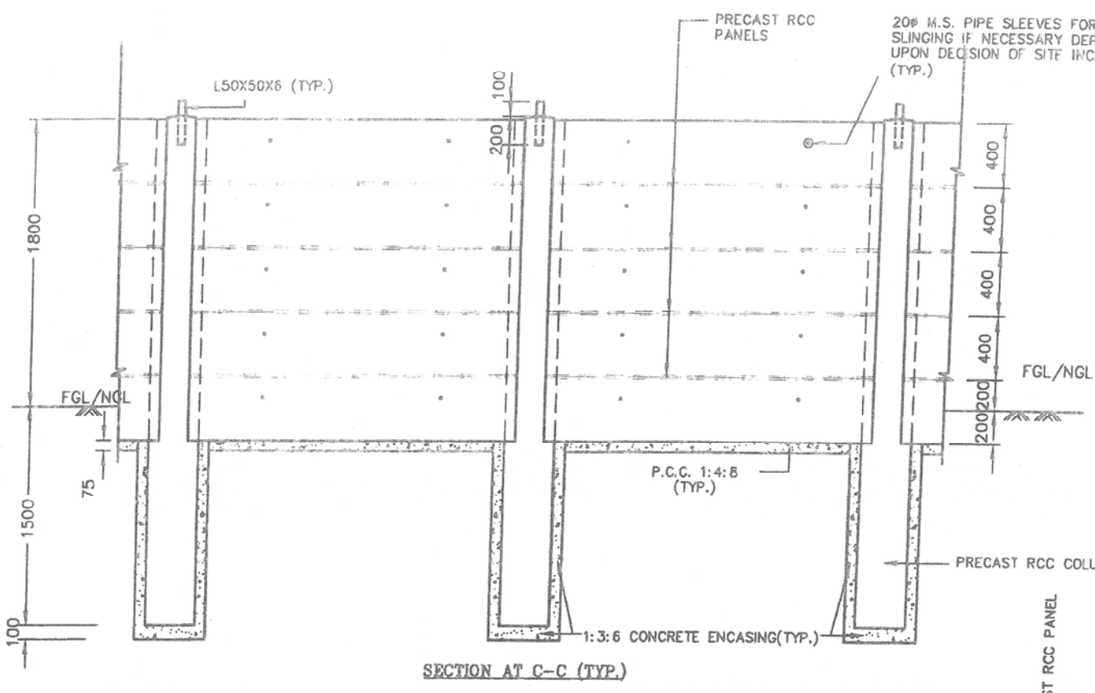
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

PROJECT : 400/220 SUB STATIONS

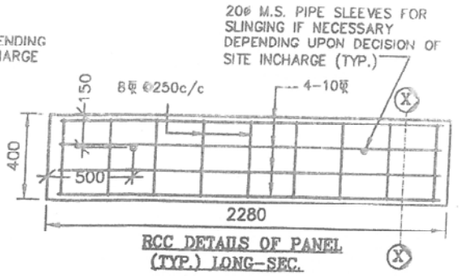
TITLE : DETAILS OF MAIN ENTRANCE GATE

REV	DE (ENGG-CIVIL)	ASSTT GM (ENGG-CIVIL)	AGM (ENGG-CIVIL)	GM (ENGG-CIVIL)	DATE
00					18.4.17

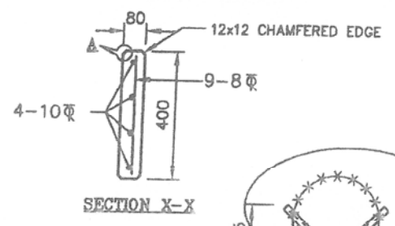
SCALE	DRG NO.:-	SHEET	
NTS	C/ENGG/MAIN GATE/01	1 OF 1	R-0



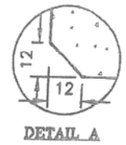
SECTION AT C-C (TYP.)



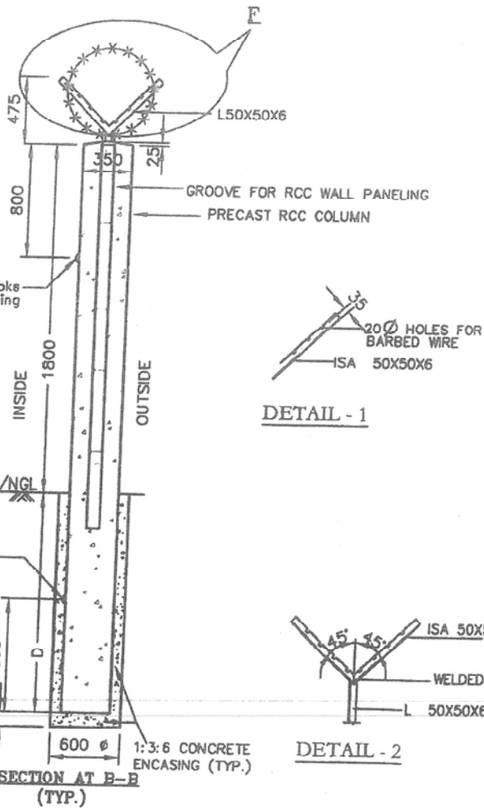
RCC DETAILS OF PANEL (TYP.) LONG-SEC.



SECTION X-X

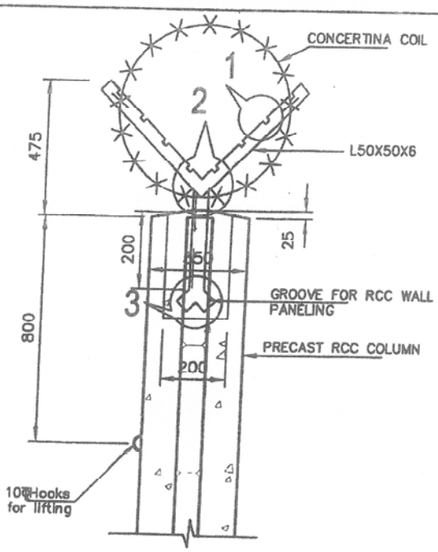


DETAIL A

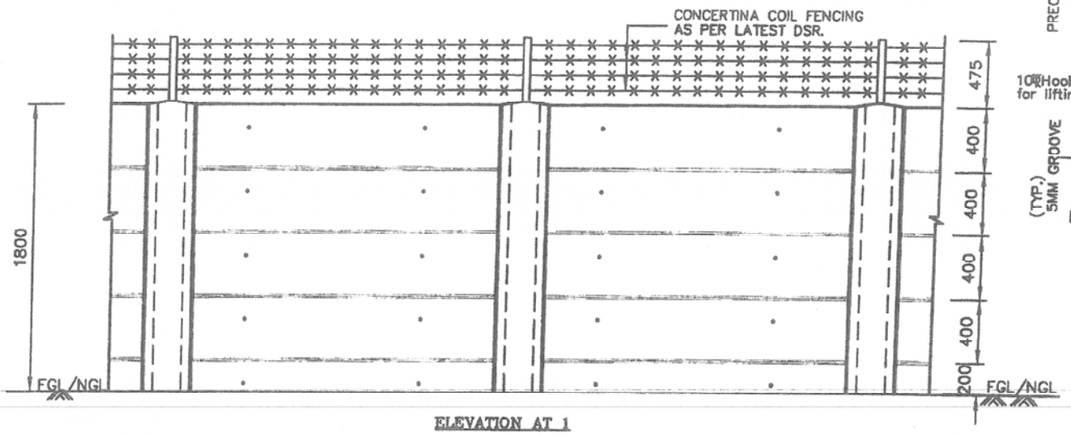


SECTION AT B-B (TYP.)

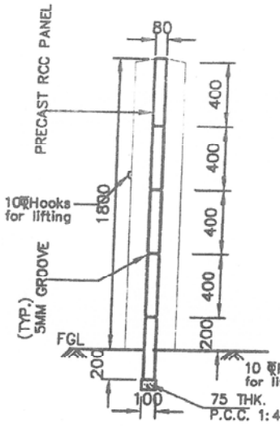
DETAIL - 1



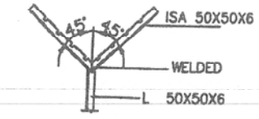
DETAIL - F



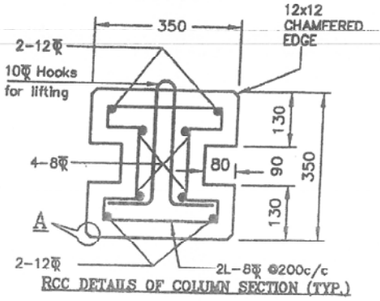
ELEVATION AT 1



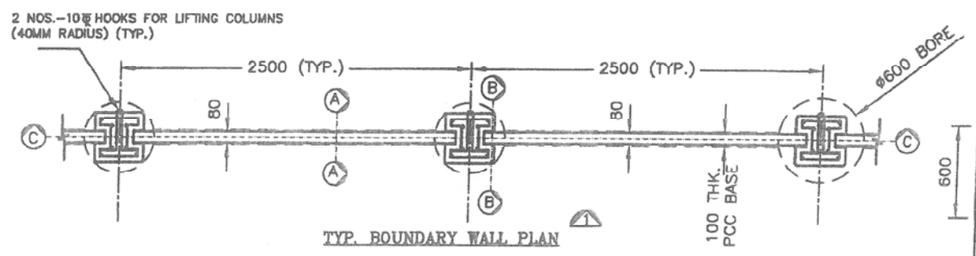
SECTION AT A-A (TYP)



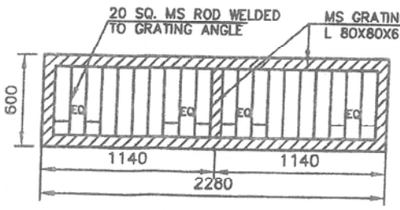
DETAIL - 2



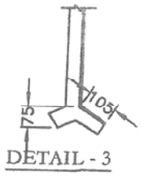
RCC DETAILS OF COLUMN SECTION (TYP.)



TYP. BOUNDARY WALL PLAN



TYP. GRATING PANEL DETAILS



DETAIL - 3

Where "D"=1.50m for earth fill upto 300mm
=2.00m for earth fill upto 800mm

RELEASED FOR TENDER/CONSTRUCTION.

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. LOCATION OF BOUNDARY WALL SHALL BE AS PER APPROVED G.A. DRAWING.
3. ALL CONCRETE SHALL BE OF M 30 GRADE (DESIGN MIX).
4. CONCERTINA COIL FENCING OF 800 MM DIA. SHALL BE AS PER LATEST DSR.
5. P.C.C. OF 1:3:6 GRADE SHALL BE WITH 20 MM NOMINAL SIZE AGGREGATE.
6. EXPANSION JOINTS ARE TO BE PROVIDED IN THE BOUNDARY WALL AT A MAX. OF 45.00 M.
7. ALL STRUCTURAL STEEL SHALL CONFORM TO IS: 2062. ANGLE FOR CONCERTINA COIL SHALL BE PAINTED WITH TWO OR MORE COATS OF SYNTHETIC ENAMEL PAINT OF APPROVED BRAND AND MANUFACTURE OVER A PRIMING COAT OF APPROVED STEEL PRIMER. IT WILL ALSO TO BE WELDED TO INSERTED ANGLE PROVIDED IN PRE-FABRICATED COLUMN.
8. THE RISE / FALL IN BOUNDARY WALL FOUNDATION SHALL BE PROVIDED WHEREVER THE DIFFERENCE IN GROUND LEVEL IS MORE THAN 300 MM.
9. NO. OF M.S. GRATING PANELS, THEIR LOCATION AND THE LEVELS SHALL BE DECIDED BY SITE AS PER THE SITE CONDITIONS KEEPING IN VIEW THE MAX. POSSIBLE CATCHMENT AREA FOR EACH GRATING.
10. ALL M.S. SECTIONS USED FOR GRATING SHALL BE PAINTED WITH TWO OR MORE COATS OF BLACK ANTI-CORROSIVE BITUMASTIC PAINT OF APPROVED BRAND AND MANUFACTURE OVER A PRIMING COAT OF APPROVED STEEL PRIMER.
11. REINFORCEMENT BARS SHALL BE C.R.S. BARS OF GRADE Fe 500, OR TMT BARS OF EQUIVALENT GRADE.
12. CLEAR COVER TO MAIN REINFORCEMENT FOR COLUMN SHALL BE 40 MM AND REINFORCEMENT IN WALL PANELS SHALL BE CENTRALLY PLACED.
13. THIS DRAWING IS APPLICABLE FOR NORMAL SOILS ONLY & SHALL NOT BE APPLICABLE FOR FILLED-UP AREAS, MARSHY AREAS & ROCKY AREAS.
14. DOUBLE COLUMNS SHALL BE PROVIDED AT LOCATIONS, WHERE THE DIFFERENCE IN GROUND LEVEL IS MORE THAN 300 MM, OR CHANGE IN ALIGNMENT OF THE BOUNDARY WALL OCCURS.
15. THE LENGH OF COLUMN BELOW NGL MAY BE INCREASED BEYOND 1.5M & UPTO 2.0M, IF SITE CONDITIONS REQUIRE SO. HOWEVER, SAME RC DETAILS SHALL BE APPLICABLE TO THE EXTRA LENGTH OF COLUMN.
16. WALL PANELS OF SMALLER LENGTH, IF REQUIRED AT CORNERS/TURNINGS/ELSEWHERE MAY BE CAST-IN-SITU/PRE-FABRICATED. HOWEVER, SPACING OF REINFORMENT SHALL REMAIN SAME.

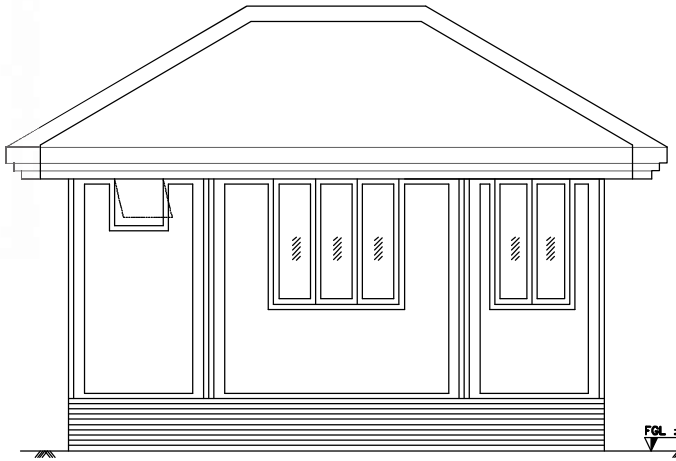
PREP.	REVD.	REVD.	APPD.	DATE
				18/11/2019

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

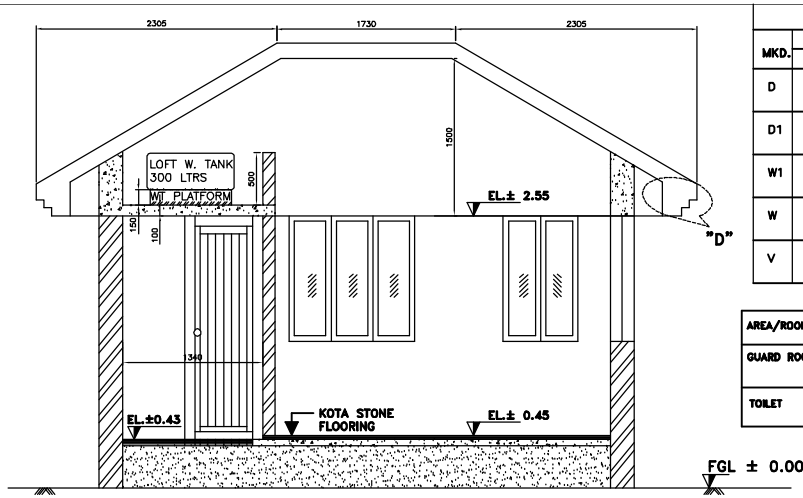
PROJECT : STANDARD PREFABRICATED RCC BOUNDARY WALL FOR TBCB PROJECTS

TITLE : DETAILS OF PRE-FABRICATED RCC BOUNDARY WALL

SCALE	DRAWING NO.	REV
NTS	C/ENGG/TBCB/PRE-FAB/01	R-0



ELEVATION



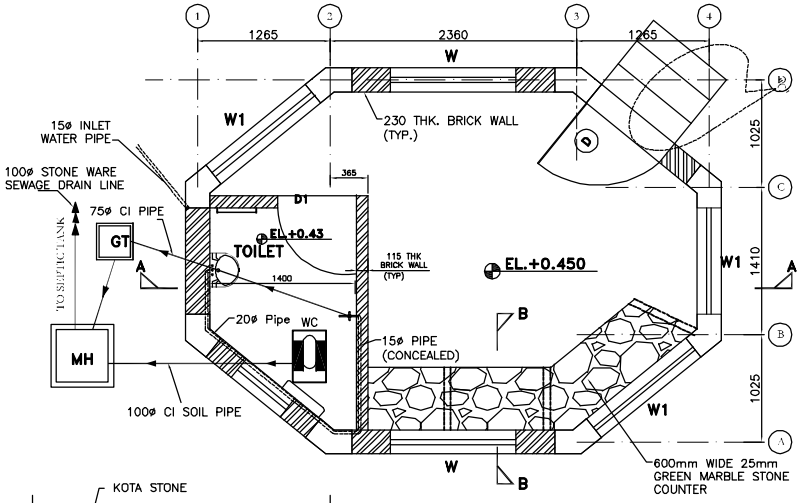
SECTION A–A

SCHEDULE OF DOORS AND WINDOWS

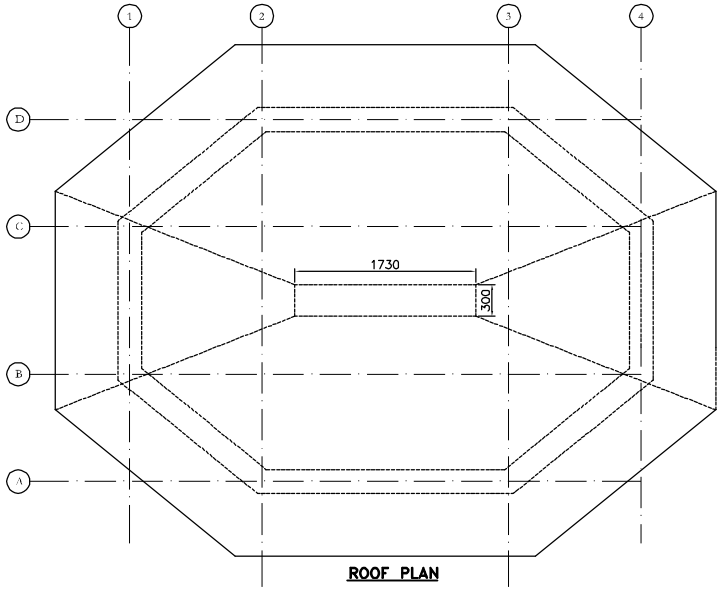
MKD.	SIZE		DESCRIPTION	NOS. REQD.
	WIDTH	HEIGHT		
D	900	2100	FULLY GLAZED PLAIN/ETCHED UPVC FRAME & DOOR AS PER SPECS.	1
D1	750	2100	UPVC DOOR & DOOR FRAME WITH LAMINATED PARTICLE BOARD DOOR	1
W1	1000	1200	2 EQ.PANNELS SLIDING/OPENABLE UPVC WINDOW	3
W	1200	1200	3 EQ.PANNELS SLIDING/OPENABLE UPVC WINDOW	2
V	900	450	UPVC TOP HUNG VENTILATOR WITH EXHAUST FAN	1

FINISHING SCHEDULE

AREA/ROOM	FLOORING	SKIRTING /DADO	CEILING	INTERNAL PAINT ON WALLS	PAINT ON CEILING	REMARKS
GUARD ROOM	20 THK KOTA STONE FLOOR	100 HIGH KOTA	RCC SLAB WITH 6mm PLASTER	OBD	OBD	
TOILET	CERAMIC TILE	GLAZED TILE DADO UP TO 1.5 HIGH	RCC SLAB WITH PLASTER	WHITE WASH	WHITE WASH	



FLOOR PLAN



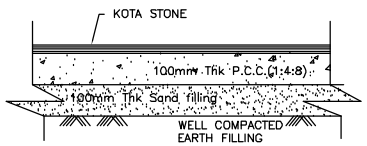
ROOF PLAN

PLUMBING & SANITARY SCHEDULE

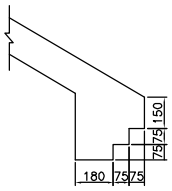
SR. NO.	ITEM	DESCRIPTION	NOS. REQD.
1.	INTERNAL/EXTERNAL WATER SUPPLY PIPES	CPCV PIPE AS PER BOQ OR uPVC PIPE SUPPLY PIPES	–
2.	INTERNAL COOLER	ADJACENT TO TOILET BLOCK (OF APPROVED MAKE).	1
3.	W.C. (INDIAN STYLE)	ORISSA PATTERN WC AS PER BOQ WITH ALL FITTING OF APPROVED MAKE.	1
4.	WASH BASIN	AS PER BOQ WITH ALL FITTING OF APPROVED MAKE	1
5.	MIRROR	ABOVE WASH BASIN SIZE – 600X450	1
6.	TOWEL RAIL	CP BRASS SIZE – 600 LONG 20 ø ROD	1
7.	SOAP HOLDER & LIQUID SOAP DISPENSER	CP BRASS	1

NOTES :—

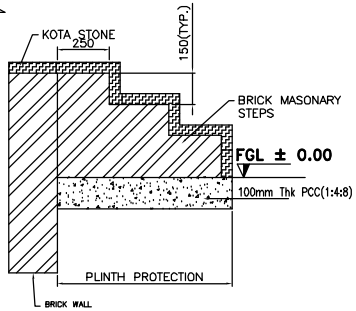
1. ALL DIMENSION ARE IN MM.
2. ALL ELEVATION ARE IN METERS.
3. ALL ITEMS SHALL BE EXECUTED AS PER BOQ.
4. PLASTERING :—
   (a) OUTER FACE SHALL HAVE TEXTURE PAINT FINISH OVER EXTERNAL 12 MM THK. PLASTER IN 1:6 CEMENT SAND MORTAR MIXED WITH WATER PROOFING COMPOUND.
   (b) INTERNAL – 15MM THK PLASTER IN 1:6 CEMENT SAND MORTAR
5. 900 MM WIDE PLINTH PROTECTION SHALL BE PROVIDED
6. SOAK PIT SHALL BE PROVIDED.
7. LOCATION OF SEPTIC TANK AND SOAK PIT SHALL BE DECIDED BY SITE
8. WATER SUPPLY CONNECTION TO BE DECIDED BY SITE



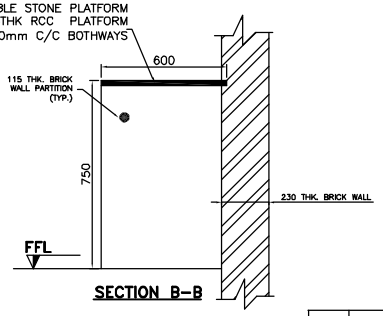
FLOORING DETAILS



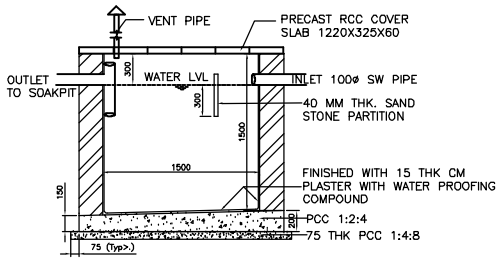
DETAIL "D"



DETAIL "C"



SECTION B–B



TYP. SECTION OF SEPTIC TANK

(NOTE: INTERNAL DIMENSION OF SEPTIC TANK IS 750MMX1500MM)

RELEASED FOR TENDER/CONSTRUCTION

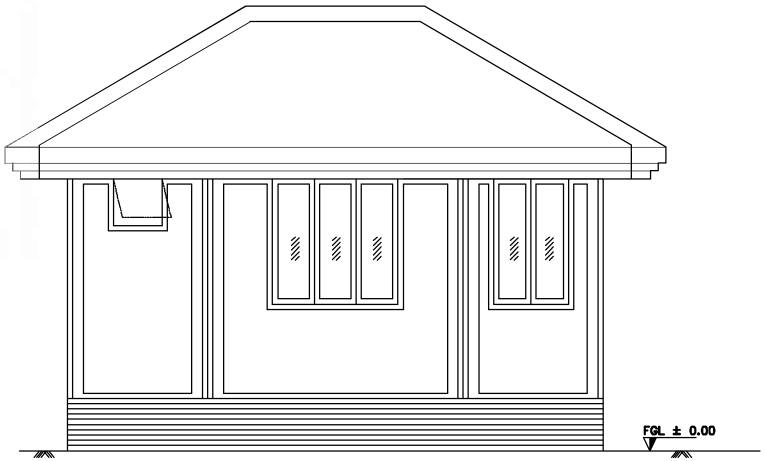
POWER GRID CORPORATION OF INDIA LIMITED

(A Government of India Enterprise)

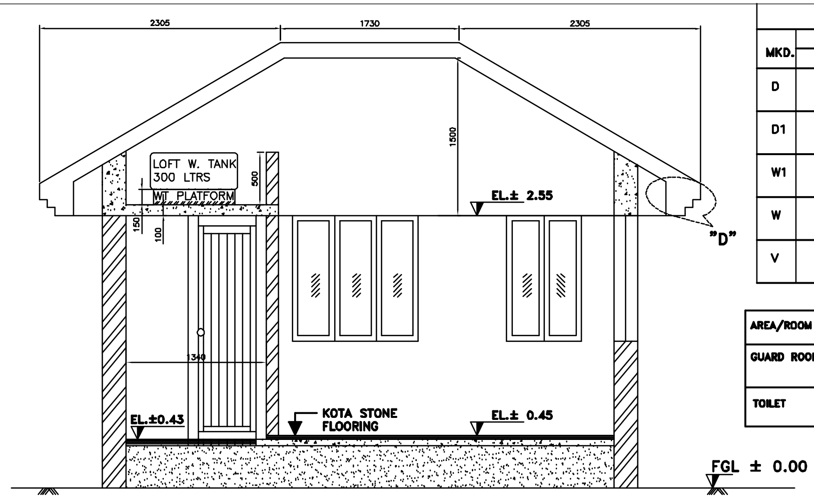
TITLE :

ARCHITECTURAL DETAILS OF SECURITY ROOM

REV	DCDE (ENGG-CIVIL)	CDE (ENGG-HVDC)	AGM (ENGG-HVDC)	GM (ENGG-CIVIL)	GM (ENGG-HVDC)	DATE	SCALE	DRG NO.:-	SHEET
00							NTS	C/ENGG/SECURITYHUT/ARCH-01	SHEET 1 OF 1 R–0



ELEVATION



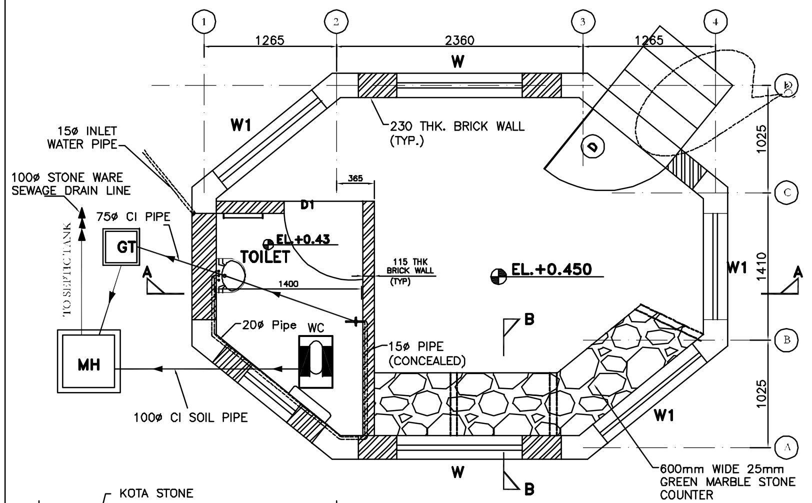
SECTION A-A

SCHEDULE OF DOORS AND WINDOWS

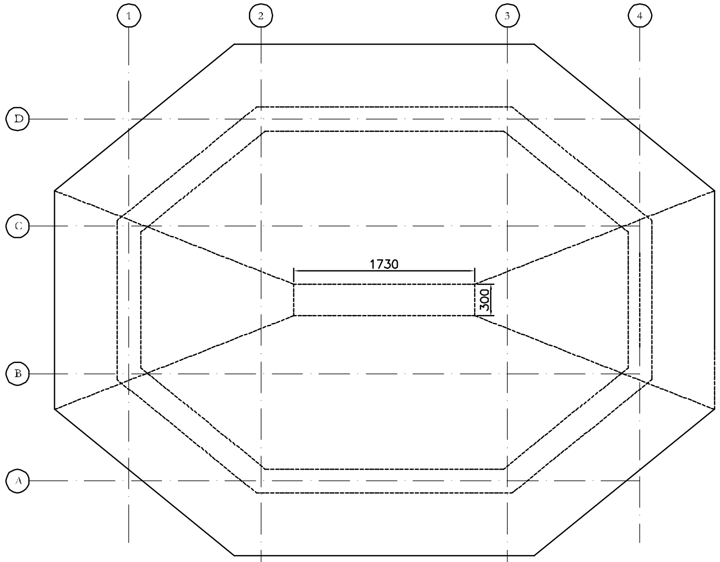
MKD.	SIZE WIDTH	SIZE HEIGHT	DESCRIPTION	NOS. REQD.
D	900	2100	FULLY GLAZED PLAIN/ETCHED UPVC FRAME & DOOR AS PER SPECS.	1
D1	750	2100	UPVC DOOR & DOOR FRAME WITH LAMINATED PARTICLE BOARD DOOR	1
W1	1000	1200	2 EQ.PANNELS SLIDING/OPENABLE UPVC WINDOW	3
W	1200	1200	3 EQ.PANNELS SLIDING/OPENABLE UPVC WINDOW	2
V	900	450	UPVC TOP HUNG VENTILATOR WITH EXHAUST FAN	1

FINISHING SCHEDULE

AREA/ROOM	FLOORING	SKIRTING /DADO	CEILING	INTERNAL PAINT ON WALLS	PAINT ON CEILING	REMARKS
GUARD ROOM	20 THK KOTA STONE FLOOR	100 HIGH KOTA	RCC SLAB WITH 6mm PLASTER	OBD	OBD	
TOILET	CERAMIC TILE	GLAZED TILE DADO UP TO 1.5 HIGH	RCC SLAB WITH PLASTER	WHITE WASH	WHITE WASH	



FLOOR PLAN

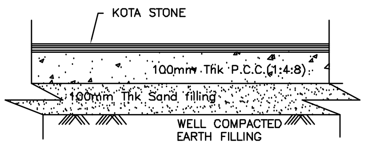


ROOF PLAN

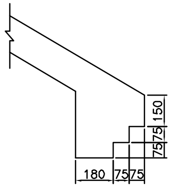
PLUMBING & SANITARY SCHEDULE

SR. NO.	ITEM	DESCRIPTION	NOS. REQD.
1.	INTERNAL/EXTERNAL WATER SUPPLY PIPES	CPCV PIPE AS PER BOQ OR uPVC PIPE SUPPLY PIPES	–
2.	INTERNAL COOLER	ADJACENT TO TOILET BLOCK (OF APPROVED MAKE).	1
3.	W.C. (INDIAN STYLE)	ORISSA PATTERN WC AS PER BOQ WITH ALL FITTING OF APPROVED MAKE.	1
4.	WASH BASIN	AS PER BOQ WITH ALL FITTING OF APPROVED MAKE	1
5.	MIRROR	ABOVE WASH BASIN SIZE – 600X450	1
6.	TOWEL RAIL	CP BRASS SIZE – 600 LONG 20 ø ROD	1
7.	SOAP HOLDER & LIQUID SOAP DISPENSER	CP BRASS	1

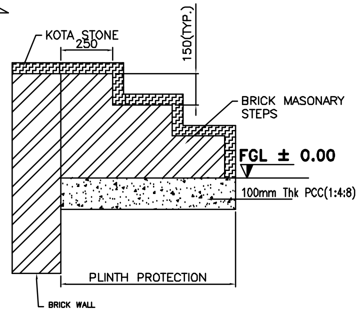
NOTES :--
1. ALL DIMENSION ARE IN MM.
2. ALL ELEVATION ARE IN METERS.
3. ALL ITEMS SHALL BE EXECUTED AS PER BOQ.
4. PLASTERING :--
   (a) OUTER FACE SHALL HAVE TEXTURE PAINT FINISH OVER EXTERNAL 12 MM THK. PLASTER IN 1:6 CEMENT SAND MORTAR MIXED WITH WATER PROOFING COMPOUND.
   (b) INTERNAL – 15MM THK PLASTER IN 1:6 CEMENT SAND MORTAR
5. 900 MM WIDE PLINTH PROTECTION SHALL BE PROVIDED
6. SOAK PIT SHALL BE PROVIDED. as per DSR 2023 Item no19.33
7. LOCATION OF SEPTIC TANK AND SOAK PIT SHALL BE DECIDED BY SITE
8. WATER SUPPLY CONNECTION TO BE DECIDED BY SITE



FLOORING DETAILS



DETAIL "D"



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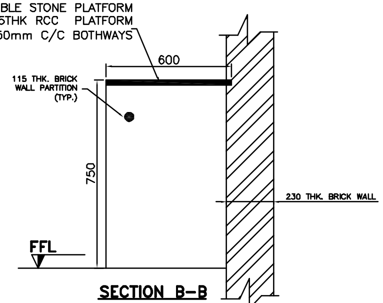
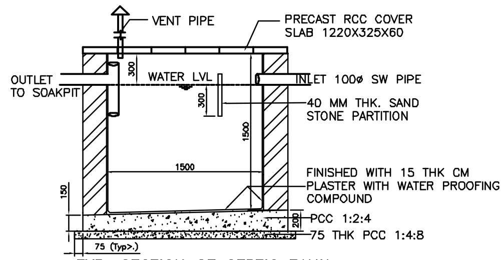


SECTION B-B



TYP. SECTION OF SEPTIC TANK

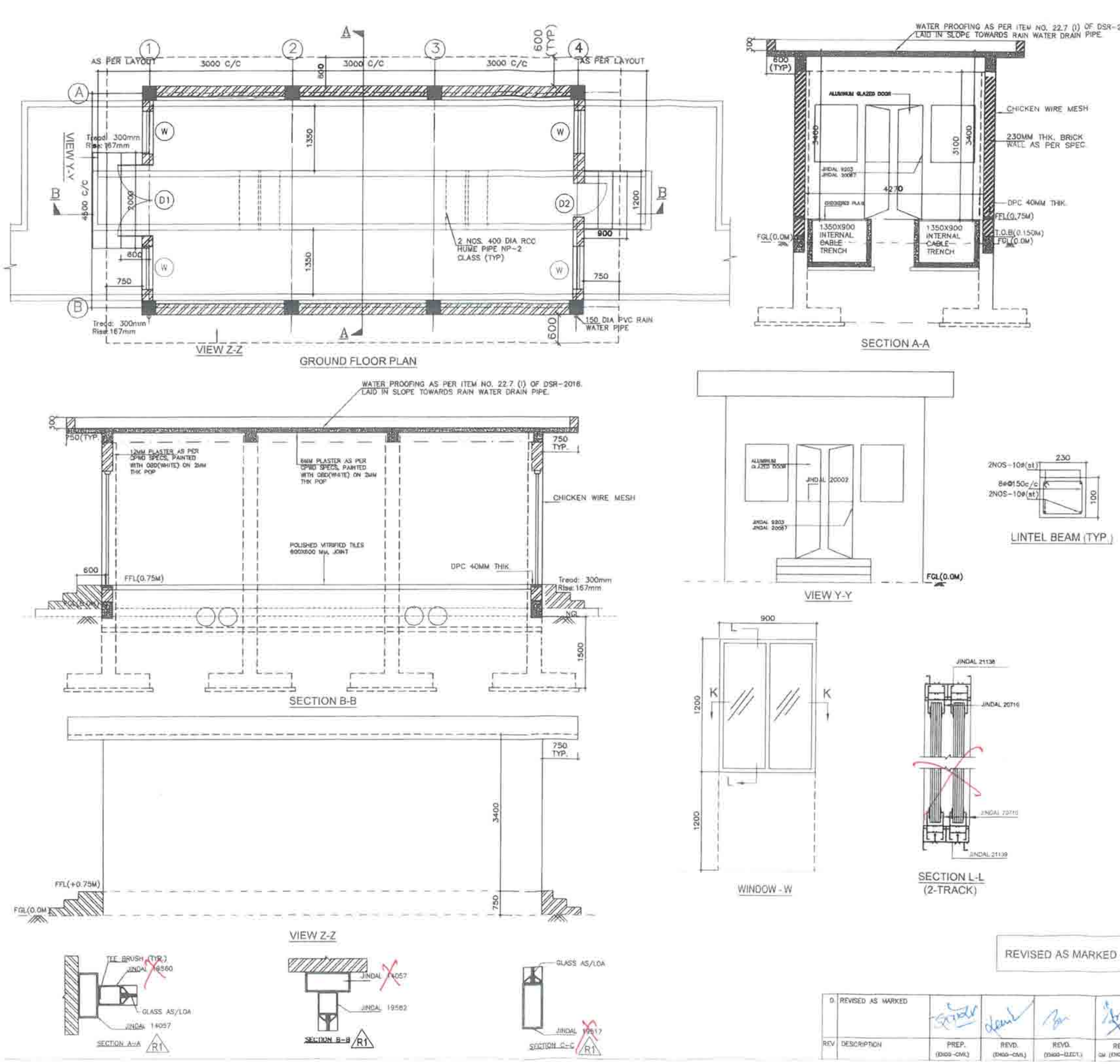
(NOTE: INTERNAL DIMENSION OF SEPTIC TANK IS 750MMX1500MM)

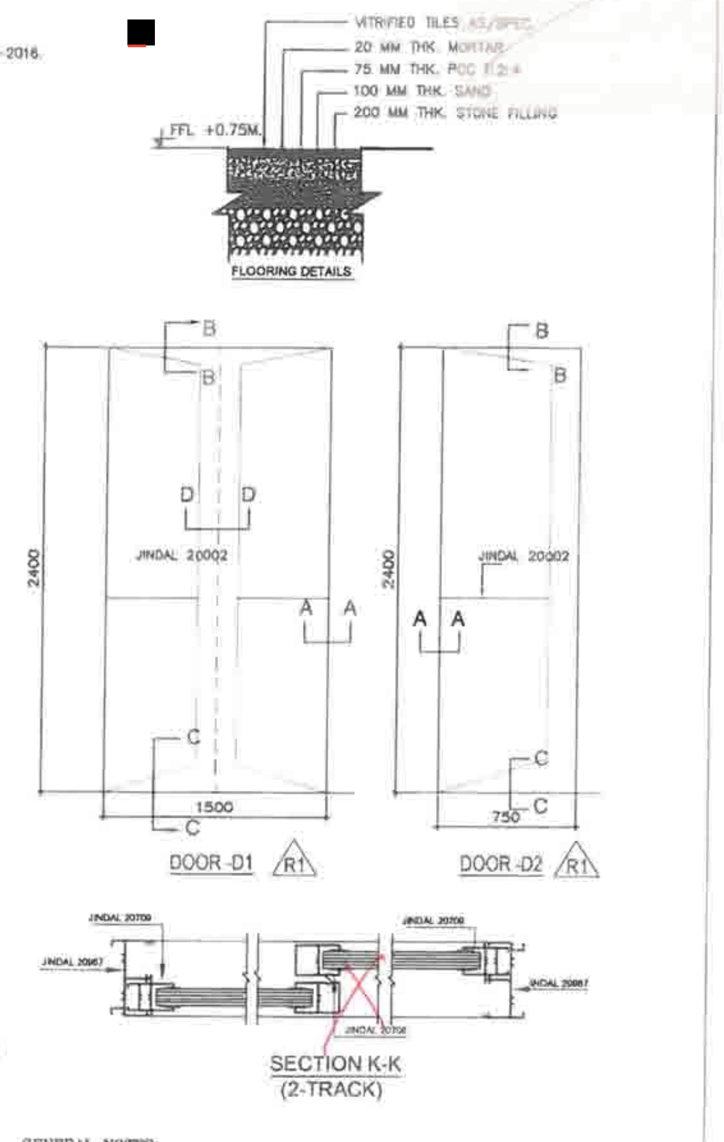
RELEASED FOR TENDER/CONSTRUCTION

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

TITLE : ARCHITECTURAL DETAILS OF SECURITY ROOM

REV	DCDE (ENGG-CIVIL)	CDE (ENGG-HVDC)	AGM (ENGG-HVDC)	GM (ENGG-CIVIL)	GM (ENGG-HVDC)	DATE	SCALE NTS	DRG NO.:- C/ENGG/SECURITYHUT/ARCH-01	SHEET 1 OF 1	R-0
00										





GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM. AND LEVELS ARE IN MTR.
2. ALL EXTERNAL SURFACE SHALL HAVE 18MM PLASTER AS PER CPWD SPECS, PAINTED WITH WITH EXTERIOR GRADE PAINT HAVING SILICON ADDITIVES.
3. THE WIRE MESH SHALL BE CONNECTED WITH EARTHING SYSTEM THROUGH 75X12MM FLAT FIXED ON DIAGONALLY OPPOSITE COLUMNS ON ITS OUTER SURFACE.
4. INTERNAL CABLE TRENCH SHALL HAVE SLOPE OF 1:1000 TOWARDS THE EXTERNAL CABLE TRENCH.
5. ALL MISC. STEEL SHALL BE PAINTED WITH ONE COAT OF ANTI CORROSIVE PAINT OVER APPROVED PRIMER COAT.
6. INTERNAL CABLE TRENCH LAYOUT SHALL BE VERIFIED/MODIFIED AS PER THE FINAL APPROVED CABLE TRENCH LAYOUT BEFORE CONSTRUCTION.
7. ALL WELDS ARE 6MM FILLET CONTINUOUS WELD UNLESS OTHERWISE SPECIFIED.
8. 22GX12 MM. CHICKEN WIRE MESH TO BE PROVIDED FOR OUTER WALL, AND ROOF. CHICKEN WIRE MESH SHALL BE CONNECTED WITH EARTHING SYSTEM THROUGH 75X12MM FLAT FIXED ON DIAGONALLY OPPOSITE COLUMNS ON ITS OUTER SURFACE.
9. FOR OPENING OF AIR CONDITIONER SUITABLE LOCATION AND SIZE TO BE DECIDED AT SITE.
10. ALL STEPS SHALL BE FINISHED WITH 18MM THK. POLISHED GRANITE STONE AS PER SPECIFICATION.
11. All doors and windows shall be of UPVC type as per specification (TS)

REVISED AS MARKED /R1\

RELEASED FOR TENDER/CONSTRUCTION.

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

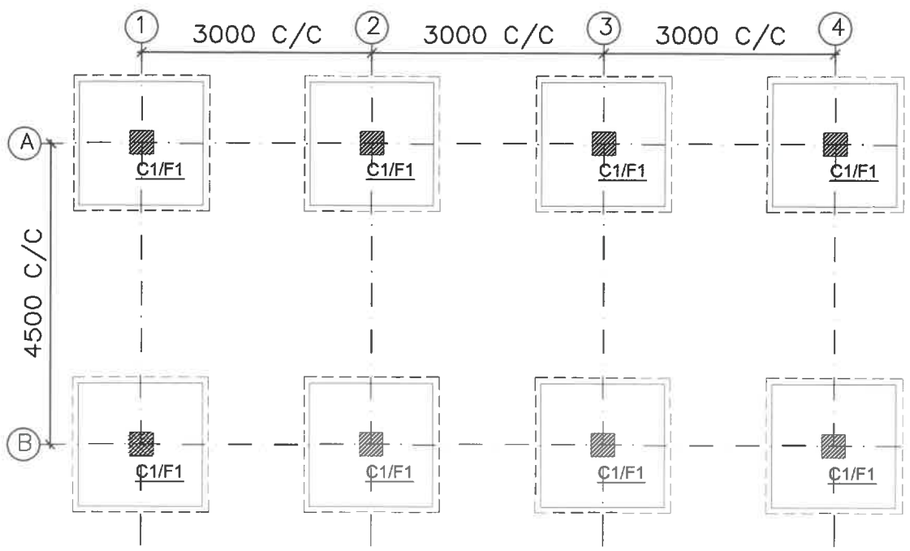
TITLE: STANDARD PANEL ROOM (9 M.)

SUB TITLE: STANDARD SWITCHYARD PANEL ROOM GENERAL ARRANGEMENT DETAIL OF PANEL ROOM

DRAWING NO: C/ENGG/STD/PR/2017 (01 OF 03)

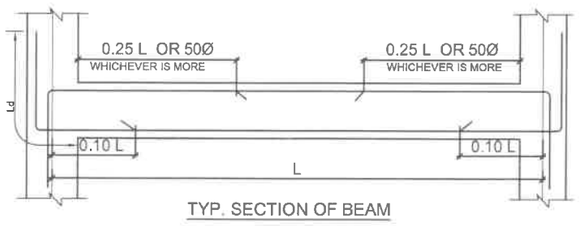
SCALE	REV
NTS	01

REV	DESCRIPTION	PREP. (ENGG-CIVIL)	REVD. (ENGG-CIVIL)	REVD. (ENGG-ELECT.)	REVD. GM (ENGG-CIVIL)	REVD. DGM (ENGG-ELECT.)	APPD.	DATE
0	REVISED AS MARKED							12/11/19

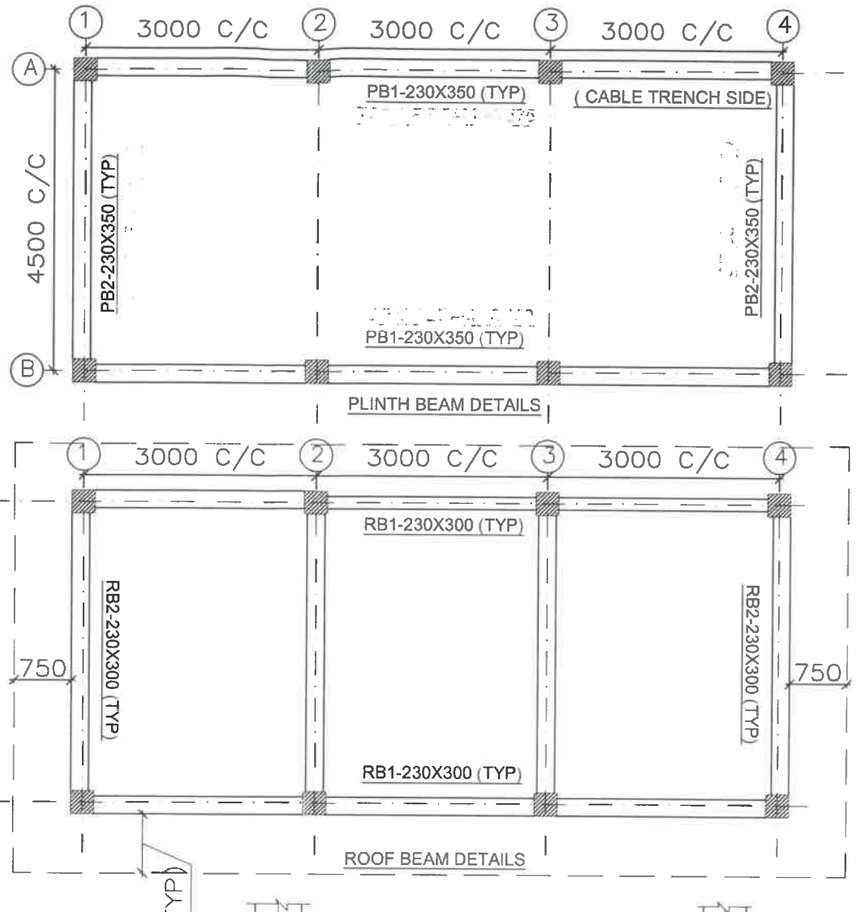


Footing Size

Sno	Bearing capacity	L(mm)	B (mm)	H (mm)
1	5 T/m2	1750	1750	300
2	9T/m2	1400	1400	300

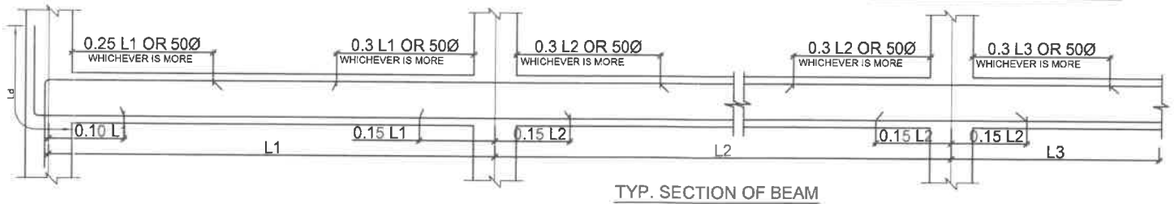


TYP. SECTION OF BEAM



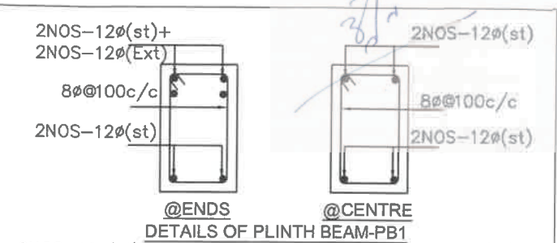
PLINTH BEAM DETAILS

ROOF BEAM DETAILS

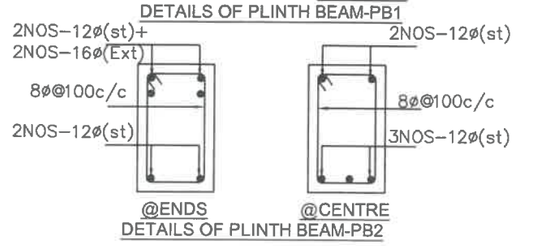


TYP. SECTION OF BEAM

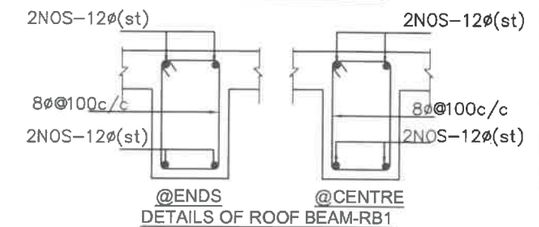
(NOTE:- WHERE "d" IS EFFECTIVE DEPTH OF BEAM)



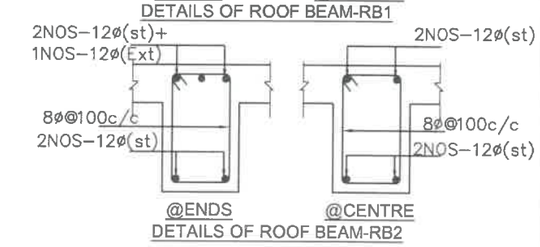
DETAILS OF PLINTH BEAM-PB1



DETAILS OF PLINTH BEAM-PB2



DETAILS OF ROOF BEAM-RB1

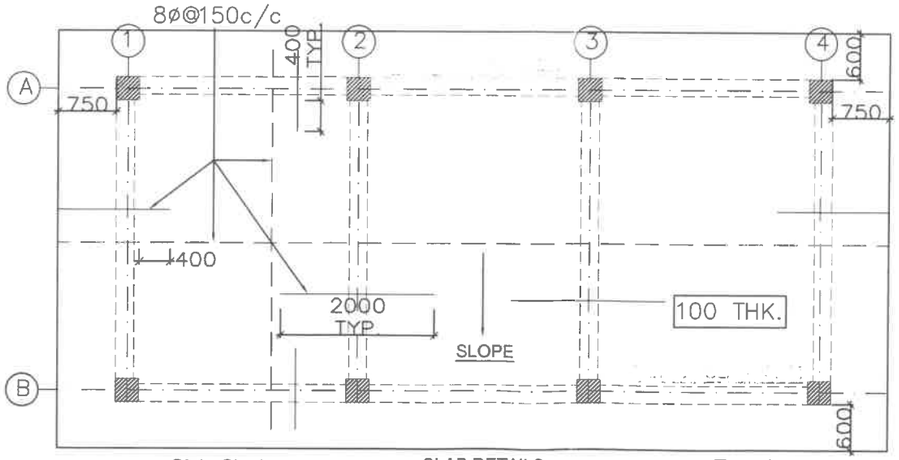


DETAILS OF ROOF BEAM-RB2

ENERAL NOTES:

1. ALL DIMENSIONS ARE IN MM AND LEVELS IN METERS.
2. THIS DRAWING IS NOT TO BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. 0.00 CORRESPONDS TO FINISHED GROUND LEVEL. (F.G.L.)
4. ALL R.C.C. USED SHALL BE OF GRADE AS PER SPECIFICATION.
5. ALL R/F STEEL SHALL BE HYSD (Fe 500) CONFORMING TO IS:1786./TMT BARS (EQUIVALENT GRADE)
6. CLEAR COVER FOR MAIN R/F BARS SHALL BE 40MM FOR COLUMN,25MM FOR BEAMS, 15MM FOR SLAB. 50MM FOR FOOTINGS
7. LAP LENGTH FOR R/F BARS SHALL BE 50 X DIA OF BAR.
8. LAP SHALL NOT BE PROVIDED WITHIN A JOINT, OR WITHIN A DISTANCE 2 X DEPTH FROM THE EACH JOINT FACE, OR ¼ OF MEMBER LENGTH FROM JOINT FACE.
9. ALL FOUNDATION SHALL BE TAKEN AT LEAST 500MM BELOW VIRGIN SOIL. LOOSE POCKET IF ANY SHALL BE COMPLETELY REMOVED AND BACK FILLED WITH P.C.C. (1:4:8)
10. NET SAFE BEARING CAPACITY AT 1.5M BELOW FGL SHALL BE VERIFIED BEFORE EXECUTION AND THE SIZE OF THE FOOTING SHALL BE ADOPTED BASED ON THE SBC. IN–CASE OF ANY DESCRIPANCY PLEASE CONTACT ENGG.
11. IN CASE OF EXPANSIVE SOIL FOUND AT FOUNDATION LEVEL, IT SHALL BE REPLACED WITH 300MM THK OF AVAILABLE LOCAL SAND.

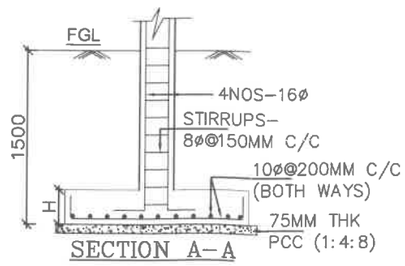
MIP: –
1.STRUCTURE MODIFIED IN LINE WITH
CHANGES MADE IN ARCHITECTRAL DRAWING



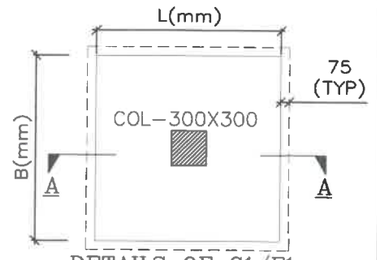
Dist. Steel–
8ø@200mm c/c TYP.

SLAB DETAILS

——— Top bar
— — — Bottom bar



SECTION A–A



DETAILS OF C1/F1

REV.	DESCRIPTION	PREP. (ENGG–CIVIL)	REVD. (ENGG–ELECT.)	REVD. (ENGG–CIVIL)	REVD. AGM (ENGG–CIVIL)	REVD. GM (ENGG–ELECT.)	APPD.	DATE
0.	REVISED AS MARKED							

RELEASED FOR TENDER/CONSTRUCTION

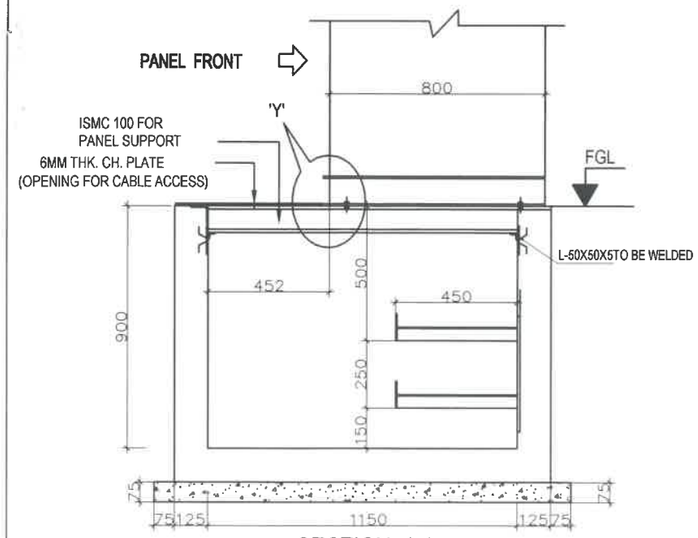
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

TITLE: STANDARD PANEL ROOM (SM)

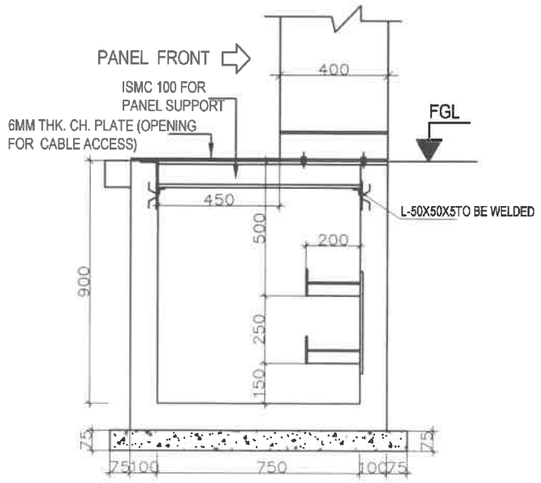
SUB TITLE: — FOUNDATIONS
STANDARD SWITCHYARD PANEL ROOM RCC DETAIL OF PANEL ROOM (9M)

DRAWING NO: C/ENGG/STD/PR/2017 (02 OF 03)

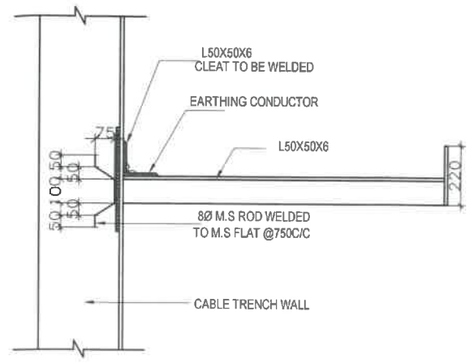
SCALE NTS | REV 0



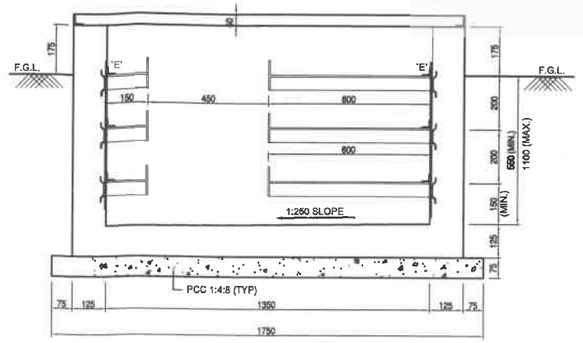
SECTION 1-1
(SHOWING GENERAL ARRANGEMENT DETAILS)



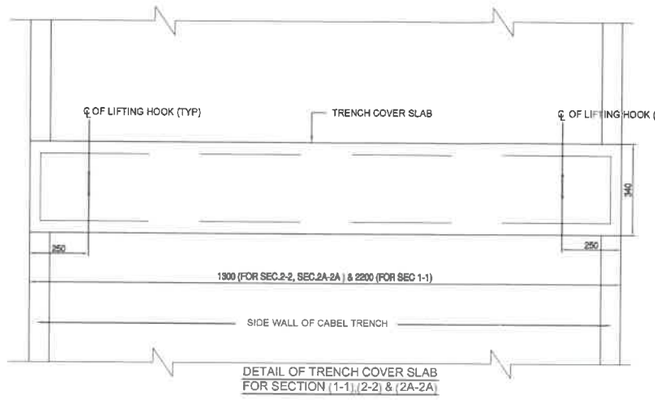
SECTION 2-2
(SHOWING GENERAL ARRANGEMENT DETAILS)



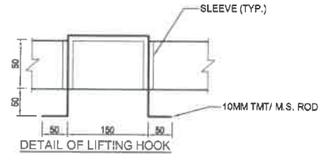
TYPICAL CABLE SUPPORT



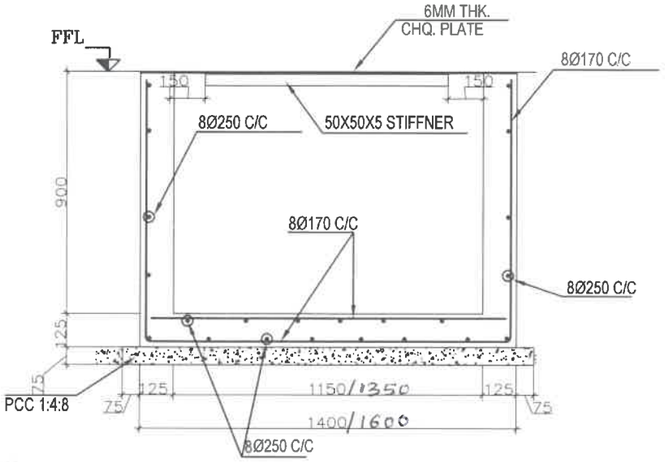
SECTION 2A-2A



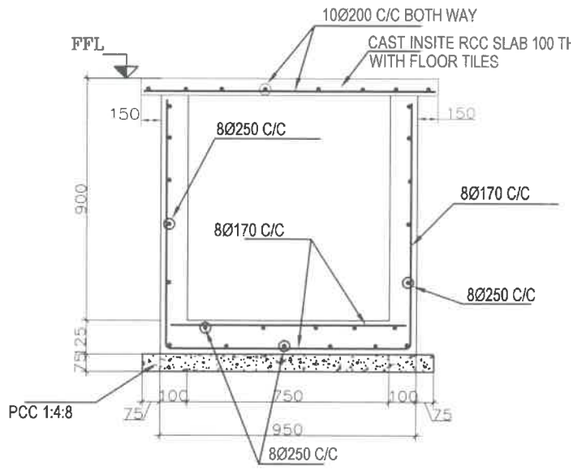
DETAIL OF TRENCH COVER SLAB
FOR SECTION (1-1),(2-2) & (2A-2A)



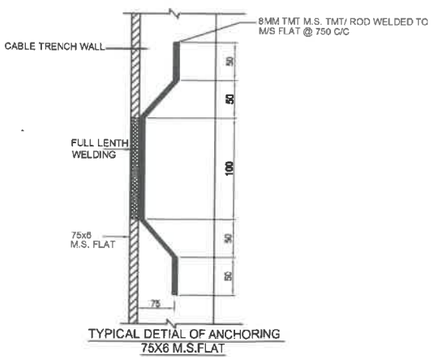
DETAIL OF LIFTING HOOK



SECTION 1-1 / 2A-2A
(SHOWING REINFORCEMENT DETAILS)



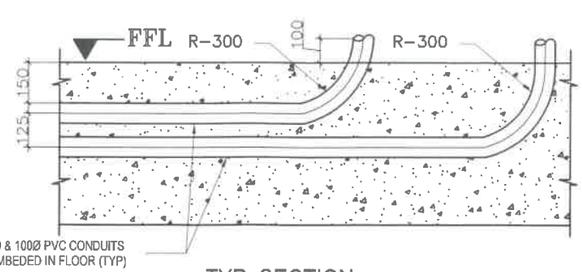
SECTION 2-2
(SHOWING REINFORCEMENT DETAILS)



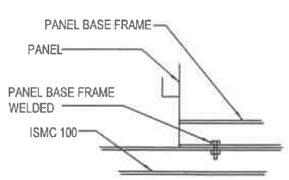
TYPICAL DETIAL OF ANCHORING
75X6 M.S.FLAT

NOTES :-

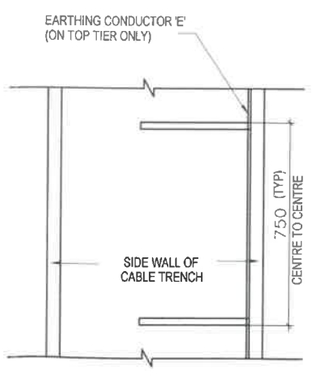
1. ALL DIMENSION ARE IN MM UNLESS NOTED OTHERWISE.
2. FOR NOTES REFER DRG. NO : C-ENGG-STD-PR-TS-10-01
3. FOR STRUCTURE NOTES REFER DRG. NO : C-ENGG-STD-PR-2016, 02,03 & 04.
4. TOP OF CHEQUERED PLATE TO FLUSH WITH FINISHED FLOOR LEVEL
5. THIS DRAWING SHALL BE MATCHED WITH VENDOR'S APPROVED INTERNAL CABLE TRENCH LAYOUT DRAWING BEFORE START OF CONSTRUCTION
6. ALL WELDS ARE 6MM FILLET CONTINUOUS WELD UNLESS OTHERWISE SPECIFIED
7. ISMC 100 SHALL BE PROVIDED @1000 C/C TO SUPPORT CHEQUERED PLATE WHEREVER CABLE TRENCH WIDTH EXCEEDS 1000 MM.
8. ISMC 100 SHALL BE PROVIDED BELOW PANELS ALSO.
9. FOR CABLE TRENCH WITH LESSER WIDTH L50x50x5 STIFFENER SHALL BE WELDED WITH CHEQUERED PLATE @ 1000 C/C.



TYP. SECTION



DETAIL - 'Y'
TYPICAL BOLT ARRANGEMENT



CABLE TRAY SUPPORT (TYP)

RELEASED FOR TENDER/CONSTRUCTION.

POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

TITLE: STANDARD PANEL ROOM

SUB TITLE: STANDARD SWITCHYARD PANEL ROOM R.C.C DETAIL OF INTERNAL CABLE TRENCH

DRAWING NO: C/ENGG/STD/PR/2017 (03 OF 03)

SCALE NTS | REV 0

REV.	DESCRIPTION	PREP. (ENGG-CIVIL)	REVD. (ENGG-ELECT.)	REVD. (ENGG-CIVIL)	REVD. AGM (ENGG-CIVIL)	REVD. GM (ENGG-ELECT.)	APPD.	DATE
0.	REVISED AS MARKED							